

Lake Stewardship Program

Volunteer Guide

Lake Stewardship Program Overview

The King County Lake Stewardship Program was established in 1994, combining two volunteer-based water quality programs for small lakes that were managed by King County and METRO before the agencies merged. The purpose of the program is to offer training, advice, and technical assistance to help people monitor and manage the County's many lakes and ponds. Monitoring water quality in small lakes can indicate important environmental impacts occurring in local watersheds, along the lake shorelines, or from climate changes. Monitoring with the assistance of volunteers helps the community understand the process behind the changes they see and focuses attention on the importance of our smaller lakes.

Lake Stewardship Program staff train volunteers reliable, consistent, and accurate methods for monitoring the health of their lakes and ponds. The baseline information gathered by monitoring can be used to assess long-term trends and support future actions to protect aquatic resources. Volunteers learn to measure physical and chemical parameters that serve as indicators of lake conditions and health.

Collaboration with trained volunteers has many benefits. Keeping labor costs down makes it possible to monitor many more lakes than could otherwise be afforded, thus getting a regional picture of lake health. Even more important, training residents increases the number of eyes on lakes, and increases the likelihood that significant changes can be detected rapidly. Additionally, working with volunteers allows King County residents to have direct involvement with work done in the Science and Technical Support Section. Volunteers receive information on water quality and watershed management and also serve as stewards in outreach to other interested citizens.

Volunteers have the option of participating in daily, weekly, or summer bi-weekly (May-October) monitoring programs. In addition to water quality monitoring, volunteers keep track of recreational use and track potential nuisances, such as geese. They also report algal accumulations that could signal a health and safety threat, such as a toxic algae bloom.

Water quality data is loaded onto the King County Small Lakes Information and Data webpage (<http://green2.kingcounty.gov/SmallLakes>). This page provides information about the lakes, including maps and physical characteristics, water quality reports, and the option to download or view water quality data.

Why Monitor? Data from the volunteer monitoring program:

- Provides baseline data about physical conditions and water quality conditions.
- Allows us to look for trends over time or changes accompanying development or climate variation.
- Determines if changes in water quality might affect beneficial uses.
- Facilitates evaluation of restoration measures to improve conditions in a lake.
- Helps to identify new concerns early.
- Offers a better understanding of how different land use practices may affect lake ecology and environments.

Monitoring Level Options

Level 1

Level 1 monitoring occurs year-round, with some measurements taken daily and others on a weekly basis. Volunteers may choose one or both sets of measurements. The monitoring year follows the water year, running from October 1 through September 30 (e.g., water year 2015= Oct. 2014- Sept. 2015). Level 1 monitors are asked to do the following:

Daily at approximately the same time every day:

- Measure and record precipitation in milliliters.
- Measure and record lake level in centimeters.
- Note any unusual or interesting conditions.
- Count geese (optional).

Weekly on the same day each week, if possible:

- Anchor boat at predetermined sampling location.
- Measure and record lake temperature at a 1 meter depth.
- Measure and record Secchi depth.
- Record weather and lake use observations.
- Assess and record algae and particle observations.
- Note any unusual or interesting conditions.
- Count geese (optional).

Level 2

Level 2 monitoring occurs bi-weekly from May through October. On scheduled sampling days volunteers are asked to:

- Anchor boat at predetermined sampling location.
- Measure and record Secchi depth.
- Measure and record temperature at a depth of 1m.
- Record weather and lake use observations.
- Assess and record algae and particle observations.
- Note any unusual or interesting conditions.
- Count geese (optional).
- Scan the lake for cyanobacterial accumulations and if found collect a scum sample for toxicity testing.
- Use the Van Dorn sampler to collect water samples from the lake. Labeled bottles are provided. Most dates involve collecting water at 1 m, but twice during the sample season multiple depths are collected (profiles).
- NEW in 2015, on 4 occasions, routine water samples for cyanobacterial toxin measurements will be collected at a public or community access point along the shoreline.
- Place data sheets and samples in a cooler for pickup.

Level 2 water samples are collected by Lake Stewardship staff and delivered to the King County Environmental Lab for analysis. Parameters measured are:

- Total phosphorus
- Total nitrogen
- Chlorophyll-*a*
- Additional parameters during profile events:
 - Nitrate-nitrite
 - Ammonia
 - Orthophosphorus
 - Alkalinity
 - UV254
 - Phytoplankton communities

What We Measure and Why

Lake level is a relative measure of the water level that is recorded daily using a staff plate installed on either a pole or a fixed height dock. These data can be used to look at the annual fluctuation of water levels in the lake, as well as response to increased water coming in due to storm event and the rate at which it drains. While most of the installed staff plates at lakes around the county are not surveyed to tie the data in with sea level, this could be done in the future to give actual elevations above sea level.

Daily **precipitation** is measured at the same time as lake level in order to relate the lake level to inputs from the watershed. These data are collected either through a plastic rain gauge provided by King County that can be emptied after reading each day or by a recording weather station if the volunteer chooses to purchase a reliable unit.

Secchi (pronounced "Seh-kee") transparency is a common method used to assess and compare water clarity. It is a measure of the water depth at which a standardized black and white disk disappears from view when lowered from the water surface. Factors in the water that affect Secchi readings include the number and size of particles present, such as algae and silt, as well as water color from dissolved organic molecules. Other factors that affect the readings are the amount of glare, waves or chopiness of the water, shade from tall trees or the boat, as well as variation in the vision of the observers.

Level I volunteers measure Secchi depth and water temperature at a station in the middle of the lake weekly throughout the year. Level II volunteers measure 12 times between May and October when they collect water samples for laboratory analysis.

Water temperature is usually measured using an alcohol-based thermometer that holds a specific temperature long enough to allow the observer to read the value after retrieving the thermometer from the water.

Phosphorus and **nitrogen** are naturally occurring elements necessary for growth and reproduction in both plants and animals. However, many activities associated with human activities, such as residential development and agriculture can increase these nutrients in water beyond natural levels. In lakes of the Puget Sound lowlands, phosphorus is often the nutrient in least supply, meaning that biological productivity is most often limited by the amount of available phosphorus. Increases in phosphorus can lead to more frequent and dense algae blooms – a nuisance to residents and lake users, and a potential safety threat if blooms become dominated by cyanobacteria (bluegreen algae) that can produce toxins.

Total phosphorus (TP) and **total nitrogen (TN)** are both measured every time the Level II volunteers collect water at the 1m depth. More specific forms of nitrogen and phosphorus are measured twice during the sampling period, when water is collected from 3 depths at the station: at 1 m, the middle depth of the water column, and 1 m from the lake bottom. These include nitrate-nitrite, ammonia, and soluble reactive phosphorus (orthophosphate), and the data can be used to infer the amount of oxygen present in deep water, as well as the presence of internal loading of nutrients from the sediments back into the lake water.

The **ratio of total nitrogen to total phosphorus (N:P)** can be used to determine if nutrient conditions are favorable for the growth of cyanobacteria (bluegreen algae), which can negatively impact uses of the lake and potentially produce toxins. When N:P ratios are near or below 25, nitrogen is equally likely to be the limiting nutrient as phosphorus. Cyanobacteria may then be able to dominate the algal community due to their ability to "fix" nitrogen (absorb nitrogen from air).

Chlorophyll-*a* concentrations indicate the abundance of phytoplankton (algae) in the lake. Although different species of algae contain varying amounts of chlorophyll, all algae must have some in order to complete the photosynthetic pathway by which they store energy. For example, some cyanobacteria have other light-catching pigments and thus have relatively little chlorophyll compared to their biovolume.

Pheophytin is a product of chlorophyll decomposition and is generally measured along with chlorophyll as an indicator of how reliable the chlorophyll measurement is for indicating the amount of living phytoplankton present. Bottom sediments will contain a large amount of pheophytin compared to chlorophyll, while samples with actively-growing algae from surface waters will have very little pheophytin present.

A common method of tracking water quality trends in lakes is by calculating the **Trophic State Index (TSI)**, developed and first presented by Robert Carlson (1977). TSI values predict the biological productivity of the lake based on three parameters that are easily measured: water clarity (Secchi), total phosphorus, and chlorophyll. The values are scaled from 0-100, which allow them to be used for comparisons of water quality over time and between lakes. If all of the operating assumptions about a lake ecosystem are met, the three TSI values should be very close together for a particular lake. When they are far apart in value, lake conditions and measurements should be examined to understand what special conditions exist at the lake or to evaluate the data for errors.

The index provides a quantitative way to separate three commonly used categories of productivity:

- *Oligotrophic*: low productivity (low in nutrient concentrations, small amount of algal growth), below 40 on the TSI scale.
- *Mesotrophic*: moderate productivity (moderate nutrient concentrations, moderate growth of algae), between 40 and 50 on the TSI scale.
- *Eutrophic*: high productivity (high nutrient concentrations, high level of algal growth), above 50 on the TSI scale.

A lake may fall into any of these categories naturally, depending on the conditions in the watershed, climate characteristics, vegetation, geology, as well as the shape and volume of the lake basin. Activities of people, such as land development, sanitary waste systems, and agricultural practices, can also increase productivity, which is known as “cultural eutrophication.”

Determining Sample Location

Both Level 1 and Level 2 volunteer lake monitors will need to locate the deepest part of their lake in order to set a sampling site. You will return to this site each time to measure Secchi depth and/or collect water samples. Depth contour maps of the lakes are available at the King County Small Lakes Information and Data webpage, located at the web address below. Additionally, volunteers will be provided with laminated lake maps illustrating the sample station, as well as listing coordinates that may be used with handheld GPS units or smartphones.

<http://green2.kingcounty.gov/SmallLakes>

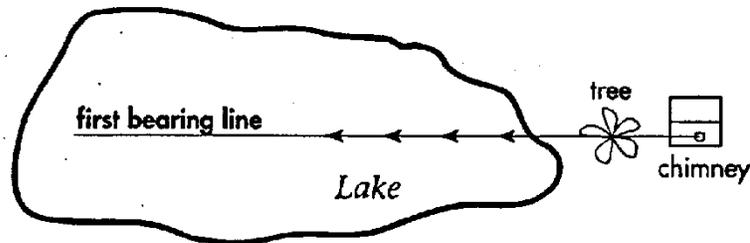
To determine your sample station, begin by positioning your boat at the location shown on your lake map. This is marked with an “X” and located at the deepest portion of your lake. To verify that you are close to the lake’s deepest spot, measure the length of line it takes to anchor your boat. The depth should correspond closely to the maximum (or estimated maximum) depth listed on your contour map.

If you find yourself at a depth significantly less than the depth listed for your lake, try repositioning your boat until you have located the deepest area. If the maximum depth you measure is significantly different from what is listed, or if the deepest area is in a different location, notify a Lake Stewardship staff member so we can update the maps.

If you have a GPS unit or phone with GPS capabilities, use it to mark your location, and note the coordinates on your data sheet. If you do not have a GPS unit, you can establish visual markers for your site by creating bearing lines.

Bearing Lines

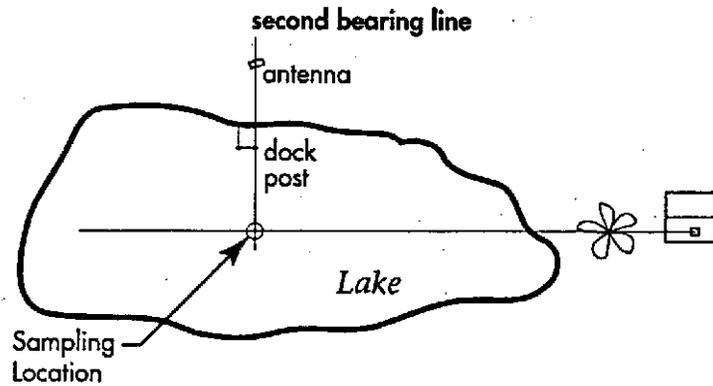
Establish your first bearing line by identifying two fixed objects on the shore (houses, chimneys, docks, trees, fence posts) that align with one another – one in the foreground and one in the background. Once you have identified two objects, you may need to alter your position slightly on the lake to get them to line up. The line that is formed between you and the shoreline objects is your first bearing line (see below).



Establishing the first bearing line.

To establish your second bearing line, you will need to examine the shoreline area that is as close as possible to a right angle from your first bearing line. Again, find two objects that line up with one

another. The intersection of your two bearing lines should coincide with the deepest point in your lake and will mark your permanent sampling station.



Establishing the second bearing line and sample location.

Write a description of the objects used for establishing the bearing lines onto the back of your datasheet so the Lake Stewardship Program has a record of it for future reference. To get the most reliable data, use these same bearing lines each time you take sample.

Level 1 Sampling Procedures

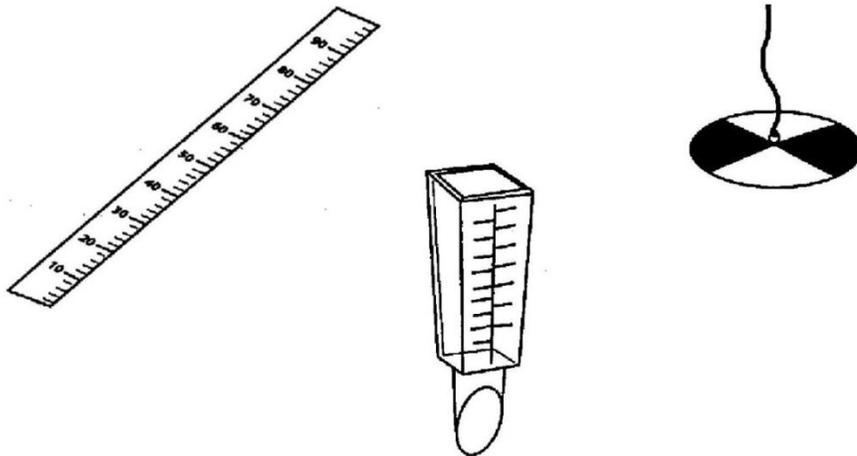
Monitoring Equipment and Materials

Volunteers Provide:

- Daily access to the lake you wish to monitor. Living on the lake you monitor is ideal, but not necessary if you have an access point.
- Access to a boat and a place to launch it.
- Life jacket.
- Dock or fixed post for lake level gauge.
- Pencil (pens do not work on “rite-in-the-rain” data sheets) and a hard surface to write on (e.g., a clipboard or notebook).

King County Provides:

- Training
- Data sheets
- Lake level gauge
- Rain gauge
- Secchi disk
- Thermometer with line and float



Lake level gauge, rain gauge, and Secchi disk.

Monitoring Procedures

The following instructions are provided to ensure that all Level 1 monitors collect data in the same manner. Please read the instructions thoroughly, and contact Lake Stewardship staff if you have any questions. Proper data collection and entry will help to eliminate discrepancies and ambiguities in your data and allows for simplified data entry and analysis. Furthermore, if all volunteers collect and record data according to these protocols, data from different lakes can more easily be compared and contrasted.

Sampling Days and Times

Conduct your daily measurements at the same time each day, if possible. For weekly measurements, it is ideal to collect measurements on the same day each week, at the same time of day. It is important to be as consistent as possible from day to day and week to week. Of course, some changes are likely to be necessary because of everyone's busy lives. It is much better to change the date or time than to miss a sample event.

Filling Out the Data Sheet

Please make sure that your name and date are on the data sheet (very important!). If you are unable to take any measurements, leave the space blank or write "No Data." We cannot equate a blank with a zero because they actually mean two different things. This is especially important with precipitation measurements. If you are going to be away for more than a few days, try to arrange for a substitute, but if you cannot, please note your absence on the sheet. Additional notes are ALWAYS appreciated.

Data sheets are available in both paper (waterproof, "rite-in-the-rain") and electronic (Excel) formats, and may be submitted either through the mail or by email.

Daily Tasks

Precipitation Measurements

- Install the rain gauge in an area open to the sky and away from overhanging objects such as trees or buildings. If you need assistance we can help with the location and installation.
- Please record rainfall measurements in millimeters (mm). Once you record the precipitation value on your data sheet, empty the rain gauge.
- Snow: If snow collects in the rain gauge, bring it inside and allow the snow to melt. Then take a normal reading of the amount of water in gauge, writing "snowmelt" on your data sheet.
- Freezing: If extended freezing occurs, make sure your rain gauge is empty or bring it inside until temperatures rise above freezing, otherwise the gauge may crack. Also, make sure to write "frozen" on your data sheet.
- Missing days: If you are unable to take a precipitation measurement daily and rainfall has accumulated in the gauge over numerous days, record the total measurement on your data sheet, writing "cumulative," and indicating how many days the precipitation was collected over.

Lake Level Measurements

- Lake Stewardship staff will assist you in identifying a location on your dock or other permanent fixture in the lake on which to place your lake level gauge. Complete installation instructions can be found in the **Equipment Installation, Maintenance, and Repair** section of the Volunteer Guide.
- Please record lake level in centimeters (cm). Lake stewardship staff can also assist in the installation of your lake level gauge.
- On windy days, you will have to estimate the approximate lake level by taking an average of the high and low marks created by waves.

Weekly Tasks

Sampling Equipment

- Boat
- Anchor
- Life jacket
- Secchi disk
- Thermometer
- Data sheet and pencil

Date, Time, Weather, and other Notes

- Record the date and time. Please enter the time using a 24-hour time format (e.g., 6 AM = 0600, Noon = 1200, 6 PM = 1800, and Midnight = 2400).
- Record observations for cloud cover and wind conditions.
- Fill out number of swimmers, fishers, and boats in the lake (include your boat in the count, so there should always be at least one boat!). Provide goose counts (optional).
- Make any additional notes about weather, water color, wildlife, etc., in the “Comments” section.

Secchi Depth

- To eliminate glare, always take Secchi readings on the shady side of the boat.
- Remove sunglasses while taking Secchi measurements – some types make it easier to see into the water and may interfere with readings.
- The Secchi disk line will be marked with either 0.1, 0.25, or 0.5 meter increments. You can put new marks on the line to help you, but please be sure they are in meters!

- To take a Secchi depth reading, lower the disk into the water until it just disappears from view. Watch the disk while carefully raising and lowering it a few times to make sure you have the most accurate reading.
- Place your finger on the line at the water's surface to mark the point where the disk just disappears.
- Raise the disk and, using the marks on the line, measure the Secchi depth. Report on your data sheet to the nearest 0.1 meters (or 0.25 meters if your line is marked as such).

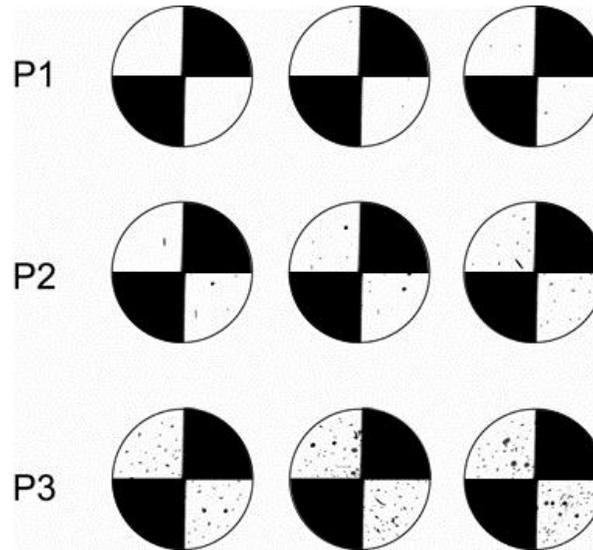
Water temperature

- Take your temperature measurements at the same location as the Secchi depth measurement.
- Measure lake temperature by lowering the thermometer to 1 meter below the surface, as marked on the line. There should be a fishing float on the line to mark the 1 m depth. If you do not have one, please contact us so we can update your equipment.
- Wait at least 2 minutes for the reading to stabilize.
- Remove the thermometer quickly from the water and read it immediately. Record temperature to the nearest 0.5 degrees Celsius (Centigrade).
- If the fluid in the thermometer separates, temperature readings will not be accurate. You can see the separation by looking closely at the colored fluid in the thermometer, which should be continuous from bottom to top. If you see clear spots, it has separated and is no longer accurate. For instructions on recombining the fluid, see the **Equipment Installation, Maintenance, and Repair** section of the Volunteer Monitoring Guide. If the fluid will not combine, contact a Lake Stewardship Program staff member for a replacement.

Algae and Particle Observations

- Algae and particles are counted at both the sample site and near the shoreline if possible.
- Lower your Secchi disk to 6 inches below the surface of the water. At this depth, the volume of water above the white portions of the disk is approximately two liters.
- Look at the amount of particles in the water above the white portions of the disk. Estimate the amount of particles above *both* white portions by using the table or picture below.
- Alternatively, you can pour two liters of water into a clean white bucket to make the assessment.
- Algae in the water can appear as nebulous clouds or as small floating particles, depending on the species. Please do not count particles smaller than the period at the end of this sentence.

Algae particle rating categories.



	<u>Description</u>	<u>Particle Count</u>
P1	Few algae particles visible above disk	0-10
P2	Moderate numbers of particles	10-100
P3	A lot of algae- bloom conditions	>100

Canada Goose Counts

Counting the number of geese you observe at your lake can give us a general idea of how many geese are present, as well as how often. This information can then be used to assess the possibility of geese contributing to water quality issues.

Recording goose counts is optional. If you do not see large numbers of geese on your lake, or do not perceive them to be a problem, it is unnecessary to record goose counts. If you do want to participate in the goose count, please choose **one** option below.

- **Daily goose count:** Record the greatest number of geese you see **at once** anywhere on the lake, at any time of day. For example, if you see 10 geese in the morning, eight at noon, and 14 in the evening, record "14."

- **Weekly goose count:** Every week, record the greatest number of geese you've seen **at once** anywhere on the lake over the past week. For example, if you see five geese on Monday morning, 15 on Tuesday morning, 12 Tuesday evening and 10 on Friday, you would record "15" on your data sheet.

Level 2 Sampling Instructions

Monitoring Equipment and Materials

Volunteers Provide:

- Access to a boat and a place to launch it.
- Life jacket.
- A secure place to store monitoring equipment.
- Approximately one hour every other Sunday between early May and October.
- Pencil (pens do not work on “rite-in-the-rain” data sheets) and a hard surface to write on (e.g., a clipboard or notebook).
- Small cooler and ice to store samples for pick-up.

King County Provides:

- Training
- Data sheets
- Labeled sample bottles and field sheets delivered for each sample event
- Van Dorn sampler with thermometer inside
- Secchi disk
- Pick-up of samples and delivery to the King County Environmental Lab



Van Dorn sampler and sample bottles.

Monitoring Procedures

The following instructions are provided to ensure that all Level 2 monitors collect data in the same manner. Please read the instructions thoroughly, and contact Lake Stewardship staff if you have any questions. Proper data collection and entry will help to eliminate discrepancies and ambiguities in your data, which allows for simplified data entry and analysis. Furthermore, if all volunteers collect and record data according to these protocols, data from different lakes can more easily be compared and contrasted.

Sampling Schedule

Level 2 monitors will collect water samples and take measurements every other week on Sundays from May through October, with the exception of two 3-week intervals in the fall (see schedule below). These longer breaks accommodate vacation and holiday schedules. Samples will be picked up by King County Staff on Mondays and delivered to the King County Environmental Lab. Sampling according to the predetermined schedule is necessary so that the lab may analyze the samples in large batches, thereby reducing costs.

2017 Lake Stewardship Monitoring Schedule	
Date	Notes
5/7/2017	
5/21/2017	Profile
6/4/2017	
6/18/2017	Father's Day
7/2/2017	
7/16/2017	
8/6/2017	3-week interval
8/20/2016	Profile, 3-week interval
9/10/2017	
9/24/2017	
10/8/2017	
10/22/2017	

Other notes about the sampling schedule:

- Collect samples at roughly the same time each sampling day, if possible.
- If you are unavailable to sample, please make arrangements with a back-up monitor and notify program staff of the change by Monday at 8am, or sooner if possible. If you do not have contact information for your back-up or do not have a back-up, please let us know as soon as possible if you cannot sample.
- Always place water samples on ice in a cooler and leave them at the pre-designated pick-up location by 8am on Monday, unless you have made other arrangements with us.

Sampling Procedures

See the ***Determining Sample Location*** section of the Volunteer Guide to locate your sampling station. Once at your sample location, you will be making observations and taking notes, getting a Secchi depth reading with the Secchi disk, and using the Van Dorn to collect water samples and take temperature readings. On two occasions, you will collect water samples from multiple depths (profile sampling).

Sampling Equipment

- Boat
- Anchor
- Life jacket
- Secchi disk
- Van Dorn sampler with thermometer
- Sample bottles
- Cooler with ice or cold pack
- Data sheet and pencil

Date, Time, Weather, and other Notes

- Ensure your name, phone number, and lake name are on the data sheet. This is extremely important!
- Use pencil only, as pens will not work on “rite-in-the-rain” data sheets.
- Record the date and time. Please enter the time using a 24-hour time format (e.g., 6 AM = 0600, Noon = 1200, 6 PM = 1800, and Midnight = 2400).
- Record observations for cloud cover and wind conditions. Draw wind direction on the lake map provided on your data sheet.
- Fill out lake use observations (number of boats, swimmers, etc.). Numbers do not need to be exact if quantities are large. Make sure to include your boat in the count, so there should always be at least one boat on the lake!
- Provide goose counts if desired (optional). On your data sheet, write the greatest number of Canada geese observed at any one time on or near the lake.
- Make any additional notes about weather, water color, wildlife, etc. on the back of your data sheet.

Secchi Depth

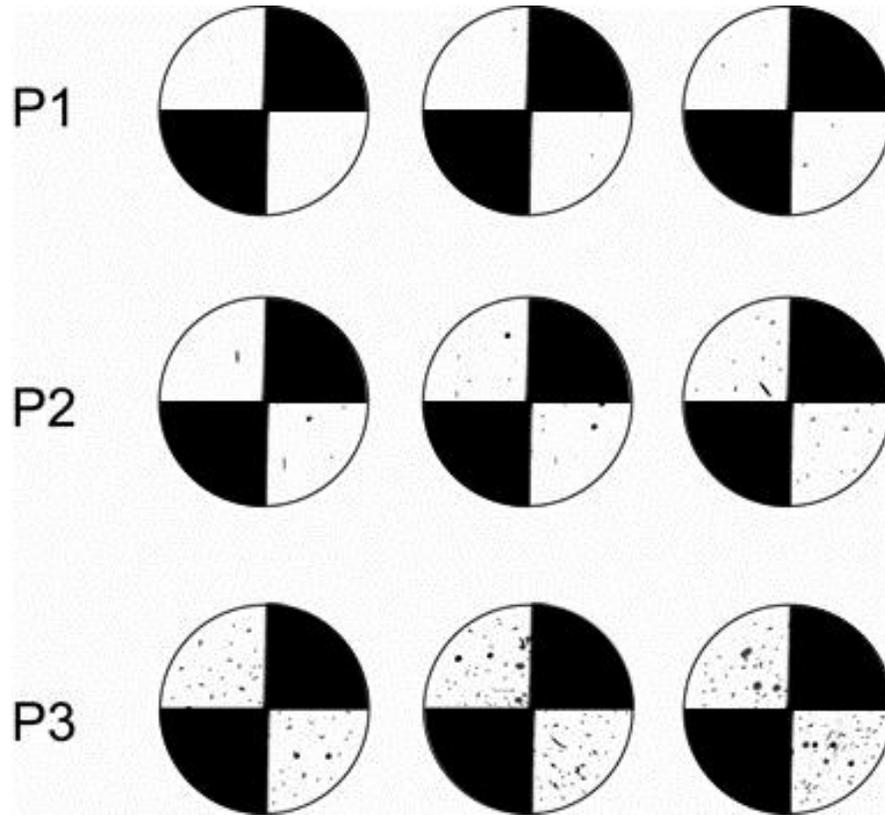
- To eliminate glare, take Secchi readings on the shady side of the boat.
- Remove sunglasses while taking Secchi measurements – some types make it easier to see into the water and may interfere with readings.
- The Secchi disk line will be marked with either 0.1 or 0.25 meter increments.

- To take a Secchi depth reading, lower the disk into the water until it just disappears from view. You may want to carefully raise and lower the disk a few times to make sure you have the most accurate reading.
- Place your finger on the line at the water's surface to make the point where the disk just disappears from view.
- Raise the disk and, using the marks on the line, measure the Secchi depth. Report on your data sheet to the nearest 0.1 or 0.25 meter.

Algae and Particle Observations

- Algae and particles are counted at the sample site located at the deepest point in your lake.
- Lower your Secchi disk to 6 inches below the surface of the water. At this depth, the volume of water above the white portions of the disk is approximately two liters.
- Look at the amount of particles in the water above the white portions of the disk. Estimate the amount of particles above *both* white portions by using the table or picture below.
- Alternatively, you can pour two liters of water into a clean white bucket to make the assessment.
- Algae in the water can appear as nebulous clouds or as small floating particles, depending on the species. Please do not count particles smaller than the period at the end of this sentence.
- Take notes about any algae scum, if present, including color and appearance.

Algae particle rating categories.



<u>Rating</u>	<u>Description</u>	<u>Particle Count</u>
P1	Few algae particles visible above disk	0-10
P2	Moderate numbers of particles	10-100
P3	A lot of algae- bloom conditions	>100

2015 Level II Monitoring Data Sheet

PLEASE FILL IN ALL INFORMATION

Volunteer Monitor: JANE SECCHI Phone: (555) 123-4567

Sample Collected: (Sunday) Monday 5/3/15 at 1430 Lake: Green
(Circle day) (Date) (24hr Time)

TEMPERATURE

At one meter: 12.0 °C (to the nearest 0.5°C)
Profile Sample Events (May 17 and Aug. 23):
 at ___ m depth: ___ °C (mid depth)
 at ___ m depth: ___ °C (near-bottom depth)

SECCHI DEPTH

Secchi Depth: 4.2 m (to nearest 0.10m)
 Notes: _____

WEATHER

Sunny No wind (glassy water)
 Partly cloudy Slight wind (small ripples)
 Overcast Breezy (small wavelets)
 Dark clouds Stormy (waves/whitecaps)
 Raining - light rain Rain last 24hr (mm): _____

OPTIONAL GOOSE COUNT

Greatest number of Canada geese on your lake at any one time in the last week? 2
 Other geese observations? _____

LAKE USE

Number of boats on lake: 4
 Number of swimmers at lake: 2
 Number of people on shoreline: Many
 Number of people fishing: 5-10
 Number of dogs in/ around lake: ~20
MOST ON TRAIL, ~3 IN WATER

ALGAE PARTICLE COUNT

Algae at your sampling location: (Circle one)
 P1 0-10 particles P2 11-100 particles P3 >100 particles
 Notes: _____

Is there algae scum present?
 Yes No
 (If yes, mark location on map)

Algae color: GREEN, BRIGHT

Algal form (scum, clumps, particulate):
SCUM, THICK FILM IN SPOTS

Algae sample provided?
 Yes No
 (If yes, mark location on map)

Wind direction (indicate on map)

WIND Sample HERE
 Green Lake - 1 SCUM
 5 10 15 20 25
 SCUM
 0 1000
 SCALE IN FEET
 47°40'39.051" -122°20'2.649"

Questions? Please contact
 Chris Knutson at 206-477-4739 or
 chris.knutson@kingcounty.gov

King County
 Revised: 04/07/15

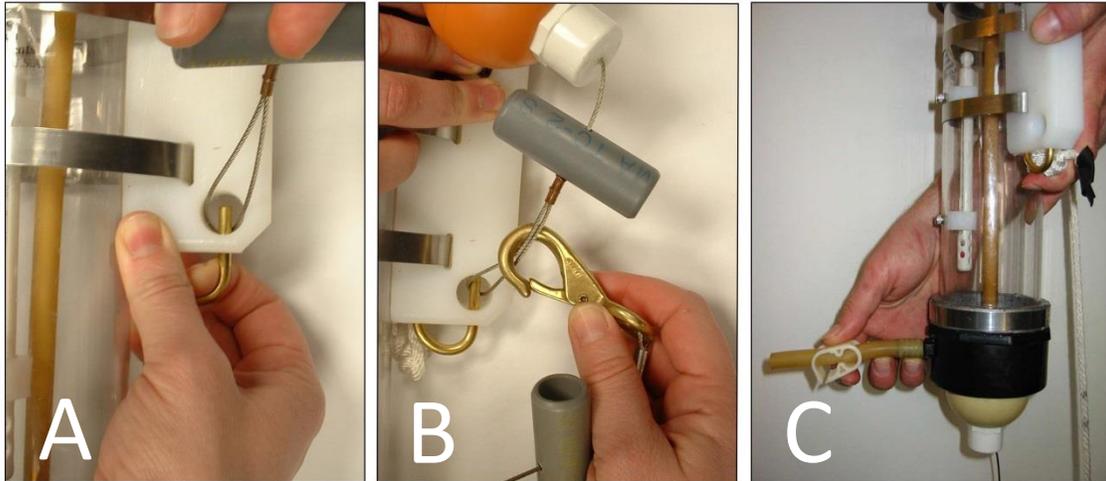
Sample of Level 2 data sheet.

Prepare the Sample Bottles

- Rinse all nutrient bottles at the sample station before collecting samples.
- To rinse a bottle, remove the cap, dip the bottle into the lake to fill it with a small amount of water, swirl the water in order to rinse all surfaces of the bottle, and pour the water back into the lake, away from where you will be collecting the sample.
- Repeat three times for each bottle. On the third rinse, use water to rinse the cap as well.
- 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 water surface, such as pollen or algae, rinse the Van Dorn sampler first (as follows), and use the water from the first sampler drop to rinse the bottles one more time.

Prepare the Van Dorn Sampler

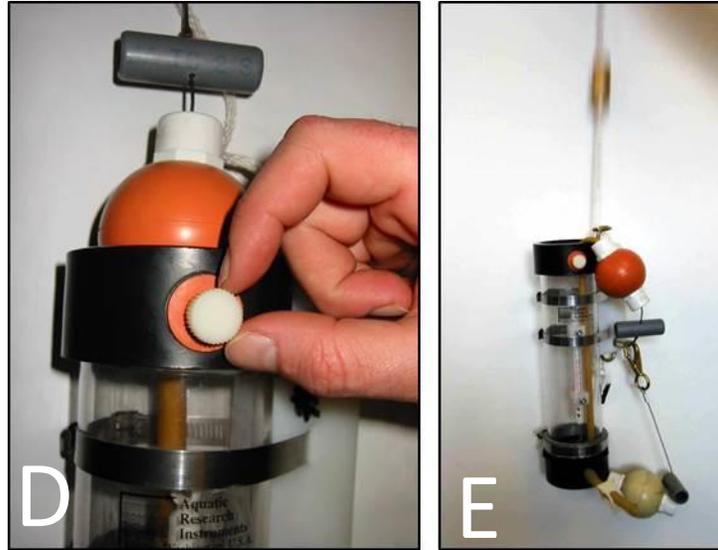
- While sitting, rest the Van Dorn across your knees so you can see the thermometer.
- With one hand, pull the rubber ball with the loop only (no clip attached) out of the tube and hold tightly. With the other hand push on the brass trigger on top of the white plastic housing so that you may insert the cable loop into the hole in the mechanism (see photo A below). Release the trigger so that it holds the cable loop in place.
- Pull the bottom ball out of the tube and towards the top ball, hooking the clip around the cable loop attached to the brass hook. Make sure the hook is around the entire loop, including both wires (see photo B below). The sampler is now set.
- To rinse the sampler, set as described above. Open the small plastic clamp on the drain tube (see photo C below). Keep the messenger (the weight attached to the Van Dorn line) with you on the boat and lower the sampler into the water until it is submerged. Gently raise and lower the sampler several times so that water passes through the chamber to rinse it.
- Raise the sampler to the boat, letting all of the water drain out, and close the drain tube clamp. You are now ready to collect your samples.



Van Dorn sampler set-up (photos A, B, and C).

Collect Water Samples and Read Temperature

- Set the Van Dorn as described above, making sure the drain tube clamp is closed. If there is a small white release valve on your Van Dorn, turn it clockwise to close it (see photo D below).
- To obtain a sample, keep the brass messenger in the boat and gently lower the sampler vertically into the lake so that the desired depth mark on the line is just visible at the surface of the water. Release the messenger down the line to activate the closure of the sampler (See photo E below).
- Turn the release valve counterclockwise to open it, open the drain tube clamp, and direct water from the Van Dorn into your rinsed sample bottles, filling the bottles to the neck.
- Reset the sampler and continue to drop to the desired depth until all samples are filled. Unless it is a profile sampling event, you will always collect your samples at a depth of **1 meter**.
- **Before emptying water from your final sample drop**, let the water sit for about one minute in the Van Dorn and read the water temperature from the thermometer located inside the sampler tube and record it on the data sheet to the nearest 0.5 °C.
- Immediately place samples in a cooler filled with ice. If you cannot fit a cooler into your boat, put the bottles in the shade, and when you get off the lake, place the samples in a cooler filled with ice as soon as possible.



Collecting water samples with the Van Dorn (photos D and E).

Profile Sampling

On two occasions, once in May and again in late August, you will collect samples from one or two additional depths. Depending on the total depth of your lake, you will collect profile samples from a mid-lake depth and/or a near-bottom depth. Sample bottles delivered for these dates will have labels indicating at what depths you should sample. Follow standard sampling methods for these sessions, and use the markings on the Van Dorn line to measure the appropriate depths.

If you hit the bottom of the lake when collecting the deepest sample, there will be sediment in the water. You may also feel the line go slack if you have contacted the bottom. If this happens, please discard the water and rinse the Van Dorn thoroughly, then take a sample 0.5 meters up from the depth marked on the label. Make a note on the field sheet so we know that the sample is from a shallower depth. This is very important, as water samples containing sediment cannot be used for laboratory tests.

Algae Bloom Samples

There may be occasions in which you see an algae scum at your lake that is not on a cyanotoxin sampling date or at your designated bluegreen algae sample location. We will provide extra bottles for you to collect samples in this situation. In cooperation with the Washington State Department of Ecology, we will analyze this additional sample for algae toxins. Please collect the sample in a similar manner, describe the algae scum appearance and location in the designated section of your data sheet, and mark the location on the lake map.

For additional information about harmful algae blooms, please see the Washington State Toxic Algae webpage at www.nwtoxicalgae.org.

Sample and Equipment Storage and Pick-Up

- Store your samples in the refrigerator overnight to keep cool and in the dark. On Monday, transfer your samples from the refrigerator to a cooler filled with ice. Be sure to keep the cooler

in the shade and replenish the ice if necessary. Place the cooler and your completed data sheet at the designated pick-up location.

- Samples will be picked up by staff and new bottles left for the next sampling date.
- If you miss a sample date, return the empty bottles from the missed sampling date with your next set of samples. If we miss leaving the next set of bottles for any reason, staff will either drop off or mail new bottles to you prior to the next sampling date.
- To store the Van Dorn, carefully wedge the metal clip underneath the end ball so air can circulate inside the tube and dry it before your next trip. This will avoid any mold or mildew build-up from wet conditions inside the equipment. For additional information about equipment maintenance and repair, please see the **Equipment Installation, Maintenance, and Repair** section of the Volunteer Manual.

Quality Assurance

The quality of the data collected through the Lake Stewardship Program depends on the level of adherence to the standard collection methods provided in this manual. Following are some additional notes on ways to ensure you are collecting quality data.

- Sample at the same location each time and anchor your boat to prevent drifting.
- Fill out the data sheet completely and note any unusual observations or conditions. The more notes we get, the better!
- Double check the field sheet and 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. Please let us know if you have the wrong bottle set. Note: If you sample on a different date than listed on the labels of the bottles, you can change the date on the labels to reflect your actual sample collection date.
- Sample the same way and generally at the same time (between 2 pm and 5 pm if possible).
- Rinse the Van Dorn completely before you begin, and allow it to dry completely after sampling.
- Rinse the sample bottles thoroughly three times before filling with water for proper analysis, with the exception of the bluegreen algae samples, which should not be rinsed.
- Keep your fingers out of the sampling equipment and bottles to avoid contamination, and hold bottle caps by their edges only. If you have trouble handling the equipment this way, wearing nitrile gloves can prevent contamination coming from hands.
- Fill bottles to the neck only (not full to the top) and cap tightly.
- Store samples in a refrigerator after sampling and transfer to a cooler with ice, placing it in the shade on pick-up day.

- Call Lake Stewardship Program staff when you have any questions or concerns. We like to hear from you and keep in touch.

The staff at the King County Environment Laboratory adhere to additional quality assurance procedures for water samples, including logging samples, reviewing data sheets, verifying lab work orders, and distributing the samples for analysis. Lab analysts follow detailed protocols to ensure that test results are as precise and accurate as possible. Lab staff also track samples, analyze data, and report final results.