

**PENNSYLVANIA'S CITIZENS' VOLUNTEER MONITORING PROGRAM
TSI (Trophic State Index)
LAKE MONITORING PROGRAM**

Welcome to Pennsylvania's Volunteer Lake Monitoring Program! This is a one-year monitoring program designed to train you how to collect baseline data on your lake of interest. For this program you will sample three times in one year - spring, summer, and fall. You will be measuring Secchi depth and pH, conducting temperature and dissolved oxygen profiles, and collecting samples to be analyzed at DEP's laboratory for total phosphorus (TP), total nitrogen (TN), alkalinity (ALK), total suspended solids (TSS), and chlorophyll *a* (chl_a). This information is used to help assess the trophic state index (TSI) of your lake. We are able to determine where along the productivity continuum your lake is. If a lake has very low productivity it is typically classified as oligotrophic. However, if there are excessive amounts of nutrients in the lake system, it may be classified as eutrophic or even hyper-eutrophic. Knowing this information can aid you in making educated management decisions.

This lake sampling program is fairly rigorous. You are expected to strictly adhere to the protocol. If you have any problems or have to deviate from the protocol, make notes on the field sheet. You may also want to call Dana Walker (717) 772-2413 or Barb Lathrop (717) 787-5259.

Make sure that you also read the Quality Assurance/Quality Control (QA/QC) document. Any specifics about the samples should be in that document. The QA/QC document does however assume that you know how to collect the samples. If you do not remember or need a refresher, the instructions that follow are to guide you in the field as to actual collection of the samples.

Thank you for helping to monitor Pennsylvania's lakes!

GENERAL PROCEDURES

1. Before you go out, make sure you have gas, or a charged up battery & all your equipment. Don't forget anchor, lifejackets, etc. Use the checklist.
2. Start sampling as early in the morning as feasible. If you are doing only one lake, there's no problem with starting at 10 AM. If you are doing two lakes in one day, you will need to start at 8AM or earlier (depending on the number of stations in your lakes & travel time between them). Dissolved Oxygen profiles must be taken before noon.
3. Make sure ice is in the cooler and that you have enough collection bottles. You may want to pre-label the bottles.
4. You will need:
 - 4 bottles per station: 1 for TN, TSS & ALK - surface
 1 for TP - surface
 1 for TN, TSS, & ALK - bottom
 1 for TP - bottom
 - 2 bottles for **blank**: 1 marked for TP - filled with DI water
 1 marked for TN, TSS, ALK - filled with DI water
 - 2 bottles for **duplicate**: Decide which of the "real " samples to duplicate (surface or bottom), fill 1 bottle for the TP sample and 1 bottle for the TN, TSS & ALK sample.

Take a couple of extra bottles along incase you lose one.
5. Use a permanent marker & write directly onto the bottle (follow template). Remember, 2 bottles get labeled the same number - 1 for TP and 1 for TSS/ALK/TN. "**Surface**" means 1 meter below the surface and "**Bottom**" means 1 meter above the bottom when doing water samples.
6. When you are done for the day, make a copy of the recorded field sheet for your records and then send the field sheet to:

PADEP Citizens' Volunteer Monitoring Lake Program
C/O Dana Walker
Bureau of Watershed Management
P.O. Box 8555
Harrisburg, PA 17105-8555

CALIBRATING THE pH METER

(pHTestr2)

The pH pens are two-point calibrated. This means you calibrate the meter to either 4 & 7 or 7 & 10, depending on if your lake is below or above pH 7. If you don't know which pH standard to use, do one set of calibrations and if your lake sample reading is not in the range you expected, recalibrate for the other range. The pH probe storage box also has calibration instructions.

PROCEDURE - pHTestr 2 (by Oakton)

1. Take the cap off the bottom of probe. Put probe into known 7.01 solution (use about 1-inch of solution).
2. Press ON/OFF button to turn unit on.
3. Press CAL button to enter calibration (CA) mode. 'CA" flashes on the display. Then, a pH value close to the pH buffer value will flash repeatedly.
4. After 30 seconds (about 30 flashes) press the HOLD/CON button to confirm calibration. Display will show 'CO' and then switch to the buffer value reading. Record this information on the Meter Calibration sheet.
5. Take probe out of pH 7 solution and rinse with water.
6. Pour a little of 4 or 10 standard on your probe (depending on which standard you are going to use). This will rinse away the water.
7. Put probe in 4 or 10 standard, repeat steps 3 & 4. Record results on the Meter Calibration sheet.
8. The pH meter is now ready to use.

CALIBRATING THE OAKTON CONDUCTIVITY METER

The conductivity meter should be set to the "AUTO" range (default setting). For this setting, the conductivity pens will be calibrated using a single-point calibration, and they will use the auto calibration feature.

Procedure (Oakton Waterproof ECTestr 11+)

1. Remove the protective cap and soak the electrode for 5-10 min. in the conductivity probe storage solution to remove any oil stains on the electrodes, which will affect the accuracy of the meter. Rinse thoroughly with deionized (DI) water and shake off dry.
2. Turn the meter on using the "ON/OFF" button.
3. Make sure the meter is in measuring mode (the LCD display will show "MEAS" in the top left corner of the display).
4. Unscrew the top of the meter at the battery compartment. Press the small "INC" or "DEC" key located inside the battery compartment to enter conductivity calibration mode. The keys are two small white buttons near the white plastic strip that surrounds the batteries (see image below).
5. The "CAL" indicator appears briefly in the display window and the number of points to which the meter will be calibrated (1-point). The upper display shows the conductivity reading, and the lower display should show the calibration standard value of 1413 $\mu\text{S}/\text{cm}$.
6. Place a small amount of the Conductivity Standard Solution (1413 $\mu\text{S}/\text{cm}$) into a small container.
7. Immerse the tip of the meter in the standard. Swirl the meter gently to create a homogenous sample and then allow the meter to stabilize.

8. Once the reading is stable, press the "HOLD/ENT" key to confirm the calibration. The display window will show "CO" for 2 seconds. The calibration is complete and the meter will return to measurement mode - the reading displayed should now be close to the 1413 $\mu\text{S}/\text{cm}$ value (+/- 20 units). Record this reading on the meter calibration sheet.

9. Your meter is now ready to use.

CALIBRATING THE DISSOLVED OXYGEN (DO) METER

PROCEDURE

1. Connect the probe wire into the meter. (Don't lose the red cap that goes over the connection).
2. Take the probe out of its humid plastic storage bottle and check the probe membrane to be sure it is not dry and does not have any air bubbles under it. If it is dry or has air bubbles, then you need to recondition the probe first. Instructions for this are in the meter carrying case.
3. Put the probe back onto its humid bottle cap to calibrate.
4. Turn the meter ON. It will do a self-check for about 10 seconds. If it says LO BATT, you will need to replace the batteries (6 D's 1.5 V) by opening up the back of the meter with a screwdriver. If it has any other error, see the manual.
5. Switch dial to CALIBRATE. It will ask "Calibrate in percent?" Push the CONFIRM button. On the back of the meter, find your altitude (elevation) and corresponding percent calibration. If you are on an elevation in-between two given numbers, make the calibration value in-between the ones given in the chart. (i.e. for 1000ft elevation, the calibration value is 96.5%). On the display "Enter cal value", push the up/down arrows to get to 96.5%. If you have calibrated the meter before and are at the same location, you can use the number that comes up as "Last = 96.5%". When the value is what you want, press CONFIRM. It will tell you what the calibration % is and you are ready to use the meter.
6. Record what you did on the Meter Calibration sheet.
7. Switch dial to 'O2'. Take the humid bottle cap off to take lake readings

NOTE: The meter's calibration can "drift" when you turn it off; so do not turn it off until you are finished for the day. If you turn it off during your day of sampling, you should re-check the calibration.

FIELD PROCEDURES

1. Find your first station. Anchor (as gently as you can). If it is not windy, hold off on anchoring to prevent disturbance of bottom.
2. Get out the field sheets and begin filling them out as to lake name, station location, weather, air temperature, etc.
3. Determine & record depth. If you don't have an electronic depth reader, use your marked Secchi line. Lower the Secchi disk until the disk lies on the bottom. Take reading on measured line.
4. Follow instructions for collecting all of the necessary information and samples.
5. Move to your second station and repeat the field procedures.

Secchi Depth

1. Take off sunglasses.
2. Lower the Secchi disk over the shady side of the boat.
3. Note the depth at which you can no longer see the disk.
4. Raise the disk and note the depth at which you can see it again.
5. Average these 2 depths & record that as the Secchi depth.

NOTE: If the Secchi goes all the way to the bottom and you can still see it, record "bottom" on the field sheet next to the Secchi reading in ft or m.

Water Sampling

1. Take the deep-water sample first if you did not anchor. If you did anchor, take it last. (You do not want kicked up mud from the anchor's disturbance to be in your sample. If you see dirt floating in your sampler when you bring it up, dump that water and get a new sample.)
2. Use the Van Dorn or Kemmerer sampler. Rinse it out **3 times** with lake water. You'll need to have a calibrated (measured) line securely attached. Don't forget to set the sampler. Do NOT touch the inside of any parts that will be in contact with sample water. Lower it to 1 meter below the surface. Send the messenger down, feel the sampler snap shut, and retrieve the sampler. Record the **TIME** on your field sheet.
3. Thoroughly rinse each sampling bottle & cap **3 times** with sample water before filling with lake sample. Do NOT touch the stream of water, the tube where water discharges, or the caps or bottle rims with your fingers. Your fingers have TP (phosphorus) on them, and we do not want your phosphorus in the sample water - only lake phosphorus! Be wary of sample contamination at all times! For instance, if it is pouring rain, you probably should NOT be collecting samples because rainwater will get into the bottles.
4. You have just retrieved a "sample". This sample has 1 sequence number because it is 1 sample, even though you are putting the sample in 2 different bottles.
5. Fill 1-500 mL bottle marked for TN, TSS & ALK (full) and 1-500 mL bottle marked for TP (only needs half filled, extra is OK).
6. Take some of the sample for a pH reading & put it in a small bottle (rinsed 3 times with sample water).

(Reminder - if you think you are short on water for pH, just fill the TP bottle to half full, saving 250 mL)

7. Make sure the bottles are labeled & caps are on tight. Immediately put bottles into cooler w/ ice.
8. Repeat for bottom sample. Send water sampler to 1 m above the bottom, retrieve, rinse & fill 2 bottles, label them properly, and take a pH reading.

TP Preservation Procedure

The TP samples will have to be preserved with a few drops of sulfuric acid (H_2SO_4). You can do this now in the boat OR later back on shore, but DON'T FORGET! Not preserving will render this sample useless!

This acid is VERY strong - do not spill it, it will ruin everything it touches. If you get it on you, treat it as a hazardous substance & rinse, rinse, rinse!

1. Open your bottles labeled for TP analysis.
2. Draw a dropper-full of acid out of its container using a plastic pipette. Put 3 to 4 pipettes-full into the TP sample bottle.
3. Recap the bottle tightly without touching the inside of the cap and shake.
4. Pour a little sample water into the cap.
5. Check the pH of the water with the pH paper strips.
6. Make sure the pH paper is near or just below a pH of 2.0. VERY IMPORTANT!
7. Empty the cap of sample water into a waste container.
8. Recap the bottles.
9. Put the bottles into cooler with ice.

Duplicate Sample

Doing a duplicate sample is a quality assurance/quality control (QA/QC) check for you and the laboratory.

Take a duplicate water sample at least once every 20 samples.

Take an extra sample at either site (if you are doing two sites) from either the surface or the bottom depth & fill your 2 bottles with it.

Treat duplicate samples the same as the real samples in all respects

Label exactly the same as regular sample, **EXCEPT** the collecting time and collection number will be different & that's how I tell which one is the duplicate. (I never see the bottles - make sure the time & all other information is on the **field sheet** and that it corresponds properly to the labeled sample).

DO NOT mark "duplicate" on the bottle, we don't want the lab to know, but **DO** mark it on the field sheet so that I know.

You **MUST** put acid in the bottle for the sample that will be analyzed for TP.

Blank Sample

Doing a blank (or 'blind') sample is a quality assurance/quality control (QA/QC) check for you and the laboratory.

Take a blank water sample at least once every 20 samples.

Fill 2 bottles with DI (deionized/distilled) water (NOT TAP WATER).

Treat blank samples the same as the real samples in all respects

Label exactly the same as regular sample, **EXCEPT** the collecting time and collection number will be different & that's how I tell which one is the blank. (I never see the bottles - make sure the time & all other information is on the **field sheet** and that it corresponds properly to the labeled sample).

DO NOT mark "blank" on the bottle, we don't want the lab to know, but **DO** mark it on the field sheet so that I know.

You **MUST** put acid in the bottle for the sample that will be analyzed for TP.

pH Measurement:

You will take 3 pH readings: 1 from the bottom sample, 1 from the surface sample (which in reality is at 1 meter depth), and 1 from the "real" surface of the lake.

RINSE the probe in lake (sample) water once or twice before taking pH reading.

Using water from the sampler, in a separate open container, take a pH reading & record the value on the field sheet.

When done with the pH probe for the day, make sure the cap has a little storage solution in it (pH standard 4 is second best). Make sure switch is OFF. Store in pH case DRY.

Conductivity Measurement

You will take 3 conductivity readings: 1 from the bottom sample, 1 from the surface sample (which is at 1 meter depth), and 1 from the "real" surface of the lake.

RINSE the probe in lake (sample) water once or twice before taking the conductivity reading.

Using water from the sampler, in a separate open container, take a conductivity reading and record the value on the field sheet.

When done with the conductivity probe for the day, make sure that the probe is rinsed well and stored DRY. The conductivity probe storage solution sounds deceptive. This storage solution is meant to be used at the BEGINNING of each sampling event, prior to calibrating the meter. The solution is intended to clean the probe before it is calibrated, and before taking a reading in the lake.

DO & Temperature Profile

Due to the physical/chemical changes that take place in a lake during a 24-hr period, we require that you take all DO readings before noon. This is helpful for 2 reasons. First, you will minimize the variation that would occur as a result of sampling at different times of the day. Second, during the morning hours is when you will typically see the lowest DO levels. Low DO levels can be harmful to aquatic life.

When you are doing profiles (measuring oxygen & temperature every meter from surface to bottom) the surface is at the very top of the water.

Once your meter is calibrated (done either onshore or on the boat), you should leave it ON. If someone should happen to turn it off, re-check the calibration.

Start at the surface (right at the top of the water). Put the probe in the water & keep it in slight motion. Keep the probe at that depth until you get steady temperature and DO readings, about 1-2 minutes. Record the temperature & DO reading. Lower probe to 1-meter depth. Take reading & record. Do this at each meter all the way to the bottom.

When done with both stations, turn the meter OFF. Make sure the probe is put back into its tight fitting small plastic cover/bottle. A piece of wet paper towel placed in the bottom of the bottle will keep the membrane moist. Change it if it becomes dirty.

Make sure the meter is DRY before storing. Store meter & probe secure in the carrying case.

Chlorophyll *a* Sampling:

1. Put your filtering apparatus together.
2. Put a filter in the filter area Rough Side up.
3. Hook up your suction hand pump.
4. Get another water sample from 1 meter down.
5. Rinse the graduated cylinder three times with sample water.
6. Fill the graduated cylinder w/ 1000 mL of sample water.
7. Pour water into the receiving vessel from the graduated cylinder & pump it through the filter. Be sure to RECORD the amount actually filtered on the field sheet & also on the lab submission form!
8. You can use all of the 1000 mL but you don't have to. The **minimum amount is 250 mL**. You need to have a definite green stain on the filter when you are done. If its not very discolored, filter more (although you do not have to filter more than 1000 mL).
9. Remove the filter paper (try to only touch the edges of the filter paper – its not critical not to touch the filter – its just better not to). Fold filter in half, onto itself. Put in aluminum foil packet & fold to keep light out. Write the sample number on the foil packet. Put the foil packet into a small-labeled plastic bag. **Label with: date, collection number, lake name (& station if more than 1)**. Put on ice until you can put the sample in a freezer. Freeze overnight. Chlorophyll samples can be kept for a period of time in the freezer & can be sent in with later samples.
10. Run a duplicate chlorophyll *a* in the summer.

SHIPPING PROCEDURES

***NOTE: Chlorophyll samples can be kept for a period of time in the freezer. After the fall sampling session, all the chlorophyll samples can be shipped together. ***

1. Make sure all water sample bottle lids are on tight.
2. Place bottles in the cooler with ice.
3. Place the chlorophyll samples in a padded manila envelope
4. Put the envelope in a large sealed plastic bag.
5. Place the plastic bag down one side of the cooler in ice.
6. Put the lab submission sheets for the chlorophyll a samples with the water sample lab submission sheets.
7. Put all lab submission sheets in a sturdy plastic Zip-loc bag.
8. Tape the plastic bag (with duct tape) to the INSIDE top of cooler lid.
9. Make sure that the samples are well **iced** (especially in the hot, summer months).
10. CURRIER??? – I'm working on this with Barb's help.
11. Get the samples to the drop off point.

WRAP-UP

That's It! Great Job!