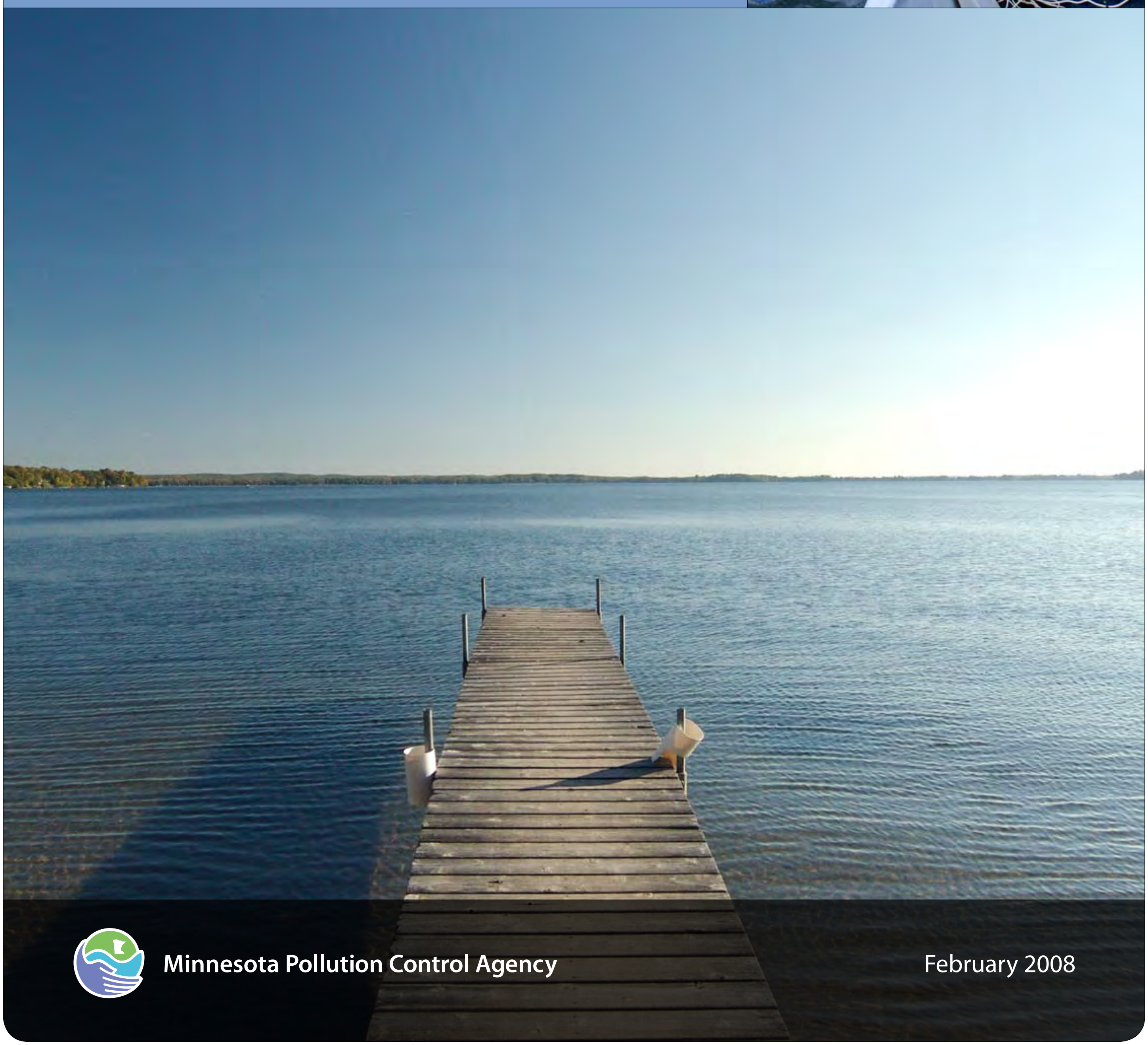
Citizen Lake-Monitoring Program

Instruction manual



Minnesota Pollution Control Agency

February 2008

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Preface

This manual has been prepared to help answer any questions that new or veteran volunteer monitors may have about the Citizen Lake Monitoring Program and/or lake monitoring in general. It is our hope that you will find this booklet useful as well as informative.

Did you know that participants in the Citizen Lake Monitoring Program belong to the longest-running volunteer lake monitoring program in the nation? Volunteer lake monitors are one of Minnesota's most important lake water quality tracking systems. The Minnesota Pollution Control Agency thanks volunteer monitors for all their hard work and dedication toward protecting and improving the surface waters of Minnesota.

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Introduction

Thank you for joining the Citizen Lake Monitoring Program (CLMP)! You have joined over 1,200 volunteers monitoring over 1,000 Minnesota lakes. Because lakes are central to Minnesota's economy and our way of life, it is imperative that we maintain or improve their water quality. Data collected by CLMP volunteers is vitally important to that effort.

The CLMP was started in 1973 at the University of Minnesota by Dr. Joe Shapiro. During its first year, volunteers monitored 74 lakes. Administration of the CLMP was transferred to the Minnesota Pollution Control Agency (MPCA) in 1978. The CLMP is a cooperative program that combines the technical resources of the MPCA and the efforts of citizen volunteers statewide who collect water quality data on their lakes. The participation of citizen volunteer monitors in the CLMP effectively increases the monitoring capabilities of the MPCA. The CLMP is a cost-effective way to obtain good, basic, water quality data on many of Minnesota's lakes. For many of them, CLMP data is the only water quality information available.

The CLMP involves voluntary participation of citizens residing on or near lakes or those who are frequent lake users. CLMP participants are asked to take weekly transparency measurements on their lake during the summer using a Secchi disk. A minimum of eight to ten readings per season are required in order to adequately define each summer's water quality. Data collected by CLMP volunteers are entered into the U.S. Environmental Protection Agency's water quality database along with all other water quality data collected by the MPCA. These data are used to analyze water quality trends, characterize trophic status, and provide a basis for water quality goal setting.

CLMP volunteers provide the state and others with valuable information on the water quality of Minnesota's lakes. By participating in CLMP, volunteers learn about the water quality of lakes in their area and gain a greater awareness of the causes and effects of lake degradation.

What is a Secchi Disk?

A Secchi (pronounced "Seh-kee") disk is a circular metal plate attached to a calibrated rope. It is probably the least expensive and easiest to use tool in water quality monitoring. Information provided by the Secchi disk is easily interpreted by volunteers and can be used to detect water quality trends in lakes.

Figure 1.
Pietro Angelo Secchi (1818-1878)

The Secchi disk is named after Fr. Pietro Angelo Secchi (Figure 1), astrophysicist and scientific advisor to the Pope. Secchi was asked by Commander Cialdi, head of the Papal Navy, to measure the transparency of the Mediterranean Sea. The first disk was lowered from the papal yacht, *l'immacolata Concezion* (Immaculate Conception), on April 20, 1865 (Carlson and Simpson, 1996). There have been many revisions to the disks used by Secchi in terms of size and color. The two most common color variations in use today are the all-white disk and the black and white quadrant version disk (Figure 2). In Minnesota, we use an all-white, 8 inch diameter metal disk with notched sides for rope storage when the disk is not in use.

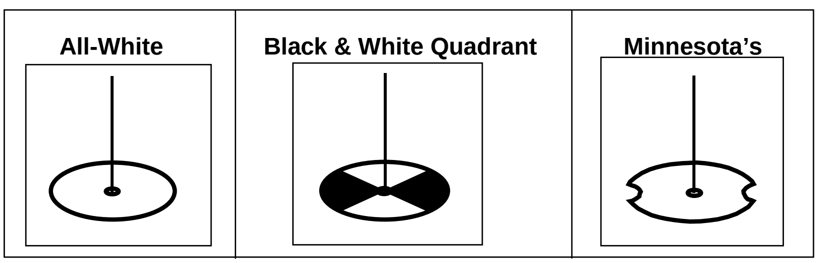


Figure 2. Secchi Disk Color and Style Varieties

What Does a Secchi Disk Measure?

A Secchi disk measures water transparency or clarity. It is a quick and easy measurement that tells scientists a lot about a lake's water quality. First, it indicates the amount of light penetration into a lake (Figure 3). Second, Secchi transparency provides an indirect measure of the amount of suspended material in the water, which in many cases is an indication of the amount of algae in the water. Long-term transparency monitoring by CLMP volunteers provides a valuable basis for detecting trends in water quality. Generally, the sooner water-quality problems are detected, the easier and less expensive it is to restore the lake to its previous state.

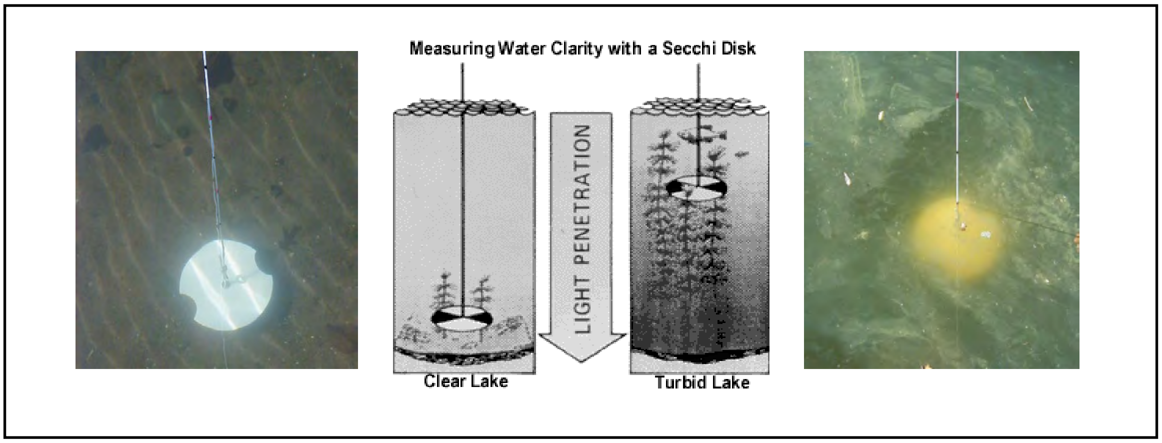
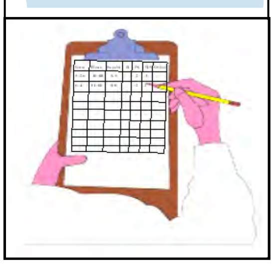


Figure 3. Measuring Water Clarity with a Secchi Disk

How to Take and Record Secchi Readings

Readings should be taken once a week (at least three days apart) primarily during the months of June through September between 10 a.m. and 3 p.m. on bright, calm days. **A minimum of two readings per month is needed to provide meaningful information about your lake**. You should select one location, well off-shore and in a deep part of the lake, and continue monitoring at that one site throughout the summer (See page 5 on selecting a monitoring location).



1. Travel to your designated monitoring location and then anchor your boat.
2. Do *not* wear sunglasses while making a reading, as this affects the accuracy of your reading. If you wear photogradient prescription eyeglasses, prevent them from darkening by wearing a hat with a wide brim.
3. Lower the Secchi disk into the lake on the shaded side of the boat, until the disk *just disappears* completely from view[1]. Note the disk's depth using the marks on the cord.
4. Lower the disk a bit farther and then raise it until it *just reappears*, then note this depth.
5. Average the two depths to the nearest ½ foot to get the transparency reading. Record this average in the "Secchi" column on the CLMP datasheet. Also record the date and time of this reading.

Note: If you monitor more than one site on a lake, each site must have a separate datasheet.

[1] If you can still see the disk on the lake bottom and cannot find deeper water, write a capital "B" in the column after the "Secchi" column. If the lake is choppy, try taking the reading from the stern.

Secchi Disk Tips

- Your disk will last longer and give better service if it is kept clean and protected from scratches and direct sunlight which can damage the paint.
- It is always a good idea to calibrate your Secchi disk rope before beginning each monitoring season to be sure your rope markings reflect accurate measures.
- You may find that your lake is exceptionally clear and that the rope is not long enough. If so, feel free to request a 50 foot calibrated rope from the Citizen Lake Monitoring Program by calling 651-296-6300 (Twin Cities) or 1-800-657-3864 (Greater Minnesota) or email us at **clmp.pca@state.mn.us**.

Additional Lake Monitoring Information

Following the "Secchi" column on your datasheet are columns for recording additional information that will help to accurately denote the condition of your lake. **Please fill out these columns BEFORE you take your Secchi reading so that your observations are not biased by your transparency reading.** For each of these columns, please select only one number. We will not record ranges or fractions.

Physical Condition ("PC" on your datasheet)

Each time that you sample, please select the one number that best describes the physical condition of the lake water *at your sampling site* (not whole-lake conditions).

1 = Crystal clear water
2 = Not quite crystal clear—a little algae present/visible
3 = Definite algae—green, yellow, or brown color apparent
4 = High algal levels with limited clarity and/or mild odor apparent
5 = Severely high algae levels with one or more of the following: massive floating scums on the lake or washed up on shore; strong, foul odor; or fish kill

Suitability for Recreation ("RS" on your datasheet)

Each time that you sample, please select the one number that best describes your opinion of how suitable the lake is for recreation and/or aesthetic enjoyment.

1 = Beautiful, could NOT be better
2 = Very minor aesthetic problems; excellent for swimming, boating
3 = Swimming and aesthetic enjoyment are slightly impaired due to algae levels
4 = Desire to swim and level of enjoyment of the lake substantially reduced due to algae levels (i.e., would not swim, but boating is okay)
5 = Swimming and aesthetic enjoyment of the lake nearly impossible due to algae levels

Water Color

The "Water Color" column is to record the color of the lake water *at your sampling site*. Each time that you sample, please write down the color (i.e., clear, green, tea-stained, etc.) that best describes the color of the water at your sampling site.

Other Notes

The last column is for you to record information about that sampling day for your own use, for example: “saw three loons today,” “slightly cloudy with wind from NE,” or “lake treated with copper sulfate last week.”

Selecting a Monitoring Location

When selecting a lake monitoring site, try to choose one that represents the water quality of the whole lake, as opposed to one that is simply convenient. To do this, study the depth contour map (bathymetric map) of the lake included in your enrollment materials and choose a location that is deep and centrally located in the lake (Figure 4). The site should be away from the shoreline, aquatic vegetation (if possible), underwater bars, points, islands, and river or stream inlets, as these areas may influence the water transparency.

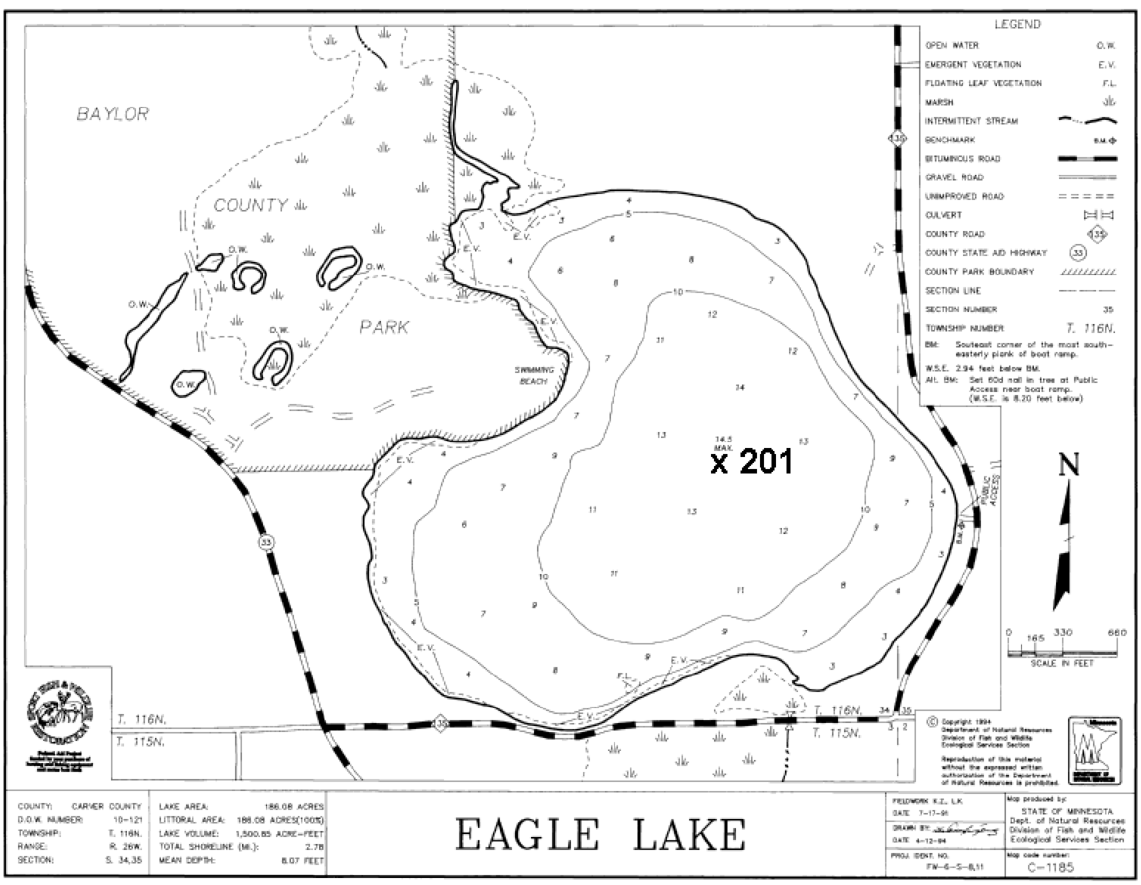


Figure 4. Representative Site Centrally Located on Eagle Lake, Carver County

Some lakes have two or more significant bays or basins. In this case, identify the most representative site of the bay you’re interested in monitoring (it will likely be the deepest point in the center of the bay). We refer to the representative site in the main basin as the “primary site” and representative sites in the smaller basins as “secondary sites” (Figure 5). Water quality can vary between bays or parts of a lake, and the primary site may only represent the water quality of the main basin. By monitoring the secondary sites we can determine if differences in water quality exist between the various basins. Remember, if you choose to monitor more than one site, **please use a separate datasheet for each site**.

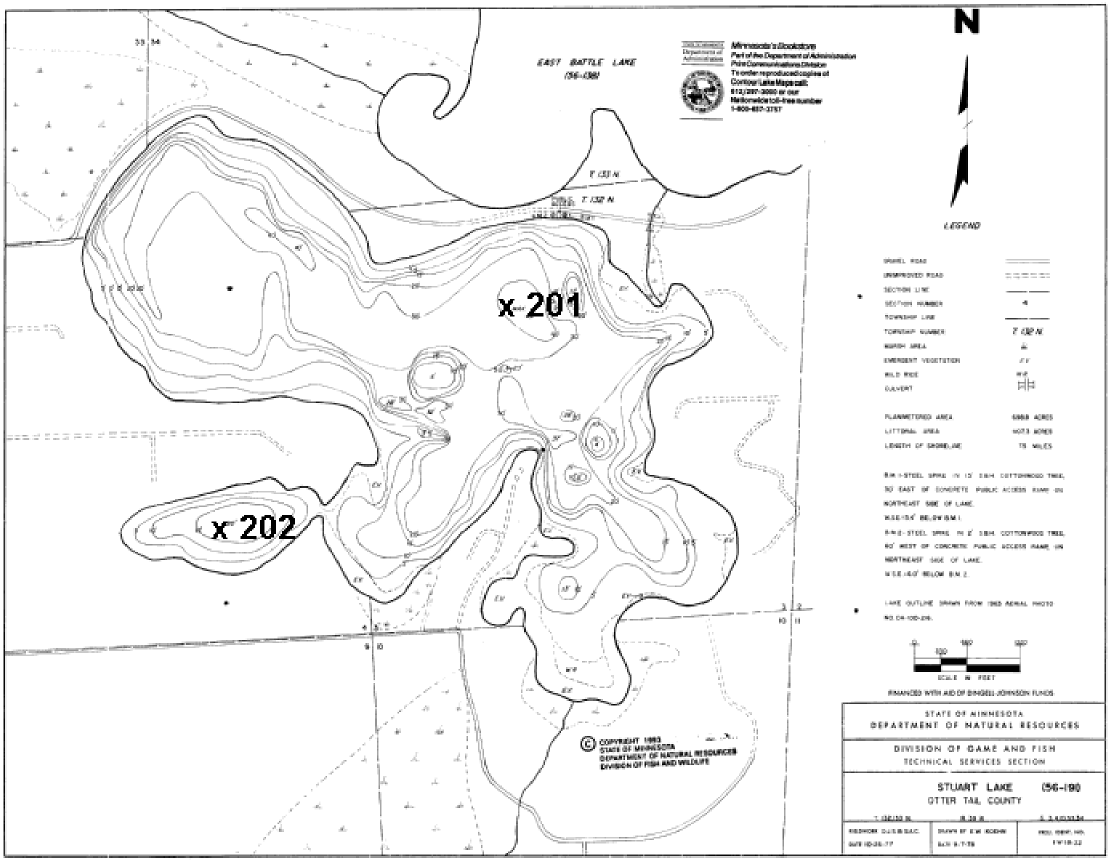


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Figure 5. Representative Sites for Multiple Site Selection: Stuart Lake, Otter Tail County

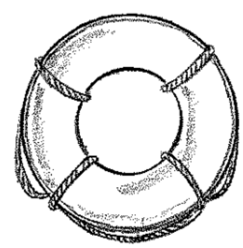
If you would like help in selecting a monitoring site, please contact the CLMP Program staff for assistance (see page 12). It is important to remember that consistent monitoring at the same site increases the ability to detect trends in water quality. When traveling to your site, use equipment such as a depth finder or GPS (Global Positioning Satellite) units on your initial trips until you become familiar with shoreline landmarks. This will make it easier to accurately find your site(s) the next time you monitor.

Site Numbering System

The MPCA has a site numbering system to track lake monitoring locations (sites) over time. All sites are recorded on a series of lake maps and stored in hard copy and in a GIS database. Sites are denoted with a number prefix for each organization or group that conducts monitoring activities. All locations monitored by CLMP participants begin with a "200" prefix number (e.g. 201, 202, 203…etc.). The numbers are assigned on a "first come, first served" or rather, "first monitored, first numbered" basis. For example: John Smith is the first person to monitor his lake. His site is numbered Site 201. The following year, Mark Doe begins monitoring on the same lake at a second site (Site 202). Remember, consistency is the key to detecting long-term water quality trends. When you start monitoring at a specific site, please try to return to that same site each following year. If you participate in more than one monitoring group, such as CLMP or COLA (Coalition of Lake Associations), you need to be sure you record the correct site number for that group's data. If you have any questions, please contact the CLMP Program staff.

Safety Issues

Always take the appropriate safety precautions when conducting your monitoring activities. What may seem like simple, routine monitoring can turn dangerous very quickly. Using the "buddy system" when conducting monitoring activities is not only more fun, it can also reduce danger in case of an emergency. Following are some safety tips to ensure your safety while conducting your monitoring activities:

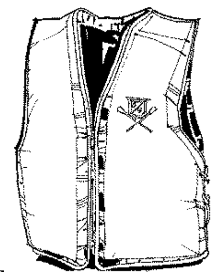


Boating Tips

1. Know and follow all boating rules.
2. Learn how to swim.
3. Make sure you and all occupants of your boat, especially children, wear their Personal Flotation Device (PFD or life jacket) at all times.
4. If your boat should tip over and it still floats, stay with it. If it capsizes, try to right it and re-board. If you cannot right your boat, climb on top and hang on. Immersion in cold water can quickly cause hypothermia.
5. Always obey signs and keep away from lock and dam structures on river systems.
6. Never consume alcohol while boating – this can potentially be a deadly combination.
7. Watch out for other boaters to avoid collisions – for your safety as well as theirs.
8. Minnesota weather can change quickly, so be alert to current weather conditions. Watch for wind shifts or distant lightening. **Never monitor when lightning is present**.
9. Tell someone where you are going and when you expect to return. If there is an emergency, this will help authorities looking for you find you faster.
10. If you get caught in rough waters, head to shore, making sure to head into heavy waves at an angle.

Taking appropriate safety precautions refers not only to following boating tips, but also to having safety equipment along that can help you in times of emergency. Some equipment listed below is optional and some is actually required by Minnesota boating laws, depending upon watercraft and waterbody size. Check your Minnesota Boating Guide booklet to see what equipment is required for your boat.

Safety Equipment



1. Personal Flotation Devices (PFDs). Make sure you have a PFD for each passenger and the right types for your watercraft, including throwable devices such as buoyant boat cushions and ring buoys.
2. Navigational lights.
3. Fire extinguishers – especially for motorized boats.
4. Signaling system. A whistle, horn, bell, flags or flares work well as distress signals.
5. Bailing device. A coffee can, ice cream pail or minnow bucket can work well.
6. Anchor and line.
7. Paddle and/or oars.
8. Flashlight.
9. Small tool kit. Carry a few basics such as screwdriver, pliers, hammer, and wrench along with a few common spare parts for your particular motor.
10. First aid kit.
11. Radio. A portable or two-way radio to catch weather reports can be handy.
12. Compass and charts (or portable GPS unit) can be useful on unfamiliar or large lakes.

The Minnesota Department of Natural Resources (MDNR) offers boating safety information. Some of the free publications you can get include: Minnesota Boating Guide; Hypothermia: The Cold Facts; and Danger-Thin ice. Call the Boat & Water Safety Section of the MDNR at (651)-259-5400 or toll-free at (888)-MINNDNR for more information. Information is also available online at:
www.dnr.state.mn.us/safety/boatwater/index.html.

How Secchi Data is Used

Trophic State Index

Secchi transparency data can be used to convey information about the quality of lakes and be used to predict the amount of nutrients (phosphorus) and algae (chlorophyll-*a*) in a lake. Carlson's Trophic State Index (TSI) is a common way to characterize a lake's trophic status (overall health or productivity). Comparing phosphorus, chlorophyll-*a* and Secchi transparency on Carlson's Trophic State Index scale can establish current trophic status and establish interrelationships between these three variables. It is assumed that Secchi is a good estimator of trophic status for your lake and comparing these variables on the scale will help to confirm this assumption.

The term "trophic status" refers to the level of productivity in a lake. Carlson's Trophic State Index (TSI, Carlson 1977) is one way to examine the relationship between total phosphorus, chlorophyll-*a*, and Secchi disk readings in a lake. Individual TSI values can be calculated from the following equations:

Total phosphorus TSI (TSIP) = 14.42*[ln(TP average)] + 4.15

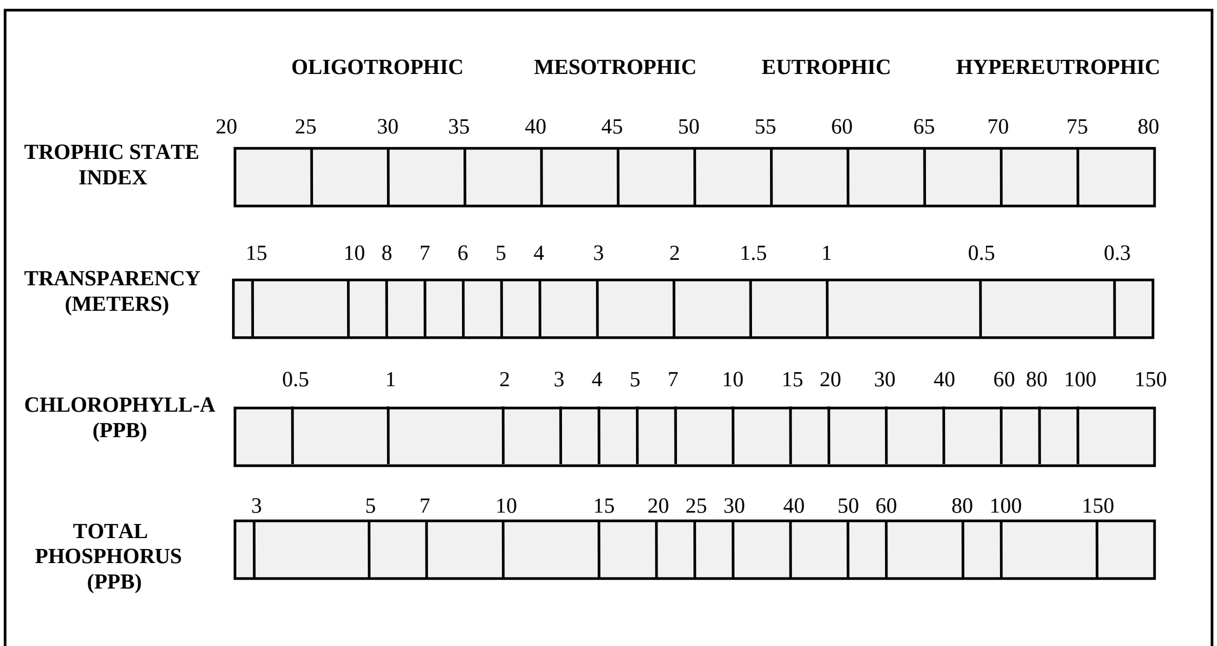
Chlorophyll-*a* TSI (TSIC) = 9.81*[ln(Chlorophyll-*a* average)] + 30.6

Secchi disk TSI (TSIS) = 60 - (14.41*[ln(Secchi average)])

Total phosphorus and chlorophyll-*a* are measured in micrograms per liter (µg/L) and Secchi disk transparency is measured in meters (3.281 feet per meter). The ln function in these equations is the "natural log." (The ln key is found next to the log key on most calculators.) The TSI scale ranges from 0 ("ultra-oligotrophic" or nutrient poor) to 100 ("hypereutrophic" or nutrient rich). Low trophic values (oligotrophic) are often associated with very clean and clear lakes such as those found in the Boundary Waters Canoe Area. High and/or increasing trophic status values indicate more eutrophic (greener, less healthy) conditions. Although total phosphorus and chlorophyll-*a* concentrations are not measured in the basic CLMP, the summer-mean Secchi transparency generally provides a good indication of trophic status for Minnesota's lakes and can be used to estimate likely ranges of total phosphorus and chlorophyll-*a* for your lake (Figure 6).

Figure 6. Carlson's Trophic State Index
R.E. Carlson

TSI < 30	Classical Oligotrophy: Clear water, oxygen throughout the year in the hypolimnion, salmonid fisheries in deep lakes.
TSI 30 - 40	Deeper lakes still exhibit classical oligotrophy, but some shallower lakes will become anoxic in the hypolimnion during the summer.
TSI 40 - 50	Water moderately clear, but increasing probability of anoxia in hypolimnion during summer.
TSI 50 - 60	Lower boundary of classical eutrophy: Decreased transparency, anoxic hypolimnia during the summer, macrophyte problems evident, warm-water fisheries only.
TSI 60 - 70	Dominance of blue-green algae, algal scums probable, extensive macrophyte problems.
TSI 70 - 80	Heavy algal blooms possible throughout the summer, dense macrophyte beds, but extent limited by light penetration. Often would be classified as hypereutrophic.
TSI > 80	Algal scums, summer fish kills, few macrophytes, dominance of rough fish.



After Moore, l. and K. Thornton, [Ed.]1988. Lake and Reservoir Restoration Guidance Manual. USEPA>EPA 440/5-88-002.

Trends

Detecting trends in lake water quality over time is a primary goal for many lake managers and is a concern for local units of government and citizens. For lakes, a minimum of 8–10 years of data (with four or more readings per season) are typically required to detect trends in trophic status. Secchi transparency is one of the best parameters for characterizing lake trophic status and detecting trends. It provides an economical means to assess water quality, estimate lake trophic status, and document water quality trends over time. Transparency is also easily incorporated into volunteer lake monitoring programs, and it allows for the collection of a large number of samples in a given sampling period on many different lakes.

Plotting the summer-mean transparency readings of a lake over time is one way to identify patterns or trends over time (Figure 7). The summer-mean transparency is the average of all readings taken from June – September. Lakes' summer-mean transparencies often vary from year to year in response to changes in the amount of algae due to changes in amounts of nutrient reaching the lake, fisheries composition, and/or climatic changes. It is important to consider these factors when trying to determine if significant long-term changes have occurred or if changes are merely natural variation in a living system. Based on an analysis of several lakes with long-term Secchi transparency data, yearly mean transparencies tend to vary within one to two feet (or about 20 percent) of the long-term mean (Heiskary and Lindbloom, 1993). Consistent variation of more than 20 percent of the long-term mean (or consistent increasing or decreasing summer-means) may be indicative of a trend.

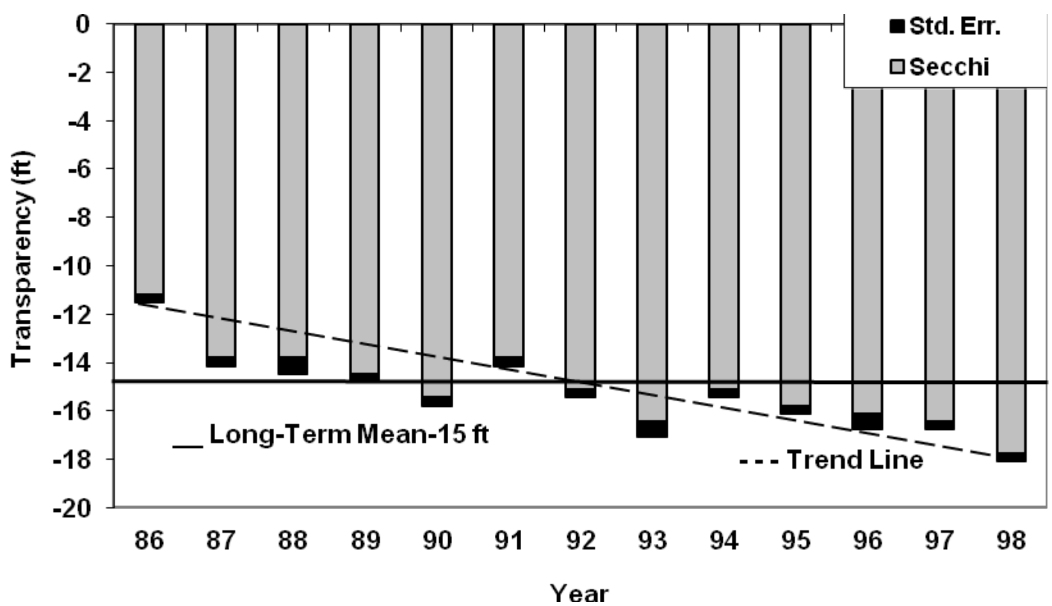


Figure 7. Summer Mean Secchi Transparency Big Turtle Lake (31-0725), Itasca County

In addition to plotting the data, it is helpful to statistically analyze the data. Kendall's tau-b is a statistical test that has been used in previous MPCA 305(b) reports to Congress (MPCA, 1990 and 1992) for assessing trends in Secchi transparency over time. In 2006, the decision was made to switch statistical packages to one that could easily analyze all the data in one quick process. The statistical package SYSTAT[G], was selected. The minimum requirements remained the same: only lakes with 4 or more transparency readings per summer (June – September) and 8 or more years of data were analyzed. When performing trend analysis, it is important to consider the strength of the correlation, p-level, and number of years of data before determining if the trend is "significant"; and if further investigation, including additional monitoring, is warranted.

What's the next step after you've identified a possible trend? Gathering historic data on the lake and its watershed is a good place to start. This can include reviewing existing water quality data as well as information on land uses within the watershed of the lake. Examining activities in the watershed may provide anecdotal and perhaps quantitative information which might help substantiate or explain why a trend has occurred. Collecting additional water chemistry, in particular additional trophic status data—phosphorus and chlorophyll-*a*, is helpful as well. Comparing current water quality data to historic data can also help to understand trend findings. It is important to develop a monitoring plan before collecting additional chemistry data. This plan should help you decide what questions you are trying to answer and what parameters and sampling frequency will best help you answer those questions. It should be developed cooperatively by a committee of representatives from state agencies such as the Minnesota Department of Natural Resources and MPCA, local units of government, and lake association members.

To view trends determined with CLMP data, visit our web site at**:**
http://cf.pca.state.mn.us/water/cmp/index.cfm.

Submitting Data Electronically

We don't currently have a way for volunteers to enter their data on-line via the Web. However, if you would like to submit your data electronically, and you have completed at least one year in the program, you can submit your data electronically via Excel spreadsheet. If you are interested in this opportunity, please email us and we'll send you the spreadsheet. (Volunteers need to complete at least one year in the program because their 200-series site number is assigned after the first year of monitoring.)

Citizen Lake Monitoring Program Staff

For information or assistance with CLMP please call 651-296-6300 (Twin Cities) or 1-800-657-3864 (Greater Minnesota) and ask to speak with the Citizen Lake Monitoring Program coordinator or email **clmp.pca@state.mn.us**.

Glossary of Important Lake-Related Terms

Acid Rain: Rain with a higher than normal acid range (low pH). Caused when polluted air mixes with cloud moisture. Can damage fish populations.

Algal Bloom: An unusual or excessive abundance of algae.

Alkalinity: Capacity of a lake to neutralize acid.

Bioaccumulation: Build-up of toxic substances in fish flesh. Toxic effects may be passed on to humans eating the fish.

Biomanipulation: Adjusting the fish species composition in a lake as a restoration technique.

Dimictic: Lakes which thermally stratify and mix (turnover) once in spring and fall.

Ecoregion: Areas of relative homogeneity. EPA ecoregions have been defined for Minnesota based on land use, soils, landform, and potential natural vegetation.

Ecosystem: A community of interaction among animals, plants, and microorganisms, and the physical and chemical environment in which they live.

Epilimnion: Most lakes form three distinct layers of water during summertime weather. The epilimnion is the upper layer and is characterized by warmer and lighter water.

Eutrophication: The aging process by which lakes are fertilized with nutrients. *Natural eutrophication* will very gradually change the character of a lake over time. *Cultural eutrophication* is the accelerated aging of a lake as a result of human activities.

Eutrophic Lake: A nutrient-rich lake – usually shallow, "green" and with limited oxygen in the bottom layer of water.

Fall Turnover: Cooling surface waters, activated by wind action, sink to mix with lower levels of water. As in spring turnover, all water is now at the same temperature.

Hypolimnion: The bottom layer of lake water during the summer months. The water in the hypolimnion is denser and much colder than the water in the upper two layers.

Lake Management: A process that involves study, assessment of problems, and decisions on how to maintain a lake as a thriving ecosystem.

Lake Restoration: Actions directed toward improving the quality of a lake.

Lake Stewardship: An attitude that recognizes the vulnerability of lakes and the need for citizens, both individually and collectively, to assume responsibility for their care.

Limnetic Community: The area of open water in a lake providing the habitat for phytoplankton, zooplankton and fish.

Littoral Community: The shallow areas around a lake's shoreline, dominated by aquatic plants. The plants produce oxygen and provide food and shelter for animal life.

Mesotrophic Lake: Midway in nutrient levels between the eutrophic and oligotrophic lakes.

Nonpoint Source Pollution: Polluted runoff – nutrients and pollution sources not discharged from a single point: e.g. runoff from agricultural fields or feedlots.

Oligotrophic Lake: A relatively nutrient- poor lake, it is clear and deep with bottom waters high in dissolved oxygen.

pH Scale: A measure of acidity.

Photosynthesis: The process by which green plants produce oxygen from sunlight, water and carbon dioxide.

Phytoplankton: Algae – the base of the lake's food chain, it also produces oxygen.

Point Source Pollution: Specific sources of nutrient or polluted discharge to a lake: e.g. stormwater outlets.

Polymictic: A lake which does not thermally stratify in the summer. Tends to mix periodically throughout summer via wind and wave action.

Profundal Community: The area below the limnetic zone where light does not penetrate. This area roughly corresponds to the hypolimnion layer of water and is home to organisms that break down or consume organic matter.

Respiration: Oxygen consumption.

Secchi Disk: A device measuring the depth of light penetration in water.

Sedimentation: The addition of soils to lakes, a part of the natural aging process, makes lakes shallower. The process can be greatly accelerated by human activities.

Spring Turnover: After ice melts in spring, warming surface water sinks to mix with deeper water. At this time of year, all water is the same temperature.

Thermocline: During summertime, the middle layer of lake water. Lying below the epilimnion, this water rapidly loses warmth.

Trophic Status: The level of growth or productivity of a lake as measured by phosphorus content, algae abundance, and depth of light penetration.

Turbidity: Particles in solution (e.g. soil or algae) which scatter light and reduce transparency.

Water Density: Water is most dense at 39 degrees F (4 degrees C) and expands (becomes less dense) at both higher and lower temperatures.

Watershed: The surrounding land area that drains into a lake, river or river system.

Zooplankton: Microscopic animals suspended or drifting in the water column.

References

Carlson, R.E. 1977. A Trophic State Index for Lakes. Limnology and Oceanography 22:361-369.

Carlson, R.E. and Simpson, J. 1996. A Coordinators Guide to Volunteer Lake Monitoring Methods. North American Lake Management Society, Madison, Wisconsin.

Heiskary, S.A. and Lindbloom, J.L. 1993. Lake Water Quality Trends in Minnesota. MPCA. St. Paul, Minnesota.

Related Web Sites:

www.pca.state.mn.us	MPCA Web site
www.pca.state.mn.us/water/clmp.html	CLMP Web site
http://www.pca.state.mn.us/water/clmp-plus.html	Advanced CLMP Web site
www.dnr.state.mn.us	Minnesota DNR Web site
www.minnesotawaters.org	Minnesota Waters Web site

Related Publications

You can find additional information on lakes from these publications. They cover information for both the beginner and advanced lake enthusiast from identifying lake and watershed characteristics to advanced monitoring practices.

1. *Guide to Lake Protection and Management.* A publication available from the Freshwater Society for purchase. For a copy, call 952-471-9773. It is also available online at **www.pca.state.mn.us/water/lakeprotection.html**.

2. *Volunteer Surface Water Monitoring Guide.* This publication is available from the MPCA. For a copy, call 651-296-6300 (Twin Cities) or 1-800-657-3864 (Greater Minnesota) or download a copy from **www.pca.state.mn.us/water/monitoring-guide.html**.

Additional MPCA Monitoring Programs

Advanced Citizen Lake Monitoring Program (CLMP+) – Volunteers who have participated in the CLMP for at least two years may be eligible to participate in the Advanced Citizen Lake Monitoring Program (CLMP+). The CLMP+ enables participants to collect additional water quality parameters including temperature, dissolved oxygen, phosphorus and chlorophyll-a. For more information about the CLMP+, please visit **http://www.pca.state.mn.us/water/clmp-plus.html**. You can also call 651-296-6300 (Twin Cities) or 1-800-657-3864 (Greater Minnesota) and ask to speak with the Citizen Lake Monitoring Program coordinator or email **clmp.pca@state.mn.us**.

Citizen Stream Monitoring Program –Modeled after the Citizen Lake-Monitoring Program, this program focuses on monitoring streams and rivers throughout Minnesota. For more information, please visit **www.pca.state.mn.us/water/csmp.html**. You can also call 651-296-6300 (Twin Cities) or 1-800-657-3864 (Greater Minnesota) and ask to speak with the Citizen Stream Monitoring Program Coordinator or email **csmp.pca@state.mn.us**.

Clean Water Partnerships - The Clean Water Partnership Program provides matching grants to local units of government to protect and improve lakes, streams, and ground water that are affected by nonpoint source pollution. These programs provide a detailed characterization of in-lake water quality and information to develop a detailed nutrient and water budget for the lake. For more information about the Clean Water Partnership Program, call 651-296-6300 (Twin Cities) or 1-800-657-3864 (Greater Minnesota).

Clarity: A measure of water quality

A Secchi disk is used to measure lake water's transparency (clarity). An example of a lake with low transparency is shown on the left, and an example of a lake with high transparency is shown on the right. Water with high transparency allows light to reach further down into the water column and benefits the lake's plant and animal life, as well as people who use the lake for recreation.