

Cover Sheet
Standard Operating Procedure

Operation Title: Surface Water and Sediment Sampling

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1. Applicability

This Standard Operating Procedure (SOP) applies to all programs in the Maine Department of Environmental Protection's (MEDEP) Division of Remediation (DR). It may be utilized by other Divisions within MEDEP, as determined by the respective Division Directors or their designees.

This SOP is not a rule and is not intended to have the force of law, nor does it create or affect any legal rights of any individual, all of which are determined by applicable statutes and law. This SOP does not supersede statutes or rules.

2. Purpose

The purpose of this document is to describe the MEDEP/DR procedure for collecting surface water and sediment samples from streams, rivers, ponds, lakes, lagoons, impoundments, and other surface waterbodies throughout the State of Maine.

3. Key Definitions

See Section 5.2

4. Responsibilities

All MEDEP/DR Staff must follow this procedure when performing this task. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this SOP. MEDEP/DR staff reviewing data by outside parties should ensure that this SOP (or an equivalent) was followed, depending on the specific Data Quality Objectives (DQOs) of the task.

Other MEDEP SOPs may also apply when performing this task, including, but not limited to MEDEP/DR SOP *RWM-DR-014 - Development of a Sampling and Analysis Plan (SAP)*. The SAP should consider quality assurance and quality control (QA/QC) samples and measures, the specifics of which will depend on the DQOs for the task. Types of QA/QC samples are discussed in more detail in the DR Quality Assurance Plan (QAP). SAP development includes provisions for creating a Health and Safety Plan (HASP) associated with the activity, including compliance with [Dig Safe](#) notifications when disturbing soil with powered equipment or tools (i.e., not hand tools). Dig Safe notification does not include public utility clearance requests which must be completed separately (e.g., sewer and water lines). These utility marking requests typically do not extend onto marking private property (i.e., they may only

mark lines in the public right of way), so hiring a private utility marking company may be necessary, depending on site specifics. Fieldwork and data collection tasks must be properly documented in accordance with applicable MEDEP SOPs and policies.

5. Guidelines and Procedures (or rename as needed)

5.1. Introduction

Collecting representative surface water and/or sediment samples can be challenging due to multiple factors associated with waterbodies. In moving surface water systems, for example, mixing and flow rate may affect the sample. In stagnant surface water systems, stratification and lack of significant currents are important considerations when selecting sampling devices and methods. Sediment sampling presents similar challenges, given the changing depositional characteristics of rivers, streams, lakes, and other surface waterbodies. This SOP shall be used as a guideline to ensure that environmental samples collected from surface waterbodies are as representative as possible.

Surface water sampling equipment and procedures outlined in this SOP are largely based on SOPs developed by the MEDEP Bureau of Water Quality's (BWQ) Division of Environmental Assessment (DEA). For additional information on surface water and sediment sampling methodologies and procedures, please refer to MEDEP/DEA's SOPs:

- SOP DEPLW0952R2: Surface Grab Sample Collection
- SOP DEPLW0949R3: Collection of Grab (Discrete) Samples
- SOP DEPLW0946R3: Epilimnetic Core Sample Collection

Contacting MEDEP/DEA staff for guidance and assistance may be warranted for more complex sites or unique surface water conditions.

5.2. Sampling Equipment

The selection of sampling equipment should be based on the data quality objectives (DQOs) of the sampling event and the parameters being analyzed. Careful consideration of sampling equipment components is important to ensure the equipment will not influence sampling results. The following is a list of standard equipment for sampling surface water and sediment in waterbodies.

5.2.1. Surface Water

5.2.1.1. Sample Container

A direct grab (dip) sample using the sample container provided by the laboratory. A grab sample directly into the sample container limits the potential for cross-contamination that could occur when transferring a surface water sample from a sampling device into the sample container. Waterbody conditions, DQOs, and parameters to be analyzed will dictate whether a direct grab sample using the lab sample container is appropriate.

5.2.1.2. Peristaltic Pump

A peristaltic pump can be used to collect surface water samples by attaching the intake tubing to a stick or pipe, or weighing the end of the intake tubing, and lowering it to the desired sampling depth. Note that a peristaltic pump cannot pump water from depths greater than approximately 24 feet.

5.2.1.3. Vertical Sampling Device

A messenger-activated water sampling device that is oriented so that water vertically passes through the unit. A Kemmerer bottle is a type of vertical sampling device. Vertical sampling devices are typically used to collect discrete surface water samples in the water column, especially in stratified waterbodies.

5.2.1.4. Horizontal Sampling Device

A messenger-activated water sampling device is oriented so that water horizontally passes through the unit. The Beta and Van Dorn bottles are types of horizontal sampling devices. Horizontal sampling devices are typically used for collecting samples from the bottom of the surface water column and for collecting discrete samples at targeted depths in the water column.

5.2.1.5. Epilimnetic Core Sampler

An epilimnetic core sampler is used to collect a water sample that is equally representative of the entire epilimnion layer (the top part of the water column above the thermocline).

5.2.1.6. Other Samplers

Other sampling equipment can be used for collecting representative surface water samples. Alternative sampling devices and custom-made tools must be described in the sampling plan and/or trip report for the sampling event.

5.2.2. Sediment Sampling

The following standard equipment is available to MEDEP/DR staff for collecting sediment samples. Other sediment sampling equipment and methods may be available through MEDEP/DEA.

5.2.2.1. Ponar Grab

A self-closing, center-pivot benthic grab sampler used for collecting samples from hard bottoms such as sand, gravel, cobbles, or clay.

5.2.2.2. Ekman Grab

A center-pivot benthic grab sampler used for collecting samples in soft, finely divided littoral bottoms.

5.2.2.3. Geoprobe Systems Large Bore Sampler

A sampling device typically used for soil borings but can also be used in sediment sampling with a manual slide hammer and removal jack. Specific instructions on the use of the large bore sampler can be found in the Geoprobe System's operator's manual.

5.2.2.4. Vibracore Sampler

A sampling device that advances by vibration, not rotation, that facilitates unconsolidated sediment sampling in a complete core.

5.2.2.5. Other Tools

Additional digging, coring, or scooping tools may be used for collecting representative sediment samples depending on the DQOs and waterbody conditions. Alternative and custom-made sediment sampling devices must be described in the sampling plan and/or trip report for the sampling event.

5.3. Preparation

Before undertaking any surface water or sediment sampling at a site, a Sampling and Analysis Plan (SAP) and Health and Safety Plan (HASP) for the sampling event should be developed (see MEDEP/DR SOP# RWM-DR-014 Development of a

Sampling and Analysis Plan). A SAP for a surface waterbody sampling event should specify the sample collection tools and describe how sampling locations will be accessed. As with any sampling event, a well-developed Conceptual Site Model (CSM) is imperative for effective and representative surface water and sediment sampling. Whenever MEDEP/DR staff are working near waterbodies, appropriate personnel floatation devices (PFD) are required.

There are three (3) primary ways of accessing surface waterbodies for water and sediment sampling: 1) sampling from the shore or a surface water crossing; 2) wading into the waterbody; and 3) boat access. The size and flow conditions of the waterbody will generally dictate the means of accessing the sampling points. Waterbody access will also generally dictate the sampling equipment. In a shallow, low-flow stream, it may be possible to collect samples by dipping the containers directly into the waterbody by hand or with an extendable sampling arm from the shore, or by wading into the stream. In larger streams or shallower ponds, entering the surface water with boots or waders may still be the safest and easiest way to collect a representative sample, provided the depth of water and strength of the current are not prohibitive. In moderate flow conditions, a safety line should be attached to personnel entering the waterbody. Personnel must ensure their boots/waders do not leak and are compatible with the potential contaminants in the surface waterbody. Samples can then be collected by either direct dipping with the container or with a separate sampling device.

For sampling large waterbodies, personnel may need to utilize a boat to access sampling locations. If a boat is used by MEDEP/DR staff, the boat must be appropriately equipped with proper safety gear/equipment as specified by the Coast Guard, including personal flotation devices (PFDs) (one per person), anchors, flares, etc. One member of the sampling team should be dedicated to operating the boat for safety and to prevent contamination of samples, especially from petroleum products if using a motorized boat. Personnel operating the boat must be trained and/or have adequate experience in using the boat or a similar watercraft.

Safety is the top priority when accessing surface waterbodies for sample collection. Do not attempt to collect a sample if the waterbody cannot be safely accessed. The HASP for the sampling event should cover all the safety considerations, hazards, and PPE for the planned sampling event; however, sampling personnel must also observe waterbody conditions on the day of the sampling event to determine the safest means of access for collecting waterbody samples.

Sample locations should be approached from the downstream direction with sampling occurring upstream of sampling personnel. Sampling personnel must avoid collecting turbid samples that may have been disturbed when accessing the sample location.

5.3.1. Special Consideration for Waterbody Types

5.3.1.1. Flowing Water

In flowing surface waterbodies there is potential for mixing and less stratification than in stagnant waterbodies. Discharge points, merging streams, springs, and the presence of pools and eddies must all be considered when sampling flowing surface water. A reconnaissance of all sampling locations is recommended before conducting the sampling event. All sample locations should be clearly marked if multiple sampling events are planned. Sample location coordinates should also be recorded.

As noted previously, samples collected from flowing surface waterbodies should be collected from a downstream to upstream direction to avoid disturbing sampling areas. If these precautions are taken, the sample should be free of any sediment and/or contaminants disturbed by the sampling personnel. The location of waterbody samples, sampling devices, and parameters to be analyzed depend on the DQOs of the sampling event and site-specific conditions. For example, sediment sampling to assess risk to biota may target very shallow depths, while sampling to determine a remediation (e.g. excavation) area may target deeper sediments.

5.3.1.2. Stagnant Water

The sampling of stagnant surface waterbodies is different from the sampling of flowing surface waterbodies because stagnant water may be stratified in zones based on temperature and dissolved oxygen within the surface waterbody. The lack of movement may result in very little mixing and require more selective sampling that does not disturb the natural conditions.

5.3.1.3. Estuarine and Marine Waters

Sampling estuarine and marine environments differ from sampling freshwater environments due to the dissolved salt content of the water and the propensity for stratification to occur over varying time

frames due to tidal influences. Analytical and field measurement procedures may need to be modified to accommodate for these conditions (e.g. increased salinity/TDS). MEDEP/DR staff should refer to the MEDEP/DEA Marine Unit for guidance and SOPs for collecting samples in estuarine and marine environments.

5.4. Sampling Procedures for Surface Water Samples

Before collecting the sample, laboratory sample containers should be clearly labelled with relevant sample information. Sampling personnel should wear nitrile gloves or other appropriate PPE to avoid contaminating the sample when handling sampling devices, containers, and during sample collection.

5.4.1. Sample Container Grab Sample

In many instances, MEDEP/DR sampling personnel will be sampling a waterbody from the shore/bank using the sample container provided by the laboratory. Using the sample container to collect the sample reduces the potential for cross-contamination (by unnecessary transfer of samples from a sampling device to a sample container) and eliminates the need for decontamination of sampling equipment.

After labelling the sample container, the sample container should be rinsed by removing the cover and rinsing both the cover and container three times in the waterbody that is going to be sampled. Be careful not to touch the inner surface or the mouth of the container or cover. If sampling from a boat, rinse the sample container on the opposite side of the boat from where the sample will be collected. If sampling on the shore or wading in the waterbody, rinse the sample containers downstream of the sample location.

Invert the uncovered sample container so it is upside down and submerge it to a depth of about 6 inches below the surface (note that sample depth may vary depending on waterbody conditions and DQOs for the sampling event). Slowly begin to push the sample container away from the boat and/or in the upstream direction while turning the container right side up. The sample container should be full and vertical when removing it from the waterbody (see Figure 1). After collecting the sample, the outside of the container should be wiped dry or if necessary, decontaminated (see MEDEP/DR SOP# RWM-DR-017 – Equipment Decontamination Protocol) prior to being placed in a cooler with other samples.

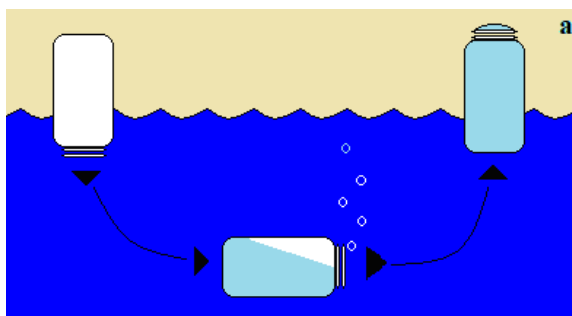


Figure 1: Sampling schematic for collecting a surface water grab (dip) sample using the laboratory sample container. In this schematic, the boat and/or flow direction would be to the left.

Direct grab samples using the sample containers should be avoided if the containers contain sample preservatives.

Direct grab samples using the sample containers may not be appropriate for large surface waterbodies, such as lakes or rivers, as the water conditions directly at the surface of the waterbody might not be representative of conditions throughout the waterbody. As with all sampling, a sufficient CSM must be part of the SAP to ensure representative samples are collected to meet DQOs.

5.4.2. Vertical and Horizontal Sampling Devices

5.4.2.1. Peristaltic Pump

A peristaltic pump can be used by lowering the tubing intake to the appropriate depth in the water column. This can be done by using stainless steel tubing, PVC well material, other inert material, or using a weight at the end of the tubing. Purge 1 to 3 tubing volumes of water at the desired sampling depth before collecting the sample in the laboratory sample container.

5.4.2.2. Epilimnetic Core Sampler

Refer to the Bureau of Water Quality's Division of Environmental Assessment Lake Assessment Program Standard Operating Procedure DEPLW0964R3 on collecting epilimnetic core samples.

It is recommended that DEP BRWM staff contact the DEP Lake Assessment Program for guidance and assistance if epilimnetic core

samples are being collected at a site.

5.4.2.3. Other Equipment

Sampling personnel may choose alternative or custom-fabricated sampling devices designed for a sampling event based on site-specific conditions. Sampling equipment must be described in the SAP for the sampling event and in the trip report for the event (see MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of a Trip Report).

5.5. Sampling Procedures for Sediment Sampling

Ponar and Ekman Grab sediment sampling devices operate similarly. Sampling personnel should be careful when preparing these sampling devices because the jaws are sharp and spring-loaded. After carefully opening and locking the jaws of the sampling device, gently lower it to the sediment surface to be sampled. It is best to lower the sampling device slowly, hand-over-hand with the rope, rather than dropping or rapidly lowering it into the water, which can prematurely activate the sampling device. Upon contact with the sediment, the spring mechanism should release, and the jaws should close to collect the sample. The sampler is then raised to the surface, allowing excess water to drain from the sampling device. After excess water is drained, the sampling device can be carefully opened, and the sample can be transferred to a clean, non-reactive bowl (e.g. metal bowl). Depending on the DQOs, homogenize the sediment sample in the bowl before filling the sample container. The sample containers should be filled using clean, non-reactive spatulas and/or by filling the container by hand while wearing appropriate chemical-resistant gloves, as directed by the laboratory conducting the analysis. If the sampling device does not activate upon contact with the sediment surface, raising and lowering it quickly may activate it.

Shovels are intuitive in their use, but care should be taken to select the sampling depth based on the DQO's for the sampling event.

Sediment samples should be collected from areas that are believed to be least contaminated to areas of greater contamination. As with surface water sampling, sampling points should be approached from the downstream to upstream direction, and care must be taken not to disturb the area to be sampled.

5.5.1. Additional Considerations for Sediment Sampling

An attempt should be made to obtain sediment samples that are similar in their organic content and formation (i.e. silt, sand, clay, etc.). Excess organic

material, such as leaves, roots, and larger aquatic organisms (slugs, mussels, clams, etc.) should be removed from the sample before containerization. The relationship between grain-size and the contaminants of concern should be carefully considered when developing the SAP. For example, many contaminants are associated with finer-grained sediments (e.g. sand, silt and clay) versus larger-grained sediments (e.g. gravels and cobbles).

For sediment sampling in estuarine/marine environments, refer to the USEPA National Coastal Condition Assessment 2020 Field Operations Manual: [National Coastal Condition Assessment 2020 Manuals](#)

6. References

None