



Environmental Analysis Program

Pomona College
Biogeochemistry Laboratory

SOP-F305

Sediment Sampling – Streams and Lakes

Standard Operating Procedure

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1. Purpose

This procedure describes the collection, handling, and field documentation of sediment samples from streams, rivers, lakes, and reservoirs. Sediment is a major sink and source of nutrients, metals, organic contaminants, and fine particles in aquatic systems. The procedures in this SOP are designed to produce samples suitable for physical characterization (grain size, organic matter content), chemical analysis (metals, nutrients, organic contaminants), and biological assessment (benthic invertebrate habitat substrate) (Mudroch et al., 1999; US Environmental Protection Agency, 2001).

2. Scope

- **Applies to:** Surficial sediment sampling (top 0–10 cm) in wadeable streams, non-wadeable rivers (from bridges or boats), and lentic systems (lakes, ponds, reservoirs). Deeper cores for stratigraphic or paleolimnological work follow the same safety and documentation requirements but use specialized coring equipment not covered in detail here.
- **Does not apply to:** Soil sampling on upland or riparian surfaces (see [SOP-F400](#)); suspended sediment sampling by filtration (see future SOP-L312); bedload transport measurements; marine sediment sampling
- **Location:** All EA Program surface water field sites

3. Responsibilities

Role	Responsibility
PI / Field Lead	Approve sampling plan, coordinate permits
Trained Personnel	Collect and handle samples per this SOP
New Students	Complete training before independent sampling

4. Definitions

- **Benthic sediment:** Material that has settled and accumulated on the bed of a stream, lake, or estuary; composed of mineral particles, organic matter, and biological material; the primary matrix for sampling of trace metals, nutrients, and benthic organisms.
- **Core sample:** A cylindrical sediment sample extracted with a tube corer or freeze corer that preserves the vertical stratigraphy and depth profile of deposited material; used for porewater analysis, dating, and historical pollutant records.
- **Disturbed sample:** A bulk sediment sample collected without preserving internal structure (e.g., by grab sampler or trowel); used for bulk chemical analysis, particle size, and loss on ignition when stratigraphy is not required.
- **Ekman grab:** A spring-loaded, box-shaped sampler lowered on a cable that closes on impact with the sediment bed; collects an undisturbed surface sample from soft, fine-grained sediments in lakes and slow-moving water.

- **Fine earth fraction:** The portion of sediment passing through a 2 mm sieve (sand, silt, and clay); the standard fraction for chemical analysis; gravel and coarser material are excluded.
- **Grab sample:** A surface sediment sample collected from the top 1–5 cm of the bed using a grab sampler, trowel, or scoop; represents recently deposited material and is appropriate for screening contamination in surface sediments.
- **Porewater:** Water occupying the spaces between sediment particles; often enriched in dissolved nutrients, metals, and gases released by diagenetic processes; collected by in situ peepers or by centrifugation of sediment cores.
- **Sediment trap:** A cylindrical or funnel-shaped container deployed in the water column to intercept settling particles; used to measure particle flux rates and collect settling material for chemical characterization.

5. Safety and Hazards

Hazards

- **Physical:** Wading in streams and working from boats carry slip, fall, and drowning hazards. Sediment sampling often involves bending, lifting, and handling heavy wet material.
- **Biological:** Sediment may harbor pathogens, parasites (e.g., *Schistosoma*, *Naegleria*), and sharp debris (glass, metal).
- **Chemical:** Sediment from urban or industrial sites may contain heavy metals, hydrocarbons, or pesticides. Avoid skin contact and do not ingest.

5.1. Required PPE

- ☐ Nitrile gloves (doubled for contaminated sites)
- ☐ Wading boots or hip waders
- ☐ Personal flotation device (boat sampling)
- ☐ Safety glasses
- ☐ Sun protection

5.2. Emergency Procedures

A minimum of two people must be present for any in-water work. Refer to [SOP-F001 Field Safety](#).

6. Equipment and Materials

6.1. Sampling Devices

Device	Application	Notes
Stainless steel scoop or trowel	Wadeable stream surficial sediment	Simplest; suitable for coarse to fine sediment
Ponar grab sampler (standard or petite)	Lakes, deep pools, non-wadeable rivers	Collects approximately 0.023 m ² (petite) to 0.052 m ² (standard)
Ekman grab sampler	Soft lake-bottom sediment (silt, clay, organic muck)	Lighter than Ponar; not suitable for sand or gravel
Hand corer (acrylic tube, 5–7 cm ID)	Intact surficial cores in soft sediment	Preserves vertical stratigraphy
Gravity corer or piston corer	Deep cores for paleolimnological work	Specialized; consult PI

6.2. Support Equipment

Item	Notes
Stainless steel bowls and spoons	For homogenizing grab samples
Pre-labeled sample bags (Whirl-Pak) or jars	Appropriate to analyte (see Section 7)
Cooler with ice packs	Maintain samples at 4 C
Deionized water (squeeze bottle)	For rinsing equipment
Measuring tape and depth rod	For recording water depth at sample location
GPS unit	For recording coordinates per SOP-F006
Field notebook and data sheets	Waterproof (Rite in the Rain)
Camera	For photo-documenting sample location and sediment appearance
Chain of custody forms	Per SOP-F008

7. Procedure

7.1. Site Selection and Documentation

1. Identify the sampling location based on the study design (e.g., depositional zones for contaminant assessment, riffles for substrate characterization)
2. Record GPS coordinates, date, time, water depth, and a visual description of the sediment surface (color, texture, odor, presence of debris or biota) in the field notebook
3. Photograph the site and the sediment surface before disturbing it

7.2. Stream Sediment (Wadeable)

1. Approach the sampling location from downstream to avoid disturbing the target area
2. Using a stainless steel scoop or trowel, carefully skim the top 5–10 cm of sediment. Avoid collecting underlying undisturbed substrate unless the study requires a depth profile.

3. Transfer the sediment into a stainless steel bowl
4. If a composite sample is required, collect sediment from 3–5 locations within the reach (e.g., across the channel width at the designated transect) and combine in the bowl
5. Homogenize using a stainless steel spoon; remove large rocks, sticks, and debris
6. Transfer the homogenized sample into the appropriate container(s) (see Section 7)

7.3. Lake and Reservoir Sediment (Grab Sampler)

1. Lower the Ponar or Ekman grab sampler to the bottom on a measured line from a boat or dock. Record the water depth.
2. Trip the sampler per the manufacturer's instructions
3. Raise the sampler slowly to avoid losing material; keep it horizontal as it breaks the water surface
4. Inspect the sample: a successful grab is at least half full with an undisturbed sediment surface and overlying water. Reject and re-sample if the grab is less than one-third full, tilted, or shows evidence of washout (US Environmental Protection Agency, 2001).
5. Carefully drain overlying water without disturbing the sediment surface
6. For surficial samples, subsample the top 2–5 cm using a stainless steel spoon
7. Homogenize and containerize as in Section 6.2

7.4. Intact Cores (Hand Corer)

1. Push the acrylic core tube vertically into soft sediment to the desired depth (typically 10–30 cm)
2. Cap the top of the tube (creating suction) before pulling the core from the sediment
3. Once extracted, cap the bottom immediately
4. Label the core tube with sample ID, date, depth, and orientation (top/bottom)
5. Keep the core vertical during transport and store at 4 C

7.5. Decontamination Between Sites

1. Scrub all stainless steel equipment with a brush and rinse with site water
2. Follow with a deionized water rinse
3. For trace metal work, perform an additional acid rinse (10% HNO₃) followed by a triple DI water rinse
4. See [SOP-F007 Field Decontamination](#)

8. Sample Containers and Preservation

Analyte	Container	Preservative
Grain size / texture	Whirl-Pak or poly bag	Refrigerate 4 C
Organic matter (LOI)	Whirl-Pak or poly bag	Refrigerate 4 C
Total metals	Glass jar (acid-washed)	Refrigerate 4 C; freeze if holding > 7 days

Analyte	Container	Preservative
Nutrients (N, P)	Whirl-Pak or poly bag	Refrigerate 4 C; freeze if holding > 48 hours
Organic contaminants	Glass jar (solvent-rinsed)	Refrigerate 4 C
Benthic macroinvertebrates	Separate container	95% ethanol or 10% formalin

i Note

Confirm specific container requirements and holding times with the analytical laboratory before each sampling event.

9. Quality Control

- Collect field duplicates at a rate of at least 1 per 10 samples (or 1 per sampling event, whichever is greater)
- Collect one equipment blank per sampling event: rinse decontaminated equipment with DI water and submit the rinse as a sample
- Record all deviations from this SOP in the field notebook
- Complete the chain of custody form per [SOP-F008](#)
- Photograph each grab or core before subsampling

10. Data Management

1. Enter field data into the project database within 48 hours
2. Archive original field data sheets (scan if paper)
3. When laboratory results are received, merge with field data and apply QC flags per [SOP-L802](#)

11. References

- Mudroch, A., Azcue, J. M., & Mudroch, P. (1999). *Manual of physico-chemical analysis of aquatic sediments*. CRC Press. <https://doi.org/10.1201/9781003069823>
- US Environmental Protection Agency. (2001). *Methods for collection, storage and manipulation of sediments for chemical and toxicological analyses: Technical manual* (EPA-823-B-01-002). Office of Water, US EPA. <https://www.epa.gov/sites/default/files/2015-09/documents/collectionmanual.pdf>

12. Related SOPs

SOP	Title	Relationship
F001	Field Safety	Required prerequisite

SOP	Title	Relationship
F007	Field Decontamination	Between-site decontamination
F008	Sample Labeling and COC	Sample ID and chain of custody
F300	Surface Water Sampling	Companion water collection
F400	Soil Sampling	Upland soil sampling
L406	Loss on Ignition	Sediment organic matter analysis
L410	Acid Digestion	Sediment metals preparation

13. Training Record

Before collecting sediment samples independently, personnel must:

1. Read this SOP, [SOP-F001](#), and [SOP-F007](#) in full
2. Observe a trained operator demonstrate grab sampler deployment, core collection, and decontamination
3. Practice deploying the Ponar or Ekman sampler (or hand corer) under supervision
4. Demonstrate proper homogenization, containerization, and labeling
5. Be signed off by the PI or field lead