Ohio Environmental Protection Agency

Surface Water Field Sampling Manual - Appendix III

Sediment Sampling

Division of Surface Water
May 19, 2021
Next Revision Due April 22, 2023

Revision History

This table shows changes to this controlled document over time. The most recent version is presented in the top row of the table. Previous versions are maintained by the Ohio EPA Division of Surface Water Modeling, Assessment and TMDL Section Manager.

History	Effective Date
Ohio EPA Surface Water Quality Sampling Manual version 8.0 Appendix III: Sediment Sampling Guide and Methodologies Restructure of Section A. Sediment Sampling Guide and Methodologies Removal of Section B. Sediment Data Quality Objectives for Biological Water Quality Studies Update of Section A8. References	May 11, 2021
Ohio EPA Surface Water Quality Sampling Manual version 7.0 Appendix III: Sediment Sampling Guide and Methodologies	April 22, 2019
Ohio EPA Surface Water Quality Sampling Manual version 6.0 Appendix III: Sediment Sampling Guide and Methodologies Added APPENDIX A9: Incremental Sediment Sampling for Surficial Stream/River Samples. Added definition of surficial sediment sample.	March 30, 2018
Ohio EPA Surface Water Quality Sampling Manual version 5.0 Appendix III: Sediment Sampling Guide and Methodologies Newly created: Combines previously separate documents below into one Appendix to the Surface Water Quality Sampling Manual. Updates the decontamination protocol for sediment sampling and adds equipment blank instructions in Section 4.d of the Sediment Sampling Guide.	July 31, 2015
Sediment Sampling Data Quality Objectives Sediment Sampling Guide, 3rd Edition	April 14, 2014 March 1, 2012

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Definitions and Abbreviations

Aliquot	A portion or subset of a sample. An aliquot can be any size, but it must be representative of the parent sample.
Background	Refers to the concentration of a chemical at an upstream site or other location having similar physiochemical characteristics which can be compared to the concentration of the same chemical found at the site of interest.
BNA	Base Neutral Acid extractible compound
COC	Chain of Custody
Collection Container	Stainless or aluminum pan utilized for sample processing.
Composite Sample	A thoroughly homogenized set of two or more grab samples.
Contaminated Sediment	A sediment where the concentration of a chemical exceeds a level of toxicological concern.
Decontaminated	Equipment and supplies that have been cleaned and subjected to decontamination rinses using the procedures set forth in section A3.b.i. of this manual.
DERR	Ohio EPA Division of Environmental Response and Revitalization
DES	Division of Environmental Services
DQO	Data Quality Objectives
DSW	Ohio EPA Division of Surface Water
EA3	Ecological Assessment and Analysis Application
Field Duplicate	An aliquot of a sample collected to make an exact copy of the original sample. Often referred to as a split sample. Duplicate samples are used to check sample preparation techniques, laboratory precision and comparison of different laboratory results.
Grab Sample	A single, discrete sample collected from one location at one point in time.
Impacted Sediment	A contaminated sediment where an adverse biological impact is observed.
MDL	Method Detection Limit
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyl
Project Manager	For the purposes of this document, a person that is responsible for the design, implementation, and reporting of a sediment sampling project.
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
Reference Sediment	Refers to the concentration of a chemical at an Ohio EPA ecoregional reference site which represents conditions of least impact as a result of known human activity.
Sediment	Unconsolidated inorganic and organic material that is suspended in and being transported by surface water or has settled out and deposited under surface waters. Sediment includes: 1) materials below the water surface under bankfull conditions in streams, lakes, and ditches; 2) materials at normal pool elevation for reservoirs; 3) materials within the federal jurisdictional boundaries of wetlands; 4) materials at and below maximum capacity for ponds and lagoons; 5) for Lake Erie, materials found at or below high-water conditions as defined by the United States Geological Survey over a five year period.
SOP	Standard Operating Procedure

Station Replicate	Samples from a location that were taken in the same general area (e.g., 20 to 200 meters depending on waterbody), during the same time period, using the same sampling equipment (decontaminated between samples), and using the same sampling techniques as the original sample. Station replicates are usually used to determine sample variability at a given location at a given point in time.
Superficial Sediment Sample	A sediment sample collected with a stainless-steel scoop or a subsample collected from an Eckman dredge with a stainless-steel scoop, of the upper 0 to 6 inches of the stream bottom, focusing on fine grained sediment.
Supernatant	The liquid lying above a solid residue after crystallization, precipitation, centrifugation, or other process.
U.S. EPA SW-846	A document containing test methods for evaluating solid waste. SW-846 provides test procedures & guidance which are recommended for use in conducting the evaluations and measurements needed to comply with the Resource Conservation and Recovery Act (RCRA).
VOC	Volatile Organic Compound
40 CFR Parts 87 to 149	The Code of Federal Regulations is a codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal Government.

A1. Purpose

This field manual details sediment sampling procedures used by collectors when handling and collecting sediment samples for projects with an approved Quality Assurance Project Plan (QAPP). During any sampling event, sampling procedures described within this document are determined to be inadequate or unfeasible, then the alternate sampling procedure used must be documented on the ***Sediment Data Collection Sheet*** and within a QAPP addendum.

Sediment information can be utilized in a variety of environmental assessments and investigations. Sediment data collected at established reference sites that define ecoregion background conditions will be used for data comparisons among sampling locations and data evaluation of contaminated areas. Chemical and physical analysis of sediments can assist in determining the cause and source of impairment for a waterbody's designated use. Sediments can be used to help locate nonpoint, historical, or intermittent discharges that may not be readily apparent in water column samples. Data generated from a sediment sampling project can assist in dredge management 404/401 decisions. Sediment sampling is a tool in fish tissue contamination investigations and in the evaluation of the effectiveness of pollution source controls. To better understand nutrient cycling of a system, sediment samples can be collected in lake or river habitats to determine potential release of nutrients (e.g., phosphorus) back into the water column.

A2. Safety

Everyone involved in the preparation, collection and analysis of the sediment samples should be familiar with the safety plan and policies outlined in Section C1 of the Ohio EPA Surface Water Field Sampling Manual. Special attention should be given to physical dangers such as slip, trip, and fall hazards when working around water. In general, it is recommended that the sample collector(s) avoid skin contact with all sediments.

A3. Methodologies

Once a Quality Assurance Project Plan (QAPP) has been completed and approved, then the following methodologies should be followed to minimize sample contamination and collect a representative sample. Examples of sampling locations are identified in ***Section A7***.

A3.a. Sampling Location Reconnaissance and Selection

The sampler should be open to site revisions and able to adapt the sampling design to meet unforeseen site conditions. If sediment composition does not meet the criteria of the Data Quality Objectives (DQOs) or the site contains more than ~70 percent sand or larger particles, the sampler should decide site abandonment or relocation using their best professional judgement. The chemical and physical nature of sediments is strongly influenced by the size of the individual particles of sediment. Sediments composed of sands (0.06-2.0 mm) and larger sized particles are often stable inorganic silicate mineral. These larger particles form non-consolidated deposits, have a relatively lower specific capacity (amount of interstitial water) and a more neutral surface electrical charge. These types of materials are usually not associated with contaminants. Fine grained silts and clays (<0.06 mm) have a much larger specific capacity, because they have unbalanced electrical charges and much larger surface area to volume ratio. These properties make finer grain sediments more chemically active and make them the target substrate for sediment collection.

A3.b. Collection of QA/QC Samples

Duplicates - Duplicates are collected by "splitting" a sample into two identical samples for analysis after sample collection.

Equipment Blanks - Equipment blanks should be done to verify that decontamination techniques are sufficient enough to prevent cross contamination between samples. Please see ***Section A3.j.ii.*** for methodology.

A3.c. Sample Preparation

This section details the appropriate sample collection and handling procedures.

Sample Volume and Container Type - The volume of sample and type of container should be listed in the QAPP for each sample collected. Sample volumes and container types are defined in the Division of Environmental Services (DES) Field Sampling Handbook and summarized in ***Section A6***. Due to field conditions, some samples may not yield enough material for analysis. These samples are to be handled on a case-by-case basis. When this or other special conditions occur, contact the DES sample coordinator for advice. Proper communication between the sample collector and DES is necessary to maintain Quality Assurance (QA) and Quality Control (QC) outlined by the DQOs.

Sample Labeling - All sample container labels should include the site name (as it appears on the Laboratory Submission Form), the sample collection date, and other information specified by DES.

Sample Handling, Preservation, and Shipment - Sample containers should be placed in clear plastic bags to minimize soiling of the shipping container and to protect DES personnel. Glass containers should be protected from breakage. All sediment samples should be chilled and stored in coolers or similar containers at 4°C and shipped to DES for analysis. A chain of custody form must accompany each sample shipment.

A3.d. Sample Types

A description of sample types to be collected must be included in the QAPP. See ***Section A5*** for more details on different types of sediment samplers.

Cores - Vertical discrete samples or depth integrated composites samples.

G*rabs* - Surface discrete samples or multi-grab longitudinal composite samples.

A3.e. Surface Discrete Grab Collection with Scoops and Dredges

Discrete sediment grab samples are a single sample collected with a scoop or a dredger. Discrete grab samples are not composited (homogenized) and are used to evaluate recent ambient conditions or recent contamination investigations.

Plastic or stainless-steel scoops are used to collect surface discrete grab samples primarily from wadeable waters. However, plastic utensils should not be used when collecting sediment for organic analysis. Scoops are used to collect a surface sediment sample which is approximately the top six centimeters of depositional sediment. Care should be taken when the scoop is raised through the water column or is passed through a river current during retrieval to minimize the loss of fine-grained material.

Dredges provide a means of collecting sediment from surface water bodies that are too deep to wade. Free, vertical clearance is required to use any of the dredges. Dredges, attached to ropes, are lowered vertically from the sampling platform (boat, bridge, etc.) to the substrate beneath the deployment point. The dredge should be carefully lowered the last few feet to minimize dispersal of fine material due to a dredge induced shock wave. For a discrete grab sample collection, deploy dredge and empty into a stainless-steel collection

container. Sample can then be scooped into the sample container for analysis. There are several types of dredges that can be used, such as, the Ponar dredge and the Ekman dredge.

The Ponar dredge is easily operated by one person and is one of the most effective sediment samplers. The Ponar dredge has two scoops or "jaws" with tapered cutting edges that collect a 0.05 m^2 surface area. The screen over the sample compartment permits water to pass through the sampler as it descends, thus reducing turbulence caused by dredge deployment. After setting the pinch-pin (tripping mechanism), the ponar is deployed in an open configuration. It is lowered gently through the water column from a sampling platform into the substrate. After the dredge lands on the substrate, the rope is tugged upward releasing the pinch-pin, closing the dredge and capturing the sample. The dredge is then pulled to the surface, where it is opened into a collection container. Then the discrete sample is scooped into the appropriate laboratory sample container.

Similar to the Ponar, the Ekman dredge has two spring-gate doors or "jaws" held open during dredge deployment. It is lowered gently through the water column from a sampling platform into the substrate. A "messenger" is dropped down the line to trigger the closing of the over-lapping gate doors and trapping the sample. The dredge is pulled to the surface, where it is opened into a collection container to acquire a discrete sample. Ekman dredges typically allow for the attachment of weight to assist sampling in deeper water or sampling locations with a current. Both the Ekman and Ponar dredges can be manually pushed into sediments in shallower water and manually triggered to close to acquire the sample.

A3.f. Discrete Grab or Composite Collection with Core Sampler

Vertical discrete samples or depth integrated composite samples are particularly useful when a historical picture of sediment deposition is desired since they preserve sequential layering. Core samplers can be as basic as a plastic coring tube. Hand-driven push tubes and manual coring devices minimize turbulence created by descent through the water. The sediment-water interface is minimally disturbed; the sample is withdrawn intact, permitting the removal of only those layers of interest (U.S. EPA, 2020). Depending on the core diameter, multiple sample collections may be required to acquire adequate sample volume.

Plastic tubes are used for collection of samples for physical and inorganic parameters. A Teflon® or polycarbonate core tube allows for sampling of parameters such as, nutrients and organics. An end cap is placed over the top opening after gently pushing the corer into sediment creating a suction as the tube is withdrawn. A second end cap is placed over the bottom opening just below the water's surface securing the sample within the tube. For manual push tube sampling, plastic tubes about two inches in diameter is usually the best size with a 1/3-inch wall thickness. The inside wall edge can be filed down to sharpen the tube's bottom ensuring easier substrate penetration.

Metal (hand-driven) push tubes provide a better cutting edge and higher strength than plastic tubes. The use of a tube insert eliminates any possible interference due to metals contamination from core barrels, cutting heads (nose piece), and core catchers (retainers). To facilitate complete core collection and retention, it is recommended that the corer have a check valve built into the driving head. This allows water and air to escape from the cutting core, thus creating a partial vacuum, helping to hold the sediment core in the tube. The corer can be pushed into shallow water sediment using a detachable handle. In deeper water, a five- to 15-foot-long extension handle can be attached to the head or a line can be attached to the head and the metal corer dropped. A corer attached to an extension pole and handle can be used from a dock, boat or while wading.

Before extracting the sediment from the coring tubes or liner tube, the clear supernatant above the sediment-water interface should be decanted from the tube carefully using a syringe. The intact sediment core can be removed by pushing the core through the tube with a core sample removal tool (plunger). The sample can then be separated into different depth zones or vertical discrete samples creating a dispositional grab sample record. Or the entire tube of sediment can be composited following the method described below (A3.h) depending on DQOs.

A3.g. Grab or Core Sample Collection for Volatile Organic Compounds (VOC)

A sediment sample for VOC analysis may also be collected with conventional stainless steel sampling equipment (scoops, corer or dredges). For surface grab or core sample collection, the sample must be placed in the final sample container as soon as possible with no head space. When collecting a VOC sample using a dredge sediment sampler, the sample is placed into a collection container and immediately spooned out into the VOC sample container, filling to top. When collecting a discrete grab sample for VOC, the sample can be spooned from a scoop and placed directly into the sample container. Working quickly and not agitating or mixing the sediment will reduce volatilization losses.

A3.h. Surface Grab Composite Collection

Composite samples are composed of multiple (two or more) grab samples of sediments from several depositional areas within a sampling zone (sample station location). The multi-grab longitudinal composite sample zone should be approached from downstream to upstream. All grab collection locations should be documented on the ***Sediment Data Collection Sheet*** with a site drawing of collection locations within the sampling zone. When sufficient sample volume has been collected, the sample should be combined and thoroughly mixed (homogenized) with a scoop or spoon. All debris, sticks, rocks, and leaves should be removed. A thoroughly homogenized sample is typically uniform in color, consistency, and water content (see ***Section A7.a.***). Once mixed, a physical description and other sample observations should be documented on the Sediment Data Collection Sheet. Randomly remove small sub-samples from across the homogenized composite sample to fill the analytical sample containers.

For deep river locations and lakes, the same approach applies when using a sediment dredge sampler. Multiple dredge grab samples can be combined and thoroughly mixed (homogenized). For compositing deeper river samples, a minimum of three grab samples (as near the same volume as possible) from a site should be taken and thoroughly homogenized. An aliquot of the composite should be collected and submitted as the sample for the site.

Sampling equipment and supplies do not have to be cleaned between sub-samples of a composite sample at a site. Equipment and supplies must be decontaminated and cleaned between collections at different sampling locations.

A4.i. Stream Reach Sediment Depositional Areas within Sampling Zones

Composited sediment samples can be collected from multiple depositional areas throughout a sampling zone. The sampling zone should be located at or near the station ID sampling locations. Sampling zones should never contain a confluence with a tributary. If a tributary is within proximity of the sample location, position the sampling zone completely upstream or downstream of the tributary confluence and document the location of confluence in relation to the sampling zone on the sediment collection form. Eddies, downed trees, woody debris, or areas where the stream flow is slow provide potential sediment depositional zones.

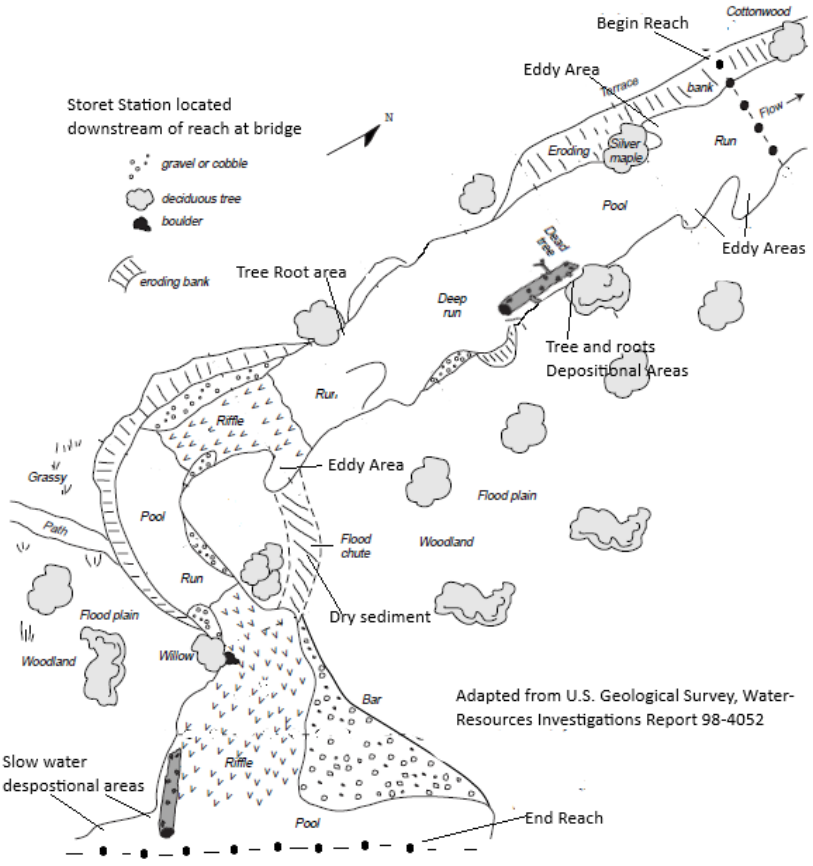


Figure 1. Sediment sampling zone diagram.

Do not sample sediment recently deposited allowed to dry out during low flows. Collect sediment below water's surface, where greatest potential for aquatic life and human exposure occurs. Stream reaches should be upstream of bridges when possible or depending on the DQOs. The stream structural features (i.e. riffle, run…) and depositional zones are to be documented in the Sediment Data Collection Sheet drawings.

A3.j. Decontamination, Equipment Blanks, Calibration, Equipment

A3.j.i. Decontamination

DSW historically used hexane to decontaminate sediment sampling equipment until Summer 2019. DSW has updated the decontamination procedure, to be more in line with recommendations from US EPA and to limit staff exposure to unnecessary VOCs. All collection equipment and supplies such as dredges, corers, spoons, scoops and compositing trays that may come into contact with the sample should be cleaned prior to use as follows:

1) Physically remove any sediment or visible particles on the sampling equipment. This can be accomplished with a brush.
2) Wash with Phosphate-Free soap (e.g. Liquinox) and potable water.
3) Tap/potable water rinse.
4) Rinse thoroughly with deionized (DI) water.
5) Allow to air dry.
6) Store in clean plastic wrapping in between uses.

Please note: If submitting samples for low-level analyses, additional decontamination procedures may be required. For example, a nitric acid rinse may be necessary for low-level metals analysis (however, nitric acid can interfere with ammonia analysis). And a pesticide grade solvent rinse may be required for low-level organic analyses. It is best to review DQOs and decontamination procedures with a chemist at the laboratory where low-level samples will be submitted.

A3.j.ii. Equipment Blanks

Equipment blanks should be done to verify that cleaning techniques are sufficient to prevent cross contamination between sample locations. Equipment blanks can be prepared in the field but are easier to prepare in a laboratory. The blank should be prepared using a full set of sampling equipment; dredge (Ponar or Ekman) or corer, mixing bowl and spoon.

1) Place sampler with jaws open upside down inside a mixing bowl with spoon. If a corer is used it may be necessary for a second person to hold the instrument upright.
2) Rinse the inside of the sampler with about 8L of Nanopure water, being sure to rinse all surfaces.
3) Transfer the rinsate to a clean churn splitter being sure to dispense all material. It may be necessary to swirl the water in the bowl and/or mix using the spoon.
4) Use the churn splitter to keep the rinsate homogenized and dispense into labeled sample containers.

QA/QC parameters to analyze should be determined based on project specific pollutants of concern. Submit a quart cubitainer preserved with 5ml of nitric acid for metals (ICP1, ICPMS1). Submit two 1L non-preserved amber jars for PAHs (USEPA 625) and two 1L non-preserved amber jars for PCBs/Pesticides (USEPA 608). Submit a quart cubitainer preserved with 2ml of sulfuric acid for nutrients. Submit one 125 ml glass jar preserved with 0.625 ml HNO_3 for Hg.

A3.j.iii. Calibration

Maintain and operate the meter in accordance with the manufacturer's instructions. Record all calibration, use, and repair and maintenance information in the logbook including name/initials and date. If using an instrument with provided electronic calibration procedures, ensure that calibration data was logged.

A3.k. Equipment for Sediment Collection

Below is a list of supplies specific to sediment collection. Please read "Pre-sampling Activities and Checks" in the *Surface Water Field Sampling Manual 2021* for a general list of field sampling supplies.

- ❒ Sediment Chain of Custody Forms
- ❒ Sediment Collection Data Sheets
- ❒ One sampler per site if possible (Dredge, Corer, Scoop, SOD Chamber, etc.)/extra weights/extra corer inserts
- ❒ Sediment Sample Containers, Labels and Self-Sealing Plastic Bags
- ❒ Stainless Steel Collection Container
- ❒ Calibrated D.O./Temperature/Conductivity/pH Meters/Turbidity
- ❒ DI Water Wash Bottle(s)
- ❒ Nanopure Wash Bottle(s)
- ❒ Shoulder length neoprene gloves
- ❒ Compositing Container and Mixing Spoon
- ❒ Munsell Color Chart

A3.l. General Considerations

While sediment sampling the following precautions should be considered.

- Sediment collector should approach sampling area from downstream to upstream. Care should be taken to create the least disturbance of the sampling area as possible. Especially when collecting a composite grab samples by wading in shallow waters with a current.
- When using a boat, all engines should be turned off during sample collections. The samples should be collected upstream from the engines or any other machinery that may release exhaust fumes/oils into the sample.
- If the sampling locations are located within a short distance of each other, then the most downstream sample should be collected first to avoid contamination from disturbance and re-suspension of sediment due to sampling activities.
- Sampling in areas of aquatic vegetation where macrophyte roots or other vegetation may be collected should be avoided, unless specified in the projects DQOs.
- All stones, shells, detritus, roots, and other foreign matter should be removed from the sample.
- As much water as possible should be decanted from the sample prior to compositing. Care should be taken however to avoid loss of extremely fine material from the sample during decanting.
- Samples for analysis of VOCs should not be composite or homogenized and should be collected first as discrete grabs.
- Depending on project DQOs, depositional areas with finer grain sediments should be targeted and sample depth should be a maximum of 15 cm to ensure the entire benthic biotic zone is captured in the sample.
- Samples from free-flowing rivers or streams should be collected from: both banks of a relatively straight section of a stream; on the inside edges of a meander; in slack water or eddy current areas.
- On medium sized and smaller rivers and streams, the use of hands, feet, fingers, and toes with the "Wading Braille" technique (locating sediments by touch and feel) in conjunction with best professional judgment can be extremely effective in locating fine grained deposits.

A3.m. Sample Preservation and Holding Times

All sediment samples should be cooled to 4°C as soon as possible after collection. Samples for metals, except for mercury, must be analyzed within six months. Sediment samples for mercury must be analyzed within 28 days. See ***Section A6***.

A3.n. Other Data Collection

Field measurements for water temperature, conductivity, pH, water depth, dissolved oxygen (mg/L), and turbidity (observational) should be collected from the water column within one meter of the sediment prior to sediment sample collection. Notes on sediment appearance, texture, color and odor should be documented on the sediment Data Collection Sheet.

The sampling location (with sufficient detail to allow a revisit to the same sample location) including latitude and longitude, river mile (if available), a brief description of the sampling site and information about unusual conditions should be recorded for each location. A hand drawn map of the sampling site showing landmarks and depicting the sample location (including measurements from trees, etc.) can be very effective in re-locating the exact sampling site. This drawing can be placed on the back of the ***Sediment Data Collection Sheet***.

A3.o. Sample Labeling/Shipping/Paperwork/COC

For samples submitted to DES, these procedures are the same as described in the Ohio EPA Surface Water Field Sampling Manual, Appendix IV Data Management (addresses primarily water samples). This manual should be used as guiding principles for the information needed. Specific procedures or forms should adhere to any administrative order, contract, or QAPP directive for samples submitted to non-Ohio EPA laboratories.

A4. Data Reporting and Storage

A4.a. Data Storage & Reporting

All sediment analytical data is to be entered into EA3. Sediment data collected for watershed biological and water quality studies will be reported in a Technical Support Document (TSD) and published on ***Ohio EPA's Biological and Water Quality Reports*** webpage. For sediment data collected for other studies or investigations, the report type will be defined within the project's QAPP.

Ohio EPA Sediment Data Collection Sheet

Project: _____

Collection Date: _____ Collection Start Time:_____ End Time: _____

Collector(s):_____

Weather Conditions: _____

Sample Location Description (Provide diagram of sampling location(s) on opposite side and check box)

Station Id: _____

Waterbody Name: _____ River Mile Location: _____

Latitude: _____ Longitude: _____ Length of Collection Area: _____

Sample Site Description: _____

Ambient Site Information (water):

Conductivity _____ Dissolved Oxygen (mg/L) _____ pH _____

Temperature _____ Current Velocity _____ Meter ID: _____

Turbidity _____

Sediment Collection Information:

Sample ID: _____

Water Depth Above Sample: _____ Sediment Sample Depth: _____

Collection Device: Scoop/Spoon (plastic/stainless steel) _____ Eckman Dredge _____ Corer _____ Other _____

Sample Type: Grab _____ Composite: _____

Sample Replicate Collected? YES or NO Sample Duplicate Collected? YES or NO

Replicate ID/Name: _____ Duplicate ID/Name: _____

Sample Information:

Color (Munsell® Soil Color Chart Number): _____

Texture (particle size description): _____

Odor: _____

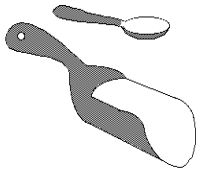
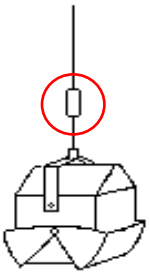
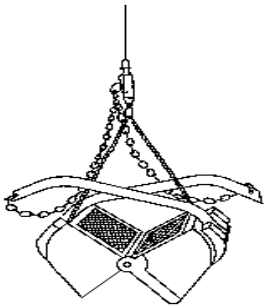
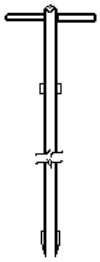
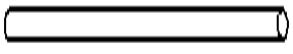
Additional Comments: _____

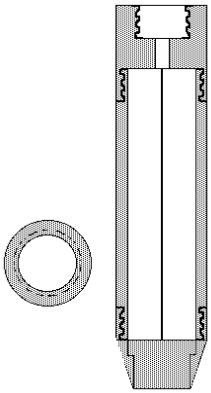
_____

_____

Sand - Materials 0.06 - 2.0 mm in diameter, gritty in texture when rubbed between fingers. Loose materials (not cohesive) that often cannot be molded into shapes (non-plastic).
Silt - 0.004 - 0.06 mm in diameter, generally this is fine material which feels greasy or has a smooth talc-like feel when rubbed between fingers. Non-plastic and not cohesive.
Clay/Hardpan - Particles less than 0.004 mm in diameter, usually clay, which forms a dense, gummy surface that is difficult to penetrate with tools. Clay is both plastic and cohesive.
Marl - Calcium carbonate; usually greyish-white; often contains fragments of mollusk shells.
Detritus - Dead, unconsolidated organic material including sticks, wood, leaves and other partially or undecayed coarse plant material.
Peat - Partially decomposed plant remains; Plant remains such as Sphagnum moss sometimes visible.
Muck - Black, extremely fine, flocculent, completely decomposed organic matter (does not include sewage sludge).
Sludge - Thick layer of organic matter that is decidedly of human or animal origin.

A5. Table of Sediment Sampling Equipment

Type	Model	Current	Substrate Type	Remarks	Illustration
GRAB	Spoon Scoop	Zero to Slight	All	• Use only in relatively calm and shallow water. • Relatively little sample disturbance. • Simple and inexpensive • Fines may washout when retrieved through water column.	
GRAB	Eckman (Birge)	Zero to Very Slight	Clay and Silt	• Use in relatively calm water. • Pebbles and branches may interfere with jaw closure • Excellent jaw shape and cut. • Relatively little sample disturbance. • Poor stability. Light weight allows for tendency to "swim" in a current. Sometimes causes miss triggers. • 0.02 m^2 sample area. • Weight with sample is 10 kg. • The "Messenger" is outlined in the red circle	
GRAB	Petite Ponar Peterson	Zero to Very Slight	Clay to fine gravel	• Need relatively calm/sheltered waters. • Good stability. • Poor jaw shape and cut. Sample disturbance. • Less washout if extra weights are used. • More cumbersome than an Eckman • 0.02 m^2 sample area. • Weight with sample is 30 - 50 kg.	
CORE	Manual	Zero to strong	Clay to sand. Inserts needed for sandy samples.	• Recommended for use in shallow water. • Deployed by hand or by driver (hammer). • Extension handles can be used for deeper waters.	
CORE	Coring Tubes	Zero to moderate	Clay to sand. Inserts needed for sandy samples.	• Quick and easy. • Relatively undisturbed sample. • Small sample volume. • Samples sometimes compressed.	

Type	Model	Current	Substrate Type	Remarks	Illustration
CORE	Split Spoon	Zero to moderate	Clay to sand. Inserts needed for sandy samples.	• Recommended for use in shallow water. • Deployed by hand or by driver (hammer). • Vertical profile remains intact and is visible. • Point design can reduce sample compaction. • Stones can interfere with collection. • Equipment is heavy.	
CORE	Manual / Gravity	Zero to moderate	Clay to sand	• Can be pushed manually into sediment or dropped by rope in deeper waters • Can use core extension handles up to 15 feet. • Use with Liner Tubes and Eggshell Core Catcher • Wildco® user manual https://wildco.com/wp-content/uploads/2017/04/2424-B-Hand-Corer.pdf	

A6. Sediment Sample Volume and Container Type for Samples Submitted to the Ohio EPA DES Laboratory

Parameters	Method	Holding Time	Container Type
Metals (ICP): Al, Ba, Ca, Fe, Mg, Mn, Na, K, Sr, Zn, V, Ti *	USEPA 6010B	6 Months	500 ml wide mouth amber glass with Teflon lined lid.
Metals (ICPMS): As, Be, Cd, Co, Cr, Cu, Ni, Pb, Se *	USEPA 6020A	6 Months	500 ml wide mouth amber glass with Teflon lined lid.
Percent Solids*	SM 2540G	7 Days	500 ml wide mouth amber glass with Teflon lined lid.
Mercury	USEPA 245.1	28 Days	Plastic "Zip lock" bag or 500 mL HDPE
Total Organic Carbon (TOC) *	OEPA 335.4	28 Days	500 ml wide mouth amber glass with Teflon lined lid.
Total Phosphorus (TP)*	USEPA 365.4	28 Days	500 ml wide mouth amber glass with Teflon lined lid.
Ammonia*	SM 4500 NH3BE	28 Days	500 ml wide mouth amber glass with Teflon lined lid.
Particle Size Analysis	OEPA 160.1	7 Days	Plastic "Zip lock" bag or 500 mL HDPE
PCBs/Pesticides*	USEPA 8081/8082	14 Days	500 ml wide mouth amber glass with Teflon lined lid.
SVOCs/PAHs (BNAs)*	USEPA 8270C	14 Days	500 ml wide mouth amber glass with Teflon lined lid.
pH*			500 ml wide mouth amber glass with Teflon lined lid.
VOCs	USEPA 8260	14 Days	Septum vial or 60 ml wide mouth glass with Teflon lined lid - Fill with stream water to eliminate head space

*All parameters can be analyzed from one 500 ml wide mouth amber glass with Teflon lined lid.

A7. Sediment Sampling Locations

Slow moving water area with depositional sediments. Great care must be taken to avoid disturbance of bottom material at sampling point – notice light-grey sediment plume. When wading always approach sampling site from downstream. (Little Scioto River Marion, Ohio).

Sediment depositional area – sediment sample is collected below water surface level. When using boat to collect sediment always turn motor off before sampling and collect sample from bow of boat. Mad River – Dayton Ohio

Slow water depositional area. Take care to remove woody and vegetive material from fine-grained sediment sample. Breakneck Creek – Kent, Ohio

Ekman Dredge Grab sampler – typically used in deep waters and lakes.
Ponar Dredge Grab samplers are also used in deep waters and lakes.

Sediment sampling location in the main stream channel. Woody debris blocks strong stream flow creating good sediment depositional area.

Ramp Creek – Newark Ohio

Eddy depositional area behind woody debris. Sediment deposition may occur nearer the main stream channel behind woody debris. Cuyahoga River – Streetsboro, Ohio

A7.a. Examples of Acceptable/Unacceptable Sediment

Recent Depositional (Acceptable)

Leaves/Twigs/ Course Material (Unacceptable)

Course Bottom Sediment (Unacceptable)

Organically Enriched Depositional (Acceptable)

Ekman Dredge Sample

Homogenized Sample

A8. References

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2021. *Surface Water Field Sampling Manual: for Water Quality Parameters and Flows*.

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2021. Surface Water Field Sampling Manual - Appendix I: Inland Lakes Sampling Procedure Manual.

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2021. *Surface Water Field Sampling Manual - Appendix II: for Water Quality Parameters and Flows*.

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2021. *Surface Water Field Sampling Manual - Appendix IV: Data Management*.

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2019. *Surface Water Field Sampling Manual - Inland Lakes Sampling Procedure Manual*.

U.S. EPA (United States Environmental Protection Agency – Laboratory Services and Applied Science Division). 2020. *Sediment Sampling*. ID: LSASDPROC-200-R4