REPORT

SAMPLING AND ANALYSIS PLAN
KENMORE AREA SEDIMENT AND WATER CHARACTERIZATION

Prepared for

Washington State Department of Ecology

Dredged Material Management Program

Washington State Department of Health

On Behalf of

City of Kenmore

18120 68th Avenue NE

Kenmore, Washington 98028

Prepared by

Anchor QEA, LLC

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Seattle, Washington 98101

November 2012

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
µg	microgram
ARI	Analytical Resources, Inc.
BT	bioaccumulation trigger
CCV	continuing calibration verification
City	City of Kenmore
cm	centimeter
COC	chain-of-custody
COI	chemical of interest
CSL	Cleanup Screening Level
cy	cubic yard
DDT	dichlorodiphenyltrichloroethane
DGPS	differential global positioning system
DMMO	Dredged Material Management Office
DMMP	Dredged Material Management Program
DMMU	dredged material management unit
DOH	Washington State Department of Health
DQO	data quality objective
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management
FC	field coordinator
GC/MS	gas chromatograph/mass spectrometer
g	gram
HDPE	high density polyethylene
HPAH	high-molecular-weight polycyclic aromatic hydrocarbon
ID	identification
kg	kilogram
KGM	Kiewit General Manson
KIP	Kenmore Industrial Park
LCS	laboratory control sample

LPAH	low-molecular-weight polycyclic aromatic hydrocarbon
m	meter
mg	milligram
ml	milliliter
MS	matrix spike
MSD	matrix spike duplicate
MTCA	Model Toxics Control Act
NA	not applicable
NAD	North American Datum
ng	nanogram
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD/F	polychlorinated dioxins and furans
PSEP	Puget Sound Estuary Program
QA	quality assurance
QC	quality control
QAPP	Quality Assurance Project Plan
Results Memorandum	Sampling and Analysis Results Memorandum
RL	reporting limit
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SL	Screening Level
SQS	Sediment Quality Standard
SQV	Sediment Quality Value
SRM	standard reference material
SAPA	Sediment Sampling Analysis Plan Appendix
SVOC	Semi-volatile organic compound
SQS	Sediment Quality Standard
TBT	tributyltin
TEQ	toxic equivalency
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

1 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared by the City of Kenmore (City) in partnership with the Washington State Department of Ecology (Ecology) to characterize sediment and water in northeastern portion of Lake Washington south of Kenmore and northwest of the mouth of the Sammamish River. The characterization effort supports a number of objectives for the City and Ecology. First, the characterization is intended to support the City's ongoing work with the U.S. Army Corps of Engineers (USACE) to support a request for federal funding for maintenance dredging of the federal Kenmore Navigation Channel (Figure 1). Second, with assistance from a grant from Ecology, the City and Ecology are conducting additional characterization activities to evaluate the presence and concentration of possible chemicals and the potential presence of contamination along the shoreline. The characterization has been designed to support Ecology's Model Toxics Control Act (MTCA) cleanup action requirements and the Health Consultations to be developed by Washington State Department of Health (DOH). Additionally, at the request of the City of Lake Forest Park, two sediment samples will be collected along the northwestern shoreline of Lake Washington adjacent to Lyon Creek Park.

This SAP describes the screening level sediment characterization to support a request for federal funding for maintenance dredging of the federal Kenmore Navigation Channel in the USACE's maintenance dredging budget. The SAP also characterizes and evaluates nearshore sediment and surface water for public health, safety, and environmental concerns. This plan represents the maximum number of samples and analyses feasible at this time, given the available Clean Sites Initiative Grant funds from Ecology and the City budget. In the future, if more sampling is necessary, additional funds will need to be secured and a new SAP developed.

1.1 Kenmore Navigation Channel Screening Level Characterization

The Kenmore Navigation Channel was constructed in 1981 as a USACE project authorized in Section 107 of the 1960 River and Harbors Act (Figure 1) to a depth of 15 feet below lake level. The Kenmore Navigation Channel is approximately 100 to 120 feet wide and 2,900 feet long, and primarily serves barge and other marine traffic for industrial and commercial uses. The Kenmore Navigation Channel was last sampled in 1996 for dredge

characterization, dredged in 1997, and last surveyed in 2010. The recent survey conducted by the USACE in February 2010 showed shallow areas (i.e., less than 15 feet below lake level) present within the Kenmore Navigation Channel. The most recent maintenance dredging of the Kenmore Navigation Channel was prior to the City's 1998 incorporation. Currently, King County is the Local Sponsor Authority for the Kenmore Navigation Channel and the Sammamish River Small Boat Navigation Channel. The City, King County, and the USACE are presently exploring the possible transfer of the Local Sponsor Authority for the Kenmore Navigation Channel to the City. The USACE estimates that maintenance dredging would require removal of 31,700 cubic yards (cy) of sediment within the channel.

LEGEND

- Harbor Village Marina Cores
- Kenmore EIM-Sediment Results
- Navigation Channel
- DMMUs Not Dredged, Due to not meeting Open Water Suitability
- DMMUs Dredged
- Catchbasin
- Connections
- Conveyance
- Stream

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ANCHOR QEA

Feet
0 200 400 600 800

Figure 1
Existing Information
Sampling and Analysis Plan
Kenmore Sediment Characterization

The Dredged Material Management Office (DMMO) at the USACE has indicated that a screening level characterization will provide information about potential options for disposal of dredged sediment. A full sediment characterization according to Dredged Material Management Program (DMMP) protocols would provide information to determine if sediment is suitable for unconfined open-water disposal. However, these results are only valid for 2 years in areas ranked "High" by DMMP, which includes the Kenmore Navigation Channel. Acquisition of funding and completion of maintenance dredging will not likely occur within the next 2 years. Given the timing of the maintenance dredging, the DMMO agreed that it made sense for the City to conduct a screening level assessment to provide information to support pursuing federal funding for maintenance dredging, and hold off on a full DMMP characterization effort until within two years of the anticipated maintenance dredging event.

The owners of North Lake Marina are also participating parties in the sediment characterization efforts to assess the options for sediment disposal in the event that maintenance dredging is conducted within the marina. The marina owners are interested in privately funding the dredging of the marina in conjunction with the dredging of the Kenmore Navigation Channel to save money and share costs (e.g., dredge equipment mobilization fees) with the USACE.

Any future proposed dredging plans for Kenmore Navigation Channel, Harbour Village Marina, or North Lake Marina will be determined by each party based on navigational needs, cost, and other considerations.

1.2 Additional Nearshore Sediment and Surface Water Characterization

The City and Ecology will be conducting additional characterization activities to evaluate the condition of nearshore sediment and surface water in the Kenmore area waterfront. The purpose of the characterization is to determine sediment and water quality and possible health and environmental risks. This information is to assist better understanding whether potential contamination is present in sediment and surface water. The results are intended to be used by Ecology for characterization activities to evaluate the presence and

concentration of chemicals and possible contamination in the lake and river waterfront areas and to continue the MTCA evaluation of nearshore sediments. The SAP results will also be used to support the Health Consultations to be developed by DOH in the vicinity of Log Boom Park and adjacent to Kenmore Industrial Park (KIP) site also referred to as Lakepointe. The results of this SAP may show that additional testing will be required to further detail source or sources of contamination. The testing parameters and sample locations have been reviewed by Ecology and DOH to support their anticipated evaluations.

1.3 Purpose and Objectives

Sampling for this project is intended to satisfy several objectives:

- The screening level characterization for the Kenmore Navigation Channel and North Lake Marina is intended to provide additional information on potential sediment disposal options and preliminary future dredge budget costs in order to support pursuing federal funding for maintenance dredging.
- Additional characterization activities are intended to:
  - Describe the nearshore sediment matrix, grain size, chemical characteristics and organic carbon content at the Kenmore area waterfront.
  - Evaluate the nearshore sediment and water column chemistry for human health and environmental conditions as defined under MTCA by Ecology.
  - Evaluate the next step in determining waterfront conditions and may need further testing and whether specific areas serve as sources of potential contamination.
  - Prepare Health Consultations by DOH in the vicinity of Log Boom Park and nearshore to KIP site area.

This SAP has been developed in accordance with the 2008 DMMP User's Manual (DMMO 2009) and Ecology's Sediment Sampling and Analysis Plan Appendix (SAPA 2008). For the screening level characterization in the navigation channel, sample density is lower than required for a dredge material suitability determination since this is an initial screening level investigation.

This SAP identifies specific sampling and analysis protocols for the sediment sampling activities and provides detailed information regarding the field sampling objectives; sample

location and frequency, equipment, and procedures to be used during the sampling; and sample handling and analysis. The SAP also provides the basis for planning field activities and describes specific quality assurance (QA) protocols. All sample handling and analyses will follow the most recent Puget Sound Estuary Program (PSEP) protocols for collecting and handling sediment and water samples (PSEP 1986, 1997a, 1997b, 1997c) and the 2008 DMMP User's Manual (including the 2009 update) and Clarification Papers and updates (DMMO 2009; Hoffman 1998; Kendall 2001; USACE 2010; Inouye and Fox 2011).

A Health and Safety Plan for field sampling activities is also provided under separate cover and presents the guidance for field health and safety procedures and considerations.

1.4 Background Information

1.4.1 Site Setting

The Kenmore Navigation Channel is located in the northeastern portion of Lake Washington south of the City of Kenmore and northwest of the mouth of the Sammamish River. Lake Washington is a freshwater lake that is connected to Lake Union by the Lake Washington Ship Canal and to Puget Sound by way of the Hiram M. Chittenden Locks. Historical activities in the area include lumber shipping and log booming. Current surrounding land includes commercial, industrial and residential properties, parks, recreational marinas, and a commercial float plane facility.

Washington Department of Fish and Wildlife operates a public boat launch west of the Juanita Drive (68th Avenue NE) Bridge in Kenmore. There is also shoreline access at the western portion of Log Boom Park that is used as a hand kayak launch (Figure 1).

One of the few remaining industrial ports on Lake Washington is in Kenmore at the mouth of the Sammamish River. Businesses near and at the port include:

- Rinker Materials Kenmore plant (cements and asphalts)
- Kenmore Ready-Mix, a division of the CalPortland Company (cements and asphalt)
- Kiewit General Manson (KGM; temporarily leasing property for the construction of sections for the new State Route 520 bridge at the KIP site)
- Kenmore Air Harbor (the nation's largest seaplane-only, commercial air facility)

- North Lake Marina
- Harbour Village Marina

CalPortland, Rinker Materials, and KGM rely on barge access to provide and distribute materials (e.g., sand, gravel, landscape materials, and construction materials) for their operations (ESA Adolfson 2010).

1.4.2 Summary of Previous Sediment Characterization and Dredging

The sediment data and dredging information presented in this section are from readily available information. The sediment data were obtained from Washington State Department of Ecology's (Ecology) Environmental Information Management (EIM) database and from dredge material evaluations from the DMMO, which also included the dredging information. Previous suitability determinations were accessed from the DMMO website (http://www.nws.usace.army.mil/Missions/CivilWorks/Dredging/SuitabilityDeterminations.aspx).

In 1993, King County characterized and dredged 16,800 cy of sediment from the Sammamish River Small Boat Navigation Channel (Figure 1). Four dredge material management units (DMMUs) were characterized, with the DMMP Screening Level (SL) interpretive criteria for dichlorodiphenyltrichloroethane (DDT) exceeded in one DMMU. This DMMU was subsequently submitted for bioassay testing and passed, resulting in all four DMMUs determined to be suitable for open water disposal. No dioxin and furan testing was performed during this dredge characterization (USACE 1992).

Sediment from the Kenmore Navigation Channel was last characterized in 1996 (USACE 1996) and dredged in 1997. Fifteen DMMUs were analyzed for DMMP analytes (metals, polychlorinated biphenyls [PCBs], semi-volatile organic compounds [SVOCs], volatile organic compounds, pesticides, tributyltin [TBT] and conventionals) to evaluate 60,000 cy of sediment. PCB sediment concentrations from the DMMUs ranged from 17 to 88 micrograms per kilogram (µg/kg), which is below the SL of 130 µg/kg (USACE 1996). Three of the DMMUs exceeded DMMP interpretive criteria; DMMU each exceeded for polycyclic aromatic hydrocarbons (PAHs), TBT and DDT. However, the one DMMU with PAH

exceedances passed biological testing and was determined to be suitable for non-dispersive open-water disposal.[1] The two other DMMUs with TBT and DDT exceedances failed the biological interpretive criteria and were unsuitable for open-water disposal (Figure 1). The unsuitable material (8,000 cy) was not dredged and 52,000 cy of sediment was dredged. No dioxin and furan testing was performed during this dredge characterization.

In 2011, in preparation for proposed maintenance dredging of Harbour Village Marina, the marina owners conducted dredge characterization sediment sampling and analysis. Three DMMUs from the Harbour Village Marina, as shown in Figure 1, were evaluated for disposal options for an anticipated 7,427 cy of sediment. From each DMMU, two or three (depending on the DMMU) cores were composited and submitted for DMMP analytes to evaluate dredge sediment. Additionally, z-samples were collected and composted for each DMMU from the underlying sediment surface that would be exposed after dredging is completed (i.e., z-layer) to evaluate the new sediment surface.

The DMMU samples from Harbour Village Marina had total PCB concentrations of 196, 237, and 277 µg/kg (parts per billion) and dioxin/furan toxic equivalency (TEQ) of 43.2, 77.3, and 92.1 nanograms per kilogram (ng/kg; or parts per trillion), respectively. Additionally, sediment within the underlying sediment surface that would be exposed after dredging is completed (z-layer) had total PCB concentrations of 104, 126, and 237 µg/kg and dioxin/furan TEQ of 0.9, 11.1, and 6 ng/kg. To address the elevated PCB and dioxin/furan concentrations in the sediment that could be exposed by dredging, the DMMP agencies will require the placement of a 1-foot cover of clean sand as a special condition to the dredging permit (USACE 2011). Further testing needs to be conducted. Dredging in Harbour Village Marina has not been completed.

In 2005, a surface sediment sample (LW-SS3-010) and field duplicate sample (LW-SS6-010) were collected adjacent to the Kenmore Navigation Channel as part of a regional background investigation. The sediment samples were analyzed for dioxin and furans, and PCBs. PCBs were not detected in either sample, however dioxin/furan TEQ, which was reported as an

[1] PAH exceedances were based on 1996 interpretive criteria for acenaphthene, anthracene, fluorene, and phenanthrene, which would not have been exceedances based on the current DMMP guidance.

average concentration between the sample and duplicate resulted in an estimated concentration of 13.2 ng/kg (Windward 2010).

In 2000, as part of a lake-wide sediment evaluation investigation, one sample, L18493-1, was collected near Kenmore (King County 2004). PCBs were not detected and no chemicals exceeded DMMP interpretive criteria. Dioxin and furans were not analyzed.

1.4.3 Potential Sediment Loading and Contamination Sources

The principal sediment loading source for the Kenmore Navigation Channel is likely from the Sammamish River and wind and wave transport on Lake Washington (including storms). The 14-mile Sammamish River drains from Lake Sammamish and flows through Redmond, Woodinville, Bothell, and Kenmore, before emptying into Lake Washington bringing suspended solids and sediment with the river. Also, westerly winds blow across Lake Washington toward the east and northeast, bringing increased wave action and suspended solids within the lake water column toward the northeast shoreline (SoundEarth Strategies and Lally Consulting 2011).

Sediment also enters the lake from small creeks and stormwater drains. Tributary 0056 discharges at the north shore at Harbour Village Marina, and Log Boom Park area. Creek 0056 diverges just before the Lake Washington shoreline, and drains to the central portion and just to the west of Harbour Village Marina. The creek drains approximately 1.85 square miles associated with State Route 522 (Northeast Bothell Way) and other residential and urban areas (Herrera 2007) and has experienced flooding and sediment loading (ESA Adolfson 2010). The City conducted investigations in 2005 and 2007 to investigate the current and historical sediment production within this creek, develop sediment management strategies, and evaluate sedimentation reduction alternatives (Herrera 2005, 2007). The City reinforced the western part of the discharge in 2010 to prevent further erosion. Other sources of sediments to the shoreline include stormwater outfalls, which are shown on Figure 1.

There are several areas with historical activities that could have contributed to contamination. One area is the KIP site located adjacent to and north of the mouth of the

Sammamish River. The 45-acre KIP site forms a peninsula that extends into Lake Washington southeast of the Kenmore Navigation Channel. Another area is a plywood mill that was formerly located north of the Kenmore Navigation Channel and east of the North Lake Marina. Other sources are various current and historic commercial and industrial activities, such as the current locations of the CalPortland Company and Cemex in Kenmore Harbor.

In the late 1970s, at the current location of CalPortland Company, there was a fire on the wharf that burned about half of the decking. The wharf was constructed of old creosote timbers and the burned wharf remained along the Kenmore shoreline for several years before the burned debris was removed (LaFlam 2012).

The KIP is currently under Consent Decree with Ecology for site cleanup and monitoring activities (Ecology 2012a). This area was submerged prior to 1916, when the USACE lowered the level of Lake Washington approximately 8 feet when the locks were installed. Subsequently, the area was filled with demolition debris in the 1950s and 1960s to form its present day configuration. It operated as a King County Landfill under permits P-69-138 and 118-72-P, primarily receiving wood construction debris. Landfilling ended in 1969, and the landfill was graded and covered with soil (AMEC 2001). Subsequently, the site has been used as an industrial yard for maritime and concrete manufacturing businesses. Extensive testing has been conducted at the KIP site including soil, groundwater, and sediment testing. Testing has confirmed neither medical wastes nor transformers at the site. Test results have shown no known chemicals of concern are migrating from the former landfill, and the five chemicals of concern are petroleum diesel and oil, and three metals (arsenic, barium, and lead). Specifically, testing in 2001, 2011, and 2012 show no PCBs detected at this site, other than one sample composed of wood chips that was dismissed based on poor quality. Hence, the KIP site does not appear to be a source for PCBs. No testing for dioxin and furans has occurred to date. The sediment sampling offshore of the KIP will be used to evaluate PCBs and dioxin and furans in addition to metals, PAHs, pesticides and semi-volatile organic compounds, and tributyltin (bulk).

Historical operations at the KIP site included assorted small storage and manufacturing industries, sand and gravel staging and support facilities, marine construction, and associated

offices. Currently, the site is operated as an industrial park including SR 520 bridge reconstruction, a sand and gravel stockpile yard, Lakeshore Marine Construction, and storage and light industrial operations.

A contractor for the SR 520 bridge reconstruction, Kiewit General Manson (KGM) is temporarily leasing the 14-acre western portion of the property for the construction of sections for the new bridge and their work is estimated to be finished in 2015.

The KIP site conducts periodic groundwater monitoring to evaluate if any chemicals are migrating from the site to adjacent waterways (i.e., Lake Washington, Sammamish River, and the Kenmore Navigation Channel). Recent monitoring in 2009, 2010, and April and October 2012 show continued compliance with the 2001 Consent Decree. The 2009-2012 groundwater compliance results show all known chemicals of concern at this site (petroleum diesel and oil, arsenic, barium, and lead) are below detection level and/or below cleanup action level (Ecology 2012a). The October 2012 groundwater monitoring results (SCS Engineers 2012) confirm the earlier results and no known chemicals of concern are migrating off the KIP site. In addition, the owner also tested for copper, cadmium, zinc, and semi-volatile organic compounds, which were below detection limits and significantly below action levels.

2 PROJECT MANAGEMENT AND RESPONSIBILITIES

This section describes the overall project management strategy for implementing and reporting for the SAP results.

2.1 Project Planning and Coordination

Dan Berlin of Anchor QEA will be the overall project manager responsible for developing and completing the SAP. Following SAP approval by DMMO and Ecology, Mr. Berlin will be responsible for administrative coordination to ensure the timely and successful completion of the screening level characterization. He will provide a copy of the approved SAP to all sampling and testing subcontractors. Any significant deviation from the approved sampling plan will be coordinated with the DMMO and Ecology.

2.2 Field Sample Collection

David Gillingham of Anchor QEA will serve as the field coordinator (FC) and will provide overall direction to the field sampling in logistics, personnel assignments, and field operations. The FC will supervise field collection of the sediment and water samples and will be responsible for ensuring accurate positioning and recording of sample locations, depths, and identification; ensuring conformity to sampling and handling requirements, including field decontamination procedures; physical evaluation and documentation of the samples; and delivery of the samples to the laboratory. Ecology will participate in the sampling event.

Anchor QEA will ensure that sediment and water samples are stored under proper conditions in their custody until delivery to the laboratory. The FC will be responsible for summarizing field sampling activities. This summary will include details of the sampling effort, sample preparation, sample storage and transport procedures, field QA, and document any deviation from the final SAP.

The sampling and analysis will be completed with equipment owned or rented by Anchor QEA. All subconsultants, Ecology and Anchor QEA will follow the protocols established in this SAP.

2.3 Laboratory Preparation and Analyses

Sue Dunnihoo of Analytical Resources, Inc. (ARI), Tukwila, Washington, will be responsible for physical and chemical analyses. Ms. Dunnihoo will ensure that the submitted samples are handled and analyzed in accordance with DMMP analytical testing protocols, QA/quality control (QC) requirements, and the requirements specified in this SAP (Section 5). ARI will provide certified, pre-cleaned sample containers and sample preservatives as appropriate. ARI will prepare a data package containing all analytical and QA/QC results.

2.4 Quality Assurance/Quality Control Management

Delaney Peterson of Anchor QEA, or her designee, will serve as QA/QC Manager for this project and will be responsible for all coordination with the analytical laboratory. She will perform oversight for both the field sampling and laboratory programs. She will be kept fully informed of field program procedures and progress during sample collection and laboratory activities during sample preparation. She will record and correct any activities that vary from this SAP. Upon completion of the sampling and analytical program, she will review laboratory QA/QC results and incorporate findings into the Sampling and Analysis Results Memorandum (Results Memorandum). Any QA/QC problems will be brought to the attention of the DMMO and Ecology as soon as possible to discuss issues related to the problem and to evaluate potential solutions.

2.5 Sampling and Analysis Results Memorandum

Mr. Berlin, or his designee, will be responsible for preparation of the Results Memorandum to support the suitability determination. The Results Memorandum will summarize the sampling effort; analytical methods; QA/QC narrative; and analytical sediment results with comparison to DMMP interpretive criteria (for screening level characterization sediment samples) and Ecology's interim freshwater Sediment Quality Values (Ecology 2003) (SQV; for all sediment samples) as shown in Table 2. Ecology's 2003 SQVs are currently undergoing re-evaluation under the SMS rule revision process. If new SQVs are finalized when the sediment results are reported, then the sediment results will be compared to the new SQVs. The water sample analytical results will also be presented in the Results Memorandum. The complete content of the Results Memorandum is described in Section 6.

3 SAMPLE COLLECTION, PROCESSING, AND HANDLING PROCEDURES

This section addresses the sample collection, processing, and handling procedures that will be used to ensure data quality and chain-of-custody (COC).

3.1 Sampling Schedule

Sampling will occur within 3 weeks after approval of this SAP by DMMO and Ecology in November 2012. The Anchor QEA project manager will coordinate with the appropriate City manager and Ecology. It is anticipated that field sampling activities can be completed within three days.

3.2 Station and Sample Identification and Nomenclature

Figure 2 presents the proposed surface sediment and water sampling locations. Table 1 presents detailed summaries of the sediment and water sampling design including sample nomenclature for each station and sample. The sample nomenclature is described below.

Each sample will be assigned a unique alphanumeric identifier according to the following method:

- Each sample identification (ID) will be identified by *Sample Method-Location Number-Matrix-Sample Sponsor*
  - Sample method will be identified by two letters: SG for sediment grab, HT for sediment hand trowel, WS for surface water (back ground location only). Three of the water sample locations are co-located with hand trowel locations and therefore will begin with HT and the same location number to indicate that the sample is co-located and followed by W to indicate water sample.
  - Sample location number will be in order of sampling locations beginning with -01 (e.g., SG-01-S-C)
  - Sample matrix will be S for sediment and W for water
  - Sample sponsor will C for City and E for Ecology
- A field duplicate collected from a sample will be identified by the addition of "Dup" to the sample number. A duplicate sample of the above example would be SG-01-S-C-Dup.

Table 1
Sample Locations, Collection Methods, and Rationale

Location ID	Sample ID	Sample Location Description	Collection Method	Sample Type	Collection Depth	Coordinate		Ownership	Purpose	Analyses [b, c ,d]
						X[a]	Y[a]			
Sediment										
HT-01	HT-01-S-C	Log Boom Park; west kayak launch pad	Hand trowel	Sediment	0 - 10 cm	1288073	279596	City	Location investigation for site COIs, concentrations, and source(s)	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC
HT-02	HT-02-S-C	Log Boom Park; east kayak launch pad	Hand trowel	Sediment	0 - 10 cm	1288199	279600	City	Location investigation for site COIs, concentrations, and source(s)	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC
HT-03	HT-03-S-C	Log Boom Park; mid nearshore	Hand trowel	Sediment	0 - 10 cm	1288480	279517	City	Location investigation for site COIs, concentrations, and source(s)	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC
HT-04	HT-04-S-C	Log Boom Park; north of northwest corner of pier	Hand trowel	Sediment	0 - 10 cm	1288688	279423	City	Location investigation for site COIs, concentrations, and source(s)	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC
HT-05	HT-05-S-C	Log Boom Park; south of pier at northeast corner of pier	Hand trowel	Sediment	0 - 10 cm	1288689	279263	City	Location investigation for site COIs, concentrations, and source(s)	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC
HT-06	HT-06-S-E	Harbour Village Marina; Pier 3, confluence Tributary 0056	Hand trowel	Sediment	0 - 10 cm	1288798	279224	State	Further investigation for lateral extent, concentrations, and source(s)	SVOCs and metals, PCBs, TBT (bulk), D/Fs, DMMP pesticides, grain size, TS, and TOC
HT-07	HT-07-S-E	Harbour Village Marina; northwest 500-foot upgradient confluence, Creek 0056	Hand trowel	Sediment	0 - 10 cm	1289073	279448	City	Further investigation for lateral extent, concentrations, and source(s)	SVOCs and metals, PCBs, TBT (bulk), D/Fs, DMMP pesticides, grain size, TS, and TOC
HT-08	HT-08-S-C	Sammamish River; west boat launch	Hand trowel	Sediment	0 - 10 cm	1291775	278398	State	Preliminary investigation for COIs and concentrations	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC
HT-09	HT-09-S-C	Sammamish River; east boat launch	Hand trowel	Sediment	0 - 10 cm	1291926	278362	State	Preliminary investigation for COIs and concentrations	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC
HT-10	HT-10-S-LFP	Lake Forest Park; nearshore	Hand trowel	Sediment	0 - 10 cm	TBD	TBD	City of Lake Forest Park	Preliminary investigation for COIs and concentrations	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC

Location ID	Sample ID	Sample Location Description	Collection Method	Sample Type	Collection Depth	Coordinate		Ownership	Purpose	Analyses [b, c ,d]
						X[a]	Y[a]			
HT-11	HT-11-S-LFP	Lake Forest Park; offshore	Hand trowel	Sediment	0 - 10 cm	TBD	TBD	City of Lake Forest Park	Preliminary investigation for COIs and concentrations	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC
SG-01	SG-01-S-C	Sammamish River; Small Boat Navigation Channel	Grab	Sediment	0 - 10 cm	1289452	277890	State	Preliminary investigation for COIs and concentrations	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC
SG-02	SG-02-S-C	North Lake Marina	Grab/ Box Core	Sediment	0 - 25 cm	1289548	279178	Private	Pre-dredge screening for COIs and concentrations	SVOCs and metals, PCBs, TBT (porewater), D/Fs, DMMP pesticides, grain size, TS, and TOC, archive for bulk TBT
SG-03	SG-03-S-C	North Lake Marina	Grab/ Box core	Sediment	0 - 25 cm	1289660	279175	Private	Pre-dredge screening for COIs and concentrations	SVOCs and metals, PCBs, TBT (porewater), D/Fs, DMMP pesticides, grain size, TS, and TOC, archive for bulk TBT
SG-04	SG-04-S-C	Kenmore Navigation Channel	Grab/ Box core	Sediment	0 - 25 cm	1290226	279112	Private	Pre-dredge screening for COIs and concentrations	SVOCs and metals, PCBs, TBT (porewater), D/Fs, DMMP pesticides, grain size, TS, and TOC, archive for bulk TBT
SG-05	SG-05-S-C	Kenmore Navigation Channel	Grab/ Box core	Sediment	0 - 25 cm	1289799	278863	State	Pre-dredge screening for COIs and concentrations	SVOCs and metals, PCBs, TBT (porewater), D/Fs, DMMP pesticides, grain size, TS, and TOC, archive for bulk TBT
SG-06	SG-06-S-C	Kenmore Navigation Channel	Grab/ Box core	Sediment	0 - 25 cm	1289359	278612	State	Pre-dredge screening for COIs and concentrations	SVOCs and metals, PCBs, TBT (porewater), D/Fs, DMMP pesticides, grain size, TS, and TOC, archive for bulk TBT
SG-07	SG-07-S-C	Kenmore Navigation Channel	Grab/ Box core	Sediment	0 - 25 cm	1289070	278254	State	Pre-dredge screening for COIs and concentrations	SVOCs and metals, PCBs, TBT (porewater), D/Fs, DMMP pesticides, grain size, TS, and TOC, archive for bulk TBT
	SG-07-S-C-Dup	Field Duplicate of SG-07	Grab/ Box core	Sediment	0 - 25 cm	1289070	278254	State	Field duplicate	SVOCs and metals, PCBs, TBT (porewater), D/Fs, DMMP pesticides, grain size, TS, and TOC, archive for bulk TBT

Location ID	Sample ID	Sample Location Description	Collection Method	Sample Type	Collection Depth	Coordinate		Ownership	Purpose	Analyses [b, c ,d]
						X[a]	Y[a]			
SG-08	SG-08-S-C	Kenmore Navigation Channel	Grab/ Box core	Sediment	0 - 25 cm	1288696	277759	State	Pre-dredge screening for COIs and concentrations	SVOCs and metals, PCBs, TBT (porewater), D/Fs, DMMP pesticides, grain size, TS, and TOC, archive for bulk TBT
SG-09	SG-09-S-C	Kenmore Navigation Channel	Grab/ Box core	Sediment	0 - 25 cm	1288458	277396	State	Pre-dredge screening for COIs and concentrations	SVOCs and metals, PCBs, TBT (porewater), D/Fs, DMMP pesticides, grain size, TS, and TOC, archive for bulk TBT
SG-10	SG-10-S-E	Harbour Village Marina; southwest of channel 5, west of slip 501	Grab	Sediment	0 - 10 cm	1288816	279194	State	Further investigation for lateral extent, concentrations, and source(s)	SVOCs and metals, PCBs, TBT (bulk), D/Fs, DMMP pesticides, grain size, TS, and TOC
SG-11	SG-11-S-E	Harbour Village Marina; channel 3, between slip 301 and 433	Grab	Sediment	0 - 10 cm	1289047	279149	State	Further investigation for lateral extent, concentrations, and source(s)	SVOCs and metals, PCBs, TBT (bulk), D/Fs, DMMP pesticides, grain size, TS, and TOC
SG-12	SG-12-S-E	Harbour Village Marina; southwest of channel 5, west of slip 513	Grab	Sediment	0 - 10 cm	1288782	278974	State	Further investigation for lateral extent, concentrations, and source(s)	SVOCs and metals, PCBs, TBT (bulk), D/Fs, DMMP pesticides, grain size, TS, and TOC
SG-13	SG-13-S-E	Harbour Village Marina; channel 1, between slip 115 and 218	Grab	Sediment	0 - 10 cm	1289314	278856	State	Further investigation for lateral extent, concentrations, and source(s)	SVOCs and metals, PCBs, TBT (bulk), D/Fs, DMMP pesticides, grain size, TS, and TOC
	SG-13-S-E-Dup	Field Duplicate of SG-13	Grab	Sediment	0 - 10 cm	1289314	278856	State	Field Duplicate	SVOCs and metals, PCBs, TBT (bulk), D/Fs, DMMP pesticides, grain size, TS, and TOC
SG-14	SG-14-S-E	Kenmore Harbor	Grab	Sediment	0 - 25 cm	1290608	279416	Private	Pre-dredge screening for COIs and concentrations	SVOCs and metals, PCBs, TBT (porewater), D/Fs, DMMP pesticides, grain size, TS, and TOC, archive for bulk TBT

Location ID	Sample ID	Sample Location Description	Collection Method	Sample Type	Collection Depth	Coordinate		Ownership	Purpose	Analyses [b, c ,d]
						X[a]	Y[a]			
SG-15	SG-15-S-E	Kenmore Industrial Park; western shoreline of site	Grab	Sediment	0 - 10 cm	1290070	278638	State	Location investigation for site COIs, concentrations, and source(s)	SVOCs and metals, PCBs, TBT (bulk), D/Fs, DMMP pesticides, grain size, TS, and TOC
SG-16	SG-16-S-E	Kenmore Industrial Park; Sammamish River midway between wells AW-06 and AW-11	Grab	Sediment	0 - 10 cm	1290550	278329	State	Location investigation for site COIs, concentrations, and source(s)	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC
SG-17	SG-17-S-E	Kenmore Industrial Park; Sammamish River south of well AW-010	Grab	Sediment	0 - 10 cm	1291541	278637	State	Location investigation for site COIs, concentrations, and source(s)	SVOCs and metals, PCBs, D/Fs, grain size, TS, and TOC
Water										
HT-01	HT-01-W-C	Log Boom Park; west kayak launch pad	hand dipped or dipper	Water	0.6 in -3 ft below surface	1288073	279596	City	Water column investigation for chemicals of COIs; Co-located with sediment sample location	SVOCs, total and dissolved priority pollutant metals, TSS, TDS, hardness, and WQ parameters[e]
HT-04	HT-04-W-C	Log Boom Park; north of northwest corner of pier	hand dipped or dipper	Water	0.6 in -3 ft below surface	1288688	279423	City	Water column investigation for chemicals of COIs; Co-located with sediment sample location	SVOCs, total and dissolved priority pollutant metals, TSS, TDS, hardness, and WQ parameters[e]
	HT-04-W-C-dup	Field Duplicate of HT-04	hand dipped or dipper	Water	0.6 in -3 ft below surface	1288688	279423	City	Field duplicate	SVOCs, total and dissolved priority pollutant metals, TSS, TDS, hardness, and WQ parameters[e]
WS-10	WS-10-W-C	Center of Lake Washington in the vicinity of Kenmore	hand dipped or dipper	Water	0.6 in -3 ft below surface	1287855	278271	State	Water column investigation for COIs and concentrations; background	SVOCs, total and dissolved priority pollutant metals, TSS, TDS, hardness, and WQ parameters[e]

Notes:

a – Washington North Zone, NAD 83 geographic and state plane coordinates - U.S. survey feet

b – All sediment samples will be tested for SMS and DMMP SVOCs and metals.

c – Any remaining sediment after the jars for the analyses listed are filled will be archived

d – The analyses of pesticides, PCBs, and dioxin and furans is not being conducted in the water samples at this time since these chemicals are usually not detected in water even when detected in co-located sediment because they do not readily dissolve in water. However, if these chemicals are found in sediments at significant levels, additional surface water samples may be collected and analyzed in the future.

e – Water quality parameters to be collected in the field include turbidity, conductivity, temperature, dissolved oxygen, and pH.
City = City of Kenmore
cm = centimeter
COI = chemical of interest
D/F = dioxin and furan
DMMP = Dredged Material Management Program
m = meter
ft = feet
PCB = polychlorinated biphenyl
SMS = Sediment Management Standards
SVOC = semivolatile organic compound
TOC = total organic carbon
TBT = tributyltin
TS = total solids
TDS = total dissolved solids
TSS = total suspended solids
WQ = water quality

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ANCHOR QEA

Feet
0 200 400 600 800

Figure 2
Proposed Sample Locations
Sampling and Analysis Plan
Kenmore Sediment Characterization

3.3 Station Positioning

Horizontal positioning will be determined by the onboard differential global positioning system (DGPS) based on target coordinates shown in Table 1. Measured station positions will be converted to latitudinal and longitudinal coordinates (North American Datum [NAD] 83) to the nearest 0.01 second and referenced to state plane coordinates (WAC 173-340-840 4(f)). The accuracy of measured and recorded horizontal coordinates is typically less than 1 meter and will be within 2 meters following DMMP guidance. Vertical elevation of each station will be measured using a fathometer or lead line. Lake elevations will be based the USACE's monitoring station at the Lake Washington Ship Canal Elevation at the Hiram M. Chittenden Locks and recorded each day of the sampling event.

3.4 Collection Methods

Thirty sediment samples (including two field duplicates) will be collected from 28 locations at the following areas: Kenmore Navigation Channel, Sammamish River, near shore at Log Boom Park, offshore of the KIP, at the public motor boat launch in the Sammamish River, from Tributary 0056, from the Harbor Village Marina and North Lake Marina, and from near shore adjacent to Lyon Creek Park in the City of Lake Forest Park. Three water samples (including a duplicate) will be collected at Log Boom Park and one background water sample will be collected offshore and south of Log Boom Park at Lake Washington.

The sediment and water sampling methods are described in greater detail below. The location ID, sample ID, collection method, and collection depth are presented on Table 1. The sample locations are shown on Figure 2.

3.4.1 Sediment

Samples from the navigation channel are anticipated to be collected using a box core or power grab sampler or similar device to the maximum penetration possible (target 25 centimeter [cm] below mudline) to better represent deeper sediment that could be removed during dredging. Samples from other submerged areas away from the shoreline will be collected from the top 10 cm using a grab sampler (e.g., VanVeen or Ekman sampler) to represent the biologically active zone, consistent with guidance in Ecology's SAPA (Ecology 2008).

Samples from Log Boom Park, at the public motor boat launch, and in Tributary 0056 will be collected on foot using a hand trowel from shallow submerged sediment areas. Sample HT-10 at Lake Forest Park may be exposed due to lower lake levels at this time of year. At hand collected locations, care will be taken to prevent re-suspension of sediment prior to and during sampling. Sediment will be collected as close as possible to the target coordinates to collect fine grained material (to the extent available) to represent areas where people are likely to come in contact with the sediment. Sampling will be conducted from submerged locations as close as possible to each target location. The sediment will be collected at a uniform depth across the sample area within the top 10 cm to represent what individuals would be exposed to during swimming and/or other recreational activities.

For all other samples, sampling locations will be approached at slow boat speed with minimal wake to minimize disturbance of bottom sediments prior to sampling. Sediment samples will be handled carefully to minimize disturbance during collection, and to equally represent each depth interval (top and bottom of sample). Samples will be placed into laboratory certified containers and transported to the laboratory under COC. The sampler will be lowered over the side of the boat from a cable wire at an approximate speed of 0.3 feet per second. When the sampler reaches the mudline, the cable will be drawn taut and DGPS measurements recorded.

Each surface grab sample will be retrieved aboard the vessel and evaluated for the following acceptance criteria:

- Overlying water is present and has low turbidity
- Adequate penetration depth is achieved
- Sampler is not overfilled
- Sediment surface is undisturbed
- No signs of winnowing or leaking from sampling device

Samples not meeting these criteria will be rejected near the location of sample collection. The process will be repeated until criteria have been met. Deployments will be repeated within a 20-foot radius of the proposed sample location. If adequate penetration is not achieved after multiple attempts, less volume will be accepted and noted in the sediment

sampling log form. Once accepted, overlying water will be siphoned off and a decontaminated stainless steel trowel, spoon, or equivalent will be used to collect the required sediment from inside the sampler without touching the sidewalls. The sampler will be decontaminated between stations.

After sample collection, the following information will be recorded on the Sediment Sampling daily log form:

- Date, time, and name of person logging sample
- Weather conditions
- Sample location number and coordinates
- Project designation
- Depth of water at the location and surface elevation
- Sediment penetration and depth
- Sediment sample interval
- Sample recovery
- Physical observations in general accordance with the visual-manual description procedure (ASTM D-2488 modified) such as apparent grain size, wood debris, color, odor, layering, anoxic contact, and presence of sheen, shells or other debris

3.4.2 Surface Water

Prior to collecting the water sample, water quality parameters will be measured in the field at each surface water sampling location using a multi-probe water quality meter (e.g., YSI). The water quality meter will be lowered 1ft below the surface and allowed to equilibrate before taking measurements of turbidity, conductivity, temperature, dissolved oxygen, and pH. Results for water quality parameters will be recorded on the water quality and sample collection form (Appendix A).

At each water sample location, water will be collected according to Ecology's Standard Operating Procedure guidance (Ecology 2006) which is consistent with the protocols of the Beach Environmental Assessment, Communication and Health (BEACH) program (Schneider 2004). Water will be collected by hand by dipping the laboratory supplied water bottle or by using a dipper attached to an extension rod to a depth of at least 6 inches below

the surface (Ecology 2006). Since the water samples will be collected from a beach, Ecology recommends wading into knee deep water (2.5 feet) and avoid collecting disturbed sediment or coming in contact with the bottom substrate (Ecology 2010). The background location will be collected from Lake Washington, offshore of Log Boom Park to the south, from a boat on the same day as the shoreline water samples. The same sampling methods will be used from the boat. Care will be taken to collect the water sample from an area that is undisturbed.

The actual surface water sample location will be determined in the field, selected as the most representative accessible location to safely sample and achieve the goals of the project. The total water depth and field parameters will be recorded on the surface water collection form (Appendix A) at each water sample location. Water samples will be placed in a cooler with ice, entered into COC and shipped or delivered on ice to the laboratory within 24 hours of collection. Water quality field measurement data, sample collection information, and ancillary information from each collection station and event will be recorded on field data forms (Appendix A). Ancillary information will include:

- Date and time of each sample/measurement collection
- Water sample collection depth and total water column depth
- Field parameter measures recorded on field data form
- Weather conditions and general observations (e.g., boating traffic, river flow for the sample in the Sammamish River, sheen, or turbid water)
- Visual observations of water and samples at each sampling location
- Field calibration check and calibration information
- Names of personnel present collecting samples and recording data
- General observations about collection procedures and any deviations from this SAP
- Condition of equipment or meters that might impact water quality data

Generally, all information pertinent to water quality will be recorded on the field data forms. Each water grab sample will be treated as a discrete sample and labeled with a unique sample number. The sample numbering scheme for each sample is provided in Table 1. Each sample collected will be clearly labeled using a waterproof label with an indelible pen. Each sample label will contain the project name and project number, the unique sample

identification number, date and time of sample collection, analysis to be performed, preservative (as applicable), and the initials of the person collecting the sample.

3.4.3 Sample Processing

Sediment from the sampler will be placed into a stainless steel bowl and homogenized with a stainless steel spoon. Homogenized surface sediment will be spooned immediately into appropriate pre-cleaned, pre-labeled sample containers (Table 2), placed in coolers filled with ice or equivalent, and maintained at 4°C. Debris and materials not representative of the sediment will be omitted from sample containers. Water samples will be poured directly from the sampler into appropriate pre-cleaned, pre-labeled sample containers (Table 2), placed in coolers filled with ice or equivalent, and maintained at 4°C. All samples collected will be entered into COC. All samples for chemical and physical analysis will be securely packed and hand delivered to ARI in Tukwila, Washington as described in Section 4. Archived samples will be held at the laboratory.

Table 2
Guidelines for Sample Handling and Storage

Parameter	Sample Size	Container Size and Type[a]	Holding Time	Preservative
Sediment				
Total metals	50 g	4-oz glass	6 months; 28 days for Hg	Cool/4°C
			3 years; 28 days for Hg	Freeze[b]/-18°C
Tributyltin (porewater)	500 ml	2 32-oz glass	7 days until porewater extraction	Cool/4°C
			14 days until extraction	
			40 days after extraction	
Tributyltin (bulk)	50 g	8-oz glass	14 days until extraction	Cool/4°C
Semivolatile organic compounds/ Pesticides/ Polychlorinated Biphenyls	150 g	16-oz glass	14 days until extraction	Cool/4°C
			1 year until extraction	Freeze/-18°C
			40 days after extraction	Cool/4°C
Dioxins and Furans	150 g	8-oz glass	1 year to extraction	Freeze -18°C
			1 year after extraction	Freeze -18°C
Total solids/total volatile solids	50 g	8-oz glass	14 days	Cool/4°C
			6 months	Freeze -18°C

Parameter	Sample Size	Container Size and Type[a]	Holding Time	Preservative
Total organic carbon	125 g	from TS/TVS container	14 days	Cool/4°C
			6 months	Freeze -18°C
Grain size	500 g	16-oz glass	6 months	Cool/4°C
Archive	---	8 or 16-oz glass[c]	14 days until extraction	Cool/4°C
			1 year until extraction	Freeze/-18°C
Surface Water				
Semivolatile organic compounds	500 ml	2 500 ml amber glass	7 days until extraction	Cool/4°C
			40 days after extraction	
Dissolved metal[d]	100 ml	500 ml HDPE	6 months; 28 days for mercury	Cool/4°C
Total metals	100 ml	500 ml HDPE	6 months; 28 days for mercury	5.0 ml of 1:1 nitric acid
Total Suspended Solids	500 ml	1 L HDPE	7 days	Cool/4°C
Total Dissolved Solids	500 ml	1 L HDPE	7 days	Cool/4°C
Hardness	100 ml	from total metals container	6 months	Cool/4°C

Notes:
a – All sample containers will have lids with Teflon inserts
b – Samples will be analyzed for mercury before freezing
c – Container size dependent on available amount of extra sediment; at a minimum 8 ounces will be archived, but not more than 16 ounces
d –Sample will be filtered in the lab with a0.45-µm filter
°C = degrees Celsius
g = gram
HDPE = high density polyethylene
mL = milliliter
oz = ounce
TS/TVS = total solids/total volatile solids

3.5 Equipment Decontamination Procedures

Sample containers, collection equipment, working surfaces, and other items that may come into contact with sediment and surface water must meet high standards of cleanliness. All equipment and instruments used that are in direct contact with the sediment collected for analysis will be made of glass, stainless steel, or high density polyethylene (HDPE), and will be cleaned prior to each day's use and between sample locations. Decontamination of all items will follow PSEP protocols. The decontamination procedure is as follows:

- Perform pre-wash rinse with site water
- Wash with solution of laboratory-grade, non-phosphate based soap (e.g., Alconox®)
- Rinse with site water

- Rinse three times with laboratory-grade distilled water
- Cover all decontaminated items with aluminum foil
- Store in clean area or closed container for next use

3.6 Field Quality Assurance/Quality Control Samples

Field QA/QC samples will be used to evaluate the efficiency of field collection and processing and decontamination procedures. All field QA/QC samples will be documented on the collection form. Two sediment and one water field duplicate samples will be collected and analyzed for the same chemical parameters as the original sample (Table 2).

3.7 Waste Management

All sediment and water remaining after sampling will be washed overboard at the collection station prior to moving to the next sampling station. Any sediment spilled on the deck of the sampling vessel will be washed into the surface water at the collection site.

All disposable sampling materials and personnel protective equipment used in sample processing, such as disposable coveralls, gloves, and paper towels, will be placed in heavy-duty garbage bags or other appropriate containers.

4 SAMPLE TRANSPORT AND CHAIN-OF-CUSTODY PROCEDURES

This section addresses the sampling program requirements for maintaining custody of the samples throughout the sample collection and delivery process.

4.1 Sample Custody Procedures

Samples are considered to be in one's custody if they are: 1) in the custodian's possession or view; 2) in a secured location (under lock) with restricted access; or 3) in a container that is secured with an official seal such that the sample cannot be reached without breaking the seal.

COC procedures will be followed for all samples throughout the collection, handling, and analysis process. The principal document used to track possession and transfer of samples is the COC form. Each sample will be represented on a COC form the day it is collected. All data entries will be made using indelible ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, then dating and initialing the change. Blank lines/spaces on the COC form will be lined-out and dated and initialed by the individual maintaining custody.

A COC form will accompany each cooler of samples to the analytical laboratory. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured. Copies of all COC forms will be retained in the project files.

4.2 Sample Delivery and Receipt Requirements

All samples will be hand delivered to the analytical laboratory no later than 24 hours after collection. Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample container will sign the COC form and date, time, and sample condition. Upon receipt of samples at the laboratory the receiver will record the condition of the samples on a sample receipt form. COC forms will be used internally in the laboratory to track sample handling and final disposition.

5 CHEMICAL AND PHYSICAL ANALYTICAL TESTING

Surface sediment samples will be submitted for chemical and physical analyses for the full DMMP analyte list (DMMO 2010, 2011) for the screening level characterization. The DMMP analyte list includes laboratory analysis for metals, SVOCs, pesticides, PCBs, dioxin and furans, and TBT porewater in the navigation channel and in North Lake Marina (or bulk if insufficient porewater is available for those locations), and physical parameters including total organic carbon, grain size, and moisture content. These results will be compared to DMMP interpretive criteria for open water disposal (DMMO 2010, 2011).

The remaining sediment samples collected in nearshore areas will be tested for the Sediment Management Standards (Ecology 1995) including metals, semi-volatile organic compounds, pesticides, PCBs, and dioxin furans; and physical parameters, including total organic carbon and grain size. Bulk TBT analysis will also be conducted at these locations. These results will be compared to Ecology's Sediment Quality Values (Ecology 2003, or Sediment Evaluation Framework for fresh water, if finalized [under review]).

Ecology's SAPA (Ecology 2008) and the DMMP User's Manual (DMMO 2009) specify sampling and testing protocols for the chemical characterization of sediment, with the DMMP process designed specifically for dredged material being considered for open-water disposal. Method detection limits will be below the RLs specified in Table 3, if technically feasible. To achieve the required RLs, some modifications to the methods may be necessary. These modifications from the specified analytical methods will be provided by the laboratory at the time of establishing the laboratory contract. The modifications must be approved by DMMO and Ecology prior to implementation.

Water samples will be submitted for Washington State drinking water primary and secondary metals (246-290 WAC) as total and dissolved metals, SVOCs, hardness, total suspended solids, and total dissolved solids. Surface water samples will be analyzed by ARI.

Chemical and physical testing will be conducted at ARI, which is accredited by the National Environmental Laboratories Accreditation Program and Washington Accreditation. All chemical and physical testing will adhere to the most recent PSEP analysis protocols and

QA/QC procedures (PSEP 1997b, 1997c) and follow the 2008 DMMP User's Manual (DMMO 2009) and Clarification Papers (Hoffman 1998; Kendall 2001). For dioxin/furan analysis, the information contained in the Revised Supplemental Information on Polychlorinated Dioxins and Furans (PCDD/F) for Use in Preparing a Quality Assurance Project Plan (QAPP; USACE 2010) will be followed. Porewater extraction for TBT analysis will not be performed in the field, but rather will be done in the laboratory according to standardized methods and following the most recent DMMP clarification paper (Hoffman 1998).

Table 3 provides the sediment analyte list, analytical method, and the target RL for each analyte to support Ecology and DMMP goals, where appropriate. Table 4 provides the water analyte list, analytical method, and the target RL. All sample analyses will be conducted in accordance with Ecology-approved methods.

Table 3
Sediment Analyte List, Interpretive Criteria, Analytical Methods, and Reporting Limits

Parameter	DMMP Interpretive Criteria (Marine)			Sediment Quality Values (Freshwater)		Analytical Method	Reporting Limit
	Screening Level	BT	Maximum Level	SL1	SL2		
Conventional Parameters, %							
Gravel	---	---	---	---	---	PSEP	0.1
Sand	---	---	---	---	---	PSEP	0.1
Silt	---	---	---	---	---	PSEP	0.1
Clay	---	---	---	---	---	PSEP	0.1
Fines	---	---	---	---	---	PSEP	0.1
Total solids	---	---	---	---	---	PSEP	0.1
Total volatile solids	---	---	---	---	---	PSEP	0.1
Total organic carbon	---	---	---	---	---	PSEP	0.1
Metals, mg/kg dry weight							
Antimony	150	---	200	---	---	6010B/6020	15
Arsenic	57	507.1	700	20	51	6010B/6020	10
Cadmium	5.1	11.3	14	1.1	1.5	6010B/6020	0.5
Chromium	---	260	---	95	100	6010B/6020	10
Copper	390	1,027	1,300	80	830	6010B/6020	10
Lead	450	975	1,200	340	430	6010B/6020	4
Mercury	0.41	1.5	2.3	0.28	0.75	7471A	0.05
Nickel	---	---	---	60	70	6010B/6020	0.5
Selenium	---	3[a]	---	---	---	6010B/6020	0.5
Silver	6.1	6.1	8.4	2.0	2.5	6010B/6020	0.6

Parameter	DMMP Interpretive Criteria (Marine)			Sediment Quality Values (Freshwater)		Analytical Method	Reporting Limit
	Screening Level	BT	Maximum Level	SL1	SL2		
Zinc	410	2,783	3,800	130	400	6010B/6020	15
Organometallic Compounds							
Tributyltin (porewater) µg/L	0.15	0.15	---	---	---	GC/MS Krone	0.15
Triutyltin (bulk) µg/kg[b]	73.2	73.2	---	75	75	GC/MS Krone	5
Polycyclic Aromatic Hydrocarbons, µg/kg dry weight[c]							
Total LPAH	5,200	---	29,000	6,600	9,200	---	---
Naphthalene	2,100	---	2,400	500	1,300	8270D SIM 8270D	5.0 20
Acenaphthylene	560	---	1,300	470	640	8270D SIM 8270D	5.0 20
Acenaphthene	500	---	2,000	1,100	1,300	8270D SIM 8270D	5.0 20
Fluorene	540	---	3,600	1,000	3,000	8270D SIM 8270D	5.0 20
Phenanthrene	1,500	---	21,000	6,100	7,600-	8270D SIM 8270D	5.0 20
Anthracene	960	---	13,000	1,200	1,600	8270D SIM 8270D	5.0 20
2-Methylnaphthalene[d]	670	---	1,900	470	560	8270D SIM 8270D	5.0 20
Total HPAHs	12,000	---	69,000	31,000	55,000	---	---
Fluoranthene	1,700	4,600	30,000	11,000	15,000	8270D SIM 8270D	5.0 20
Pyrene	2,600	11,980	16,000	8,800	16,000	8270D SIM 8270D	5.0 20
Benzo(a)anthracene	1,300	---	5,100	4,300	5,800	8270D SIM 8270D	5.0 20
Chrysene	1,400	---	21,000	5,900	6,400	8270D SIM 8270D	5.0 20
Total benzo(b+j+k)fluoranthenes	3,200	---	9,900	600	4,000	8270D SIM 8270D	5.0 20
Benzo(a)pyrene	1,600	---	3,600	3,300	4,800	8270D SIM 8270D	5.0 20
Indeno(1,2,3-cd)pyrene	600	---	4,400	4,100	5,300	8270D SIM 8270D	5.0 20
Dibenz(a,h)anthracene	230	---	1,900	800	840	8270D SIM 8270D	5.0 20
Benzo(g,h,i)perylene	670	---	3,200	4,000	5,200	8270D SIM 8270D	5.0 20
Chlorinated Hydrocarbons, µg/kg dry weight							
1,4-Dichlorobenzene	110	---	120	---	---	8270D	20
1,2-Dichlorobenzene	35	---	110	---	---	8270D	20
1,2,4-Trichlorobenzene	31	---	64	---	---	8270D	20
Hexachlorobenzene	22	168	230	---	---	8081B	1.0

Parameter	DMMP Interpretive Criteria (Marine)			Sediment Quality Values (Freshwater)		Analytical Method	Reporting Limit
	Screening Level	BT	Maximum Level	SL1	SL2		
Phthalates, µg/kg dry weight							
Dimethyl phthalate	71	---	1,400	46	400	8270C	20
Diethyl phthalate	200	---	1,200	---	---	8270C	50
Di-n-butyl phthalate	1,400	---	5,100	---	---	8270C	20
Butyl benzyl phthalate	63	---	970	260	370	8270C	20
Bis(2-ethylhexyl) phthalate	1,300	---	8,300	220	320	8270C	25
Di-n-octyl phthalate	6,200	---	6,200	26	45	8270C	20
Phenols, µg/kg dry weight							
Phenol	420	---	1,200	---	---	8270C	20
2-Methylphenol	63	---	77	---	---	8270C	20
4-Methylphenol	670	---	3,600	---	---	8270C	40
2,4-Dimethylphenol	29	---	210	---	---	8270C	40
Pentachlorophenol	400	504	690	---	---	8270C	200
Miscellaneous Extractables, µg/kg dry weight							
Benzyl Alcohol	57	---	870	---	---	8270D	20
Benzoic Acid	650	---	760	---	---	8270D	400
Dibenzofuran	540	---	1,700	400	440	8270D	20
Hexachlorobutadiene	11	---	270	---	---	8081B	1.0
N-Nitrosodiphenylamine	28	---	130	---	---	8270D	20
Pesticides, µg/kg dry weight							
4,4'-DDD	16	---	---	---	---	8081B	6.0
4,4'-DDE	9	---	---	---	---	8081B	6.0
4,4'-DDT	12	---	---	---	---	8081B	6.0
Total DDT[e]	---	50	69	---	---	8081B	6.0
Aldrin	9.5	---	---	---	---	8081B	2.0
Chlordane[f]	2.8	37	---	---	---	8081B	2.0
Dieldrin	1.9	---	1,700	4.9	9.3	8081B	2.0
Heptachlor	1.5	---	270	---	---	8081B	2.0
Polychlorinated Biphenyls, µg/kg dry weight							
Total PCBs[g]	130	38 (mg/kg OC)	3,100	110	2,500	8082	20
Dioxin and Furans, ng/kg dry weight							
Dioxin Furan TEQ[h]	4	---	10	---	---	---	---
Dioxins							
2,3,7,8-TCDD	---	---	---	---	---	1613B	1.0
1,2,3,7,8-PeCDD	---	---	---	---	---	1613B	1.0
1,2,3,4,7,8-HxCDD	---	---	---	---	---	1613B	2.5
1,2,3,6,7,8-HxCDD	---	---	---	---	---	1613B	2.5
1,2,3,7,8,9-HxCDD	---	---	---	---	---	1613B	2.5
1,2,3,4,6,7,8-HpCDD	---	---	---	---	---	1613B	2.5

Parameter	DMMP Interpretive Criteria (Marine)			Sediment Quality Values (Freshwater)		Analytical Method	Reporting Limit
	Screening Level	BT	Maximum Level	SL1	SL2		
OCDD	---	---	---	---	---	1613B	5.0
Furans							
2,3,7,8-TCDF	---	---	---	---	---	1613B	1.0
1,2,3,7,8-PeCDF	---	---	---	---	---	1613B	2.5
2,3,4,7,8,-PeCDF	---	---	---	---	---	1613B	1.0
1,2,3,4,7,8-HxCDF	---	---	---	---	---	1613B	2.5
1,2,3,6,7,8-HxCDF	---	---	---	---	---	1613B	2.5
1,2,3,7,8,9-HxCDF	---	---	---	---	---	1613B	2.5
2,3,4,6,7,8-HxCDF	---	---	---	---	---	1613B	2.5
1,2,3,4,6,7,8-HpCDF	---	---	---	---	---	1613B	2.5
1,2,3,4,7,8,9-HpCDF	---	---	---	---	---	1613B	2.5
OCDF	---	---	---	---	---	1613B	5.0

Notes:
a – Because no SL value exists for toxicity testing, selenium will only be evaluated for its bioaccumulation potential
b – Bulk sediment measurement of TBT is used only when porewater extraction cannot be accomplished
c – PAHs for DMMP screening level characterization (SG-02 through SG-09) will be analyzed with method 8270D since the lower detection limit achieved with SIM is unnecessary for DMMP criteria comparison
d – 2-Methylnapthalene is not included in the sum of LPAHs
e – Total DDT consists of the sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT
f – Chlordane includes all chlordane isomers, including cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, and oxychlordane
g – Total PCBs consists of the sum of all Aroclors
h – The dioxin TEQ is calculated using the methods described in van den Berg et al. 2006. 4 ng/kg TEQ is a volume-weighted average. 10 ng/kg TEQ is a maximum level. Suitability for open water disposal can also be managed on a case-by-case basis by DMMO.
µg/kg = micrograms per kilogram
BT = bioaccumulation trigger
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
GC/MS = gas chromatography/mass spectrometry
HPAH = high-molecular-weight polycyclic hydrocarbon
LPAH = low-molecular-weight polycyclic hydrocarbon
mg/kg = milligrams per kilogram
mg-N/kg = milligrams of nitrogen per kilogram
ng/kg = nanograms per kilogram
PSEP = Puget Sound Estuary Program
SL1 = Screening Level 1
SL2 = Screening Level 2

Table 4
Surface Water Analyte List, Analytical Methods, and Reporting Limits

Parameter	Analytical Method	Reporting Limit
Conventionals		
Total Suspended Solids	SM 2540D	5.0 mg/L
Total Dissolved Solids	SM 2540B	10 mg/L
Hardness	SM 2340B	2.0 mg/L
Metals		
Antimony	200.8/6020A	0.2 µg/L
Arsenic	200.8/6020A	0.2 µg/L
Barium	200.8/6020A	0.5 µg/L
Beryllium	200.8/6020A	0.2 µg/L
Cadmium	200.8/6020A	0.1 µg/L
Chromium	200.8/6020A	0.5 µg/L
Copper	200.8/6020A	0.5 µg/L
Iron	200.8/6020A	20 µg/L
Lead	200.8/6020A	0.1 µg/L
Manganese	200.8/6020A	0.5 µg/L
Mercury	7471A	0.10 µg/L
Nickel	200.8/6020A	0.5 µg/L
Selenium	200.8/6020A	0.5 µg/L
Silver	200.8/6020A	0.2 µg/L
Thallium	200.8/6020A	0.2 µg/L
Zinc	200.8/6020A	4.0 µg/L
SVOCs		
Polycyclic Aromatic Hydrocarbons		
Naphthalene	8270-SIM	0.1 µg/L
Acenaphthylene	8270-SIM	0.1 µg/L
Acenaphthene	8270-SIM	0.1 µg/L
Fluorene	8270-SIM	0.1 µg/L
Phenanthrene	8270-SIM	0.1 µg/L
Anthracene	8270-SIM	0.1 µg/L
2-Methylnaphthalene	8270-SIM	0.1 µg/L
Fluoranthene	8270-SIM	0.1 µg/L
Pyrene	8270-SIM	0.1 µg/L
Benz[a]anthracene	8270-SIM	0.1 µg/L
Chrysene	8270-SIM	0.1 µg/L
Total benzofluoranthenes	8270-SIM	0.1 µg/L
Benzo[a]pyrene	8270-SIM	0.1 µg/L
Indeno[1,2,3-c,d]pyrene	8270-SIM	0.1 µg/L
Dibenz[a,h]anthracene	8270-SIM	0.1 µg/L

Parameter	Analytical Method	Reporting Limit
Benzo[g,h,i]perylene	8270-SIM	0.1 µg/L
Chlorinated Benzenes		
1,2-Dichlorobenzene	8270D	1.0 µg/L
1,4-Dichlorobenzene	8270D	1.0 µg/L
1,2,4-Trichlorobenzene	8270D	1.0 µg/L
Hexachlorobenzene	8270D	1.0 µg/L
Phthalates		
Dimethyl phthalate	8270D	1.0 µg/L
Diethyl phthalate	8270D	1.0 µg/L
Di-n-butyl phthalate	8270D	1.0 µg/L
Butyl benzyl phthalate	8270D	1.0 µg/L
Bis[2-ethylhexyl]phthalate	8270D	3.0 µg/L
Di-n-octyl phthalate	8270D	1.0 µg/L
Miscellaneous SVOCs		
Dibenzofuran	8270D	1.0 µg/L
Hexachlorobutadiene	8270D/8081[a]	3.0 µg/L / 0.05 µg/L
N-nitrosodiphenylamine	8270D	1.0 µg/L
Phenol	8270D	1.0 µg/L
2-Methylphenol	8270D	1.0 µg/L
4-Methylphenol	8270D	2.0 µg/L
2,4-Dimethylphenol	8270D	3.0 µg/L
Pentachlorophenol	8270D/8041[b]	10 µg/L / 0.025 µg/L
Benzyl alcohol	8270D	2.0 µg/L
Benzoic acid	8270D	20 µg/L

Notes:
a – Method 8081 will be used to achieve lower reporting limit for samples HT-01 through HT-05.
b – Method 8041 will be used to achieve lower reporting limit for samples HT-01 through HT-05.
µg/L = micrograms per liter
SVOC = semivolatile organic compound

In completing chemical analyses for this project, the contract laboratory is expected to meet the following minimum requirements:

- Adhere to the methods outlined in this SAP, including methods referenced for each analytical procedure (Table 2).
- Deliver hard copy and electronic data as specified.
- Meet reporting requirements for deliverables.
- Meet turnaround times for deliverables.
- Implement QA/QC procedures including data quality objectives (DQOs), laboratory

quality control requirements and performance evaluation testing requirements (Tables 5 and 6).

- Notify the project QA/QC Manager of any QA/QC problems when they are identified to allow for quick resolution.
- Allow laboratory and data audits to be performed, if deemed necessary.

Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates, matrix spikes, surrogate spikes (for organic analyses), and method blanks. Table 5 lists the frequency of analysis for laboratory QA/QC samples, and Table 6 summarizes the data quality objectives for precision, accuracy, and completeness.

Results of the QC samples from each sample group will be reviewed by the analyst immediately after a sample group has been analyzed. All samples are diluted and reanalyzed if target compounds are detected at levels that exceed their respective established calibration ranges. Any cleanups will be conducted prior to the dilutions. The QC sample results will be evaluated to determine if control limits have been exceeded. If control limits are exceeded in the sample group, the QA/QC Manager will be contacted immediately, and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

Table 5

Laboratory Quality Assurance/Quality Control Sample Analysis Summary for Sediment and Water

Analysis Type	Initial Calibration	Ongoing Calibration	Replicates	Matrix Spikes	SRM/LCS	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
Grain size	Each batch[a]	NA	1 per 20 samples	NA	NA	NA	NA	NA
Total solids/Total volatile solids	Each batch[b]	NA	1 per 20 samples	NA	NA	NA	NA	NA
Total suspended solids/total dissolved solids	Each batch[b]	NA	1 per 20 samples	NA	NA	NA	NA	NA
Hardness	Each batch[b]	NA	1 per 20 samples	NA	NA	NA	NA	NA
Total organic carbon	Daily or each batch	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Metals	Daily	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Dioxin and Furans	As needed[c]	Every 12 hours	1 per 20 samples	NA	1 per 20 samples	NA	1 per 20 samples	Every sample
Tributyltin	As needed[c]	Every 12 hours	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Semivolatile organics	As needed[c]	Every 12 hours	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Pesticides/Polychlorinated biphenyls[d]	As needed[c]	1 per 10 samples	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample

Notes:

a – Calibration and certification of drying ovens and weighing scales are conducted bi-annually

b – Initial calibration verification and calibration blank must be analyzed at the beginning of each batch

c – Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new initial calibration is performed

d – Pesticides and PCBs will have all detects confirmed via second column confirmation. The second column must be of a dissimilar stationary phase from the primary column and meet all method requirements for acceptance.

NA = not applicable

SRM = standard reference material

LCS = laboratory control sample

Table 6
Data Quality Objectives for Sediment and Water

Parameter	Precision	Accuracy	Completeness
Grain size	± 20% RPD	NA	95%
Total solids/total volatile solids	± 20% RPD	NA	95%
Total suspended solids/total dissolved solids	± 20% RPD	NA	95%
Hardness	± 20% RPD	NA	95%
Total organic carbon	± 20% RPD	65-135% R	95%
Metals	± 35% RPD	75-125% R	95%
Dioxin and Furans	± 50% RPD	50-140% R	95%
Tributyltin	± 50% RPD	50-150% R	95%
Semivolatile organic compounds	± 50% RPD	50-150% R	95%
Pesticides/Polychlorinated biphenyls	± 50% RPD	50-150% R	95%

Notes:
R = recovery
RPD = relative percent difference

5.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used prior to the start of the project, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method control criteria. A calibration verification will be analyzed following each initial calibration and will meet method criteria prior to analysis of samples. Continuing calibration verifications (CCV) will be performed daily prior to any sample analysis to track instrument performance. The frequency of CCVs varies with method. For gas chromatograph/mass spectrometer (GC/MS) methods, one will be analyzed every 12 hours. For GC, metals, and inorganic methods, one will be analyzed for every ten field samples, or daily, whichever is specified in the method. If the ongoing continuing calibration is out of control, the analysis must come to a halt until the source of the control failure is eliminated or reduced to meet control specifications. All project samples analyzed while instrument calibration was out of control will be reanalyzed.

Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to, or immediately following, CCV at the instrument for each type of applicable analysis.

5.2 Laboratory Duplicates/Replicates

Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates and replicates are subsamples of the original sample that are prepared and analyzed as a separate sample.

5.3 Matrix Spikes/Matrix Spike Duplicates

Analysis of MS samples provides information on the extraction efficiency of the method on the sample matrix. By performing duplicate MS analyses, information on the precision of the method is also provided for organic analyses.

5.4 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. The method blank for all analyses must be less than the MRL of any single target analyte/compound. If a laboratory method blank exceeds this criterion for any analyte/compound, and the concentration of the analyte/compound in any of the samples is less than five times the concentration found in the blank (ten times for common contaminants), analyses must stop and the source of contamination must be eliminated or reduced.

5.5 Laboratory Control Samples

Laboratory control samples (LCS) are analyzed to assess possible laboratory bias at all stages of sample preparation and analysis. The LCS is a matrix-dependent spiked sample prepared at the time of sample extraction along with the preparation of sample and the MSs. The LCS will provide information on the precision of the analytical process, and when analyzed in duplicate, will provide accuracy information as well.

5.6 Standard Reference Materials

Standard Reference Materials (SRM) is analyzed to assess possible matrix affects at all stages of sample preparation and analysis. The SRM is a matrix-matched sample that is carried

through all aspects of preparation and analysis as a field sample and has a known concentration of target analytes. Puget Sound SRM will be used for dioxin and furan and PCB analyses (DMMO 2012). Performance will be evaluated using the DQOs listed in Table 6 and as outlined in DMMO (2010) and Ecology (2008).

5.7 Laboratory Data Package

ARI will prepare a detailed laboratory data package documenting all activities associated with the sample analyses. The following information will be included in this data package:

- **Project Narrative:** A detailed narrative that describes the samples received, analyses performed, and corrective actions undertaken.
- **COC Documentation:** Laboratory policy requires that COC documentation be available for all samples received. The COC will document basic sample demographics such as client and project names, sample identification, analyses requested, and special instructions.
- **Data Summary Form:** A tabular listing of concentrations and/or detection limits for all target analytes. The data summary form will also list other pertinent information such as amount of sample analyzed, dilution factors, sample processing dates, extract cleanups, and surrogate recoveries.
- **QC Summary:** Includes results of all QC analyses, specifically recovery information. LCSs are reported with each batch. Additional QC analyses may include laboratory replicates, MS, and SRMs.
- **Instrument Calibration Forms and Raw Data:** Includes initial and continuing calibration summaries and instrument tuning data, laboratory bench sheets, and logbook pages.

5.8 Data Validation and Verification

Laboratory data will be provided in both PDF and EQuIS electronic format. Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. A Stage 2A level (USEPA 2009) data quality review (equivalent to a QA1 review) will be performed by Anchor QEA (or a subconsultant), in accordance with U.S. Environmental Protection Agency (USEPA) National Functional Guidelines (USEPA 2004, 2008) by considering the following:

- Data completeness
- Holding times
- Method blanks
- Surrogate recoveries
- Detection limits
- RLs
- LCSs
- MS/MSD samples
- SRM results

The data will be validated in accordance with the project-specific DQOs (Table 6), analytical method criteria, and the laboratory's internal performance standards based on their Standard Operating Procedures. Dioxin and furan data will be validated at a Stage 4 level (USEPA 2009) by a subconsultant using the DQOs outlined in DMMO (2010) and/or the SAPA (Ecology 2008). The results of the data quality review, including text assigning qualifiers in accordance with the USEPA National Functional Guidelines and a tabular summary of qualifiers, will be generated by the Database Manager and submitted to the project QA/QC Manager for final review and confirmation of the validity of the data. A copy of the validation report will be submitted by the QA/QC Manager and will be presented as an appendix to the Results Memorandum.

Laboratory data, which will be electronically provided and loaded into the database, will undergo a 10% check against the laboratory hard copy data. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually. The accuracy of all

manually entered data will be verified by a second party. Data tables will be exported from EquIS database to Microsoft Excel tables.

6 SAMPLING AND ANALYSIS RESULTS MEMORANDUM

The Results Memorandum will be prepared by Anchor QEA documenting all activities associated with sample collecting, compositing, transporting, and chemically analyzing sediment and water samples. The laboratory data packages will be included as appendices and also submitted in electronic formats including Ecology's EIM format. The following will be included in the Results Memorandum:

- Summary of all field activities including a description of any deviations from the approved SAP
- Locations of sediment and water sampling stations in state plane coordinates to the nearest foot (Washington North Zone), and in latitude and longitude in degrees and minutes to four decimal places (NAD 83); all vertical elevations of mudline and water surface will be reported to the nearest 0.1-foot
- A project map with actual sampling locations
- A QA/QC narrative for laboratory results
- Summary data results tables
- Summary of comparison of chemical results with DMMP interpretive criteria (DMMO 2010, 2011) and Ecology's interim freshwater SQV (Ecology 2003) as shown in Table 2. If available and finalized, the new SQVs that are currently under review will be presented.

Hard copies of field data will be provided with the Results Memorandum and laboratory analysis results and associated QA/QC data will be available. Results of the laboratory analyses will be submitted to the DMMO in DAIS format and to Ecology in EIM format. The Results Memorandum will be submitted to DMMO, Ecology, and DOH within 12 weeks after completion of the field sampling activities. Ecology and DOH will be responsible for preparing separate reports with additional evaluations and interpretation based on the information included in the Results Memorandum.

7 PROJECT SCHEDULE

The estimated schedule for the sampling, analysis, and reporting activities are summarized in Table 7. Finalization of the SAP and sampling is anticipated in early November. Validated sampling results are anticipated to be available in January 2013. The Results Memorandum is anticipated to be submitted in February 2013. When the Results Memorandum is available, Ecology may participate in an informal discussion of the results.

Table 7
Estimated Schedule

Description	Schedule
Approved Sampling and Analysis Plan	Early November 2012
Field Sampling and Lab Coordination	1 week; initiated within 2-3 weeks of SAP approval by Ecology and other agencies
Lab Testing	4 weeks for chemistry testing
Data Validation	4 weeks for data validation and QA/QC
Results Memorandum and Submittal of data to EIM	4 weeks after receipt of validated results and completion of QA/QC
Evaluations Conducted by Ecology	4-8 weeks after submittal of Results Memorandum
Health Consultations Conducted by DOH	Spring 2013

Notes:
DOH = Washington State Department of Health
Ecology = Washington State Department of Ecology
EIM = Ecology's Environmental Information Management database
QA/QC = quality assurance/quality control

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APPENDIX A
FIELD FORMS AND LOGS

Chain of Custody Record & Laboratory Analysis Request

COC#

Date:
Laboratory :
Project Name:
Project Number:
Project Manager:
Phone Number:
Shipment Method:

Line	Field Sample ID	Collection Date/Time	Matrix	No. of Containers	Dioxin and Furans	Pesticides[1]	PCB Aroclors	SVOCs[1]	Tributyltin (porewater)	Metals[1]	Ammonia, Sulfide, TOC	Grainsize, TS, TVS	Archive	Tributyltin (bulk)[2]										Comments
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								

1 See SAP Table 2 for analyte lists and test methods

2 Only analyzed if there is insuffcient volume for the porewater analysis

Additional notes/comments:

Relinquished By:	Company: Anchor QEA LLC.	Received By:	Company:
Signature/Printed Name	Date/Time	Signature/Printed Name	Date/Time

Relinquished By:	Company:	Received By:	Company:
Signature/Printed Name	Date/Time	Signature/Printed Name	Date/Time

Distribution: A copy will be made for the laboratory and client. The Project file will retain the original.

Daily Log

Anchor QEA L.L.C.
720 Olive Way, Suite 1900
Seattle, WA 98101
Phone 206.287.9130 Fax 206.287.9131

PROJECT NAME: **DATE:**

SITE ADDRESS: **PERSONNEL:**

WEATHER: **WIND FROM:**

N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY

SUNNY CLOUDY RAIN ?

TEMPERATURE: ° F . ° C
[Circle appropriate units]

TIME	COMMENTS
See Field Logs for detailed logging and sampling	
Equipment on site:	

Notes: Work performed, Phone calls made, Problems Issues/Resolutions, Visitors on site
Safety infractions, Important comments/instructions to contractors

Signature: _____

Surface Sediment Field Log

Job: Station:

Job No: Date:

Field Staff: Sample Method:

Contractor: Target Coordinates: Lat.

Horizontal Datum: Long.

Water Height

DTM Depth Sounder:

DTM Lead Line:

Tide Measurements

Time:

Height:

Sample Acceptability Criteria:

1) Overlying water is present
2) Water has low turbidity
3) Sampler is not overfilled
4) Surface is flat
5) Desired penetration depth

Mudline Elevation (lower low water-large tides): calculated after sampling

Notes:

Grab #	Time	Actual Coordinates		Sample Accept (Y/N)	Recovery Depth (cm)	Comments: jaws close, good seal, winnowing, overlying water, surface intact, etc
		Longitude/Easting	Lattidue/ Northing			

Sample Description: surface cover, (density), moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

Sample Containers:

Analyses:

ANCHOR QEA

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

Water Quality and Sample Collection Form

Station ID:			**Date:**		**Time:**
Project Name:			**Project Number:**		
Coordinates: Datum**:**					
Lat/Northing			Long/Easting		
Sample Depth:			Total Water Depth:		
Weather Observations:					
Field Parameters					
Temperature	°C	Turbidity	NTU	Others:	
pH		DO	mg/L		
Conductivity					
Sample Description					
Evidence of floating or suspended materials:			Y / N		
Evidence of oil/hydrocarbon sheen:			Y / N		
Describe any discoloration and turbidity:					
Odor	none, slight, moderate, strong H_2S, petroleum, septic				
Comments (e.g., boat activity, river flow rate, stormwater discharges in the vicinity) :					
Recorded by:					