

# **NH Volunteer River Assessment Program**

## **Water Quality Monitoring Sampling Protocols For Volunteer Monitors**

**LaMotte 2020e Turbidity Meter**

**Oakton pH 11 Meter**

**YSI 85 Water Temperature/Dissolved Oxygen/Conductivity Meter**



**New Hampshire Department of Environmental Services**

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**<http://des.nh.gov/organization/divisions/water/wmb/vrap/index.htm>**

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## Sampling Reminders

**Calibrate the pH and dissolved oxygen meters before each measurement!**

**Do not turn off the dissolved oxygen meter until the end of the day!**

**Run a replicate sample once a day!**

**Test the pH 6.0 buffer, turbidity DI blank, and zero oxygen once a day (QA/QC Meter Checks)!**

**Check the conductivity meter with the known standard at the beginning & end of the day!**

**Calibrate the turbidity meter with the 1.0 NTU standard at the beginning of the day and check it with the 1.0 NTU standard at the end of the day.**

**Rinse everything with DI water - a lot!**

# Introduction: What is VRAP?

The New Hampshire Volunteer River Assessment Program (VRAP) was established in 1998 to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP aims to educate people about river and stream water quality and ecology and to improve water quality monitoring coverage for the protection of water resources.

Today, VRAP loans water quality monitoring equipment, provides technical support, and facilitates educational programs to volunteer groups on numerous rivers and watersheds throughout the state. These groups conduct water quality monitoring on an ongoing basis and increase the amount of river water quality information available to local, state and federal governments, which allows for better watershed planning.

This manual is meant to be used as a guide for VRAP monitors. Take this manual with you in the field as a reminder of the proper sampling procedures. Each meter has a very important calibration procedure which must be followed to ensure the sampling results are as accurate as possible. If you encounter problems during calibration, refer to the manufacturer's operation manuals or contact the VRAP staff.

This manual is also designed to compliment the annual VRAP volunteer training workshop and is not a replacement for attending a training workshop. VRAP staff are also available to visit with each group in the field. Please contact us to schedule a visit.

## Informational Resources

- **Water Quality Monitoring Field Sampling Protocols:**  
[http://des.nh.gov/organization/divisions/water/wmb/vrap/documents/protocols\\_new\\_meters.pdf](http://des.nh.gov/organization/divisions/water/wmb/vrap/documents/protocols_new_meters.pdf)
- **VRAP Field Data Sheet:**  
[http://des.nh.gov/organization/divisions/water/wmb/vrap/documents/field\\_data\\_sheet.pdf](http://des.nh.gov/organization/divisions/water/wmb/vrap/documents/field_data_sheet.pdf)
- **A Quick-Reference Guide to Water Quality Standards**  
[http://des.nh.gov/organization/divisions/water/wmb/vrap/documents/wq\\_standards.pdf](http://des.nh.gov/organization/divisions/water/wmb/vrap/documents/wq_standards.pdf)
- **Interpreting VRAP Water Quality Parameters:**  
[http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/vrap\\_parameters.pdf](http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/vrap_parameters.pdf)
- **Troubleshooting Guide to VRAP Water Quality Meters:**  
[http://des.nh.gov/organization/divisions/water/wmb/vrap/documents/troubleshooting\\_meters.pdf](http://des.nh.gov/organization/divisions/water/wmb/vrap/documents/troubleshooting_meters.pdf)

## For More Information

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# Safety in the Field

It is important to ensure that adequate safety precautions are taken in the field. The most common hazards associated with conducting VRAP sampling are listed below along with recommended safety precautions. This is not a comprehensive safety protocol, but rather a guideline to ensure safe field conditions.

## General

- Always monitor with at least one person.
- Listen to weather reports and exercise caution if inclement weather is forecasted.
- Have a first-aid kit accessible.
- If you feel uncomfortable about the condition of the stream or your surroundings, terminate monitoring efforts for the day.

## Stream Safety

- Do not enter the water if the stream is at flood stage.
- Streambeds composed of coarse substrates and/or bedrock can be slippery and have deep pools.
- Streambeds composed of finer substrates can prove treacherous in areas where mud, silt, or sand creates unstable terrain.
- If you must cross the stream, use a walking stick to steady yourself and to probe for deep water and unstable terrain.

## Poison Ivy

- Look for poison ivy, poison oak, sumac, and other types of vegetation that can cause rashes and irritation.

## Mosquitoes

Mosquito-borne illnesses such as West Nile virus and Eastern Equine Encephalitis (EEE) have become more prevalent. The following steps can reduce the incidence of mosquito bites.

- Apply an effective repellent to exposed skin and clothing.
- Wear long-sleeves, long pants, and socks.

## Ticks

Ticks, which can carry the Lyme disease bacterium, prefer wooded and bushy areas with high grass and abundant leaf litter. Exercise precaution in May, June, and July, when ticks that transmit Lyme disease are most active.

- Wear long pants, long sleeves, and long socks to keep ticks off your skin. Wear light-colored clothing to help you spot ticks more easily. Tuck pant legs into socks or boots and tuck shirts into pants to help keep ticks on the outside of clothing.
- Perform daily tick checks after being outdoors. Inspect all parts of your body carefully. Remove ticks immediately using fine-tipped tweezers.

## Sun/Heat

- Dress for the heat. Wear a hat and lightweight, light-colored clothing. Light colors will reflect some of the sun's energy.
- Drink water.
- If you or someone else is showing the signals of a heat-related illness, stop activity and find a cool place.

# Quality Assurance & Quality Control

In order for VRAP data to be used in the assessment of New Hampshire's surface waters, the data must meet quality control guidelines as outlined in the VRAP Quality Assurance Project Plan (QAPP). The QAPP is reviewed annually and is officially updated and approved every five years. The VRAP Quality Assurance/Quality Control (QA/QC) measures include a six-step approach to ensuring the accuracy of the equipment and consistency in sampling efforts.

## 1. Calibration

- Calibrate the pH and dissolved oxygen meters prior to each measurement of the day.
- Check the conductivity meter against a known standard prior to the first measurement of the day. Check and calibrate the turbidity meter against a known standard prior to the first measurement of the day.

## 2. Replicate Analysis

- Measure and record a second measurement by each meter from the original sample at one of the stations during the sampling day. Replicates should be measured within 15 minutes of the original measurements. If more than one team is out sampling each team should complete a replicate analysis.

## 3-5. QA/QC Meter Checks

- **6.0 pH Standard:** Measure and record a reading of the 6.0 pH buffer at one of the stations during the sampling day. Do not calibrate the meter prior to this measurement as it is intended to detect drift in the meter
- **Zero Oxygen Solution:** Measure and record a reading of a zero oxygen solution at one of the stations during the sampling day. The dissolved oxygen concentration value should be below 1.0 mg/L.
- **DI (De-Ionized) Turbidity Blank:** Measure and record a reading of the DI turbidity blank (0 NTU) at one of the stations during the sampling day.

## 6. End of the Day Conductivity & Turbidity Meter Checks

- Re-check and record a reading of the conductivity and turbidity meters against a known standard at the conclusion of each sampling day.

## Please Note

- If the same sampling schedule is used throughout the monitoring season, the Replicate Analysis and QA/QC Meter Checks should be conducted at different stations.

# Completing the VRAP Field Data Sheet

One person should perform all of the data entry on the VRAP Field Data Sheet for that particular sampling date so that entries are consistent.

## Completing the VRAP Field Data Sheet

### Do:

- Write in black or blue pen.
- Enter data neatly, legibly, and thoroughly so that there is not any missing, incomplete, or incorrect information.
- Ensure that all sections of the VRAP Field Data Sheet are completed before proceeding to the next sampling station.
- If a parameter cannot or was not measured (i.e., instrument failure), record the reason for the missing data under the “Comments” section on the back of the VRAP Field Data Sheet.
- When the measurements have been taken at a station, review the VRAP Field Data Sheet to ensure that all the necessary data are accurately recorded and that everything is legible.
- If an error is made in recording data, do not erase. Please draw a single pencil line through the incorrect values and enter the correct values.
- Lastly, remember to legibly print the first and last name of each volunteer for that particular sampling date on the VRAP Field Data Sheet, so that we can give all volunteers proper credit!

### Do Not:

- Write in pencil or red pen.
- Write “%” in pH Calibration Slope, Dissolved Oxygen Calibration Value, Dissolved Oxygen Chamber Reading, or Dissolved Oxygen % Saturation.
- Write “N/A” or cross out the cells of the data sheet if you did not collect that particular measurement.
- Include a NHDES Station ID if you were unable to sample at that station for a particular reason, please draw a single pencil line through the NHDES Station ID.

## Submitting the VRAP Field Data Sheet

Field Data Sheets can be mailed to:

**NH Volunteer River Assessment Program**  
NH Department of Environmental Services  
Watershed Management Bureau  
29 Hazen Drive PO Box 95  
Concord, NH 03302-0095

They can also be e-mailed as PDF to [jen.drociak@des.nh.gov](mailto:jen.drociak@des.nh.gov) or faxed to (603) 271-7894.

Please submit Field Data Sheets as soon as possible after data collection so that VRAP staff can enter and assess data in a timely manner. Please do not wait until the end of the sampling season to submit all of your data sheets!

# Collecting Samples for Field & Laboratory Analysis

## Order of Field Tests

- Pour and/or collect samples for laboratory analysis
- Turbidity
- pH
- Water Temperature, Dissolved Oxygen
- Specific Conductance

## Collecting Samples for Field Analysis

**Please label all bottles *prior to filling them with the following information:* NHDES Station ID, date and time of collection, test(s) required, and collector's initials.**

Begin with the most downstream sampling station so that sampling activities do not affect water quality at downstream stations.

### Method 1: Bridge Sampling

1. Lower the bucket into the river from the **upstream** side of the bridge (water flowing toward you).
2. Fill  $\frac{1}{4}$  of the bucket with water.
3. Pull the bucket up, swish the water around in it to rinse, and discard the rinse water off the downstream/opposite side of the bridge. Repeat this process two more times.
3. Return the bucket into the river from the upstream side of the bridge and slowly fill  $\frac{1}{2}$  -  $\frac{3}{4}$  of the bucket with water (you may wish to weight one side of the bucket).
4. Slowly pull up the bucket with sample water. Do not bump the bucket against the bridge or otherwise agitate the sample water in the bucket as this may introduce additional oxygen and sediment and may yield inaccurate readings.
5. Carefully carry the sample to a safe location for analyses. Do not place the sample bucket in direct sunlight or on hot pavement as this may alter water temperature and dissolved oxygen measurements and may yield inaccurate readings.

### Method 2: Offshore Sampling

1. Carefully wade out into the river as close as possible to the center (to collect the most representative sample). Do not enter water above your waist and be sure someone on shore knows where you are.
2. Facing **upstream** (water flowing toward you), rinse the bucket with water. Do not collect the water that is running over your legs/boots. Discard the rinse water behind you, downstream. Repeat this process two more times.
3. With the bucket held in front of you, dip the lip of the bucket into the flowing water slowly fill  $\frac{1}{2}$  -  $\frac{3}{4}$  of the bucket with water.
4. Carefully carry the sample to a safe location for analyses. Do not place the sample bucket in direct sunlight or on hot pavement as this may alter water temperature and dissolved oxygen measurements and may yield inaccurate readings.

## Collecting Samples for Laboratory Analysis

- Please contact the VRAP Coordinator and complete the Laboratory Services Login & Custody Sheet prior to relinquishing samples to NHDES.
- Remember to pour off water for laboratory analyses prior to sampling field parameters.
- If you are collecting ***E. coli*** or **chloride** samples for laboratory analysis the bottles may be filled either directly from the river (offshore sampling method), or by pouring from the bucket sample (bridge sampling method).
- If you are collecting samples which have strong acid preservatives in them (such as **total phosphorous, total Kjeldahl nitrogen** and **metals**), the bottles should only be filled by pouring from the bucket sample (bridge sampling method only).
- Preserve the bottles in a cooler on ice, and relinquish the samples to the NHDES Laboratory Services within the sample holding time appropriate to each test.
- Always return samples to the NHDES Laboratory Services before 3:00PM (Monday – Thursday) or before 12:00PM on Friday.

### **Method 1: Bridge Sampling (*Any laboratory parameters*)**

1. Immediately after the bucket sample is collected, pour off any samples for laboratory analysis to the neck of the sample bottle without overflowing.
2. Place sample(s) in a cooler on ice.

### **Method 2: Offshore Sampling (*E.coli and chloride parameters only*)**

1. Carefully wade out into the river and sample about knee deep or midway between the top and bottom of a flowing stream.
2. Remove the cap of a sterilized *E.coli* bottle and ***avoid touching the neck, inside the bottle, or cap to prevent contamination.***
3. Point the mouth of the bottle down towards the water's surface.
4. Using a “U”-shaped motion, thrust the bottle under the water's surface and fill in one continuous upstream motion (*away from you*), turning the bottle right side-up at the bottom of the “U”. In this fashion, the water will flow into the bottle, then over your hand. If sampled in a downstream fashion, the water would flow over your hand then into the bottle causing contamination from the sampler. Fill to the neck only, leaving some air at the top of the bottle for laboratory analytical processes.
5. Replace the cap on the bottle, carry the sample to shore, and place sample in a cooler on ice.

# Completing the NHDES Laboratory Services Login & Custody Sheet

VRAP staff is available to assist you with the login procedure for laboratory samples. Please contact the VRAP Coordinator prior to relinquishing samples at NHDES. The following is a guideline for how to complete the NHDES Laboratory Services Login & Custody Sheet which is required to be submitted along with your samples.

- **Client ID:** Please leave blank.
- **Lab Account (Billing):** Please write in either your group's laboratory account number or the VRAP lab account number which is 05-0022518
- **One Stop Project:** Please write in "VRAP".
- **NHDES Site Number:** Please leave blank.
- **Description:** Please write in your river or watershed name.
- **Town:** Please leave blank.
- **Collected By:** Please write in the name and phone number of the person who should be contacted if there are any questions about the samples.
- **Contact & Phone Number:** Please write in "Jen Drociak, 271-3307 or 271-0699"
- **Sample Location/Station ID:** Please use NHDES VRAP Station IDs. If the ID is not exactly the same as the one in our database it holds up the reporting of the results of the entire sampling batch which was relinquished.
- Common mistakes include not including a zero where it is needed (1-BKB instead of 01-BKB), adding text to the end of the station ID (00M-BKB Front Street instead of just 00M-BKB), and forgetting to include the dash between the number and Station ID or REP for replicates (01BKB instead of 01-BKB or 01-BKBREP instead of 01-BKB-REP).
- **Date/Time Sampled:** Please write the date and time of each sample collected.
- **# of Containers:** Please list the number of sample bottles per station.
- **Matrix:** Please write "AQ" for aqueous.
- In the columns to the right of the "Matrix" column, please write in the parameter to be analyzed. (For example TP, TKN, *E.coli*, chloride, nitrate, etc.)
- **Sampler Comments:** Please leave blank.
- **Lab Login #.** Please leave blank.
- **Relinquished By:** Please sign your name on the top line and leave the bottom line blank.
- **Date & Time:** Please write the date and time you relinquished the samples on the top line and leave the bottom line blank. If you measured field parameters, the time(s) on the Login & Custody sheet should match the time(s) on the VRAP Field Data Sheet.
- **Received By:** Please leave blank. This will be completed by the NHDES Laboratory Services personnel.

Please fill in the number of pages (Example: Page 1 of 1) at the bottom of the sheet.

# Turbidity: LaMotte 2020e Turbidity Meter

## Before Sampling: Perform and Record the Initial Turbidity Check Value

1. Turn the meter **ON**.
2. Select **MEASURE** mode by pressing **\*OK**. The screen will display “Scan Blank”.
3. Carefully wipe off any water, dust and/or fingerprints from the “DI Blank” (0.0 NTU) vial with a Kimwipe only.
4. Open the lid of the turbidimeter and align the single, squared-off notch (or the vertical white line located on the vial) on the “DI Blank (0.0 NTU)” vial with the arrow under the meter lid.
5. Close lid. **SCAN BLANK** by pressing **\*OK**.
6. Carefully wipe off any water, dust and/or fingerprints from the “1.0 NTU” vial with a Kimwipe.
7. Open the lid of the turbidimeter and align the single, squared-off notch (or the vertical white line located on the vial) on the “**1.0 NTU**” vial with the arrow under the meter lid.
8. Insert the vial into the chamber. Close lid. **SCAN SAMPLE** by pressing **\*OK**.
9. Record the value on the top left of the VRAP Field Data Sheet as the “**Initial Turbidity Meter Check Value**”. If the value is “1.00” you do not need to calibrate.

## Before Sampling: Calibrate the Meter

**Note:** The turbidimeter needs to be calibrated prior to the first measurement and checked once after the last measurement. Please turn the meter off when not in use to conserve battery power.

1. Press **DOWN ARROW** until calibrate appears on the LCD screen, and then press **\*OK** to select **CALIBRATE**.
2. Use **DOWN ARROW** and/or **UP ARROW** to change highlighted digits on the display to read **01.00**. **\*OK** moves the highlight to the next digit.
3. Select **SET** by pressing **\*OK**.

## Measuring Turbidity

1. **Rinse** the small plastic sample container with DI water. Then rinse the same container twice with a small amount of river water from the bucket.
2. Slowly pour sample water from the bucket into the plastic sample container (1/2 full) to avoid adding bubbles to the sample.
3. From the turbidimeter case remove the sample vial labeled “Sample” or “S”.
4. **Rinse** the sample vial once with DI water and then twice with river water from the plastic sample container.

5. Fill the sample vial with river water by carefully and slowly pouring the water down the side of the sample vial to avoid introducing any bubbles.
6. Wipe any water, dust and/or fingerprints off the sample vial with a Kimwipe. **Note: Any residue on the vials will interfere with an accurate turbidity reading. Anything other than Kimwipes may scratch the vials, causing inaccurate readings.**
7. Open the lid of the turbidimeter and align the single, squared-off notch (or the vertical white line located on the vial) on the cleaned sample vial with the vertical, white indexing line that is printed on the tube.
8. If the meter is turned off, turn it **ON** and select **MEASURE** mode by pressing **\*OK**.
9. If the meter is already **ON**, ensure you scroll down so the meter reads “Scan Sample” (otherwise the meter will read “Scan Blank”).
10. **SCAN SAMPLE** by pressing **\*OK**.
11. **Record** the displayed turbidity value on the VRAP Field Data Sheet.
12. If the turbidity value is great than 10 NTU you should recalibrate the meter with the 10 NTU standard and take another reading. This will give a more accurate measurement of how high the turbidity level is. If you do recalibrate with the 10 NTU standard, be sure to indicate this under the “Comments” section on the back the VRAP Field Data Sheet. **Recalibrate with the 1.0 NTU at the next station to prevent the readings from being artificially elevated.**
13. Turn the meter **OFF**. Remove the sample vial, empty it and rinse with DI water. Fill the sample vial with DI water.

### QA/QC Meter Check

1. At one of the stations during the sampling day measure and record a reading of the DI Turbidity Blank (0.0 NTU) standard. If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.
2. **Record** the value, station, and time on the VRAP Field Data Sheet.

### End of the Day Meter Check

1. At the end of the day, read the 1.0 standard.
2. **Record** the value under the “**End of Day Meter Check**” on the VRAP Field Data Sheet.
3. Turn the meter off.
4. **Rinse** the sample vial with DI water and fill the vial with DI water for storage.

# pH: Oakton pH 11 Meter

## Before Sampling: Calibrate the Meter

**Note:** The pH meter must be calibrated prior to each measurement (at each station) including a replicate.

1. Ensure electrode connections are properly fastened in the appropriate ports.
2. Unscrew the cap on the Electrode Storage Container and remove the end of the pH probe (the screw cap can remain on the electrode). Clean any salty deposits off by rinsing the probe with DI water. Blot dry with a Kimwipe. **CAUTION:** Be sure to never touch the glass bulb on the bottom; even with a Kimwipe.
3. Press the **ON/OFF** button to turn the meter on. The **MEAS** indicator should be shown.

## First Standard to Test (7.0 pH Buffer):

4. Immerse the probe into the 7.0 buffer (yellow solution). The end of the probe must be completely immersed into the sample.
5. Press the **CAL/MEAS** button to enter pH calibration mode. The **CAL** indicator will be shown. The primary display will show the measured reading while the smaller secondary display will indicate the pH standard buffer solution (the meter will recognize the pH buffer).
6. Wait for the measured pH value to stabilize and the **READY** indicator to appear on the display. The **READY** indicator may flash on and off so wait until it is steady.
7. Press **HOLD/ENTER** key to confirm calibration. The meter is now calibrated to the current buffer.
8. Remove the electrode from the 7.0 buffer, rinse it with DI water and blot dry with a Kimwipe.

## Second Standard to Test (4.0 pH Buffer):

9. Place the electrode in the second (4.0) buffer (red solution).
10. Wait for the measured pH value to stabilize and the **READY** indicator to appear on the display. The **READY** indicator may flash on and off so wait until it is steady.
11. Press **HOLD/ENTER** button to confirm calibration. The meter is now calibrated to the current buffer.
12. Remove the electrode from the 4.0 buffer, rinse it with DI water and blot dry with a Kimwipe.

## View pH Electrode Slope:

13. Enter measurement mode by pressing the **MEAS/CAL** button.
14. Press the **SETUP** button to enter Set Up mode.
15. Press the **MI/UP** or **MR/DOWN** buttons to scroll through until you view parameter P3.0.

16. Press the **HOLD/ENTER** button. The display shows the electrode offset mV value. If you have not calibrated at any buffer, the primary display shows “---”.
17. Press the **HOLD/ENTER** key again to proceed to electrode slope display. The display shows electrode slope in percentage.
18. **Record** the slope on the VRAP Field Data Sheet
19. To return to **MEAS** mode press the CAL/MEAS button twice.
20. The meter will proceed to the measure mode; **MEAS** is displayed above the main display field. The meter is now ready for use.

## Measuring pH

**Note:** The pH meter must be calibrated prior to each measurement (at each station) including a replicate.

1. Remove the probe, **rinse** with DI water and blot the plastic areas dry with a Kimwipe. **CAUTION:** Be sure to never touch the glass bulb/measurement end; even with a Kimwipe.
2. Immerse the pH probe into the small plastic sample container. The meter should be in the **MEAS** mode. Submerge the bottom two inches of the electrode and agitate by slowly moving the electrode back and forth in the sample for the pH reading to stabilize (this should take approximately two minutes).
3. Wait for the **READY** indicator to be displayed and record the value on the VRAP Field Data Sheet. The READY indicator may blink on and off. It is important to wait until drifting of the pH value has stopped before recording measurement.
4. **Rinse** the probe with DI water and return it to the electrode solution storage container. Ensure the pH electrode storage container is filled about halfway with pH storage solution. Be careful not to push the electrode against the bottom of the container as this could damage the electrode. **Never store pH probe in DI water!**
5. Turn the meter **OFF** and return the meter and the probe to its kit.

## QA/QC Meter Check

1. At one of the stations during the sampling day measure and record a reading of the 6.0 pH buffer. If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.
2. **Record** the value, station, and time on the VRAP Field Data Sheet.

## End of the Day

1. Turn the meter off. **Rinse** the probe with DI water and blot dry with a Kimwipe.
2. Return the probe to the storage solution container. Store probe upright.

# Water Temperature, Dissolved Oxygen & Specific Conductance YSI 85 Multimeter

## Before the Meter is Turned On: Check the Dissolved Oxygen Membrane & Calibration Chamber

To ensure the dissolved oxygen membrane remains moist inside the meter calibration/storage chamber, pull the probe out of the chamber and add a few drops of deionized (DI) water to the sponge at the bottom of the calibration/storage chamber. Turn the meter on its side to allow any excess water to drain out of the chamber. *This step will only be necessary once per sampling day, but be sure the sponge in the calibration/storage chamber is moist before storage.* Be careful not to over-wet the sponge. *Calibrate the meter after 15 minutes and after any excess “puddled” water is drained from the chamber.*

**Note:** The wet sponge creates a 100% saturated air environment within the chamber for ideal calibration conditions. Ensure that the sensor does not contact the wet sponge by inserting the probe only until the rubber seal is flush with the outer edge of the chamber.

## If Bubbles ARE Detected: Change the Membrane

Membrane life depends on usage. Membranes will last a long time if installed properly and treated with care. Erratic readings are a result of loose, wrinkled, damaged, or fouled membranes, or from large bubbles in the electrolyte reservoir. If erratic readings or evidence of membrane damage occurs, you should replace the membrane and the solution, following Step A through Step G. (Record the performed maintenance under the “Comments” section on the back of the VRAP Field Data Sheet). To keep the membrane from drying out, store the probe in the calibration chamber with the damp sponge.

- A. Unscrew and remove the black protective cage.
- B. Unscrew and remove the old membrane cap.
- C. Thoroughly rinse the sensor tip (gold and silver areas) with DI water.
- D. Hold the membrane cap upside down and add enough drops of the membrane probe solution to form a meniscus in the probe membrane cap.
- E. Tap the bottom of the cap with your finger a few times to remove any trapped air bubbles.  
**CAUTION:** Do not touch the membrane surface.
- F. Screw the membrane cap onto the probe tightly by hand (to prevent leakage of probe solution). A small amount of probe solution should overflow.
- G. Shake off any excess probe solution and rinse the sensor thoroughly with DI water to prevent corrosion.

## Before Sampling: Turn the Meter On And Perform & Record the Initial Conductivity Meter Check Value

1. Turn the meter on by pressing the **ON/OFF** button.
2. **Record** the time the dissolved oxygen meter was turned on - on the upper right front page of the VRAP Field Data Sheet.
3. Ensure the meter is in the temperature compensated specific conductance mode by pressing **MODE** until the °C is flashing to indicate this mode.

4. **Rinse** the probe with DI water and blot dry with a Kimwipe. Gently shake the probe to remove water from the oval upper conductivity opening.
5. Submerge the entire probe in **conductivity standard solution**, and allow to stabilize. Ensure there is enough solution to cover the top opening of the probe.
6. Record the **“Initial Conductivity Meter Check Value”** on the top left of the VRAP Field Data Sheet. A 20% error regardless of the standard used (1,600 – 2,400 $\mu$ S for 2,000 $\mu$ S standard, 160-240 $\mu$ S for 200 $\mu$ S standard or 80 $\mu$ S - 120 $\mu$ S for 100 $\mu$ S standard) is acceptable. If the reading is outside of this range, please check again with new standard if available. If new standard is unavailable please sample anyway and contact VRAP staff as soon as possible.
7. **Rinse** the probe with DI water and return it to the storage chamber.

### Wait 15 Minutes with Probe in Chamber Prior to Calibration

1. Ensure the meter has been turned ON with the probe in its chamber for at least 15 minutes before calibrating.

### Before Sampling: Calibrate the Meter for Dissolved Oxygen

**Note:** The Dissolved Oxygen/Temperature meter must be calibrated prior to each DO measurement (each station) including a replicate.

1. **Record** the time of the first dissolved oxygen calibration on the upper right front page of the VRAP Field Data Sheet.
2. Press the **MODE** button until dissolved oxygen is displayed in % saturation. The **MODE** button on the YSI 85 can be used to toggle back and forth between % saturation and mg/L however, the YSI 85 will also cycle through the specific conductance modes.
3. Press and release both the **DOWN** and **UP** arrow buttons (DOWN slightly prior to UP) to enter the DO/Temperature meter calibration menu. You will see **CAL** in the lower left hand corner when you have successfully entered calibration mode.
4. The screen will prompt you to enter the local altitude in hundreds of feet. Use the **UP** and **DOWN** arrows to adjust the value appropriately (For example, entering a 12 indicates 1200 feet above sea level) and press **ENTER**.
5. **Record** the dissolved oxygen calibration value (**displayed on the bottom right-corner of the LCD screen**) on the VRAP Field Data Sheet. The calibration value will vary with altitude and thus may be different at each station if the altitude varies.
6. Press **ENTER** again. The display should read **SAVE** and then return to normal measurement mode.
7. Wait approximately one minute for dissolved oxygen % saturation to stabilize. Once it has stabilized, record the dissolved oxygen % saturation (chamber reading) on the VRAP Field Data Sheet. If drift occurs (goes up or down by more than 5%) ensure you have waited long enough for the reading to stabilize. If drift still occurs, recalibrate.
8. **Leave the meter on until you are finished with all measurements for the day. Calibration must be repeated before each individual measurement. If the meter shuts off, you must wait 15 minutes with the probe in its chamber before calibrating.**

## Measuring Water Temperature & Dissolved Oxygen

**Note:** This meter should remain on until the last station has been sampled. If the meter is turned off prior to the end of the sampling day, the meter must be turned on and allowed a 15-minute warm-up period, with the probe in its chamber, prior to calibration and additional sampling. Remember, the dissolved oxygen/temperature meter must be calibrated prior to each dissolved oxygen measurement.

1. Remove the probe from the calibration chamber and **rinse** the probe and cable (approximately 6 inches) with DI water. If necessary, press the **MODE** button until dissolved oxygen is displayed in % saturation.
2. Submerge the probe into the bucket and agitate by slowly moving the probe back and forth in the sample until the water temperature stabilizes. Record the water temperature (°C) on the VRAP Field Data Sheet.
3. After the water temperature has stabilized, wait for the dissolved oxygen (% saturation) to stabilize. Once it is stable, record the value on the VRAP Field Data Sheet.
4. Immediately press the **MODE** button and immediately **record** the value for dissolved oxygen concentration (mg/L) on the VRAP Field Data Sheet.

## Measuring Specific Conductance

1. Press the **MODE** button twice to put the meter into the temperature compensated specific conductance mode. The °C should be flashing on and off to indicate this mode.
2. Ensure the probe is immersed in the sample and is deep enough to cover the entire probe. Do not allow the probe to touch any solid object or the bottom of the bucket while you are taking readings. It is also important that there are no air bubbles on/in the electrode. To dislodge any bubbles, gently move the electrode through the water before recording the measurement.
3. Agitate by slowly moving the probe back and forth in the sample until the specific conductance value stabilizes. **Record** the specific conductance value on the VRAP Field Data Sheet.

**Note:** Please keep the reference temperature of the meter at 25 °C at all times of the year, instead of changing it to 20 °C during the winter months and 25 C after April 1<sup>st</sup>. If you receive an error message of “LErr”, switch modes to conductivity (the °C will not flash on and off in this mode), and take that measurement instead. Cross out the word “Specific” on the VRAP Field Data Sheet and write “Actual”.

## QA/QC Meter Check

1. At one of the stations during the sampling day measure and record a reading of the Zero Dissolved Oxygen Solution (% saturation and mg/L). If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.
2. **Record** the value, station, and time on the VRAP Field Data Sheet.
3. **Rinse** the probe with DI water and return it to the storage chamber.

## End of the Day Meter Check

1. Ensure the meter is in the temperature compensated specific conductance mode by pressing **MODE** until the °C is flashing to indicate this mode.
2. **Rinse** the probe with DI water and blot dry with a Kimwipe. Gently shake the probe to remove water from the oval upper conductivity opening.
3. Submerge the entire probe in the **conductivity standard solution**, and allow to stabilize. Ensure there is enough solution to cover the top opening of the probe.
4. **Record** the “**End of the Day Meter Check**” value on the VRAP Field Data Sheet. A 20% error regardless of the standard used (1,600 – 2,400 $\mu$ S for 2,000 $\mu$ S standard, 160-240 $\mu$ S for 200 $\mu$ S standard or 80 $\mu$ S - 120 $\mu$ S for 100 $\mu$ S standard) is acceptable. If the reading is outside of this range, please check again with new standard if available. If new standard is unavailable please contact VRAP staff as soon as possible.

## End of the Day

1. **Rinse** the probe with DI water.
2. Return the probe to the chamber with a wet sponge. Drain any water from the chamber.
3. Turn the meter off.