



STANDARD OPERATING PROCEDURE
MAINE VOLUNTEER RIVER MONITORING PROGRAM (VRMP)
METHODS FOR COLLECTING
WATER GRAB SAMPLES IN RIVERS AND STREAMS



Note: The mention of brand names does not constitute recommendation of a specific company.



Volunteer River Monitoring Program (VRMP)

Standard Operating Procedure Methods for Collecting Water Grab Samples

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1. **Applicability.** This standard operating procedure (SOP) is used by the Volunteer River Monitoring Program (VRMP) of the Maine Department of Environmental Protection's (DEP) Division of Environmental Assessment. It applies to the collection of water grab samples for water chemistry analysis [generally for nutrients, suspended sediments/solids, biochemical oxygen demand; see section 5-C-(1), below] that are collected by volunteers from rivers and streams in Maine.
2. **Purpose.** The purpose of this SOP is to provide standardized methods for collecting water grab samples from rivers and streams in Maine.
3. **Definition.** A water grab sample is a sample of river and stream water collected for the purpose of analyzing its constituent water chemistry.
4. **Responsibilities**
 - A. **Volunteer Monitors & Volunteer Groups**
 - **Certification.** It is the responsibility of the individual obtaining these water grab samples to maintain a current certification for the parameter(s) they collect if they wish their data to be entered into the VRMP database. Training for water sampling/testing will be provided to volunteers on an annual basis by VRMP/DEP staff, and certification will last for one year from the date of training.
 - **Water Sample Collection.** It is the responsibility of the volunteer to collect water samples as specified in their (VRMP) volunteer group's Sampling and Analysis Plan (SAP).
 - **Data Recording.** It is the responsibility of the individual obtaining this data to record the results and additional qualifying information on current VRMP field data sheets obtained from their affiliated watershed association or through the VRMP program of the DEP.



- **Submitting Samples to VRMP-Approved Laboratories.** Volunteers and/or volunteer groups will submit water grab samples to a VRMP-approved laboratory for analyses following protocols outlined in their approved sampling and analysis plan (SAP). This includes the completion of laboratory chain of custody forms.

- **Data Quality Checks and Data Submission.** The data manager for the volunteer group will collect and enter volunteer field sheet data onto the appropriate computer file, perform quality assurance checks (Refer to Section 5.10 of the Quality Assurance Program Plan), and submit data to the VRMP – all following protocols outlined in the volunteer group’s latest sampling and analysis plan (SAP) that has been approved by the VRMP.

B. *VRMP-Approved Laboratories Used by the Volunteer Groups*

- **Sample Processing.** Laboratories will accept water quality samples and chain of custody forms from volunteer groups and then process/analyze the samples.

- **Sending Data and Quality Assurance Results.** Laboratories will send water quality data and quality assurance results to both the volunteer group’s data manager and the VRMP, simultaneously, using an electronic “EDD” (electronic data deliverable) format.

C. *Volunteer River Monitoring Program (VRMP) Staff*

- **Oversight of Volunteer Groups and Volunteers.** VRMP staff will oversee volunteer groups and volunteers through a variety of ways including maintaining an up-to-date VRMP quality assurance program plan (QAPP); reviewing sampling and analysis plans (SAPs) of the volunteer groups; providing annual training/certification sessions for volunteers; conducting quality assurance checks on data submitted by volunteer groups and laboratories; and uploading data into the DEP’s EGAD database. These tasks are described in greater detail in the VRMP’s latest QAPP.

5. Guidelines and Procedures

A. Sampling period and location. Sampling period and site location information will be documented in SAPs (which require approval by the VRMP) that are submitted by the volunteer groups prior to the beginning of a sampling season. Detailed information regarding how volunteer groups are to obtain and document site location information can be found in the VRMP’s Appendix 2 (SOP - Documenting Site Location) and Appendix 6 (Sampling Site Location Form).



B. Supplies

- (1) For water samples:
 - (a) Water quality kits from a VRMP-approved laboratory, which include containers specific to parameter(s) measured [see section C (1) below] and preservatives, as required
 - (b) Waterproof labels (BE SURE TO STICK ON CONTAINER PRIOR TO SAMPLING)
 - (c) VRMP-approved water sampling device, if using OPTION 3 [i.e., sampling from bridges or boats; see section C below]
 - (d) VRMP approved laboratory-chain of custody sheets
 - (e) Permanent marker
 - (f) Pencil
- (2) Miscellaneous supplies (as needed [refer to Tables 3a {QA criteria} and 3d {sample preservation} in the latest VRMP QAPP])
 - (a) Cooler with ice
 - (b) Waders
 - (c) Gloves
 - Currently, gloves are considered OPTIONAL.
 - In the future, if groups begin to monitor phosphorus or metals, this issue may be revisited.
 - If wearing gloves, the VRMP recommends non-latex glove materials (e.g., nitrile) to help avoid possible allergic reactions.
 - (d) Personal floatation device (PFD)
 - (e) Anchor, if sampling from a boat (e.g., OPTIONS 2 or 3)

C. Collecting Water Grab Samples in Field

- (1) Water samples for the Volunteer River Monitoring Program are collected for all or a subset of the following parameters: bacteria (*E. coli*, fecal, or *Enterococcus*); turbidity; suspended sediment concentration (SSC); hardness; alkalinity (ANC); total phosphorus (TP); ortho-phosphorus; total Kjeldahl-nitrogen; nitrate/nitrite-nitrogen; ammonia-nitrogen; total suspended solids; total dissolved solids; chloride; pH; and specific conductance. (Other parameters, such as metals, are not currently part of the VRMP program, but may be so in the future.) Parameters such as dissolved oxygen (D.O.), temperature, specific conductance, and turbidity will usually be analyzed by volunteer groups using a water quality meter or test kit. Separate VRMP SOPs exist for those parameters.
- (2) Record the sample kit number (pre-assigned by the laboratory) on the VRMP Data Sheet.



- (3) Collect water samples using appropriate sample container before stirring up sediments from the river or stream bottom, or, alternatively, collect samples upstream of any agitated (stirred-up) water where you have walked. Collect samples choosing one of the following OPTIONS:
- 1 - (wading),
 - 2 - (collecting from edge of river/stream or boat by reaching one's arm or by using an extension pole), or
 - 3 - (VRMP-approved water sampling device, from either a bridge or boat), as appropriate.
- Be sure to avoid eddies, pools, and deadwater. See Appendix B of this document for more information on acceptable location of sample collection.
- (4) Avoid touching the inside or lip of the sample containers (e.g., bottles, cubitainers, Whirl-Pak® bags) or caps.
- (5) **OPTION 1** (“wading method”, collecting from within a stream/river)
- (a) Caution should be used in all cases, but 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. Additional caution should be used when the streambed or streambanks are composed of loose or slippery material such as rocks, bedrock, clay, or mud. Algae can make these materials even more slippery. *Do not wade into streams/ivers that are deeper than your thighs!!*
 - (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, as specified in Appendix A of this document).
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 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, submerge bottle underwater. (It is okay 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 submerge 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.

(6) **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.
- Boat Situations: For boat situations, refer to Appendix B to determine whether samples can be collected by reaching or whether a VRMP-approved sampling device (OPTION 3) is required.

Reaching Method

- (a) Caution should be used in all cases. If in a boat, wear a USCG-approved Type-III flotation vest (PFD) at all times for safety. Anchor the boat when in the correct position to sample. When sampling from a boat, sample from the upstream side of the boat.
- (b) Be sure waterproof label is on sampling container and is properly labeled.
- (c) Be careful not to contaminate the cap, neck, or inside the container with your fingers or other foreign objects.
- (d) Rinse sample containers in stream water three times (only for certain parameters, as specified in Appendix A of this document).
If using a Whirl-Pak® for bacteria sampling (avoid collecting surface film):
 - (a) The Whirl-Pak® should be submerged before opening it to collect the water sample. Submerge it under water, open the bag and remove 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):
- (e) (Alternative 1-a; submersing bottle before cap is unscrewed)
With cap still screwed on, submerge bottle underwater. (It is okay 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.
- (f) (Alternative 1-b; unscrewing cap first and then submersing bottle)
Remove cap from bottle. With bottle pointed upside-down, quickly submerge 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.

Extension Pole Method (not recommended for sampling by boat)

- (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 or other foreign objects.
- (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 container in stream water three times (only for certain parameters as specified in Appendix A of this document).
- (g) Prepare to collect water sample by first rotating the extension pole until the sample container is oriented upside down.
- (h) Immerse the sample container to desired depth and then rotate the rod underwater to fill the container. (Avoid collecting surface film.)
- (i) Once the sample container is full, remove it from the water, cap it and remove it from the clamp.

(7) OPTION 3 (“VRMP-approved water sampling device” method; if collecting from a bridge or from a boat:)

(See Appendix D of this document for a list and description of approved sampling devices. See Appendix B of this document for information on acceptable location of sample collection.)

- (a) Caution should be used in all cases. If sampling from a bridge, wear an orange vest for safety. If collecting samples from a boat, wear a USCG-approved Type-III flotation vest (PFD) at all times for safety.
- (b) If on a boat, anchor it when in the correct position to sample.
- (c) Be sure waterproof label is on appropriate containers and that they are properly labeled.
- (d) Make sure the VRMP-approved water sampling device has been cleaned ahead of time according to directions in Appendix C of this document.
- (e) Rinse the sampling device and any associated sample containers in stream water three times (only for certain parameters as specified in Appendix A of this document). (Make sure this is done from a safe location!) When on a bridge, dump the rinse water at least 20 feet away from where you plan to take the water sample. When on a boat, dump the rinse water on the downstream side of the boat.
- (f) 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. (See Appendix B for information on appropriate depth for sampling.)
- (g) Pull the filled sampling device up and carry to a safe location. (Be sure to watch out for traffic.) Avoid bumping the sampling device against the bridge as you raise it to avoid any potential sample contamination.



- (h) 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. Carefully open the sample device in order to access the water inside.
 - (i) *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 from the water within your sampling device, analyze the sample for DO and temperature first, following the appropriate equipment SOPs, before analyzing else. Do not agitate the water before DO and temperature have been measured.
 - (j) *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 (following their specific SOPs), or pour off water samples into their appropriate sample containers.
 - (k) Follow Appendix C for directions on how to clean and store the water sampling device.
- (9) Store and transport samples in cooler with ice, as appropriate (refer to Table 3d of the VRMP QAPP for more information).
 - (10) Complete VRMP field data sheet and VRMP-approved laboratory chain of custody sheet.
 - (11) Drop off samples at VRMP-approved laboratory within the holding time frame discussed in Table 3d of the VRMP QAPP for more details. Include a completed chain of custody sheet specific to your VRMP-approved laboratory.

D. Quality Control

- (1) At the beginning of each field season, all VRMP staff and VRMP volunteers who will collect water grab samples will have a training/refresher session to (re)familiarize themselves with the contents of this SOP.
- (2) For every volunteer, a field duplicate will be collected for 10% (i.e., 1 for every 10 water grab samples) collected for laboratory analysis. However, if, for example, only 5 samples were collected for a given parameter in a given year by a volunteer, 1 field duplicate must still be collected for that parameter. The field duplicate must be processed by the same laboratory.
- (3) Laboratory: quality control samples analyzed in the laboratory are specified in their respective SOPs and generally include duplicate, spiked, and blank samples.
- (4) Refer to the VRMP quality assurance project plan (QAPP) for more QA/QC details.



6. References.

Maine Department of Environmental Protection (MDEP). 2004. Protocols for Collecting Water Grab Samples in Rivers, Streams, and Freshwater Wetlands. Prepared by Tom Danielson, MDEP, Augusta, Maine. Document ID: DEPLW0637.

Maine Healthy Beaches Program. April 2011. Field Monitoring Methods.

Maine Volunteer River Monitoring Program (VRMP). 2009. Appendix 8: Catalog of Standard Operating Procedures Used by VRMP-Approved Laboratories.

Massachusetts Water Watch Partnership (MassWWP). 2008. MADEP-DWM Sample Collection Rod. Last viewed on February 24, 2009 at:
<http://www.umass.edu/tei/mwwp/files/Sample%20Collection%20Staff.doc> .

New Hampshire Department of Environmental Services (NHDES). 2008. Water Quality Monitoring Field Sampling Protocols for Volunteer Monitors.



Appendix A. List of Water Quality Parameter Containers that Require or Don't Require Rinsing with Stream Water (3 times) Prior to Actual Sampling. Containers for certain parameters should not be rinsed prior to sampling because they are a) easily contaminated, b) already washed/rinsed by the laboratory using a special protocol, or c) already contain a pre-measured preservative in them, which would be washed out if the container were to be rinsed.

Water Quality Parameter Containers REQUIRING Rinsing Prior to Sampling	
Maine State Health and Environmental Testing Laboratory (HETL)	<ul style="list-style-type: none"> • pH • total dissolved solids • chloride • turbidity • solids/sediments (i.e., total suspended solids; suspended sediment concentration) • ortho-phosphorus (soluble reactive phosphorus) • nitrogen (NO₂, NO₃, TKN) • alkalinity <i>or</i> hardness • biochemical oxygen demand (BOD)
<i>Add to this list as more labs get added to the VRMP list of approved labs.</i>	
Water Quality Parameter Containers Which SHOULD NOT or DO NOT NEED TO BE RINSED Prior to Sampling	
Maine State Health and Environmental Testing Laboratory (HETL)	<ul style="list-style-type: none"> • total phosphorus • bacteria (i.e., <i>E. coli</i>, fecal, or <i>Enterococcus</i>)
<i>Add to this list as more labs get added to the VRMP list of approved labs.</i>	

Appendix B. Required river/stream sampling and monitoring locations for inclusion in the VRMP (from Table 4a of VRMP QAPP).

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”. The center half of flow is usually close to the middle of the channel, though it sometimes can move away from the middle of the channel, following the thalweg (Figure 2), 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 they within the center half of flow).

→ To obtain a well-mixed representative sample, volunteers can use a variety of techniques including:

- wading out by foot
- reaching out
- using an extension pole
- using a boat
- sampling from a bridge/culvert using a VRMP-approved water sampling device¹

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 will 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.

→ Be sure to document where the sampling takes place with respect to a crossing, especially on the Site Location Description Form (Appendix 6).

Impoundments

→ Sample as close as possible* to the deepest “hole” (depth) of the impoundment – generally in the vicinity of the upstream side of the dam. Bathymetry maps or sonar equipment can be used to determine river depths. *(Do not risk your safety! Do not get too close to the dam! Do not go into “roped-off” sections of the impoundment.)

¹ See VRMP’s QAPP’s section 5.2 and also Appendix 2 SOP Cookbook (specifically, “Standard Operating Procedure - Methods for Collecting Water Grab Samples”; SOP-01, Appendix D) for details regarding VRMP-approved water sampling devices.



Appendix C. Cleaning and storage methods for VRMP-approved water sampling devices.

A. Cleaning of sample devices before and after sampling events.

1. Rinse devices thoroughly with distilled water.
2. Store upside down or covered between site visits.
3. Rinse devices with stream water three times prior to each sampling site and also after the last sampling site.

B. Storage of sample devices between sampling events.

1. Empty out any water from with the device.
2. Prop open the sampling device a little so it can air dry. A clean plastic spoon or small, clean stick may do the trick.
3. Store the device in a clean area.

C. End of season storage.

1. VRMP staff will collect all loaned water sampling devices, wash them with Liqui-Nox (non-phosphate) detergent, rinse with deionized or distilled water, and dry the equipment prior to the next sampling season.
2. Equipment will be stored in a clean location, either by the VRMP or volunteer group, depending upon storage space availability.