Volunteer River Monitoring Sampling Protocols

Volunteer River Monitoring Program
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Introduction

In 2009, the DEP launched a statewide volunteer river monitoring program (VRMP). The VRMP is a network of volunteer groups participating in quality assisted river and stream sampling. The program operates under a program level Quality Assurance Program Plan (QAPP). Volunteer groups develop Sampling and Analysis Plans that tailor the program level QAPP to their project goals.

The VRMP is designed to guide and train volunteer groups to collect high quality data that is useful to various agencies within the State of Maine and beyond. Volunteers are able to sample and monitor parts of rivers and streams that state agencies do not have the resources to monitor on a regular basis. Volunteer groups are able to identify parts of rivers or streams which may have degraded water quality, thus helping organizations such as MDEP, Maine Department of Inland Fisheries & Wildlife, Maine Department of Marine Resources, non-profits, conservation districts, and towns prioritize where to investigate conditions further and where to focus best management practice (BMP) implementation efforts. These data are also used to gather baseline information and track trends over time. This work has the added important benefit of engaging citizens in learning about and protecting the ecological integrity of Maine's rivers and streams through the hands-on experience of volunteer water quality monitoring.

The intent of these water quality sampling protocols is to serve as a guide and reference for VRMP volunteers. It covers all aspects of monitoring to include safety, QA/QC procedures, sampling schedule, collection of water samples, processing of samples for lab analysis, completion of datasheets, and proper use of field meters.

Field Safety

Follow these precautions to have a safe and enjoyable experience. **YOUR SAFETY IS MORE IMPORTANT THAN COLLECTING A SAMPLE!**

General Precautions:

- **Work in teams** – If possible, monitor with at least one other person.
- **Notify friends or family** – Tell somebody where you will be and when you expect to return. Carry a cell phone, if available.
- **Avoid working in streams during stormy weather or high water** – If it is specifically required to by your sampling plan to sample during a storm, work in teams and exercise extreme caution. Do not wade in if the water is high or fast.
- **Avoid being outside when lightning is nearby** – Avoid water, high ground, and open spaces if lightning is nearby. Avoid all metal objects including extension poles, electric wires, fences, machinery, motors, power tools, etc. If you are outside and lightning is nearby, avoid areas underneath canopies, partially open or small picnic or rain shelters, or near trees. Where possible, find shelter in a substantial building or in a fully enclosed metal vehicle such as a car, truck or van with the windows completely shut. For more information, visit: http://lightningsafety.noaa.gov/outdoors.shtml.
- **Be wise with water contact** – During and after sample collection, keep hands away from eye and mouth areas. Always wash hands with soap and clean water after sampling. Wear disposable gloves and rubber boots, especially if the stream is likely to be polluted.
- **Sample collection** –
    - Be careful around traffic (wear bright orange clothing or safety vests if working in or near streets and/or bridges).
    - Avoid sampling at areas having high or steep stream banks.
    - Do not enter water that goes above your thighs.
    - Do not enter water if there is any concern for one's safety (e.g. high, fast flows).
    - Be careful walking on slippery surfaces such as stream banks and stream bottoms.
    - Dress appropriately for field conditions.
    - Wear an appropriate personal floatation device when working in or near water and especially when working in boats.
- **Avoid working in areas where hunting may be taking place** – Wear two articles of bright orange clothing (hat, vest, etc.) if your are unsure whether hunting is taking place near your stream monitoring sites.
- **Be careful around animals and plants** – Learn to identify poisonous plants, especially poison ivy, and be aware of your sensitivity to them. Wear a long sleeve shirt and tuck your pants into your socks. Do a tick check after being in the field.

Quality Control Steps

Standard Operating Procedures (SOPs) and Sampling and Analysis Plans (SAPs) are a part of the VRMP's quality assurance foundation. Within each SOP and SAP, there may be specific quality control measures that are recommended. The following summarize the various QA/QC measures that are part of the VRMP program.

1. Individual volunteers are evaluated for the adequacy of their sampling techniques and the measurement abilities of their monitoring/sampling equipment at annual volunteer certification/re-certification workshops.

2. Monitors follow an approved SOP for each parameter monitored. Additionally, field calibration and/or accuracy determination procedures are performed for those parameters that require it.

3. A field duplicate is obtained by each volunteer for at least 10% (1 duplicate per 10 samples collected or monitored) annually of their own sampling efforts for all parameters.

4. For water samples requiring laboratory analyses, duplicate samples are obtained for at least 10% of samples (i.e. 1 duplicate per 10 samples) collected per parameter. This set of samples is designated as a set of duplicates for that particular sampling event on the label (i.e. "Duplicate" or "Dup").

5. Sample bottles or containers, if used, are appropriately prepared (e.g. rinsed, sterilized) prior to sampling, by either a laboratory or the volunteer group according to approved SOPs.

6. Laboratories that are used by volunteer groups must be a DEP approved lab. Quality control data must be submitted by each laboratory to their patron volunteer monitoring groups who will, in turn, submit electronic copies of this information to the VRMP.

Sampling Sites and Schedule

Freshwater Monitoring and Time of Day

In order to assess attainment of dissolved oxygen (DO) criteria within Maine's water quality standards, early morning monitoring may be necessary. DO values generally fluctuate depending on time of day with lowest values often occurring in early morning and the highest values late in the day. The fluctuation may be minimal or significant depending on a number of factors (e.g. streamflow, water temperature, and plant and algae growth). DO data collected during the early morning (between dawn and 8:00 AM) are therefore important for water quality monitoring purposes. Except as naturally occurs, if DO concentration falls below the applicable DO criteria at any time of day, this also signals non-attainment.

Not all of the samples need to be collected early in the morning, but it is important to include at least some early morning samples. Collecting water quality data at particular times of the day (e.g. very early in the morning or late in the day if looking for diurnal differences) can be difficult and inconvenient; however, it is encouraged whenever possible.

Coastal Waters Monitoring and Time of Day

Depending on the goals of the sampling plan and tidal influences, sample teams may want or need to time sampling around high tide. At some coastal sampling sites, it may be difficult to collect samples at other than close to high tide. Also if a goal of the sampling plan is to assess watershed influences, it is best to sample on the outgoing tide.

Sampling Season and Frequency

Sampling season and frequency vary by individual volunteer group. However, to improve consistency and comparability, groups are encouraged to sample at least once every two weeks between the months of May and September. If possible, include at least 1 or 2 sampling events after rain events. This is particularly important if the groups are monitoring for bacteria.

Sampling Sites

Each sample team should be clear on the location of their monitoring site(s) and sample approach (e.g. Cold Brook Road crossing- sample from upstream side of bridge crossing). It is critical that volunteers consistently sample from the same location time after time (whenever feasible and safe) to ensure comparability of data at that particular river or stream location. If a volunteer needs to deviate from the standard sampling location, for example such as for safety reasons, carefully note this on the datasheet.

Sample Approach

Lateral Position Across a River/Stream

→ Sampling needs to occur so that a flowing, well-mixed, representative sample is collected. If possible, volunteers should try to sample in the "center half of flow". This is usually close to the middle of the channel, though it can sometimes move away from the middle of the channel, following the thalweg (deepest part of the channel),towards the outside of a river-bend.

→ Samplers need to avoid shore-related features such as :
• eddies • deadwaters • shallows • jetties
• pools (even though parts of the thalweg may pass through them)
• docks (unless a well-mixed sample can be obtained)

→ To obtain a well-mixed, representative sample, volunteers can use a variety of techniques including:
• wading out • reaching out • using an extension pole • using a boat
• sampling from a bridge/culvert using a VRMP approved water sampling device

Vertical Position in a River/Stream

(In all cases, avoid allowing water surface films or "stirred-up bottom sediments" into the sample. Always face upstream when sampling)

(*For Dissolved Oxygen & Temperature as well as any Other Water Quality Parameters*)
→ For rivers/streams that are non-wadeable, sample at mid-depth (if depth is known) or 1-meter below the surface
→ For rivers/streams that are wadeable, sample at mid-depth or 1 ½ feet below the surface (Volunteers should specify which depth on their data sheet.)

(*For Dissolved Oxygen & Temperature Profiles*)
→ Sample at 1-m increments to obtain a vertical profile

Longitudinal Position in River/Stream

(when near crossing such as a bridge or culvert)

→ To avoid the possible effects of roads, bridges, or scour pools on water quality, the preferred location to sample is at the upstream end of a bridge or culvert crossing (as opposed to the downstream end) unless:
(1) it is safer to sample at the downstream end;
(2) the purpose of sampling at the downstream end of the crossing is to include any effects of the crossing on water quality

Sample Collection Protocols

Supplies for Water Samples

□ Water quality kits from a VRMP-approved laboratory, which include containers specific to parameter(s) measured and preservatives, as required
□ Waterproof labels (BE SURE TO STICK ON CONTAINERS PRIOR TO SAMPLING)
□ VRMP-approved water sampling device if sampling from a bridge or boat
□ VRMP-approved laboratory chain of custody sheets
□ Permanent marker
□ Pencil

Option 1 (Wading)

a) Caution should be used in all cases, especially when wading in rivers and streams deeper than two feet. If sampling within a stream or river, wearing waders and a USCG-approved Type-III floatation vest (PFD) are recommended.
b) Be sure waterproof label is on container and is properly labeled.
c) Approach the stream from a downstream location, walking upstream to the sampling site. (This prevents the disturbance of bottom sediments that could contaminate the water quality sample.)
d) Rinse sample containers in stream water three times (only for certain parameters). Be careful not to contaminate the cap, neck or inside of container with your fingers.
If using a Whirl-Pak ® for bacteria sampling avoid collecting surface film:
e) The Whirl-Pak ® should be submerged before opening it to collect the water sample. Submerge it under water, open the bag and remove it once it is approximately half-full. Roll up (whirl) the bag to close it and seal it by tying the two yellow tabs together. Using clean tongs with alligator clips that attach to the Whirl-Pak ® bag by its two yellow tabs is acceptable for holding the bag.
For all other containers (in both options, avoid collecting surface film):
f) (Alternative 1-a: submersing bottle before cap is unscrewed)
With cap still screwed on, submerse bottle underwater. (It is ok to loosen cap before submersion.) Tip container upright, remove cap (keeping hand downstream of bottle), and allow water to fill container. Once container is full, place cap on while the container is still submersed. Remove container from water.
g) (Alternative 1-b: unscrewing cap first and then submersing bottle)
Remove cap from bottle. With bottle pointed upside-down, quickly submerse the bottle under water, turn it upright, and allow it to fill with water. Once container if full, quickly remove it from water and cap.

Option 2 (Collecting from edge of river/stream or boat by reaching one's arm or by using an extension pole.)

Edge of River or Stream: Reaching to collect a sample from edge of river/stream is acceptable if a well-mixed sample may be obtained. Use an extension pole to collect sample if well-mixed sample cannot be obtained by reaching.

Reaching Method

a) Be sure waterproof label is on sampling container and is properly labeled.
b) Rinse sample containers in stream water three times (only for certain parameters). Be careful not to contaminate the cap, neck or inside of container with your fingers.
If using a Whirl-Pak ® for bacteria sampling avoid collecting surface film:
c) The Whirl-Pak ® should be submerged before opening it to collect the water sample. Submerge it under water, open the bag and remove it once it is approximately half-full. Roll up (whirl) the bag to close it and seal it by tying the two yellow tabs together. Using clean tongs with alligator clips that attach to the Whirl-Pak bag by its two yellow tabs is acceptable for holding the bag.
For all other containers (in both options, avoid collecting surface film):
d) (Alternative 1-a: submersing bottle before cap is unscrewed)
With cap still screwed on, submerse bottle underwater. (It is ok to loosen cap before submersion.) Tip container upright, remove cap (keeping hand downstream of bottle), and allow water to fill container. Once container is full, place cap on while the container is still submersed. Remove container from water.
e) (Alternative 1-b: unscrewing cap first and then submersing bottle)
Remove cap from bottle. With bottle pointed upside-down, quickly submerse the bottle under water, turn it upright, and allow it to fill with water. Once container is full, quickly remove it from water and cap it.

Extension Pole Method

a) Be sure waterproof label is on container and is properly labeled.
b) Rinse the clamp end of the extension pole in the stream/river prior to sampling.
c) Remove lid or stopper from sample container prior to sampling. Be careful not to contaminate the cap, neck, or inside the container with your fingers.
d) Securely attach the sample container to the extension pole using the clamps.
e) Extend the pole to desired length. Ensure that a well-mixed sample will be collected. (Do not, however, extend the pole too far when sampling in high velocity streams to avoid damage to the pole.)
f) Rinse sample containers in stream water three times (only for certain parameters).
g) Prepare to collect water samples by first rotating the extension pole until the sample container is oriented upside down.
h) Immerse the sample container to desired length and then rotate the pole underwater to fill the container. (Avoid collecting surface film).
i) Once the sample is full, remove it from the water, cap it and remove it from the clamp.

Option 3 (VRMP approved water sampling device method if collecting from a bridge or from a boat:)

a) Be sure waterproof label is on appropriate containers and that they are properly labeled.

b) Make sure the VRMP approved water sampling device has been cleaned ahead of time.
c) Rinse the sampling device and any associated sample containers in stream water three times (only for certain parameters).
d) Lower the sampling device from the upstream side of the bridge or boat (whenever possible) into the river to the appropriate depth. Completely fill the sampling device with water.
e) Pull the filled sampling device up and carry to a safe location. Avoid bumping the sampling device against the bridge as you raise it to avoid any potential sample contamination.
f) Prepare to analyze your water sample. Place the sample container on a clean stable surface such as the bottom of an upside-down 5 gallon bucket.
g) *Dissolved oxygen and temperature:* In many cases volunteers will be monitoring dissolved oxygen (DO) and temperature directly off of bridges using meters and probes with long cords that follow other standard operating procedures (SOPs). If instead, you are analyzing dissolved oxygen and temperature directly from the water within you sampling device, analyze the sample for DO and temperature first, following the appropriate equipment SOPs, before analyzing anything else. Do not agitate the water before DO and temperature have been measured.
h) *Other water quality parameters:* After DO and temperature have been measured, swirl and mix the water sample. Measure other parameters using the appropriate meters/probes, or pour off water samples into their appropriate sample containers.
i) Empty out any water from the device. After the last sample site, rinse three times with stream water. Prop it open a little to allow it to air dry. Store in a clean area.

Lab Samples

a) Label bottle with the following information:
    - □ Volunteer group/organization name (or at least initials)
    - □ Site name and/or ID number
    - □ Date and time of sample collection
    - □ Type of analysis to be performed on the sample (e.g. E. coli)
b) Store and transport samples in cooler with ice, as appropriate.
c) Complete VRMP field data sheet.
d) Complete either chain of custody or sample submission forms to be submitted along with samples at VRMP approved laboratory.
e) Drop off samples at laboratory within holding time frame.
f) (See your SAP for specifics on sample handling).

Datasheets

Make sure you are using the most up-to-date VRMP data sheet. The data sheets are provided at the training session. If you need more, contact your group's coordinator or the VRMP (mary-ellen.c.dennis@maine.gov or 207-215-7946).
Data sheets are also available on the VRMP webpage:
www.maine.gov/dep/water/monitoring/rivers_and_streams/vrmp/index.html

1. When filling out the data sheet, write as neatly as possible.
2. Make sure the following are completed on the data sheet:
   - The QA/QC section must be completed. If not, the data will be rejected.
   - If you did a zero dissolved oxygen test check, record the information on the data sheet.
   - Remember to do duplicate sampling for 10% of the measurements/samples.
   - If samples were collected for laboratory analyses, make sure to record that in the "SAMPLES FOR LABORATORY ANALYSIS" section.
   - Under additional comments, record any information that would be helpful in interpreting the results. Such comments as: there was heavy rain in the last couple of days, ducks near sampling site (affects bacteria), sampled upstream 50 feet due to high water are useful.
3. Review the data sheet to ensure that it is complete and sign it.
4. Forward your datasheet(s) to your group's data manager.

Water Quality Monitoring Equipment Standard Operating Procedures

General procedures for monitoring equipment:

1. Remember to do a zero dissolved oxygen check of the DO meter halfway through the sampling season.
2. Leave the dissolved oxygen meter on between sampling stations. Other equipment may be turned off between stations.
3. Store meters in a cool, dry place. Meters should not be left in your car, except for the period of time when you are out sampling.
4. If equipment is used in saltwater, rinse the cable and probe with freshwater after each sample day. The refractometer should not be rinsed-just wipe with soft cloth.
5. After sampling for the day, leave storage cases open overnight to allow equipment to dry.
6. Equipment used for collecting water samples (e.g. van dorn bottle, kemmerer bottle) should be kept clean. Rinse devices with stream water 3X at each sample site and after the last sample site. Prop open to allow it to dry and then keep covered between sample events. (Keep in a bucket or clean trash bag).

The next section provides step by step instructions for use of water quality monitoring equipment:

YSI 85 Meter

Check the calibration chamber and turn on the meter

NOTE: Always store the probe in the calibration/storage chamber. It should be kept in the storage chamber at all times except when taking measurements.

1. Ensure that the dissolved oxygen membrane remains moist inside the storage chamber. If needed, wet the sponge with a few drops of tap water. Allow any excess water to run out.
2. Turn the meter on for at least 15 minutes before calibration.

Calibrate the meter:

NOTE: The meter must be calibrated before use. Do not turn the meter off between sampling stations. If it is unintentionally turned off, turn the meter back on for 15 minutes and re-calibrate.

(Calibration Steps):

1. Record the time the meter was turned on and the calibration time on the data sheet.
2. Press the **MODE** button until the meter is in the dissolved oxygen percent saturation mode as indicated by '%' on the right side of the screen.
3. Press and release both the **DOWN and UP** arrow buttons at the same time. (You will see 'CAL' in the lower right hand corner of the screen.)
4. The screen will prompt you to enter the local altitude in hundreds of feet. For example, enter 8 for an altitude of 800 feet. Use the **UP or DOWN** arrow to increase or decrease the altitude. When the proper altitude appears on the screen, press the **ENTER** button.
5. The screen should now display 'CAL' in the lower left hand corner. The calibration value in the lower right hand corner and the current DO reading (before calibration) on the main display.
6. Make sure the current % reading (large reading) is stable, then press the **ENTER** button. The display should read 'SAVE' and then return to normal operation mode.
7. Record the calibration value on the data sheet. If the calibration value is <97% or >103%, re-calibrate the meter.

Measuring water temperature, dissolved oxygen and specific conductivity:

1. Remove the probe from the calibration chamber and place in the stream at the required depth. (Mid-depth or 1 ½ feet below the surface in wadeable streams. Mid-depth or 3 feet below the surface in non-wadeable streams.)
2. Slowly move the probe back and forth or up and down (jig) at a rate of 1 foot per second. If placing the sensor in a stream or fast moving water, it is best to place it perpendicular to the flow and not facing into the flow.
3. Wait for the temperature and dissolved oxygen readings to stabilize. Record the temperature and dissolved oxygen in both mg/l and % saturation on the data sheet. You will need to press the **MODE** button to get to either mg/l or % saturation.

4. To measure specific conductivity, press the **MODE** button twice to get to temperature compensated specific conductivity as indicated by the flashing ‘°C’ and the uS/cm units. Record the specific conductivity value on the datasheet.

YSI 550A Meter

Check the calibration chamber and turn on the meter

NOTE: Always store the probe in the calibration/storage chamber. It should be kept in the storage chamber at all times except when taking measurements.

1. Ensure that the dissolved oxygen membrane remains moist inside the storage chamber. If needed, wet the sponge with a few drops of tap water. Allow any excess water to run out.
2. Turn the meter on for at least 15 minutes before calibration.

Calibrate the meter:

NOTE: The meter must be calibrated before use. Do not turn the meter off between sampling stations. If it is unintentionally turned off, turn the meter back on for 15 minutes and re-calibrate.

(Calibration Steps):

1. Record the time the meter was turned on and the calibration time on the data sheet.
2. Pass the **MODE** button until the meter is in the dissolved oxygen percent saturation mode as indicated by '%**'** on the right side of the screen.
3. Press and release both the **DOWN and UP** arrow buttons at the same time. (You will see 'CAL' on the lower left hand corner of the screen.)
4. The screen will prompt you to enter the local altitude in hundreds of feet. For example, enter 8 for an altitude of 800 feet. Use the **UP and DOWN** arrows to increase or decrease the altitude. When the proper altitude appears on the screen, press the **ENTER** button.
5. The screen should now display 'CAL' in the lower left hand corner, the calibration value in the lower right hand corner and the current dissolved oxygen reading (before calibration) on the main display. Make sure the current '%' reading (large display) is stable, then press the **ENTER** button.
6. The screen will now prompt you to enter the approximate salinity of the water you will be measuring. You can enter any number from 0 to 70 parts per thousand (PPT) of salinity. Use the **DOWN and UP** arrow buttons to decrease or increase the salinity setting. When the proper salinity value appears on the screen, press the **ENTER** button.

NOTE: If sampling in freshwater, ensure that salinity is set to zero (0).

If sampling in estuarine-marine waters, you will need to measure salinity at your site with a refractometer and then enter that value.

If you have multiple sites, salinity will need to be measured at each site and the meter re-calibrated with the appropriate salinity value. If you move to a freshwater site, re-calibrate and enter zero for the salinity value.

Measuring water temperature and dissolved oxygen

1. Remove the probe from the calibration chamber and place in the stream at the required depth. (Mid-depth or 1 ½ feet below the surface in wadeable streams. Mid-depth or 3 feet below the surface in non-wadeable streams.)

2. Slowly move the probe back and forth or up and down ("jig") at a rate of 1/2 foot per second. If placing the sensor in a stream or fast moving water, it is best to place it perpendicular to the flow and not facing into the flow.
3. Wait for the temperature and dissolved oxygen readings to stabilize. Record the temperature and dissolved oxygen in both mg/l and % saturation on the data sheet. You will need to press the **MODE** button to get to either mg/l or % saturation.

YSI Pro 2030 Meter

Check the dissolved oxygen membrane and calibration chamber

NOTE: Always keep the grey rubber storage sleeve over the probe at all times (except when taking measurements) to keep the probe in a moist environment.

1. Ensure that the dissolved oxygen membrane stays moist inside the storage sleeve. If needed, add a few drops of clean water to the sponge. Pour off excess water.
2. Turn the meter on for at least 15 before calibration.

NOTE: There are seven options for displaying conductivity to include Cond-mS/cm, Cond-us/cm, SPC-mS/cm, SPC-us/cm, Salinity-ppt, TDS-g/l and TDS-mg/l. Only two units can be enabled at the same time. Specific conductivity (uS/cm) and salinity are enabled. If other units are required, contact the VRMP.

Calibrate the meter

NOTE: The meter must be calibrated prior to use. Do not turn the meter off between sampling stations. If it is unintentionally turned off, turn the meter on for 15 minutes and re-calibrate.

(Calibration steps):

1. Record the time the meter was turned on and the calibration time on the data sheet.
2. Press and hold the calibrate key for 3 seconds.
3. Scroll with the arrow keys to highlight 'Dissolved Oxygen' and press **ENTER**.
4. Select 'DO%' when prompted and then press **ENTER**. The screen will show a '%' saturation reading and '%' calibration.
5. Wait at least 3 seconds, then, once the DO% and temperature readings are stable, press **ENTER**. 'Calibration Successful' will display for a few seconds to indicate a successful calibration. The meter returns to the main screen.
6. Record the dissolved oxygen % saturation value on the data sheet.

Measuring water temperature, dissolved oxygen, specific conductance and salinity

1. Remove the probe from the calibration/storage sleeve and place in the stream at the required depth. (Mid-depth or 1 ½ feet below the surface in wadeable streams. Mid-depth or 3 feet below the surface in non-wadeable streams.) Make sure the conductivity sensor is completely submerged. The two holes near the cable should be covered for accurate readings.
2. Slowly move the probe back and forth or up and down ("jig") at a rate of 1/2 foot per second. If placing the sensor in a stream or fast moving water, it is best to place it perpendicular to the flow and not facing into the flow.
3. Wait for the temperature and dissolved oxygen readings to stabilize. Record the temperature, dissolved oxygen (mg/l and % saturation) on the data sheet.
4. Freshwater: Record the specific conductivity (uS/cm) on the data sheet.
   Estuarine waters: Record the salinity (PPT) on the data sheet.

NOTE: DO NOT make any changes to the screen menu settings. The meter has been set up with particular settings and options.

YSI ProODO Professional Plus (Optical Meter)

Check the sensor cap and calibration chamber

NOTE: Always keep the grey rubber storage sleeve over the probe at all times (except when taking measurements) to keep the probe in a moist environment.

1. Ensure that the dissolved oxygen probe stays moist inside the grey rubber storage sleeve. If needed, add a few drops of clean water to the sponge. Pour off excess water.

Calibrate the meter

NOTE: The ProODO is an optical meter and therefore does not need to be calibrated before each sampling event. It is calibrated at the beginning of the field season when the sensor cap is replaced. It will need to be re-calibrated if the sensor cap is allowed to dry out. If this occurs, please contact the VRMP.

NOTE: There is no warm-up period associated with the ProODO optical meter. It also may be turned off between sample sites to conserve battery power.

Measuring water temperature and dissolved oxygen

1. Remove the probe from the storage sleeve and place in the stream at the required depth. (Mid-depth or 1 ½ feet below the surface in wadeable streams. Mid-depth or 3 feet below the surface in non-wadeable streams.)
2. Move the probe to release any air bubbles. Movement is only necessary initially. Since the ProODO utilizes optical luminescent technology, continuous movement is not required.
3. Wait for the temperature and dissolved oxygen readings to stabilize. Record the temperature and dissolved oxygen (mg/l and % saturation) on the datasheet.

EC Testr 11/11+ Pen

Measuring temperature and conductivity

1. Remove electrode cap and turn the pen on.
2. Hold the electrode directly in the stream or into a clean sample bottle with the collected sample. (Clean means that the sample container has been rinsed 3X with stream water at the sample site.) Make sure the sensor is fully covered by water.
3. Wait for the reading to stabilize. This may take a couple of minutes or more, particularly if the water is very cold. A good check is to cross check against the temperature reading obtained with the dissolved oxygen meter. Record the reading on the data sheet.
4. Replace the electrode cap.

EC 300A Conductivity Meter

Measuring specific conductivity in freshwater

1. Remove the screw-on cap on the meter (where probe connects). Connect the conductivity probe and cable to the unit. Place the cap in the small plastic container so as not to lose it.
2. Turn the unit on.
3. Place the probe in the stream or a clean sample bottle with the collected sample. (Clean means that the sample container has been rinsed 3 times with stream water at the sample site.) Completely submerge the probe and shake lightly to remove any trapped air bubbles in the conductivity cell.
4. Press and release the **MODE** button until specific conductivity is displayed. The display will show 'conductivity compensated' at the top of the screen. The main display will show 'conductivity' (uS/cm or MS/cm) and 'temperature'. If the conductivity is very high, it will display the reading in MS/cm instead of uS/cm. Note this on the data sheet.
5. Allow the temperature to stabilize. This may take a couple of minutes or more, particularly if the water is very cold. A good check is to cross check against the temperature reading obtained with the dissolved oxygen meter. Record the specific conductivity reading on the data sheet.
6. Turn off the meter.
7. When finished sampling for the day, disconnect the probe and cable. Replace the screw-on cap on the meter.

Measuring salinity in estuarine water

1. Remove the screw-on cap on the meter (where probe connects). Connect the conductivity probe and cable to the unit. Place the cap in the small plastic container so as not to lose it.
2. Turn the unit on.
3. Place the probe in the stream or a clean sample bottle with the collected sample. (Clean means that the sample container has been rinsed 3 times with stream water at the sample site.) Completely submerge the probe and shake lightly to remove any trapped air bubbles in the conductivity cell.
4. Press and release the **MODE** button until 'salinity' (PPT) is displayed at the top of the screen.
5. Allow the temperature to stabilize. This may take a couple of minutes or more, particularly if the water is very cold. A good check is to cross check against the temperature reading obtained with the dissolved oxygen meter. Record the salinity reading on the data sheet.
6. Turn off the meter.
7. When finished sampling for the day, disconnect the probe and cable. Replace the screw-on cap on the meter.

Extech RF20 Refractometer

Calibrate the refractometer

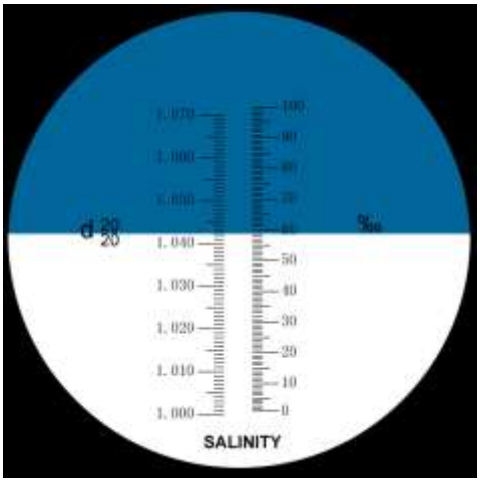
NOTE: The refractometer must be calibrated (preferably at home) before each sampling event.

1. Open the cover plate.
2. Place a few drops of distilled water on the prism.
3. Close the cover plate. The distilled water should spread out as a thin layer between the cover plate and the prism. It should cover the entire surface of the prism-there should be no air bubbles or dry spots.
4. Looking through the eyepiece, rotate the adjusting screw so that the light/dark boundary line (known as the shadow line) evens up with the zero line.
5. When calibration is complete, clean the prism with a soft cloth.

Measuring salinity

1. Open the cover plate.
2. Place a few drops of the sample on the prism.
3. Close the cover plate. The sample should spread out as a thin layer between the cover plate and the prism. It should cover the entire surface of the prism-there should be no air bubbles or dry spots. Allow the sample to remain on the prism for approximately 30 seconds.
4. Looking through the eyepiece, hold the refractometer toward the light.
5. Read the salinity concentration determined by the intersection of the boundary of the light and dark fields (known as the shadow line) on the printed scale. The left side of the scale indicates the specific gravity and the right side salinity in parts per thousand. If the scale is out of focus, adjust the eyepiece by turning the ridged portion of the eyepiece.
6. Record the measurement on the data sheet.
7. Wipe the prism dry with a clean cloth (do not wash or rinse).

Field of view



Hanna Pocket pH Tester

NOTE: The probe must be stored wet by keeping the sponge in the cap moist. If the sponge is dry-add a few drops of tap water. If the probe is allowed to dry out, it must be soaked in tap water for 1 hour or more before calibration.

Calibration

NOTE: The pH tester must be calibrated (preferably at home) before each sampling event.

1. Remove the cap from the pH tester. Do not wipe the probe with a kimwipe or other tissue as this may cause an electrostatic charge that can affect accuracy.
2. Cut open the top of the pH 7.01 and pH 4.01 calibration buffer solutions (sachets) with scissors being careful to not spill the solution.
3. Turn on the pH tester by pressing the **POWER/MODE** button.
4. Insert the pH tester all the way into the pH 7.01 calibration solution.
5. Press and hold the **POWER/MODE** button until 'off' is replaced by 'Cal'. Release the button. The pH tester will display '7.01' and 'use' and then 'Rec'. After the first calibration point of 7.01 has been accepted, 'pH 4.01' and 'Use' will appear. This message will be held for 12 seconds.
6. Remove the probe from the pH 7.01 sachet and place it in the pH. 4.01 buffer solution. When the buffer is accepted, 'pH 4.01' and 'OK 2' message appears. It then returns to normal operation.
7. Record calibration check on the data sheet.
8. Turn the pH tester off and rinse with tap water (not distilled water).
9. Replace the cap.
10. Discard the calibration solutions or clip shut and keep until the end of the day for another calibration check. Solutions must be discarded after 1 day.

Measuring pH

1. Remove the cap from the pH tester.
2. Turn on the pH tester by pressing the **POWER/MODE** button.
3. Hold the tester directly in the stream or into a clean sample bottle while stirring gently. (Clean means that the sample container has been rinsed 3 times with stream water at the sample site.)
4. [Alternatively, use a bucket for collecting a sample and follow these steps:
   - Put the bucket somewhere where it is protected from direct wind and sun as much as possible.
   - Set the handle of the bucket upright and clip it in place with a clothespin.
   - Hang the pH tester from the handle so that it sits upright (not flat on the surface of the water). The water line should be somewhere between the 'C/F' markings on the tester.
   - Once the pH tester is in the water, give it at least 3 minutes to equilibrate, but do not let it sit for more than 5 minutes.]
5. The measurement should be taken when the stability symbol on the top left of the screen disappears. Record the pH measurement on the data sheet.
6. Press the **POWER/MODE** button to turn the tester off. Replace the storage cap.