Introduction

As King County residents, we want clean lakes so that we can enjoy the recreational opportunities and the natural beauty they afford. We also want to ensure that our lakes provide a quality environment for fish, frogs, waterfowl, and other wildlife that inhabit our water resources.

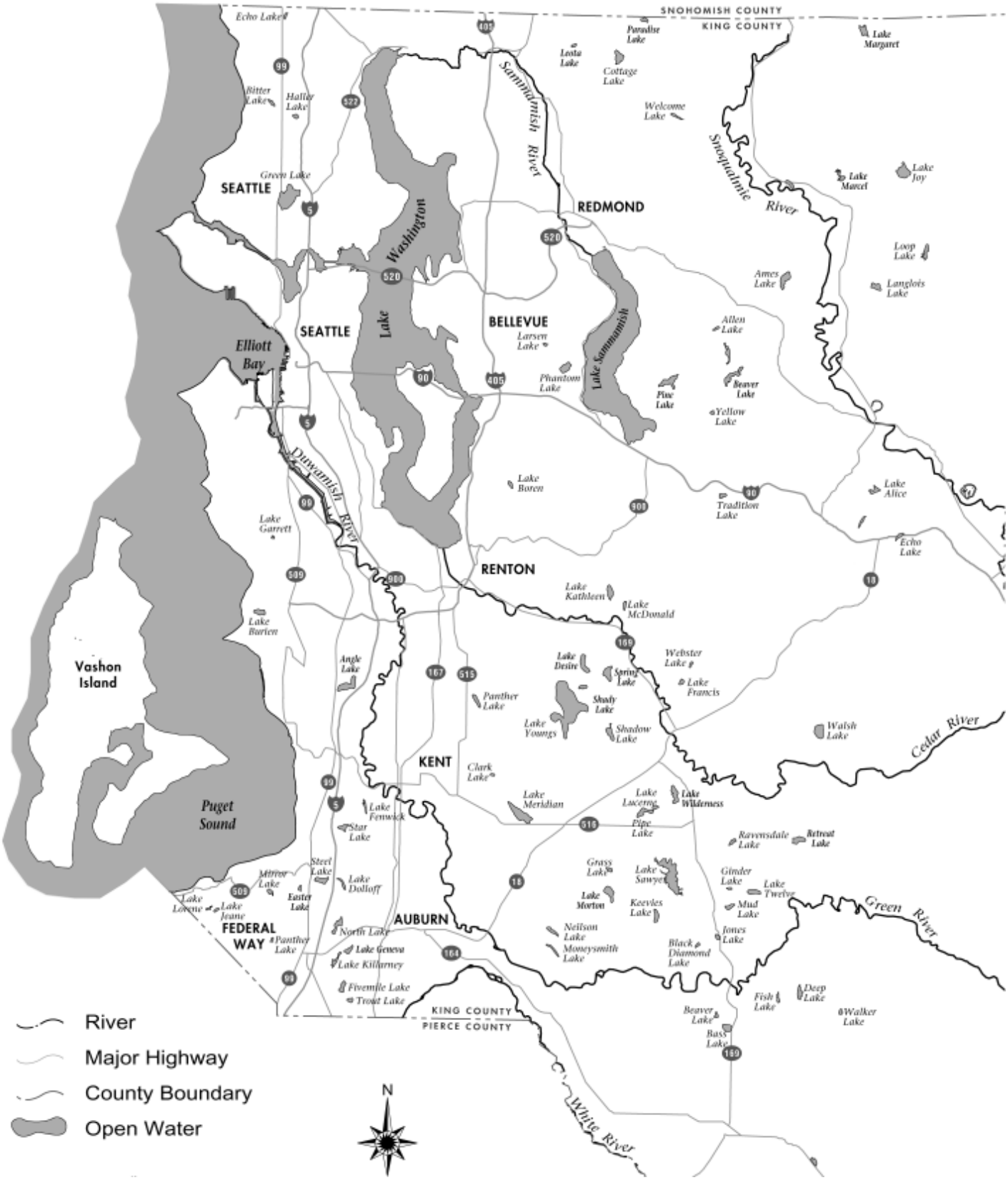
Our everyday actions can profoundly affect these fragile freshwater systems, degrading the very qualities that attracted us to them in the first place. For example, nutrients in fertilizers, detergents, failing septic systems, eroding soil, and animal waste can cause algae to bloom and aquatic plants to grow and multiply rapidly. Too many plants, in turn, can reduce water clarity and clog our lakes, interfering with swimming, boating, and other recreational uses.

By regularly monitoring the status of our lakes, we can evaluate how our actions may affect lake water quality. This information teaches us how to be better stewards of our lakes and watersheds. King County's Lake Stewardship Program provides many opportunities to learn how lakes function and how to protect their water quality. The program offers technical assistance to lakeside residents, publishes a quarterly newsletter, provides lake-related workshops, and supports a network of volunteer lake monitors.

Lakeside residents may volunteer their time to serve as Level I, Level II, or back-up monitors on their lake. Level I volunteers collect information on lake level and precipitation every day, as well Secchi depth and lake temperature on a weekly basis. Level I volunteers participate in these activities year round. Level II volunteers collect water samples for chemical analysis (phosphorus, nitrogen, and chlorophyll *a)* as well as phytoplankton identification every other week from late April through October. They also collect data on physical parameters such as temperature and Secchi depth. Back-up monitors serve an important role by filling in for regular Level I or Level II monitors when they go on vacation or have to miss their data collection activities for a specified period.

This manual provides a standard set of methods for Level I or Level II volunteers. By following manual guidelines, volunteers will collect consistent, reliable, and representative data from their lakes that can be used to evaluate both seasonal and long-term trends in lake water quality and lake level.

Lake Locations for Western King County



Paradise Lake

Purpose of Data Collection

Lake water quality is affected by both the quantity and quality of the water flowing into it. In a watershed, human activity and associated land use practices play a large role in determining the lake's overall water quality.

The Lake Stewardship program depends on the data collected by volunteers to:

- Develop data records for individual lakes
- Evaluate trends in lake level and water quality over time
- Measure how water quality varies with water depth
- Detect lake problems and assist residents in problem solving
- Educate lake users
- Encourage stewardship of the region's lake resources

With your participation as a volunteer monitor, we can build a program that enables us to evaluate and track the health of the region's lakes.

Getting Started

Time commitment varies between Level I and level II monitoring programs. Requirements of each monitoring program are outlined below. Many volunteers choose to participate in both Level I and Level II programs, although it is not required.

For Level I, we provide all necessary monitoring equipment. You will need:

- A boat or access to a boat and a place to launch it
- A lifejacket
- Dock or fixed post for lake level gauge
- About 10 minutes each day and about 30 minutes once a week

For Level II, we provide all necessary monitoring equipment. You will need:

- A boat or access to a boat and place to launch it
- A lifejacket
- About one hour every other Sunday or Monday between late April and October
- A secure place to store monitoring equipment

Level I Requirements: All Year

Task	Frequency	Notes
Measure accumulated precipitation	Daily	~ Same time each day
Measure lake level	Daily	~ Same time each day
Measure Secchi depth	Weekly	~ Same day each week
Measure lake temperature	Weekly	~ Same day each week
Wildlife and lake use observations	Weekly	~ Same day each week
Mail completed datasheets	Monthly	

Level II Requirements: Late April-October

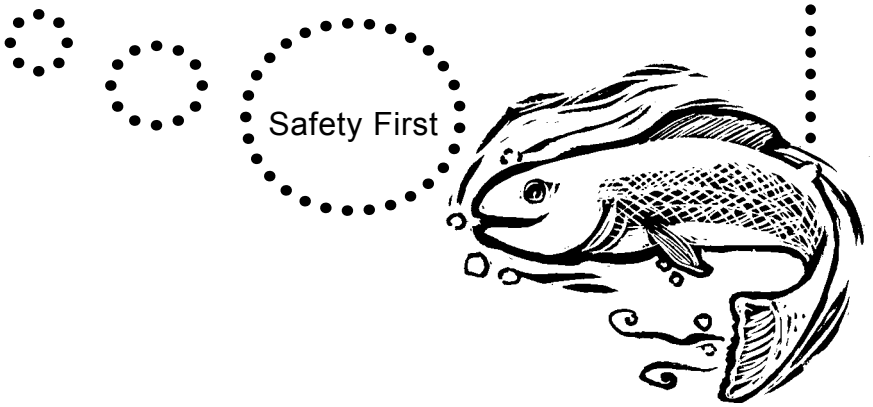
Task	Frequency	Notes
Collect water sample	Every other week	Either Sunday or Monday
Measure Secchi depth	During each sampling trip	Using Secchi disk
Measure lake temperature	During each sampling trip	Using thermometer in sampler
Wildlife and lake use observations	During each sampling trip	
Put sample on ice in cooler on porch	After each sampling trip	Call Lake Stew Program staff if anything changes
Place datasheets with samples	After each sampling trip	

We can accommodate levels of participation other than the two outlined above. Discuss options with a Lake Stewardship program staff person.

Safety Rules for All Monitors

Safety should be the primary consideration for all volunteer monitors. Everyone needs to take personal responsibility for safety, especially during bad weather (thunderstorms and windy or rainy conditions). Additionally, docks and boats can have slippery surfaces and small boats like canoes can become unstable. Remember to follow these common sense rules:

- Wear a life jacket when sampling from a boat.
- Know your local boating requirements and obey any specific restrictions applicable to your lake.
- Know how to operate the boat you are using, especially if it is not your own.
- Take a free boating safety course (Call (800) 336-BOAT for more information).
- Obey all laws and practice safe boating.
- Use good judgment—**Do not go out on the lake and collect data if you think it is unsafe!** No data is worth the risk of an accident.



Lake Sawyer

Sampling Location

Both Level I and Level II volunteer monitors will need to locate the deepest part of their lake in order to record Secchi depth measurements and/or gather water samples. A depth contour map for your lake is provided on page 13. This map identifies the deepest portion of your lake and will help you to establish a permanent sampling location. Follow the steps below to establish bearing lines that will enable you to return to the same location each time you sample or make your measurements.

1. Position your boat in the sampling location shown on your lake map.
2. Before establishing your first bearing line, verify that you are at the lake's deepest spot by measuring the length of line it takes to anchor your boat in this location. The depth should correspond closely to the maximum depth shown on your lake map.
3. If you find yourself at a depth less than the depth shown for your sampling location, try repositioning your boat until you have located the deepest area. Let us know if it is significantly different than what is shown on the map. We can come out to get GPS coordinates for your location for our records.

GPS _____

Latitude _____

Longitude _____

1st Bearing Line:

_____

_____

_____

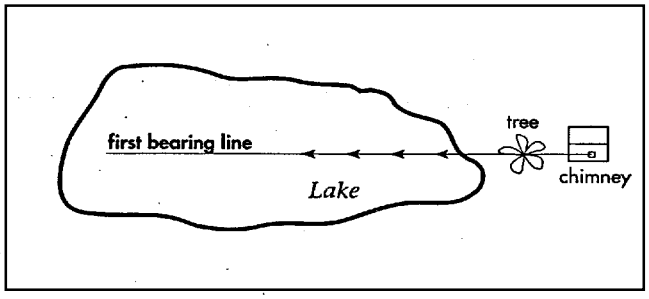
2nd Bearing Line:

_____

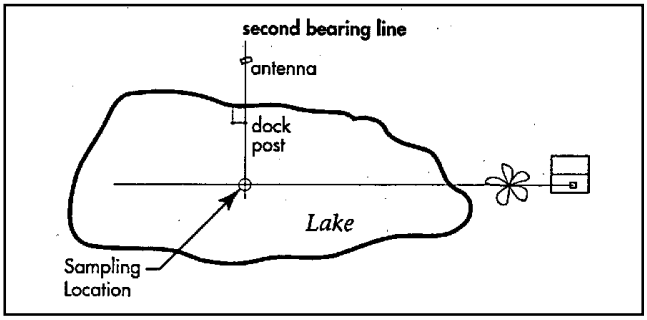
_____

_____

4. If you have a hand-held GPS device, you can use this to mark your position. Otherwise, you can use the following procedure.
5. To return to the same location every time you sample, you will establish your first bearing line by identifying two fixed objects (trees, chimneys, docks, houses, fence posts) on the shore that can be lined up with one another, one in the foreground and one in the background.



6. Once you have identified the two objects to use, you may need to alter your position slightly on the lake to get them to line up. The line that is formed between you and the shoreline objects is your first bearing line.
7. To establish your second bearing line, you will need to examine the shoreline area that is as close as possible to a right angle (90 degrees) from your first bearing line. Again, find two objects that line up with one another and form your second bearing line.



8. The intersection of your two bearing points should coincide with the deepest point in your lake and your permanent sampling location.
9. In the space provied at the left, write a description of the objects you are using for establishing your bearing lines onto your lake map.
10. Each time you sample, be sure to use these same bearing lines to pinpoint your sampling location.

Level I Sampling Instructions

The following instructions are provided to ensure that all Level I monitors collect data in the same manner. By following these procedures, data collected by different volunteers can easily be compared and contrasted.

These instructions will help you understand how to collect and record your data correctly. Please read them throughly. Proper data collection and entry will help staff by eliminating questions, discrepancies, and ambiguities in your data. Proper record keeping also makes it easier for staff to enter your data into the database, report the data in the program's newsletter, and analyze the data for the annual report as well as for trends over time.

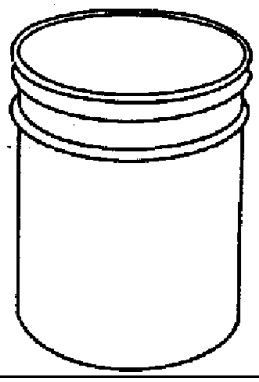
As a Level I monitor you will:

- Measure lake level and precipitation on a daily basis from your property or a specific site you have chosen on the shoreline.
- Measure Secchi depth and lake temperature on a weekly basis from your boat while anchored at your designated lake sampling location.

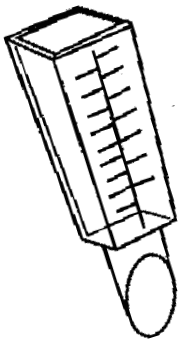
Level I Monitoring Equipment

Your Level I sampling kit should contain the following equipment:

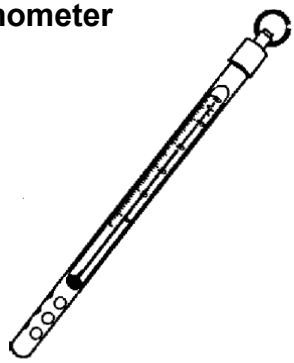
Bucket



Rain Gauge

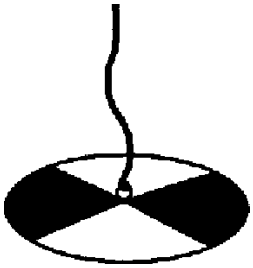


Thermometer

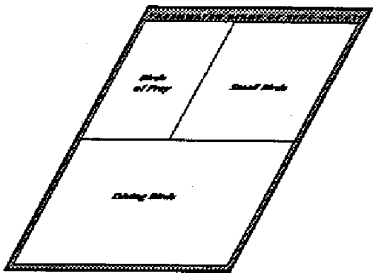


Manual

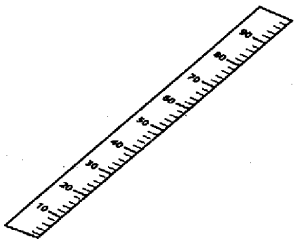
Secchi Disk



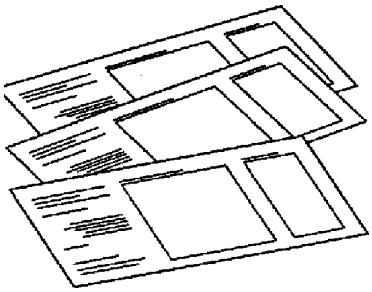
Bird/Algae Info Card



Lake Level Gauge



Data Sheets



Note: You will need to supply your own boat, anchor, and life preserver.

Record Initial Data

If possible, conduct your daily measurements at the same time each day. For weekly measurements, conduct them on the same day of the week and at the same time of day. The most important thing to remember is to be consistent from day to day and from week to week. For the weekly sampling trip:

1. Gather your sampling gear, anchor, and safety equipment in your boat. Locate your sampling station and anchor your boat (see "Sampling Location" section, pages 11-12).
2. Use a #2 pencil to record data on the data sheets. Fill out your name, lake name, phone, date, and time on the data sheet.
3. Under "Time," enter the time using a 24-hour time format: 6 a.m.= 0600, Noon =1200, 6 p.m.=1800, and Midnight=2400.
4. Fill in data sheet. Under each column heading, indicate cloud cover, wind conditions, algae level and aquatic plant estimates, and bird counts. In the lake use column, indicate the total number for each category. In the comment column, make notes on other items of interest.
5. If for some reason you are unable to record your measurements, draw a line through the dates you missed. If you are going to be away for more than a few days, try to arrange for a substitute.

Level I Weekly Data Sheet Example (Blank)

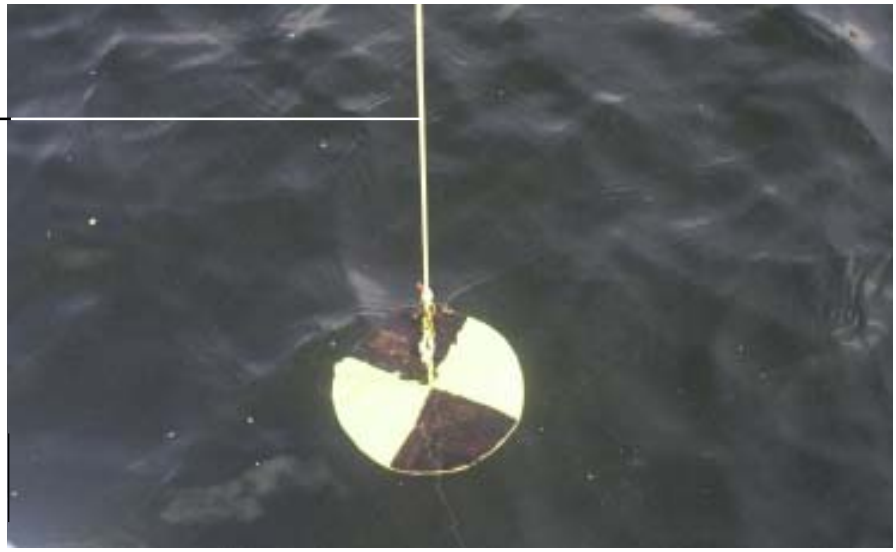
Level One Weekly Datasheet

Week Starting	Date Recorded	Time (24:00)	Secchi Depth (m)	Temp. °C (at 1m)	Cloud Cover	Wind Conditions	Algae and Aquatic Plants	Shoreline	Sample site	Bird Count	Shoreline	Sample site	Lake Use	Comments
1-Jul-02					❑ Sunny ❑ Pt. Cloudy ❑ Cloudy ❑ Raining	❑ None ❑ Slight ❑ Breezy ❑ Stormy	Algae Aquatic plants	/ /		Canada Geese Domestic Geese	/ /		Boats____ Fishing____ Swimmers____	
7-Jul-02					❑ Sunny ❑ Pt. Cloudy ❑ Cloudy ❑ Raining	❑ None ❑ Slight ❑ Breezy ❑ Stormy	Algae Aquatic plants	/ /		Canada Geese Domestic Geese	/ /		Boats____ Fishing____ Swimmers____	
14-Jul-02					❑ Sunny ❑ Pt. Cloudy ❑ Cloudy ❑ Raining	❑ None ❑ Slight ❑ Breezy ❑ Stormy	Algae Aquatic plants	/ /		Canada Geese Domestic Geese	/ /		Boats____ Fishing____ Swimmers____	

Measure Secchi Depth

1. On sunny days, work on the shady side of the boat to eliminate glare.
2. If you are wearing sunglasses, remove them before you begin making your measurements.
3. The Secchi disk line is marked in 0.5 meter increments. Lower the Secchi disk into the water. Continue lowering the disk into the water until the disk is no longer visible.

Disk line (marked in 0.5 meter increments)



4. Place a finger on the line at the water's surface to mark that point.
5. Raise the disk until it becomes visible again. Mark this spot on the line with your other hand.
6. Record the midpoint between these two measurements as the Secchi depth, estimating your value to the nearest 0.25 meter.

Measure Temperature

1. Take your temperature measurement at the same location as the Secchi depth measurement.
2. Measure lake temperature by lowering the thermometer to one meter below the surface for approximately two minutes.
3. Record your lake temperature under "Temp" to the nearest 0.5 degrees Celsius (Centigrade).

Count Nuisance Geese

We are instituting a count of Canada geese and domestic geese on our lakes. In large numbers these birds can contribute to water quality problems. Domestic geese (escaped or feral birds) can also be aggressive and hostile. Count the birds you can identify ***without binoculars*** from two locations:

1. from your launch point
2. from your sampling site

Observe Algae and Aquatic Plants

Each time you venture onto the lake to collect a sample and/or measure physical attributes, record the density of algae and aquatic plants you see in two areas of the lake:

1. around the shoreline (at and near your launch point), and
2. at your sampling site (distance you can see from where you anchor)

Use these guidelines when making your observations of algae and aquatic plant density and distribution.

Categorizing Visible Algae

Algae in the water can appear as nebulous clouds or as small floating particles, depending on the species. Lower the Secchi disk to a depth of about one meter and look at the water above it against the white portions of the disk. Use the chart on the next page as a guide in making your observations of algae along the shoreline and at your sampling site.

Algae Classification Chart

Rating	Description
NA	Clear water; no visible algae, either cloudy or particulate
C1	Very faint cloudiness
C2	Moderate cloudiness
C3	Very cloudy, murky water
P1	A few algae particles or colonies visible above the Secchi disk (1–10)
P2	Moderately dense with particles (10–100)
P3	A lot of algae - bloom conditions. (>100 particles or colonies)

If an algae bloom manifests with cloudy water and particulate algae or colonies, you may combine a “C” rating with a “P” rating on your datasheet.

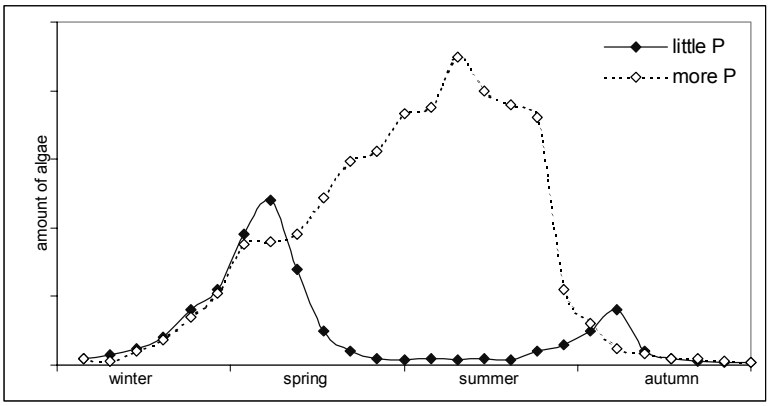
Categorizing Visible Aquatic Plants

Use these categories to estimate the density of floating and rooted aquatic plants around the shoreline and at your sampling site. Use F1-F3 for floating-leaved aquatic plants (water lilies, hyacinth) and S1-S3 for submersed aquatic plants (milfoil, fanwort). You don’t need to include emergent plants such as iris, cattails, or rushes.

Rating	Description
NP	No visible aquatic plants
F1 or S1	1-10 plants per square meter
F2 or S2	10 – 50 plants per square meter
F3 or S3	>50 plants per square meter

Be consistent in how you categorize aquatic plant and algae density through the course of the season. If you think plant densities at your lake could become a problem, please contact a member of the Lake Stewardship program staff.

Illustration of Seasonal Abundance



This figure shows the two general patterns that volumes of algae in a lake can make over a calendar year. The solid line illustrates a common pattern when little phosphorus is available for growth. The dotted lines illustrate what may happen with more phosphorus available.

Did You Know?

Lakes undergo numerous changes seasonally. These changes include the following highlights:

- Most lakes stratify into temperature layers during the late spring and early summer as the warmer, less dense surface waters float on the cooler, denser bottom waters.
- The stratification process leads to decreased oxygen levels in the cooler waters and facilitates internal cycling of nutrients within the lake.
- Nutrients combined with warm water temperatures and long days, increase the rate of plant growth.
- More plants (especially microscopic algae), in turn, decrease the water clarity.

A Little History Lesson

The Secchi Disk is named after its inventor, astronomer Pietro Angelo Secchi. Secchi was born in Italy in 1818 and trained as a Jesuit priest. He spent his early years teaching physics in Rome before being sent into exile to the United States in 1848. Secchi eventually returned to Rome in 1849 to direct the Roman Observatory. As the Pope's scientific advisor, he was asked in 1865 to assist the papal fleet in measuring the transparency of nearby coastal waters. During a series of optical experiments, Secchi fashioned and tested a variety of disks. From these experiments, the modern-day Secchi disk was developed. Even in this day of advanced technology, this simple measuring device remains a mainstay for both lake and ocean scientists around the world.

Measure Precipitation

1. Install your rain gauge in an area open to the sky and away from overhanging objects (such as trees or the side of a building).
2. Try to read your gauge at the same time each day and record the total rainfall in **millimeters**. Record this number in the precipitation column and empty your gauge.
3. If you collect snow in your rain gauge, take it inside, allow the snow to melt, and then enter the data. If extended freezing occurs, make sure your rain gauge is empty or take it inside until temperatures are above freezing again, otherwise the gauge may crack. Also, remember to mark "frozen" on your data sheet for these dates.

Measure Lake Level

1. Staff will assist you in identifying a place on your dock or other permanent fixture in the lake to locate your lake level gauge. Complete installation instructions for your lake level gauge are found in Appendix B.
2. Try to read your lake level at the same time each day. Record this number in **centimeters** on your data sheet under in the lake level column. On windy days, you may have to estimate the approximate lake level by taking an average of the high or low marks created by each wave.

Daily Data Sheet

Date	Precip. (mm)	Lake Level (cm)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		

Completed Data Sheet

1. At the end of each month, make a copy of your data sheet for yourself and mail in the original so that we can incorporate the data into our quarterly newsletter and annual volunteer report.
2. Double check that you have filled in your name and contact information.

Example of Completed Weekly Data Sheet—Remember to send in completed data sheets at the end of each month.

Level One Weekly Datasheet

Week Starting	Date, Time, Secchi, Temp.		Cloud Cover	Wind Conditions	Algae & Aquatic Plants	Shoreline	Sample site	Bird Count	Shoreline	Sample site	Lake Use	Comments
1-Jul-02	Date:	3-JULY	☐ Sunny	☐ None (glassy water)							Boats 11	Cold day for July!
	Time (24hr):	1430	☐ Pt. Cloudy	☑ Slight (ripples)	Algae	NA	NA	Canada Geese	4	Ø	Fishing 2	
	Secchi (m):	3.25	☐ Cloudy	☐ Breezy (small wavelets)							Swimmers Ø	
	Temp. (° C at 1m):	17	☑ Raining	☐ Storm (waves/whitecaps)	Aquatic plants	F1/S1	NP	Domestic Geese	Ø	Ø		
7-Jul-02	Date:	10-JULY	☐ Sunny	☐ None (glassy water)							Boats 2	
	Time (24hr):	1545	☑ Pt. Cloudy	☐ Slight (ripples)	Algae	NA	NA	Canada Geese	4	Ø	Fishing 1	
	Secchi (m):	3.5	☐ Cloudy	☑ Breezy (small wavelets)							Swimmers Ø	
	Temp. (° C at 1m):	18	☐ Raining	☐ Storm (waves/whitecaps)	Aquatic plants	F1/S1	NP	Domestic Geese	Ø	Ø		
14-Jul-02	Date:	16-JULY	☑ Sunny	☐ None (glassy water)							Boats 1	
	Time (24hr):	1500	☐ Pt. Cloudy	☑ Slight (ripples)	Algae	NA	NA	Canada Geese	5	Ø	Fishing Ø	
	Secchi (m):	3.5	☐ Cloudy	☐ Breezy (small wavelets)							Swimmers Ø	
	Temp. (° C at 1m):	20	☐ Raining	☐ Storm (waves/whitecaps)	Aquatic plants	F1/S1	NP	Domestic Geese	Ø	Ø		
21-Jul-02	Date:	24-July	☐ Sunny	☑ None (glassy water)							Boats 3	
	Time (24hr):	1430	☑ Pt. Cloudy	☐ Slight (ripples)	Algae	NA	NA	Canada Geese	6	Ø	Fishing 1	
	Secchi (m):	3.75	☐ Cloudy	☐ Breezy (small wavelets)							Swimmers Ø	
	Temp. (° C at 1m):	20	☐ Raining	☐ Storm (waves/whitecaps)	Aquatic plants	F1/S1	NP	Domestic Geese	Ø	Ø		
28-Jul-02	Date:	31-July	☑ Sunny	☑ None (glassy water)							Boats 4	Green algae; Bloom began 30-July
	Time (24hr):	1415	☐ Pt. Cloudy	☐ Slight (ripples)	Algae	P1	P1	Canada Geese	4	Ø	Fishing 1	
	Secchi (m):	3.0	☐ Cloudy	☐ Breezy (small wavelets)							Swimmers 4	
	Temp. (° C at 1m):	21	☐ Raining	☐ Storm (waves/whitecaps)	Aquatic plants	F1/S2	NP	Domestic Geese	Ø	Ø		

Record observations of algae, aquatic plants, and birds at both the shoreline (your launch site) and your sample location.

KEY: Algae: No algae (NA) Cloudy algae (C1-C3) Particulate algae (P1-P3) Aquatic plants: None (NP) Floating (F1-F3) Submersed (S1-S3)

Lake Desire

Level II Sampling Instructions

This section provides Level II monitors with an overview of monitoring equipment, data record keeping, and sampling methods. This information is provided to ensure that all Level II monitors collect data in the same manner and at the same intervals. By following the same sampling methods each time, data collected by different volunteers can be easily compared and contrasted.

Please take a moment to read over these data collection instructions. Proper data collection and entry will help reduce questions and discrepancies when staff enter your data into the database, report the data in the program's newsletter, and analyze the data for the annual report.

From late April through October, you will collect water samples every other week, as well as reading the Secchi depth and water temperature. The water samples will be analyzed for:

- nitrogen
- phosphorus
- chlorophyll *a*

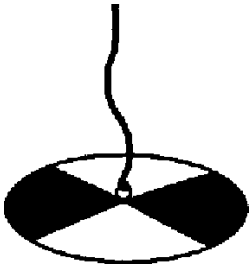
Level II Monitoring Equipment

Your Level II sampling kit should contain the following equipment:

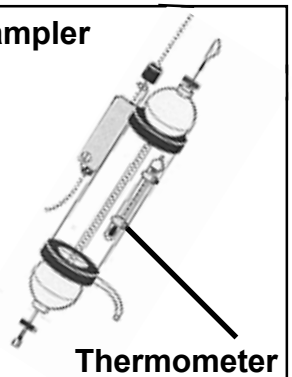
Bucket

Manual

Secchi Disk



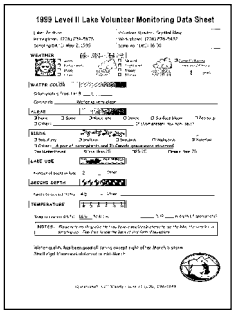
Water Sampler



Thermometer

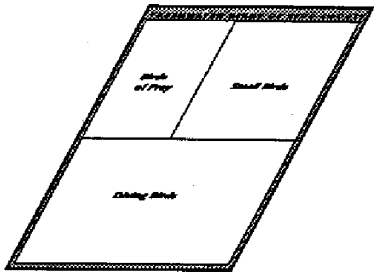
Sample Bottles

Data Sheets



1999 Level II Lake Volunteer Monitoring Data Sheet

Bird/Algae Info Card

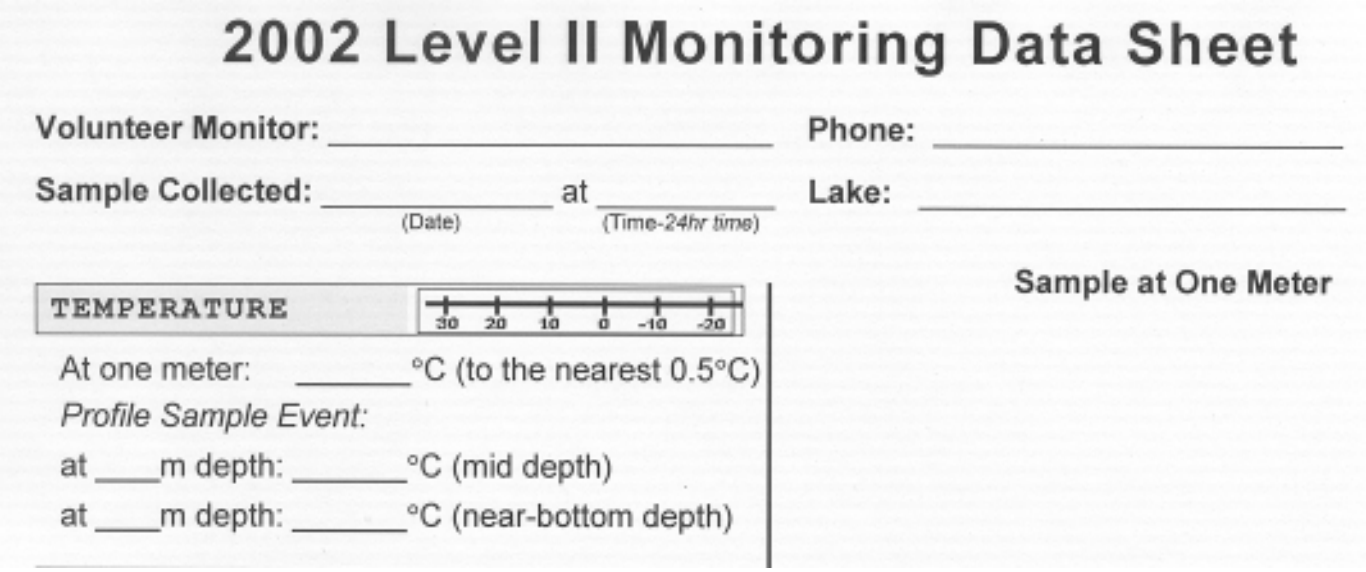


Note: You will need to supply your own boat, anchor, and life preserver.

Record Initial Data

The most important thing to remember is to be consistent in how you collect your samples, take your measurements, and record your data. **Whenever possible, conduct your biweekly sample collection and measurements at the same time of day.**

1. Gather your sampling gear, anchor, and safety equipment in your boat. Locate your sampling station and anchor your boat. (See Sampling Location, page 11-12 if you have questions.)
2. Use a #2 pencil to record data on the data sheets. Fill out Name, Phone, Date, and Time. Under "Time," enter the time you measured your data and took water samples using a 24-hour time format, that is 6:00 AM=0600, 6:00 PM=1800, Noon=1200, and 12:00 Midnight=2400.
3. Note the weather conditions, the presence or absence of algae and aquatic plants, and bird counts. Also indicate the total number of boats on the lake.
4. If for some reason you are unable to collect your samples and make your measurements, please notify a staff member. Try to arrange for a substitute whenever you are going to be away for an extended period of time.



2002 Level II Monitoring Data Sheet

Volunteer Monitor: _____ **Phone:** _____

Sample Collected: _____ (Date) at _____ (Time-24hr time) **Lake:** _____

Sample at One Meter

TEMPERATURE 30 20 10 0 -10 -20

At one meter: _____°C (to the nearest 0.5°C)

Profile Sample Event:

at ____m depth: _____°C (mid depth)

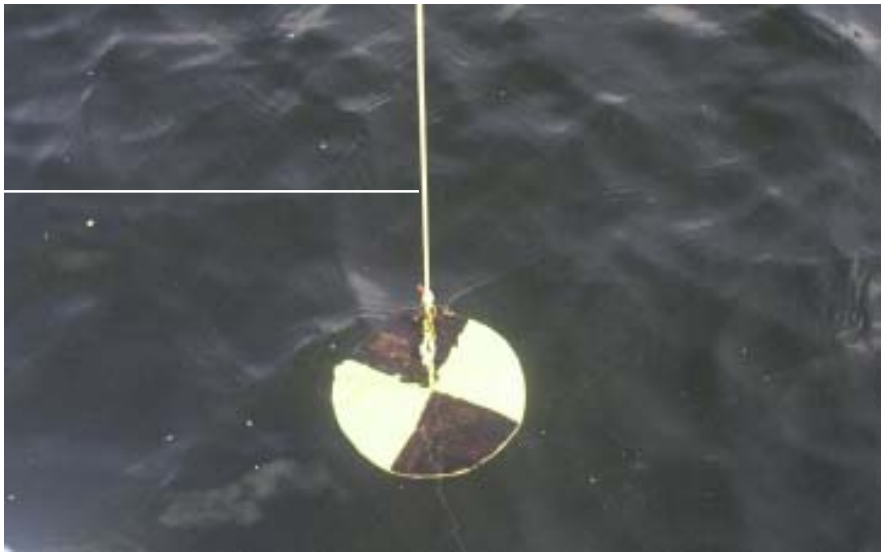
at ____m depth: _____°C (near-bottom depth)

(Example of entire Level II Data Sheet on Page 33)

Measure Secchi Depth

1. On sunny days, you will need work on the shady side of the boat to eliminate glare.
2. If you are wearing sunglasses, remove them before you begin making your measurements.
3. The Secchi disk line is marked in 0.5 meter increments. Lower the Secchi disk into the water. Continue lowering the disk into the water until the disk is no longer visible.

Disk line (marked in 0.5 meter increments)



4. Place a finger on the line at the water's surface to mark that point.
5. Raise the disk until it becomes visible again. Mark this spot on the line with your other hand.
6. Record the midpoint between these two measurements as the Secchi depth, estimating your value to the nearest 0.25 meter.

Count Nuisance Geese

We are instituting a count of Canada geese and domestic geese on our lakes. In large numbers these birds can contribute to water quality problems. Domestic geese (escaped or feral birds) can also be aggressive and hostile. Count the birds you can identify ***without binoculars*** from two locations:

1. from your launch point
2. from your sampling site

Observe Algae and Aquatic Plants

Each time you venture onto the lake to collect a sample and/or measure physical attributes, record the density of algae and aquatic plants you see in two areas of the lake:

1. around the shoreline (at and near your launch point), and
2. at your sampling site (distance you can see from where you anchor)

Use these guidelines when making your observations of algae and aquatic plant density and distribution.

Categorizing Visible Algae

Algae in the water can appear as nebulous clouds or as small floating particles, depending on the species. Lower the Secchi disk to a depth of about one meter and look at the water above it against the white portions of the disk. Use the chart below as a guide in making your observations of algae along the shoreline and at your sampling site.

Algae Classification Chart

Rating	Description
NA	Clear water; no visible algae, either cloudy or particulate
C1	Very faint cloudiness
C2	Moderate cloudiness
C3	Very cloudy, murky water
P1	A few algae particles or colonies visible above the Secchi disk (1–10)
P2	Moderately dense with particles (10–100)
P3	A lot of algae - bloom conditions. (>100 particles or colonies)

If an algae bloom manifests with cloudy water and particulate algae or colonies, you may combine a “C” rating with a “P” rating on your datasheet.

Categorizing Visible Aquatic Plants

Use these categories to estimate the density of floating and rooted aquatic plants around the shoreline and at your sampling site. Use F1-F3 for floating-leaved aquatic plants (water lilies, hyacinth) and S1-S3 for submersed aquatic plants (milfoil, fanwort). You do not need to include emergent plants such as cattails, iris, or rushes.

Rating	Description
NP	No visible aquatic plants
F1 or S1	1-10 plants per square meter
F2 or S2	10 – 50 plants per square meter
F3 or S3	>50 plants per square meter

Be consistent in how you categorize aquatic plant and algae density through the course of the season. If you think plant densities at your lake could become a problem, please contact a member of the Lake Stewardship program staff.

Rinse the Sample Bottles

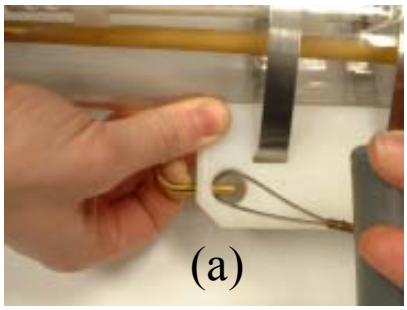
You will rinse all the bottles before collecting samples. To rinse the bottles, remove the top, dip the bottle into the lake to fill the bottle ~1/4 full, swirl the water around the bottle to cover all surfaces, and pour the water back into the lake. Repeat this three times for each bottle. On the third rinse, use the water to rinse the cap of the bottle. Replace the cap and leave it on until just before you fill it with the sample. If there is any material visible on or near the surface of the water such as pollen or algae, rinse the sampler first as described on next page, and then use water from your first sampler drop to rinse the bottles.

Rinse the Van Dorn Sampler

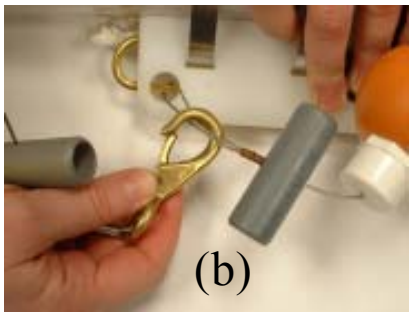
1. While sitting, lay sampler across your knees so you can see the thermometer inside. With one hand, pull the rubber ball with loop only (no clip attached) out of the tube and hold tightly. With the other hand pull the brass rod (see picture "a" below) and insert the cable loop (see picture "b" below) into the hole located near the bottom of large white closing mechanism. Release the rod to hook the loop.

2. Then pull the bottom ball toward the top ball and hook the clip around the entire cable loop (include both wires) from the top ball. The sampler is now set.

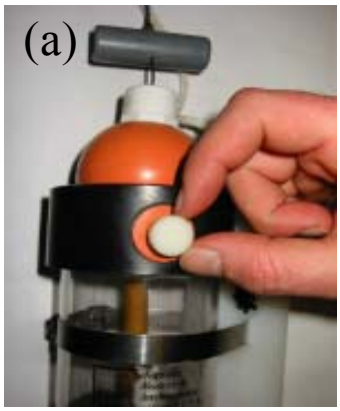
3. Open the small plastic clamp on the drain tube near the bottom of the sampling chamber. Ensure that the clamp is not too close to the end of the drain tube.

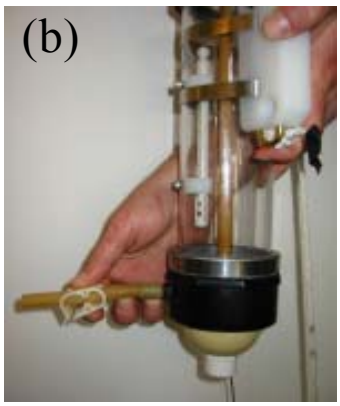


4. To rinse the sampler, set the sampler as described above. Keep the messenger with you on the boat and lower the sampler to a depth of about one-meter. Gently raise and lower the sampler several times so that water passes through the open chamber of the sampler to rinse it.



5. Raise the sampler to the boat, letting all the water drain out, close the drain tube clamp, and reset the sampler as described in steps one and two. You are now ready to collect your samples.





Collect Water Samples

1. To obtain a sample at one-meter depth, hold the bronze messenger and gently lower the sampler vertically into the lake so that the one-meter mark is just visible at the water surface. Release the messenger to activate closure of the sampler.

2. Bring sampler to boat and hold vertically. If there is a small white round valve (a) on top of sampler, turn it to relieve pressure, then open the clip (b) on the surgical tubing to empty the water from inside the cylinder. Direct the water from tube into the sample bottles, filling the bottles to the neck. You will need to fill the sampler at least twice to fill the bottles.

3. Before emptying water from the second sampler drop, let the water sit for about two minutes and read the water temperature from the thermometer located inside the sampler and record it on the field sheet (__°C @1m to the nearest 0.5°).

4. Reset the sampler and collect water at a depth of one-meter until you have filled each of the bottles. Twice should suffice unless you have duplicate bottles to fill, or you are collecting profile samples. (See page 35-36.)

5. Place samples immediately in a cooler filled with ice. If you cannot fit a cooler into your boat, return home and place the samples in a cooler filled with ice as soon as possible or in the refrigerator overnight until placing them out for pickup the following day.

2002 Level II Monitoring Data Sheet

Volunteer Monitor: Jane Secchi **Phone:** (206) 555 - 5253

Sample Collected: 28 - July (Date) at 1430 (Time-24hr time) **Lake:** Serene

TEMPERATURE

At one meter: 20 °C (to the nearest 0.5°C)

Profile Sample Event:

at ____m depth: _____°C (mid depth)

at ____m depth: _____°C (near-bottom depth)

SECCHI DEPTH

Secchi Depth: 3.5 m (to nearest 0.25m)

Notes: _____

WEATHER

- ☑ Sunny
- ☐ Partly cloudy
- ☐ Overcast
- ☐ Dark clouds
- ☐ Raining
- ☐ No wind (glassy water)
- ☑ Slight wind (small ripples)
- ☐ Breezy (small wavelets)
- ☐ Stormy (waves/whitecaps)

Rain last 24hr (mm): Ø

ALGAE AND AQUATIC PLANTS

	Algae	Plants
Along shoreline:	NA	FI / SI
At your sampling location:	NA	NP

Notes: _____

BIRDS

Total number of birds present:

	Launch site	Sample site
Canada geese	Ø	Ø
Domestic geese	Ø	Ø

LAKE USE

Number of boats on lake: 2

Notes: 1 fisherman @ North end

KING COUNTY

Sample at One Meter

SAMPLE NUMBER: P23668-7
LOCATOR : A736 - Serene

LOC. DESC. : LAKE /2.5 MILES SW OF AUBURN
SITE : MINOR LAKES
SAMPLE DATE : 21-APR-2002
PROJECT : 421195C11
MATRIX : LK - FRESH WTR
DEPARTMENT : 2 - Environmental Services
DEPTH-METERS : 1
PARAMETERS : PERSONNEL;SAMP DEPTH;SAMP TEMP;TIME;TRANS
PRESRVD WITH : _____

Mid-depth Sample (or Duplicate)

Near-bottom Sample

Please provide any other information on the back of this sheet. THANKS!!!

Questions?
Call Michael Murphy
(206) 296-8008

Rev 3/19/02:\FORMS\LEVEL 2

Storing Monitoring Equipment and Sample Pick-up

1. Allow water sampler to completely dry internally by leaving it open for 24 hours before storing in bag for next sampling session. Between sampling sessions, be certain to close the water sampler after it is dry to prevent stretching the latex tubing and shock cord.

2. The next morning, if your samples have been stored in the refrigerator, transfer them to a cooler filled with ice. Be sure to check the ice level in your cooler and replenish it if necessary. Then, place the cooler at your designated pick-up location.

3. Your samples will be picked up by staff and new bottles left for your next sampling date.

Quality Assurance

The quality of the data collected through this volunteer monitoring program depends on how well volunteers adhere to the standard collection methods provided in this manual. To ensure you collect high quality data for your lake:

1. Sample at the same location and **use an anchor** to prevent drifting.
2. Fill out the data sheet completely and note items of interest.
3. Check the labels on the sample bottles to make sure they have the correct lake name, date, and sample depth. Make sure the date on the labels matches the date on your data sheet.
   If you sample on a different date than listed on the labels of the bottles, change the date on the labels to reflect your actual sample collection date.

4. Sample the same way and generally at the same time (**between 2 p.m. and 5 p.m.** if possible).
5. Rinse the sampler completely before you begin.
6. Rinse the plastic sample bottles three times before filling with water to be analyzed.
7. Keep your fingers out of the sampling equipment and bottles and hold the bottle caps by their edges only.
8. Sample at **one meter** depth unless instructed otherwise.
9. Fill the bottles to the neck ONLY (not full to the lip) and cap tightly.
10. Store your samples in an ice chest or refrigerator until pick-up.
11. Call us when you cannot sample or train a neighbor or buddy to collect samples when you are away.

All of the samples obtained from volunteers are picked up and delivered to the King County Laboratory in Seattle. It is very important to have the samples preserved and/or analyzed within 24-48 hours; otherwise the analytical results are unreliable. Additional quality assurance procedures are implemented for your samples at the laboratory. These activities include logging your samples, reviewing your data sheet, verifying the laboratory work order, and distributing the samples for analysis. In addition, laboratory personnel keep track of samples, analyze data, and report final results. To provide quality assurance, the laboratory will "split" some samples in two and analyze the samples separately to measure the variability associated with the laboratory analysis.

Profile and Field Replicate Sampling

Standard sampling methods should be followed during all sampling sessions with two exceptions. First, once in May and again in September, you will collect lake profile samples from two or three

depths, depending on the total depth of your lake—surface, mid-lake depth, and near-bottom. Read the labels on your bottles to determine your sample depths.

Second, you may be asked during one sampling session to collect a field replicate of your samples to ensure that sampling procedures are consistent and to look at variability. Field replicates are separate samples collected at the same location but analyzed separately. If there is little sampling variability, the replicate sample should closely match the original sample data. Advance notice and additional instructions will be included with your sample bottles when these exceptions occur.

Sampling Schedule

Lake Stewardship Program staff coordinate the activities of volunteers for over 50 lakes. This coordination requires time as well as significant advance planning. The sampling schedule is established in advance with the King County Laboratory and requires that you sample either on Sundays or Mondays. Staff will collect your samples and field sheets and deliver new sample bottles to you the day after you sample.

Following this schedule is very important to ensure that your samples will be delivered to the laboratory in a timely manner. Our quality assurance methods require that the samples be analyzed within 48 hours of collection. If you cannot sample on your scheduled day, **please notify staff ahead of time**. With proper notice we may be able to switch sampling days for a given week. If you will be out of town for both sampling days, please notify staff. If you have a back-up monitor, make arrangements to have him or her collect the lake samples so data will not be incomplete for your lake. Always place your samples on ice at the agreed upon sample pick-up location. Ask your back-up to do the same.

2002 Sampling Calendar

April

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

May

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

June

Sun	Mon	Tue	Wed	Thu	Fri	Sat
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

July

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

August

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

September

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

October

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26

Monday Pick-up Schedule

☐ Sample Day ⬡ Pick-up Day

Please call Murph at (206) 296-8008 or Katie at (206) 296-0516 if you have to change your sample/pick-up date.

2002 Sampling Calendar

April

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

May

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

June

Sun	Mon	Tue	Wed	Thu	Fri	Sat
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

July

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

August

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

September

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

October

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26

Tuesday Pick-up Schedule

Sample Day Pick-up Day

Please call Murph at (206) 296-8008 or Katie at (206) 296-0516 if you have to change your sample/pick-up date.

Staff Contacts

For additional instructions or assistance, please contact one of the following individuals:

Katie
Sauter
(206)
296-0516

Michael
Murphy
(Murph)
(206)
296-8008

Sally
Abella
(206)
296-8382

Suzanne
Rowe
(206)
296-1959

Appendix A: Additional Information

English To Metric Conversion

To convert from...	To...	Multiply by:
inches	millimeters	25.4
inches	centimeters	2.54
inches	meters	0.0254
feet	meters	0.305
feet	centimeters	30.5
yards	meters	0.914
yards	centimeters	91.4

Metric To English Conversion

To convert from...	To...	Multiply by:
millimeters	inches	0.0394
centimeters	inches	0.394
centimeters	feet	0.0328
centimeters	yards	0.0109
meters	yards	1.09
meters	feet	3.28
meters	inches	39.4

Temperature Conversions

Fahrenheit to Centigrade: (^{O}F - 32) / 1.8

Centigrade to Fahrenheit: (^{O}C X 1.8) + 32

Other Lake Organizations

Washington State Lake Protection Association (WALPA)
P.O. Box 1206 Seattle, WA 98111-1206
(800) 607-5498

North American Lake Management Society (NALMS)
(608) 233-2836

Western Aquatic Plant Management Society (WAPMS)
(360) 407-6562

Video Resources

Lakeside Living is a 23-minute video that focuses on shoreline management and lakeside landscaping practices to improve water quality, shoreline stability, and wildlife habitat. The video is available for loan from the King County Library or for sale by calling (206) 296-8332.

Internet Resources

http://dnr.metrokc.gov/wlr/waterres/smlakes
King County's lakes website

http://www.epa.gov/owow/lakes
United States Environmental Protection Agency website: In the documents area you can order the *Lake and Reservoir Restoration Guidance Manual* plus other lake items of interest.

http://www.nalms.org/
North American Lake Management Society website: You can order lake publications as well as get membership information for the Washington State Lake Protection Association.

http://www.terrene.org/index.htm
Terrene Institute website: Look for their online catalogue. Several publications may be of interest including *LakeSmarts, The First Lake Maintenance Handbook*.

http://www.ecy.wa.gov
Washington State Department of Ecology's website.

http://www.scn.org/earth/savelake/
Save Lake Sammamish website

Print Resources

The following materials are available from King County Water and Land Resource Division by calling (206) 296-6519.

General Lake Management

- Lakeside Logic: A Guide to Lake Stewardship in King County
- Watershed Waltz and the Sammamish Swing--How to Dance Your Way to Healthier Lakes and Streams
- Aquatic Plants: Identification, Benefits, and Management
- Noxious Weeds: A Guide to Non-native Plants
- Toxic Algae

Landscaping

- Grow Your Own Native Landscape: A guide to identifying, propagating and landscaping with Western Washington Native Plants.
- Going Native
- Blueprint for a Lake-friendly Landscape

Water Quality Protection

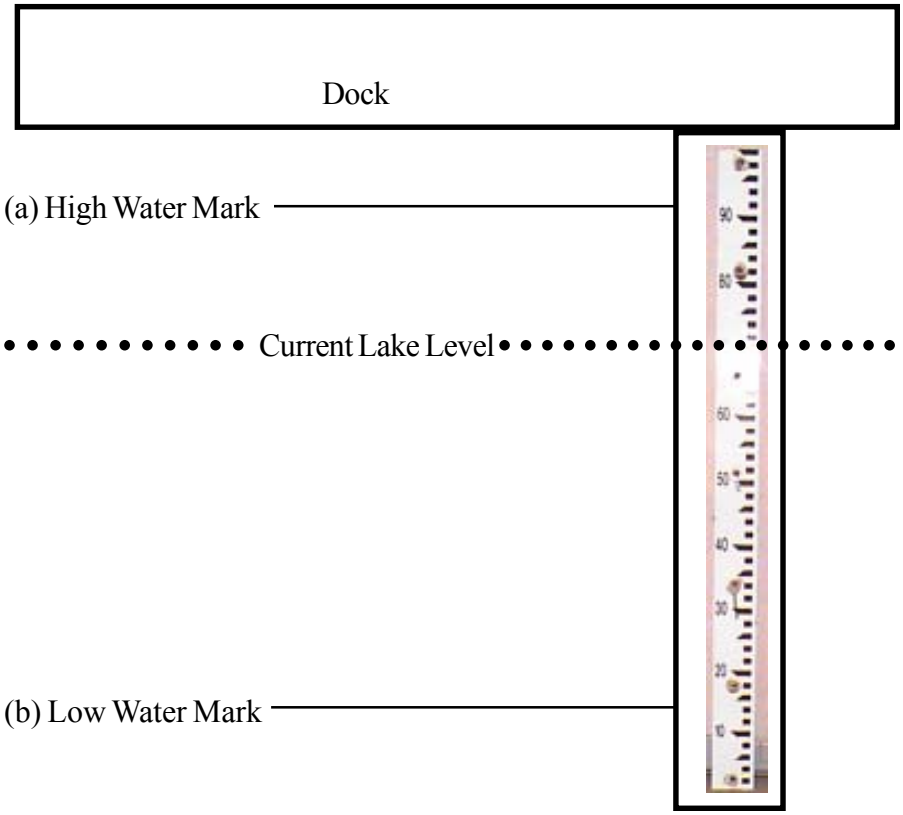
- Septic Tank Maintenance Guidelines
- Hazards On the Homefront
- Community Stewardship Network Directory

Appendix B: Lake Level Gauge Installation

The depth of a lake naturally fluctuates as the seasons change. In the Pacific Northwest, most rainfall occurs from late fall through spring. During the dry summer season, water levels drop and most lakes will be at their lowest point between September and October. As rainfall increases through the winter, water levels rise and usually peak in January or February. The difference between the peak of winter and the low of fall is generally less than one meter.

The lake level gauge in your kit is one meter long and should accommodate the fluctuation of water levels at your lake. The gauge should be mounted to your dock in such as way as to handle the peak levels of winter and the low levels of early fall. (See graph on the next page.) If you know your lake fluctuates more than one meter, discuss alternative measurement methods with the Lake Stewardship program staff.

1. Identify a fixed object such as a dock piling or a 2x4 post that is well anchored in the lake bottom. Do not attach the gauge to a floating structure that rises and drops with the water level.

2. Identify a high water mark (a) on your dock or another post where you intend to attach your gauge. Locate the top of your gauge (100 cm mark) slightly above your estimated high water mark.

3. If your installing the gauge during the rainy season, make sure you locate the gauge so that you can also measure the low water mark (b).