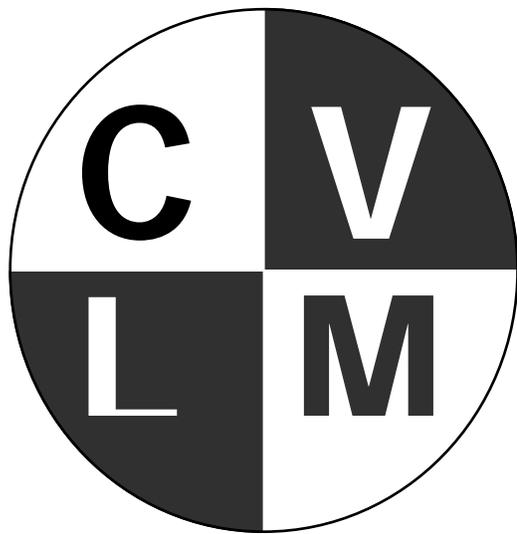


Colorado Volunteer Lake Monitoring



Monitoring Handbook

April 2009

Background

Colorado has over 1,500 lakes and reservoirs over 10 acres in size. These lakes and reservoirs offer tremendous recreational opportunities, whether they are used for boating, fishing, swimming, or quiet enjoyment. They also offer habitat for waterfowl and other wildlife. Many reservoirs are used for drinking water supplies and flood control. In short, Colorado lakes and reservoirs are an integral part of our lives.

Because they are so important, we all must insure that our lakes and reservoirs maintain their beauty and water quality. Unfortunately, keeping close track of the water quality of each body of water would be a costly and difficult undertaking.

The time and expense of monitoring the water quality of all our publicly owned lakes and reservoirs has encouraged the Colorado Division of Wildlife (CDOW) to work with Colorado Lake & Reservoir Management Association (CLRMA) to form the Colorado Volunteer Lake Monitoring (CVLM) program. Through this program, you can learn more about your favorite lake or reservoir and other lakes throughout Colorado. CVLM is modeled closely after the successful citizen monitoring programs in Wisconsin, Illinois, Indiana, and Minnesota.

Who Runs the Program?

The CVLM program is a cooperative effort by three groups: Volunteers, CDOW, and CLRMA.

Volunteers will determine the success of this program. With proper training and consistency, the volunteer data will be useful and reliable. CDOW will manage the data that you collect and will enter it into a database. CLRMA will take care of the administration and communication with the volunteers. At the end of the sampling season, CLRMA will send you a “Lake Report Card” and a summary of all the lakes. The statewide summary will allow you to compare the water quality of your lake to others. It will be presented in easy-to-understand graphs and written comments. The annual summaries will allow the State to closely monitor water quality changes and identify management needs at the participating lakes and reservoirs. Colorado’s volunteer data will also be shared with the annual “Great North American Secchi Dip-In” event and your data can be compared to other regions of the country.

Why is a volunteer lake monitoring program so important?

According to the State’s 2004 305(b) water quality assessment report, only 45% of Colorado’s lake’s and reservoir’s surface area has been sampled over the past six years. Colorado needs to monitor many more lakes and reservoirs around the state to get a better understanding on the overall conditions. Your efforts will provide a number of benefits not only for the State, but also for you. Here’s how:

As a volunteer you will learn more about lake science (*limnology*).

You will learn not only about taking Secchi disk transparency readings but also about other water quality tests. However, the data you collect will be valuable *only* if you take the readings carefully and according to the following set of procedures.

By analyzing and summarizing the information that you collect, we will be able to assess the changes in water quality of your lake. This is particularly important for lakes where little information has been gathered in the past.

After we have summarized the data, we will be able to compare the water quality of lakes around the state. This information will allow us to better understand our Colorado lakes and reservoirs and see what is happening in certain areas of the state.

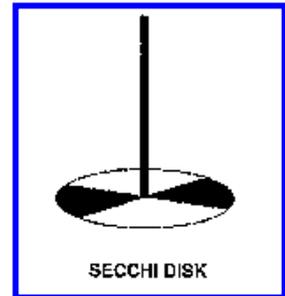
Once we have several seasons' worth of data for a particular lake, we can begin to assess the long-term trends in the lake's water quality. Five years' worth of Secchi disk data will provide an indication if the lake is being degraded, is improving, or is stable when it comes to water clarity. Five seasons of sampling is the minimum to establish long-term trends.

You will become a spokesperson for your lake or reservoir. You will understand how the system works and where the best fishing spots are for that water body.

Your monitoring can identify if your lake needs more intensive management and/or monitoring.

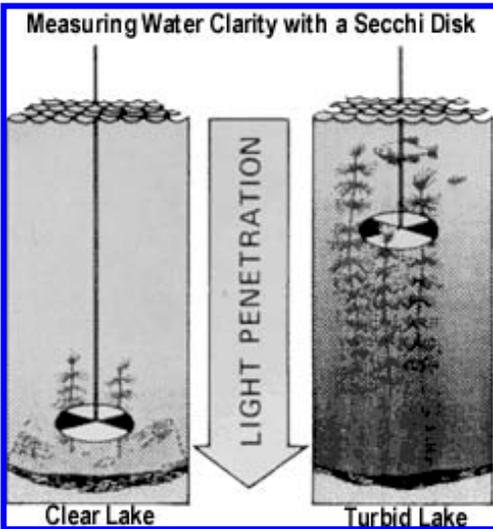
What Do These Measurements Say About Water Quality?

The Secchi disk that you receive as part of your volunteer kit is used to measure water clarity (transparency). It is one of the oldest and most basic tools used by limnologists around the world. The Secchi disk is an eight-inch diameter disk painted black and white in alternating quarters. It is attached to a fiberglass measuring tape marked in **tenths** of feet.



Secchi disk measurements of water clarity can tell a great deal about the water quality of lakes. Water clarity is affected by two factors: algae and suspended sediments. Sediments may be introduced into the water by either runoff from the land or from sediments already on the bottom of the lake.

Many activities may introduce sediments to lakes via runoff: examples include erosion from construction sites, agricultural lands, and riverbanks. Bottom-feeding fish such as carp may re-suspend bottom sediments. In shallow lakes, motorboats or strong winds may suspend bottom sediments.



Algae are a natural component of the food chain in lakes. They are food for microscopic animals (zooplankton), which are, in turn eaten by fish. We are usually only aware of algae when they become overly abundant. Algae are microscopic plants, which grow like all other plants; they need sufficient light and nutrients to survive. When there are too many nutrients in the lake, the algae multiply enough to cause a decrease in water clarity. The decrease will be seen when you take the Secchi disk transparency reading.

Of course, algae and suspended sediments are not the only factors that will affect your Secchi disk reading. Other factors that may affect your reading will be the color of the water, wind, waves, sunlight, and even your eyesight. Some lakes have a natural brown color. The color is not an indication of pollution or suspended sediments, but of tannic acids produced by decaying plants. Light

does not penetrate as deeply in these darkened waters so these “stained” lakes will generally have fewer algae than clear lakes.

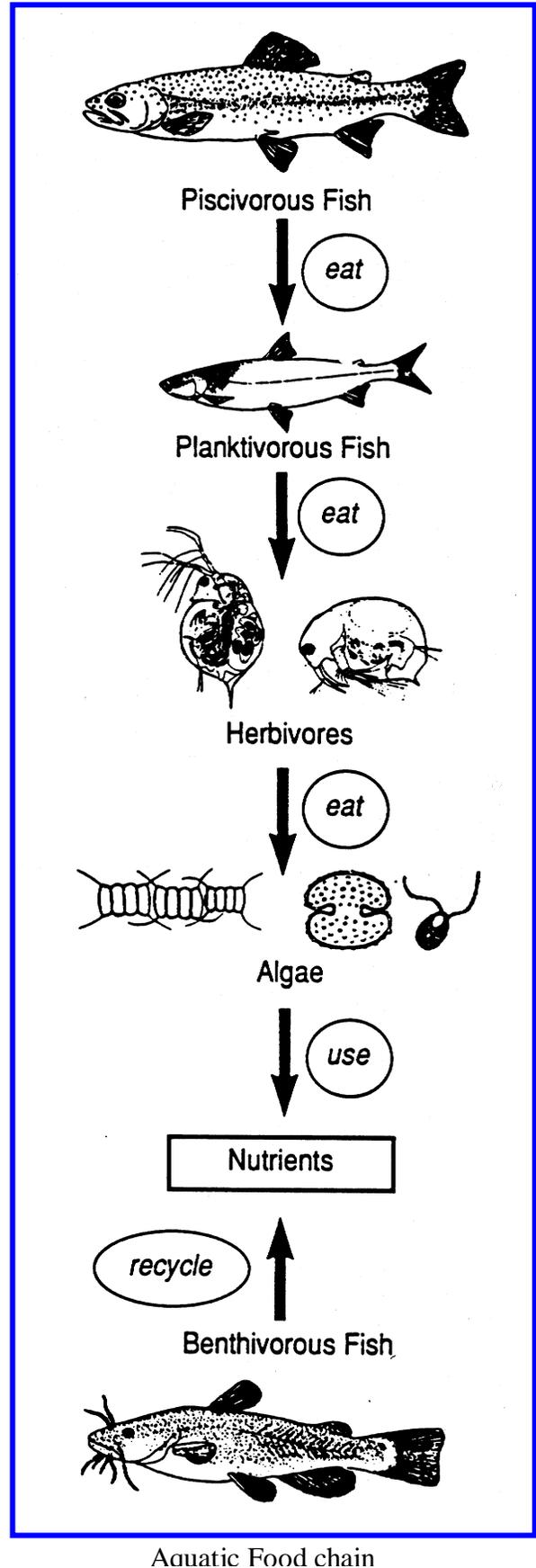
Secchi disk transparency readings can also give a rough estimate of the depth to which oxygen can support fish and other aquatic life. Generally the Secchi disk depth times 1.7 is the depth to which light can penetrate. For example, if your Secchi disk reading was 10 feet, then light can penetrate to a depth of approximately 17 feet. If light can penetrate this far, then there is enough light to support an algal population. The *photic zone* is defined as the vertical depth of a lake that has enough light to support plant growth. Algae use the light to produce energy through a process called photosynthesis. The algae release oxygen as a by-product of photosynthesis. The fish that live in the deeper waters of the lake use this oxygen.

When to Take a Reading?

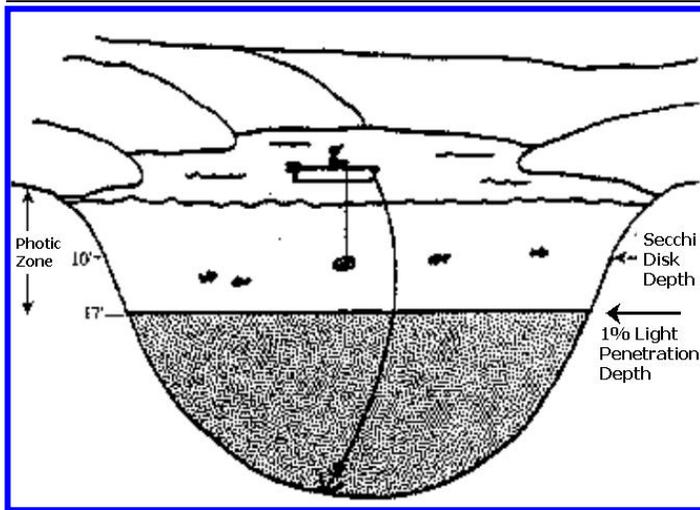
The weather is another factor that will affect your ability to read the Secchi disk. Try to take your readings on days when the lake is calm and the sky is clear. The angle of the sun will affect your ability to see the disk, so take readings between 10 a.m. and 4 p.m. Winds creating high waves will adversely affect your ability to read the disk.

The goal of our program is to have transparency monitored *once every two weeks*. Try to make the sampling a regular part of your activities. If you are able to take a reading every week, great!

Water transparency following intense rainstorms or heavy boating activity is often lower than other times. This is to be expected. For example: with other state volunteer monitoring programs, many of the volunteers report shallower transparencies on Saturdays, Sundays, and Mondays than on other days of the week. We encourage you to vary the day of the week that you make your Secchi disk measurement. This will help cover the range of conditions common on your lake. We especially encourage you to make a measurement after a heavy storm runoff, weather permitting of course. Use the comment section of the data card to indicate if there was a recent heavy rain or other event that could affect your reading. We will analyze your



Aquatic Food chain



data according to day of the week measured and according to any special conditions you note.

If you are unable to take your scheduled reading, do not worry. Take it as soon as you are able. If for some reason you are unable to continue to sample during the sampling season, please contact CLRMA. In this event, it would be extremely helpful to the program if you could provide us with the name of another person interested in volunteering to take the readings.

Where to Take a Reading?

It is important to take your measurement at the same location every time, in the center/deepest area of your lake. In order to be consistent, you will need to either have a GPS unit that will record your lat/long coordinates or you will need use permanent landscape features and a topo map to line you up. Please record the lat/long coordinates from your GPS unit or from a map your first time out.

Other Information to Collect

After you make each Secchi disk transparency measurement, we'd like you to also record the water color, recreation potential of the lake, and physical appearance of the water.

Date/Time/Weather: It is important to document the date, time, and weather when you sample. The time of day and what day of the week can help explain the Secchi reading. Sunny, cloudy, wind direction, and wave action observations can also help with interpreting the data that is collected.

Water Color: A lake's water color can give insight into whether transparency is affected by algae (green color) or suspended sediments (brownish color) or even what kind of algae (green, blue-green, yellow-brown...). Water color can be determined by lowering your Secchi disk into the water to about one-half the Secchi disk depth. Look at the water color against the white background of the disk. Compare the water color to one of the 6 colors represented on your color chart. Record this color number on the Secchi Disk data log and the data postcard.

Recreational Potential: We would also like to get your opinion of your lake's "recreational potential" at the time you take your Secchi disk measurement. This helps us relate Secchi disk transparency to the use and appearance of your lake. Remember, this should be your opinion on the condition of your lake. For the "recreational potential", if everything looks great, circle "beautiful" on the date card. If the water looks really scummy and you personally wouldn't want to swim in the lake, circle "no swimming". If swimming isn't allowed in your lake, we'd still like you to consider "recreational potential" as if swimming was allowed.

Physical Appearance: Similarly, circle the condition that you feel best represents the lake's physical appearance when it comes to algae. Lakes can change hourly in algae appearance so make your observation right after you take your Secchi depth readings.

Sampling Checklist

Before going out on the lake to take your Secchi disk reading, make sure that you have everything you need and the weather conditions are okay for sampling!! Please confirm everything on this checklist.

Weather:

- Sunny/partly sunny/partly cloudy
- Winds calm to breezy **(NO WHITECAPS!!)**

Time of day:

- Between 10:00 a.m. and 4:00 p.m.

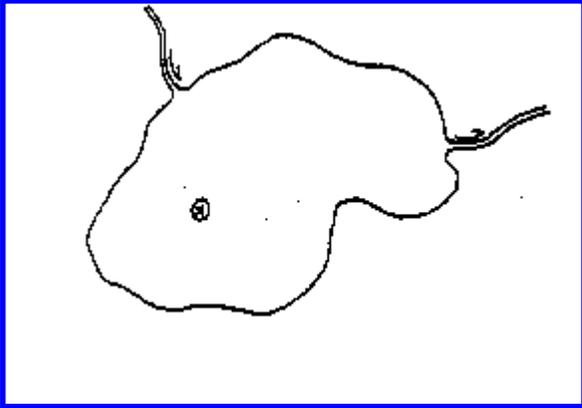
Do you have:

- Secchi disk with secured tape measure
- Boat anchor with long enough rope
- Lake or Reservoir map
- Coordinates or barrings of monitoring location
- GPS unit if you have one
- Cell phone if you have one
- Color chart
- Sampling instructions
- Secchi Disk Data Log
- A new data postcard
- 2 permanent ink pens to write with
- Life vest and whistle
- Colorado Safety Boating Booklet
- All the necessary equipment for your boat (e.g. gas and oars)

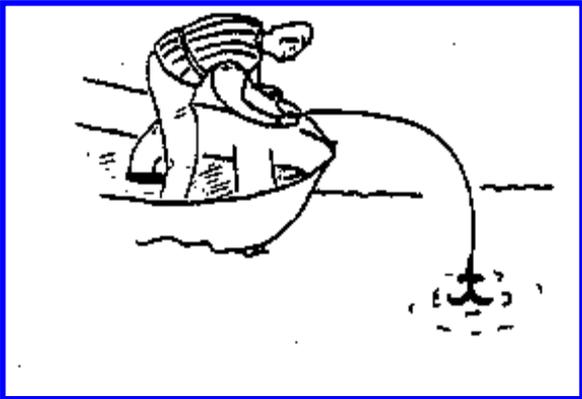
INSTRUCTIONS: How to Take a Secchi Disk Reading

When taking the Secchi disk readings, be sure to follow these instructions exactly!

It is vital that all the volunteers collect the same data the same way so we can compare your lake to others. In order for your data to be usable, you must follow these directions exactly. Remember, do not feel guilty about missing a scheduled reading, do it when you have the time. **NEVER** make up data. We would rather have no data than invalid data. Most of all enjoy your time on the lake.

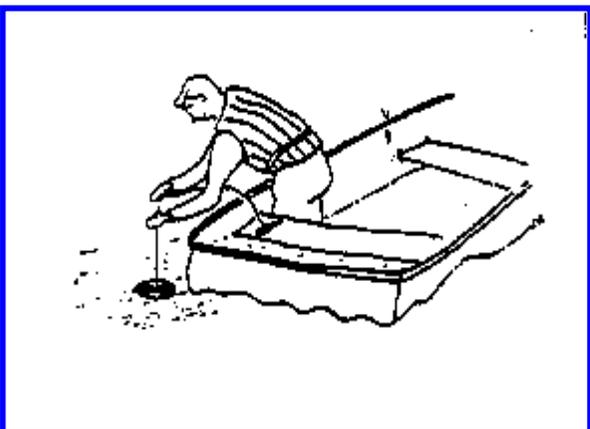


Use the map of your lake and its marked sampling site and proceed to the site. (Always take your Secchi disk measurements from the same location.)



Anchor the boat at the sampling site. Remove sunglasses if wearing them. Wait a couple of minutes to check that your boat is not drifting.

Double check your Secchi Disk to make sure it is securely connected to the tape measure.

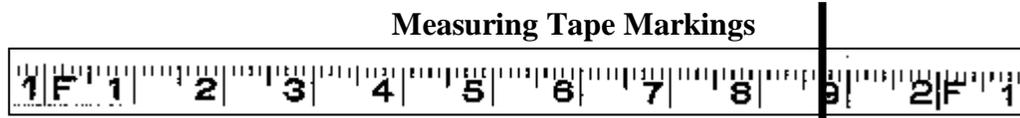


Lean over the **shady** side of the boat and slowly lower the Secchi disk into the water until it can no longer be seen. Record this “*lowering depth*” in tenths of feet (where the waterline touches the tape measure).

Lower the disk another 4-5 feet and then slowly pull the Secchi disk up. When the disk reappears, record this “*raising depth*” to the nearest tenth of a foot (where the waterline touches the tape measure).

Take the average depth between these two recordings and that is your “*Secchi depth*”.

Remember: the tape measure has two different sides, one side is marked off in inches (white side) and the other side is marked off in tenths (1/10) of feet (yellow side). **MAKE SURE YOU RECORD IN TENTHS OF FEET (YELLOW SIDE OF THE TAPE MEASURE).** Between each foot marker, there are 10 divisions, not 12. For example, if you record 1.6 it is **1.6 feet**, not 1 foot 6 inches, which would actually be 1.5 feet.



Tape Measure: Carefully read off the depth to the nearest **tenth** of a foot.
(Example above (dark line) is 1.9 feet, not 1 foot 9 inches)

Record the three measurements (Lowering Depth, Raising Depth, and Average Depth) on the date card and data log sheet in the boat as soon as you take the measurements so you don't forget them.

INSTRUCTIONS: How to Take a Water Color Reading

To determine the water color after taking the Secchi disk reading, lower the Secchi disk into the water to ½ the Secchi disk depth and observe the water color against the white background. Record your observation by writing down the number that corresponds to the color square that closely matches what you see. With only 6 options, please select the color that is the closest to what you see.

Finally, record what you think the “Recreation Potential” and “Physical Appearance” are for your lake at the time of your monitoring. Remember to record the corresponding value on your data log sheet and your postcard.

INSTRUCTIONS: How to Record your Readings and Observations

It is important for you to fill out the Secchi Disk Data Log and a data postcard as soon as you are done monitoring. Double-check all data entry fields for completeness and errors before leaving the lake.

The Secchi Disk Data Log is for you to keep track of your data during the year. At the end of the season, you will mail the data log in. It's important for you to keep your own datasheet incase a data postcard gets lost in the mail. It will help you remember when you have been out on your lake and what the previous conditions were like. It will also be an end-of-the-year QA/QC check for us to compare your datasheet to the CDOW database.

Data Postcard:

The data postcards must be completely filled out. They can either be physically mailed to CLRMA or e-mailed to Slundt@mwr.dst.co.us (e-mail is preferred).

For physically mailing, make sure the postcard is completed and legible. Also make sure the correct amount of postage is on the postcard.

For e-mailing, make sure you provide all the information from the postcard into the body of the e-mail. This will help avoid any technical problems with attached documents.

Sample of Data Postcard

	Colorado Volunteer Lake Monitoring Program	
	<u>Data Postcard</u>	
Your Name: _____	Lake Name: _____	
Sample Date: _____	County: _____	
Sample Time: _____	Weather: _____	
<u>SECCHI DISK TRANSPARENCY: (record to nearest 1/10 foot)</u>		
Lowering Depth: _____	Raising Depth: _____	Ave. Depth: _____
Water Color (select one number from color chart): 1 2 3 4 5 6		
<u>RECREATION POTENTIAL</u>		<u>PHYSICAL APPEARANCE</u>
<i>(Circle One)</i>		<i>(Circle One)</i>
1 Beautiful		1 Crystal Clear
2 Minor Aesthetic problems		2 Some Algae
3 Swimming Impaired		3 Definite Algae
4 Would not Swim		4 High Algae (scum)
5 No Recreation Possible		5 Severe Algae
Comments: _____		

Make sure you fill in all the information (your name, lake name, county, sample data/time, weather, lowering depth, raising depth, and average Secchi depth, water color number, circle appropriate recreation potential and physical appearance, and write down any other comments).

Mail the data postcard at your earliest convenience or at least monthly to:
 CLRMA
 P.O. Box 9504
 Denver, CO 80209

After taking your Secchi disk reading, be sure to:

- Store your Secchi disk, color chart and equipment in a dry place.
 - Go over the data form and make sure it's complete.
 - Carefully copy the data onto the CVLM postcard. Make sure it's all filled out. Mail the postcard to CLRMA, P.O. Box 9504, Denver, CO 80209
- OR-**
- Send an e-mail with all the information in the body of the e-mail to: slundt@mwr.dst.co.us