CHAPTER 7

SAMPLING PROTOCOLS

7.1 OVERVIEW

When required, sampling and testing must be coordinated far enough in advance of dredging to allow time for chemical testing, possible biological testing, and data review. An accurate assessment of the physical, chemical and biological characteristics of proposed dredged sediment is dependent upon the collection of representative samples. Steps must be taken during the sampling process to ensure that samples accurately represent the area to be dredged. This chapter discusses the recommended procedures for sample acquisition and handling. This is the first step in the quality assurance, quality control process that is needed to guarantee reliable data for dredged material evaluation. A number of regional programs have developed standard sampling protocols. This chapter and the associated appendices provide an overview of these widely accepted practices.

Pre-sampling bathymetric surveys should be conducted to provide information on current shoaling patterns and volumes of sediment present at the time of sampling. **The timing of sampling should be coordinated with the DMMO/DMMT.**

7.2 SAMPLING APPROACH

If sampling and analysis are required for a project, the applicant will be required to sample the sediment for chemical, and if necessary, biological analyses. The recommended volume needed for each type of analysis is listed in Table 7-1. There are four sampling approaches which the dredging proponent may take:

Alternative #1: Collect enough sediment for physical characterization only.

Alternative #2: Collect only enough sediment to conduct the physical and chemical analyses. If biological testing is necessary, resampling will be required.

Alternative #3. Collect sufficient sediment for all physical, chemical and biological tests. Archive adequate sediment for biological testing pending the results of the chemical analysis.

Alternative #4: Collect sufficient sediment for all chemical and biological tests. Run these tests concurrently.

The sampling approach should be clearly documented in the sampling and analysis plan. The selection of either alternative #3 or #4 is encouraged if chemical analysis is anticipated, because they provide chemical and biological data on sub-samples of a single homogenized sediment. These alternatives are also advantageous because they both preclude the cost involved with collection of additional sediment. Alternative #4 is the least time consuming, and is likely the most economical when the need for biological testing is expected (Note the sediment holding times in Table 7-1). For alternative #2, biological analysis can proceed without re-analysis of sediment chemistry. Biological samples must be taken from the same stations as the sediment chemistry samples.

7.3 POSITIONING METHODS

Accurate positioning of sampling stations is essential in investigations of sediment characteristics. All samples should be obtained as close as possible to the target locations provided in the project sampling plan. All sediment sampling locations should be recorded to a horizontal accuracy of ± 2 meters (or as approved in the sampling and analysis plan). Such accuracy can be obtained by survey landmarks and a variety of positional hardware. If sampling locations are referenced to a local coordinate grid, the local grid should be tied to the North American Datum (NAD 1983) to allow conversion to latitudes and longitudes. The use of a standard horizontal datum will allow dredging data to be accurately mapped, including display and analysis using geographic information system (GIS) software.

7.4 SAMPLING METHODS

The goal of sediment sampling for characterization of each individual dredged material management unit (DMMU) is to collect a sample (or a number of composited samples) which will be representative of the DMMU. The agencies have established minimum sampling requirements based on volumetric measurements. The type of sampling required, however, depends on the type of project. The sampling methodology to be used should be presented in the sampling and analysis plan along with the rationale for its use.

a. Core Sampling. For projects in heterogeneous areas and for most new-work dredging, the proponent will be required to take core samples from the sediment/water interface down to the maximum depth of dredging. There are numerous methods available for obtaining core samples including impact corers, hydraulic push corers, Gus samplers, augers with split spoons or Shelby tubes, jet samplers, etc. The methodology chosen will depend on availability, cost, efficacy, and anticipated sediment recoveries.

b. Grab Sampling. It is anticipated that sediments in frequently dredged areas or in areas of high energy will be relatively homogeneous. In these locations, grab samples will be considered adequate to represent the dredged material, even if shoaling results in sediment accumulation greater than four feet. A number of factors need to be considered in the selection of a grab sampler, including type of sediment, volume needed and ease of deployment.

7.5 SAMPLE COLLECTION AND HANDLING PROCEDURES

Proper sample collection and handling procedures are vital to maintain the integrity of the sample. If the integrity of the sample is compromised, the analysis results may be skewed or otherwise unacceptable. Sample collection and handling include procedures for decontamination, sampler deployment, sample logging, sample extrusion, compositing, sample transport, chain of custody, archiving and storage, all of which need to be treated in the sampling and analysis plan. Guidance can be found in the *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound* (PSEP 1996) which contains detailed information on sample handling procedures. Project proponents are urged to contact the DMMO/DMMT for the latest protocols. General guidance can be found in Appendix 7-A and is summarized below.

a. Decontamination Procedures. Sampling containers should be decontaminated by the laboratory or manufacturer prior to use. The intention is to avoid contaminating the sediments to be tested, since this could possibly result in dredged material, which would otherwise be found acceptable for aquatic disposal, being found unacceptable.

b. Sample Collection. Sampling procedures and protocols will vary depending on the sampling methodology chosen. Whatever sampling method is used, measures should be taken to prevent contamination from contact with sources of contamination such as the sampling platform, grease from winches, engine exhaust, etc. Core sampling methodology should include the means for determining when the core sampler has penetrated to the required depth. The sampling location must be referenced to the actual deployment location of the sampler, not another part of the sampling platform such as the bridge of a sampling vessel.

c. Volatiles and Sulfides Sub-sampling. The volatiles and sulfides sub-samples should be taken immediately upon extrusion of cores or immediately after accepting a grab sample for use. For composited samples, one core section or grab sample for each DMMU should be selected for the volatiles and sulfides sampling.

d. Sampling Logs. As samples are collected, and after the volatiles and sulfides sub-samples have been taken, logs and field notes of all samples should be taken and correlated to the sampling location map.

e. Extrusion, Compositing and Sub-sampling. Depending on the sampling methodology and procedure proposed, sample extrusion, compositing and subsampling may take place at different times and locations.

f. Sample Transport and Chain-of-Custody Procedures. Sample transport and chain of custody procedures are listed in Appendix 7-A.

g. Sample Storage and Holding Times. Proper sample storage is critical to accurate assessment of sediment toxicity. Table 7-1 outlines the storage and holding time requirements for each type of analysis.

TABLE 7-1
SAMPLE STORAGE CRITERIA

SAMPLE TYPE	HOLDING TIME	SAMPLE SIZE[1]	TEMPERATURE[2]	CONTAINER	ARCHIVE[3]
Particle Size	6 Months	100-200 g (150 ml)	4^oC	1-liter Glass (combined)	X
Total Solids	14 Days	125 g (100 ml)	4^oC		
Total Volatile Solids	14 Days	125 g (100 ml)	4^oC		
Total Organic Carbon	14 Days	125 g (100 ml)	4^oC		
Ammonia	7 Days	25 g (20 ml)	4^oC		
Metals (except Mercury)	6 Months	50 g (40 ml)	4^oC		
Semi-volatiles, Pesticides and PCBs	14 Days until extraction 1 Year until extraction 40 Days after extraction	150 g (120 ml)	4^oC -18^oC		
Total Sulfides	7 Days	50 g (40 ml)	4^oC[4]	125 ml Plastic	
Mercury	28 Days	5 g (4 ml)	-18^oC	125 ml Glass	
Volatile Organics	14 Days	100 g (2-40 ml jars)	4^oC	2-40 ml Glass	
Bioassay	8 Weeks	4 liters	4^oC[5]	5-1 liter Glass	
Bioaccumulation	8 Weeks	16 liters	4^oC[5]	16-1 liter Glass	

[1] Recommended minimum field sample sizes for one laboratory analysis. Actual volumes to be collected have been increased to provide a margin of error and allow for retests.
[2] During transport to the lab, samples will be stored on ice. The mercury and archived samples will be frozen immediately upon receipt at the lab.
[3] For every DMMU, a 250 ml container is filled and frozen to run any or all of the analyses indicated.
[4] The sulfides sample will be preserved with 5 ml of 2 Normal zinc acetate for every 30 g of sediment.
[5] Headspace purged with nitrogen.

7.6 ARCHIVING ADDITIONAL SEDIMENT

In areas where the exposed sediment is anticipated to be contaminated above the *in situ* sediment, a sample from the first foot below the dredging overdepth will be collected and archived. This will allow possible future analysis to evaluate chemical concentrations in the newly exposed sediment if this is deemed necessary by the Regional Management Team.

The archived sediment must be frozen. Because the holding time for mercury will likely be exceeded, and sediments for volatiles analysis can not be frozen, mercury and any volatile chemicals-of-concern will not need to be analyzed for the archived sediments unless these chemicals are anticipated to be a problem in the newly-exposed sediments. In this case, analysis will need to occur immediately.

7.7 DATA SUBMITTAL

A key component of the sampling effort is the completeness of the data package submitted for regulatory review. Chapter 11 contains detailed information regarding data submittal requirements.