PORTLAND HARBOR RI/FS

Round 3A FIELD SAMPLING PLAN STORMWATER SAMPLING

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1.0 INTRODUCTION

This Field Sampling Plan (FSP) presents the approach and procedures to implement stormwater sampling activities in early 2007 for the Remedial Investigation and Feasibility Study (RI/FS) of the Portland Harbor Superfund Site (Site). This FSP describes the field sampling and the Quality Assurance Project Plan Addendum (QAPP Addendum; Integral 2007) provides the laboratory analysis procedures to accomplish the following types of data collection:

- Stormwater chemistry, total suspended solids (TSS), and associated conventionals
- Stormwater suspended sediment chemistry and associated conventionals.

The field study sampling procedures, methods, and analyses for stormwater are described in this document. This FSP is a companion document to the Round 3A Stormwater Sampling Rationale (Anchor and Integral 2007), which describes the reasoning behind the overall approach. The RI/FS project conducted by the Lower Willamette Group (LWG) is currently collecting Round 3A of sampling data in the river for various purposes, which will extend well into 2007. Therefore, this stormwater sampling is considered part of the Round 3A sampling.

1.1 BACKGROUND AND CONTEXT

Surface water chemicals are suspected to contribute to fish tissue burdens (and related risks) within the Site. The importance of various sources of surface water chemicals, particularly stormwater, is not well understood. The sources to the water column from resuspension of sediment versus other water borne sources (such as stormwater) must be known to develop sediment and surface water preliminary remediation goals (PRGs) that are intended to minimize fish tissue related risks for the Site.

Additionally, stormwater discharges have the potential to contribute to recontamination of sediments near outfalls (and/or potentially Site-wide for some chemicals) following cleanup when the discharge contains settleable solids with associated chemicals. The potential for this outcome must be assessed at an FS-appropriate level of detail to understand the general extent and need for stormwater source controls.

To understand the relative contribution of stormwater chemicals to fish tissue burdens and predict whether sediments would recontaminate at levels above PRGs eventually set for the Site, estimates of stormwater loads are needed for inputs to estimation tools and models (Hope 2006).

Existing stormwater quality data for the Site are sporadic and relatively limited (Integral et al. 2004). Consequently, estimation of stormwater loads to the river based on existing data or literature values would be highly uncertain. Site-specific stormwater sampling is needed to support stormwater chemical loading estimates for input into the fate and transport model and other estimation tools that will be used to understand the relative contribution of stormwater chemicals to fish tissue burdens and predict whether sediments would recontaminate at levels above PRGs eventually set for the site.

Since the draft RI report is due in spring 2008 this information needs to be collected in the 2006/2007 wet-weather season to prevent slippage of the RI/FS schedule. Additional information may be collected by individual upland sites to supplement this effort and included in the final RI report.

As a result of the lack of information on the stormwater pathway, a Stormwater Technical Team comprised of representatives of the Environmental Protection Agency (EPA), Oregon Department of Environmental Quality (DEQ), and the LWG was established in November 2006. The recommendations of the Team (Koch et al. 2006) were presented to the Portland Harbor Managers (also comprised of representatives of EPA, DEQ, Tribes and LWG) in December 2006 and are the basis of this FSP.

Additional background information is provided in the Stormwater Sampling Rationale (Anchor and Integral 2007).

1.2 SAMPLING PURPOSE

The purpose of the sampling is briefly described in Section 1.1 and is detailed in the Stormwater Sampling Rationale. In summary, the purpose of this sampling and analysis effort is to provide data for evaluating the potential risk related to in-river fish tissue chemical burdens and sediment recontamination from stormwater discharges to the river. These data will be used for understanding the relative magnitude of stormwater impacts to the harbor, developing the draft Site RI, identifying remaining stormwater data gaps, and eventually, evaluating remedial alternatives in the Site FS.

This FSP describes the approach for measuring the chemical concentrations in stormwater and for obtaining stormwater flow data at 31 locations around the Site to meet the above objectives. These data will be used, in conjunction with estimation and evaluation tools described in the Stormwater Sampling Rationale to assess the nature and extent of chemical loading from stormwater discharges to the Site. In summary, the sampling approach involves:

1. Flow-weighted composite water samples from three storm events including whole water for organic compound analyses and filtered/unfiltered pairs for metals analyses.

2. One additional set of grab stormwater samples at 10 of the 31 sampling locations for sampling of filtered/unfiltered pairs and analysis of selected organic compounds and associated conventionals.

3. Sediment trap deployment (to collect suspended sediment from stormwater and analyze for sediment chemistry)[1] for a minimum duration of 3 months.

4. Continuous flow monitoring at each sampling site for the duration of the sampling effort.

1.4 DATA QUALITY OBJECTIVES

Sample collection will adhere to the Standard Operating Procedures (SOPs) contained in the Appendices A through F in this FSP and accepted analytical methods as described in the QAPP Addendum (Integral 2007) in an effort to limit sources of bias. An overview of the procedures for sample collection, processing, and analysis are presented in Sections 2 and 3. Every attempt will be made to achieve the reporting limit goals identified in Section 2. Issues related to analytical data quality objectives that apply to any Round 2 or 3 LWG sampling are discussed in QAPP Addendum, which references the specific data quality indicators and objectives detailed in the Round 2 QAPP (Integral and Windward 2004). This document discusses the specific PARCC parameters (i.e., precision, accuracy or bias, representativeness, completeness, comparability) that are commonly used to assess the quality of environmental data. Each of these parameters as they apply to this sampling effort is summarized briefly below.

1.4.1 Precision

Precision is a measure of scatter in the data due to random error from sampling and analytical procedures. Precision will be measured using relative percent difference (RPD) on laboratory duplicates and matrix spike duplicates. Acceptable limits and frequencies for these duplicates and other laboratory control samples are described in the Round 2 QAPP. These tests will allow estimates of the precision of the data set. Specific details regarding field and laboratory quality control samples (including batch frequency) are discussed in Section 3.8 including number of field replicate and duplicate samples.

1.4.2 Bias

Bias is a measure of the difference between the parameter result and the true value due to systematic errors. Possible sources of systematic errors are collection, sample instability (physical/chemical), interferences, calibration, contamination, etc.

[1] The term "sediment trap" refers to the process of collecting suspended sediments in stormwater by deploying traps within stormwater conveyance systems and later sampling those sediments for chemical analysis. This should not be confused with sediment traps that are deployed within the river, which is one type of Round 3A sampling currently underway for the Site.

Bias associated with sample matrix will be measured using the percent recovery (%R) on laboratory control samples (LCS), matrix spikes recoveries and surrogate recoveries. Matrix spikes may provide an estimate of bias for the entire analytical procedure. The acceptable recoveries and frequencies for LCS, matrix spikes, and surrogates for the parameters to be analyzed are listed in the Round 2 QAPP.

Bias associated with contamination will be assessed by analysis of equipment rinsate blanks and laboratory method blanks. The equipment rinsate blank is a measure of field contamination whereas the method blank is a measure of laboratory contamination. The handling and qualification of results based on blank contaminant information is detailed in the Round 2 QAPP. The frequency of laboratory method and field rinsate blanks is discussed in the Round 2 QAPP and Section 3.8, respectively.

A field duplicate sample for sediment traps will be deployed at two locations and analyzed with each sediment trap batch to provide an estimate of overall variability in the sediment data (Section 3.8). Certified Reference Materials (CRM) will be analyzed to monitor performance of the analytical systems. Information regarding CRM requirements for this project is included in the Round 2 QAPP.

1.4.3 Representativeness

1.4.3.1 Whole Water

This project will measure chemical concentrations in stormwater. With regard to stormwater, representativeness is achieved by selecting sample locations, methods and times so that the data describes the characteristics of stormwater runoff over the range of land use conditions in the drainage basins, the varying hydrologic conditions within an individual storm event (i.e., rising and falling portions of the hydrograph), and a representative cross-section of storm types. Additional details regarding representativeness of sample location, collection of storm flows, and the criteria used for sampling are presented in Sections 2.1.1 and 3.4.

Representativeness of Individual Storm Events. Stormwater (both whole water and filtered) samples will be flow-weighted composite samples representing the range of discharge conditions during the sampling event, including where possible the rising and falling portions of the runoff hydrograph.

Representativeness of Storm Types. Storm events are variable in nature by runoff volume, flow rate, antecedent rainfall, and season. This variability will be evaluated by comparing the magnitude and intensity of the runoff hydrographs, where samples were collected on the hydrographs, time between storm events, and time of year the samples were collected to determine whether a representative range of storm types was included in the monitoring program.

The LWG will evaluate data, progress, sampling methodology, and sample locations on an ongoing basis as data is analyzed and the project is implemented. While it is anticipated that a sufficient number of samples will be collected, the number of samples will be reevaluated at the end of the sampling project. Through the course of this sampling effort, the LWG may request from EPA modifications to the procedures in the FSP to help better represent storm types, if needed.

1.5.3.2 Sediment Traps

Sediment traps are useful monitoring tools to help identify chemical concentrations in suspended sediments in stormwater. There are several issues relevant to the representativeness of sediment trap samples, which are discussed in the Stormwater Sampling Rationale (Anchor and Integral 2007). In summary, this sampling method captures only the particulate fraction of the stormwater and provides little information on dissolved chemicals. Further, it is difficult to predict potential sampling biases that may occur during sediment trapping, but considering the perturbations in the flow field that the bottle creates, certain grain size fractions in the suspended load could be preferentially trapped.

In addition, the physical characteristics of each sediment trap sampling location vary such that a different range and/or type of flows, and therefore, storm conditions may be sampled. Because there is a minimum height at which the sediment trap is over topped and starts to collect sample, some sediment traps may not be collecting sample during smaller storms, and the frequency of such occurrence will vary from location to location.

The LWG will evaluate data, progress, sampling and analytical methodology, design of sample apparatus (bottle size, installation) and sample locations on an ongoing basis as data is analyzed and the project is implemented. Through the course of this sampling effort, the LWG may request from EPA modifications to the FSP procedures to help increase the representativeness of the sediment trap sampling, if necessary.

1.4.4 Completeness and Comparability

The completeness of the data will be maximized by using proven sampling techniques, packaging samples for transport to avoid breakage, and timely processing at the laboratory. The analytical requirements in sample volumes to achieve goals will be met to assure acceptable data. Where possible, excess sample will be archived until the laboratory results can be reviewed by the project manager. The goals for generation of usable data are provided in the Round 2 QAPP.

For comparability, the analytical chemistry methods were selected consistent with other data collection activities for the RI/FS, which also follow the Round 2 QAPP. It is realized that if reporting limits differ, it will limit the ability to make direct comparisons and may limit future cleanup decisions. It is further realized that modifications to sampling locations over the course of the project can also limit the ability to make comparisons. In addition, one field replicate (the sediment trap samples only and if there is enough sample available) will be collected and analyzed from two outfall locations (see Section 3.8). If a field replicate is not feasible, a field duplicate will be collected.

1.5 DOCUMENT ORGANIZATION

The remaining sections of this document describe the sampling field and analytical procedures that will be used to collect stormwater and sediment samples:

- Section 2 describes the sampling design.
- Section 3 summarizes stormwater sample collection, processing, and measurement procedures for stormwater samples, sediment samples, and stormwater flows.
- Section 4 describes the sampling implementation and schedule including contingency procedures that may be employed to collect data.
- Section 5 summarizes how the data will be reported.
- Section 6 provides references.

Detailed SOPs for sampling and flow measurements are provided in appendices. The appendices also contain a Chain of Custody SOP, field sampling forms, and health and safety procedures and are organized as follows:

- Appendix A Stormwater Composite Sampling SOP
- Appendix B Stormwater Grab Sampling SOP
- Appendix C-1 Sediment Trap Sampling SOP
- Appendix C-2 Stormwater Filtering for Sediment Collection (Back Up Procedure)
- Appendix D Flow Meter Measurements
- Appendix E Field Forms
- Appendix F Chain of Custody SOP
- Appendix G Confined Space Health and Safety Plan Addendum

2.0 SAMPLING DESIGN

The Stormwater Sampling Rationale (Anchor and Integral 2007) describes the general approach and rationale for the overall study to support RI/FS objectives described there and summarized in Section 1. This section describes the overall sampling design based on that rationale.

2.1 SAMPLE LOCATIONS, TYPES, AND NUMBERS

Tables 2-1 and 2-2 summarize the proposed stormwater sampling locations, types, numbers, and analyses. Sample locations are presented in Figure 2-1. Tables 2-3 and 2-4 summarize the priority order of sampling of analytes for each sample type and the approximate sample volumes that will be needed for these analyses. Table 2-5 provides the laboratories and methods that will be used for sample analysis. Table 2-6 presents the analytes, analytical concentration goals, method detection limits, and method report limits. The analytical concentration goals achievable with these sample volumes are discussed more in Section 2.2.

All sampling equipment will be deployed at locations that are as close to the point of discharge (for outfall locations) or the junction[2] associated with the land area of interest (for the land use based locations). In all cases, equipment will be placed at elevations sufficient to minimize the potential for river water to back up to the sample location and compromise flow data quality, the integrity of the sediment traps, and collection of quality stormwater samples. These locations as determined through field site visits, review of site drainage plans, and other research are shown in Figure 2-1. Additional reconnaissance of some locations is still ongoing and the exact locations to be sampled will be coordinated with the Stormwater Technical Team and may vary from those shown in Figure 2-1.

Three types of measurements will be conducted each station. Each measurement type is discussed further in the following sections.

2.1.1 Stormwater Composite Samples

Flow-weighted composite samples of three storm events from each location will be collected to obtain Event Mean Concentrations (EMCs) of chemicals. Flow-weighted, whole water (unfiltered) sample aliquots will be collected over the course of the storm event with Isco 6712 automatic samplers. The samplers will be located either within the junction being sampled (above the expected water levels) or at secure sites, on the ground surface immediately adjacent to the junction access (e.g., manhole). The sampling tube

[2] The term "junction" refers to any accessible location where two or more pipes are joined by a structure such as a manhole. This may include locations where drainage from surface runoff also enters the junction, such as catch basins that connect two or more pipes.

will be placed inside the junction with the intake screen for the tube close to but not in contact with the bottom of the junction.

The whole water samples will be collected by the sampling teams, identified in Section 4, and transported to the LWG Field Laboratory. At the LWG Field Laboratory, sampler performance will be evaluated and the water from the individual sample bottles will be combined and mixed in a single container. Whole water samples for organic compounds and TSS analyses as well as unfiltered/filtered water pairs for metals and total organic carbon (TOC)/dissolved organic carbon (DOC) analyses will be prepared by the sampling teams from the combined composite sample. Each sample will be analyzed for the chemicals shown in Tables 2-2 and 2-3. In addition, the priority order and list of chemicals analyzed will vary somewhat between locations as shown in Table 2-4a for reasons discussed in the Stormwater Sampling Rationale (Anchor and Integral 2007).

Sampling of composite water samples will be attempted whenever weather conditions present themselves in order to obtain three stormwater samples within the wet-weather season during storms that meet the acceptable target storm conditions. The target storm conditions for sampling are:

- storms predicted to produce more than 0.2 inches rainfall over a minimum of a 3-hour period, not to exceed approximately 2.25 inches in a 24 hour period (equivalent to the 2-year event),

- and to have been preceded by at least a 24-hour dry period (less than 0.1 inches rainfall).

The objective is to get a composite sample that represents aliquots over the entire storm hydrograph. This is the primary reason for the approximate maximum in the target storm conditions. National Oceanic and Atmospheric Administration (NOAA) storm predictions will generally be used in the evaluation of storms potentially meeting these criteria (http://www.wrh.noaa.gov/forecasts/graphical/sectors/pqrWeek.php#tabs).

The above target storm conditions should be considered goals. Each event sampled will be evaluated relative to these goals but circumstances may arise where all these goals cannot be met. In that event, EPA and DEQ will be contacted to discuss sampling or storm conditions that substantially do not meet the target storm conditions prior to analyzing the samples. The justification for accepting samples that deviate from these target storm conditions will be provided in the Field Report.

For each sampling location, drainage basins will be evaluated for basin size and runoff characteristics to facilitate calculation of expected discharge flows for a variety of storm conditions meeting the storm criteria. Samplers will be pre-programmed to collect aliquots of stormwater following the discharge of the calculated "trigger volume" for each storm event. The objective is to collect a composite sample that represents aliquots collected into seven 1.8-liter bottles over the entire storm hydrograph (the eighth bottle in the sampler will be used for a field blank for quality assurance/quality control [QA/QC]).

However, this is only an approximate guideline that will be considered in the above evaluation of expected discharge flows and may be modified at one or more sampling locations. If storm flows exceed expected volumes, the sampling period will be concluded when the sample bottles are full and thus in some cases, the falling limb of the storm hydrograph may not be sampled in its entirety.

2.1.2 Stormwater Grab Samples

During one storm event, discrete stormwater "grab" samples will be collected from 10 locations where it is most likely that organics would be detected in water samples. Because the purpose of the grab samples is to collect partitioning (chemical dissolved phase/suspended sediment) rather than loading data, samples will be collected during storm periods expected to have higher chemical concentrations (e.g., first flush or rising limb), to increase the likelihood of detecting these chemicals. All samples will be analyzed for TOC/DOC in addition to chemical parameters. The sampling locations were selected based on general knowledge of site uses and potential chemical sources as described in the Stormwater Sampling Rationale (Anchor and Integral 2007). Table 2-4a describes the locations where stormwater grab sampling will occur and the chemicals that will be analyzed at each of these locations.

The sample teams will collect the stormwater from the automated samplers and transport it to the LWG Field Laboratory, where it will be composited and one aliquot will be filtered and distributed appropriately to sample bottles for laboratory analyses and a second aliquot will be distributed directly to sample bottles for laboratory analysis. The analytical methods and concentration goals are the same as those discussed above for composite water samples. Target storm conditions for grab sampling are the same as for composite sampling described above, with grab samples taken sometime in the rising limb of the hydrograph of a continuous storm meeting the above requirements.

2.1.3 Sediment Trap Samples

Sediment traps will generally be installed at each sampling location as close to the target junction as possible and downstream of the automatic sampler intake tube, but this may vary at some locations. Figure 2-2 presents a photograph of a sediment trap of the type that will be deployed. For large pipes draining larger areas (i.e., land use based locations) the sediment traps will be placed at the bottom of the junction or adjacent outlet pipe. For smaller pipes, the opening of the collection bottle will be placed as close as possible to the same elevation as the invert of the junction or outfall outlet. Some sampling locations may require the use of sandbags or structural modifications to generate flow conditions conducive to sediment trap sampling. The sediment traps will be deployed at each location for a minimum target period of 3 months during the wet-weather period.

Sediment traps will be inspected at a minimum on a monthly basis. When inspected, if the collection bottle is more than half full of sediments, the bottle will be capped with screw closures, removed from the mounting brackets, packaged and placed on ice in coolers for transport to the Field Laboratory to be archived. A clean empty collection bottle will then be placed in the trap. If the collection bottle is less than one third full at the first monthly inspection, options for repositioning or relocating the equipment or adding additional traps to obtain a higher collection rate will be considered.

Sediments will be collected and archived throughout the 3-month deployment period. At the end of the deployment period, all sediments for each location will be combined and homogenized and sampled for analyses in the priority order shown in Tables 2-3 and 2-4b as the available sediment volume allows.

In Tables 2-3 and 2-4b, analytes are ranked in priority order in the event that any collected sample size is insufficient to run all analyses. The Stormwater Sampling Rationale (Anchor and Integral 2007) describes the reasoning for this priority order. Grain size is the last priority analyte because it is unlikely that large enough sample volumes for grain size analysis will be obtained at most locations, and it is more important to obtain information on chemistry.

Also, due to physical constraints, it may be impossible to deploy sediment traps at some locations or obtain sufficient sample volume. Contingency procedures in the event of this problem are discussed more in Section 4.3. One possible contingency measure is to pump and actively filter sediments from large volumes of stormwater at some sites. This contingency technique is described in Section 3.5.2.

2.1.4 Flow Measurements

Isco Model 750 Area Velocity flow modules will be used in conjunction with the Isco automatic samplers to allow the collection of flow-weighted composites at each sampling location. The flow modules will also continuously record flow data for the duration of sediment trap deployment.

2.2 SAMPLE ANALYSIS

Stormwater and sediment samples will be analyzed as described below. Table 2-5 summarizes the analytes and methods of analysis for each analyte group for each sample type (sediment and stormwater).

2.2.1 Water Samples

The stormwater samples will be analyzed for pH, conductivity, turbidity, and temperature in the field. Stormwater samples will be analyzed at selected chemical laboratories for conventionals, metals, and organic parameters as summarized in Table 2-5b. It is anticipated that sufficient sample volume (as noted in Table 2-3) will be collected during each stormwater event to conduct all analyses listed in Table 2-5b. The specific analytes for each parameter group and the analyte concentration goals (ACGs) are included in

Table 2-6b. Table 2-2 shows the number of natural samples and identifies the QA/QC samples for each sampling event. The QAPP Addendum (Integral 2007) summarizes the analytical program and provides details on the laboratory methods, QA procedures, and QA/QC requirements.

2.2.2 Sediment Trap Samples

The sediment samples will be analyzed at selected chemical laboratories for conventionals, metals, and organic parameters as summarized in Table 2-5a. The analytes are listed in the priority for analysis in Table 2-3. If sufficient mass (as shown on Table 2-3) is not available to complete all analyses, the analyses will be conducted by the laboratory in the priority order identified in this table. Any additional mass available will be used for laboratory quality control analyses (matrix spike samples, laboratory duplicate samples, matrix spike duplicate samples). The specific analytes for each parameter group and the ACGs are included on Table 2-6b. Table 2-2 shows the number of natural samples and identifies the QA/QC samples for each sampling event. The QAPP Addendum (Integral 2007) summarizes the analytical and provides details on the laboratory methods, sediment sample cleanup procedures, QA procedures, and QA/QC requirements.

3.0 SAMPLE COLLECTION AND PROCESSING PROCEDURES

This section describes the sampling procedures, record keeping, sample handling, storage, and field quality control procedures that will be used during stormwater and sediment sampling.

3.1 FIELD LOGBOOK AND FORMS

All field activities and observations will be noted in a field logbook. The field logbook will be a bound document containing individual field and sample log forms. Any changes that occur at the site (e.g., personnel, responsibilities, deviations from the FSP) and the reasons for these changes will be documented in the field logbook. Logbook entries will be clearly written with enough detail so that participants can reconstruct events later, if necessary. The following data will be included in the field logbook:

- General filed observations during location inspection or sample retrieval including, but not limited to, weather conditions, presence of other activities in the area, and any factors which may affect the quality of the data.
- Date and time of sample collection.
- Names of field coordinators and person(s) collecting and logging in the samples.
- Observations made during sample collection.
- A general description of the sample including color, odor, and presence of an oil sheen.

A sample collection checklist will be completed following sampling operations at each sample station. The checklist will include station designations, types of samples to be collected, and whether field replicates/duplicates, rinsate blanks, or additional sample volumes for laboratory QC analyses are to be collected. A set of field log forms for this purpose is included in Appendix E.

3.2 EQUIPMENT AND SUPPLIES

Equipment and supplies will include sampling equipment, utensils, decontamination supplies, sample containers, coolers, logbooks and forms, personal protection equipment, and personal gear. Protective wear (e.g., gloves, steel-toed boots) will be worn by field personnel as specified in the Health and Safety Plan (Appendix G; Integral 2004b).

A detailed list of sampling equipment and supplies are listed in SOP Appendices as follows:

- Stormwater composite sampling – Appendix A
- Stormwater grab sampling – Appendix B
- Sediment sampling – Appendix C

- Flow meter measurements – Appendix D

For water sampling, the primary equipment used will be 31 Isco 6712 samplers with flow monitoring modules, sampler base and support equipment (batteries, data modules, sampler tubs, strainers, glass sample containers, etc.). The samplers are composite samplers with sequential sampling capabilities. Each sampler base contains eight 1.8-liter glass sample containers. Teflon intake screen, Teflon intake tubing, silicone pump tubing, and glass sample containers will be used in all locations.

Once water from Isco sample containers is processed (per procedures below), the samples will be transferred to individual laboratory sample containers, will be submitted to the laboratory for analyses. The analytical laboratory will supply individual laboratory sample containers and preservatives, as well as coolers and packing material. Individual sample containers will be clearly labeled at the time each container is filled. Labels will include the project name, sample location and number, sampler's initials, analysis to be performed, date, and time. The nomenclature used for designating field samples is described in Section 3.6.

3.3 EQUIPMENT DECONTAMINATION PROCEDURES

The following is a brief description of decontamination procedures for each set of equipment. Details of these procedures are described in Appendices A, B, and C.

For all samples, commercially available pre-cleaned sample containers will be used, and the laboratory will maintain a record of certification from the suppliers. The sample container shipment documentation will record batch numbers for the containers. With this documentation, containers can be traced to the supplier, and container wash analysis results can be reviewed. The container wash certificate documentation will be archived in the project file.

3.3.1 Water Sampling Equipment

All sampling equipment and containers will be prepared prior to the sampling event. Any portion of the Isco sampler (including intake screen, intake tubing, pump tubing, sample containers), filters, or other materials coming into contact with sampled stormwater will decontaminated prior to use or certified pre-cleaned from the equipment source. Appendices A and B contain detailed procedures and equipment material requirements to avoid potential contamination of samples. These procedures are summarized below. The sampler intake tubes and screens will be cleaned once prior to installation of the samplers using the decontamination procedure in Appendices A and B. They will be subsequently cleaned and/or decontaminated under conditions described in Appendix A. The laboratories listed in Table 2-5 will provide certified pre-cleaned (as described above and in Appendix A) containers for collecting processed samples at the Field Laboratory.

3.3.2 Sediment Sampling Equipment

Sediment Traps. The sediment trap bottles, and any portion of the sample collection, and homogenization equipment coming into contact with sediment samples will be decontaminated prior to use or certified pre-cleaned from the equipment source. Detailed decontamination procedures for sampling equipment and sample containers are included in the Appendix C-1.

Water Filtering for Sediment Collection (Back up Procedure). Any portion of the tubing, pump, filters, or other materials coming into contact with sampled stormwater will be decontaminated prior to use or certified pre-cleaned from the equipment source. Detailed decontamination procedures for sampling equipment and sample containers are included in Appendix C-2.

3.4 STORMWATER SAMPLE COLLECTION PROCEDURES

Stormwater collection procedures are described in detail in Appendices A and B. Two methods of stormwater collection will be used:

- Flow weighted composite sampling of organics, metals, and conventionals that will be collected using an automated Isco pump and sample container system and Teflon™ tubing (Appendix A).
- Grab water sampling of organics and conventionals using Isco pump, sample containers, and Teflon™ tubing (Appendix B).

The SOPs (Appendices A-C) for stormwater sampling follow the general concepts used in the sampling and analysis of trace metals in relatively clean surface waters. Examples, of these procedures are in EPA’s Method 1669, *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* (EPA 1996), and by the *Field Sampling Manual for the Regional Monitoring Program for Trace Substances* (David et al. 2001). These methods use the “clean hand-dirty hand” (or CH/DH) approach to sample collection. Because this sampling effort does not involve sampling trace levels of chemicals in relatively clean surface waters there is no need for a strict CH/DH procedure. However, the general concept of separating equipment and sample handling jobs to minimize the potential for contamination of samples is employed throughout the SOPs. Detailed procedures for each type of sample collection that follow this general concept are described in Appendices A and B.

3.4.1 Composite Stormwater Sampling Methods

Automated Samplers. Stormwater samples for standard chemical and conventional analyses will be collected using a peristaltic pump through a Teflon-lined intake tube with a Teflon coated stainless steel pickup screen, which will feed to a silicon pump tube. The intake tube and screen will be attached to the bottom of the junction outlet along with the Area Velocity (AV) flow sensor (described more below). The pre-cleaned Isco sampler (following procedures discussed above) will be delivered to the sample site by the sampling team.

Sampler Installation and Initialization. Wherever possible, the sampler will be located above ground and next to the junction selected for sampling. The pick up screen and the AV flow sensor will be installed on the sensor carrier. Although there are tools that allow surface installation of sensors, confined space entry may be required to install the pickup screen and flow sensor. In addition, at some locations accessible to the public (e.g., manholes on streets), the actual sampler and battery case will be installed within the junction selected for sampling. The mounting specifications in these locations will vary by location, but in each case the sampler will be secured in such a fashion that is stable and will not be inundated by stormwater. If confined space entry is required for any location, it will follow procedures in the HSP Addendum (Appendix G).

The sample pickup screen and sensor will be attached to the inside the junction using a stainless steel plate or similar. The plate will be bolted using concrete bolts to the bottom of the pipe or junction. Hoses and electrical cords will be attached to the side of the pipe and manhole using concrete bolts and plastic ties or similar attachments.

After the pickup and sensor have been installed, the sampler will be powered up and allowed to go through the self check process. If the sampler check is acceptable, the clean sample containers will be installed. Once the sample container section of the sampler is closed, the sampler will be manually enabled. The sampler will then be lowered into the junction, if necessary, or otherwise secured above ground on the site. Care will be taken not to pinch or kink the pick up tube of the flow sensor cable.

Once the sampler is deployed and the cover is closed, the sampling team leader, or designate, will call the sampler to disable it until an appropriate storm is forecasted. The automatic sampler, when enabled by calling the sampler, will be pre-programmed to initiate sampling once specified trigger conditions (e.g., flow depth and/or volume) have been met and will continue to sample until the conditions are no longer met within the 24-hour sampling duration or the bottle capacity is reached. The trigger conditions will be different for each sampling station due to differences in basin sizes, pipe/junction configurations, and runoff characteristics, as well as non-stormwater discharges such as base flow.

Flow Weighted Sampling Methods. The automated sampler will collect flow weighted samples into seven 1.8-liter glass bottles. The sampler will be programmed to collect flow proportional sample volumes. Samples will collected on a uniform time basis and the volume collected at each time step will be proportional to the volume of water that has passed the flow meter since the previous time step. The automated sampler collects the stormwater in 10-ml increments. The number of 10-ml increments collected at each time step is dependent on the flow rate and the sampler programming that is unique to each sampling site. The volume of stormwater water that passes the flow module per 10-ml sample increment will be estimated for each basin to maximize the likelihood that the minimum volume of water required for analysis is collected without exceeding the total volume capacity of the sampler. A complete sampling event would result in 7 1.8-liter bottles being filled or nearly filled over the duration of the storm such that most of the storm hydrograph is sampled.

Sampler Programming. As noted above, the volume collected at each time interval is dependent on the flow in the pipe, which is related to the storm magnitude. Each sampler will be pre-programmed with several sampling routines that include different proportional volume sampling rates so that an appropriate program can be selected based on the magnitude of the storm that is being predicted, the size of the basin, the pipe conditions, etc. For example, for a predicted small storm, a sampler program would be selected that collects relatively large flow proportional volumes at each time interval to achieve the necessary total volumes to perform the necessary analyses. Similarly, for a predicted large low intensity storm, a low flow proportional volume for each time interval will be selected to improve the chances that most of the hydrograph is sampled. For all sampling conditions, the samplers will be programmed to perform one pre-flush prior to taking a sample.

The minimum volume collected will be based on the minimum storm expected to generate runoff (0.2 inches). The maximum volume will be based on the forecasted precipitation with some allowance for under-predictions of rainfall associated with a storm.

Storm Watch Procedures. The Team Coordinator (see Section 4.1 for team organization) will monitor storm predictions from the NOAA website (http://www.wrh.noaa.gov/forecasts/graphical/sectors/pqrWeek.php#tabs) area rain gauges (e.g., City of Portland and Portland Airport). Once the required amount of dry weather is achieved, the team will be on "storm watch." Isco samplers will remain at each location for the duration of the deployment period. When weather forecasts indicate that a storm is coming that may meet the target storm conditions, the weather and rainfall conditions will be monitored on a frequent basis. Samplers may be periodically polled via cell phone to determine if flow conditions at various locations are changing, indicating the local rainfall is starting. Once the appropriate height/volume conditions have been achieved at each location (as described above) and the storm appears to be likely to meet the target storm conditions, the samplers will be activated via cell phone to use a specified pre-program consistent with the type of storm occurring as discussed above. The samplers may be polled periodically during the sampling event to understand whether it is likely that the best program is underway for the storm conditions actually occurring and to determine when the sampling routine is likely to be complete.

Sample Collection. After the sampling event is completed, the sampling team leader will call the sampler and disable it if the storm event concludes prior to the 24-hour cutoff, to prevent additional stormwater from being collected. Isco sample containers will be recovered within a goal of 12 hours after the conclusion of the sampling event. The sampling team will retrieve the automatic sampler and remove sample containers and seal them with Teflon lined caps, label, and package them appropriately for transportation to the LWG Field Laboratory. The sampling team will install new clean containers and re-deploy the sampler as described previously. The Isco samplers will be decontaminated prior to the first installation and will not be subsequently decontaminated except as noted in Appendix A.

Flow Data Interpretation. It is possible during a given event that not all the sample containers are filled or that the container volume is exceeded due to differences between the forecasted precipitation and the actual precipitation at the site. The flow data collected at the time of sample collection will be examined to determine if the sample appears to be valid or needs special compositing considerations (as described below) before compositing and shipment to the analytical lab.

As part of the field sampling procedures, the sampling team will download the sampling report and flow data from the data logger to a desk top computer for data analysis using the manufacturer supplied software. The data will be reviewed to determine the flow hydrograph and where on that hydrograph samples were taken. The storm data will be compared to the target storm conditions to determine if the samples are representative of the storm. The Team Leaders in coordination with the Team Coordinator or his/her designee will determine whether the samples meet the sampling criteria, and which of the sample containers will be composited for analyses. The following criteria will be used to determine the acceptability of stormwater samples:

- Sufficient Sample for Analysis. The samples will be checked to determine if there are adequate sample aliquots and volume for analysis.

- Review Rainfall Data and Criteria. The total rainfall and antecedent dry weather period will be determined to see if the target storm conditions were met using data from the City of Portland and Portland Airport rainfall gauges.

- Review Flow Hydrograph, Sample Collection (time and number), and Storm Criteria. The Team Coordinator will determine which of the sample containers should be composited by reviewing the flow hydrograph, the discrete sampling times relative to storm flow.

If it appears that samples may not be reasonably representative of the storm or the target storm conditions and the issue cannot be resolved by using one of the contingency measures discussed below, the LWG will discuss the representativeness of the sample containers selected for compositing with EPA and DEQ. However, it should be noted that laboratory holding times will be in effect and decisions must be made in a timely manner.

Sample Processing and Compositing. At the LWG Field Laboratory, the sampling team will combine the stormwater samples into a single composite and samples will be filtered (for metals analyses only) and prepared for laboratory analyses. The compositing, filtering, and sample preservation will occur at the Field Laboratory as soon as possible after sample collection. The goal will be to conduct filtering within 24 hours of sample retrieval from the samplers. The compositing procedure and field filtering procedures for metals are described in detail in Appendix A. Throughout this process, the samples will be handled following the procedures described in the Chain of Custody SOP (Appendix F).

The field collected samples will be transported to the LWG Field Laboratory and held per requirements of Section 3.7 until the sampling report and flow data can be reviewed. If the sampling report and flow data indicate that there was no malfunction and all the sample bottles are intact, the compositing and sample preparation would continue as described in Appendix A. The samples would be emptied into a large sample container and mixed (i.e. using a churn splitter or other suitable apparatus) while samples are distributed to sample bottles for laboratory analyses.

No preservatives will be added in the pre-processed samples. All preservatives will be present in individual analytical sample bottles per Table 3-1 and Section 3.7. Thus, preservation will take place in the Field Laboratory at the time processed samples are placed into the individual sample containers for laboratory analyses.

After compositing, each sample container will be clearly labeled with the project name, sample identification, date and time of first aliquot collected that is used in the composite, initials of person(s) preparing the sample, analysis specification, and pertinent comments such as preservatives present in the sample. A laboratory analysis request form (see Appendix E) with the date and time of the first aliquot collected that is used in the composite will be generated. The sample analysis request form will be used by the analyst in performing the appropriate analyses for the sample.

Sample Compositing and Processing Contingencies. As discussed above, several problems could occur that may affect the viability of a sample collected. Common potential problems and their contingencies are as follows.

1. Sample volume is not adequate to conduct all of desired analyses. This may occur when the forecasted precipitation is substantially greater than the actual site precipitation. Under these sampling conditions, the sample will be composited as normal and samples for analyses will be prepared in the priority shown in Table 2-3.

2. Sample exceeds bottle capacity. The sampler report indicates that the bottle capacity was exceeded. This may occur when the forecasted precipitation is substantially less than the actual site precipitation. In this case the flow data will be evaluated; if the collected volume represents 50 percent or greater of the total storm and encompasses some of the falling limb of the storm, the total volume will be composited and analyzed per normal procedure. If the sample volume represents less than 50 percent of the total storm volume, it should be composited and held at the LWG Field Laboratory under conditions shown in Table 3-1 for possible later analyses in the event that no further storm events can be successfully captured.

3. A portion of the sample is lost. This would occur when one or more of the sampling bottles were damaged or the sampler malfunctioned. In this situation, the sampling report and flow data will be reviewed to determine what representative portion of the storm volume is missing. In this situation, it may be possible that a significant portion of the storm was not sampled, and/or there is not adequate volume to complete the desired analyses. Following the process of the two previous scenarios, if the sample includes sample that represents 50 percent of the storm and both rising and falling limb conditions are included, then the sample will be used. If not, it will be archived at the Field Laboratory as described above. If the sample meets the above conditions but the volume is inadequate to conduct all analyses, the sample containers will be filled in the priority order of analyses shown in Table 2-3.

Laboratory Sample Receipt and Holding. Once samples are accepted at the laboratory, the laboratory will handle and store samples consistent with the QAPP Addendum (Integral 2007) and Table 3-1. After analysis, remaining sample will be archived according to the laboratory's SOP. The remaining sample will be kept at 4ºC and retained for 6 months beyond issue of the laboratory report.

3.4.2 Summary of Grab Stormwater Sampling Methods

Stormwater grab samples for standard chemical and conventional analyses will be collected using a peristaltic pump that is part of the Isco automatic sampler. The sampler case will be opened and the delivery tube will be removed from the bulk head fitting. A Teflon lined tube will be connected to the bulkhead fitting to collect the desired samples. The sampler will be put into "Grab" mode and the specified volume will be programmed into the sampler. Once activated, the sampler will purge and the grab sample will be collected into 1.8 liter glass containers.

The sampling team will seal the samples with Teflon lined caps, label, and package them appropriately for transportation to the LWG Field Laboratory. The sampling team will remove the grab sampling tube from the bulkhead fitting and reconnect the distribution tube and close up the sampler. The sampling team will re-deploy the sampler as described previously.

Samples will be generally transported and handled from field site, to Field Laboratory, to analytical laboratory per procedures described above for composite water samples. At the LWG Field Laboratory, the sampling team will combine the field samples into a single composite and samples will be filtered and prepared for laboratory analyses. The compositing, filtering, and sample preservation will occur at the Field Laboratory as soon as possible after sample collection. The goal will be to conduct filtering within 24 hours of sample retrieval from the samplers. Field filtering procedures for organic compounds are described in detail in Appendix B. The samples will be handled following the procedures described in the Chain of Custody SOP (Appendix F).

3.4.3 Flow and Rain Data Collection

Flow will be measured with the Teledyne/Isco 750 AV Module (module). The module is an add-on enhancement to the Teledyne/Isco's 6700 Series Samplers that are being used to collect stormwater samples. The module provides the ability to collect flow proportional sample volumes and flow-paced samples. The sampler displays the real-time level, velocity, flow rate, and total flow provided by the module. The sampler records this data for later analysis.

The module is designed to measure flow in open channels without a primary device. (A primary device is a hydraulic structure, such as a weir or a flume, which modifies a channel so there is a known relationship between the liquid level and the flow rate.) Area velocity flow conversion requires three measurements: water level, velocity, and pipe dimensions. The AV sensor provides the level and velocity measurements. The pipe dimensions will be measured in the field and entered during module programming. The flow calculation is made in two steps. First, the module calculates the pipe cross-section (or area) using the programmed pipe dimensions and the level measurement. Then, the module multiplies the channel cross section and the velocity measurement to calculate the flow rate.

The sampler will be programmed to use the customary U.S. measurement units, such as feet (depth), cubic feet per second or gallons per minute (flow, depending on size of the contributing basin), and gallons or millions of gallons (volume, depending on the size of the contributing basin). The sampler will be programmed to record flow data at 5-minute intervals. These data will be periodically downloaded throughout the course of the sampler deployment (as determined by data storage capacity) and entered into the project database.

In addition, data on rainfall will be obtained from various existing established rain gauge stations around the Portland area. These data will be used to make sampling decisions throughout the course of the sampling and to understand flow results for data reporting as described above.

3.5 SEDIMENT SAMPLE COLLECTION PROCEDURES

Collection procedures for stormwater sediments are detailed in Appendix C and summarized below.

3.5.1 Sediment Traps

Sediment traps will be used to collect stormwater suspended sediments. The sediment traps consist of a stainless steel bracket and a certified phthalate free HDPE bottle. Figure 2-2 presents a photograph of a sediment trap of the type that will be deployed. Sediment traps will be installed by bolting the steel base plate directly to the location junction or pipe (see example in Figure 2-2) with the orientation discussed in Section 2.1.3.

As described in Section 2.1, sediment traps will be deployed at each location for a minimum target period of 3 months. Sediment traps will be inspected on a monthly basis at a minimum. When inspected, if the collection bottle is half full, sediments will be collected and archived and a clean bottle, filled with deionized water will be returned to the trap. This process will be repeated, and sampled sediments archived at the LWG Field Laboratory for additional later compositing until the trap deployment period ends.

Sediment samples will be capped with Teflon lined lids, labeled, sealed and packaged appropriately for transport to the LWG Field Laboratory per the collection procedures presented in Appendix C-1 At the field laboratory, the samples will be removed from the sampler bottles and stored in wide-mouth jars in the freezer. Sediment removal from the sediment trap bottle to the sample containers will follow the procedures in Appendix C-1.

Once the deployment period has ended, all sampled sediments (including archived aliquots) will be combined and subsampled following the procedures in Appendix C-1.

Sample analysis containers will be filled in the priority order shown in Table 2-4b, until there is no more sample available. Any additional sediment will be collected into sample bottles for laboratory QA/QC analyses.

3.5.2 Water Filtering for Sediment Collection (Back up Procedure)

This procedure will be used in the event that a sediment trap cannot be deployed at a location because of limited space availability or other logistical reasons or insufficient sediment volume can be collected in sediment traps. To mimic the deployment of sediment traps, this procedure would be employed over several storm events at the location in question. The sediment samples obtained over several events will then be composited in the analytical laboratory to mimic the deployment of a sediment trap over 3 months.

Large volumes of water will be pumped through Teflon™ tubing to collect the particulate fraction from the water for subsequent analysis of the particulate fraction. Currently, two techniques are being evaluated as options for sediment collection: collection with a portable continuous flow centrifuge pump; and collection with a peristaltic pump system with sequential filters and glass fiber filter cartridges. The total volume of water pumped for each sample will be determined based on the analytes selected for the station. Table 3-2 provides estimates of stormwater sample volumes required for each of these sample collection techniques. The high volume collection procedure will follow methods detailed in Appendix C-2.

The portable continuous flow centrifuge pump system samples would be collected by pumping water from the sample location (junction) and sequestering the suspended particles in sample collection jar, which would avoid collecting and retaining large volumes of water for subsequent filtration. The accumulated sediment would then be transferred from the centrifuge pump sample collection vessel, homogenized, and subsampled into sample jars for chemical analysis. The peristaltic pump system would require a high pressure tubing setup and large volume capacity filters, in series, to extract the suspended particles. The large capacity filters would be connected in series with the smallest pore size of 4 or 5 µm, which is the low-end range for silt particles (ASTM 1985). The peristaltic system could be conducted by collection of water into a container (e.g., 20L carboy) and subsequent filtration. The reconnaissance survey will help determine whether the high-volume collection could be conducted directly from the sampling location without intermediate storage. The minimum filter pore size to be used will be 4-5 µm.

Samples will be collected using the using methods that minimize the potential for contamination through sample or sample equipment handling and will follow the general concept of the CH-DH approach described above. Once the desired volume is pumped, the glass fiber filters will be removed, placed in sample jars, and stored in a cooler containing wet ice. At the analytical laboratory, the filters will be archived until the last sampling event is conducted. Once filters from the last event arrive in the laboratory, the laboratory technicians will combine the sediments from all the filters at each location and homogenize using clean implements. The resulting homogenized sediment sample will be analyzed to determine the concentration of chemicals present within the collected particulates. Detailed procedures for this sampling technique are described in Appendix C-2.

3.6 SAMPLE IDENTIFICATION

All samples will be assigned a unique identification number based on a sample designation scheme designed to meet the needs of the field personnel, laboratory and LWG data management, validation chemists, and data users. The unique code will be assigned to each sample as part of the data record and will indicate the project phase, sampling location, sample type, sampling event, and level of replication/duplication. Sample identifiers will consist of two to three components separated by dashes. The first component, LW3, identifies the data as belonging to the Lower Willamette River RI/FS as a part of the Round 3 sampling. The second component will begin with the abbreviation “STW” to designate the stormwater sample, followed by a CW, GW, or S for composite water, grab water, or sediment, followed by a single-number code that designates the sampling event. The station number will complete the second component.

Additional codes may be adopted, if necessary, to reflect sampling equipment requirements. Leading zeros will be used for stations with numbers below 100 for ease of data management and correct sorting. The third component will be used to code field duplicate and replicate samples. A single digit number will be used to indicate field duplicates or splits in the third component of the sample identifiers. For equipment decontamination blanks, sequential numbers starting at 900 will be assigned instead of station numbers. The sample type code will correspond to the sample type for which the decontamination blank was collected.

Example sample identifiers are:

- LW3-STW-CW-1022: stormwater composite sample from Station 22 collected during the first sampling event.
- LW3-SW-CW-1022-1: stormwater composite sample from Station 22 collected during the first sampling event; field duplicate is associated with this sample.
- LW3-SW-CW-1022-2: field duplicate stormwater composite sample from Station 22 collected during first sampling event.

3.7 SAMPLE HANDLING AND STORAGE

The number, size, and type of sample containers needed for each sample are listed in Table 3-1. This table also includes the preservative and holding times for the various analyses. In general, preservatives will be added to the sample containers by the analytical laboratory prior to shipment to the field. The sampling team will confirm the presence or absence of preservative in the containers prior to filling. Any discrepancies with preservatives will be noted on the field sampling records, and corrective action will be initiated.

Once the sample is collected and preserved, the sample container will be capped, labeled, and placed in double-sealed polyethylene bags (except for phthalate water samples—see Appendix C for phthalate related procedures) and stored on ice or refrigerated until shipped to the laboratory under the chain-of-custody procedures outlined in Appendix F.

Each storage freezer or refrigeration unit in the LWG Field Laboratory will be monitored bi-weekly to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

3.8 QA/QC

3.8.1 Field Quality Control

Field QC samples are used to assess sample method variability (e.g., replicates) and sample variability (e.g., duplicates), evaluate potential sources of contamination (e.g., equipment rinsate and trip blanks), or confirm proper storage conditions (e.g., temperature blanks). The estimated numbers of field and QC samples are listed in Table 2-2. Details on field replicate samples and field QC samples are described in the QAPP Addendum (Integral 2007).

In summary, the QAPP Addendum describes QA/QC procedures that will be used to complete the stormwater investigation. The QAPP Addendum for the stormwater investigation was developed within the framework of the existing LWG Round 2 QAPP (Integral and Windward 2004) and Addenda (Integral 2004a) for the ongoing LWG investigations.

For sediment trap samples, the mass of material collected is anticipated to be limited. For sediment samples, the QAPP Addendum includes the collection of field QC samples and additional mass for laboratory QC samples (matrix spike, matrix spike duplicate or laboratory duplicate) as follows and per Table 2-2:

- Field replicate, 1 per 20 samples
- Laboratory QC samples, 1 per 20 samples
- Equipment rinsate blank for phthalates, 1 per 20 samples

Field replicates will be generated by deploying sediment traps with additional sample collection vessels, and compositing the sediment from each half of the sediment trap collection vessels, separately, into two subsamples for analysis. Deployment of two vessels will only be possible at some of the locations, due to expected space limitations within the junctions. Consequently, after the location reconnaissance, the locations of the replicate trap deployment will be determined based on available space and other constraints noted above for sediment trap deployment. Replicate trap deployment will be conducted at sufficient locations to meet the 1 in 20 requirement. If this is not possible, the replicate analysis will be substituted with a duplicate analysis consisting of homogenizing sediment from one vessel and splitting into two equal aliquots for analyses, at locations where sufficient volume is present, so that the 1 in 20 requirement. Analysis for laboratory QC samples will be conducted by dividing the total sediment collected from one sediment trap vessel at select locations with sufficient volume into three aliquots of equal mass for the laboratory analysis of the sample, matrix spike, and matrix spike duplicate.

For water samples, the sampling program will be designed to collect additional volume for field and laboratory QC samples. The QC program for water samples includes:

- Field duplicates, 1 per 20 samples
- Laboratory QC samples, 1 per 20 samples
- Field blank for all analyte groups, 1 per 20 samples
- Equipment rinsate blank for all analyte groups prior to field deployment of automated samplers.

The inclusion of phthalates in the analyte list requires careful consideration in the design of the sample collection program to ensure that the sediment and water samples do not come into contact with phthalate-containing material. Because the water samples require pumping and additional handling for compositing, the likelihood of field contamination from contact with phthalate-containing components increases and could result in qualification of the data if phthalates are detected in the associated field blank samples. The procedures detailed in Appendices A, B, and C include careful consideration of the materials and handling procedures used in order to avoid such sampling contamination if at all possible.

It is possible that the samplers may be deployed with open bottles for up to several weeks before a storm sample is collected. Airborne deposition of chemicals from the sampler bodies, which are made from various plastic materials, or ambient atmospheric urban sources may be potential source of contamination to the open bottles. Consequently, the bottle eventually used for the rinsate blanks will also be left un-capped inside the samplers during sampler deployment and will be handled identically to the actual samples during the sample collection process.

One equipment rinsate blank prior to deployment of the Isco samplers will be performed by pumping DI through the Isco sampler and into a clean sample bottle. This will include the full Isco sampler set up including intake screen, Teflon sampler hose, and silicone pump tube installed in the sampler. Sufficient volume will be collected to conduct all analyses in Table 2-4a, and the sample will be treated identical to any other water sample described in this FSP and QAPP Addendum in terms of storage, transport, analyses, and laboratory QA/QC procedures.

3.8.2 Laboratory Quality Control

Standard quality control procedures will be used by the laboratories for methods listed in Table 2-5 and following the QAPP Addendum (Integral 2007) and Round 2 QAPP (Integral and Windward 2004). In summary, laboratory quality control samples will include analysis of surrogates, replicates, duplicates, laboratory control samples, method blanks matrix spike and matrix spikes duplicates in each batch of samples where appropriate. Specific recommendations for QC samples and control limits are summarized in the QAPP Addendum.

3.9 Equipment Maintenance

The primary equipment to be maintained during the course of this sampling program is the Isco samplers and the sediment traps. Both types of samplers will remain in the field for the duration of the deployment period (i.e., approximately March through May). The Isco samplers and sediment traps will be routinely inspected throughout the course of the deployment period on a frequency dictated by the need for Isco battery replacement. Upon each inspection the proper functioning of Isco samplers and sediment traps will be confirmed by visually inspecting the equipment both inside and outside of the junction or pipe (as relevant to the particular sampling location).

Sediment traps will be inspected to determine that the trap is still properly attached to the junction or pipe and that the bottles are properly seated within the sampler. Any debris will be cleared away from around the samplers.

For Isco samplers, the proper attachment and placement of the flow sensor and intake tube will be verified and any debris will be cleared from this equipment. Tubes will be inspected for bending or occlusions and cleared as necessary. The Isco sampler battery will be replaced as necessary and the proper power up and re-initialization of the sampler will be confirmed prior to leaving the site. The flow sensor will be calibrated as necessary. The flow log memory capacity will be checked and data will be downloaded to a lap top if the memory is near full. The sampler will be called to make sure the cell phone connection is properly working.

If either sediment traps or Isco samplers are damaged beyond field repair capability, they will be removed and replaced with a spare sampler. For Isco samplers, the sampler will be shipped to a company designated repair site and repaired as quickly as possible, so that it can be used as a potential spare in the future.

4.0 SAMPLING IMPLEMENTATION AND SCHEDULE

4.1 SAMPLING TEAMS AND ORGANIZATION

Successful completion of the sampling and analysis requires coordination and adherence to the FSP and QA/QC procedures. Staffing and responsibilities are outlined below; an organization chart is provided in Figure 4-1. The following discussion briefly outlines the duties of the key participants. The LWG will notify the Agencies if there are any changes in the project organization listed below.

4.1.1 Project Planning and Coordination

As shown on the organization chart (Figure 4-1) Anchor has the lead role in implementing the FSP. Carl Stivers will act as the overall Anchor project manager. As the manager, he will act as the primary contact to the Portland Harbor Stormwater Technical Team and the EPA/DEQ/LWG management team.

4.1.2 Field Sample Collection

Simon Page, Anchor Environmental, is overseeing the field program. Mr. Page will participate in the station reconnaissance and preparation, described in Section 4.2. He will direct the sampling teams in equipment installation, when to activate the automatic samplers, assist in troubleshooting equipment problems, and be available to act as an alternate on the sampling teams.

The sampling teams will be each lead by an Anchor water quality specialist familiar with the equipment operation. Each team will also have a specialist from Integral to oversee the collection, processing, and shipment of the samples to the laboratory. The team leader will have the responsibility to deploy and redeploy their automatic samplers as needed, activate their automatic samplers when notified of a storm meeting the sampling criteria is imminent, conduct collection the samples in a timely manner, download sampler storm event data, conduct or coordinate delivery of the samples to the LWG Field Laboratory, coordinate delivery of samples to the analytical laboratories, filling out all field forms and chain of custody forms, and ensure that all field work is conducted in accordance to the HSP (Appendix G and Integral 2004b).

The operations and maintenance team will be based in Portland and have responsibility to routinely inspect and repair the sediment traps, Isco samplers, and other equipment, calibrate flow meters and samplers as needed, download the flow data loggers, and rotate the batteries in the automatic samplers to ensure that they are ready at all times to initiate sampling. They may also deliver samples to the LWG Field Laboratory as needed.

The Field Laboratory Team will assist in the processing, tracking, and archiving of samples, maintain sample archives, conduct packing of coolers and filling out chain-of-custody forms for laboratory delivery, will coordinate with the laboratories for sample delivery and/or pickup, facilitate the tracking of samples, and coordinate with laboratories to ensure correct analyses following the QAPP addendum are conducted.

The laboratories used for the sampling program are listed in Table 2-5. The laboratories will be responsible for providing "certified clean" sample bottles and equipment to the sampling teams, coolers and packaging materials, labels, seals, and chain-of-custody forms. The laboratories will designate a project coordinator who will be responsible for receiving the samples from the field laboratory team and coordination of data reporting. The laboratory coordinator will also be responsible to ensure that the samples are analyzed according to the specified methodologies.

4.1.3 Chemical Analysis

The laboratories used for the sampling program are listed in Table 2-5. The samples will be analyzed for the analytes listed in Table 2-5 for the ACGs listed in Table 2-6. The laboratory coordinator will also be responsible to ensure that the samples are analyzed according to the specified methodologies.

4.1.4 Laboratory QA/QC Management

The laboratory designee will direct the QA/QC review of the data and produce the Quality Assurance Data Summary Package. Sandy Browning at Integral will oversee data validation as required by the RI/FS Work Plan (Integral et al. 2004) and the Round 2 QAPP (Integral and Windward 2004) and will serve as the overall Quality Assurance Manager for the Project.

4.1.5 Data Management

Sandy Browning at Integral will supervise data management and entering of the data into the RI/FS project database per the requirements of the project Work Plan (Integral et al. 2004).

4.1.6 Final Report

Carl Stivers at Anchor will be responsible for directing assembly of the Final Report describing sample locations; sampling, handling, and analytical methods; data reports including QA/QC chemistry and data validation, and database management.

4.2 STATION RECONNAISSANCE AND PREPARATION

Sample locations will be verified during a reconnaissance visit consisting of the sampling team leader for those sample locations and persons knowledgeable with the particular location in question. Conditions encountered in the field during implementation of this

FSP may result in modifications to the sampling design at some or all locations. The Stormwater Technical Team will be made aware of the conditions and will approve substantial location-specific modifications to the FSP.

During the reconnaissance survey, the teams will identify the targeted discharge point and inspect the site to identify the location where the equipment can be installed to meet the sampling objectives. At each site, the team will locate the junction or structure nearest the outfall where the equipment may be installed. At these locations, the team will:

- Attempt to determine the sampling location elevation from the site map as well as measuring down to the invert of the junction outlet and comparing known or measured relative elevations to observed elevations of shoreline features such as the limit of permanent vegetation (which is often approximately equivalent to ordinary high water mark within the Portland Harbor area)
- Verify that flow conditions are conducive to flow-paced sampling (e.g., orientation of incoming laterals, debris)
- Verify that there is space available within or adjacent to the site to secure the Isco automatic sampler
- Verify that there is space available to install the sediment trap and/or replicate traps for some locations
- Measure outlet pipe size to order or fabricate the appropriate mounting brackets for the sampler pick up tube, flow meter sensor, and the sediment trap.

The primary purpose of determining the sampling location elevation will be to determine whether back up of river water into the junction or adjoining pipes is reasonably likely. Such a condition will be avoided to prevent sampling of river water instead of, or in combination with, stormwater. Table 4-1 presents statistics on river heights based on USGS data from the Morrison Street Bridge gauge for the proposed months of sampling. This gauge is located 2.9 feet above City of Portland datum (i.e., add a value of 2.9 to the Morrison Street Bridge gauge height to obtain a value in City of Portland datum). As shown in Table 4-1, the upper range (i.e., above 80th percentile) statistics on the average monthly river height in this period is in the range of 10 to 14 feet as measured by the gauge. Because a monthly average does not explicitly capture daily highs that may have occurred within any given period, the daily 90th percentile statistics are also presented. The upper range (i.e., above 80th percentile) statistics on these values range from 11.9 to 17 feet in this period, as measured by the gauge.

No specific criteria for acceptable junction elevation are proposed here. Rather, the field reconnaissance information for each location (and potential alternate locations) should be compared to Table 4-1 to determine the relative likelihood of river backup at any particular location. The field crews will make determinations in coordination with the Stormwater Technical Team of acceptable levels of risk for river backup at each sampling location. These decisions will also consider other factors such as the relative feasibility of moving to a nearby location (i.e., within the same basin) and the availability of any other alternate locations (i.e., in other basins entirely) that might also meet the objectives of the location in question. For example, where few if any nearby or alternative sampling locations exist that meet the intended objectives of the sampling location, then acceptance of a greater risk of river backup at a particular location may be warranted. Conversely, if an alternate location that meets all the location objectives can easily be found, there should be a relatively low tolerance for the potential of river backup at a given location.

Where the junction elevation of a particular location appears to have a reasonable potential for river backup based on the field reconnaissance information, more accurate surveys of the location elevation may be warranted and will be conducted as necessary to reach decisions consistent with the above framework.

Another key measurement that will be needed is the depth of the junction structure below the invert of the outlet. Ideally, sediment traps will be mounted adjacent to the outlet with the opening of the sampling bottle at the same elevation of the invert. If the bottle is located higher, it may not effectively collect the heavier fractions of the sediment or may introduce excessive turbulence that interferes with the function of the flow meter. In some situations, this ideal location may not be possible and alternate locations within the junction structure that would be expected to still capture substantial amounts of sediments and avoid excessive turbulence may need to be evaluated and determined.

In addition, the team will attempt to identify any non-stormwater flows that could enter the conveyance during the sampling period (e.g., groundwater, stream flows, sheet flow from adjacent sites, batch discharges). Depending on the source, the location-specific procedures may need to include collection of information on the nature, amount, and timing of those flows.

If the targeted sampling location is not adequate, the team will move upstream to the next available representative structure for evaluation. Anchor will report the identified sampling locations to the Stormwater Technical Team for approval. It is possible that a suitable monitoring station cannot be found and an alternative outfall will be needed to be selected to meet the study goals, see Section 4.3 for a discussion of the contingency process for selecting and alternative sampling location

4.3 BACKUP AND CONTINGENCY PROCESS FOR LOCATION SELECTION AND SAMPLING

If it is determined that a sediment trap or automated water sampler deployment is infeasible for the selected basin, or that available sampling locations within that basin will not meet location objectives (i.e., are not representative of targeted land uses or site activities), several alternatives may be implemented.

4.3.1 Land Use Based Sampling Sites

If it is a land use based sampling site, another representative outfall or basin could be selected; alternately, another location within the basin could be selected, as long as the remaining basin area is still representative of that land use. Based on the identification of a physically suitable site by the reconnaissance team, as described previously, the site will be re-evaluated in the office. The selected location will be first compared to the infrastructure maps to determine what areas will be captured by the sampling location. The land uses in the captured area will be evaluated to determine if they meet the sampling goal.

If the revised basin does not meet the land use selection criteria an alternative outfall will be selected and a reconnaissance survey will be conducted to determine if the equipment can be installed.

Time is of the essence to collect the stormwater samples in the 2006/2007 rainy season. From that perspective, selecting a truncated area of the original basin would be superior if the remaining area provided the land use characteristics desired. Deciding to look for an alternative basin and investigating it may result in not getting the desired number of water quality samples or the desired volume of sediment. However, because all the equipment will not be delivered and installed simultaneously, there may be a 2-week period during which an alternative site can be selected and approved by the Stormwater Technical Team without greatly affecting the implementation of the FSP.

If the primary issue is that a sediment trap cannot be installed, the high volume water filtering alternate technique could be employed at these sites without need for moving to alternate locations.

4.3.2 Industrial Sampling Sites

If it is not feasible to install the sampling equipment at an industrial sampling site, the same procedure described above for land use-based sites would be employed by moving the pipe up or to another site drainage basin to see if another sampling point that drains most of the desired site can be found. If such an on-site alternate location cannot be found, it may or may not be feasible to select another industrial site to fulfill the role of the desired site. Any such proposals to move sites would be closely coordinated with the Stormwater Technical Team to obtain approval.

It is difficult to speculate what problems may occur and what the solutions may be without the basic reconnaissance of the sites completed. Consequently, we do not attempt to discuss alternate procedures for all potential situations. In general, if an Isco sampler cannot be installed for any reason and selection of an alternate site is not acceptable, the alternate approach of manually collecting discrete or manual composites could be considered. If a sediment trap cannot be installed, high volume filtered sampling could be conducted.

4.3.3 Inadequate Sediment Collection

The sediment generation rate varies by land use, topography, implementation of best management practices (BMPs), and rainfall intensity. A well swept, nearly level, industrial area may not generate a significant quantity of sediment. Low intensity storms may not detach and mobilize sediments. Further, sediment traps may not collect sediments from low flow storm events. Consequently, if the collection bottle is less than one-third full at the first monthly inspection, the rainfall records will be evaluated to determine if there were storms likely to generate runoff, the sampler will be inspected to ensure that it was installed properly, the junction will be inspected to see if it is accumulating sediment, and the contributing basin will be visually surveyed to see if sediment is available to wash off. Based on the findings, it may be recommended that the sediment trap be repositioned or relocated to obtain better collection rate, additional bottles deployed, or that another sampling method be employed. An alternative sediment sampling method would be high volume filtered samples.

4.4 SITE SPECIFIC SAMPLING REPORTS

Site specific sampling reports will be developed for the Field Sampling Report (described in Section 5) based on the field reconnaissance surveys and decisions made in coordination with the Stormwater Technical Team. A description of each sampling site will be developed for the report that describes the specific details for implementation of this FSP at the each site. The specific details of the report will include:

1. Figure showing the drainage basin and actual sampling location within the basin.
2. The reconnaissance survey datasheets, notes, and photographs as necessary to describe the situation.
3. Diagram of sample equipment set up within the specific site pipe or junction noting key dimensions.
4. Photographs of the installation.
5. Calculations of estimated runoff quantity and responses for various ranges of storms for sampler programming.
6. Key parameters for sampler programming (i.e., number and size of bottles, sampling rate for various storm totals, trigger conditions, length of pickup tube, etc.).

7. Sample team leader responsible for sampler.

8. Sampler telephone number.

9. Any site specific considerations that will result in deviations from the FSP standard procedures.

10. Descriptions of any planned deviations from detailed procedures in this FSP including appendices that will be applied to this site.

11. Alternate or contingency procedures (as discussed above) that are proposed for that site.

4.5 PROJECT SCHEDULE

The actual start dates for the sampling will be determined following EPA approval of this Stormwater FSP. Other conditions that may affect the sampling schedule are weather and equipment conditions and availability. Currently, it is anticipated that the stormwater and sediment samples will be begin to be collected in late February through early March. Figure 4-2 shows the currently projected schedule. The most critical item beyond EPA approval is the acquisition and deployment of the water samplers. There is a 3 to 6 week lead time to acquire all the equipment. It is anticipated that each sampling crew will be able to install two sampling kits per day. Consequently, it will take approximately 4 to 7 weeks to deploy the first sampler from the time that it is ordered and approximately 8 weeks from the time the samplers are ordered for all of them to be deployed.

The automated samplers will be activated as soon as they are installed to record flow rates and will be enabled to collect samples during the first storm event that exceeds the predetermined precipitation conditions. The sediment traps will also begin functioning as soon as they are installed. While flow is present in the stormwater system the samplers will be trapping sediments. Based on the weather forecasts and anticipated precipitation, sampling teams will be notified to enable the samplers and deployed to collect samples following the storm events. Additionally, the sampling teams will be deployed based on forecasted weather to collect grab samples from selected locations.

5.0 REPORTING

5.1 LABORATORY AND CHEMICAL DATA

Preliminary data obtained from the laboratory will be validated following the Round 2 QAPP (Integral and Windward 2004) and QAPP Addendum (Integral 2007) procedures. These data will then be entered into the LWG database including any laboratory or validation assigned qualifiers. Validated analytical laboratory data from the LWG database will be provided to EPA in an electronic format within 120 days of completion of each sampling event. A sampling event will generally be considered complete when the last sample of that type described in this FSP has been collected.

5.2 FIELD MEASUREMENT DATA

Results of field parameters (e.g., pH) and flow data measurements at each location will be provided to EPA on schedule with and as a part of the Stormwater Site Characterization Summary Report described in Section 5.3. Field parameters will be validated consistent with the Round 2 QAPP and QAPP Addendum procedures (Integral and Windward 2004 and Integral 2007, respectively). Flow data results will be compiled into a separate project database. Rainfall data from publicly available area rain gauges will also be obtained and entered into the flow database.

Initially, these data will be reviewed against information obtained on the flow conditions and monitoring history at each site (e.g., structure and sensor placement issues, the presence of base flows, periods of known equipment malfunction) to identify and flag any periods of questionable or censored data. Data will also be reviewed for any questionable data in periods not associated with any of the above known issues and flagged accordingly (e.g., periods of very high recorded flow with no rainfall, highly erratic readings in small periods of time, periods of no flow during high intensity rain fall, etc.). Periods associated with chemistry sample collection will be identified and flagged within the flow database as well.

5.3 REPORTING

A Field Sampling Report will be prepared and submitted to EPA within 120 days of completing all stormwater and sediment field sample collection efforts described in this FSP. The Field Sampling Report will summarize field sampling activities, including sampling locations (i.e., information described in Section 4.4), requested sample analyses, sample collection methods, and any deviations from the FSP. At a minimum, the following will be included in the field report:

- Description of each sampling event including date, time, antecedent and rainfall data, river stage (as measured by the Morrison bridge USGS gauge), storm duration (water samples only).
- Comparison to rainfall event goals (water samples only).
- Description of sample collection and compositing at each location: plot of flow hydrograph and aliquot number subsample collection time, river stage, identify total number and which subsamples were composited, and Isco sampler program settings/sample results reports.
- Comparison to sampling criteria (water samples only).
- Description of each sampling event including dates if installation and retrieval and total rainfall during that period (sediment trap only)
- Field observations.
- Deviation from field procedures.

Stormwater and sediment chemistry results, field measurements, and storm flow data will be reported in tabular format in a Stormwater Site Characterization Summary Report that will be submitted to EPA within 120 days of completing sampling and analysis for all stormwater activities. The report will also include summaries of weather conditions (e.g., field observations), field observations associated with each location inspection and/or sampling event, and rain gauge data throughout the sampled period. Preliminary data evaluations relevant to the objectives of the study also will be included in the Stormwater Site Characterization Summary Report. However, the report will not include annualized loading estimates for use in modeling evaluations. This information will be developed and reported within the framework of the overall fate and transport modeling and data evaluations for the RI/FS.

6.0 REFERENCES

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Table 2-1. Proposed Stormwater Sampling Locations.

Outfall(s)	Facility or Location	River Mile	Land Use	Industrial or Land Use Activities
Industrial Locations (11)				
WR-24	OSM	2.1	Heavy Industrial	Steel manufacturing
WR-121 or WR-123	Schnitzer International Slip	3.7	Heavy Industrial	Metals
WR-108	Schnitzer - Riverside	4	Heavy Industrial	Metals
WR-107	GASCO	6.4	Heavy Industrial	MGP
WR-96	Arkema	7.3	Heavy Industrial	Chemical manufacturing
WR-14	Chevron - Transportation	7.7	Heavy Industrial	Bulk Fuel
WR-161	Portland Shipyard	8.2	Heavy Industrial	Ship maintenance and repair
WR-4	Sulzer Pump	10.4	Heavy Industrial	Manufacturing
WR-145	Gunderson	8.9	Heavy Industrial	Barge and railroad car manufacturing
WR-147	Gunderson (former Schnitzer)	9	Heavy Industrial	Metals handling
Drains to OF-17	GE Decommissioning	9.7	Heavy Industrial	Transformer decommissioning
Land Use Locations (11)				
Hwy 30	Hwy 30	TBD	Major Transportation	Highways
OF-49	City - St. Johns Area	6.5	Residential	Local traffic/residential
WR-67	Siltronic	6.6	Heavy Industrial	Silicon wafer manufacturing
OF-22C, above Hwy 30	City - Forest Park Area	6.9	Open Space (Forest Park)	Forest land
OF-22B	City - Doane Lake Industrial Area	6.9	Heavy Industrial	Chemical manufacturing
OF-M1, above Devine	City - Mocks Bottom Industrial Area	Lagoon	Light Industrial	Various light industrial uses
OF-M2	City - Mocks Bottom Industrial Area	Lagoon	Light Industrial	Trucking and distribution
OF-22	City - Willbridge Industrial Area	7.7	Heavy Industrial	Petroleum/Forest Park drainage
OF-16	City - Heavy Industrial	9.7	Heavy Industrial	Mixed industrial/highway
WR-218	UPRR Albina	10	Heavy Industrial	Railyard
St. Johns Bridge	Highway drainage	5.8	Major Transportation	Highways
Multiple Land Use Locations (2)				
OF-18	City - Multiple Land Uses	9.7	Open Space/Heavy Industrial	Also includes highway

Table 2-1. Proposed Stormwater Sampling Locations.

Outfall(s)	Facility or Location	River Mile	Land Use	Industrial or Land Use Activities
OF-19	City - Multiple Land Uses	8.4	Open Space/Heavy Industrial	Also includes highway
Terminal 4- Recontamination Evaluation (7)				
OF-52C	City - Terminal 4 Industrial Area	4.3	Light Industrial	Mixed industrial
OF-53	City - Residential above Terminal 4	5.1	Residential	Local traffic/residential
WR-183/Basin R	Terminal 4 - Slip 1	4.3	Heavy Industrial - Site Specific	Grains storage/transport
WR-181/Basin Q	Terminal 4 - Slip 1	4.3	Heavy Industrial - Site Specific	Vacant/former grain storage
WR-177/Basin M	Terminal 4 - Slip 1	4.3	Heavy Industrial - Site Specific	Car parking/liquid bulk storage
WR-20/Basin L	Terminal 4 - Wheeler Bay	4.5	Heavy Industrial - Site Specific	Kinder Morgan bulk storage
WR-169/Basin D	Terminal 4 (Toyota)	4.7	Light Industrial	Vacant/former petroleum storage

Table 2-2. Number of Samples Collected

Sediment Samples

Parameter	**Natural Samples**	**Field Replicates**	**Field Rinsate Blank for Phthalates**	**Total Number of Samples**
PCB Congeners	31	2	0	33
TOC	31	2	0	33
Percent Solids	31	2	0	33
Organochlorine pesticides	31	2	0	33
PAHs and Phthalates	31	2	2	35
Metals	31	2	0	33
Herbicides	31	2	0	33
Grain size	31	2	0	33

Stormwater Samples

Parameter	**Natural Samples**	**Field Replicates**	**Field Rinsate Blanks**	**Total Number of Samples per Event**	**Total for 3 events**
Stormwater Composite Samples					
TSS	31	2	2	35	105
TOC	31	2	2	35	105
Total Metals	31	2	2	35	105
Filtered Metals	31	2	2	35	105
PAHs	31	2	2	35	105
Phthalates*	11	1	1	13	39
PCB Congeners	31	2	2	35	105
Herbicides	31	2	2	35	105
Organochlorine pesticides	2	1	1	4	12
Stormwater Grab Samples [1]					
TSS	20	1	1	22	NA
TOC	20	1	1	22	NA
PAHs	20	1	1	22	NA
Phthalates*	7	1	1	9	NA
PCB Congeners	20	1	1	22	NA
Organochlorine pesticides	2	1	1	5	NA
Herbicides	20	1	1	22	NA

[1] These 10 grab samples will be analyzed for total and dissolved constituents to yield 20 samples for the laboratory. Each of these samples will be field filtered prior to analysis. Concentrations from the field filtered aliquots will be reported by the laboratory as dissolved concentrations. Does not yet include T-4 sampling sites (locations need to be confirmed).

*Phthalates are only sampled at potential source and a few selected non-potential source sites. Does not yet include T-4 phthalate sampling sites (locations need to be confirmed).

Table 2-3. Stormwater Analytes, Methods, Detection Limits, and Sample Size.

February 7, 2007

Priority	Analyte	Method Protocol	Method Procedure	Units	Min. Sample Size		Additional mass for Lab QC		Addl. MassField for field dup/rep	
Sediment Samples										
1A	PCB Congeners	EPA 1668A	HRGC/HRMS	pg/g	10	g	20	g	10	g
1B	TOC	Plumb 1981	Combustion: coulometric titration	percent	1	g	2	g	1	g
1C	Percent Solids	PSEP 1986	Gravimetric	percent	1	g	2	g	1	g
2	Organochlorine pesticides	EPA 8081A	GC/ECD	µg/kg	10	g	20	g	10	g
3	PAHs and Phthalates	EPA 8270C	GC/MS low-level LVI	µg/kg	20	g	40	g	20	g
4	Metals	EPA 6020/7471A	ICP/MS; CVAA for Hg	mg/kg	15	g	30	g	15	g
5	Herbicides	EPA 8151A	GC/ECD	µg/kg	10	g	20	g	10	g
6	Grain size	PSEP 1986	Sieves and pipette method	percent	100	g	200	g	100	g
Subtotal					167	g	334	g	167	g
Composite Water Samples										
1	TSS	EPA 160.1	Filtration and drying	mg/L	0.5	L	1	L	0.5	L
2	TOC	EPA 414.1	Chemical oxidation	mg/L	0.05	L	0.1	L	0.05	L
3	Metals	EPA 6020/7471A	ICP/MS; CVAA for Hg	µg/L	0.3	L	0.6	L	0.3	L
4	PAHs[1]	EPA 8270C	GC/MS SIM	µg/L	1	L	2	L	1	L
5	Phthalates[1]	EPA 525.2	GC/MS	µg/L	1	L	2	L	1	L
6	PCB Congeners[2]	EPA 1668A	HRGC/HRMS	pg/L	1	L	2	L	1	L
7	Herbicides	EPA 8151A	GC/ECD	µg/L	1	L	2	L	1	L
8	Organochlorine pesticides	EPA 8081A	GC/ECD	µg/L	1	L	2	L	1	L
Subtotal					4.85	L	9.7	L	4.85	L

For sediments for priority 1A, 1B, and 1C, the available sample mass will be split to conduct analyses for all 3 analytes if PCB congeners are analyzed.
Metals in sediment: Aluminum, antimony, arsenic, cadmium, chromium, copper, lead, nickel selenium, silver, zinc, mercury (Round 2)
Metals in water: Aluminum, antimony, arsenic, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc, mercury (Round 2A)
Organochlorine Pesticides in Water: Will only analyze for pesticides in stormwater samples on a site-specific basis, because the Round 2 data suggests data will be mostly non-detects for 1 or 2 Liter samples.

[1] The ACGs for selected organochlorine pesticides, PAHs, and phthalates cannot be met for all analytes by the available analytical methods However, these methods/MRLs provide consistency because they are being us for analysis of the Round 2 and 3 surface water data.

[2] The ACG (from LWG QAAP) is for total PCBs; there are no ACGs for individual congeners. One liter will be a sufficient sample size given where most detection limits are compared to the Total PCB congener results for the Round 2A surface water samples (in the 100 pg/L range). If stormwater sample concentrations are lower than that, they are effectively diluting the river water.

Table 2-4a. Composite and Grab Water Sample Analyses Priorities.

Outfall(s)	**Facility or Location**	**TSS**	**TOC**	**Metals[1]**	**PAHs**	**Phthalates**	**PCB Congeners**	**Herbicides**	**Organochlorine Pesticides**
WR-24	OSM	1,G	2,G	3	4,G	5,G	6,G	7,G	
WR-121 or WR-123	Schnitzer International Slip	1,G	2,G	3	4,G	5,G	6,G	7,G	
WR-108	Schnitzer - Riverside	1	2	3	4		5	6	
WR-107	GASCO	1,G	2,G	3	4,G		5,G	6,G	
Drains to OF-17	GE Decomissioning	1	2	3	4		5	6	
WR-96	Arkema	1,G	2,G	4,G	5,G	6,G	7,G	8,G	3,G
WR-14	Chevron - Transportation	1	2	3	4		5	6	
WR-161	Portland Shipyard	1,G	2,G	3	4,G	5,G	6,G	7,G	
WR-4	Sulzer Pump	1	2	3	4		5	6	
WR-145	Gunderson	1,G	2,G	3	4,G	5,G	6,G	7,G	
WR-148	Gunderson (former Schnitzer)	1	2	3	4	5	6	7	
Land Use Locations (11)									
Hwy 30	Hwy 30	1	2	3	4		5	6	
OF-49	City - St. Johns Area	1	2	3	4	5	6	7	
WR-66	Siltronic	1	2	3	4		5	6	
OF-22C, above Hwy 30	City - Forest Park Area	1	2	3	4	5	6	7	
OF-22B	City - Doane Lake Industrial Area	1,G	2,G	4,G	5,G		6,G	7,G	3,G
OF-M1, above Devine	City - Mocks Bottom Industrial Area	1	2	3	4		5	6	
OF-M2	City - Mocks Bottom Industrial Area	1	2	3	4	5	6	7	
OF-22	City - Willbridge Industrial Area	1,G	2,G	3	4,G		5,G	6,G	
OF-16	City - Heavy Industrial	1	2	3	4		5	6	
WR-218	UPRR Albina	1	2	3	4		5	6	
St. Johns Bridge	Highway drainage	1,G	2,G	3	4,G	5,G	6,G	7,G	
Multiple Land Use Locations (2)									
OF-18	City - Multiple Land Uses	1,G	2,G	3	4,G	5,G	6,G	7,G	
OF-19	City - Multiple Land Uses	1	2	3	4		5	6	
T-4- Recontamination Evaluation (7)[2]									
OF-52C	City - T-4 Industrial Area	1	2	3	4	?	5	6	
OF-53	City - Residential above T-4	1	2	3	4	?	5	6	
WR-183/Basin R	T-4, Slip 1	1	2	3	4	?	5	6	
WR-181/Basin Q.	T-4, Slip 1	1	2	3	4	?	5	6	
WR-177/Basin M	T-4, Slip 1	1	2	3	4	?	5	6	
WR-20/Basin L	T-4 - Wheeler Bay	1	2	3	4	?	5	6	
WR-169/Basin D	T-4 (Toyota)	1	2	3	4	?	5	6	

Number indicates priority order for analyses for composite water samples.
G - Indicates additional grab sampling for organic compounds that will also be conducted at these locations for filtered/unfiltered analyses.
1 - Metals analyses will be for filtered and unfiltered samples for composite sampling.
2 - T-4 composite water samples will include filtered and unfiltered samples for each chemical.

Table 2-4b. Sediment Sample Analyses Priorities

Outfall(s)	Facility or Location	PCB Congeners	TOC	Percent Solids	Organochlorine pesticides	PAHs and Phthalates	Metals	Herbicides	Grain size
WR-24	OSM	1A	1B	1C	3	2	4	5	6
WR-121 or WR-123	Schnitzer International Slip	1A	1B	1C	3	2	4	5	6
WR-108	Schnitzer - Riverside	1A	1B	1C	3	2	4	5	6
WR-107	GASCO	1A	1B	1C	3	2	4	5	6
Drains to OF-17	GE Decomissioning	1A	1B	1C	2	3	4	5	6
WR-96	Arkema	1A	1B	1C	2	3	4	5	6
WR-14	Chevron - Transportation	1A	1B	1C	3	2	4	5	6
WR-161	Portland Shipyard	1A	1B	1C	3	2	4	5	6
WR-4	Sulzer Pump	1A	1B	1C	3	2	4	5	6
WR-145	Gunderson	1A	1B	1C	2	3	4	5	6
WR-148	Gunderson (former Schnitzer)	1A	1B	1C	3	2	4	5	6
Land Use Locations (11)									
Hwy 30	Hwy 30	1A	1B	1C	2	3	4	5	6
OF-49	City - St. Johns Area	1A	1B	1C	2	3	4	5	6
WR-66	Siltronic	1A	1B	1C	2	3	4	5	6
OF-22C, above Hwy 30	City - Forest Park Area	1A	1B	1C	2	3	4	5	6
OF-22B	City - Doane Lake Industrial Area	1A	1B	1C	2	3	4	5	6
OF-M1, above Devine	City - Mocks Bottom Industrial Area	1A	1B	1C	2	3	4	5	6
OF-M2	City - Mocks Bottom Industrial Area	1A	1B	1C	2	3	4	5	6
OF-22	City - Willbridge Industrial Area	1A	1B	1C	2	3	4	5	6
OF-16	City - Heavy Industrial	1A	1B	1C	2	3	4	5	6
WR-218	UPRR Albina	1A	1B	1C	2	3	4	5	6
St. Johns Bridge	Highway drainage	1A	1B	1C	2	3	4	5	6
Multiple Land Use Locations (2)									
OF-18	City - Multiple Land Uses	1A	1B	1C	2	3	4	5	6
OF-19	City - Multiple Land Uses	1A	1B	1C	2	3	4	5	6

T-4- Recontamination Evaluation (7)										
OF-52C	City - T-4 Industrial Area	1A	1B	1C	2	3	4	5	6
OF-53	City - Residential above T-4	1A	1B	1C	2	3	4	5	6
WR-183/Basin R	T-4, Slip 1	1A	1B	1C	2	3	4	5	6
WR-181/Basin Q.	T-4, Slip 1	1A	1B	1C	2	3	4	5	6
WR-177/Basin M	T-4, Slip 1	1A	1B	1C	2	3	4	5	6
WR-20/Basin L	T-4 - Wheeler Bay	1A	1B	1C	2	3	4	5	6
WR-169/Basin D	T-4 (Toyota)	1A	1B	1C	2	3	4	5	6

Table 2-5a. Laboratory Methods for Sediment Samples.

Analysis	Laboratory	Sample Preparation		Quantitative Analysis	
		Protocol	**Procedure**	**Protocol**	**Procedure**
Conventional Analyses	CAS Kelso				
Total solids		--	--	PSEP 1986	Balance
Grain size		--	--	PSEP 1986	Sieve and pipette method
Total organic carbon		Plumb 1981	Acid pretreatment	Plumb et al. 1981	Combustion; coulometric titration
Metals	CAS Kelso				
Antimony, arsenic[a], cadmium, lead, silver		EPA 3050	Strong acid digestion	EPA 6020	ICP/MS
Aluminum, chromium, copper, nickel, zinc		EPA 3050	Strong acid digestion	EPA 6010B	ICP/AES
Selenium		EPA 3050	Strong acid digestion	EPA 7742	AAS
		EPA 7742	Hydride generation		
Arsenic[a]		EPA 3050	Strong acid digestion	EPA 7062	AAS
Mercury		EPA 7471A	Acid digestion/oxidation	EPA 7471A	CVAA
Chlorinated herbicides	CAS Kelso	EPA 8151A	Solvent extraction	EPA 8151A	GC/ECD
			Esterification		
Organochlorine pesticides and selected SVOCs	CAS Kelso	EPA 3541	Soxhlet extraction	EPA 8081A	GC/ECD
		EPA 3620B	Florisil® cleanup		
		EPA 3660B	Sulfur cleanup		
PCB Aroclors	CAS Kelso	EPA 3541	Soxhlet extraction	EPA 8082	GC/ECD
		EPA 3665A	Sulfuric acid cleanup		
		EPA 3620B	Florisil® cleanup		
		EPA 3660B	Sulfur cleanup		
Semivolatile organic compounds	CAS Kelso				
PAHs and phthalates		EPA 3541	Automated Soxhlet Extraction	EPA 8270C	GC/MS-LVI
		EPA 3640A	Gel permeation chromatography		
PCB Congeners[b]	Vista	EPA 1668A	Soxhlet/Dean Stark extraction	EPA 1668A	HRGC/HRMS

Table 2-5a. Laboratory Methods for Sediment Samples.

Analysis	Laboratory	Sample Preparation		Quantitative Analysis	
		Protocol	Procedure	Protocol	Procedure
			Sulfuric acid cleanup		
			Silica column cleanup		

Notes:

[a] Arsenic will be analyzed by EPA Method 7062 if it is not detected at the MRL by EPA Method 6020.

[b] Analysis will be completed for all 209 PCB congeners.

AAS - Atomic absorption spectrometry
CAS - Columbia Analytical Services
CVAA - cold vapor atomic absorption spectrometry
EPA - U.S. Environmental Protection Agency
GC/ECD - gas chromatography/electron capture detection
GC/FID - gas chromatography/flame ionization detection
GC/MS - gas chromatography/mass spectrometry
HRGC/HRMS - high-resolution gas chromatography/high-resolution mass spectrometry
ICP/AES - inductively coupled plasma/atomic emission spectrometry
ICP/MS - inductively coupled plasma - mass spectrometry
LVI - large-volume injector
TPH - total petroleum hydrocarbon
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
PSEP - Puget Sound Estuary Program
SIM - selected ion monitoring
STL - Severn Trent Laboratories
SVOC - semivolatile organic compound

Table 2-5b. Laboratory Methods for Water Samples.

Analytes	Laboratory	Sample Preparation		Quantitative Analysis	
		Protocol	Procedure	Protocol	Procedure
Conventional Analyses	CAS				
Total Suspended Solids		EPA 160.2	Filtration and drying	EPA 160.2	Balance
Total Organic Carbon		EPA 415.1	Chemical oxidation	EPA 415.1	Infrared detector
Metals	CAS				
Aluminum, antimony, cadmium, total chromium, copper, lead, nickel, selenium, silver, zinc		EPA 3005	Acid digestion	EPA 200.8	ICP/MS
Arsenic		EPA 3005A (Modified)	Acid Digestion/pre-concentration	EPA 200.8	ICP/MS
Mercury		EPA 7470	Acid digestion/oxidation	EPA 7470	CVAA
Phthalate Esters	CAS	EPA 525.2	Solid-phase extraction	EPA 525.2	GC/MS
Chlorinated Herbicides	CAS	EPA 8151A	Solvent extraction	EPA 8151A	GC/ECD
			Esterification		
Organochlorine pesticides and selected SVOCs	CAS	EPA 3545	Pressurized fluid extraction	EPA 8081A	GC/ECD
		EPA 3640A	Gel permeation chromatography		
		EPA 3630C	Florisil® cleanup		
		EPA 3660B	Sulfur cleanup (as needed)		
Polycyclic Aromatic Hydrocarbon	CAS	EPA 3520C	Continuous liquid-liquid extraction	EPA 8270C	GC/MS-SIM
PCB congeners[2]	Axys	EPA 1668A	Florisil® cleanup	EPA 1668A	HRGC/HRMS
			Extract fractionation		
			Layered Acid/Base SiO_3 Alumina		

CAS - Columbia Analytical Services
EPA - U.S. Environmental Protection Agency
GC/ECD - gas chromatography/electron capture detection
GC/MS - gas chromatography/mass spectrometry
HRGC/HRMS - high resolution gas chromatography/high resolution mass spectrometry
ICP/MS - inductively coupled plasma - mass spectrometry
LVI - large-volume injector
SIM - selected ion monitoring
SOP - standard operating procedures

Table 2-6a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	Congener number (PCBs only)	ACG[a]	MDL	MRL[b]
Conventional Analyses				
Total solids (percent of whole weight)		*	0.01	0.01
Grain size (percent)[c]		*	0.1	0.1
Total organic carbon (percent)		*	0.02	0.05
Metals, mg/kg dry wt				
Aluminum		*	10.0	10.0
Antimony		*	0.02	0.05
Arsenic		*	0.07	0.5
Cadmium		*	0.007	0.05
Chromium		*	0.6	2.0
Copper		*	2.0	2.0
Lead		*	0.02	0.05
Mercury		*	0.008	0.02
Nickel		*	3.0	4.0
Selenium		*	0.2	1
Silver		*	0.003	0.02
Zinc		*	0.5	2.0
Chlorinated Herbicides, µg/kg dry wt				
2,4,5-T		**2.8**	5.9	50
2,4,5-TP (Silvex)		**2.2**	3.9	50
2,4-D		**2.8**	8	50
2,4-DB		**2.2**	9.7	50
Dalapon		*	7	50
Dicamba		*	5.4	50
Dichlorprop		*	9.5	50
Dinoseb		*	3.5	50
MCPA		*	520	10000
MCPP		*	530	10000
Organochlorine Pesticides and Selected SVOCs, µg/kg dry wt				
2,4'-DDD		*	0.02	0.13
2,4'-DDE		*	0.009	0.13
2,4'-DDT		*	0.01	0.13
4,4'-DDD		**0.083**	0.012	0.13
4,4'-DDE		**0.0588**	0.01	0.13
4,4'-DDT		**0.0588**	0.021	0.13
Total DDT		*	--	--
Aldrin		**0.00038**	0.031	0.13
alpha-BHC		**0.001**	0.01	0.13
beta-BHC		**0.0036**	0.028	0.13
delta-BHC		*	0.018	0.13
gamma-BHC (Lindane)		**0.005**	0.012	0.13
alpha-Chlordane		*	0.008	0.13

Table 2-6a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	**Congener number (PCBs only)**	**ACG[a]**	**MDL**	**MRL[b]**
gamma-Chlordane		*	0.005	0.13
Oxychlordane		*	0.012	0.13
cis -Nonachlor		*	0.005	0.13
trans -Nonachlor		*	0.004	0.13
Total chlordane[d]		**0.057**	--	--
Dieldrin		**0.0004**	0.01	0.13
Endosulfan I		1.7	0.014	0.13
Endosulfan II		*	0.008	0.13
Endosulfan sulfate		*	0.026	0.13
Endrin		**0.084**	0.03	0.13
Endrin aldehyde		*	0.02	0.13
Endrin ketone		*	0.007	0.13
Heptachlor		**0.0014**	0.012	0.13
Heptachlor epoxide		**0.0007**	0.018	0.13
Methoxychlor		1.4	0.024	0.13
Mirex		**0.056**	0.007	0.13
Toxaphene		**0.0059**	0.9	10
Hexachlorobenzene		0.33	0.02	0.2
Hexachlorobutadiene		0.6	0.12	0.2
Hexachloroethane		2.0	0.12	0.2
Semivolatile Organic Compounds, µg/kg dry wt				
Polycyclic Aromatic Hydrocarbons				
2-Methylnaphthalene		*	1.2	10
Acenaphthene		72	1	10
Acenaphthylene		*	1.4	10
Anthracene		360	1.4	10
Benz(a)anthracene		**0.038**	1.4	10
Benzo(a)pyrene		**0.0038**	1.6	10
Benzo(b)fluoranthene		**0.038**	2.5	10
Benzo(g,h,i)perylene		*	2.3	10
Benzo(k)fluoranthene		**0.38**	2.5	10
Chrysene		**3.8**	1.4	10
Dibenz(a,h)anthracene		**0.0038**	2.2	10
Dibenzofuran		8.2	1.3	10
Fluoranthene		48	2.2	10
Fluorene		48	1.7	10
Indeno(1,2,3-cd)pyrene		**0.038**	1.9	10
Naphthalene		24	1.3	10
Phenanthrene		*	1.3	10
Pyrene		36	1.3	10
Phthalates				

Table 2-6a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	**Congener number (PCBs only)**	**ACG[a]**	**MDL**	**MRL[b]**
Bis(2-ethylhexyl) phthalate		**3.4**	1.7	200
Butylbenzyl phthalate		400	1.5	10
Dibutyl phthalate		204	2.6	10
Diethyl phthalate		*	3.5	10
Dimethyl phthalate		20000	1.8	10
Di-n-octyl phthalate		40.9	1.2	10
PCB congeners				
Dioxin-like PCB congeners (WHO list)	**Congener number**			
3,3',4,4'-TetraCB	PCB-77	10	1.1	5
3,4,4',5-TetraCB	PCB-81	10	1.0	5
2,3,3'4,4'-PentaCB	PCB-105	10	0.9	5
2,3,4,4',5-PentaCB	PCB-114	2	0.7	5
2,3',4,4',5-PentaCB	PCB-118	10	2.1	5
(coelution with 2,3,3',4,5-PentaCB)	(coelution with PCB 106)			
2',3,4,4',5-PentaCB	PCB-123	10	0.9	5
3,3',4,4',5-PentaCB	PCB-126	0.01	0.6	5
2,3,3',4,4',5-HexaCB	PCB-156	2	0.8	5
2,3,3',4,4',5'-HexaCB	PCB-157	2	0.6	5
2,3,4,4',5,5'-HexaCB	PCB-167	100	0.5	5
3,3',4,4',5,5'-HexaCB	PCB-169	0.1	0.8	5
2,3,3',4,4',5,5'-HeptaCB	PCB-189	10	0.3	5
Other PCB congeners				
2-MonoCB	PCB-1		0.5	2.5
3-MonoCB	PCB-2		0.6	2.5
4-MonoCB	PCB-3		0.6	2.5
2,2'-DiCB/2,6-DiCB	PCB-4/10		4.3	2.5
2,3-DiCB/2,4'-DiCB	PCB-5/8		4.4	2.5
2,3'-DiCB	PCB-6		2.2	2.5
2,4-DiCB/2,5-DiCB	PCB-7/9		4.6	2.5
3,3'-DiCB	PCB-11		5.0	2.5
3,4-DiCB/3,4'-DiCB	PCB-12/13		6.1	2.5
3,5-DiCB	PCB-14		3.0	2.5
4,4'-DiCB	PCB-15		2.8	2.5
2,2',3-TriCB/2,4',6-TriCB	PCB-16/32		2.5	2.5
2,2',4-TriCB	PCB-17		1.3	2.5
2,2',5-TriCB	PCB-18		1.4	2.5
2,2',6-TriCB	PCB-19		1.0	2.5

Table 2-6a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	**Congener number (PCBs only)**	**ACG[a]**	**MDL**	**MRL[b]**
2,3,3'-TriCB/2,3,4-TriCB/2,3,5 TriCB	PCB-20/21/33		1.4	2.5
2,3,4'-TriCB	PCB-22		0.9	2.5
2,3,5-TriCB	PCB-23		0.7	2.5
2,3,6-TriCB/2,3',6-TriCB	PCB-24/27		2.5	2.5
2,3',4-TriCB	PCB-25		0.8	2.5
2,3',5-TriCB	PCB-26		0.8	2.5
2,4,4'-TriCB	PCB-28		1.5	2.5
2,4,5-TriCB	PCB-29		0.6	2.5
2,4,6-TriCB	PCB-30		0.9	2.5
2,4',5-TriCB	PCB-31		1.2	2.5
2',3,5-TriCB	PCB-34		0.9	2.5
3,3',4-TriCB	PCB-35		0.4	2.5
3,3',5-TriCB	PCB-36		0.9	2.5
3,4,4'-TriCB	PCB-37		0.6	2.5
3,4,5-TriCB	PCB-38		0.9	2.5
3,4',5-TriCB	PCB-39		0.6	2.5
2,2',3,3'-TetraCB	PCB-40		1.2	5
2,2',3,4-TetraCB/2,3,4',6-TetraCB/2,3',4',6-TetraCB/2,3',5,5'-TetraCB	PCB-41/64/71/72		3.5	5
2,2',3,4'-TetraCB/2,3,3',6-Tetra	PCB-42/59		2.0	5
2,2',3,5-TetraCB/2,2',4,5'-Tetra	PCB-43/49		2.2	5
2,2',3,5'-TetraCB	PCB-44		5.3	5
2,2',3,6-TetraCB	PCB-45		1.3	5
2,2',3,6'-TetraCB	PCB-46		1.1	5
2,2',3,4'-TetraCB	PCB-47		3.4	5
2,2',4,5-TetraCB/2,4,4',6-Tetra(	PCB-48/75		1.8	5
2,2',4,6-TetraCB	PCB-50		1.5	5
2,2',4,6'-TetraCB	PCB-51		1.1	5
2,2',5,5'-TetraCB/2,3',4,6-Tetra	PCB-52/69		3.3	5
2,2',5,6'-TetraCB	PCB-53		1.0	5
2,2',6,6'-TetraCB	PCB-54		1.9	5
2,3,3',4'-TetraCB	PCB-55		1.0	5
2,3,3',4'-TetraCB/2,3,4,4'-Tetra	PCB-56/60		2.5	5
2,3,3',5-TetraCB	PCB-57		1.2	5
2,3,3',5'-TetraCB	PCB-58		1.2	5
2,3,4,5-TetraCB	PCB-61		1.2	5
2,3,4,6-TetraCB	PCB-62		0.9	5

Table 2-6a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	**Congener number (PCBs only)**	**ACG[a]**	**MDL**	**MRL[b]**
2,3,4',5-TetraCB	PCB-63		1.1	5
2,3,5,6-TetraCB	PCB-65		1.3	5
2,3',4,4'-TetraCB	PCB-66		1.8	5
2,3',4,5-TetraCB	PCB-67		1.2	5
2,3',4,5'-TetraCB	PCB-68		1.3	5
2,3',4',5-TetraCB	PCB-70		1.4	5
2,3',5',6-TetraCB	PCB-73		0.7	5
2,4,4',5-TetraCB	PCB-74		1.1	5
2',3,4',5-TetraCB	PCB-76		2.3	5
3,3',4,5-TetraCB	PCB-78		2.8	5
3,3',4,5'-TetraCB	PCB-79		1.7	5
3,3',5,5'-TetraCB	PCB-80		0.9	5
2,2',3,3',4-PentaCB	PCB-82		1.3	5
2,2',3,3',5-PentaCB	PCB-83		0.9	5
2,2',3,3',6-PentaCB/2,2',3,5,5'-P	PCB-84/92		1.6	5
2,2',3,4,4'-PentaCB/2,3,4,5,6-Pe	PCB-85/116		1.3	5
2,2',3,4,5-PentaCB	PCB-86		1.8	5
2,2',3,4,5'-PentaCB/2,3,4',5,6-PentaCB/2',3,4,5,6'-PentaCB	PCB-87/117/125		1.8	5
2,2',3,4,6-PentaCB/2,2',3,4',6-P	PCB-88/91		1.6	5
2,2',3,4,6'-PentaCB	PCB-89		0.7	5
2,2',3,4',5-PentaCB/2,2',4,5,5'-P	PCB-90/101		1.5	5
2,2',3,5,6-PentaCB	PCB-93		1.5	5
2,2',3,5,6'-PentaCB	PCB-94		0.4	5
2,2',3,5',6-PentaCB/2,2',3',4,6-PentaCB/2,2',4,5,6'-PentaCB	PCB-95/98/102		6.4	5
2,2',3,6,6'-PentaCB	PCB-96		0.5	5
2,2',3',4,5-PentaCB	PCB-97		1.3	5
2,2',4,4',5-PentaCB	PCB-99		1.0	5
2,2',4,4',6-PentaCB	PCB-100		0.3	5
2,2',4,5,6'-PentaCB	PCB-103		0.4	5
2,2',4,6,6'-PentaCB	PCB-104		0.5	5
2,3,3',4',5-PentaCB/2,3,3',4,6-PentaCB	PCB-107/109		1.3	5
2,3,3',4,5'-PentaCB/2,3,3',5,6-PentaCB	PCB-108/112		1.0	5

Table 2-6a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	**Congener number (PCBs only)**	**ACG[a]**	**MDL**	**MRL[b]**
2,3,3',4',6-PentaCB	PCB-110		1.8	5
2,3,3',5,5'-PentaCB/2,3,4,4',6-PentaCB	PCB-111/115		1.7	5
2,3,3',5',6-PentaCB	PCB-113		1.0	5
2,3',4,4',6-PentaCB	PCB-119		0.9	5
2,3',4,5,5'-PentaCB	PCB-120		1.0	5
2,3',4,5,6-PentaCB	PCB-121		0.9	5
2',3,3',4,5-PentaCB	PCB-122		1.0	5
2',3,4,5,5'-PentaCB	PCB-124		1.1	5
3,3',4,5,5'-PentaCB	PCB-127		0.8	5
2,2',3,3',4,4'-HexaCB/2,3,3',4',5,5'-HexaCB	PCB-128/162		1.2	5
2,2',3,3',4,5-HexaCB	PCB-129		0.8	5
2,2',3,3',4,5'-HexaCB	PCB-130		0.8	5
2,2',3,3',4,6-HexaCB	PCB-131		2.5	5
2,2',3,3',4,6'-HexaCB/2,3,3',4,5',6-HexaCB	PCB-132/161		1.0	5
2,2',3,3',5,5'-HexaCB/2,2',3,4,5,6-HexaCB	PCB-133/142		3.9	5
2,2',3,3',5,6-HexaCB/2,2',3,4,5,6'-HexaCB	PCB-134/143		4.1	5
2,2',3,3',5,6'-HexaCB	PCB-135		1.4	5
2,2',3,3',6,6'-HexaCB	PCB-136		1.2	5
2,2',3,4,4',5-HexaCB	PCB-137		1.0	5
2,2',3,4,4',5'-HexaCB/2,3,3',4',5,6-HexaCB/2,3,3',4',5',6-HexaCB	PCB-138/163/164		2.1	5
2,2',3,4,4',6-HexaCB/2,2',3,4',5',6-HexaCB	PCB-139/149		1.8	5
2,2',3,4,4',6'-HexaCB	PCB-140		1.0	5
2,2',3,4,5,5'-HexaCB	PCB-141		0.6	5
2,2',3,4,5',6-HexaCB	PCB-144		1.7	5
2,2',3,4,6,6'-HexaCB	PCB-145		1.1	5

Table 2-6a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	**Congener number (PCBs only)**	**ACG[a]**	**MDL**	**MRL[b]**
2,2',3,4',5,5'-HexaCB/2,3,3',5,5',6-HexaCB	PCB-146/165		1.7	5
2,2',3,4',5,6-HexaCB	PCB-147		0.7	5
2,2',3,4',5,6'-HexaCB	PCB-148		1.1	5
2,2',3,4',6,6'-HexaCB	PCB-150		1.3	5
2,2',3,5,5',6-HexaCB	PCB-151		1.5	5
2,2',3,5,6,6'-HexaCB	PCB-152		1.3	5
2,2',4,4',5,5'-HexaCB	PCB-153		1.2	5
2,2',4,4',5',6-HexaCB	PCB-154		1.1	5
2,2',4,4',6,6'-HexaCB	PCB-155		0.9	5
2,3,3',4,4',6-HexaCB/2,3,3',4,5,6-HexaCB	PCB-158/160		1.3	5
2,3,3',4,5,5'-HexaCB	PCB-159		0.5	5
2,3,4,4',5,6-HexaCB	PCB-166		0.6	5
2,3',4,4',5',6-HexaCB	PCB-168		0.4	5
2,2',3,3',4,4',5-HeptaCB	PCB-170		0.4	5
2,2',3,3',4,4',6-HeptaCB	PCB-171		0.6	5
2,2',3,3',4,5,5'-HeptaCB	PCB-172		0.5	5
2,2',3,3',4,5,6-HeptaCB	PCB-173		0.7	5
2,2',3,3',4,5,6'-HeptaCB	PCB-174		1.4	5
2,2',3,3',4,5',6-HeptaCB	PCB-175		1.2	5
2,2',3,3',4,6,6'-HeptaCB	PCB-176		0.4	5
2,2',3,3',4',5,6-HeptaCB	PCB-177		0.7	5
2,2',3,3',5,5',6-HeptaCB	PCB-178		0.6	5
2,2',3,3',5,6,6'-HeptaCB	PCB-179		0.3	5
2,2',3,4,4',5,5'-HeptaCB	PCB-180		0.7	5
2,2',3,4,4',5,6-HeptaCB	PCB-181		0.8	5
2,2',3,4,4',5,6'-HeptaCB/2,2',3,4,5,5',6-HeptaCB	PCB-182/187		1.1	5
2,2',3,4,4',5',6-HeptaCB	PCB-183		0.6	5
2,2',3,4,4',6,6'-HeptaCB	PCB-184		0.5	5
2,2',3,4,5,5',6-HeptaCB	PCB-185		0.6	5
2,2',3,4,5,6,6'-HeptaCB	PCB-186		0.8	5
2,2',3,4',5,6,6'-HeptaCB	PCB-188		0.5	5
2,3,3',4,4',5,6-HeptaCB	PCB-190		0.7	5
2,3,3',4,4',5',6-HeptaCB	PCB-191		0.5	5

Table 2-6a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	**Congener number (PCBs only)**	**ACG[a]**	**MDL**	**MRL[b]**
2,3,3',4,5,5',6-HeptaCB	PCB-192		0.8	5
2,3,3',4',5,5',6-HeptaCB	PCB-193		0.5	5
2,2',3,3',4,4',5,5'-OctaCB	PCB-194		0.9	7.5
2,2',3,3',4,4',5,6-OctaCB	PCB-195		2.1	7.5
2,2',3,3',4,4',5,6'-OctaCB/2,2',3,4,4',5,5',6-OctaCB	PCB-196/203		2.3	7.5
2,2',3,3',4,4',6,6'-OctaCB	PCB-197		0.9	7.5
2,2',3,3',4,5,5',6-OctaCB	PCB-198		1.4	7.5
2,2',3,3',4,5,5',6'-OctaCB	PCB-199		1.5	7.5
2,2',3,3',4,5,6,6'-OctaCB	PCB-200		1.2	7.5
2,2',3,3',4,5',6,6'-OctaCB	PCB-201		1.1	7.5
2,2',3,3',5,5',6,6'-OctaCB	PCB-202		0.6	7.5
2,2',3,4,4',5,6,6'-OctaCB	PCB-204		0.7	7.5
2,3,3',4,4',5,5',6-OctaCB	PCB-205		1.2	7.5
2,2',3,3',4,4',5,5',6-NonaCB	PCB-206		0.5	7.5
2,2',3,3',4,4',5,6,6'-NonaCB	PCB-207		0.5	7.5
2,2',3,3',4,5,5',6,6'-NonaCB	PCB-208		0.7	7.5
DecaCB	PCB-209		0.9	7.5

Notes: Sed table

* A risk-based ACG has not been established.

[a] Values are provided in bold font when the MRL is not expected to meet the ACG.

[b] The MRL is provided on a dry-weight basis and assumes 50% moisture in the samples.
The MRL for project samples will vary with moisture content in the samples.
The MRL represents the level of lowest calibration standard (i.e., the practical quantitation limit).

[c] Grain-size intervals will include the following:

Gravel	Fine sand	Fine silt
Very coarse sand	Very fine sand	Very fine silt
Coarse sand	Coarse silt	Clay, phi size >8
Medium sand	Medium silt	

[d] Total chlordane will be calculated as the sum of the five components listed above this entry.

ACG = Analytical concentration goal; ACGs were established by EPA during *ad hoc* meeting with LWG on May 10, 2002

MDL = Method detection limit

MRL = Method reporting limit

PCB - polychlorinated biphenyl

Notes: Congener table

[1] ACGs for the dioxin-like congeners are based on the ACG of 0.01 pg/g dry wt for PCB-126 from the Round 1 QAPP and adjusted using the WHO TEFs.

Table 2-6a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	Congener number (PCBs only)	ACG[a]	MDL	MRL[b]

[2] The MRLs and MDLs are provided on a dry-weight basis and assume 50% moisture in the samples and a sample weight of 10 or 50 g, as noted.

The MRL represents the level of lowest calibration standard (i.e., the practical quantitation limit).

Sample-specific MDLs are reported with the final data and will vary based on sample size and characteristics.

ACG = Analytical concentration goal

MDL = Method detection limit
MRL = Method reporting limit
tbd = to be determined
TEF = Toxicity equivalent factor

WHO = World Health Organization

Table 2-6b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening		Human Health Screening Values			Analytical Concentration Goals			Laboratory MDLs and MRLs	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**
Conventional Analyses, mg/L (ppm)											
Total suspended solids							1 [9]	1 [9]	1 [9]	1	1
Total organic carbon							NE	NE	NE	0.07	0.5
Metals/Inorganics, mg/L (ppm)											
Aluminum		0.087	0.46	36			0.087	0.087	0.087	0.0007	0.002
Antimony			0.61	0.015	0.64	0.064	0.015	0.015	0.015	0.00002	0.00005
Arsenic		0.15	0.914	0.000045	0.00014	0.000014	0.000045	0.000045	0.000014	TBD	0.00005
Cadmium [10]		0.000094	0.00015	0.018			0.000094	0.000094	0.000094	0.00001	0.00002
Chromium, total							NE	NA	NA	0.00006	0.0002
Copper [10]		0.00274	0.00023	1.5			0.00023	0.00023	0.00023	0.00004	0.0001
Lead [10]		0.000541	0.012				0.000541	0.000541	0.000541	0.00001	0.00002
Mercury		0.00077	<0.00023	0.011			<0.00023	<0.00023	<0.00023	0.0001	0.0002
Nickel [10]		0.016	<0.005	0.73	4.6	0.46	<0.005	<0.005	<0.005	0.00004	0.0002
Selenium		0.005	0.0883	0.18	4.2	0.42	0.005	0.005	0.005	0.0002	0.001
Silver			0.00012	0.18			0.00012	0.00012	0.00012	0.00001	0.00002
Zinc [10]		0.0365	0.03	11	26	2.6	0.03	0.03	0.03	0.0002	0.0005
Chlorinated Herbicides, µg/L (ppb)											
Dalapon				1100			1100	1100	1100	0.06	0.4
Dicamba				1100			1100	1100	1100	0.071	0.4
MCPA							NE	NE	NE	24	100
Dichlorprop							NE	NE	NE	0.061	0.4
2,4-D				360			360	360	360	0.079	0.4
2,4,5-TP (Silvex)				290			290	290	290	0.085	0.2
2,4,5-T				360			360	360	360	0.017	0.2
2,4-DB				290			290	290	290	0.13	0.4
Dinoseb				36			36	36	36	0.091	0.2
MCPP				360			360	360	360	23	100
Organochlorine Pesticides, µg/L (ppb)											
2,4'-DDD							0.28	0.28	0.28	TBD	0.0005
2,4'-DDE							0.2	0.2	0.2	TBD	0.0005
2,4'-DDT							0.2	0.2	0.2	TBD	0.0005
4,4'-DDD			0.011	0.28	0.00031	0.0000	0.280	0.00031	0.000031	TBD	0.0005
4,4'-DDE				0.2	0.00022	0.0000	0.2	0.00022	0.000022	TBD	0.0005
4,4'-DDT		0.001	0.013	0.2	0.00022	0.0000	0.001	0.00022	0.000022	TBD	0.0005
Total DDT				0.2			NE	NE	NE	NE	NE
Aldrin				0.004	0.00005	0.000005	0.004	0.00005	0.000005	TBD	0.0005
alpha-BHC			2.2	0.011	0.0049	0.00049	0.004	0.0049	0.00049	TBD	0.0005
beta-BHC				0.037	0.017	0.0017	0.004	0.017	0.0017	TBD	0.0005

Table 2-6b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening		Human Health Screening Values			Analytical Concentration Goals			Laboratory MDLs and MRLs	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**
delta-BHC				0.037			0.004	0.004	0.004	TBD	0.0005
gamma-BHC (Lindane)		0.08		0.052	1.8	0.18	0.052	0.052	0.0063	TBD	0.0005
alpha-Chlordane							0.0043	0.00081	0.000081	TBD	0.0005
gamma-Chlordane							0.0043	0.00081	0.000081	TBD	0.0005
Oxychlordane				0.19			0.19	0.19	0.19	TBD	0.0005
cis -Nonachlor				0.19			0.19	0.19	0.19	TBD	0.0005
trans -Nonachlor				0.19			0.19	0.19	0.19	TBD	0.0005
Total Chlordane [a]		0.0043		0.19	0.00081	0.000081	NE	NE	NE	NE	NE
Dieldrin		0.0019	0.051	0.0042	0.000054	0.0000054	0.0042	0.000054	0.0000054	TBD	0.0005
Endosulfan I		0.056	0.051	220	89	8.9	0.051	0.051	8.9	TBD	0.0005
Endosulfan II		0.056		220	89	8.9	0.051	0.051	0.051	TBD	0.0005
Endosulfan sulfate					89	8.9	NE	89	8.9	TBD	0.0005
Endrin		0.0023	0.061	11	0.06	0.006	0.036	0.036	0.006	TBD	0.0005
Endrin aldehyde					0.3	0.03	NE	0.3	0.03	TBD	0.0005
Endrin ketone							NE	NE	NE	TBD	0.0005
Heptachlor		0.0038	0.0069	0.015	0.000079	0.0000079	0.0038	0.000079	0.0000079	TBD	0.0005
Heptachlor epoxide		0.0038		0.0074	0.000039	0.0000039	0.0038	0.000039	0.0000039	TBD	0.0005
Methoxychlor		0.03	0.019	180			0.019	0.019	0.019	TBD	0.0005
Mirex							NE	NE	NE	NE	NE
Toxaphene		0.0002		0.061	0.00028	0.000028	0.0002	0.0002	0.000028	TBD	0.025
Hexachlorobenzene							0.042	0.00029	0.000029	TBD	0.0005
Hexachlorobutadiene							0.86	0.86	0.86	TBD	0.001
Hexachloroethane											
Semivolatile Organic Compounds, µg/L (ppb)											
Polycyclic Aromatic Hydrocarbons											
Naphthalene			620	6.2			6.2	6.2	6.2	0.014	0.02
2-Methylnaphthalene							NE	NE	NE	0.012	0.02
Acenaphthylene							NE	NE	NE	0.0089	0.02
Acenaphthene		23	74	370	990	99	23	23	23	0.0097	0.02
Fluorene		3.9		240	5300	530	3.9	3.9	3.9	0.011	0.02
Phenanthrene		6.3	200				6.3	6.3	6.3	0.013	0.02
Anthracene		0.73	0.09	1800	40000	4000	0.09	0.09	0.09	0.01	0.02
Fluoranthene		6.2	15	1500	140	14	6.2	6.2	6.2	0.013	0.02
Pyrene				180	4000	400	180	180	180	0.012	0.02
Benz(a)anthracene		0.027	0.65	0.092	0.018	0.0018	0.027	0.018	0.0018	0.013	0.02
Chrysene				9.2	0.018	0.0018	9.2	0.018	0.0018	0.012	0.02
Benzo(b)fluoranthene				0.092	0.018	0.0018	0.092	0.018	0.0018	0.0098	0.02
Benzo(k)fluoranthene				0.92	0.018	0.0018	0.92	0.018	0.0018	0.011	0.02

Table 2-6b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening		**Human Health Screening Values**			**Analytical Concentration Goals**			**Laboratory MDLs and MRLs**	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**
Benzo(a)pyrene		0.14	0.3	0.0092	0.018	0.0018	0.0092	0.0092	0.0018	0.0087	0.02
Indeno(1,2,3-cd)pyrene				0.092	0.018	0.0018	0.092	0.018	0.0018	0.0087	0.02
Dibenz(a,h)anthracene				0.0092	0.018	0.0018	0.0092	0.0092	0.0018	0.0079	0.02
Benzo(g,h,i)perylene							NE	NE	NE	0.009	0.02
Phthalate Esters, µg/L (ppb)											
Dimethylphthalate		3		360000	1100000	110000	3	3	3	0.015	0.5
Diethylphthlalate		3	85,600	29000	44000	4400	3	3	3	0.007	0.5
Di-n-butylphthalate		1.0		3600	4500	450	1	1	1	0.013	0.6
Butylbenzylphthalate		3		7300	1900	190	3	3	3	0.013	0.5
Di-n-octylphthalate		3		1500			3	3	3	0.005	0.1
Bis-(2-ethylhexyl) phthalate		0.12	912	4.8	2.2	0.22	0.12	0.12	0.12	0.049	0.5
PCB congeners, pg/L (ppq)											
2-MonoCB	PCB-1									2.4	5.0 - 10
3-MonoCB	PCB-2									1.1	5.0 - 10
4-MonoCB	PCB-3									2.0	5.0 - 10
2,2'-DiCB	PCB-4									1.7	5.0 - 10
2,3-DiCB	PCB-5									1.4	5.0 - 10
2,3'-DiCB	PCB-6									2.0	5.0 - 10
2,4-DiCB	PCB-7									4.0	5.0 - 10
2,4'-DiCB	PCB-8									2.7	5.0 - 10
2,5-DiCB	PCB-9									2.4	5.0 - 10
2,6-DiCB	PCB-10									4.0	5.0 - 10
3,3'-DiCB	PCB-11									9.5	5.0 - 10
3,4-DiCB/3,4'-DiCB	PCB-12/13									5.1	5.0 - 10
3,5-DiCB	PCB-14									3.1	5.0 - 10
4,4'-DiCB	PCB-15									2.2	5.0 - 10
2,2',3-TriCB	PCB-16									1.4	5.0 - 10
2,2',4-TriCB	PCB-17									2.0	5.0 - 10
2,2',5-TriCB/2,4,6-TriCB	PCB-18/30									3.4	5.0 - 10
2,2',6-TriCB	PCB-19									2.8	5.0 - 10
2,3,3'-TriCB/2,4,4'-TriCB	PCB-20/28									3.9	5.0 - 10
2,3,4-TriCB/2,3,5-TriCB	PCB-21/33									3.9	5.0 - 10
2,3,4'-TriCB	PCB-22									2.7	5.0 - 10
2,3,5-TriCB	PCB-23									3.9	5.0 - 10
2,3,6-TriCB	PCB-24									2.6	5.0 - 10
2,3',4-TriCB	PCB-25									3.3	5.0 - 10
2,3',5-TriCB/2,4,5-TriCB	PCB-26/29									4.7	5.0 - 10
2,3',6-TriCB	PCB-27									2.5	5.0 - 10
2,4',5-TriCB	PCB-31									4.5	5.0 - 10
2,4',6-TriCB	PCB-32									2.2	5.0 - 10

Table 2-6b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

Analytes	Congener number (PCBs only)	Ecological Screening		Human Health Screening Values			Analytical Concentration Goals			Laboratory MDLs and MRLs	
		AWQC [1]	ORNL [2]	EPA Region 9 Tap water PRG [3]	Fish Consumption Only [4]	Site-Specific Fish Consumption Only [5]	Level 1 ACG [6]	Level 2 ACG [7]	Level 3 ACG [8]	MDL	MRL
2',3,5-TriCB	PCB-34									2.1	5.0 - 10
3,3',4-TriCB	PCB-35									4.3	5.0 - 10
3,3',5-TriCB	PCB-36									4.0	5.0 - 10
3,4,4'-TriCB	PCB-37									2.8	5.0 - 10
3,4,5-TriCB	PCB-38									2.5	5.0 - 10
3,4',5-TriCB	PCB-39									3.5	5.0 - 10
2,2',3,3'-TetraCB/2,2',3,4-TetraCB/2,3',4',6-TetraCB	PCB-40/41/71									5.3	5.0 - 10
2,2',3,4'-TetraCB	PCB-42									3.7	5.0 - 10
2,2',3,5-TetraCB	PCB-43									5.2	5.0 - 10
2,2',3,5'-TetraCB/2,2',4,4'-TetraCB/2,3,5,6-TetraCB	PCB-44/47/65									5.1	5.0 - 10
2,2',3,6-TetraCB/2,2',4,6'-TetraCB	PCB-45/51									3.5	5.0 - 10
2,2',3,6'-TetraCB	PCB-46									1.5	5.0 - 10
2,2',4,5-TetraCB	PCB-48									2.8	5.0 - 10
2,2',4,5'-TetraCB/2,3',4,6-TetraCB	PCB-49/69									6.4	5.0 - 10
2,2',4,6-TetraCB/2,2',5,6'-TetraCB	PCB-50/53									6.2	5.0 - 10
2,2',5,5'-TetraCB	PCB-52									3.7	5.0 - 10
2,2',6,6'-TetraCB	PCB-54									2.2	5.0 - 10
2,3,3',4'-TetraCB	PCB-55									6.0	5.0 - 10
2,3,3',4'-TetraCB	PCB-56									5.1	5.0 - 10
2,3,3',5-TetraCB	PCB-57									4.0	5.0 - 10
2,3,3',5'-TetraCB	PCB-58									6.9	5.0 - 10
2,3,3',6-TetraCB/2,3,4,6-TetraCB/2,4,4',6-TetraCB	PCB-59/62/75									7.0	5.0 - 10
2,3,4,4'-TetraCB	PCB-60									4.4	5.0 - 10
2,3,4,5-TetraCB/2,3',4',5-TetraCB/2,4,4',5-TetraCB/2',3,4',5-TetraCB	PCB-61/70/74/76									10.1	5.0 - 10
2,3,4',5-TetraCB	PCB-63									2.4	5.0 - 10
2,3,4', 6-TetraCB	PCB-64									3.3	5.0 - 10
2,3',4,4'-TetraCB	PCB-66									6.5	5.0 - 10
2,3',4,5-TetraCB	PCB-67									5.8	5.0 - 10
2,3',4,5'-TetraCB	PCB-68									4.6	5.0 - 10
2,3',5,5'-TetraCB	PCB-72									4.3	5.0 - 10
2,3',5',6-TetraCB	PCB-73									1.9	5.0 - 10
3,3',4,4'-TetraCB	PCB-77									2.8	5.0 - 10
3,3',4,5-TetraCB	PCB-78									3.2	5.0 - 10

Table 2-6b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening		Human Health Screening Values			Analytical Concentration Goals			Laboratory MDLs and MRLs	
Analytes	Congener number (PCBs only)	AWQC [1]	ORNL [2]	EPA Region 9 Tap water PRG [3]	Fish Consumption Only [4]	Site-Specific Fish Consumption Only [5]	Level 1 ACG [6]	Level 2 ACG [7]	Level 3 ACG [8]	MDL	MRL
3,3',4,5'-TetraCB	PCB-79									4.2	5.0 - 10
3,3',5,5'-TetraCB	PCB-80									3.7	5.0 - 10
3,4,4',5-TetraCB	PCB-81									3.0	5.0 - 10
2,2',3,3',4-PentaCB	PCB-82									2.2	5.0 - 10
2,2',3,3',5-PentaCB/2,2',4,4',5-PentaCB	PCB-83/99									4.0	5.0 - 10
2,2',3,3',6-PentaCB	PCB-84									1.9	5.0 - 10
2,2',3,4,6-PentaCB/2,2',3,4',6-PentaCB	PCB-88/91									3.8	5.0 - 10
2,2',3,4,6'-PentaCB	PCB-89									1.5	5.0 - 10
2,2',3,5,5'-PentaCB	PCB-92									2.3	5.0 - 10
2,2',3,5,6'-PentaCB	PCB-94									4.0	5.0 - 10
2,2',3,5',6-PentaCB/2,2',3,5,6 -PentaCB/2,2',4,4',6 -PentaCB/2,2',4,5,6'-PentaCB	PCB-95/100/93/102									9.7	5.0 - 10
2,2',3,6,6'-PentaCB	PCB-96									2.0	5.0 - 10
2,2',4,5,6'-PentaCB	PCB-103									3.9	5.0 - 10
2,2',4,6,6'-PentaCB	PCB-104									3.2	5.0 - 10
2,3,3'4,4'-PentaCB	PCB-105									0.9	5.0 - 10
2,3,3'4,5-PentaCB	PCB-106									4.1	5.0 - 10
2,3,3',4',5-PentaCB/2',3,4,5,5'-PentaCB	PCB-107/124									1.9	5.0 - 10
2,3,3',4,5'-PentaCB/2,3',4,4',6-PentaCB/2,2',3,4,5-PentaCB/2,2',3',4,5-PentaCB	PCB-108/119/86/97									8.4	5.0 - 10
2,3,3',4,6-PentaCB	PCB-109									2.9	5.0 - 10
2,3,3',4',6-PentaCB/2,3,4,4',6-PentaCB	PCB-110/115									2.7	5.0 - 10
2,3,3',5,5'-PentaCB	PCB-111									2.0	5.0 - 10
2,3,3',5,6-PentaCB	PCB-112									1.7	5.0 - 10
2,3,3',5',6-PentaCB	PCB-113									5.1	5.0 - 10
2,3,4,4',5-PentaCB	PCB-114									1.6	5.0 - 10
2,3,3',5',6-PentaCB/2,3,4,5,6-PentaCB/2,2',3,4,4'-PentaCB	PCB-117/116/85									7.2	5.0 - 10
2,3',4,4',5-PentaCB	PCB-118									2.4	5.0 - 10
2,3',4,5,5'-PentaCB	PCB-120									2.5	5.0 - 10
2,3',4,5,6-PentaCB	PCB-121									2.1	5.0 - 10
2',3,3',4,5-PentaCB	PCB-122									4.7	5.0 - 10
2',3,4,4',5-PentaCB	PCB-123									3.2	5.0 - 10
3,3',4,4',5-PentaCB	PCB-126									1.5	5.0 - 10
3,3',4,5,5'-PentaCB	PCB-127									3.5	5.0 - 10

Table 2-6b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening		Human Health Screening Values			Analytical Concentration Goals			Laboratory MDLs and MRLs	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**
2,2',3,3',4,4'-HexaCB/2,3,4,4',5,6-HexaCB	PCB-128/166									3.2	5.0 - 10
2,2',3,3',4,5'-HexaCB	PCB-130									1.3	5.0 - 10
2,2',3,3',4,6-HexaCB	PCB-131									1.9	5.0 - 10
2,2',3,3',4,6'-HexaCB	PCB-132									2.5	5.0 - 10
2,2',3,3',5,5'-HexaCB	PCB-133									2.4	5.0 - 10
2,2',3,3',5,6-HexaCB/2,2',3,4,5,6'-HexaCB	PCB-134/143									3.3	5.0 - 10
2,2',3,3',6,6'-HexaCB	PCB-136									2.3	5.0 - 10
2,2',3,4,4',5-HexaCB	PCB-137									2.5	5.0 - 10
2,2',3,4,4',5'-HexaCB/2,3,3',4',5,6-HexaCB/2,2',3,3',4,5 -HexaCB/2,3,3',4,5,6-HexaCB	PCB-138/163/129/160									4.5	5.0 - 10
2,2',3,4,4',6-HexaCB/2,2',3,4,4',6'-HexaCB	PCB-139/140									3.9	5.0 - 10
2,2',3,4,5,5'-HexaCB	PCB-141									1.5	5.0 - 10
2,2',3,4,5,5'-HexaCB	PCB-142									3.9	5.0 - 10
2,2',3,4,5',6-HexaCB	PCB-144									2.0	5.0 - 10
2,2',3,4,6,6'-HexaCB	PCB-145									2.0	5.0 - 10
2,2',3,4',5,5'-HexaCB	PCB-146									1.3	5.0 - 10
2,2',3,4',5,6-HexaCB/2,2',3,4',5',6 -HexaCB	PCB-147/149									2.3	5.0 - 10
2,2',3,4',5,6'-HexaCB	PCB-148									2.7	5.0 - 10
2,2',3,4',6,6'-HexaCB	PCB-150									2.5	5.0 - 10
2,2',3,5,5',6-HexaCB/2,2',3,3',5,6'-HexaCB/2,2',4,4',5',6-HexaCB	PCB-151/135/154									6.8	5.0 - 10
2,2',3,5,6,6'-HexaCB	PCB-152									1.5	5.0 - 10
2,2',4,4',5,5'-HexaCB/2,3',4,4',5',6-HexaCB	PCB-153/168									3.8	5.0 - 10
2,2',4,4',6,6'-HexaCB	PCB-155									3.1	5.0 - 10
2,3,3',4,4',5-HexaCB/2,3,3',4,4',5'-HexaCB	PCB-156/157									1.2	5.0 - 10
2,3,3',4,4',6-HexaCB	PCB-158									1.3	5.0 - 10
2,3,3',4,5,5'-HexaCB	PCB-159									2.3	5.0 - 10
2,3,3',4,5',6-HexaCB	PCB-161									1.6	5.0 - 10
2,3,3',4',5,5'-HexaCB	PCB-162									2.8	5.0 - 10
2,3,3',4',5',6-HexaCB	PCB-164									1.7	5.0 - 10
2,3,3',5,5',6-HexaCB	PCB-165									3.1	5.0 - 10
2,3,4,4',5,5'-HexaCB	PCB-167									1.5	5.0 - 10
3,3',4,4',5,5'-HexaCB	PCB-169									1.2	5.0 - 10
2,2',3,3',4,4',5-HeptaCB	PCB-170									2.0	5.0 - 10

Table 2-6b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

Analytes	Congener number (PCBs only)	Ecological Screening		Human Health Screening Values			Analytical Concentration Goals			Laboratory MDLs and MRLs	
		AWQC [1]	ORNL [2]	EPA Region 9 Tap water PRG [3]	Fish Consumption Only [4]	Site-Specific Fish Consumption Only [5]	Level 1 ACG [6]	Level 2 ACG [7]	Level 3 ACG [8]	MDL	MRL
2,2',3,3',4,4',6-HeptaCB/2,2',3,3',4,5,6-HeptaCB	PCB-171/173									2.1	5.0 - 10
2,2',3,3',4,5,5'-HeptaCB	PCB-172									2.3	5.0 - 10
2,2',3,3',4,5,6'-HeptaCB	PCB-174									2.9	5.0 - 10
2,2',3,3',4,5',6-HeptaCB	PCB-175									1.7	5.0 - 10
2,2',3,3',4,6,6'-HeptaCB	PCB-176									2.7	5.0 - 10
2,2',3,3',4',5,6-HeptaCB	PCB-177									3.4	5.0 - 10
2,2',3,3',5,5',6-HeptaCB	PCB-178									0.8	5.0 - 10
2,2',3,3',5,6,6'-HeptaCB	PCB-179									2.3	5.0 - 10
2,2',3,4,4',5,5'-HeptaCB/2,3,3',4',5,5',6-HeptaCB	PCB-180/193									6.2	5.0 - 10
2,2',3,4,4',5,6-HeptaCB	PCB-181									3.7	5.0 - 10
2,2',3,4,4',5,6'-HeptaCB	PCB-182									2.4	5.0 - 10
2,2',3,4,4',5',6-HeptaCB/2,2',3,4,5,5',6-HeptaCB	PCB-183/185									2.3	5.0 - 10

Table 3-1. Sample Containers and Preservation Requirements for Sediment Trap and Stormwater Samples

Container [1]		Laboratory	Analysis	Preservation	Holding Time
Type	Size				
Sediment Trap Samples					
WMG	8 oz.	Alta	PCB Congeners	Deep Frozen (-20°C)	1 year
WMG	16 oz. [2]	CAS	Total organic carbon	4 ± 2°C	28 days [3]
			Percent solids		6 months [3]
			Metals		6 months [3]
			Mercury		28 days [3]
WMG	16 oz.	CAS	Organochlorine pesticides	4 ± 2°C	1 year
			PAHs and Phthalates		1 year
WMG	8 oz.	CAS	Chlorinated herbicides	4 ± 2°C	1 year
WMG	8 oz.	CAS	Grain size	4 ± 2°C	6 months
Stormwater Samples					
HDPE	1 liter	CAS	Total suspended solids	4 ± 2°C	7 days
HDPE	250 mL	CAS	Total organic carbon	H_2SO_4 to pH < 2; 4 ± 2°C	28 days
HDPE	1 liter	CAS	Total metals	5 mL of 1:1 HNO_3; 4 ± 2°C	6 months/60 days [4]
AG	1 liter	CAS	Organochlorine pesticides	4 ± 2°C	7/40 days [5]
AG	1 liter	CAS	PAHs	4 ± 2°C	7/40 days [5]
AG	1 liter	CAS	Phthalates	4 ± 2°C	7/40 days [5]
AG	1 liter	Alta	PCB Congeners	4 ± 2°C	7/40 days [5]
AG	1 liter	CAS	Chlorinated herbicides	4 ± 2°C	7/40 days [5]

Notes:

AG - amber glass
CAS - Columbia Analytical Services
HDPE - high density polyethylene
WMG - wide mouth glass

[1] The size and number of containers may be modified by the analytical laboratories. Archive samples will be collected for all of the sediment samples.

[2] An additional 8 oz. to 16 oz. jar needed for lab QC for 5% of samples.

[3] Holding times for frozen samples are as follows: Total organic carbon, 1 year; metals (except mercury) and percent solids, 2 years.

[4] The holding time for mercury is 60 days, based on CRITFC study (EPA 2002a) and EPA Method 1631 revision D (EPA 2001a). The holding time for the remaining metals is 6 months.

[5] The holding time is 7 days from collection to extraction, and 40 days from extraction to analysis.

Table 3-2. Estimates of stormwater sample volumes needed to meet minimum mass requirements.

						If sediment traps cannot be deployed			
Priority	**Analyte**	**Units**	**Minimum Sample Size**	**Additional Mass for Lab QC**	**Addl. MassField for field dup/rep**	**Estimated Particle load (min. - median)**	**Estimated Min. Sample Volume**	**Additional Vol. for Lab QC**	**Additional Vol. For field dup/rep**
Sediment Samples									
1A	PCB Congeners	pg/g	10 g	20 g	10 g	(50mg/L - 80mg/L)	200L / 130L	400L / 250L	200L / 130L
1B	TOC	percent	1 g	2 g	1 g	(50mg/L - 80mg/L)	20L / 13L	40L / 25L	20L / 13L
1C	Percent Solids	percent	1 g	2 g	1 g	(50mg/L - 80mg/L)	20L / 13L	40L / 25L	20L / 13L
2	Organochlorine pesticides	µg/kg	10 g	20 g	10 g	(50mg/L - 80mg/L)	200L / 130L	400L / 250L	200L / 130L
3	PAHs and Phthalates	µg/kg	20 g	40 g	20 g	(50mg/L - 80mg/L)	400L / 260L	800L / 500L	400L / 260L
4	Metals	mg/kg	15 g	30 g	15 g	(50mg/L - 80mg/L)	300L / 188L	600L / 375L	300L / 188L
5	Herbicides	µg/kg	10 g	20 g	10 g	(50mg/L - 80mg/L)	200L / 130L	400L / 250L	200L / 130L
6	Grain size	percent	100 g	200 g	100 g	(50mg/L - 80mg/L)	2,000L / 1,300L	4,000L / 2,600L	2,000L / 1,300L
		Subtotal	167 g	334 g	167 g		3,340L / 2,164L	6,680L / 4,328L	3,340L / 2,164L

Estimates of sampling times per analyte group priorities using two sampling methods.

Priority	**Analyte Groups**	**Min. Sample Size**	**Estimated Min. Sample Volume (50mg/L - 80mg/L)**	**Sampling Method**	**Pumping Rates**	**Estimated Sampling Time**
1A-C	PCB Congeners, TOC Percent Solids	12 g	200L / 130L	Peristaltic	1.7L/min	2 h / 1h 20min
				PCF Centrifuge	4L/min	50min / 30 min
1 - 2	Group 1 + pesticides	22 g	440L / 275L	Peristaltic	1.7L/min	4h 20min / 2h 40min
				PCF Centrifuge	4L/min	1h 50min / 1h 10min
1 - 3	Group 1, 2 + PAHs and Phthalates	42 g	840L / 546L	Peristaltic	1.7L/min	8h 15min / 5h 20min
				PCF Centrifuge	4L/min	3h 30min / 2h 15min
1 - 4	Group 1, 2, 3 + Metals	57 g	1,140L / 734L	Peristaltic	1.7L/min	11h 10min / 7h 12 min
				PCF Centrifuge	4L/min	4h 45min / 3h
1 - 5	Group 1,2, 3, 4, + herbicides	67 g	1,340L / 864L	Peristaltic	1.7L/min	13h 10 min / 8h 30min
				PCF Centrifuge	4L/min	5h 40min / 3h 40min
1 - 6	All analytes	167 g	3,340L / 2,164L	Peristaltic	1.7L/min	32h 45min / 21h 10 min
				PCF Centrifuge	4L/min	14h / 9h

Note
PCF Centrifuge = Portable continuous flow centrifuge
Peristaltic = standard volume peristaltic pump
Pumping rates are low estimates. Sampling times may decrease as better suited sampling equipment is identified.

Table 4-1. River Height Statistics (in feet USGS Morrison Street Bridge Gauge*) for Comparison to Sampling Location Elevations.

Statistic	February	March	April	May
Monthly Average				
95th Percentile	14.0	10.9	11.1	13.6
90th Percentile	11.2	10.3	10.9	11.8
80th Percentile	10.1	9.7	8.7	10.2
70th Percentile	8.4	6.6	7.7	9.4
Average	7.6	6.7	6.9	8.3
Daily 90th Percentile Values				
95th Percentile	17.5	13.0	16.6	15.9
90th Percentile	16.5	12.7	16.0	15.7
80th Percentile	15.1	11.9	14.5	15.1
70th Percentile	14.3	11.6	11.9	14.4
Average	13.6	11.3	11.5	13.3

* Morrison Street Bridge Gauge Zero Value Equals:
2.93 ft City of Portland Data (add 2.93 ft to table values to obtain values in COP datum)
1.55 ft NGVD 1929 (add 1.55 ft to table values to obtain values in NGVD 1929 datum)
5.03 ft NAVD 1988 (add 5.03 ft to table values to obtain values in NAVD 1988 datum)