PORT OF FRIDAY HARBOR
ALBERT JENSEN AND SONS INC. BOATYARD AND MARINA
FRIDAY HARBOR, WA

MODEL TOXICS CONTROL ACT (MTCA)
AGREED ORDER NO. DE 18071

IN-WATER SAMPLING AND ANALYSIS PLAN
ALBERT JENSEN AND SONS INC. BOATYARD AND MARINA IN-WATER AREA
SHIPYARD COVE, PUGET SOUND

Prepared for
The Port of Friday Harbor
Friday Harbor, WA

Prepared by
Leon Environmental, LLC
Seattle, WA

July 2022
Updated March 2023

LEON
Environmental, LLC

This page intentionally left blank.

Table of Contents

Tables

Figures

Attachments

Abbreviations and Acronyms

°C	degree Celsius
AET	Apparent Effects Threshold
COC	chain-of-custody
County	San Juan County
DGPS	differential global positioning system
DMMP	Dredged Material Management Program
DMR	discharge monitoring report
Ecology	Washington Department of Ecology
EIM	Environmental Information Management
EPA	United States Environmental Protection Agency
HASP	Health and Safety Plan
Jensen's	Albert Jensen and Sons Inc. Boatyard and Marina
L-E	Leon Environmental, LLC
m	meter
m/s	meters per second
MGD	million gallons per day
MLLW	mean lower low water
MTCA	Model Toxics Control Act
NOAA	National Oceanic and Atmospheric Administration
PARIS	Permitting and Reporting Information System
PCB	polychlorinated biphenyl
Port	Port of Friday Harbor
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCW	Revised Code of Washington
SAP	Sampling and Analysis Plan
SCO	Sediment Cleanup Objective
SCUM	Sediment Cleanup User's Manual
Site	Albert Jensen and Sons Inc. Boatyard and Marina
SIZ	sediment impact zone
SMS	Sediment Management Standards
SQS	sediment quality standards
SVOC	semivolatile organic compound
TOC	total organic carbon

1. Introduction and Background Information

The overall goal of this project is to clean up the historic contamination associated with Albert Jensen & Sons Inc. Boatyard and Marina (Jensen's) and redevelop this formerly-thriving industrial facility into a revitalized community and economic hub that honors the site's history and its central role in shaping the Friday Harbor community, while providing: environmental restoration; public access and educational opportunities; outdoor-oriented recreation; affordable housing; live-work space; and a platform to provide the economic opportunity local businesses need to thrive. The steps planned during the 2021 - 2023 biennium to achieve this goal are focused on collaborating with Ecology to deliver work described in AO No. DE 18071, including: completion of a robust RI/FS; design, permitting and construction of Interim Actions to address the most immediate risks to human health and the environment; completion of a DCAP; execution of an effective public participation plan; and strategic planning for the design and construction that is anticipated in subsequent biennia.

1.1 Site History and Current Conditions

The Jensen's is located at 1293 Turn Point Road, on the southern shore of Shipyard Cove of the Salish Sea, on San Juan Island, San Juan County (County). Turn Point Road provides a direct connection from the City of Friday Harbor (City) to the Project site, which is located approximately 1.5 miles southeast of downtown. Turn Point Road continues to the east to Kansas Cove, and then becomes Pear Point Road as it follows the Island's southern shoreline to circle back to the City. The Project site is located entirely within Shipyard Cove, a relatively shallow embayment that faces northward on the eastern side of San Juan Island. Shipyard Cove is generally protected by Brown Island; however, the Project site is exposed to roughly 2.5 miles of fetch from a northerly direction (Figure 1, Site and Vicinity Map).

The site was first developed as a shipyard before 1941; anecdotal evidence suggests that operations began as early as 1910. Originally, wooden boats were manufactured and repaired at the site, but when wooden boats were phased out in the middle of the 20th century, the site use moved from shipbuilding to boat repair and maintenance. Additional facilities, including a marina extending from the central shoreline into deeper intertidal and subtidal areas, and an upland fill area along the western property boundary extending from the upland into shallow intertidal areas, were built sometime between 1941 and 1972.

The property encompasses one parcel (351341005000) of approximately 4.8 acres of upland with 652 linear feet of shoreline, and approximately 5 acres of aquatic lands currently managed under a Port Management Agreement (PMA) (PMA No. 20-080023) with the Washington State Department of Natural Resources (WDNR). The Project site is zoned as Rural Industrial (RI). This zoning designation allows for light industrial, light manufacturing, seasonal residential[1], public, and some institutional uses. The Project site is partially developed and consists of three distinct areas: a boatyard, a marina, and an undeveloped upland and shoreline area (Figure 2, Existing Conditions).

1.1.1 Boatyard

The existing boatyard is located in the southwestern portion of the parcel. It encompasses approximately 1.5 acres of level work areas including boat storage, a laydown area and a wash pad. Four buildings are associated with current boatyard operations: an office/retail building, a machine shop, a storage building and a water treatment building through which water from the wash pad is circulated and then discharged into an evaporating pond on site. The boatyard infrastructure also includes a 35-ton travel lift that needs maintenance or replacement in the near future. The marine services provided at the boatyard include haul-out, pressure wash, bottom paint, light mechanical, chandlery and parts, and

[1] Vacation rental; Farmworker housing

boat storage. The boatyard area has several areas where maintenance was deferred by the prior owner. Ongoing releases from the degraded structures (e.g., visible sheen associated with the creosote pilings) have been observed. The Port anticipates that at least some of these deferred maintenance projects will need to be completed on an expedited basis to sustain current and future operations. These projects may be the subject of interim actions proposed under a subsequent remedial action grant application.

1.1.2 Marina

The existing marina includes approximately 50 slips; just over half are wood-framed, covered moorage. The structure consists of creosote-treated piles and wood floats on unwrapped Styrofoam. The structure itself, as well as the associated electrical system, is in very poor condition, and reconstruction and expansion of the marina is anticipated as part of the redevelopment of the property. Coordinating subsequent remedial actions with marina maintenance and redevelopment is a key consideration for this project.

1.1.3 Undeveloped Upland and Shoreline Areas

The undeveloped area in the eastern portion of the property consists of approximately 2 acres of open grassy field and gravel parking areas. This area slopes moderately from Turn Point Road toward the waterfront and terminates at a low bank.

A derelict boat building structure is located near the shoreline east of the current boatyard area. The marine rails waterward of this structure were originally used to launch boats and were later used to pull out boats for repair. The concrete pad at this location was added later and is not original to the marine rail system. The undeveloped area also contains the remnants of a small derelict cabin, a small oil storage building further east and a shallow dug well. The Port has not identified a final use for this area of the Project site; however, it is anticipated that some of the area will be used to meet requirements associated with marina redevelopment like restrooms, parking, and other support infrastructure.

Compatibility of the ongoing boatyard operations with the planned marina improvements, public access to parts of the site, and other potentially developed businesses and facilities (especially around issues such as safety, parking, and access) will be addressed as part of the master planning effort that is currently underway. The master plan will be coordinated with Ecology and the public. Marina improvements may also be compatible and conducted co-incident with anticipated remedial actions for the site.

The site was first developed as a shipyard before 1941; anecdotal evidence suggests that operations began as early as 1910. Originally, wooden boats were manufactured at the site, but when wooden boats were phased out in the middle of the 20th century, the site use moved from shipbuilding to boat repair and maintenance.

1.2 Regulatory Framework

Agreed Order No. DE 18071 (Order) was issued pursuant to the Model Toxics Control Act (MTCA), RCW 70.105D.050(1). The Order requires the Port of Friday Harbor to perform a Remedial Investigation and Feasibility Study (RI/FS) and to prepare a draft Cleanup Action Plan (dCAP), addressing both upland and in-water contamination for the Albert Jensen and Sons, Inc. Boatyard and Marina Site. This SAP was prepared as part of the Work Plan in compliance with WAC 173-340-820 and WAC 173-204-600 for defining the nature and extent of contamination in the in-water area of the site.

1.3 Summary of Previous Sediment Investigations

1.3.1 Upland

This In-Water Sampling and Analysis Plan specifically addresses the initial in-water work proposed for the Remedial Investigation at Albert Jensen and Sons Inc. Boatyard and Marina. The past field investigation of the upland areas, which are defined as areas of the Site that fall outside of the In-Water Area as generally depicted in Exhibit A of the Agreed Order, are discussed in the *Remedial Investigation Work Plan* (L-E 2022).

1.3.2 In-Water

The past field investigations of the in-water areas were primarily conducted by Whatcom Environmental Services (WE) as part of preliminary redevelopment planning. These data are summarized in the *Intertidal and Subtidal Conceptual Site Model and Data Gaps Report* (L-E 2019), and in three reports WE prepared previously: *Phase I Environmental Site Assessment* (WE 2017a), *Draft Sediment Data Report* (WE 2018c), and the *Draft Remedial Investigation Report* (WE 2018d). Additional data were acquired from publicly available information sources.

Table 1-1. Previous Sediment Investigations

Author	Year	Report
Washington Department of Ecology	2001	Concentrations of Selected Chemicals in Sediments from Harbors in the San Juan Islands
Whatcom Environmental Services	2017	Phase I Environmental Site Assessment, Jensen's Shipyard, 1293 Turn Point Road, Friday Harbor, Washington
Whatcom Environmental Services	2017	Sediment Sampling and Analysis Plan, Jensen's Shipyard and Marina, 1293 Turn Point Road, Friday Harbor, Washington
Whatcom Environmental Services	2018	Initial Investigation Report, Jensen's Shipyard, 1293 Turn Point Road, Friday Harbor, Washington
Whatcom Environmental Services	2018	Sediment Investigation, Sediment Sampling and Analysis Plan, Jensen's Shipyard and Marina, 1293 Turn Point Road, Friday Harbor, Washington
Whatcom Environmental Services	2018	Draft Sediment Data Report, Jensen's Shipyard and Marina, 1293 Turn Point Road, Friday Harbor, Washington
Whatcom Environmental Services	2018	Draft Remedial Investigation Report, Jensen's Shipyard and Marina, 1293 Turn Point Road, Friday Harbor, Washington
San Juan Surveying	2018	Topographic Survey for Port of Friday Harbor – Jensen's Shipyard Planning Map
Leon Environmental, LLC	2019	Intertidal and Subtidal Conceptual Site Model and Data Gaps Report, Jenson and Sons Boatyard and Marina, Friday Harbor, Washington.
Fairbanks Environmental Services, Inc.	2020	Port of Friday Harbor Albert Jensen and Sons Boatyard and marina Eelgrass and Macroalgae Survey
Marine Surveys & Assessments	2021	Jensen Marina Habitat Survey Report

2. Objectives and Design of the In-Water Investigation

2.1 Objectives of the In-Water Investigation

The mutual objective of the State of Washington, Department of Ecology (Ecology) and the Port of Friday Harbor (PFH) under Agreed Order No. DE 18071 (Order) is to provide for remedial action at the Albert Jensen & Sons Inc. site (Facility Site ID 42226979) (site) where there has been a release or threatened release of hazardous substances. The work under the Order involves conducting a Remedial Investigation (RI) and Feasibility Study (FS), conducting interim actions if required or agreed to by Ecology, and preparing a preliminary Draft Cleanup Action Plan (DCAP) to select a cleanup alternative. The purpose of the RI/FS, and preliminary DCAP for the Site, is to provide sufficient data, analysis, and evaluations to enable Ecology to select a cleanup alternative for the Site.

The objective for this remedial investigation is to address identified data gaps and refine the nature and extent of sediment contamination exceeding preliminary Model Toxics Control Act (MTCA) cleanup levels, preliminary Sediment Management Standards (SMS) cleanup standards, and other regulatory requirements. This sediment investigation is focused on the in-water areas of the Albert Jensen and Sons, Inc. Boatyard and Marina, which are defined as the intertidal (areas exposed to air at low tide) and subtidal (areas always covered by water) areas associated with adjacent marine waters. This effort is expected to:

- Establish vertical contamination profiles in areas where prior sediment investigation work (WE 2018c) reported surface sediments that exceed SQS chemical criteria.
- Include additional samples (depth and surface) along the eastern shoreline area.
- Delineate the vertical and horizontal extent of dioxins/furans beyond the surface concentrations measured along the central marina shoreline, which may correlate with observed PCB surface exceedances.
- Focus PCB analysis on areas showing benthic exceedances in surface sediments to facilitate subsequent background/human health evaluations.
- Delineate the vertical and horizontal extent of pesticides measured in surface sediments.

2.2 Overall Design of the In-Water Investigation

The in-water investigation will focus initially on defining the nature and extent of potential sediment contamination, and will generally follow guidance provided in Ecology's current Sediment Cleanup User's Manual (SCUM) (Ecology 2021). Sampling procedures and collection will follow current Puget Sound Estuary Program (PSEP) protocols. If supplemental sampling is required, a SAP addendum may be prepared.

Debris appears to be present throughout intertidal elevations out to at least shallow subtidal depths, and also within the boathouse areas. These are the areas where the sediment investigation is required to delineate the nature and extent of contaminants of potential concern (COPCs); therefore, debris is expected to interfere with the collection of sediment grab samples and cores.

The overall design of this initial study is intended to determine the nature and extent of sediment contamination at Albert Jensen and Sons Boatyard and Marina. To meet the remedial investigation objectives, surface sediment grab samples (sample depth of 0 – 10 cm) will be collected from seven (7) sampling stations and core samples (sample depth of 0 - 7 ft) will be collected from twelve (12) sampling stations located within the study area (Figure 3, Sampling Station Locations and 2018 Chemical Exceedances). Four (4) additional surface grab samples (sample depth of 0 – 1 ft) will be co-located with some core samples where the prior sediment characterization (WE 2018c) reported either minor detected or non-detected SMS screening criteria exceedances for non-bioaccumulative chemicals. These

samples will be archived to perform potential bioassay testing, based on the chemical results of the 0 – 1 ft sampling interval. We propose to reoccupy ten (10) previous sampling locations (WE 2018c) and sample nine (9) new sampling locations around Jensen's. Samples will be analyzed for known contaminants of potential concern (COPCs), the full suite of SMS chemical analytes, and conventional sediment parameters. The need for additional sampling and analysis (including bioassays and/or bioaccumulation testing) will be evaluated if samples exceed the numerical chemical concentration criteria identified in WAC 173-204-320.

2.3 Chemical Analytes

Sediment samples will be analyzed for known contaminants of potential concern (COPCs) (WE 2018c), and conventional sediment parameters. Table 2-1 shows the COPCs identified in previous sediment investigations. As shown in Table 2-2, conventional sediment parameters are measured to characterize sediments and aid in interpreting chemical tests. Conventional parameters include total organic carbon (TOC), grain size, percent solids (total solids), ammonia, and total sulfides. SMS chemical sediment parameters are shown in Table 2-3; however, only those chemicals identified in Tables 2-1 and 2-5 are proposed to delineate the nature and extent of COPCs identified previously.

Table 2-1. Chemicals of Potential Concern Identified in Previous Sediment Investigations (WE 2018c)

Chemical of Potential Concern	Included in SMS Chemicals	CAS Number	Chemical Criteria	Screening Level
COPCs that do not have an established SQS numeric criteria value				
Tributyltin (TBT)	No	36643-28-4	DMMP (USACE 2021)	73 µg/kg dry weight
Dioxins/Furans	No	--	DMMP (USACE 2021)	4-10 ng/kg dry weight[1]
Total Chlordane (sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, oxychlordane)	No	5103-71-9 5103-74-2 5103-73-1 39765-80-5 27304-13-8	DMMP (USACE 2021)	2.8 µg/kg dry weight
COPCs that established SQS numeric criteria value				
Polychlorinated Biphenyls (PCBs; total Aroclors[2])	Yes	--	SQS	See Table 2-3
Metals (copper, mercury, zinc)	Yes	7440-50-8 7439-97-6 7440-66-6	SQS	See Table 2-3
Organic Chemicals (benzyl alcohol)	Yes	100-51-6	SQS	See Table 2-3
Phthalates (butylbenzyl phthalate, dimethyl phthalate)	Yes	85-68-7 131-11-3	SQS	See Table 2-3
Polycyclic Aromatic Hydrocarbons (PAHs)	Yes	See Table 2-3	SQS	See Table 2-3
Chlorinated Organics	Yes	See Table 2-3	SQS	See Table 2-3

Notes:
1. See Table 8-3 in the DMMP User Manual (USACE, 2021).
2. Phase I sampling will evaluate samples for PCB Aroclors; however, if PCB Congeners are required, they will be collected in subsequent sampling events. A SAP addendum will be prepared if supplemental sampling is required.

Table 2-2. Conventional Sediment Variables

Conventional Parameter	Use
Total organic carbon (TOC)	• Normalization of the concentrations of nonionizable organic compounds • Identification of appropriate reference sediments for biological tests • Presence of eutrophic and/or low dissolved oxygen conditions • Understand contaminant availability and toxicity
Sediment grain size	• Identification of appropriate reference sediments for biological tests • Interpretation of sediment toxicity data • Evaluation of sediment transport and deposition
Total solids	• Expression of chemical concentrations on a dry-weight basis
Ammonia	• Interpretation of sediment toxicity test data and/or other deleterious substances
Total sulfides	• Interpretation of sediment toxicity test data and/or other deleterious substances

Table 2-3. Marine Sediment Quality Standards--Chemical Criteria WAC 173-204-320

Chemical Parameter	CAS Number	Sediment Quality Standards WAC 173-204-320[a]	Sediment Impact Zone Maximum Level, WAC 173-204-420[a]
SMS Metals		**mg/kg dw (ppm dw)**	
ARSENIC	7440-38-2	57	93
CADMIUM	7440-43-9	5.1	6.7
CHROMIUM	7440-47-3	260	270
COPPER	7440-50-8	390	390
LEAD	7439-92-1	450	530
MERCURY	7439-97-6	0.41	0.59
SILVER	7440-22-4	6.1	6.1
ZINC	7440-66-6	410	960
PAHs		**mg/kg OC[c] (ppm OC)**	
LPAH[b,d]		370	780
NAPHTHALENE	91-20-3	99	170
ACENAPHTHYLENE	208-96-8	66	66
ACENAPHTHENE	83-32-9	16	57
FLUORENE	86-73-7	23	79
PHENANTHRENE	85-01-8	100	480
ANTHRACENE	120-12-7	220	1,200
2-METHYLNAPHTHALENE	91-57-6	38	64
HPAH[b,e]		960	5,300
FLUORANTHENE	206-44-0	160	1,200
PYRENE	129-00-0	1,000	1,400
BENZ(A)ANTHRACENE	56-55-3	110	270
CHRYSENE	218-01-9	110	460
TOTAL BENZOFLUORANTHENES[b,f]	205-99-2; 205-82-3 207-08-9	230	450
BENZO(A)PYRENE	50-32-8	99	210
INDENO (1,2,3,-C,D) PYRENE	193-39-5	34	88
DIBENZO (A,H) ANTHRACENE	53-70-3	12	33
BENZO(G,H,I)PERYLENE	191-24-2	31	78
Chlorinated Hydrocarbons		**mg/kg OC[c] (ppm OC)**	
1,2-DICHLOROBENZENE	95-50-1	2.3	2.3
1,4-DICHLOROBENZENE	106-46-7	3.1	9
1,2,4-TRICHLOROBENZENE	120-82-1	0.81	1.8
HEXACHLOROBENZENE	118-74-1	0.38	2.3
Phthalates		**mg/kg OC[c] (ppm OC)**	
DIMETHYL PHTHALATE	131-11-3	53	53
DIETHYL PHTHALATE	84-66-2	61	110
DI-N-BUTYL PHTHALATE	84-74-2	220	1,700
BUTYL BENZYL PHTHALATE	85-68-7	4.9	64
BIS (2-ETHYLHEXYL) PHTHALATE	117-81-7	47	78
DI-N-OCTYL PHTHALATE	117-84-0	58	4,500
DIBENZOFURAN	132-64-9	15	58
HEXACHLOROBUTADIENE	87-68-3	3.9	6.2
N-NITROSODIPHENYLAMINE	86-30-6	11	11
TOTAL PCBs[b]		**12**	**65**

Table 2-3. Marine Sediment Quality Standards--Chemical Criteria WAC 173-204-320 (continued)

Chemical Parameter	CAS Number	Sediment Quality Standards WAC 173-204-320[a]	Sediment Impact Zone Maximum Level, WAC 173-204-420[a]
Phenols and Misc. Extractables		**µg/kg dw (ppb dw)**	
PHENOL	108-95-2	420	1,200
2-METHYLPHENOL	95-48-7	63	63
4-METHYLPHENOL	106-44-5	670	670
2,4-DIMETHYL PHENOL	105-67-9	29	29
PENTACHLOROPHENOL	87-86-5	360	690
BENZYL ALCOHOL	100-51-6	57	73
BENZOIC ACID	65-85-0	650	650

Notes:

[a] Where laboratory analysis indicates a chemical is not detected in a sediment sample, the detection limit shall be reported and shall be at or below the Marine Sediment Quality Standards chemical criteria value set in this table.

[b] Where chemical criteria in this table represent the sum of individual compounds or isomers, the following methods shall be applied:

(i) Where chemical analyses identify an undetected value for every individual compound/isomer then the single highest detection limit shall represent the sum of the respective compounds/isomers; and

(ii) Where chemical analyses detect one or more individual compound/isomers, only the detected concentrations will be added to represent the group sum.

[c] The listed chemical parameter criteria represent concentrations in parts per million, "normalized," or expressed, on a total organic carbon basis. To normalize to total organic carbon, the dry weight concentration for each parameter is divided by the decimal fraction representing the percent total organic carbon content of the sediment.

[d] The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds as listed.

[e] The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3,-c,d)pyrene, Dibenzo(a,h)anthracene, and Benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.

[f] The TOTAL BENZOFLUORANTHENES criterion represents the sum of the concentrations of the "B," "J," and "K" isomers.

2.4 Biological Tests

In marine and estuarine environments, biological testing will be implemented if SMS chemical criteria are exceeded for the 47 SMS chemicals (or chemical groups) listed in Table 2-3. Surface (0 – 1 ft) samples will be collected at four (4) locations co-located with core samples where the prior sediment characterization (WE 2018c) reported either minor detected or non-detect exceedances of SMS Sediment Cleanup Objective (SCO) screening criteria for non-bioaccumulative chemicals. No other biological testing is included in the initial sediment characterization; however, biological testing is anticipated in subsequent efforts if SMS chemicals exceed screening criteria.

In the event that biological testing is required, the SMS require the use of two acute effects biological tests and one chronic effects biological test for each of the following purposes:

- To determine whether the SQS biological effects level is exceeded [WAC 173-204-310(2)(a)]
- To determine whether the SIZmax biological effects level is exceeded [WAC 173-204-420(3)(a)]

Acute Effects Tests

- Amphipod: A 10-day acute sediment toxicity test that assesses mortality of one of the following amphipods: *Rhepoxynius abronius*, *Ampelisca abdita*, or *Eohaustorius estuaries*, which is chosen based on the interstitial water salinity and the percentage of sediment fines.

- Larval: Any one of several acute sediment toxicity tests that assess mortality and/or abnormality of larvae of the following organisms:
  - Pacific oyster, *Crassostrea gigas*
  - Blue mussel, *Mytilus galloprovincialis*

- Purple sea urchin, *Strongylocentrotus purpuratus*
- Green sea urchin, *Strongylocentrotus droebachiensis*
- Pacific sand dollar, *Dendraster excentricus*

Chronic Effects Tests

- Juvenile polychaete: A 20-day sublethal sediment toxicity test that assesses decreases in biomass of the juvenile polychaete *Neanthes* sp.

2.5 Sampling Station Locations

To meet the remedial investigation objectives, surface sediment grab samples (sample depth of 0 – 10 cm) will be collected from seven (7) sampling stations and core samples (sample depth of 0 - 7 ft) will be collected from twelve (12) sampling stations located within the study area (Table 2-4, Figure 3). Four (4) additional surface grab samples (sample depth of 0 – 1 ft) will be co-located with some core samples and archived to perform potential bioassay testing, based on the chemical results of the 0 – 1 ft sampling interval.

Stations SED-1 through SED-17 were reported in WE 2018a, WE 2018c, and WE 2018d. Resampling at ten (10) of the seventeen (17) previous sampling locations is proposed to define the nature and extent of potential contamination. No resampling is proposed at seven (7) of the previous sampling locations. Stations SED-18 through SED-26 are new sampling locations proposed to define the nature and extent of potential contamination. The locations of previous and proposed new sampling stations are provided in Table 2-4; however, these locations will be relocated the minimum distance necessary to collect an acceptable sample if debris obstructs sample collection at the target sampling location. Sample relocation, if required, will be determined in consultation with Ecology.

Table 2-4. Previous (WE 2018c) and New Sediment Sample Location Coordinates

Sample Station	Sample Type[1]	Northing (ft.)	Easting (ft.)	Latitude (NAD83)	Longitude (NAD83)
SED-1	Core + Grab[2]	564577.70	1115755.95	48.5274908	-122.998782
SED-2	N/A	564595.96	1116041.40	48.52756284	-122.997607
SED-3	Core + Grab[2]	564437.42	1115844.30	48.52711326	-122.998401
SED-4	N/A	564340.59	1115603.42	48.52682935	-122.999384
SED-5	Core + Grab[2]	564288.64	1115797.22	48.52670196	-122.998578
SED-6	N/A	564283.69	1115905.01	48.52669671	-122.998133
SED-7	Core	564115.38	1115473.10	48.52620222	-122.999895
SED-8	Core	564090.06	1115530.40	48.52613728	-122.999656
SED-9	Core	564057.95	1115594.68	48.52605424	-122.999387
SED-10	Core	564036.61	1115682.78	48.52600256	-122.999021
SED-11	Core + Grab[2]	564045.21	1115718.42	48.52602889	-122.998875
SED-12	Core	564032.00	1115777.80	48.52599726	-122.998628
SED-13	N/A	563999.37	1115675.97	48.52590001	-122.999045
SED-14	Core	564162.12	1115715.16	48.52634897	-122.998902
SED-15	N/A	564161.08	1115609.68	48.52633799	-122.999337
SED-16	N/A	564180.22	1115513.50	48.52638300	-122.999736
SED-17	N/A	564168.18	1115436.07	48.52634403	-123.000054
SED-18	Grab	564576.19	1115694.41	48.52748193	-122.999036
SED-19	Grab	564614.89	1115813.31	48.52759713	-122.998550
SED-20	Grab	564476.99	1115906.18	48.52722643	-122.998151
SED-21	Grab	564365.82	1115754.91	48.52691016	-122.998762
SED-22	Grab	564369.34	1115891.42	48.52693033	-122.998199
SED-23	Grab	564245.50	1115708.47	48.52657691	-122.998939
SED-24	Grab	564233.54	1115835.82	48.52655396	-122.998413
SED-25	Core	564116.04	1115602.23	48.52621399	-122.999362
SED-26	Core	564106.18	1115687.36	48.52619356	-122.999010

Notes:

1. All 2018 sampling locations (WE 2018c) are summarized above; however, sample locations that are not proposed for re-sampling are indicated as N/A.
2. Grab sample to archive additional sediment for potential bioassay testing.

2.6 Rationale for Station Locations

The initial sediment sampling is proposed to reoccupy ten (10) previous sampling locations and sample nine (9) new sampling locations around Jensen's. The sampling locations were selected to determine the nature and extent of sediment contamination exceeding preliminary Model Toxics Control Act (MTCA) cleanup levels, preliminary Sediment Management Standards (SMS) cleanup standards, and other regulatory requirements. The proposed COPC list for each sample location and depth interval is provided in Table 2-5, and the rationale for each sampling station is summarized below in Table 2-6. A detailed list of analyses and archives by sample location ID, type (core, grab), and interval is provided in Attachment A. The purpose for the proposed sampling locations is to define the nature and extent of chemicals detected during the initial sediment characterization (WE 2018c) that exceeded relevant regulatory criteria. A summary of surface sediment chemical exceedances of SMS and DMMP criteria measured during the initial surface sediment characterization (WE 2018c) is provided in Attachment B.

Table 2-5. Sampling Type and Parameters

Sample Location	Sample Type	Sample Interval, Analyses, and Archives			
		0 – 1 ft (core), 0 – 1 ft (bioassay grab), 0 – 10 cm (grab)	1 – 3 ft	3 – 5 ft	5 – 7 ft
SED-1	Core + Bio Grab	TOC[1], GS[1], Solids[1], Am[2], Sulfides[2], Pest[1], A[1], A (bioassay, TOC, GS, Pest)[2]	A	A	A
SED-2	N/A				
SED-3	Core + Bio Grab	TOC[1], GS[1], Solids[1], Am[2], Sulfides[2], SVOC[1], Pest[1], A[1], A (bioassay, TOC, GS, SVOC, Pest)[2]	A	A	A
SED-4	N/A				
SED-5	Core + Bio Grab	TOC[1], GS[1], Solids[1], Am[2], Sulfides[2], SVOC[1], Pest[1], A[1], A (bioassay, TOC, GS, SVOC, Pest)[2]	A	A	A
SED-6	N/A				
SED-7	Core	TOC, GS, TBT, SVOCs, A	TOC, GS, TBT, A	A	A
SED-8	Core	TOC, GS, TBT, SVOCs, Pest, PCBs, D/F	TOC, GS, TBT, A	A	A
SED-9	Core	TOC, GS, Metals, Hg, TBT, SVOCs, Pest, PCBs, D/F	TOC, GS, Metals, Hg, TBT, SVOCs, Pest, PCBs, D/F	A	A
SED-10	Core	TOC, GS, Metals, Hg, TBT, SVOCs, Pest, PCBs, D/F	TOC, GS, Metals, Hg, TBT, SVOCs, Pest, PCBs, D/F	A	A
SED-11	Core + Bio Grab	TOC[1], GS[1], Solids[1], Am[2], Sulfides[2], Metals[1], Hg[1], SVOCs[1], Pest[1], PCBs[1], D/F[1], A[1], A (bioassay, TOC, GS, Metals, Hg, SVOCs, Pest, PCBs)[2]	TOC, GS, Hg, SVOCs, Pest, PCBs, D/F, A	A	A
SED-12	Core	TOC, GS, D/F, PCBs, A	A	A	A
SED-13	N/A				
SED-14	Core	TOC, GS, Metals, Hg, TBT, SVOCs, Pest, PCBs, A	TOC, GS, TBT, SVOCs, Pest, PCBs, A	A	A
SED-15	N/A				
SED-16	N/A				
SED-17	N/A				
SED-18	Grab	TOC, GS, Pest, A	N/A		
SED-19	Grab	TOC, GS, Pest, A	N/A		
SED-20	Grab	TOC, GS, Pest, A	N/A		
SED-21	Grab	TOC, GS, Pest, A	N/A		
SED-22	Grab	TOC, GS, Pest, A	N/A		
SED-23	Grab	TOC, GS, Pest, PCBs, A	N/A		
SED-24	Grab	TOC, GS, Pest, PCBs, A	N/A		
SED-25	Core	TOC, GS, Metals, Hg, TBT, SVOCs, Pest, PCBs, D/F	TOC, GS, Metals, Hg, TBT, SVOCs, PCBs, D/F, A	A	A
SED-26	Core	TOC, GS, Metals, Hg, TBT, SVOCs, Pest, PCBs, D/F	TOC, GS, Metals, Hg, TBT, SVOCs, PCBs, D/F, A	A	A

Table Notes:

1. Core sample (specified when both core and grab samples will be collected at a sample location).
2. Grab sample (specified when both core and grab samples will be collected at a sample location).

Abbreviations: A = Archive samples; Am = Ammonia; Bio Grab = Surface grab sample (0 – 1 ft) for bioassay archive; Core = Vibracore; D/F = Dioxins/furans; Grab = Surface grab sample; GS = Grain size; Hg = Mercury; Metals = SMS metals; N/A = not applicable because no sample is proposed; PCBs = Polychlorinated biphenyls; Pest = SMS pesticides (Total Chlordane, etc.); Solids = Total solids; Sulfides = Total sulfides; SVOC = Semi volatile organic compounds; TBT = Tributyl tin; TOC = Total organic carbon.

Table 2-6. Sampling Station Rationale

Sample Station	Sample Type	Rationale
SED-1	Core	Vertical and horizontal extent of pesticides. Bound SED-3, SED-18, SED-19, SED-20.
SED-2	N/A	No chemical exceedances detected at or near sample location.
SED-3	Core	Vertical and horizontal extent of pesticides, SVOCs. Bound SED-1, SED-20, SED-21, SED-22.
SED-4	N/A	No chemical exceedances detected at or near sample location.
SED-5	Core	Vertical & horizontal extent of pesticides, SVOCs. Bound SED-21, SED-22, SED-23, SED-24.
SED-6	N/A	No chemical exceedances detected at or near sample location.
SED-7	Core	Vertical & horizontal extent of TBT, SVOCs. Bound SED-8.
SED-8	Core	Vertical & horizontal extent of TBT, pesticides, PCBs, dioxins/furans, SVOCs. Bound SED-7, SED-9, SED-25.
SED-9	Core	Vertical & horizontal extent of metals, Hg, TBT, pesticides, PCBs, dioxins/furans, SVOCs. Bound SED-8, SED-10, SED-25, SED-26.
SED-10	Core	Vertical & horizontal extent of metals, Hg, TBT, pesticides, PCBs, dioxins/furans, SVOCs. Bound SED-9, SED-11, SED-25, SED-26.
SED-11	Core	Vertical & horizontal extent of metals, Hg, pesticides, PCBs, dioxins/furans, SVOCs. Bound SED-10, SED-12, SED-26.
SED-12	Core	Vertical & horizontal extent of dioxins/furans. Bound SED-11.
SED-13	N/A	Known exceedances, which will be bounded by cores at SED-10, SED-11, and SED-12.
SED-14	Core	Vertical & horizontal extent of Hg, TBT, pesticides, PCBs, SVOCs. Bound SED-23, SED-24, SED-25, SED-26.
SED-15	N/A	No chemical exceedances detected at or near sample location.
SED-16	N/A	No chemical exceedances detected at or near sample location.
SED-17	N/A	No chemical exceedances detected at or near sample location.
SED-18	Grab	Horizontal extent of pesticides. Bound SED-1.
SED-19	Grab	Horizontal extent of pesticides. Bound SED-1.
SED-20	Grab	Horizontal extent of pesticides. Bound SED-1, SED-3.
SED-21	Grab	Horizontal extent of pesticides. Bound SED-3, SED-5, SED-22.
SED-22	Grab	Horizontal extent of pesticides. Bound SED-3, SED-5, SED-21.
SED-23	Grab	Horizontal extent of pesticides, PCBs. Bound SED-5, SED-14, SED-24.
SED-24	Grab	Horizontal extent of pesticides, PCBs. Bound SED-5, SED-23.
SED-25	Core	Vertical & horizontal extent of metals, Hg, TBT, PCBs, dioxins/furans, SVOCs. Bound SED-8, SED-9, SED-10, SED-15, SED-26.
SED-26	Core	Vertical & horizontal extent of metals, Hg, TBT, PCBs, dioxins/furans, SVOCs. Bound SED-9, SED-10, SED-11, SED-14, SED-25.

2.7 Proposed Reference Stations

If additional sampling for toxicity testing is required, we propose to collect reference samples in Carr Inlet. The reference area will be selected based upon sample grain size and input provided by the bioassay laboratory around the time reference sediments are collected. Reference sediment coordinates

will be determined based on grain size results and bathymetry from on-site sample locations. Standard field procedures will be followed to ensure that the quality of the sample will not be compromised (PSEP 1997). Bioassay testing requires that test sediments be matched and run with appropriate reference sediment to factor out background conditions and sediment grain-size effects on bioassay organisms. If reference sediments are collected at the same time that other samples are collected for supplemental chemical analyses, test samples (project) and reference samples will be wet-sieved in the field to determine grain size (% fines) required to identify a suitable reference location within Carr Inlet. These wet-sieving results will be recorded and submitted with the sample analysis results. If reference sediments are collected by the bioassay laboratory at a later time, as a result of chemistry failures, the reference location will be identified based on results provided by the chemical analytical laboratory (PSEP, 1986/ASTM D-422).

3. Field Sampling Methods

3.1 Sub-Bottom Profile Sonar Survey

Prior to finalizing sediment sample locations, the Port is considering implementing a sub-bottom profile sonar survey using an EdgeTech SB216S sub-bottom sonar to provide sediment stratigraphy data for the sediment sampling area. Unlike a multibeam survey that fully covers a survey area, the sub-bottom profile sonar survey is similar to a conventional single-beam survey. Data collection occurs on transect lines spaced at consistent distant intervals throughout the sediment sampling area.

The sub-bottom profile data, if collected, will be processed to digitize the presence of debris layers and assign horizontal and vertical locations of each layer. The digitized layers will then be exported to a GIS platform to create a digital elevation model (DEM) of each of the identified debris layers. Calculations can then be made to infer the concentration and thickness of the debris. This will assist in finalizing sediment sample locations that are more likely to result in the collection of suitable sediment samples.

3.2 Station Positioning Methods

The objective of the sampling station positioning procedures is to collect each sample within 3 m of the proposed position, and to record the actual positions where samples were collected.

3.2.1 Horizontal Positioning in Open Water – Vibracores and Power Grabs

Horizontal station positioning will be accomplished from the sampling vessel using a differential global positioning system (DGPS) or similar to locate and document the coordinates of each sample location. If it is not possible to obtain coordinates of the sample locations because of signal interference by structures, then the sample locations will be mapped relative to an identifiable landmark or a position for which coordinates can be obtained.

The DGPS data logger will be loaded with the proposed coordinates of each pre-determined sampling location (station). Using the navigation mode of the DGPS, each station will be located.

The sampling vessel will approach each station and position the sediment sampling device, stainless-steel pneumatic power grab or equivalent, directly over the desired sample location. As the grab sample is collected, the DGPS will log the final coordinates of the actual sampling position. Should wind interfere with positioning and/or holding on station, the vessel will be anchored in such a way as to position the sampling equipment directly over the sample location. The actual latitude and longitude of all final sampling positions will be recorded to the nearest 0.01 foot in the NAD 83, Washington State North Zone horizontal datum.

3.2.2 Vertical Positioning in Water

The vertical control parameters measured are depth to sediment (mudline) and the current water elevation, which will be recorded from the Friday Harbor station (Station ID#: 9449880). Tidal elevations at the project site may be established using the most recent version of Tides and Currents Pro to determine the National Oceanic and Atmospheric Administration (NOAA) tide elevation data for Friday Harbor. The actual tidal elevation data for Friday Harbor can be determined using the NOAA National Water Level Observation Network available at https://tidesandcurrents.noaa.gov/waterlevels.html?id=9449880. The mudline elevation of each sampling station will be determined relative to MLLW by measuring the water depth with a lead line or calibrated fathometer (accounting for the depth of the transducer) and subtracting the tidal elevation at the time of sampling.

3.3 Sampling Equipment

The following items will be needed in the field for sediment collection:

Plans and Field Documentation

- SAP
- Study area maps and coordinates for sampling stations
- Field notebooks and pens/pencils/Sharpies®
- Field collection forms
- Chain-of-custody (COC) forms
- Clipboard

Safety

- HASP
- Health & Safety Field Meeting form
- Flashlights and temporary work lights
- First aid kit

PPE

- Personal flotation devices
- Hard hats
- Safety glasses
- Powder-free nitrile exam gloves
- Heavy work gloves
- Steel-toed work or rubber boots
- Foul weather gear (rain jacket/pants)
- Hat and sun screen

Electronic Equipment and Hand Tools

- Cellular phone
- Digital camera
- Tape measure
- Siphon hose(s)
- Battery powered drill and extra charged batteries
- Box cutter set and extra blades

Sampling Equipment and Supplies

- Sub-bottom sonar
- Pneumatic power grab
- Vibracore head
- Decontaminated 3 or 4-inch diameter core barrels
- Core caps

Decontamination

- Alconox® detergent
- Scrub brushes
- Tap water
- Distilled water
- Spray bottles for tap and distilled water

Sample Processing & Storage

- Stainless-steel bowls and spoons
- Stainless-steel ruler
- Bubble wrap
- Sample jars
- Heavy poly bags
- Custody seals
- Wet ice or frozen gel packs
- Coolers

Supplies

- Waterproof adhesive labels
- Clear packing tape and/or tape strips
- Duct tape
- Ziplock® bags
- Garbage bags (large and small)
- Aluminum foil
- Paper towels
- Batteries

Prior to mobilization, the Sediment Sampling Equipment Checklist will be consulted to ensure all equipment is available and pre-cleaned. As part of the mobilization process, each item will be double-checked by the field coordinator.

3.4 Decontamination Procedures

All sediment sampling and homogenizing equipment, including the mixing bowl and stainless-steel implements, will either be decontaminated between sampling stations or prior to sampling. Decontamination protocols will adhere to PSEP guidelines (1997).

The following procedures apply to field decontamination between sampling stations:

- Rinse with site water and wash with a scrub brush until free of sediment.
- Wash with a scrub brush and phosphate-free detergent.
- Rinse with site water.
- Rinse with distilled water.

Acid or solvent washes will not be used in the field because of safety considerations and problems associated with rinsate disposal and sample integrity.

Alternatively, all sediment sampling equipment may be decontaminated *prior* to the sampling event. In this case, a sufficient number of complete sets of decontaminated sampling utensils will be available on board the sampling vessel to avoid field decontamination requirements. The sampling equipment decontamination steps are as follows:

- Scrub with a laboratory grade soap (Alconox®) solution to remove any residual materials.
- Rinse equipment with tap water five times.
- Rinse equipment with a 10% nitric acid solution.
- Rinse equipment with tap water five times.
- Rinse equipment with methanol contacting all surfaces.
- Rinse equipment with tap water ten times.
- Rinse equipment with deionized water three times.
- Wrap equipment with aluminum foil.

Additional precautions will be taken to minimize the possibility of cross-contamination. Between surface grab sample collection stations, the power grab will be scrubbed with Alconox and rinsed with site water. The grab sampler will be visually inspected to ensure that all sediment has been removed before collecting the next grab.

Any sampling equipment that is not cleaned to the satisfaction of the Sampling Project Manager or Field Operations Coordinator will not be used for further sampling activities.

3.5 Sample Collection Procedure

3.5.1 Vibracore Sampling Procedure

Sediment cores for chemical analysis will be collected from open water areas using a generator-powered vibracorer, deployed by hydraulic winch from the A-frame of a 25-foot or greater, shallow draft sampling vessel, or similar. Cores will be collected using decontaminated 3 or 4-inch diameter core barrels (tubes), pre-cleaned cellulose acetate butyrate (CAB) liners inside a metal core tube, or similar.

The general vibracoring procedure will be as follows:

- After the sampling station has been located (Section 3.2), a 7-foot long, decontaminated core barrel, with core nose in place, will be secured to the vibracorer head.
- The vibracorer head and core barrel will be suspended from the A-frame of the vessel and the weight package will be attached to complete the coring assembly.
- The sampling vessel will position the coring assembly over the sampling position and deploy the assembly, using the weight package to maintain the coring assembly in an upright position.

- The cable umbilical to the A-frame and core assembly will be drawn in taut and perpendicular, as the core nose rests on the mudline.
- The location of the umbilical hoist will be measured and recorded and the depth to the core head assembly at full penetration or refusal will be measured with a survey tape attached to the head assembly.
- The core tube will be vibrated into the sediment so that a continuous core sample is collected to a 7-foot depth or until refusal.
- The depth of core penetration will be measured and recorded.
- The core barrel will be extracted from the sediment using the hydraulic winch.
- While suspended, the assembly and core barrel will be sprayed off with site water, photographed, and then placed on the vessel deck.

The core barrel will be removed from the sampler, inspected and photographed. The recovered core material remaining in the core barrel following retrieval will be measured to determine sediment recovery and aid in determining whether any compaction has occurred. Every effort will be made to retain as much material in the core as possible. The overlying water and core nose will be removed. Each core will be capped at both ends with aluminum foil and core barrel caps, and labeled for transport to the on-shore processing location. Cores will be placed in an upright position in an insulated cool box with ice until transported to the core processing location.

If sample acceptance criteria are not achieved, the sample will be rejected and the location re-sampled. In the event that the required penetration depth or sufficient sample volume cannot be achieved upon three successive attempts, the sample station will be relocated. The new sampling location will be recorded and the repositioning process will be noted in the field logbook. If unable to obtain a sample that meets the appropriate acceptance criteria within 50 feet of the proposed location, the sample will be relocated as determined by the Project Manager or Task Manager, as appropriate.

3.5.2 Surface Sediment Grab Sampling Procedure

Sediment samples will be collected using a stainless-steel pneumatic power grab, or equivalent, deployed by hydraulic winch from the A-frame of a 25-foot or greater, shallow draft sampling vessel, or similar.

The general procedure for collecting sediment samples using this type of grab sampler is described below:

- Maneuver the sampling vessel to the pre-identified sampling location.
- Open the grab sampler jaws into the deployment position.
- Guide the sampler overboard until it is clear of the vessel.
- Lower the sampler through the water column to the bottom.
- Once sampler is in position on the sediment surface, signal hydraulic control operator to close the sampler jaws.
- Record the location of the grab when the sampler is closed and the A-frame is centered directly over the sampler (the cable will be perpendicular to the boat deck).
- Retrieve the sampler.
- Guide the sampler aboard the vessel and place it on the work stand on the deck; use care to avoid jostling that might disturb sample integrity.
- Photograph the sample.
- Examine the sample using the following sediment acceptance criteria:
  - The sample does not contain foreign objects;

- The sampler is not over-filled with sediment so that the sediment surface presses against the top of the sampler;
- No leakage has occurred, as indicated by overlying water on the sediment surface;
- No sample disturbance has occurred, as indicated by limited turbidity in the overlying water;
- No winnowing has occurred, as indicated by a relatively flat, undisturbed surface; and
- A penetration depth of at least 11 cm has been achieved (10 – 16 inches, for bioassay archives).

If the first grab at an approved sampling station fails to meet acceptance criteria for any reason, two additional attempts will be made to collect the grab at that location. If these additional attempts fail, the Sampling Project Manager will exercise best professional judgment to move the station as necessary, in order to obtain a representative and adequate sample. Surface conditions that may prevent collection of a grab sample include hard substrate, debris, or other causes.

3.5.3 Sampling Logs

As samples are collected, and after the sulfides subsamples have been taken, logs and field notes of all samples will be recorded. The sediment within each core or grab will be described throughout the full penetration depth. All observations will be recorded on a sediment core or grab log sheet. Photographs of the exposed sediment core (Section 3.5) will further document sediment conditions. A description of each core sample will be recorded on the sediment core log sheet for the following parameters, as appropriate and present:

- Sample recovery (depth in feet of penetration and estimated sample compaction).
- Physical sediment description in accordance with the Unified Soil Classification System (includes type, density/consistency, color).
- Description of any large debris/coarse gravel including size of debris and an estimate of percent by volume in each core section.
- Odor (e.g., hydrogen sulfide, petroleum).
- Biological activity (e.g., vegetation, live or dead organisms, shells, tubes, bioturbation, or organic detritus).
- Any other distinguishing characteristics or features.

3.6 Sample Processing Procedure

3.6.1 Grab Sample Compositing

Ideally, chemical analyses will be conducted on discrete sediment samples collected from a single cast of the sampling device at each station. In practice, it is often necessary to collect more than one cast of sediment sample per station when the proposed analyses (including chemical analyses, physical analyses, and toxicity testing) require larger volumes of sediment from the targeted depth (e.g., 0–10 cm) than can be acquired in a single cast of the sampling device. In such cases, multiple casts of the sampling device will be made at the same station, taking care to sample as close as possible to other casts at that station. The station and grab number for each grab collected at each station will be logged in the DGPS memory and recorded on a grab sample log. Sediments collected from the targeted depth with each cast of the sampling device will be combined with the other sediments collected from that depth at that station and, after removal of unrepresentative material (e.g., woody debris, shells, rocks) at the discretion of the Sampling Project Manager or the Field Operations Coordinator, homogenized to a uniform appearance by stirring. Subsamples will be taken from this composite sediment sample for chemical analyses, physical analyses, and toxicity testing.

If these analyses are required, sediment samples collected for the analysis of potentially volatile chemicals (e.g., total sulfides) will not be composited and/or homogenized. Instead, samples for total

sulfide analyses will be taken from the first acceptable grab (e.g., of sufficient grab depth, no leaking, sediment undisturbed) at each station immediately after retrieval and placed in appropriate sample containers prior to homogenization and subsampling for other analyses. Remaining sediment from the targeted depth will be placed in a decontaminated stainless-steel mixing bowl and the bowl covered with aluminum foil between casts. Additional casts will be made at that station until a sufficient volume of sediment from the targeted depth is collected for all chemical and physical analyses.

3.6.2 Vibracore Sample Processing Procedure

Sediment cores will be processed as soon after collection as feasible. The capped, labeled, 7-foot core sections will be transported to the core processing facility. Each core section will be removed from the 4°C refrigerator and placed horizontally onto the core processing table. The cores will either be extruded directly onto the core processing table (preferred) or split longitudinally with a circular saw or box cutter with a roofing blade, taking care not to contaminate the sediment with excessive core tube debris. Cores will be photographed to document the processing procedure and key sampling intervals, starting with the intact core after it is first extruded.

If these analyses are required, sediment samples collected for the analysis of potentially volatile chemicals (e.g., total sulfides) will not be composited and/or homogenized. Instead, samples for total sulfide analyses will be taken from each sampling interval immediately after extrusion and placed in appropriate sample containers prior to homogenization and subsampling for other analyses.

After volatile samples have been collected (if total sulfides analyses are required), each core will be divided into the following sampling intervals:

- 0 – 1 foot: Surface sediments
- 1 – 3 feet: Shallow subsurface interval
- 3 – 5 feet: Mid subsurface interval (archive)
- 5 – 7 feet: Deep subsurface interval (archive)

Using data from the appropriate sediment core log sheet, the material for each sampling interval will be determined. Sediments from each target depth interval will be placed into a decontaminated, stainless steel bowl for homogenization, taking care not to collect material that was in direct contact with the core barrel. Sediments will be homogenized using a decontaminated stainless-steel spoon. Homogenized sediments will then be distributed to the appropriate sample containers. Containers will be secured with lids, and completed sample labels will be affixed to the containers. Clear tape may be placed over the labels to prevent damage from melt water while in the cooler.

3.6.3 Surface Sediment Grab Sample Processing Procedure for Chemical Analysis

Sediment processing for grab samples is described below:

- Siphon off any standing water from the surface of the sediment using a hose primed with site water. Be careful during siphoning not to disturb the integrity of the sediment surface.
- Photograph the grab sample surface.
- No material that has been in contact with any interior sampler surface may be collected or composited for analysis.
- Collect the remaining upper 10 cm of sediments from the sampler using a stainless-steel spoon. Place the sediment in a stainless-steel mixing bowl.
- Cover the bowl of sediment with a sheet of aluminum foil if additional sediment grabs must be collected before processing.

- Thoroughly rinse the interior of the sampler with site water until all loose sediment has been washed off.
- Repeat the sampling process until sufficient sediment volume is obtained from the station to satisfy the analytical requirements.
- Homogenize the sediment using a stainless-steel spoon.
- Distribute the homogenized sediment to appropriate sample containers, secure the container lids, and ensure that sample labels are completely and correctly filled out and affixed to the containers. Clear tape may be placed over the labels to prevent damage from melt water while in the cooler.
- Clean the exterior of all sample containers and store in an ice chest at 4 degrees Celsius (°C).
- Thoroughly decontaminate the sampler and homogenization equipment.
- Ensure that all logbook and grab sample log sheet entries are complete.
- Proceed to the next proposed sampling location.

3.6.4 Surface Sediment Grab Sample Processing Procedure for Bioassay Archive

Sediment processing for grab samples is described below:

- Siphon off any standing water from the surface of the sediment using a hose primed with site water. Be careful during siphoning not to disturb the integrity of the sediment surface.
- Photograph the grab sample surface.
- No material that has been in contact with any interior sampler surface may be collected or composited for analysis.
- Sulfides analyses are only anticipated for potential bioassay archives. For sulfides analysis, a stainless-steel spoon will be used to transfer sediments representing the upper 12 inches *immediately* to clean, laboratory-supplied sample containers pre-labeled for sulfides.
- Collect the upper 12 inches of sediments from the sampler using a stainless-steel spoon. Place the sediment in a stainless-steel mixing bowl.
- Cover the bowl of sediment with a sheet of aluminum foil if additional sediment grabs must be collected before processing.
- Thoroughly rinse the interior of the sampler with site water until all loose sediment has been washed off.
- Repeat the sampling process until sufficient sediment volume is obtained from the station to satisfy the analytical requirements.
- Homogenize the sediment using a stainless-steel spoon.
- Distribute the homogenized sediment to appropriate sample containers (borosilicate glass, high density polyethylene, or polyethylene bags), secure the container with zero headspace, and ensure that sample labels are completely and correctly filled out and affixed to the containers. Clear tape may be placed over the labels to prevent damage from melt water while in the cooler.
- Clean the exterior of all sample containers and store in an ice chest at 4 degrees Celsius (°C).
- Thoroughly decontaminate the sampler and homogenization equipment.
- Ensure that all logbook and grab sample log sheet entries are complete.
- Proceed to the next proposed sampling location.

3.7 Sample Identification

A sample identification system will be used to track all environmental samples and their analytical results. This identification system is designed to maintain unique sample designations in the electronic data transfers anticipated for this project. All samples will be designated with a unique alpha-numeric

identification, which will be used on sample labels and all other applicable documentation. The sample identification system is as follows:

SED-##@: *-* (i.e., SED-01:0-1)

SED	=	Sample origin designation (SED = sediment)
@	=	G (Grab) or C (Core)
##	=	Sample location designation number (Table 3-2)
-	=	Samples depth in feet or centimeters below mudline.

For example, sample designation SED-01C:0-1 would represent a sediment sample obtained from the vibracore sample location 01, at a depth of 0-1 feet below mudline, while SED-01G:0-1 would represent a sediment grab sample collected at location 01, at a depth of 0-1 feet below mudline. Similarly, SED-18G:0-10 would represent a sediment surface sample obtained from the grab sample location 18, at a depth of 0-10 cm.

This sample identification system is intended to provide consistency with prior sediment investigation work (WE 2018).

3.8 Sample Containers and Labels

Table 3-1 describes sample container requirements. Sample containers will be provided by the analytical laboratory.

Table 3-1. Container Size and Field Preservation

Sample Type	Container	Field Preservation
Grain size	16 oz P	4°C
Ammonia	4 oz G	4°C
Total Solids		
Total Organic Carbon		
Sulfides (Total)	4 oz GS	4°C, 2N ZnOAc, no headspace
Metals & Hg	4 oz G	4°C
Semivolatiles	16 oz G	4°C
PCBs and Pesticides		
Pesticide Archive	4 oz G	4°C
Sediment Toxicity	3 L PB	4°C, no headspace
Tributyltin	4 oz G	4°C
Dioxins/Furans	8 oz AG	4°C
Dioxins/Furans Archive	8 oz AG	4°C
Archive	16 oz G	4°C

Abbreviations and Acronyms:
AG – Amber Glass Jar
G – Glass Jar
GS – Glass Jar with Septa
P – Linear polyethylene
PB – Polyethylene Bag
2 N ZnOAc – 2 N zinc acetate

Water-resistant, self-adhesive labels will be attached to the outside of all sediment sample containers. The following information should be provided on each sample label in waterproof ink: a sample identification number, the site or project name, the station number, sampling date and time, sampling personnel, preservative (if appropriate), and note whether the sample should be archived.

3.9 Field Documentation Procedures

As samples are collected, and after the sulfides subsamples have been taken, logs and field notes of all samples will be recorded. Field documentation will include a field log, core or grab sample log, and COC form. Additionally, photographs of all samples should be taken, including an indicator of sample location.

A daily field log will be used to record general information, including names of field crew members, sampling dates, arrival and departure times, weather conditions, sample equipment performance, and other observations.

Sample collection logs will be maintained throughout grab sampling activities. Each log will include station ID, sample location coordinates, grab number, date, time, and water depth. Sample observations will be recorded, including color, sediment type(s), odor, type and amount of any debris present, obvious evidence of contamination (e.g., sheen), and any deviations from the SAP necessitated by field conditions.

COC requirements are described further in Section 4.2.

3.10 Procedures for Disposal of Excess Sediment

Excess sediment remaining after all sampling is completed will be returned to 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 heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the site by sampling personnel and placed in a normal refuse container for disposal as solid waste.

4. Sample Handling Procedures

Sample handling procedures are designed to ensure sample integrity between the time of collection and the time that laboratory analysis begins. These procedures include sample storage, chain-of-custody, and sample delivery.

4.1 Sample Storage Requirements

Chemical and Physical Analyses: All sediment samples will be placed on ice in a cooler and held at approximately 4°C until they are received by the analytical laboratories. Upon sample receipt, the laboratories will comply with storage temperatures and maximum holding times required for the specific analyses to be performed (Table 4-1). Samples for mercury analysis will be frozen by the analytical laboratory if not immediately analyzed; however, chemistry analyses are expected to proceed as soon as possible after sample collection.

Sediment samples may be archived for later analysis by freezing them and holding them at -18°C except for the analyses of grain size, ammonia, total sulfides and volatile organic compounds; allowance for expansion of the sample should be made to prevent breakage of the sample bottles upon freezing. The archived samples may be thawed within the maximum holding times and analyzed for any of the analytes, except for ammonia, total sulfides, volatile organic compounds, and grain size.

Biological Analyses: All sediment samples intended for toxicity testing will be transported to the chemical laboratory on ice at 4°C. The samples will be held in the laboratory in the dark at 4°C with zero headspace and should not be frozen. If the chemical laboratory is unable to maintain these conditions, archived toxicity samples will be transported to the bioassay laboratory for storage in a nitrogen atmosphere. According to the PSEP (1995) toxicity test guidelines, all toxicity tests should be initiated as soon as possible (ideally within 2 weeks of collecting the samples in the field, unless stored at 4°C with zero headspace or in a nitrogen atmosphere).

Toxicity testing of archived samples will be initiated if the chemical laboratory reports concentrations that exceed SCO criteria for non-bioaccumulative chemicals. Maximum holding times will be considered as part of this tiered testing event, in which toxicity testing will only occur if triggered by prior chemical analyses. This tiered approach is used by the Dredged Material Management Program (DMMP) for evaluating dredged sediments for unconfined, open-water disposal in Puget Sound. The DMMP allows sediment samples to be held at 4°C in the dark with zero headspace or in a nitrogen atmosphere up to 8 weeks prior to toxicity testing. Sediments will be stored for as short time as possible after field collection. Logistical constraints are likely to mandate a holding time greater than 2 weeks; therefore, the DMMP sample storage requirements should be followed.

Actual holding times and conditions will be reported along with the toxicity test results.

Table 4-1. Sample Handling Requirements

Parameter	Sample Preservation	Holding Time
Grain size	Cool/4 °C	6 months
Total solids	Cool/4 °C Freeze, -18 °C	14 days 6 months
TOC	Cool/4 °C Freeze, -18 °C	14 days 6 months
Ammonia	Cool/4 °C	7 days
Total sulfides	Cool/4°C 2N ZnOAc, no headspace	7 days
Mercury	Freeze, -18 °C	28 days
Other metals	Cool/4 °C Freeze, -18 °C	6 months 2 years
SVOCs, PCBs (Aroclors) After extraction	Cool/4 °C Freeze, -18 °C Cool/4 °C	14 days 1 year 40 days
VOCs*	Cool/4°C, no headspace	14 days
Sediment toxicity	Cool/4°C Cool/4°C, nitrogen atm	2 weeks 8 weeks
Tributyltin	4 ± 2°C	6 months
Dioxins/Furans	4 ± 2°C -18 ± 2°C	14 days 1 year
Pesticides (Total Chlordane) After extraction	4 ± 2°C -18 ± 2°C 4 ± 2°C	14 days 1 year 40 days

* – Not proposed for this sampling event.

4.2 Chain-of-Custody Procedures

COC procedures will document the transfer of all samples from the Field Operations Coordinator to the analytical laboratories. Duplicate or triplicate COC forms will be used to record each sample container at the end of each sampling day. At a minimum, the forms will identify the sample collection date and times, the project name and number, and the number of preserved and unpreserved sample containers. It is the Field Operations Coordinator's responsibility to ensure that each form is accurately completed and signed at the time of sample transfer. One copy of each form will be placed in a waterproof bag and taped to the inside of each sample cooler. The Field Operations Coordinator will retain one copy of each form. Sample coolers will be sealed with chain-of-custody tape and kept in a secure location when not in the presence of the Field Operations Coordinator or an assigned sampling crew member.

4.3 Delivery of Samples to Analytical Laboratories

All samples will be delivered to the laboratories within 24 to 72 hours following completion of the sample processing. All samples will be maintained at 4°C.

Individual sample containers will be placed in individual plastic bags, and packed to prevent breakage in transport coolers. Sufficient ice will be sealed in plastic bags and packed in the coolers to maintain samples at 4°C. One copy of the chain-of-custody form will be sealed in a waterproof bag and taped to the inside of the cooler lid. A chain-of-custody seal will be placed on the outside of the cooler any time it is not with the Field Operations Coordinator or assigned crew. Upon receipt of the samples at the laboratories, the condition of the samples will be inspected and recorded, and the chain-of-custody form will be signed by the receiving laboratory staff.

5. Laboratory Analytical Methods

5.1 Chemical Analyses and Target Detection Limits

Analyses of sediment samples will include contaminants of potential concern (COPCs) and conventional sediment parameters. Table 2-5 summarizes the COPCs to be analyzed for each sample location and interval. Table 5-1 summarizes the recommended sample preparation methods, cleanup methods, analytical methods, and recommended reporting limits for COPCs and conventional sediment variables (Table 5-1 includes chemicals and conventionals that are not required under this sampling framework, but include the complete SMS chemical list). Achieving the quantitation limits in Table 5-1 will generally allow comparison with most numerical criteria. However, if the sediments contain low TOC, the TOC-normalized limits for certain chemicals may be above the numerical criteria expressed on a TOC-normalized basis. Samples may be analyzed using additional cleanup steps or alternative test methods to achieve lower detection limits. For example, hexachlorobenzene, trichlorobenzene, and hexachlorobutadiene may be analyzed by GC/ECD (EPA Method 8081) as an alternative to 8270C. Detection limits should be at a level sufficient to meet the SMS chemical criteria for TOC levels as low as 0.5 percent. If, after using appropriate sample cleanup procedures, the analytical laboratory is unable to achieve sufficiently low detection limits to allow comparisons with TOC-normalized criteria, then the laboratory will contact the Sampling Project Manager to report the difficulty before completing analyses. If lower detection limits cannot be reliably attained, then non-normalized detection limits will be compared to the 1988 dry weight normalized Apparent Effects Thresholds (AETs) criteria (SCUM Table A-1; Ecology 2021).

Table 5-1. Sample Preparation Methods, Analytical Methods, and Reporting Limits

Chemical	Preparation Method	Analytical Methods	Reporting Limits
Metals			**mg/kg dw**
Arsenic	EPA 6010/6020/3050B	EPA 6010/6020	57
Cadmium	EPA 6010/6020/3050B	EPA 6010/6020	5.1
Chromium	EPA 6010/6020/3050B	EPA 6010/6020	260
Copper	EPA 6010/6020/3050B	EPA 6010/6020	390
Lead	EPA 6010/6020/3050B	EPA 6010/6020	450
Mercury	EPA 7471	EPA 7471	0.41
Silver	EPA 6010/6020/3050B	EPA 6010/6020	6.1
Zinc	EPA 6010/6020/3050B	EPA 6010/6020	410
LPAHs[a]			**µg/kg dw**
Naphthalene	EPA 3550-mod[b,c]	EPA 8270	2100
Acenaphthylene	EPA 3550-mod[b,c]	EPA 8270	1300
Acenaphthene	EPA 3550-mod[b,c]	EPA 8270	500
Fluorene	EPA 3550-mod[b,c]	EPA 8270	540
Phenanthrene	EPA 3550-mod[b,c]	EPA 8270	1500
Anthracene	EPA 3550-mod[b,c]	EPA 8270	960
2-Methylnaphthalene	EPA 3550-mod[b]	EPA 8270	670
HPAHs[a]			**µg/kg dw**
Fluoranthene	EPA 3550-mod[b,c]	EPA 8270	1700
Pyrene	EPA 3550-mod[b,c]	EPA 8270	2600
Benzo(a)anthracene	EPA 3550-mod[b,c]	EPA 8270	1300
Chrysene	EPA 3550-mod[b,c]	EPA 8270	1400
Total benzofluoranthenes[d]	EPA 3550-mod[b,c]	EPA 8270	3200
Benzo(a)pyrene	EPA 3550-mod[b,c]	EPA 8270	1600
Indeno(1,2,3-cd)pyrene	EPA 3550-mod[b,c]	EPA 8270	600
Dibenzo(a,h)anthracene	EPA 3550-mod[b,c]	EPA 8270	230
Benzo(g,h,i)perylene	EPA 3550-mod[b,c]	EPA 8270	670
Chlorinated Hydrocarbons[a]			**µg/kg dw**
1,2-Dichlorobenzene	EPA 3550-mod[b]	EPA 8270	35
1,4-Dichlorobenzene	EPA 3550-mod[b,c]	EPA 8270	110
1,2,4-Trichlorobenzene	EPA 3550-mod[b,c]	EPA 8270	31
Hexachlorobenzene	EPA 3550-mod[b,c]/3540	EPA 8270/8081	22
Phthalates[a]			**µg/kg dw**
Dimethyl phthalate	EPA 3550-mod[b,c]	EPA 8270	71
Diethyl phthalate	EPA 3550-mod[b,c]	EPA 8270	200
Di-n butyl phthalate	EPA 3550-mod[b,c]	EPA 8270	1400
Butyl benzyl phthalate	EPA 3550-mod[b,c]	EPA 8270	63
Bis(2-ethylhexyl)phthalate	EPA 3550-mod[b,c]	EPA 8270	1300
Di-n-octyl phthalate	EPA 3550-mod[b,c]	EPA 8270	6200
Phenols[a]			**µg/kg dw**
Phenol	EPA 3550-mod[b,c]	EPA 8151/8270	420
2-Methylphenol	EPA 3550-mod[b,c]	EPA 8151/8270	63
4-Methylphenol[e]	EPA 3550-mod[b,c]	EPA 8151/8270	670
2,4-Dimethylphenol	EPA 3550-mod[b,c]	EPA 8151/8270	29
Pentachlorophenol	EPA 3550-mod[b,c]	EPA 8151/8270	360
Misc. Extractables[a]			**µg/kg dw**
Benzyl alcohol	EPA 3550-mod[b]	EPA 8151/8270	57
Benzoic acid	EPA 3550-mod[b]	EPA 8151/8270	650
Dibenzofuran	EPA 3550-mod[b]	EPA 8270	540
Hexachlorobutadiene	EPA 3550-mod[b]	EPA 8270	11
N-nitrosodiphenylamine	EPA 3550-mod[b]	EPA 8270	28

Table 5-1. Sample Preparation Methods, Analytical Methods, and Reporting Limits (continued)

Chemical	Preparation Method	Analytical Methods	Reporting Limits
Polychlorinated biphenyls (PCBs)			**µg/kg dw**
PCB Aroclors/Congeners[f]	EPA 3540[c,f] /3550-mod	EPA 8082/1668	130
Conventionals			
Ammonia	[g]	Plumb (1981)	100 mg/L
Grain size[h]	[g]	PSEP, 1986/ASTM D-422	1%
Total solids	[g]	PSEP, 1986	0.1% (wet wt)
Total organic carbon (TOC)	[g]	EPA 9060	0.1%
Total sulfides	[g]	Plumb (1981)/9034/9030B	10 mg/kg
Bioaccumulative Chemicals of Concern			
Tributyltin (bulk sediment)	EPA 3550B or NMFS	Krone/Unger	10 µg/kg
Dioxins/Furans	EPA 1613B	EPA 1613B	0.5-5 or 1 ng/kg
Pesticides (Chlordane)	3540C, 3541, or 3550B	EPA 8081	2 µg/kg

Abbreviations and Acronyms:
EPA – U.S. Environmental Protection Agency
HPAH – high molecular weight polycyclic aromatic hydrocarbon
LPAH – low molecular weight polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PSEP – Puget Sound Estuary Program
TOC – total organic carbon

Notes:
[a] Selected ion monitoring may improve the sensitivity of EPA Method 8270 and is recommended in cases when detection limits must be lowered to human health criteria levels or when TOC levels elevate detection limits above ecological criteria levels. See PSEP organics chapter, Appendix B, Guidance for Selected Ion Monitoring (1997b).
[b] EPA Method 3550 is modified to add matrix spikes before the dehydration step.
[c] If sulfur is present in the samples (as is common in most marine sediment), cleanup procedures specified by EPA SW-846 Method 3660B should be used.
[d] Total benzofluoranthenes represent the sum of the b, j, and k isomers. Some laboratories report total benzofluoranthenes concentration rather than concentrations of individual isomers since isomers may not be able to be separated.
[e] In some instances, 3-methylphenol and 4-methylphenol may not be able to be separated. In this case methylphenol may be reported as the sum of the 3-methyl and 4-methylphenol isomers.
[f] PCB Congeners are not proposed in the initial sampling event, but may be collected if supplemental sampling is required. A SAP addendum will be prepared if subsequent sampling is required. All PCB extracts should be subjected to sulfuric acid/permanganate cleanup as specified by EPA SW-846 Method 3665A.
[g] Sample preparation methods for sediment conventional analyses are described in the analytical methods.
[h] Sternberg, D. (2006). Reporting of sediment-bound contaminants: standardization of sieving and analytical procedures. DMMP/SMS clarification paper on converting phi, mm, or microns to the standard "gravel, sand, silt, clay" groups. See Appendix B.

5.2 Biological Analyses and Testing

PSEP (1995) provides guidelines for conducting the amphipod, larval, and juvenile polychaete tests for marine sediments. If required, biological testing will include the tests and organisms summarized in Table 5-2. Actual test organisms will be determined by the lab based on availability.

Table 5-2. Bioassay Suite

Bioassay Test	Test Organism
10-day Amphipod Mortality Test	*Ampelisca abdita;* *Eohaustorius estuarius;* *Rhepoxynius abronius*
48-hour Larval Development Test (echinoderm or bivalve)	*Mytilus galloprovincialis*; *Dendraster excentricus*
20-day Juvenile Polychaete Growth Test	*Neanthes arenaceodentata*

If biological testing of archived sediments is required, bioassay testing requires that test sediments be matched and run with appropriate reference sediment to factor out background conditions and sediment grain-size effects on bioassay organisms. Reference sediments will be collected by the bioassay laboratory at that time, in the event that bioassays are triggered by potential chemistry failures. The reference location will be identified based on results provided by the chemical analytical

laboratory (PSEP, 1986/ASTM D-422) so that a reference sample(s) with similar (within 20%) grain size distribution (as percent fines) can be targeted for the bioassays. The location of the reference sediment sampling location will be recorded to the nearest 0.1 second (NAD 83).

All sediment samples collected for potential bioassays will be stored at 4°C, either with no headspace or under a nitrogen atmosphere (i.e., nitrogen-purged headspace) pending completion of chemical analyses and initiation of any required biological testing. All bioassays, including retests, should commence within 56 days from collection of the first grab sample in the sediment composite to be tested. The laboratory will maintain chain-of-custody procedures throughout biological testing. Bioassay testing will be initiated as soon as possible after the first chemical results become available and the decision is made to conduct bioassays. This includes obtaining test organisms and control and reference sediments in a timely manner. This approach will support the opportunity for any second-round (additional) biological testing within the allowable 56-day holding period, if such need arises. As initial chemistry data become available, the project manager and the bioassay laboratory representative will maintain close coordination with the client to expedite biological testing decisions.

5.3 Corrective Actions

The analytical laboratory may be required to implement corrective actions and reanalyze samples if data quality assurance reviews indicate that specific control limits were not met in sample analyses. SCUM (Ecology 2021) summarizes quality control procedures, control limits, and corrective actions for analyses of organic chemicals, metals and conventional sediment parameters in SCUM Tables 5-3, 5-4 and 5-5. SCUM (Ecology 2021) summarizes the SMS performance standards for toxicity testing control and reference sediment in Table 5-9.

6. Quality Assurance and Quality Control (QA/QC) Requirements

This section provides an overview of the QA/QC checks consist of measurements performed in the field and laboratory; details are provided in the Quality Assurance Project Plan (Attachment C).

The analytical methods referenced in Section 5.1 specify routine methods required to evaluate data precision and accuracy, and determine whether the data are within the QC limits. Guidelines for minimum samples for field QA/QC sampling and laboratory analysis are summarized in Table 6-1.

Table 6-1. Guidelines for Minimum QA/QC Samples for Field Sampling and Laboratory Analysis

Field		Laboratory				
Media	**Field Duplicate**	**Matrix Duplicate[a]**	**MS**	**MSD[b]**	**Method Blank**	**LCS[c]**
Sediment	1 in 20[d]	1 in 20	1 in 20	1 in 20	1 in 20	1 in 20

Notes:
[a] Matrix duplicate analyzed for metals.
[b] MSD analyzed for organic analyses.
[c] Laboratory Control Sample.
[d] All frequencies of 1 in 20 indicate 1 per batch, when the batch is less than 20 samples.

6.1 QA/QC for Field Methods

The QC samples specified in Table 6-1 will be evaluated to verify accuracy and precision of laboratory results and ensure the quality of the sampling effort and the analytical data for this project. Field QC samples are expected to include field duplicates. QC samples are to be handled in the same manner as the environmental samples collected. The frequency of QC sample evaluation may be adjusted when the final sampling schedule is determined. The frequencies of QC sample evaluation described here should be considered a minimum.

6.2 QA/QC for Chemical Analyses

QA/QC procedures for chemical analyses include analytical instrument calibration, sample holding times, blank analyses to identify potential sample contamination in the laboratory, duplicate analyses to test analytical precision, and analyses of spikes and standards to test analytical accuracy. Laboratory QA/QC procedures are discussed in detail in the analytical protocols and laboratory standard operating procedures for each chemical test. The recommended frequency of specific quality control procedures and associated control limits are summarized in Tables 5-3 through 5-5 of SCUM (Ecology 2021):

- Table 5-3 summarizes organic compounds analyses,
- Table 5-4 summarizes metals analyses, and
- Table 5-5 summarizes conventional analyses.

Minimum laboratory QA/QC is documented in Table 6-2.

Table 6-2. Minimum Laboratory QA/QC

Analysis Type	Method Blank[b]	LCS or OPR (Blank Spike)[c]	Replicate[b]	RM[b,d]	Matrix Spikes[b]	Matrix Spike Duplicate[b]	Surrogates[g]	Puget Sound Ref. Material
Volatile Organics[a]*	X	X			X	X	X	
Semivolatiles[a]	X	X		X[e]	X	X	X	
Aroclor PCBs[a]	X	X		X	X	X	X	
Metals	X	X		X[f]	X			
Total Organic Carbon	X	X	X	X[f]				
Total Solids*	X		X					
Particle Size*			X					
Tributyltin	X		X[h]		X	X	X	
Dioxins/Furans	X		X[h]				X[l]	X
Pesticides[a]**	X		X[h]	X	X	X	X	

Notes:

[a] Initial calibration is required before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet criteria. Ongoing calibration is required at the beginning of each work shift, every 10-12 samples or every 12 hours (whichever is more frequent), and at the end of each shift.

[b] Frequency of Analysis = 5 percent or one per batch, whichever is more frequent.

[c] Laboratory Control Sample or Ongoing Precision and Recovery

[d] Reference Material

[e] Canadian standard SRM-1 or other available sediment SRM.

[f] NIST certified reference material 2704 or other available sediment SRM.

[g] Surrogate spikes will be included with every sample, including matrix-spiked samples, blanks and reference materials.

[h] Matrix spike duplicates may be used.

i Labeled compounds are spiked into each analytical sample.

* Not proposed for analysis as part of the initial sampling effort.

** Total Chlordane.

The laboratory, which has not yet been selected, is responsible for monitoring the analysis, identifying analytical problems and taking corrective actions prior to the expiration of sample holding times. The laboratory will communicate analytical problems to the project manager during the analysis when the laboratory is having difficulty in meeting any project specific requirements, including detection limits. When reasonable corrective actions do not bring QC sample results into control limit, resulting data may need to be qualified, depending on specific project requirements as documented in the project planning document.

6.3 QA/QC for Biological Testing

QA/QC requirements for the various biological tests are described in detail in the protocols for each type of test (PSEP 1987; PSEP 1995; ASTM 2002; ASTM 2010; U.S. EPA 1994; Nebeker et al. 1984; Microbics Corporation 1992). QA/QC requirements for marine sediment toxicity tests generally deal with ensuring that water quality conditions remain within acceptable limits throughout testing. This minimizes contributions to observed effects that could otherwise confound toxicity interpretations. Control limits for temperature, salinity, and dissolved oxygen are shown in Table 5-9 of SCUM (Ecology 2021); there are generally no control limits specified for pH except for Microtox®, although measurements of pH may sometimes be useful in interpreting test results. There are also recommendations for selecting test species based on grain size of the sediments for the amphipod test. Monitoring of sulfides and ammonia in the test chambers is required for marine sediments where either of these chemicals is suspected as being a problem, and is also useful for interpreting test results. The marine sediment toxicity test protocols also require the testing of negative controls, positive controls, and reference sediments, as shown in Table 5-9 of SCUM (Ecology 2021). The reference sediments should have the percent fines within 20% of the sample percent fines. The SMS include marine sediment performance standards for control and reference sediment toxicity test results (WAC 173-204-315(2)).

6.4 Data Quality Assurance Review Procedures

The project QA/QC coordinator will conduct an independent internal quality assurance review. The internal review of analytical data will follow QA1 review procedures (PTI 1989) and will be documented using checklists to identify verified quality control procedures. This internal review will validate external reviews of chemistry data performed by EcoChem, Inc. (EcoChem), and bioassay and/or bioaccumulation data sets (if required) performed by EcoAnalysts, Inc. (EcoAnalysts).

A QA1 chemistry data review evaluates field collection and handling; completeness; data presentation; reporting limits (the practical quantitation limit [PQL] shall not be greater than the SQS of the SMS.); and the acceptability of test results for method blanks, certified reference materials, analytical replicates, matrix spikes, and surrogate recoveries. A QA1 review of bioassay data covers similar field and reporting elements and evaluates the acceptability of test results for positive controls, negative controls, reference sediment, replicates, and experimental conditions (temperature, salinity, pH, dissolved oxygen). Detailed guidance on QA1 review procedures is provided in PTI (1989) and is available from Ecology.

Chemistry and conventionals data may undergo an additional quality assurance review and data validation by EcoChem, Inc. (EcoChem). EcoChem validation shall include a minimum Stage 2b validation for all chemical data. Ten percent of the dioxin/furan congener data may undergo Stage 4 validation, in addition to the Stage 2b validation. Validation will be conducted using the most recent EPA (EPA 2005, 2008, 2009, 2010) guidelines. EcoAnalysts may also perform a QA1 review of bioassay data.

The analytical laboratory will provide full-level, Stage 4 chemistry data packages that will allow for examination of the complete analytical process from calculation of instrument and MSDs, RLs, final dilution volumes, samples sizes, and wet-to-dry ratios to quantification of calibration compounds and all analytes detected in blanks and environmental samples.

7. Data Analysis, Record Keeping, and Reporting

Laboratory results will be evaluated using general descriptions of the sediment chemistry data. Any stations exceeding applicable sediment quality criteria for individual chemicals will be clearly identified. This section describes how data analysis, record keeping, and reporting will occur.

7.1 Analysis of Sediment Chemistry Data

Sediment chemistry results will be tabulated for all measured analyses, including conventional sediment variables. For organic chemicals with TOC-normalized numerical criteria, tables will report TOC-normalized concentrations. Site sediments are expected to be in the range of 3% – 5% TOC, but in the event that TOC values are either very high (> 3.5%) or very low (< 0.5%), dry-weight concentrations may be compared with the dry-weight AET values (Barrick et al. 1988). The data tables will identify the sampling locations, laboratory sample identification numbers, water depth, sample collection date, sampling interval, replicates, chemistry results (same units as numeric SMS criteria, as well as dry weight concentrations for organic compounds), and practical quantitation limits. Appropriate data qualifiers will be attached to chemical concentrations, and detection limits will be reported for undetected analyses. Numerical criteria will be included in the tables, and values that exceed the criteria will be highlighted. For criteria that apply to the sum of individual compounds, isomers, or groups of congeners, the sums and their applicable criteria will be reported as recommended in SCUM (Ecology 2021).

7.2 Analysis of Biological Test Data

If required, laboratory bioassay test data will be tabulated and reported in hard-copy and electronic formats to Ecology. Reported data will include all test, reference, negative control and positive control data. The laboratory bioassay test, control and reference results will be tabulated in the EIM Bioassay data spreadsheets following Ecology's EIM data submittal guidelines. The EIM spreadsheets and Data Entry Help documents are available through the following two links.

- https://ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database
- https://apps.ecology.wa.gov/eim/help/

7.3 Data Interpretation

Results from this sediment investigation will be summarized in a data report that interprets chemical and/or biological test results compared to the legally applicable or recommended chemical and/or biological effects criteria identified in the SMS rule. Samples that exceed criteria and their respective values will be identified by footnoting, underlining, shading, or other similar means in the hardcopy data report summary. Bioassay laboratories are required to conduct evaluations of positive control data for all laboratory bioassay animals. Bioassay laboratories should maintain a "running account" of the mean + 2 standard deviation for each animal type and each positive control result. As required by Ecology, the report will interpret the laboratory reported data. The MyEIM analysis tools report export formats will be used to create and report interpretation results.

7.4 Record Keeping and Reporting Procedures

Record Keeping: Sampling and analysis records will be kept in accordance with SMS requirements. Records will include copies of this SAP, field logs, sediment sample log sheets, chain-of-custody forms, laboratory reports, summary tables, and interpretive reports. We recommend that PoFH retain copies of the following for at least 10 years from report submittal to Ecology:

- Final and Ecology-approved SAP;
- Field records that document any departures from the SAP; and
- Analytical results, including laboratory reports, summary tables and data reports.

Reporting: The results of the sediment sampling and analysis will be provided to Ecology, and other interested agencies as directed by PoFH, in a sediment characterization report. This report will be provided in both paper and electronic format, and shall include (at minimum) a statement of purpose, a description of any deviations from this SAP in sampling and analysis, a sampling station map, coordinates for all sampling locations, sediment data tables summarizing the chemical and conventional variables in the same units as the SQS criteria, and an interpretation of the results. Appendices will include copies of field logs, and copies of chain-of-custody forms.

All data will be uploaded to EIM using JENSEN22 as the EIM Study ID following Ecology's EIM data submittal guidelines.

8. Health and Safety Plan

The purpose of the Health and Safety Plan (HASP) (Attachment D) is to set forth appropriate health and safety procedures to be followed during onsite sampling activities at the site. This HASP identifies potential hazards to which L-E personnel may be exposed. L-E personnel are required to read this HASP and the L-E Corporate Health and Safety Manual. While working at this site, L-E employees shall follow the procedures described in the Corporate Health and Safety Manual and this site-specific HASP. L-E will designate a field safety officer for this project prior to mobilization.

8.1 Description of Tasks

Personnel from the L-E team will collect sediment samples using grab samplers and vibracores deployed from a watercraft designed to perform such tasks. Personnel will collect sediment samples, homogenize appropriate aliquots of sediment for sampling, fill sample containers, dispose of excess sample material, write and affix labels to sample containers, decontaminate sampling equipment, prepare sample containers for transport to one or more laboratories using coolers, prepare chain-of-custody paperwork, and transport samples to lab(s).

8.2 Hazard Assessment

L-E employees and subconsultants must be aware of the hazards onsite. The site is known to have contaminants of potential concern in sediment, which are identified and discussed in the Work Plan. Special attention should be given to physical dangers such as slip, trip, and fall hazards when working around water. Other physical hazards may include pinch points, strains due to lifting, noise, heavy equipment located on or suspended above the vessel, and heat and cold stress. Biological hazards may include insect bites/stings and coronavirus (COVID-19).

8.3 Job Safety Analysis

Level D is the minimum acceptable level for sites where petroleum hydrocarbons are the constituents of concern (COC). Upgrades to Modified Level D occur when there is a possibility that contaminated media can contact the skin or work uniform. Upgrades to Level C occur when there is a presence of product odors. Wear hearing protection when there are high noise levels (see Section 5.2.6 in Attachment D – the L-E Corporate Health and Safety Manual). Workers must maintain proficiency in the use and care of PPE that is to be worn.

Table 8-1. Activity Specific PPE/Sediment Monitoring Summary

Job Task	Safety and Health Risks	PPE Level	Special Requirements
Loading and unloading sample coolers, boat equipment, general non- sampling activities on boat	Lifting. Slips/trips/falls. Boating operations. Inclement weather. Material handling. Working over water.	Level D	Hard hat for overhead hazards. PFD when working on or near water.
Operation of sampling vessel from inside boat house	Boating operations. Confined space.	Modified Level D	Should not leave pilot house if overhead hazards, decontamination chemicals, or sediment exposure is possible. PFD when working on or near water.

Table 8-1. Activity Specific PPE/Sediment Monitoring Summary (continued)

Job Task	Safety and Health Risks	PPE Level	Special Requirements
Operation of sampling equipment outside of boat house	Lifting. Slips/trips/falls. Pinch points. Boating operations. Inclement weather. Material handling. Working over water.	Level D with potential upgrade to Level C	Potential upgrade to Level C when handling samples – presence of product odors. Hard hat for overhead hazards. Face shield for splash hazard. PFD when working on or near water.
Decontamination of sampling equipment	Lifting. Slips/trips/falls. Boating operations. Inclement weather. Material handling. Working over water.	Level D with potential upgrade to Level C	Potential upgrade to Level C when handling samples – presence of product odors. Face shield for splash hazard. Hard hat for overhead hazard. PFD when working on or near water.
General site duties, operation of equipment, etc.	Slips/trips/falls. Working over water.	Level D	Hard hat for overhead hazards. PFD when working on or near water.
Travel to/from site	Vehicular travel	None	Seatbelt while vehicle is in motion.

8.4 Health and Safety Requirements

Each contaminant should be investigated, and precautionary measures taken to protect the user being exposed to contaminants. As appropriate, employees should wear:

- Steel-toe leather or rubber boots
- Coveralls or water-proof gear
- Hard hat
- Safety glasses
- Disposable vinyl or nitrile gloves

Additionally, if the Governor's "Stay Home, Stay Healthy" Proclamation 20-25 remains in effect, employees will keep at least six feet away from coworkers and other people when feasible. When distancing isn't feasible a barrier such as a face mask will be used to prevent transmission of coronavirus.

Personnel and equipment leaving the project area shall be thoroughly decontaminated. Any excess sediment and water must be returned to the area from which it was collected. Procedures for equipment decontamination include washing with Alconox soap (or equivalent) and rinsing with distilled water. This procedure will be performed on all sample collection and preparation equipment that is not dedicated to an individual sample, personal protective equipment, and any other instruments or equipment that encounter contaminated materials.

Since work will occur around water, special attention must be given to physical dangers such as slip, trip, and fall hazards. In general, it is recommended that the sample collector(s) avoid skin contact with all sediment and inhalation of odors.

When working around equipment it is important to always be alert. Always make eye contact and express your intentions when approaching an operator of any equipment. Make sure they know where you are. Any work such as sample labeling, writing in the field note book, and sample handling should be performed in a safe area. L-E personnel will not operate equipment unless they are qualified to do so.

While working onsite, L-E employees must follow health and safety standards that meet or exceed procedures and requirements in the site-specific HASP and the Corporate Health and Safety Plan.

8.5 Emergency Response

In an emergency, call 911 for assistance. The nearest medical clinic is PeaceHealth Peace Island Medical Center, located at 1117 Spring St, Friday Harbor, WA 98250. It is approximately two miles from Albert Jensen and Sons Inc. Boatyard and Marina and less than a 10-minute drive from the site. The main phone number for the facility is (360) 378-2141.

Driving directions from Albert Jensen and Sons Inc. Boatyard and Marina to the PeaceHealth Peace Island Medical Center in Friday Harbor are as follows:

- Head west on Turn Point Rd toward Harrison St – 0.7 mi
- Continue onto Warbass Way – 0.4 mi
- Turn right onto Harrison St – 289 ft
- Continue onto 1st St S/First St S – 289 ft
- Turn left onto Spring St – 0.9 mi
- Turn left into parking lot where Spring St becomes San Juan Valley Rd – 112 ft
- Take the first left to reach the entrance to the PeaceHealth Peace Island Medical Center

A map showing the route from the Albert Jensen and Sons Inc. Boatyard and Marina parking lot to the PeaceHealth Peace Island Medical Center is provided in Figure 4.

A first aid kit will be available on site.

All accidents and near misses shall be reported promptly to the immediate supervisor for evaluation or investigation.

9. Schedule

The immediate project schedule is likely to be driven by interim actions, which we propose to associate with required maintenance actions. As described previously, a substantial amount of required maintenance was deferred by the previous owner. Several components of the existing marina infrastructure are likely to fail if maintenance is deferred much longer. Failure of this infrastructure will not only handicap marina operations, but will also exacerbate the spread of COPCs in the aquatic environment through the accelerated deterioration of creosote-treated structures and sloughing of contaminated upland soils into intertidal areas.

Under the current work plan, initial sediment sampling is expected to occur during Summer 2022.

9.1 Remedial Investigation Schedule

Summer/fall 2020 – Previously-proposed Marine Technical Center building remedial investigation sampling
Summer 2022 – Uplands remedial investigation sampling
Winter or Spring 2023 – In-water remedial investigation sampling

9.2 Remedial Investigation/Feasibility Study Deliverables Schedule

RI/FS Deliverables	Completion Times
Agency Review Draft RI Work Plan	Submitted
Final RI Work Plan including Final SAP, QAPP, and HASP	Submitted
Completion of RI/FS Field Work	24 months following completion of the Final SAP, QAPP and HASP
Agency Review Draft RI/FS Report	180 days following receipt of laboratory data
Agency Review Draft Final RI/FS Report	45 calendar days following receipt of Ecology comments on Agency Review Draft RI/FS Report
Public Review Draft RI/FS Report	45 calendar days following resolution of Ecology comments and receipt of Ecology's written request for Public Review Draft RI/FS Report
Agency Review preliminary Draft Cleanup Action Plan (DCAP)	90 calendar days following submission of the Public Review Draft RI/FS

10. Project Personnel and Responsibilities

At a minimum, the sediment sampling field crew will consist of the Sampling Project Manager, Field Operations Coordinator and a boat driver. Peter Leon, Sampling Project Manager, is responsible for: all aspects of sample collection; reporting; and coordination with PoFH, Ecology, the vessel operator and the analytical laboratory. L-E will designate a field safety officer and Field Operations Coordinator prior to mobilization. The Field Operations Coordinator is responsible for: field activities; ensuring adherence to the SAP; ensuring accurate station locations; summarizing decisions on deviations from the SAP necessitated by field conditions; completing chain-of-custody forms; and keeping field logs and sediment sampling logs. If sediment toxicity testing is triggered by analytical chemistry results, John Malek will oversee bioassays and coordination with the bioassay laboratory. Once field activities are complete, L-E will designate a Data and QA/QC Manager for the project, responsible for verifying that data quality assurance reviews are completed, and reviewing data tables.

To provide the capacity required to accommodate the accelerated in-water investigation schedule requested by the Port, L-E sampling efforts will be supported by CRETE (land-based sample processing lead) and NewFields (water-based sample collection lead and land-based sample processing support). CRETE and NewFields staff will coordinate closely with the Sampling Project Manager throughout the duration of field efforts.

11. References

ASTM Standard. E1391-02. 2002. Standard guide for collection, storage, characterization, and manipulation of sediments for toxicological testing. West Conshohocken, PA: American Society for Testing and Materials International, www.astm.org.

ASTM Standard. E1706-05. 2010. Standard test method for measuring the toxicity of sediment-associated contaminants with freshwater invertebrates. West Conshohocken, PA: American Society for Testing and Materials International, www.astm.org.

Barrick, R.C., D.S. Becker, L.B. Brown, H. Beller, and R. Pastorok. 1988. Sediment Quality Values Refinement: 1988 Update and Evaluation of Puget Sound AET. Volume 1. Final Report. Prepared for Tetra Tech, Inc., Bellevue, Washington, and U.S. Environmental Protection Agency, Seattle, Washington. PTI Environmental Services. Bellevue, Washington.

Ecology. (Washington State Department of Ecology). 2001. Concentrations of Selected Chemicals in Sediments from Harbors in the San Juan Islands. Publication No. 01-03-007. March, 2001.

Ecology. 2021. Sediment Cleanup User's Manual (SCUM), Third Revision. Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC. Publication No. 12-09-057. December, 2021.

EPA (U.S. Environmental Protection Agency). 1986. Test procedures for solid waste. 3rd Edition. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

EPA. 1991a. Method 1624C: volatile organic compounds by isotope dilution GC/MS. Method 1625C: semivolatile organic compounds by isotope dilution GC/MS. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Industrial Technology Division, Washington, D.C.

EPA. 1991b. Draft analytical method for determination of acid volatile sulfide in sediment. U.S. Environmental Protection Agency, Office of Science and Technology, Health and Ecological Criteria Division, Washington, DC.

EPA. 1994. Methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with freshwater invertebrates. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. EPA 600/R-94/024.

EPA. 2005. National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review. Prepared by U.S. Environmental Protection Agency Analytical Services Branch (ASB). September 2005.

EPA. 2008. National functional guidelines for superfund organic methods data review, Office of Superfund Remediation and Technology Innovation, Document ID USEPA-540-R-10-11, Washington D.C., January.

EPA. 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. Prepared by U.S. Environmental Protection Agency Contract Laboratory Program. January 2009.

EPA. 2010. National functional guidelines for superfund inorganic methods data review, Office of Superfund Remediation and Technology Innovation, Document ID USEPA-540-R-08-01, Washington D.C., June.

L-E (Leon Environmental, LLC). 2019. Intertidal and Subtidal Conceptual Site Model and Data Gaps Report, Jenson and Sons Boatyard and Marina, Friday Harbor, Washington. August 2019.

L-E (Leon Environmental, LLC). 2022. Remedial Investigation Work Plan, MTCA AO No. DE 1871, Port of Friday Harbor, Albert Jensen and Sons Inc. Boatyard and Marina, Friday Harbor, Washington. July 2022.

Microbics Corporation. 1992. Microtox® manual, volume 2: Detailed protocols. 1992 ed. Microbics Corporation, Carlsbad, CA.

Nebeker, A.V., M.A. Cairns, J.H. Gakstatter, K.W. Malveg, G.S. Schuytema, and D.F. Krawczyk. 1984. Biological methods for determining toxicity of contaminated freshwater sediments to invertebrates. Environmental Toxicology and Chemistry, 3, 617–630.

Plumb, R.H., Jr. 1981. Procedure for handling and chemical analysis of sediment and water samples. Technical Report EPA/CE-81-1. U.S. Environmental Protection Agency and U.S. Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi.

PSEP (Puget Sound Estuary Program). 1986. Recommended protocols for measuring conventional sediment variables in Puget Sound. Final Report. Prepared by U.S. Environmental Protection Agency. Seattle, WA.

PSEP. 1987. Recommended protocols for sampling and analyzing subtidal benthic macroinvertebrate assemblages in Puget Sound. Final Report. Prepared for U.S. Environmental Protection Agency, Seattle, WA.

PSEP. 1989. Recommended guidelines for measuring organic compounds in Puget Sound sediment and tissue samples. Final Report. Prepared by U.S. Environmental Protection Agency, Seattle, WA.

PSEP. 1991. Reference area performance standards for Puget Sound. Ecology Publication No. 06-09-096. EPA 910/9-91-041. Puget Sound Estuary Program, Prepared for the Washington Department of Ecology and U.S. Environmental Protection Agency, Region 10, Seattle, WA.

PSEP. 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Interim Final Report. Puget Sound Estuary Program, U.S. Environmental Protection Agency Region 10, Seattle, WA.

PSEP. 1997. Recommended guidelines for sampling marine sediment, water column, and tissue in Puget Sound. Puget Sound Water Quality Action Team, U.S. Environmental Protection Agency, Region 10. Seattle, WA.

PTI. 1989. Puget Sound Dredged Disposal Analysis Guidance Manual: Data quality evaluation for proposed dredged material disposal projects. Prepared for the Washington State Department of Ecology, Olympia, Washington by PTI Environmental Services. Bellevue, WA.

USACE (U.S. Army Corps of Engineers, Seattle District), U.S. Environmental Protection Agency (Region 10), Washington Department of Natural Resources, and Washington Department of Ecology. 2021. Dredged Material Evaluation and Disposal Procedures (User's Manual). July 2021.

WAC (Washington Administrative Code), Chapter 173-204, Part III – Sediment Quality Standards, Sections 300 through 350.

WE (Whatcom Environmental Services). 2017a. Phase I Environmental Site Assessment, Jensen's Shipyard, 1293 Turn Point Road, Friday Harbor, Washington. November 21, 2017.

WE. 2017b. Sediment Sampling and Analysis Plan, Jensen's Shipyard and Marina, 1293 Turn Point Road, Friday Harbor, Washington

WE. 2018a. Draft Initial Investigation Report, Jensen's Shipyard, 1293 Turn Point Road, Friday Harbor, Washington. April 2, 2018.

WE. 2018b. Sediment Investigation, Sediment Sampling and Analysis Plan, Jensen's Shipyard and Marina, 1293 Turn Point Road, Friday Harbor, Washington.

WE. 2018c. Draft Sediment Data Report, Jensen's Shipyard and Marina, 1293 Turn Point Road, Friday Harbor, Washington.

WE. 2018d. Draft Remedial Investigation Report, Jensen's Shipyard and Marina, 1293 Turn Point Road, Friday Harbor, Washington. October 15, 2018.

Figures

This page intentionally left blank.

Filename: /Friday Harbor/GIS/PoFH_WorkPlan2021/RIWP_Jensens_vicinity date: 6/22/2021

Port of Friday Harbor
Jensen and Sons Boatyard and Marina

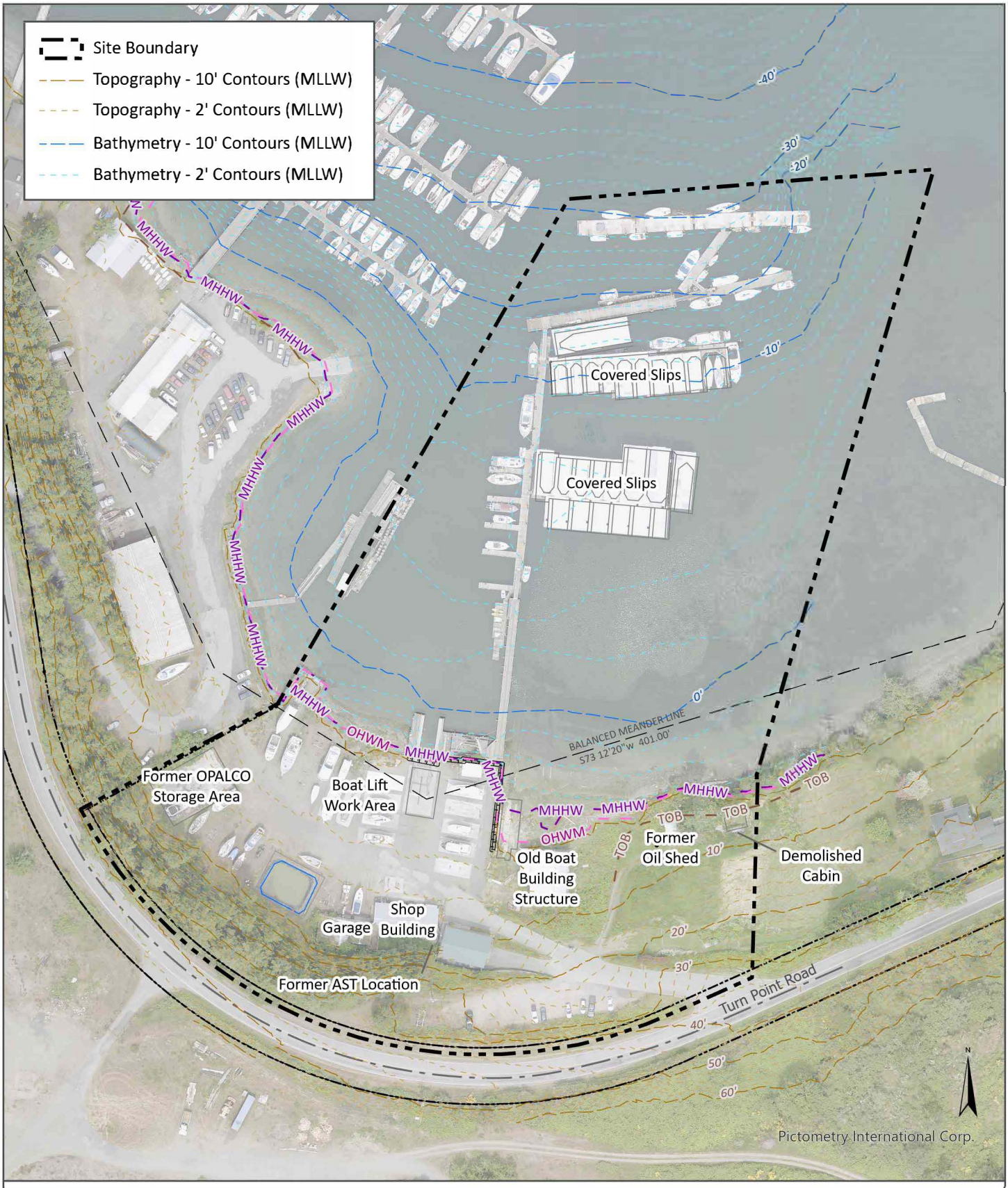
In-Water Sampling & Analysis Plan

Figure 1. Site and Vicinity Map

Data Sources:
San Juan County (2019), Whatcom Environmental (2018)

0 250 500 1,000 Feet

LEON Environmental, LLC



Filename: /Friday Harbor/GIS/PoFH_WorkPlan2021/RIWP_ExistingConditions date: 6/22/2021

Port of Friday Harbor
Jensen and Sons Boatyard and Marina

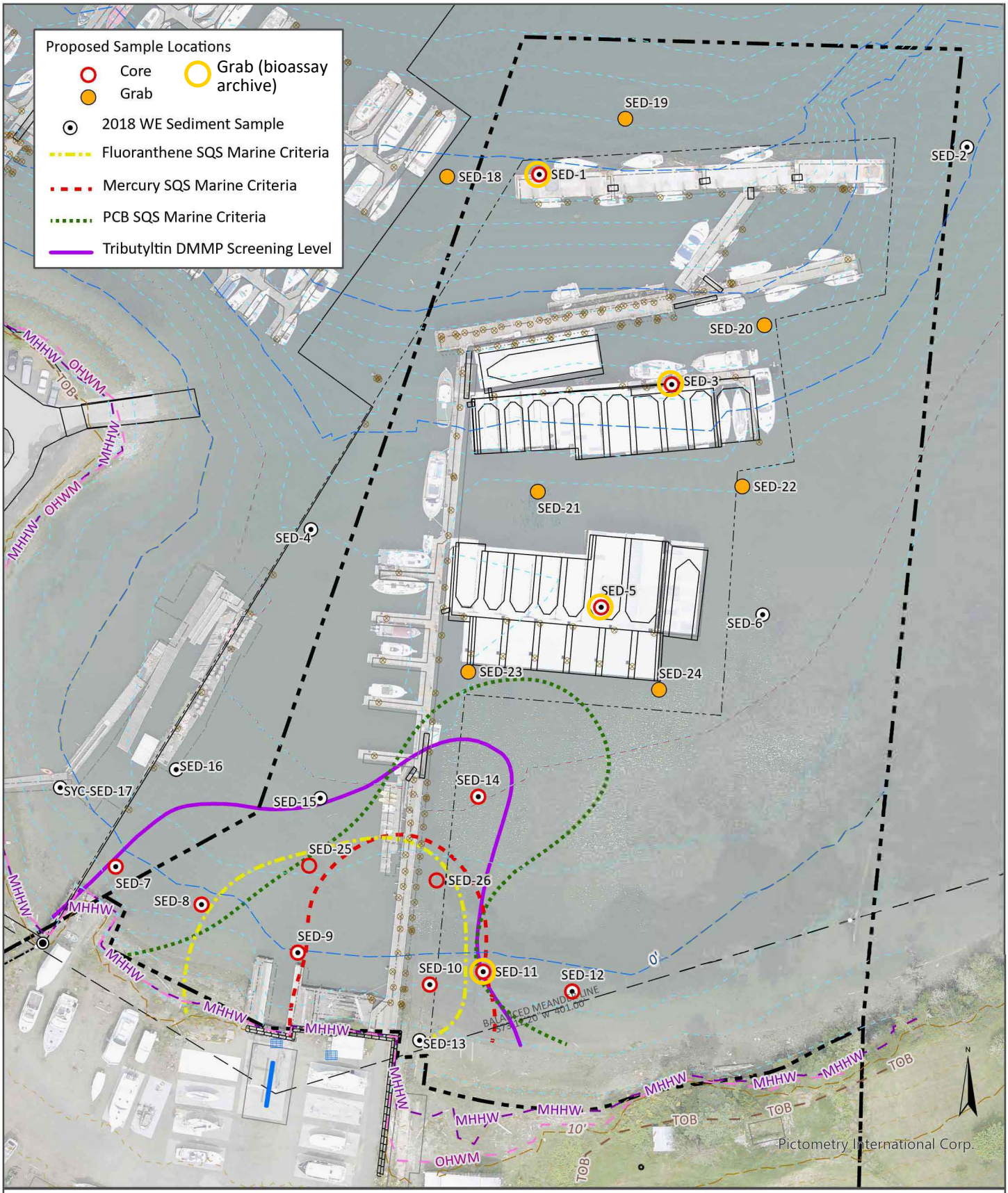
In-Water Sampling & Analysis Plan

Figure 2. Existing Conditions

Data Sources:
Leon Environmental, LLC (2018), San Juan Surveying (2019), San Juan County (2019), Whatcom Environmental (2018)

0 40 80 160 Feet

LEON Environmental, LLC



Filename: /Friday Harbor/GIS/PoFH_WorkPlan2021/ProposedSedSamplingPts date: 6/14/2021

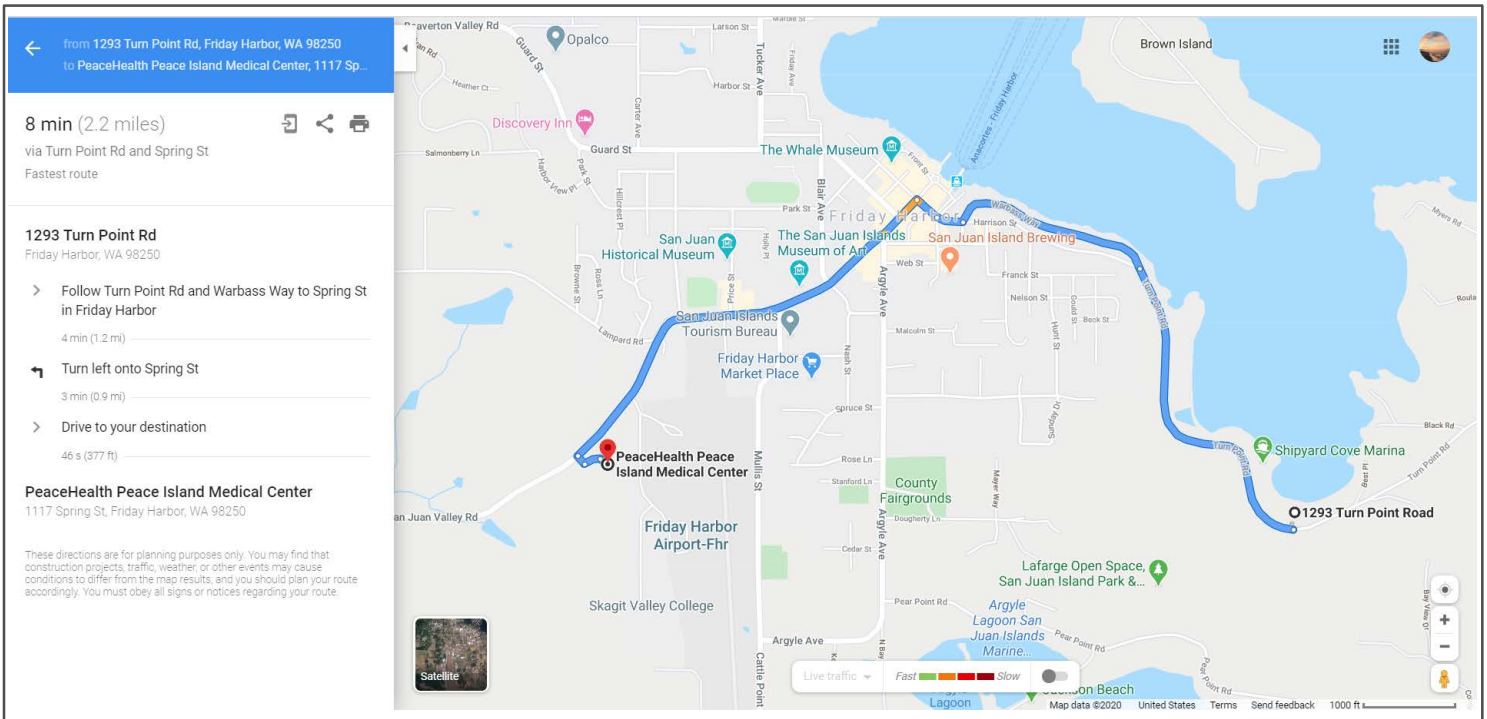
Port of Friday Harbor
Jensen and Sons Boatyard and Marina

In-Water Sampling & Analysis Plan
Figure 3. Sediment Sampling Locations

Data Sources:
Leon Environmental, LLC (2021),
San Juan Surveying (2019), San Juan County (2019),
Shannon and Wilson, Inc. (2019), Whatcom Environmental (2018)

0 25 50 100 Feet

LEON Environmental, LLC



Peace Health Peace, Island Medical Center
1117 Spring St
Friday Harbor, WA 98250
(360) 378-2141

Attachment A
In-Water Analyses & Archives by Sample Location ID, Type (core, grab), and Interval

This page intentionally left blank.

Port of Friday Harbor In-Water Sediment Sampling SAMPLE ANALYSES AND ARCHIVE DETAIL SAMPLING INTERVALS				Grain Size[1]	TOC[1]	Total Solids[1]	Ammonia	Total Sulfides	SMS Metals[1]	Hg[1]	SMS SVOCs[1]	PCB Aroclors[1]	SMS Pest[1]	SMS Pest 1699 (Archive)	TBT	Dioxins / Furans	D/F Archive	Archive	Bioassay (Archive)[2]
	HOLDING TIME			6 mos	6 mos	6 mos	7 days	7 days	2 yrs	1 yr @ 0	1 yr	1 yr	1 yr	1 yr	6 mos	1 yr	1 yr	TBD	8 weeks
	CONTAINER			16 oz P	4 oz G			4 oz GS	4 oz G		16 oz G			4 oz G	4 oz G	8 oz AG	8 oz AG	16 oz G	3 L PB
ID Sample(s)	Interval	Core	Grab																
SED-1 grab (bioassay)	0 - 1 ft		x	1	1	1	1	1					1	1				1	1
SED-1 core	0 - 1 ft	x		1	1	1							1					1	
	1 - 3 ft	x																1	
	3 - 5 ft	x																1	
	5 - 7 ft	x																1	
SED-2																			
SED-3 grab (bioassay)	0 - 1 ft		x	1	1	1	1	1			1		1	1				1	1
SED-3 core	0 - 1 ft	x		1	1	1					1		1					1	
	1 - 3 ft	x																1	
	3 - 5 ft	x																1	
	5 - 7 ft	x																1	
SED-4																			
SED-5 grab (bioassay)	0 - 1 ft		x	1	1	1	1	1			1		1	1				1	1
SED-5 core	0 - 1 ft	x		1	1	1					1		1					1	
	1 - 3 ft	x																1	
	3 - 5 ft	x																1	
	5 - 7 ft	x																1	
SED-6																			
SED-7 core	0 - 1 ft	x		1	1	1	0	0			1				1		1	1	
	1 - 3 ft	x		1	1	1									1		1	1	
	3 - 5 ft	x															1	1	
	5 - 7 ft	x															1	1	
SED-8 core	0 - 1 ft	x		1	1	1	0	0			1	1	1		1	1		1	
	1 - 3 ft	x		1	1	1									1		1	1	
	3 - 5 ft	x															1	1	
	5 - 7 ft	x															1	1	
SED-9 core	0 - 1 ft	x		1	1	1	0	0	1	1	1	1	1		1	1		1	
	1 - 3 ft	x		1	1	1			1	1	1	1	1		1	1		1	
	3 - 5 ft	x															1	1	
	5 - 7 ft	x															1	1	
SED-10 core	0 - 1 ft	x		1	1	1	0	0	1	1	1	1	1		1	1		1	
	1 - 3 ft	x		1	1	1			1	1	1	1	1		1	1		1	
	3 - 5 ft	x															1	1	
	5 - 7 ft	x															1	1	
SED-11 grab (bioassay)	0 - 1 ft		x	1	1	1	1	1	1	1	1	1	1	1				1	1
SED-11 core	0 - 1 ft	x		1	1	1			1	1	1	1	1			1		1	
	1 - 3 ft	x		1	1	1				1	1	1	1			1		1	
	3 - 5 ft	x															1	1	
	5 - 7 ft	x															1	1	
SED-12 core	0 - 1 ft	x		1	1	1	0	0				1				1		1	
	1 - 3 ft	x															1	1	
	3 - 5 ft	x															1	1	
	5 - 7 ft	x															1	1	
SED-13																			
SED-14 core	0 - 1 ft	x		1	1	1	0	0	1	1	1	1	1		1		1	1	
	1 - 3 ft	x		1	1	1					1	1	1		1		1	1	
	3 - 5 ft	x															1	1	
	5 - 7 ft	x															1	1	
SED-15																			
SED-16																			
SED-17																			
SED-18 grab (top 10 cm)	0 - 10 cm		x	1	1	1	0	0					1					1	
SED-19 grab (top 10 cm)	0 - 10 cm		x	1	1	1	0	0					1					1	
SED-20 grab (top 10 cm)	0 - 10 cm		x	1	1	1	0	0					1					1	
SED-21 grab (top 10 cm)	0 - 10 cm		x	1	1	1	0	0					1					1	
SED-22 grab (top 10 cm)	0 - 10 cm		x	1	1	1	0	0					1					1	
SED-23 grab (top 10 cm)	0 - 10 cm		x	1	1	1	0	0				1	1					1	
SED-24 grab (top 10 cm)	0 - 10 cm		x	1	1	1	0	0				1	1					1	
SED-25 core	0 - 1 ft	x		1	1	1	0	0	1	1	1	1	1		1	1		1	
	1 - 3 ft	x		1	1	1			1	1	1	1			1		1	1	
	3 - 5 ft	x															1	1	
	5 - 7 ft	x															1	1	
SED-26 core	0 - 1 ft	x		1	1	1	0	0	1	1	1	1	1		1	1		1	
	1 - 3 ft	x		1	1	1			1	1	1	1			1		1	1	
	3 - 5 ft	x															1	1	
	5 - 7 ft	x															1	1	
Field Dup core	TBD		x	2	2	2			1	1	1	1	2		1	1			
	TOTAL SEDS			33	33	33	4	4	12	13	20	18	27	4	15	11	26	59	4

TABLE NOTES

1 Archive grab samples.

2 Bioassay archived at 4 degrees C in a nitrogen atmosphere or with zero headspace.

Attachment B
Summary of Chemical Exceedances Reported in WE 2018c

This page intentionally left blank.

Port of Friday Harbor
Jensen's Surface Sediments
Summary: 2018 SMS Exceedances

Sample Location	TOC (%)	Metals (mg/kg dw)	TBT (ug/kg dw)	Organics (ug/kg dw)	Phthalates (ug/kg dw)	Pesticides (DMMP) (ug/kg)	PCBs (mg/kg OC)	PAHs (mg/kg OC)	Dioxins/Furans (ng/kg dw TEQ)	Chlorinated Organics (mg/kg OC)	Work Needed
SED-1	1.37		3.8			Heptachlor (< 4.2 Ui) Chlordane (2.8 J)	1.2	LPAH = 19.6 HPAH = 154	N/A	1,2,4-Trichlorobenzene (< 2.0 U) Hexachlorobenzene (< 2.6 U)	Core: Pest Bound: SED-3, -18, -19, -20
SED-2	0.80		1.3 J				<0.6 U	LPAH = 81.6 HPAH = 115	N/A	1,2,4-Trichlorobenzene (< 3.3 U) 1,2-Dichlorobenzene (< 3.0 U) Hexachlorobenzene (< 4.1 U)	N/A
SED-3	1.88		7.5	Benzyl alcohol (< 58 U)		Heptachlor (< 2.6 Ui) Chlordane (5.3 J)	1.8	LPAH = 9.8 HPAH = 93	N/A	1,2,4-Trichlorobenzene (< 1.6 U) Hexachlorobenzene (< 2.1 U)	Core: SVOCs, Pest Bound: SED-1, -20, -21, -22
SED-4	1.81		3.8				0.4 JP	LPAH = 17.3 HPAH = 75	N/A	1,2,4-Trichlorobenzene (< 1.5 U) Hexachlorobenzene (< 1.9 U)	N/A
SED-5	1.92		25	Benzyl alcohol (< 65 U)		Heptachlor (< 3.1 Ui) Chlordane (4.9 JP)	2.9	LPAH = 4.0 HPAH = 55	N/A	1,2,4-Trichlorobenzene (< 1.8 U) Hexachlorobenzene (< 2.3 U)	Core: Pesticides, SVOCs Bound: SED-21, -22, -23, -24
SED-6	2.21		10	Benzyl alcohol (< 66 U)			1.2	LPAH = 9.4 HPAH = 67	N/A	1,2,4-Trichlorobenzene (< 1.6 U) Hexachlorobenzene (< 2.0 U)	N/A
SED-7	1.41		75				1.6 JP	LPAH = 11.8 HPAH = 111	N/A	1,2,4-Trichlorobenzene (< 0.9 U) Hexachlorobenzene (< 1.2 U)	Core: TBT, SVOCs Bound: SED-8
SED-8	2.54		210			Chlordane (< 4.8 UiJ)	5.8	LPAH = 42.4 HPAH = 533	N/A	1,2,4-Trichlorobenzene (< 1.1 U) Hexachlorobenzene (< 1.3 U)	Core: TBT, SVOCs, Pest, PCBs, Dioxins Bound: SED-7, SED-25, SED-9
SED-9	4.29	Copper (578)	300	Benzyl alcohol (68 J) N-nitrosodiphenylamine (<43 U)	Butylbenzyl (70 J) Dimethyl (190)	Heptachlor (< 2.2 Ui) Dieldrin (5.3) Chlordane (< 5.0 UiJ)	252 ug/kg dw	HPAH (20.6 mg/kg dw) Fluoranthene (5.5 mg/kg dw) Pyrene (3.2 mg/kg dw) Benz(a)anthracene (1.9 mg/kg dw) Chrysene (4.1 mg/kg dw) Benzofluoranthenes (3.4 mg/kg dw)	80.3 J	1,2,4-Trichlorobenzene (< 35 ug/kg dw U) Hexachlorobenzene (< 44 ug/kg dw U) Hexachlorobutadiene (< 40 ug/kg dw U)	Core: Metals, TBT, SVOCs, Pest, PCBs, Dioxins Bound: SED-8, -25, -26, -10
SED-10	1.26	Copper (1370) Mercury (1.45) Zinc (589)	4000			Dieldrin (< 4.8 Ui) 4,4'-DDD (19) Chlordane (< 7.5 JP)	51.6 P	Acenaphthene (17.5) Phenanthrene (182.5) HPAH (1678) Fluoranthene (436.5) Benz(a)anthracene (134.9) Chrysene (182.5) Benzofluoranthenes (282.5) Benzo(a)pyrene (134.9) Indeno(1,2,3-c,d)pyrene (95.2) Dibenzo(a,h)anthracene (22.2) Benzo(g,h,i)perylene (111.1)	92.8 J	1,2,4-Trichlorobenzene (< 2.1 U) Hexachlorobenzene (< 2.6 U)	Core: Metals, TBT, SVOCs, Pest, PCBs, Dioxins Bound: SED-9, -25, -26, -11
SED-11	2.69	Mercury (.44)	53			Chlordane (< 4.6 UiJ)	8.7 P	LPAH = 12.0 HPAH = 123	N/A	1,2,4-Trichlorobenzene (< 1.0 U) Hexachlorobenzene (< 1.2 U)	Core: Metals, SVOCs, Pest, PCBs, Dioxins Bound: SED-10, -26, -12
SED-12	1.03		9.3				3.4 J	LPAH = 11.7 HPAH = 119	N/A	1,2,4-Trichlorobenzene (< 2.5 U) 1,2-Dichlorobenzene (< 2.3 U) Hexachlorobenzene (< 3.2 U)	Grab: Dioxins Bound: SED-11
SED-13	1.98	Copper (1380) Mercury (.85) Zinc (928)	4000			Dieldrin (< 4.7 Ui) 4,4'-DDD (36) Chlordane (12 J)	59.6 P	Fluoranthene (171.7) Indeno(1,2,3-c,d)pyrene (48.0) Benzo(g,h,i)perylene (55.6)	72.3 J	1,2,4-Trichlorobenzene (< 1.3 U) Hexachlorobenzene (< 1.7 U)	Bound: SED-10, -11
SED-14	1.87 J		91			N/A	24.8 J	LPAH = 22.0 J HPAH = 140 J	N/A		Core: TBT, SVOCs, Pest, PCBs Bound: SED-23, -24, -25, -26
SED-15	2.08 J		48.8			N/A	1.8 J	LPAH = 12.2 J HPAH = 95 J	N/A		N/A
SED-16	3.30 J		36.9			N/A	1.5 J	LPAH = 32.5 J HPAH = 302 J	N/A		N/A
SED-17	0.49 J		4.31			N/A	7 ug/kg dw	LPAH = 0.1 mg/kg dw HPAH = 0.4 mg/kg dw	N/A		N/A

Attachment C
Quality Assurance Project Plan

This page intentionally left blank.

Attachment D
Leon Environmental, LLC Corporate Health and Safety Manual

This page intentionally left blank.