

Collection and preservation of sediment

1 Purpose and scope

This document describes methods for the collection and preservation of sediments for the purpose of undertaking analysis of inorganic and organic contaminants. This will assist in an assessment of the risk to aquatic or benthic ecosystems or other environmental values. This document must be read in conjunction with the associated document *Background information on the collection and preservation of sediment*, which provides important considerations that must be made prior to determining and conducting a sediment sampling plan.

2 Associated documents

Physical and chemical assessment:

- *Background information on the collection and preservation of sediment*
- *Water quality sampling using in situ water quality instruments*
- *Sampling design and preparation*
- *Permits and approvals*
- *Operating a basic handheld GPS unit for an investigation of compliance inspection*
- *Record keeping including taking field photographs and videos*

Biological assessment: Direct toxicity assessments

3 Health and safety

Before following the methods contained in this document, a detailed risk management process (identification, assessment, control and review of the hazards and risks) must be undertaken. All work carried out must comply with the Queensland Work Health and Safety legislative obligations.

4 Permits and approvals

Permits and approvals may be required to conduct activities involving animals, plants and/or in protected areas (for example National Park/Regional Park, State Forest or State Marine Park). See *Permits and approvals* for more information on requirements.

5 Skills, training and experience

Skills, training or experience required to conduct the procedure within this section include experience in using the equipment described in the method.

6 Equipment

See Appendix 1 for example equipment checklist.

7 Procedure

7.1 Preparation for sampling

1. Determine the sampling procedure prior to sampling, giving consideration to:
 - 1.1. The exact location for sample collection, ensuring it is representative of the site.
 - 1.2. Whether a composite sample, multiple replicate samples or a single discrete sample is appropriate to obtain a representative sample of the site.
 - 1.3. The number of replicate samples (if required), the depth at which they are taken, and the distance between replicate sampling sites prior to collection.
 - 1.4. If collecting a composite sample, it can be made up with multiple samples collected one to ten metres apart and combined by thorough mixing. However, where disturbance of sediments prior to testing needs to be minimised (i.e. no mixing is possible), multiple replicate samples should be taken.
2. Prepare any sampling equipment that may be required. Stainless-steel equipment is generally appropriate for sampling sediments; however, if ultra-trace metal concentrations are to be sampled it would be appropriate to use plastic (HDPE or PTFE) sampling equipment.
 - 2.1. Clean all sampling equipment to be used with a laboratory grade detergent and rinse three times with laboratory grade distilled water. Wrap in aluminium foil or clean heavy duty plastic to keep dust free.
 - 2.2. If sampling for organics, wipe equipment down with an organic solvent (such as laboratory grade hexane) and wrap equipment in aluminium foil. Hexane is preferred for analysis of petroleum hydrocarbons.
 - 2.3. If sampling for ultra-trace metals, rinse equipment in 10% nitric acid.
3. Notify the analysis laboratory prior sampling as to whether sieving is necessary and if analysis of sub-fractions is required. Laboratory analysis may require sieving to obtain sub-fractions, with <math><2000\mu\text{m}</math> or <math><63\mu\text{m}</math> being most common. You will need to inform the laboratory if you require analysis of sub-fractions. Discuss storage requirements and holding times if unsure.

Note: It is essential that all sources of contamination are excluded from the sampling process, including residues from tobacco products, food and beverage, sunscreen lotions, cosmetics and cleansers, water and sediments carried on clothing and equipment.

7.2 Sampling

1. Label sampling containers (e.g. jars, bags) to be used.
2. Clean all sampling equipment prior to sampling as in Step 2.1 above. Use of field water for cleaning equipment may also be appropriate for relatively clean environments.
3. Put on clean gloves, ensuring the type corresponds to the chemical risk.
4. Either wade or navigate the boat (depending on type of sampling) to the sampling location to collect sediments, taking care not to disturb sampling area.
5. Find a suitable sampling location, aiming to collect sediments from locations where finer sediments tend to be deposited (i.e. at sections with low water velocities such as large and deep water-holes or inside bends in rivers).
6. Collect sediments using a suitable sampling device (such as a clean trowel, Van Veen Grab Sampler or corer).
7. Siphon off any overlying water with care to minimise loss of fine surface sediments that may be resuspended.
8. Take a photo of the sample.
9. If sub-sampling from a core sample, specific depth horizons can be selected by extruding the core and cutting the exposed sediment with a stainless steel or plastic (HDPE or PTFE) cutter.
10. If collecting a composite sample, place sediment from different individual samples into a stainless steel or plastic (HDPE or PTFE) bowl. If possible, avoid using sediment that has been in direct contact with the metal sampling device. Thoroughly mix the sediment in the bowl using a stainless steel or plastic (HDPE or PTFE) spoon or other tool before sub-sampling.

Note: It is necessary to consider whether mixing will influence the results for the contaminants being analysed. See *Background information on the collection and preservation of sediment* document for more information.

11. Place the sediment into the individually labelled sample container/s.
12. If the sample **IS NOT** to be frozen:
 - 12.1. Fill the container almost to the brim and cover with water from the collection site leaving no airspace.
 - 12.2. Seal the container with an appropriate lid that will prevent leakage or minimise ingress of air.
 - 12.3. If sediment oxidation is a concern, the headspace or cover-water can be purged with an inert gas (e.g. nitrogen or argon). Bubble gas (via a narrow tube connected to the cylinder) through the overlying water to drive off oxygen and then replace the lid tightly.
 - 12.4. Store the samples vertically to avoid mixing.
 - 12.5. Keep cool or refrigerate promptly.
13. If the sample **IS** to be frozen e.g. for measurement of acid volatile sulfide (AVS):
 - 13.1. Fill the container to only two-thirds of capacity, including any cover water taken from the same site.
 - 13.2. Store the samples vertically.
 - 13.3. Place samples promptly in dry ice or portable freezer.
14. If possible, measure in situ water quality data 5 to 20cm above the sampling site (i.e. pH, electrical conductivity, temperature, redox potential, turbidity and dissolved oxygen).
15. Collect sediment quality characteristics if required (e.g. pH, redox potential).
16. Record all relevant information relating to the sample collected in the field notebook/field data sheets, including:
 - date, time, site name, GPS coordinates
 - sediment collection method (i.e. use of sampling device, composite sampling etc.)
 - water column depth above sediment collection site
 - sampling conditions (water depth, tides, waves, water clarity).

7.3 Post sampling

Sediment samples must be delivered to the laboratory to allow for analyses or tests to be conducted within the prescribed holding and testing times. Holding times will vary depending on the analyses to be performed.

Sediment toxicity tests should be commenced as soon as practical after sample collection and two weeks is recommended as a maximum holding time. See *Direct toxicity assessments* for further information.

A summary of the holding times for various sediment analyses is presented in Table 1 of the *Background information on the collection and preservation of sediment* document.

8 References and additional reading

AS/NZS 5667.12:1999, Water quality—Sampling—Guidance on the Sampling of Bottom Sediments.

Commonwealth of Australia 2009, *National Assessment Guidelines for Dredging*, Commonwealth of Australia, Canberra, 81 pp.

Simpson, SL, and Batley, GE 2016, *Sediment quality assessment: A Practical Handbook*, CSIRO Publishing, Canberra, 360 pp.

U.S. EPA 2001, Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual, Office of Water, United States Environmental Protection Agency, Washington, DC, 208 pp.

Appendix 1

Table 1: Equipment checklist

| Equipment | ✓ |
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| Single or multi-parameter water quality instrument | |
| Field data sheets, notebook or field computer | |
| Labelling equipment (e.g. stickers and/or permanent markers) | |
| Personal Protective Equipment (PPE): <ul style="list-style-type: none"> • Safety boots, high visibility vest, long pants, long-sleeved shirt, hardhat (industrial sites); • Waders, gumboots, broad-brimmed hat or similar PPE (shore-based sampling). | |
| Gloves - non-powdered latex free (e.g. nitrile) corresponding to the chemical risk | |
| Clean collection containers as provided by the analytical laboratory | |
| Clean sediment sampling equipment* for collection of surficial layers (<10cm depth): <ul style="list-style-type: none"> • stainless steel (organics or metals) or plastic (HDPE or PTFE for ultra-trace metals) trowel for dry sediments or for exposed littoral sediments (tidal flats); • stainless steel benthic grab sampling equipment (e.g. Ponar or Van Veen) grab sampler for deployment from a boat or jetty. | |
| Clean hand corer for sediment profiling | |
| Clean stainless steel sieve (10mm) for removal of stones, plant material or fauna | |
| Cool-box with ice bricks or portable refrigerator | |

* For further information of appropriate sampling devices see U.S. EPA (2001).