

**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**

REMEDIAL INVESTIGATION WORK PLAN

Prepared for

The Port of Friday Harbor
Friday Harbor, WA



Prepared by

Leon Environmental, LLC and CRETE Consulting Inc.
Seattle, WA

LEON 
Environmental, LLC

CRETE
CONSULTING, INC.

July 2022

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Abbreviations and Acronyms

µg/kg	micrograms per kilogram
ADA	American With Disability Act
AET	Apparent Effects Threshold
BLWA	boat lift work area
BTEX	benzene, toluene, ethylbenzene, and xylene
cm	centimeter
COC	Constituent of Concern
CoC	contaminant of concern
COI	Constituent of Interest
COPC	Contaminant of Potential Concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CRETE	CRETE Consulting Inc.
CSL	cleanup screening level
DCAP	Draft Cleanup Action Plan
DMMP	Dredged Material Management Program
Ecology	Department of Ecology
EMNR	enhanced monitored natural recovery
ESA	Environmental Site Assessment
FDA	Former Dumping Area
FS	Feasibility Study
ft bgs	feet below ground surface
IOSA	Islands' Oil Spill Association
IPG	Integrated Planning Grant
Jensen	Albert Jensen and Sons Boatyard and Marina
LDW	Lower Duwamish Waterway
L-E	Leon Environmental, LLC
mg/kg	milligrams per kilogram
MNR	monitored natural recovery
mS/cm	milliSiemens/centimeter
MTC	Marine Technical Center
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
OHW	ordinary high water
OPALCO	Orcas Power and Light Company
Order	Agreed Order No. DE 18071
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PoFH	Port of Friday Harbor
ppt	parts per trillion
PQL	practical quantitation limit
PSEP	Puget Sound Estuary Program
QA	quality assurance
QC	quality control
RM	Reid Middleton, Inc.
RI	Remedial Investigation
ROC	receptors of concern

SAP	Sampling and Analysis Plan
SCO	sediment cleanup objective
SCUBA	self-contained underwater breathing apparatus
SCUM	Sediment Cleanup User's Manual
SGC	silica gel cleanup
Shipyards Cove	Shipyards Cove Marina
SL	screening level
SLR	sea level rise
SMA	sediment management area
SMS	Sediment Management Standards
SQS	Sediment Quality Standard
SRWA	ship rail work area
TBT	tributyltin
TEQ	toxicity equivalent
Town	Town of Friday Harbor
TPH	total petroleum hydrocarbon
USDA	U.S. Department of Agriculture
VOC	volatile organic compound
WAC	<i>Washington Administrative Code</i>
WDNR	Washington State Department of Natural Resources
WE	Whatcom Environmental Services

1. INTRODUCTION

The mutual objective of the State of Washington, Department of Ecology (Ecology) and the Port of Friday Harbor (PoFH) 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 or Jensen's) 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 overall goal of this project is to clean up the historical contamination associated with 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 Agreed Order 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 Objectives of the Remedial Investigation

The objective for the remedial investigation is to address identified data gaps and refine the nature and extent of contamination exceeding preliminary Model Toxics Control Act (MTCA) cleanup levels, preliminary Sediment Management Standards (SMS) cleanup standards, and other regulatory requirements. This effort is expected to:

- Establish vertical and horizontal contamination profiles in areas where surface sediments exceed SQS.
- Delineate the nature and extent of debris throughout in-water sampling areas.
- Delineate the vertical and horizontal extent of dioxins/furans beyond the surface concentrations measured along the central marina shoreline, which may correlate with observed polychlorinated biphenyl (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.
- Delineate the vertical and horizontal extents of metals, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and total petroleum hydrocarbons (TPH) in soils that exceed screening levels.
- Characterize the fill soils along the shoreline work areas and evaluate contamination exceeding corresponding screening levels.
- Delineate the extent of contamination in groundwater and characterize the potential migration of contamination in groundwater to surface water.

1.2 Regulatory Framework

Agreed Order No. DE 18071 (Order) was issued pursuant to the MTCA, RCW 70.105D.050(1). The Order requires the PoFH to perform an RI/FS and to prepare a DCAP, addressing both upland and in-water site contamination.

1.3 General Site Information

Albert Jensen and Sons, Inc. Boatyard and Marina
1293 Turn Point Road
Friday Harbor, WA 98250
Section 13, Township 35N, Range 3W
Parcel 351341005000

The project coordinator for the Port of Friday Harbor is:
Todd Nicholson
204 Front Street
Friday Harbor, WA 98250
360-378-2688
toddn@portfridayharbor.org

1.4 Legal Description of the Site

The site is referred to as Albert Jensen and Sons, Inc. Boatyard and Marina (Jensen's). The site constitutes a facility under RCW 70.105D.020(8). The site is defined by where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located. Based upon factors currently known to Ecology, the site is generally located at 1293 Turn Point Road, Friday Harbor, WA 98250 as shown in Figure 1, the Site Location Diagram provided as Exhibit A of the Agreed Order No. DE 18071.

Short/abbreviated legal description of parcel: PR GL 6 PR SE-SE EX CO RD Sec 13, T 35N, R 3W.

2. GENERAL FACILITY INFORMATION

The site 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. Turn Point Road provides a direct connection from the Town of Friday Harbor (Town) to the 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 Town. The 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 site is exposed to roughly 2.5 miles of fetch from a northerly direction (Figure 2, Location & Vicinity Map).

The PoFH recently purchased the site from Albert Jensen & Sons, Inc. with the intent to redevelop the site and address existing environmental concerns. 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 No. 20-080023) with the Washington State Department of Natural Resources (WDNR). The site is partially developed and is currently underutilized due to impaired site conditions. Surrounding land uses include industrial, commercial and residential development. Shipyard Cove Marina and a barge ramp are located immediately to the northwest of Jensen's. Residential properties with private docks extend along the shoreline to the northeast of Jensen's.

3. PAST, CURRENT, AND FUTURE CONDITIONS

3.1 Site History/Past Land Use

Over a century of industrial uses have contributed to legacy contamination in the soil and marine sediment at this historical maritime 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. 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. Activities at the shipyard that likely contributed to increased contamination concentrations include the application and removal of antifouling paints, mechanical, and general maintenance work both over water and land, and treatment of wooden boats using pesticides. Also present on site was a former underground gasoline storage tank, a machine shop that was also used for hazardous chemical storage, a small dump site, and a marine railway.

3.2 Current Conditions and Land Use

Jensen's is partially developed and is still used as a boat maintenance facility and shipyard (Figure 3, Existing Conditions). The site consists of three distinct areas: a boatyard, a marina, and an undeveloped upland and shoreline area. Jensen's is zoned as Rural Industrial, which allows for light industrial, light manufacturing, seasonal residential, public, and some institutional uses.

3.2.1 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 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 shoreline along the active boatyard area is characterized by either vertical structures or steep berms. The boat pullout area consists of two piers supported by creosote-treated piling, ecology blocks, and a concrete wall. The shoreline here is a stacked ecology block bulkhead, through which uncharacterized upland fill material is sloughing into intertidal areas. Along the western property line, a fill area partially contained by a failing creosote-treated bulkhead extends from the uplands out into intertidal area. This bulkhead is in an advanced state of failure, acting as a source of creosote-treated wood debris and allowing uncharacterized fill to spill into intertidal areas. The intertidal areas here are barren of any vegetation.

3.2.2 Marina

Jensen's also continues to operate an active marina that occupies the deeper intertidal and subtidal areas of the site. The existing marina includes approximately 50 slips; just over half are wood-framed,

covered moorage. Marina structures include the main pier and a system of floats and floating finger piers consisting of creosote-treated piles and wood floats on unwrapped Styrofoam, three areas consisted of piling-supported boat house structures, an offshore piling-supported pier, a concrete floating breakwater, and various standalone piles and dolphins. A substantial amount of maintenance to these structures, as well as the associated electrical was deferred prior to the PoFH purchase. Numerous piles are in advanced states of disrepair, including many that have already failed. Many of the floats are supported by open-cell Styrofoam, which appear to be highly degraded. Floats and piers are covered with solid wooden decking (both treated and untreated) in various conditions.

The PoFH demolished and removed most of the boathouses in 2021, and is in the process of replacing all remaining degraded marina infrastructure. Expansion of the marina is anticipated as part of the long-term redevelopment of the property.

The entire shoreline area, extending from intertidal elevations out to at least shallow subtidal depths, is heavily impacted with a substantial volume of debris, including concrete, tires, metal (motors, small parts, etc.), plastic, and other general rubbish. Within the boathouse areas, there appears to be some debris present on the seafloor, including tires that can be observed from the marina floats.

3.2.3 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. Four rails (two rails per pair), which appear to be composed of deteriorating 10-inch x 10-inch creosote-treated timbers, extend from the intertidal area waterward of the derelict boat building structure out to subtidal elevations. It is not clear how far the rails extend, because they dive under the sediments at approximately 85 feet from the waterward edge of the concrete pad. The marine rails were originally used to launch boats and were later used to pull out boats for repair. These derelict structures are likely sources of contamination to upland, intertidal, and subtidal areas. 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. An underground storage tank was formerly located in the field south of the oil storage building. The upper shoreline area appears to be composed of upland fill material and garbage (metal, plastic, concrete, wood waste, etc.), which is consistent with historical descriptions of the area being used as a dump. The garbage and fill material from the upper shoreline are emerging from the bank as it descends to upper intertidal elevations. There appears to be a remnant shoreline timber (some treated) structure, possibly an old pier or ramp, which has left a debris pile extending from the upper shoreline down to intertidal elevations.

3.3 Future Land Use

3.3.1 Master Plan

The PoFH is planning to redevelop two adjacent PoFH-owned properties: the former Albert Jensen and Sons Boatyard and Marina (Jensen's) and the former Shipyard Cove Marina (Shipyard Cove). The PoFH acquired the Jensen's property in 2018 with the goal of redeveloping the facility to retain existing marine related services and jobs, and to expand on maritime-related business opportunities, while

restoring portions of the shoreline and providing public waterfront access. To guide this process, the PoFH prepared the Albert Jensen and Sons Boatyard & Marina Master Plan in 2018 (PoFH 2018). In 2019 the PoFH embarked on an update to the 2018 Master Plan after obtaining an Integrated Planning Grant (IPG) from Ecology to support the planning, cleanup, and redevelopment of the contaminated Jensen's property. In 2019 the PoFH acquired the adjacent Shipyard Cove property and decided to include both properties in the master plan update guiding the redevelopment of the joined properties to fully realize their development potential. The PoFH completed the new Master Plan (L-E and Reid Middleton 2020) in early 2020; however, the 2021 election cycle resulted in a new PoFH Commission composition. In response to the COVID-19 pandemic, the new PoFH Commission determined in early 2022 that changing priorities and community demands warrant a reevaluation of the current Master Plan (L-E and RM 2020). The PoFH anticipates that this process will occur throughout 2022.

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. Due to the contaminated soils, sediments and groundwater resulting from decades of industrial use at the Jensen's property, the redevelopment must be integrated with the cleanup of the former Jensen's property, especially the former boatyard area, shoreline, and aquatic areas, which are subject to Ecology-led remedial actions under the MTCA. Marina improvements may also be compatible and conducted co-incident with anticipated remedial actions for the site. The master plan will be coordinated with Ecology and the public.

3.3.2 Boatyard

The PoFH has determined that at least some of the deferred maintenance projects noted in Section 3.2.1 must 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. The PoFH is coordinating all maintenance work with Ecology.

Under the 2020 Master Plan (L-E and RM 2020), the existing boatyard will be relocated further northwest from its current location on the former Jensen's property to the former Shipyard Cove property. It will extend to the vehicle turnaround planned at the future barge ramp. Moving the boatyard to this area allows for consolidating the required water access with the commercial barge ramp and freeing up the shoreline along the existing boatyard for cleanup and restoration. The new boatyard area will encompass approximately the same square footage as the existing one and will consist of a paved open-air laydown area and a paved and covered workspace built into the hillside. A substantial retaining wall of varying height will be required to construct the covered work areas on the hillside.

A barge ramp access road running through the center of the reconfigured Jensen's/Shipyard Cove facility will provide convenient access to the work areas on either side of the road and to the barge ramp. Sufficient environmental controls on runoff to keep potential hazardous materials out of Shipyard Cove will be implemented. A boatyard shop building is proposed in the northeastern corner of the future boatyard area. This building would be accessible from the marina parking area and from the shoreline promenade. The boatyard area will be fenced and gated, and either a landscape buffer and fence combination, a wall, or a combination of these two alternatives, will be constructed to separate the boatyard from the public access areas for safety and aesthetic reasons. The wall option may also be constructed to address sea level rise (SLR) and flood protection for the boatyard.

Although some infrastructure and site uses described in the 2020 Master Plan (L-E and RM 2020) are likely to change in response to the current master planning effort, the future barge ramp and associated access road are unlikely to change. The existing barge landing and Travel Lift Pier (TLP) are essential infrastructure for marina operations; however, the TLP is located in the area where the highest concentrations of potential contaminants of concern were measured, and based on existing data the PoFH presumes that the remedial investigation and feasibility study will conclude that it must be removed in order to remediate upland and in-water contaminants. Because this infrastructure is essential for marina operations, these functions must be replaced elsewhere on site before the PoFH can decommission the TLP and complete site cleanup. For this reason, the PoFH expects that the new barge ramp and associated access road described in the 2020 Master Plan (L-E and RM 2020) will be retained in the new Master Plan.

3.3.3 Marina

The PoFH has determined that at least some of the deferred maintenance projects noted in Section 3.2.2 must be completed on an expedited basis to sustain current and future operations. Coordinating subsequent remedial actions with marina maintenance and redevelopment is a key consideration for this project. Under the 2020 Master Plan (L-E and RM 2020), the two existing marinas on the project site will be consolidated into one larger marina with two access points (Attachment B, L-E and RM 2020). The PoFH does not expect this long-term goal to change as a result of the current master planning process. A variety of alternatives and potential phasing opportunities were reviewed as part of the Master Planning process for the in-water facilities. The new dock facilities will provide a range of slip sizes and provide double slip berths and side tie moorages. In the short-term, the PoFH is replacing and reconfiguring existing marina infrastructure for more efficient operations. In the long-term, the new docks will likely extend further out into the bay than the existing docks to accommodate demand for additional boat moorage in the Friday Harbor community.

The construction materials and final configuration will be determined in the design phase, but the following are general components of the long-term reconfigured dock systems. During the initial redevelopment phase, two new access piers may be constructed replacing the two existing ones in roughly similar locations. The two pile-supported fixed pier(s) would be constructed from land out to sufficient water depth to allow for an 80-foot-long gangway to access the new float systems. Any new pier infrastructure will have grated deck surfaces that meet American with Disability Act (ADA) accessibility requirements and minimize shading of nearshore habitat. The 80-foot-long gangways will meet current ADA requirements for accessibility to recreational moorage facilities. The final configuration will be determined later, but the PoFH is evaluating both a single access pier located in a central location and the dual-access configuration described above.

The new moorage slip facilities will be constructed of floating docks to allow for moorage in all tidal conditions. The docks will be placed offshore such that the docks do not ground out at extreme low tide. The PoFH is fabricating floats constructed with timber framing and grated decking supported by 18-inch high density poly ethylene (HDPE) pontoons to minimize shading. The adapted these same components in the design for the outer wave attenuators. Floats will be anchored by steel piling; however, concrete piling or anchor chain systems could be utilized for the design as well.

The new moorage facility will have full utility systems that meet code requirements and provide typical requested services for a marina. The utility systems will include a fire standpipe system (wet or dry depending on codes and local requirements), a potable water system to hose bibs, electrical and lighting services to the slips and on the docks, a boat sewage pump out or at the-slip pump out system for boat

sewage handling, and other appurtenances such as life rings, and fire extinguishers. The specific utility system features will be determined in the design phase. The final configuration, elements, and materials of construction will be determined based on permitting, design, funding, and other factors.

3.3.4 Undeveloped Upland and Shoreline Areas

Under the 2020 Master Plan (L-E and RM 2020), the undeveloped upland and shoreline areas would include public facilities including a new Marine Technical Center (MTC), a reconstructed boat building, a kayak launch, and open lawn, picnic area, and loop trail.

The MTC project was anticipated in two phases. The first phase included the MTC and the demolition of the dilapidated old boat building, to the west of the proposed MTC. The second phase was expected to include the construction of a new building replacing within the demolished boat building in its current footprint. The purpose of the project was to revitalize the property by providing marine related business incubation space, to house the Islands' Oil Spill Association (IOSA) Headquarters, other office and light industrial workspace, and to provide public shoreline access.

The MTC building was proposed to be constructed in the eastern upland portion of the parcel that is currently undeveloped and mostly consists of an open grass covered area. It was to be located between the existing main access drive to the property and the shoreline. The proposed building was anticipated with a mass timber grid and diaphragm structure with gable roofs echoing its marine industrial purpose, setting, and the history of the site. Its footprint was anticipated at nearly 9,500 sf.

Movable planters, benches, and picnic tables were considered between the reinforced lawn strip and the covered exterior space along the southside of the building. Hookups for power and water would be available to host private and public outdoor events. Landscape plantings, utilizing native plants, and a variety of well adapted plants, including trees, shrubs, and groundcovers, were proposed along the new access drive near the eastern property line, along the northern edge of the building at the small entry plaza on the southwest corner of the building, and along the southside of the building. Additionally, the area between the MTC and the old boat building may be planted with native vegetation to restore riparian function.

The topography of the site and other requirements i.e., matching the grades of the future improved main access drive to the property, and providing ADA access to both levels of the building, would necessitate import and placement of fill materials and construction of retaining walls to accommodate the MTC and associated infrastructure. Structural fill material of crushed rock would be needed under building slabs and pavement surfaces. The PoFH intends to import fill materials from their stockpile at the Friday Harbor Airport, including compactable soil and sand. Stockpile areas were intended west of the project site within existing gravel and paved surfaces upland of the shoreline. Total anticipated earthwork volumes are approximately 3,500 cy; mostly cut.

The PoFH's plans for the undeveloped upland and shoreline areas is likely to change as a result of the current planning effort. A potential alternative the PoFH is evaluating includes expanding existing boatyard uses into the undeveloped area; however, the PoFH is likely to evaluate other alternatives in response to community input provided during the new master planning process. It is essential that the new master planning effort be an integral component of the remedial investigation and feasibility study to insure that clean up is compatible with future uses.

4. PAST FIELD INVESTIGATIONS

4.1 Upland

Investigations of upland areas have been conducted by Whatcom Environmental Services and by CRETE Consulting Inc. (CRETE) and are summarized in the reports below. This work has included soil, groundwater, and stormwater pond solids sampling. Additional data and information were acquired from publicly available information sources and references cited below.

Author	Year	Report
U.S. Department of Agriculture	2009	Soil Survey of San Juan County Area, Washington
Whatcom Environmental Services	2017	Phase I Environmental Site Assessment, Jensen's Shipyard, 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	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
Shannon & Wilson	2019	Conceptual Site Model and Data Gaps Report, Former Jensen Shipyard, Friday Harbor, Washington
Leon Environmental, LLC and Reid Middleton, Inc.	2020	Port of Friday Harbor, Jensen's / Shipyard Cove Master Plan, Friday Harbor, Washington.
Essency Environmental, LLC	2020	Critical Areas Report, Jensen Marine Trades Center – Port of Friday Harbor
CRETE Consulting Inc.	2021	Summary of IOSA/MTC Test Pitting and Data – Port of Friday Harbor, Jensen's Marina

4.2 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 three reports that WE prepared for the Jensen's site: *Phase I Environmental Site Assessment* (WE, 2017a), *Draft Sediment Data Report* (WE, 2018c), and the *Draft Remedial Investigation Report* (WE, 2018d). Additional data and information were acquired from publicly available information sources and references cited below.

Author	Year	Report
Washington Department of Ecology	2001	Concentrations of Selected Chemicals in Sediments from Harbors in the San Juan Islands
U.S. Department of Agriculture	2009	Soil Survey of San Juan County Area, Washington
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

Author	Year	Report
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.
Leon Environmental, LLC and Reid Middleton, Inc.	2020	Port of Friday Harbor, Jensen's / Shipyard Cove Master Plan, 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

5. CONCEPTUAL SITE MODEL AND DATA GAPS

5.1 Physical Habitat Features

The Project site is located within Shipyard Cove, a relatively shallow embayment that faces northward on the eastern side of San Juan Island, immediately southeast of downtown Friday Harbor. Site bathymetry, uplands topography, and key subareas (San Juan Surveying, 2018) are shown in Figure 3. Shipyard Cove is generally protected by Brown Island; however, the Project site is exposed to roughly 2.5 miles of fetch through a narrow window from a direct northerly direction.

The shoreline along the active boatyard area is characterized by either vertical structures or steep berms. The less developed areas along the eastern side of the property, especially waterward of the old boat building structure, are more gently sloped with areas of estuarine marsh plants. The full extent of the site's low waterfront bank is composed of fill and debris, with contaminated soils known to exist in the active boatyard areas.

The undeveloped portions of the Project site are dominated by open grassy areas; other native vegetation is limited. Native trees and shrubs (a mix of evergreen and deciduous species) are found on the hillside east of the boatyard, near Turn Point Road, and in limited patches along the shoreline. Native plants present include Douglas fir (*Pseudotsuga menziesii*) and Pacific madrone (*Arbutus menziesii*), as well as native rose (*rosa sp.*) and ocean spray (*Holodiscus discolor*). Some areas of estuarine marsh vegetation, dominated by pickleweed (*Sarcocornia perennis*) and seaside plantain (*Plantago maritima*), were observed along the shoreline, especially waterward of the old boat building structure; however, substrate in all of these vegetated areas is highly impacted by a substantial volume of debris (typically concrete rubble, metal, plastic, wire, treated and untreated wood, etc.).

The marina occupies the deeper intertidal and subtidal areas of the Project site. Marina structures include the main pier and a system of floats and floating finger piers, three areas of piling-supported boat house structures, an offshore piling-supported pier, a concrete floating breakwater, and various standalone piles and dolphins. A substantial amount of maintenance has been deferred and the marina infrastructure was transferred to the PoFH in generally poor condition. Numerous piles are in advanced states of disrepair. Many of the floats are supported by open-cell Styrofoam, which appear to be highly degraded. Floats and piers are covered with solid wooden decking (both treated and untreated) in various conditions. Within the boathouse areas, there appears to be some debris present on the seafloor, including tires that can be observed from the marina floats. The PoFH is in the process of replacing deteriorated piling, floats, and boathouses.

The entire shoreline area, extending from intertidal elevations out to at least shallow subtidal depths, is heavily impacted with a substantial volume of debris, including concrete, tires, metal (motors, small parts, etc.), plastic, and other general rubbish.

Patches of eelgrass (*Zostera marina*) may be present in the subtidal areas of Shipyard Cove; eelgrass beds in the vicinity of the project site were found historically to occur at depths up to minus 21 feet MLLW (WDNR, 2001). An eelgrass survey conducted in June 2020 found two small patches of eelgrass at approximately -7 feet MLLW, one patch on either side of the Jensen's walkway float (Fairbanks, 2020).

A subsequent habitat survey performed on June 10-11, 2021 (MSA, 2021) documented *Zostera marina* eelgrass in one small bed and one patch between approximately -3.5 ft to -6 ft MLLW. The small bed, measuring approximately 1,000 square feet and ranging in density from 0 to 16 turions per square meter, was documented on the west side of the marina, between the two main boathouse areas. The

patch, measuring 3 feet by 1 foot with a density of 43 turions per square meter, was documented to the west of the bed and main walkway float.

5.1.1 Shoreline Characteristics

The upper shoreline areas at the Jensen's site consists predominantly of fill and debris that extend above ordinary high water (OHW). Except for the central area of the shoreline below the old boat building structure, the filled areas tend to descend steeply to upper intertidal elevations, where they generally level off to more natural slopes in intertidal and subtidal areas. Throughout the boatyard area, this filled shoreline consists of berms and vertical structures (creosote-treated bulkheads, ecology block walls, etc.). The upper shoreline of the undeveloped eastern area consists of what appears to be general rubbish and fill soils. The central shoreline of the Project site, located generally below the old boat building structure and between the marina pier (western boundary) and the old oil storage building (approximate eastern boundary), is more naturally-sloped with pickleweed growing in large areas of the upper intertidal zone; however, this shoreline is highly impacted with concrete rubble, debris, and a concrete pad. Fill materials were observed up to 7.5-feet below ground surface along the shoreline bank near the oil shed. There is no natural shoreline within the Project site. Immediately west of the Project site, a marina and barge landing facility operate along the shoreline. The shoreline immediately east of the Project site is a residential property. Additional descriptions of specific sections of the Project area shoreline are provided below.

The shoreline along the western side of the Project site shoreline below the boatyard consists of an overgrown, gravel-paved filled area partially contained by a failing creosote-treated bulkhead. The aerial photographs provided in WE's Phase I Environmental Site Assessment (ESA) (WE, 2017a) suggest that the area was filled between 1941 and 1972. The bulkhead is in an advanced state of failure, allowing fill to spill into intertidal areas. At intertidal elevations, the substrate consists of pea gravel, small cobbles, sand, and debris; this area is barren of any vegetation. Additional debris (including broken creosote-treated piling, larger metal and concrete) is present at deeper intertidal elevations.

The boatyard shoreline immediately east of the bulkhead consists of a steep berm separating the upland working area of the boatyard from intertidal areas. The berm is composed of rubble, garbage and other debris (metal, concrete, etc.). A small outfall pipe (~6-inch diameter), which serves as an emergency overflow from the boatyard stormwater detention and evaporation pond, extends from the base of the berm at roughly the midpoint of this stretch of shoreline. This outfall is shown in Figure 4. A band of vegetation (pickleweed, gumweed, henstooth, and drift algae) extends roughly 10 feet to 20 feet from the top of the berm, but ends abruptly at intertidal elevations. At upper and shallow intertidal elevations, the substrate consists of pea gravel, small cobble, sand, and debris (garbage, concrete, metal, etc.). A light sheen was observed in limited areas of the intertidal substrate. Except for potential clam shows, there was no obvious benthic activity noted within the barren intertidal area during an October 8, 2018, site evaluation; however, a benthic survey is anticipated as part of the remedial investigation phase to more fully assess the status of the benthic community. Additional debris (including broken creosote-treated piling, larger metal, and concrete) is present at deeper intertidal elevations.

The boat pullout area is located between the bermed shoreline to the west and the old overwater deck to the east. The boat pullout consists of two piers supported by creosote-treated piling, ecology blocks, and a concrete wall. Each pier is covered with timber decking and a single concrete rail for a boat lift to operate. The shoreline here is a vertical bulkhead, consisting of stacked ecology blocks. Upland fill material is sloughing through the eastern side of the ecology block bulkhead into intertidal areas. The

substrate beneath each pier is covered in a substantial volume of debris, including concrete, metal, wire, engine parts, and other garbage. The boat haulout area between the two piers is maintained at deeper depths than on either side. The substrate between the piers is covered in shell hash, with less debris evident than in surrounding areas. As throughout the Project site, debris extends throughout the intertidal area, with larger debris present at deeper elevations.

The shoreline immediately east of the boat pullout is completely covered by an old overwater deck and the marina pier. The overwater deck is composed of solid timber decking and supported by creosote-treated piles; however, the structure is in poor condition due to deferred maintenance. The marina pier is located immediately east of the overwater deck and is currently in operational condition. It is built with solid CCA-treated decking and supported by creosote-treated piles. The shoreline along the overwater deck and marina pier is a vertical bulkhead, consisting of stacked ecology blocks. The bulkhead is leaning waterward and requires maintenance. There is evidence that the bulkhead is being undermined, with settling observed in soils on the immediate upland side of the bulkhead. The substrate beneath the overwater deck and marina pier is covered in a substantial volume of debris that is consistent with shoreline conditions along the boatyard.

The shoreline immediately east of the marina pier and waterward of the old boat building structure features a more natural-appearing slope, but the intertidal substrate consists of cobbles, imported gravel, mud, and concrete rubble. Concrete pads located between the marina pier and the old boat building extend from intertidal elevations up to the active boatyard. Four rails (two rails per pair), which appear to be composed of 10-inch x 10-inch creosote-treated timbers, extend out to subtidal elevations. It is not clear how far the rails extend, because they dive under the sediments at approximately 85 feet from the waterward edge of the concrete pad. The upper intertidal area consists of pickleweed that extends all the way up to the old boat building; this upper area is addressed in the ship rail work area (SRWA) in the uplands. There is evidence that clams may be present at lower intertidal elevations, but similar to the entire western half of the Project site, the benthic community in this area appears relatively barren.

The shoreline along the eastern boundary of the Project site is located below the undeveloped area. The upper shoreline area appears to be composed of upland fill material and garbage (metal, plastic, concrete, wood waste, etc.), which is consistent with historical descriptions of the area being used as a dump (WE, 2017a). There appears to be a remnant shoreline timber (some treated) structure, possibly an old pier or ramp, which has left a debris pile extending from the upper shoreline down to intertidal elevations. The upper shoreline features mature vegetation (primarily native trees and shrubs, and invasive blackberries and scotch broom). Extending inland from the intertidal area along the eastern shoreline is buried debris and fill materials that comprise the bank. The debris and fill extend inland towards the oil shed and former abandoned cabin (demolished), comprising the Former Dumping Area (FDA). The garbage and fill material from the upper shoreline are emerging from the bank as it descends to upper intertidal elevations. Bank vegetation consists of snowberry, ocean spray, blackberry, and scotch broom. Upper intertidal vegetation consists of Turkish towel and ulva, which transition to pickleweed and rockweed at lower elevations. The intertidal substrate consists of gravel and cobble at upper intertidal elevations transitioning to mud, algae, and debris at lower intertidal elevations. Consistent with the entire Project site shoreline, a substantial field of debris extends out to subtidal elevations.

5.1.2 Upland Areas

5.1.2.1 Ship Rail Work Area

The SRWA includes rail lines east of the pier and the old boat building structure. The SRWA has a lower elevation than the surrounding uplands, including high intertidal elevations with abundant pickleweed. This rail lines were used to transport boats during ship building and maintenance, and contamination in the SRWA is likely a result these activities. As outlined by Shannon & Wilson (2019), SRWA contamination may include metals from paint stripping operations, possibly impacted fill used to develop the SRWA, and TPH-DRO and cPAH from boat maintenance and drained boat bilge water. The SRWA may have also collected stormwater runoff, soils and debris eroded from adjacent upland areas. There are currently no operations that occur within the SWRA.

5.1.2.2 Boat Lift Work Area

The boat lift work area (BLWA) is an approximately 100-foot-wide area along the shoreline, immediately west of the SRWA and extending west to the western property line. The adjacent shoreline, from west to east, includes the small fill area that projects into the water, the berm area with an outfall, the boat pullout, the old overwater deck, and the marina pier. Activities conducted in this area may be similar to those of the SRWA, including paint stripping, paint applications, draining boat bilges, treated wood use, and possibly impacted fill materials used to develop and elevate this area in the past (Shannon 2019). Current operations include best management practices to minimize the potential for contaminant releases.

5.1.2.3 Former Dumping Area

The FDA is located to the east of the SRWA along the shoreline. This shoreline area was formerly used for dumping of miscellaneous boat parts or debris was observed during the Phase I Environmental Site Assessment by Whatcom Environmental Services (Whatcom 2017). Debris observed has included tires, plastic, metal parts, two engine blocks, hoses, cables, a large battery, and other metal and wood debris. No sheen or staining has been noted in the FDA.

A former cabin was located about 50 feet east of the FDA and a former oil shed was located adjacent to the FDA. The former owner indicated that the shed contained 300-gallon gasoline and diesel ASTs and a 300-gallon waste oil tank. During the Phase 1 ESA a waste oil AST along with several smaller diesel, gasoline, and waste oil drums were observed. No evidence of spills or overtopping were noted in or around the building and concrete flooring was present throughout the shed for containment in the event of a spill (Whatcom 2017).

To the south and southeast of the FDA is a large grassy area that formerly included a residence. A water well may be present near the southern edge of the grassy area but no well information was provided in previous documents. A UST was also formerly located near the western edge of the grassy area. The former UST was used to fuel equipment onsite, and was removed in the 1980's. The former owner indicated that the former UST contained gasoline. Soil and groundwater sampling in this area suggest that no contamination is present.

5.1.2.4 Former Above Ground Storage Tank

It is suspected that an AST was formerly located south of the central former shop building. There is no documentation regarding the size or contents of the former AST. Results from a shallow soil sample suggest that the AST likely contained a heavier fuel such as heating oil.

5.1.2.5 Shop Floor Drain and Outfall

The shop building has also been noted as the machine shop building in previous documents, suggesting the presence of lubricants and cleaning solvents. A 3-inch diameter floor drain is present near the northwest corner of the building. The drain was used to dispose of liquids from the machine shop. The drain was investigated in the past, at which time it was noted that the drain appeared to flow to a holding tank or drum underground. The former owner noted that the tank or drum may have been perforated or may have contained a drain line for the contents to drain, but the destination of the contents was unclear. The tank or drum was not removed as part of previous investigations. A sample of material collected from the drain contained elevated TPH and metals plus PAHs, tetrachloroethene and a few other VOCs.

5.1.2.6 Stormwater Pond

The stormwater detention pond is located in the southwest portion of the property, west of the shop building. The pond is lined and equipped with a pump and fountain to facilitate evaporation. The pond is emptied of water annually. When emptied, the water is transported offsite and dumped on the ground and allowed to infiltrate. Ordinarily, the water is dumped on the property to the south, across Turn Point Road. A sample of pond sediment collected in 2018 indicated the presence of elevated metals concentration. No other analytes were tested.

5.1.2.7 Former Orcas Power and Light Company Pad

A former Orcas Power and Light Company (OPALCO) storage area in the western portion of the site was identified and investigated for surface contamination. The pad is the building foundation of an OPALCO building that burnt down, possibly contributing to cPAHs. Shipyard activities, paint-stripping, and stored creosote-treated wood are possible sources of contamination. (Shannon 2019).

5.1.2.8 Wooded Hillside Area Along Turn Point Road

The wooded hillside area south of the OPALCO pad area, the stormwater pond, and the shop building has not been investigated. No RECs were noted in the Phase I ESA (Whatcom 2017) and no subsequent investigation activities were conducted in this area.

5.1.3 Hydrology

The site is entirely saltwater (25 parts per thousand) and experiences mixed semidiurnal tides, with a tidal range of 7.76 feet (NOAA, Station ID 9449880). The average annual precipitation at the property is approximately 20 to 40 inches, the average annual air temperature is approximately 48 to 50°F, and the average frost-free period is 200 to 240 days (WE, 2017a). The shoreline orientation faces northward and is entirely open to the dynamics of tides, waves, and winds from Puget Sound. No wind-wave analysis has been conducted at the Project site; however, this information has been identified as necessary to support necessary marina maintenance and improvement. Freshwater input is expected to be primarily surface runoff and seepage from storm events. With the exception of the single, 6-inch pipe extending from the berm along the boatyard area (Figure 4, Outfall photo), no other watercourses or outfalls were observed. The 6-inch pipe serves as the emergency overflow from the onsite stormwater detention and evaporation pond. The pond overflow pipe is included in Jensen's National Pollutant Discharge Elimination System (NPDES) Boatyard General Permit Coverage (WAG994386). At the time of the inspection, there was no indication that discharges have occurred from the pipe. The PoFH reports that no discharges have ever occurred and anticipates vacating the pond and pipe as part of future marina improvements. WE collected limited groundwater data at the Project site and identified a generally northward movement of groundwater from the uplands to and into the intertidal and subtidal areas

(Figure 5, Groundwater Elevation) (WE, 2018d), but did not calculate volumes or definitively confirm interaction with marine waters. Although no detailed hydrologic study has been performed, the site is characterized by a relatively shallow groundwater table that may be influenced by the tidal cycle throughout the nearshore. Tidal response is typically observed in shallow shoreline aquifers of this nature to about 50 to 100 feet inland, depending on the aquifer thickness and soil type. The sloped shoreline is comprised of materials generally pervious to groundwater flux, and the surrounding upland ground surface consists of unpaved soils that do not limit infiltration and percolation of precipitation.

5.1.4 Site Geology

Soils in the upland area of the subject property are described in the Soil Survey of San Juan County Area, Washington (U.S. Department of Agriculture [USDA], 2009) and summarized in the Phase I ESA prepared by WE (WE, 2017a). The Soil Survey designates the upland soil as a mixture of Beaches-Endoaquents, tidal-Xerorthents association; Mitchellbay-Rock Outcrop-Killebrew complex; and Cady-Rock Outcrop Complex. The soil is composed of approximately 38% Beaches-Endoaquents, tidal-Xerorthents association; 26% Mitchellbay-Rock Outcrop-Killebrew complex; and 36% Cady-Rock Outcrop Complex.

Soils in the grassy uplands area included up to 1-foot of dark-brown organic-rich topsoil, with an underlying gravelly fine to medium-grained sand, orange-brown in color and observed up to 5-feet below ground surface (ft bgs). Below this gravelly sand was observed a firm to hard, brown to gray, sandy silt with minor to some clay content. An occasional erratic boulder was observed in the undisturbed upland soils (CRETE 2021).

5.2 Nature and Extent of Contaminants

5.2.1 Soil and Groundwater

Screening level (SL) development is described in detail in Section 8 of this RIWP. Conservative SLs were developed for soil and groundwater as a means of assessing constituents of interest and the nature and extent of soil and groundwater contamination based on available pre-RI data. In future RI phases, SLs will be refined into cleanup levels, including evaluating soil protective of groundwater SL exceedances versus empirical groundwater data.

Constituents of interest (COIs) were selected based on having greater than a 5% detection frequency and at least one detected value over the screening level (Appendix A). This approach is consistent with the procedure for determining Contaminants of Potential Concern (COPCs) in EPA and Oregon Department of Environmental Quality risk assessment guidance. For groundwater, due to the limited set of existing data, a groundwater COI was also assessed based on saturated soil screening level exceedances.

The selected groundwater COIs are:

- TPH-Dx
- Metals
 - Cadmium
 - Chromium
 - Copper
 - Lead
 - Mercury
 - Zinc

The selected soil COIs are:

- TPH-G
- TPH-Dx
- Dioxins/Furans
- PAHs
 - 1-methylnaphthalene
 - 2-methylnaphthalene
 - Acenaphthene
 - Anthracene
 - Fluoranthene
 - Fluorene
 - Naphthalene
 - Pyrene
- cPAHs
- Metals
 - Arsenic
 - Cadmium
 - Chromium
 - Copper
 - Lead
 - Mercury
 - Zinc

As discussed in Section 5.5.2, soil samples will be analyzed for PCB aroclors, pesticides, and TBT even though these analytes were not determined to be COIs based on existing analytical data.

5.2.1.1 Soil Contamination

A significant surface soil dataset has been developed during previous investigations but a more limited subsurface dataset is available. Table 5-1 (Tables section) provides a soil data summary for the COIs. Figures 6 through 29 illustrate the distribution of soil SL exceedances for select compounds in surface, vadose zone, and saturated zone soil.

No soil samples have been analyzed for TBT, semi-volatile organic compounds (other than PAHs), volatile organics, or pesticides.

5.2.1.1.1 Petroleum

TPH-G/benzene, toluene, ethylbenzene, and xylenes (BTEX) were analyzed in 10 soil samples. BTEX compounds have not been detected. TPH-G has been detected above the SL in 2 samples (MW-1 12 ft and SRWA-3 0-6 in) and 32 and 84 mg/kg, respectively.

The extent of TPH-Dx exceeding SLs is illustrated in Figures 6 to 28. TPH-Dx was detected at elevated concentrations in surface soil at MW-1 and SWRA-3, in the vadose zone at AST-1 2 ft bgs, and in the saturated zone at BLWA-6. Other soil concentrations of TPH-Dx are reported for the BLWA, SRWA, OPALCO pad, shop, and shipyard cove areas at concentrations below the SL.

5.2.1.1.2 Polychlorinated Biphenyls (PCBs)

Limited soil and groundwater PCB aroclor data have been collected (10 samples). Concentrations at SWRA-3 and MW-4 soil boring in surface soil were below the SL. PCB was not detected at MW-4 at 11 ft bgs. PCB was also not detected in surface or subsurface soil (up to 5 ft bgs) in the OPALCO pad area.

PCBs may also be present in surface soil at MW-3 in the SRWA as discussed in the following section.

5.2.1.1.3 Dioxins and Furans

Limited soil and groundwater dioxins/furans data have been collected (2 samples). Dioxin and furan concentrations (evaluated as total 2,3,7,8-TCDD equivalence) exceeded the SL in surface soil L at MW-4 and MW-3.

A preliminary evaluation of the homologs indicates that the MW-4 signature is similar to background data, while the MW-3 signature has elevated furans suggesting a site impact, potentially from PCBs.

5.2.1.1.4 Metals

Extensive soil sampling and analysis for metals has been performed. The distribution of SL exceedances for six of the seven metals COIs in soil are illustrated in Figures 9 through 26. Separate figures are provided for surface, vadose zone, and saturated zone soil for each COI. Copper is the most prevalent metal COI in soil. All of the metals show a similar pattern of more widespread distribution in the surface soil with vadose and saturated zone impacts focused in the primary source areas: the BLWA and SRWA. Less consistent SL exceedances of copper, zine, and arsenic occur near the OPALCO pad, the FDA, the AST, and the shop drain.

5.2.1.1.5 PAHs

Extensive soil sampling and analysis for PAHs has been performed. The distribution of SL exceedances for PAHs is similar to the distribution for the metals. CPAH exceedances are widespread in surface soil with vadose zone impacts focused in the primary source areas: the BLWA and SRWA (Figures 27 through 29).

5.2.1.2 Groundwater Contamination

Six groundwater monitoring wells were installed at the Site in 2018. Groundwater sampling has been performed twice (August 2018 and February 2020) and the data are summarized in Table 5-2 (Tables section). In 2018, groundwater samples were analyzed for metals, TPH-G/BTEX, TPH-Dx, and PAHs. In 2020 TPH-G and PAHs were not analyzed but NWTPH-Dx with silica gel cleanup (SGC) and volatile organic compounds (VOCs) were added to the analytical suite. Groundwater sampling was not performed based on tidal study results so it is not clear that sampling was performed at the appropriate time during the tidal cycle although, during the 2020 event, sampling was performed following a negative low tide at estimated tidal lags that would result in low water elevations in MW-2, MW-3, and MW-5. Specific conductivity data indicate that there is significant sea water influence at MW-2 and MW-3.

Cadmium, mercury, PAHs and VOCs (including BTEX) were not detected in any sample. During the 2018 sampling event, TPH-G was detected in MW-2 and TPH-D was detected in MW-1 and MW-2. TPH-D was not detected in these wells during the 2020 sampling event.

Chromium, lead, nickel, and zinc were detected in one to six wells, but all results were below SLs. Copper exceeded SLs in both events at MW-1. Copper exceedances also occurred at MW-2, MW-3, and MW-4, but the results were not consistent. There were no exceedances of SLs at MW-5 and MW-6.

The estimated extent of groundwater exceedances of SLs is illustrated on Figure 5.

5.2.2 Sediment Characteristics

Sediments within the Project site have been minimally characterized and additional sediment sampling is anticipated as part of a subsequent remedial investigation; however, existing data support a preliminary conclusion that contaminants originating from Jensen's operations are generally concentrated around the central boatyard area and have not migrated offsite via intertidal or subtidal pathways (WE, 2018c). A summary of grain size and other conventional sediment characteristics is provided in WE's Draft Sediment Data Report (WE, 2018c). A summary of SMS exceedances detected during the 2018 characterization (WE, 2018c) is provided in Table 5-3 (Tables section). WE's sediment data (WE, 2018c) are reproduced in Appendix A.

Previous sediment characterizations at the Jensen Shipyard were limited and focused only on surface conditions. Sediment samples were collected from the site by the Department of Ecology in 1997 as part of a larger study conducted to determine the occurrence and extent of toxic chemicals associated with marina activities in four harbors in the San Juan Islands. The results of sediment chemical testing were summarized in a 2001 Department of Ecology report titled Concentrations of Selected Chemicals in Sediments from Harbors in the San Juan Islands (Ecology, 2001). Two sediment samples collected within the aquatic area of the subject property exceeded the screening level of 73 micrograms per kilogram ($\mu\text{g}/\text{kg}$) for tributyltin (TBT) at concentrations of 135.3 $\mu\text{g}/\text{kg}$ (FR1) and 74.8 $\mu\text{g}/\text{kg}$ (FR3) (Ecology, 2001).

In February 2018, upland soil and marine sediment samples were collected by WE and the results summarized in the report Initial Investigation Report (WES, 2018a). Fifteen soil samples and thirteen sediment samples were collected during the investigation. The soil sample results indicated that portions of the site are contaminated with metals (primarily copper and lead), petroleum compounds, and cPAHs.

In August 2018, WE collected additional sediments in accordance with the Sediment Investigation, Sediment Sampling and Analysis Plan (SAP) (WE, 2018b) approved by Ecology. The purpose of the study was to further characterize sediment quality in the marine area of the Shipyard and Marina site. An additional seven surface sediment samples were collected. Three of the sampling stations had been previously sampled during February and were resampled to supplement the original data set with an evaluation of dioxins/furans. The results were summarized in WE's Draft Sediment Data Report (WE, 2018c).

Collectively, the sediment sample results indicated that marine surface sediments (particularly near the shore) contain concentrations of metals, PAHs, PCBs, phthalates, pesticides, and tributyltin that exceed regulatory thresholds. The elevated concentrations were detected in samples collected from the nearshore marine areas close to the old marine railways and the current boat travel lift. Elevated concentrations were also present to a lesser extent in samples collected further west of the lifts and beneath the covered boat moorage slips. Sediment results were compared to the Sediment Quality Standards (SQS) marine chemical criteria levels (Chapter 173-204-320 *Washington Administrative Code* [WAC]), where applicable. TBT and dioxins/furans results were compared to the established sediment natural background value, which is the basis for the Dredged Material Management Program (DMMP)

dioxin/furan screening level (USACE, 2016). Chemicals with concentrations exceeding applicable target criteria and screening levels include PCBs, various PAHs, phthalates, pesticides, copper, zinc, mercury, and TBT. WE's surface sediment concentrations figures (WE, 2018c) (TBT, PCBs, mercury, and fluoranthene) are provided in this report as Figures 30 through 33. The study recommended further sediment sampling to more thoroughly delineate the presence of chemicals in sediment at the site.

Additionally, the entire in-water area is known to be heavily impacted with a substantial volume of debris from intertidal elevations out to at least shallow subtidal depths. Within the boathouse areas, there appears to be some debris present on the seafloor, including tires that can be observed from the marina floats. The dense concentration and extent of debris observed is expected to interfere with subsequent sediment sampling efforts.

The following paragraphs describe known contaminated sediment characterization of surface sediments (WE, 2018d) and offer a starting platform for additional sediment characterization during the remedial investigation phase.

5.2.2.1 Tributyltin (TBT)

Elevated TBT concentrations were encountered throughout nearshore areas adjacent to upland work areas at the site. TBT concentrations were particularly elevated in the intertidal zone along the base of the historical western railway. The DMMP screening level was exceeded at sample locations SED-7, SED-8, SED-9, SED-10, and SED-13. Additionally, the screening level was exceeded directly offshore from the marine railways at sample location SED-14. All other samples contained detectable concentrations of TBT below the screening level. TBT concentrations reported by WE (WE, 2018c) are shown in Figure 30.

5.2.2.2 Polychlorinated Biphenyls (PCBs)

PCB concentrations (evaluated as total Aroclors) exceeded the applicable criteria levels in the nearshore area at the end of the travel lift slip (SED-9), at the intertidal zone located at base of the historical western railway (SED-10 and SED-13), and directly offshore from the marine railway (SED-14). Samples SED-10, SED-13, and SED-14 were compared to the SQS criteria. Due to the elevated organic carbon content, sample SED-9 was compared to Apparent Effects Threshold (AET) criteria, as recommended in Ecology's Sediment Cleanup User's Manual (SCUM) Table 8-1 (Ecology, 2021). All other samples contained detectable concentrations of PCBs below applicable criteria. This evaluation compared PCB Aroclors to benthic criteria. Although the initial sediment sampling effort will focus on PCB Aroclors, if required, it is anticipated that supplemental field mobilizations of the remedial investigation will collect PCB congener data for comparison to applicable toxicity equivalent (TEQ) background criteria and human health protective levels. PCB concentrations reported by WE (WE, 2018c) are shown in Figure 31.

5.2.2.3 Dioxins/Furans

Dioxins/furans concentrations (evaluated as total 2,3,7,8-TCDD equivalence) exceeded the established sediment natural background value (4 parts per trillion [ppt] TEQ), which is the basis for the applicable DMMP screening level in the nearshore areas at the north end of the boat travel lift (SED-9d) and at the base of the historic western railway (SED-10d and SED-13d). Dioxins/Furans have not been evaluated in any other marine areas of the site.

5.2.2.4 Metals

Elevated metals concentrations were encountered in the nearshore area. Copper, mercury, and zinc concentrations exceeded applicable SQS criteria at sample stations located in the intertidal zone at base

of the historical western railway (SED-10 and SED-13). Additionally, mercury exceeded the criteria just northeast of the railway (SED-11), and copper exceeded the AET criteria at the end of the travel lift slip (SED-9). No other metals exceeded the applicable criteria in marine sediment at the site. Mercury concentrations reported by WE (WE, 2018c) are shown in Figure 32.

5.2.2.5 Organic Chemicals

Benzyl alcohol concentration exceeded the SQS criteria at sample station SED-9. The result was flagged by the lab as being an estimated concentration (J-flagged) and was only slightly above the SQS criteria. The result may or may not be of concern. Detected organic chemical concentrations did not exceed applicable SQS criteria at any other sampling station. However, numerous organic chemical results were reported at elevated detection limits that are above applicable SQS (and/or AET) criteria.

5.2.2.6 Phthalates

Butylbenzyl phthalate and dimethyl phthalate concentrations exceeded the SQS criteria at one sample station located at the north end of the boat travel lift (sample station SED-9). No other phthalate exceedances were encountered in marine sediment at the site.

5.2.2.7 Polycyclic Aromatic Hydrocarbon (PAH)

Various PAH constituent concentrations exceeded the SQS criteria levels in the nearshore areas at the north end of the boat travel lift (SED-9) and at the base of the historical western railway (SED-10 and SED-13). PAH constituents detected at sample station SED-9 exceeded six of the eighteen criteria levels. PAH constituents detected at sample station SED-10 exceeded eleven of the eighteen criteria levels. PAH constituents detected at sample station SED-13 exceeded three of the eighteen criteria levels. No other PAHs exceeded the applicable criteria levels in marine sediment at the site. Evaluation of cPAH risk is anticipated in a subsequent remedial investigation. Fluoranthene concentrations reported by WE (WE, 2018c) are shown in Figure 33.

5.2.2.8 Chlorinated Organics

No chlorinated organics were detected in sediment at the site above applicable SQS criteria. However, due to the dilution factors (created by converting data to dry weight and also converting to carbon normalized data), some laboratory detection limits were elevated greater than the SQS criteria.

5.2.2.9 Pesticides

Total chlordane exceeded the DMMP screening level at two sample stations located approximately 300 and 450 feet from shore, beneath the covered boat slips (SED-3 and SED-5). There were no other chemical criteria exceedances at those sample stations. Pesticides were not evaluated during the most recent sampling event.

5.3 Physical Processes Conceptual Site Model

The physical processes description synthesizes what is known about important physical processes operative on and within the embayment where Jensen's is located. The twin foci include identifying the sources and transport pathways that introduced chemical contamination to the sediments, and on the processes that govern sediment transport. This information, coupled with data regarding the nature and extent of sediment contamination, will inform a prudent and cost-effective approach to address the need for and nature of remediation. Upland contamination can most directly impact sediment via erosion of surface soil to sediment. Surface water and sediment can also be impacted via the soil-

groundwater-surface water and the soil-groundwater-sediment pathways. These processes and pathways will be further evaluated during the RI.

The following sections discuss likely transport pathways at Jensen's. These pathways are shown conceptually in Figure 34 (In-Water Physical Conceptual Site Model – Plan View) and Figure 35 (In-Water Physical Conceptual Site Model – Cross Section).

5.3.1 Hydrodynamics

Shipyards Cove is subject to a range of hydrodynamic forces that potentially affect the movement and stability of the sediments. Water circulation is primarily influenced by the open and unimpeded connection to Puget Sound, so natural tides, currents, and wind-generated waves can be expected to sort and distribute intertidal and shallow subtidal sediments. During storm events, significant discharges from surface runoff, would be expected and (depending on storm strength, duration, and direction) could further concentrate sediment contamination along the shore or disperse it. There is regular active boat traffic via the shipyard and adjacent marine based activities (i.e., a barge landing operation located immediately north of the shipyard), which are large enough that propeller-generated currents (propwash) are likely to redistribute surface sediments in the shallower locations of the shipyard.

Sediment transport and sedimentation rates in Shipyards Cove, particularly around the Project site, are unknown. Shipyards Cove is entirely open to Puget Sound, so tides, currents, and wind-generated waves are expected to be dynamic forces that influence deposition and distribution of surface sediments. However, the Project site is generally sheltered from the east, west, and south by the shoreline of Shipyards Cove. The adjacent Shipyards Cove Marina shelters Jensen's from northwest exposure, and Brown Island also shelters Jensen's from north-northwest exposure.

The sediment bed in Shipyards Cove seems to be stable under normal circumstances. The Project site is exposed primarily to wind and wave energy coming from the north, which is expected to occur only during episodic events. Bathymetry shows a shallow sill gently sloping into deeper marine waters. Because of the embayment's northern orientation, wind and wave forces are expected to concentrate sediments up the shoreline or redistribute sediments east/west along the shoreline. Given the shallow depth of the embayment and the amount of regular boat activity, it is likely that propwash is a more important factor in sediment transport and redistribution, particularly in the vicinity of the boat lift at Jensen's and the barge landing site on the adjacent property.

5.3.2 Water Column/Suspended Sediment

Shipyards Cove is relatively sheltered, open only to wind and wave induced forces from the north. Because there is little indication of sediment deposition across the Project site, sedimentation rates are expected to be low; however, no data has been collected for the area. Similarly, no current water velocity information is available, which would help evaluate sediment transport.

5.3.3 Groundwater Transport

Groundwater flow at the site is toward the shoreline. Shoreline groundwater quality was not assessed during previous site investigations although elevated soil concentrations are present along the shoreline. Tidal fluctuation impacts groundwater flow and creates substantial dilution and attenuation within the upland shoreline and in the hyporheic zone. Soil and groundwater quality and flow will be assessed to determine if this is a significant transport mechanism.

5.3.4 Lateral Loads

A single, 6-inch pipe extends from the berm along the boatyard area (Figure 5, Outfall photo). The pipe serves as the emergency overflow from the onsite stormwater detention and evaporation pond. The pond is located in the southwest portion of the property, west of the machine shop. It is equipped with a pump and fountain to facilitate evaporation, but is emptied of water annually (WE, 2017a). The pond receives wash water from a wash pad located at the end of the boat pullout. Wash water is treated in a closed-loop system using enzymes and diverted to the pond (WE, 2017a). Although the pond has been identified as a potential area of concern for tributyltins and other heavy metals (WE, 2017a), there is no indication that discharges have occurred from the emergency overflow pipe, and the PoFH confirms that no discharges have ever occurred. No other point source outfalls or streams have been identified as discharging to the embayment where Jensen's Shipyard is located, although a sheen was observed close to the creosote pilings supporting the travel lift during a May 9, 2019, site visit.

5.4 Potential Human and Ecological Receptors

A complete CSM includes general information about sources leading to chemical contamination of sediment, water, and biota. The model also includes pathways for human exposure to chemicals through these media. With sufficient information, for each pathway-media combination, a determination can be made as to whether the pathway is complete or incomplete. A complete exposure pathway includes an exposure medium and exposure point, a potentially exposed population, and an exposure route. Incomplete pathways do not meet these criteria. They may require assessment, but cannot be evaluated quantitatively since both exposure (a complete pathway) and toxicity are required to quantify risk. The identification of complete or incomplete pathways can be used to inform the data gaps analysis. Complete pathways expected to represent a potential exposure of health concern may need to be evaluated in a risk assessment, if potential remedial alternatives include scenarios where final surface concentrations of chemicals exceed SMS criteria. For pathways identified as having low exposure and risk potential relative to other pathways being evaluated, a determination will be made in consultation with Ecology about the utility of some type of evaluation of the pathways (e.g., comparisons to other quantified exposure pathways) for risk communication purposes or to evaluate whether a standardized remediation remedy would achieve adequate compliance with existing standards and acceptable reduction of risk. The exposure parameters and the likelihood of exposure under both current and future land use at the site may need to be evaluated for any significant exposure pathways.

For the upland areas, the potential receptors may be exposed via direct contact or ingestion. Current and future human receptors may be exposed to hazardous substances by direct contact or ingestion of soil, groundwater, contaminated stormwater and associated sediment, or by inhalation of dust. These pathways are considered complete but minor as they are primarily incidental to construction and normal boatyard work where measures are taken to reduce exposure, such as the use of personal protective equipment while accomplishing work. Vapor intrusion is not considered a pathway of concern since VOCs (including naphthalene) have not been detected in groundwater and only diesel or heavier hydrocarbons are present.

5.4.1 Potential Human Exposure Scenarios

Potential human exposure scenarios are described qualitatively below. If required, subsequent quantitative analysis is expected to occur as part of a remedial investigation.

5.4.1.1 Water Recreation

Direct contact with embayment waters is a key exposure scenario to be considered for people. Recreational opportunities abound around the island and throughout the San Juan archipelago. Water recreation at Jensen's can include swimming, self-contained underwater breathing apparatus (SCUBA) diving, pleasure boating, fishing, and time spent on the marina floats. These potential exposure scenarios are focused primarily on the surface water pathway. Although sediment contact may occur during such activities, the frequency and duration of this contact is expected to be much lower than the shore recreation scenario. For this reason, any risk associated with potential sediment exposure during water recreation is addressed through the direct-contact scenario for shore recreation.

Site access, either by the upland or via boat, is not restricted to the public, but many recreational activities would be unsafe or undesirable given vessel traffic and the current debris impacts to shoreline and shallow subtidal lands.

The current frequency of swimming in the site is unknown; however, it is assumed that recreational swimming rarely occurs at or around Jensen's. Similarly, although the frequency that recreational SCUBA diving occurs around Jensen's is unknown, it is expected to be low. The most likely exposure scenarios include incidental exposure during boating, fishing, and spending time recreating on the marina's floats. Future remediation and restoration actions that could be conducted at the site could change the frequency of these recreational activities; however, a substantial increase is not anticipated.

A water recreation scenario could be developed for the site, but the utility is expected to be low. A risk assessment conducted by King County (King County, 1999) found that risks associated with swimming in the Duwamish River and Elliott Bay due to water exposure were small. As part of the anticipated remedial investigation for Jensen's, the Duwamish River and Elliott Bay water recreation exposure scenarios will be compared to conditions at Jensen's; however, because risk associated with water recreation exposure scenarios is expected to be low, these scenarios are not anticipated to require subsequent evaluation. A determination about whether subsequent evaluation is required will be made in consultation with Ecology.

5.4.1.2 Shore and Upland Recreation

Boat owners, trespassers, and other public users of the property may be exposed to surface soil through incidental contact or dust. Exposures are anticipated to be incidental but the exposure pathway is complete. Soil cleanup levels developed for the site will address this exposure pathway.

Activities with the potential for sediment exposure include beach play, clamming, launching small vessels, and shoreline fishing. Direct contact with sediments can be either incidental (e.g., sinkers and fishing lines coming into contact with bedded or suspected sediment during normal activity and fishers contacting this sediment incidentally upon retrieval) or more extreme (e.g., sunbathing or being partly buried in sand as part of the beach experience). These same fishers and other recreationalists may also make additional incidental contact with surface water and suspended sediment while wading; however, risk associated with suspended sediments is expected to be low, and surface water exposure is addressed above in the water recreation scenario. The shore recreation scenario focuses on sediment pathway exposures, including dermal contact and incidental ingestion.

Shore recreation exposure to sediments is not expected to be prominent on intertidal areas along the western half of the property in front of the active boatyard; however, the eastern half of the property is likely to serve as a primary place for the public to access intertidal habitat at Jensen's. Currently, many recreational activities would be unsafe or undesirable given the current debris-impacted shoreline, but

future remediation of the Project site is expected to address these impacts and encourage more public access.

A beach play scenario was developed to assess risks to young children (i.e., up to 6 years of age) from playing in intertidal sediments at publicly accessible beaches on the Lower Duwamish Waterway (LDW) that have public access from the shore (Windward, 2007). Assumptions in this study included unlimited public access from the shore, including from residential areas directly adjacent to the shore. The exposure parameters for this scenario, which were based on a survey of recreational lake use in King County (Parametrix, 2003), evaluated significant sediment exposure to children's bodies occurring 65 days/year. Other recreational exposure scenarios evaluated in this study focused on adult recreation are expected to be less protective than the child exposure scenario. As part of the anticipated remedial investigation for Jensen's, the LDW shore recreation exposure scenarios will be compared to conditions at Jensen's.

5.4.1.3 Occupational Exposure

Boatyard workers may be exposed to surface soil through incidental contact or dust. Exposures are anticipated to be incidental but the exposure pathway is complete. Personal protective equipment used by boatyard workers may help mitigate this exposure pathway. Soil cleanup levels developed for the site will address this exposure pathway.

Site construction workers may be exposed to soil and groundwater during earthwork activities, such as utility installation or site cleanup, due to incidental contact or dust. Workers exposed to contaminants during earthwork will use personal protective equipment to protect from the types and concentrations of contaminants that are present. Soil and groundwater cleanup levels developed for the site will address this exposure pathway.

Much of the work around piers and water craft necessarily involves some incidental exposure to site water and sediment. Work performed on piers, pilings, and boat bottoms occurs on site, resulting in more than incidental exposure to water and sediment, although such activities are expected to be relatively infrequent. Occupational exposures may also occur during marina improvements/maintenance planned by the PoFH. Workers on moored vessels and on dock structures could potentially come into contact with sediment, but are more likely to contact surface waters. Most workers are typically aboard the vessels and well above the water surface. Accordingly, worker exposure to Project site waters and sediments would be relatively infrequent, resulting in potentially complete, but low, exposure. Other occupational exposure, such as a biologist conducting field investigations for marina maintenance or restoration work, is likely, but expected to be of low risk due to a lower exposure frequency and duration. Overall, occupational exposure to water and sediments is expected to be much lower than in the shore recreation and shellfish collection exposure scenarios; however, the need to evaluate occupational scenarios will be established in consultation with Ecology.

5.4.1.4 Fish, Crab, and Shellfish Collection

The extent and frequency of recreational collection of fish, crab, and shellfish within the embayment and specifically from the Jensen Shipyard property is unknown. It is known that various fishes, crab, and shellfish (clams and oysters) are present at this location; however, the PoFH indicates that long-term residents have reported that there is no history of fishing, clamming, or crabbing in the tidal or shallow bedland areas of Jensen's. For the purposes of this CSM, it is assumed that there are no recreational or commercial fisheries that operate within the Project area. This assumption must be validated as part of

the anticipated remedial investigation. The potential for shellfish collection in the future is anticipated to be evaluated in a subsequent phase of work.

5.4.1.5 Fish, Crab, and Shellfish Consumption

Likewise, the extent and frequency of any subsequent consumption of fish, crabs, and shellfish collected from the Jensen Shipyard area (or within the shallow embayment) are unknown; however, existing evidence suggests that seafood consumption does not occur. For the purposes of this CSM, it is assumed that no shellfish consumption from the Jensen's shoreline is occurring; however, the potential for shellfish consumption in the future is anticipated to be evaluated in a subsequent phase of work. If cleanup levels are ultimately based on results of a risk evaluation and not sediment natural background, tribal consumption scenarios may be evaluated.

5.2.1.6 Selection of Exposure Scenarios for Additional Evaluation

Specific exposure assumptions will be developed in consultation with Ecology to identify complete pathways, which must include an exposure medium, exposure point, a potential exposed population, and an exposure route. Complete pathways will be subsequently evaluated to determine whether site-specific risk calculations are required, versus comparing a qualitative site-specific risk evaluation against risk quantified at similar sites.

Potential exposure scenarios are summarized in Table 5-4. These scenarios will be re-evaluated in the RI.

Table 5-4. Potential Exposure Scenarios

Exposure Scenario	Exposure Point	Exposure Medium	Exposed Population	Exposure Route	Anticipated Analysis	Comment
Water Recreation	Project Site	Sediment	Resident	Dermal, Ingestion ¹	Qualitative	Exposure via swimming is lower than exposure via other pathways.
		Surface Water	Resident	Dermal, Ingestion ²	Qualitative	King County study (King County, 1999) suggests that risks associated with water recreation are within accepted levels. Anticipated RI will validate King County conclusions against site-specific data.
Shore and Upland Recreation	Upland, Shoreline, and Intertidal	Soil	Resident	Dermal, Ingestion ¹	Soil data will be compared to MTCA criteria.	Boat owners, trespassers, and other public site users may have incidental exposure to upland soil via direct contact or dust.
		Sediment	Resident	Dermal, Ingestion ¹	Qualitative	To be further evaluated.
		Surface Water	Resident	Dermal, Ingestion ²	Qualitative	Exposure attributable to resuspended sediment in water column is insignificant compared to that from direct contact with bedded sediment. Exposure is expected to be much lower than in the swimming scenario.
Occupational	Boatyard	Surface Soil	Worker	Dermal, Ingestion ¹	Soil data will be compared to MTCA criteria.	Boatyard workers may have incidental exposure to upland soil via direct contact or dust.
		Sediment	Worker	Dermal, Ingestion ¹	Qualitative	Exposure is expected to be much lower than that evaluated in the shore recreation and shellfish collection exposure scenarios.
		Surface Water	Worker	Dermal, Ingestion ²	Qualitative	Exposure is expected to be less than in the swimming scenario.
	Construction	Soil and Groundwater	Worker	Dermal, Ingestion ¹	Data will be compared to MTCA criteria.	Workers engaged in habitat restoration or site cleanup projects may come in contact with soil and groundwater. Workers will wear appropriate PPE to limit exposure.
		Sediment	Worker	Dermal, Ingestion ¹	Qualitative	Workers engaged in habitat restoration or site cleanup projects may come in contact with sediment. Further evaluation will help to identify what level of PPE is appropriate.
		Surface Water	Worker	Dermal, Ingestion ²	Qualitative	Exposure is expected to be less than in the swimming scenario.
	Fish, Crab and Clam Collection	Shoreline and Intertidal	Sediment	Resident	Dermal, Ingestion ¹	Qualitative
Surface Water			Resident	Dermal, Ingestion ²	Qualitative	Exposure attributable to resuspended sediment in water column is insignificant compared to that from bedded sediment.
Project Site		Sediment	Resident	Dermal, Ingestion ¹	Qualitative	Incidental exposure during fishing and crabbing is insignificant.
		Surface Water	Resident	Dermal, Ingestion ²	Qualitative	Incidental exposure is less than the swimming scenario.

Exposure Scenario	Exposure Point	Exposure Medium	Exposed Population	Exposure Route	Anticipated Analysis	Comment
Fish, Crab and Clam Consumption	N/A	Tissue	Resident	Ingestion	Qualitative	To be further evaluated.

Notes:

¹ Incidental ingestion associated with dermal contact.

² Incidental water ingestion associated with dermal contact.

5.4.2 Potential Ecological Receptors

Ecological values include those roles and processes vital to ecosystem function, those providing critical resources such as habitat and fisheries, and the regulatory status of the populations (e.g., threatened or endangered species). Although no site-specific studies have been performed, it is known that several receptor groups occur in and throughout the San Juan Islands and would be expected to use the uplands and or aquatic environs of the Jensen Shipyard. Species that could directly or indirectly be exposed to contaminated sediments include the benthic invertebrate community, fish, birds, and mammals. Reptiles and amphibians are unlikely to be present on site because there is no persistent freshwater habitat present. Further evaluation will be done to determine whether the group or a representative species should be identified as a Receptor(s) of Concern.

5.4.2.1 Benthic Assemblages

Benthic invertebrate communities in the San Juan Islands are composed of a diverse set of phyla (Mollusca, arthropoda, annelida, and Echinodermata), and can be classified as infaunal (living in sediment) and epifaunal (living on the sediment or other substrate). Benthic invertebrates are in contact with sediment during some or all of their life cycles, and tend to have limited mobility (particularly as adults).

The benthic community can be an indicator of ecosystem health and performs several important ecological functions. Burrowing benthic invertebrates support nutrient cycling and bioturbation, and the benthic community is an important food source for other invertebrates, fish, birds, and mammals.

No benthic community sampling has occurred at the Project site; however, it is likely that some benthic invertebrates that humans consume are present within the study area. There is evidence that bivalves (clams, mussels, oysters, etc.) may be present at intertidal and subtidal elevations within the Project site, while crustaceans (crab and shrimp) and other benthic invertebrates are likely present around subtidal areas of Shipyard Cove.

5.4.2.2 Fish

Fish can be classified as demersal (living on or near the sediment and feeding on benthic organisms), benthopelagic (living and feeding near the sediment as well as in the water column), and pelagic (living and feeding in open water). Fish species within the proposed study area are generally expected to be mobile predators and thus exposed to chemicals through the ingestion of prey, incidental ingestion while consuming prey, and direct contact with sediments (particularly demersal species).

Fish are a food source for other fish, larger invertebrates, birds, and mammals, including people. They also provide important recreation value.

No fish surveys have been performed in the proposed study area, nor has an extensive review of other information sources been performed; however, it is likely that fish species that humans consume or that serve other important ecosystem functions are present within the study areas.

5.4.2.3 Birds

The Project site consists of habitat that numerous bird species are expected to utilize. The Project site and surrounding areas are known to support numerous species, including those that depend on the diverse riparian, intertidal, and subtidal habitat present at Jensen's. Birds that are expected to utilize the Project site include passerine and upland bird species, raptors, shorebirds and wading birds, waterfowl, and seabirds. Bird species would be exposed to chemicals through similar mechanisms as fish, including ingestion of prey (benthic invertebrates, fish, small mammals, etc.), incidental ingestion of sediments while consuming prey, and direct contact with sediments and site soils

No bird surveys have been performed in the proposed study area, nor has an extensive review of other information sources been performed.

5.4.2.4 Mammals

The proposed study area includes habitat that is expected to be utilized by marine mammal species like harbor seal, California sea lion, harbor porpoise, and killer whale. Marine mammals would be expected to consume fish, squid, octopus, and crustaceans. Additionally, semi-aquatic terrestrial mammals like raccoon, muskrat, and river otter may be present on site or in the vicinity. These species consume fish, crustaceans, and bivalves. In addition to ingesting prey, mammals are also expected to be exposed to chemicals through incidental ingestion of and direct contact with sediments and site soils.

No mammal surveys have been performed in the proposed study area, nor has an extensive review of other information sources been performed.

5.4.2.5 Terrestrial Ecological Evaluation

A simplified terrestrial ecological evaluation (TEE) was performed as described in Section 8.1.2.1. The simplified TEE indicated that substantial wildlife exposure was unlikely; therefore, potential TEE exposures were not incorporated into the soil SLs and will not be considered further in the RI/FS.

5.4.2.6 Selection of Receptors of Potential Concern (ROCs)

Specific receptors of concern (ROCs) will be identified in consultation with Ecology based on subsequent work, anticipated to include identification of key species that utilize the Project site and exposure assessments to evaluate whether a direct pathway exists and is significant. For the purposes of this CSM, sediments are assumed to be the principal source of chemicals for all exposure scenarios, regardless of the actual exposure medium (sediment, tissue, surface water, porewater).

In order for a chemical to pose a risk to a ROC, a complete exposure pathway must exist and be significant. A complete exposure pathway consists of a direct pathway between a source and the ecological receptor via one or more exposure routes.

To focus future evaluations, four exposure pathway designations have been defined:

- Complete and significant: A direct link between the ROC and chemical exists and is considered to be a potentially significant exposure. Additional qualitative evaluation is recommended to determine whether quantitative risk evaluation is warranted.

- Complete and significance unknown: A direct link between the ROC and chemical exists, but insufficient information exists to determine whether the pathway is significant. Additional qualitative evaluation is recommended to determine whether quantitative risk evaluation is possible or if the pathway must be addressed in subsequent uncertainty analyses.
- Complete and insignificant: A direct link between the ROC and chemical exists; however, the overall exposure is considered to be low. No further analysis is proposed for these pathways.
- Incomplete: There is no direct link between the ROC and the chemical. No further evaluation of these pathways is proposed.

Complete and significant pathways for the benthic invertebrate community include sediment contact, sediment ingestion, prey ingestion, and surface water contact. For fish, key exposure pathways include prey ingestion and water contact. Sediment contact and incidental ingestion are complete pathways for some fish species, but are insignificant for others. Ingestion of prey, surface water, and sediments are all complete and significant exposure pathways for birds and mammals. Sediment and water contact are also considered complete pathways for birds and mammals; however, they are insignificant in comparison to other pathways because feathers and fur limit direct dermal contact.

Table 5-5 illustrates exposure pathways for potential ROCs. ROCs are general, because insufficient information has been collected to identify specific species.

Table 5-5. Exposure Pathways for Potential ROCs

Receptor	Sediment Contact	Sediment Ingestion	Water Contact	Benthic Ingestion	Fish Ingestion	Other Ingestion
Infaunal Benthic Community					X	
Crabs	?	?				?
Fish	?	?				
Birds						
Mammals						

Pathway Key	
	Complete, significant
?	Complete, significance unknown
	Complete, insignificant
X	Incomplete

If additional risk analysis is required subsequently, a food web highlighting the connections between ROCs may be appropriate for the Project site. Given the simplicity of the Project site, however, a qualitative risk evaluation for ROCs may be appropriate.

5.5 Data Gaps Analysis

The paragraphs below summarize our conclusions regarding identified data gaps that need to be addressed to complete the Remedial Investigation phase.

5.5.1 Groundwater

Groundwater sampling conducted by WE in 2018 and CRETE in 2020 indicated arsenic and copper above SLs in the central uplands area (Figure 5) associated with monitoring wells MW-1 through MW-4. These

wells are located 100 feet or more from the shoreline and shoreline soil sampling in the BLWA suggests soil impacts up to the shoreline, potentially impacting groundwater and creating a groundwater to sediment migration pathway. To evaluate this pathway, three groundwater monitoring wells will be installed along the BLWA shoreline near previous sample locations BLWA-4, BLWA-6, and BLWA-8. Figure 36 shows the location of the three new soil borings and monitoring wells. Additional soil data collected in conjunction with monitoring well installation at these locations will be used to confirm previous soil data with high concentrations of metals. Prior to performing groundwater sampling, a tidal study will be performed on a subset of the monitoring wells to assess tidal influence and the appropriate tidal lag times for sampling each well. Groundwater sampling will be performed for four consecutive quarters.

Groundwater samples will also be collected from direct push investigation locations to assess groundwater quality along the shoreline in the SRWA and at the AST, shop floor drain, and stormwater pond.

Groundwater samples will be analyzed for the groundwater COIs identified earlier in Section 5.

5.5.2 Soil Data

Soil samples will be collected and analyzed throughout the site for the soil COIs identified earlier in Section 5. The purpose of the soil data is to define the extent of soil impacts for future remedial action alternatives analysis and to allow assessment of the soil to groundwater and the surface soil erosion to sediment pathways. Analysis of dioxins and furans will be limited to selected surface soil samples where there is the potential for soil erosion directly to sediment, primarily the SRWA. TBT and pesticides, not previously evaluated in soil samples, will also be tested in surface soil in the SRWA. Due to the lack of PCB aroclor data and the likely presence of these compounds, PCB aroclors will be analyzed in multiple soil samples from throughout the site. Soil sampling is discussed below for each of the site area to be investigated. No additional data collection is proposed for the FDA or OPALCO areas.

5.5.2.1 BLWA

Six (6) soil borings will better characterize the presumed fill and contamination in the BLWA. Multiple soil samples at each boring location, and subsequently well location, will be used to characterize the fill across this area. One additional DPT soil boring with multiple subsurface soil samples will be collected on the raised platform north/northeast of previous boring location BLWA-3. If soil screening with a PID indicates potential gross contamination, then grab groundwater sample will be collected from the DPT tooling. All samples for metals, TPH-Dx, cPAHs, and PCBs. Three boring locations will be used as monitoring well locations to evaluate the extent of copper and lead impacts to groundwater and impacts to surface water.

Surface soil impacts from the BLWA may have been transported beyond the property boundary to Shipyard Cove Marina. Three (3) hand auger locations are proposed to better delineate the extent of surface soil impacts on this adjacent property.

5.5.2.2 SRWA

Metals and TPH impacts in the FDA are present to the east. The area between the SRWA and FDA remains a data gap to further delineating the metals, TPH, and cPAHs soil impacts along the eastern and southeastern portions of the SRWA. Approximate five (5) DPT borings (SRWA-8 through SRWA-12) in a stepped layout (Figure 36) will provide data needed to better define this area of contamination. One

row of DPT borings along the lower foot of the hillside and one row of DPT borings midway up the hillside should provide adequate distribution of data to better define contamination in SRWA. If soil screening with PID indicates potential gross contamination at any DPT boring, then grab groundwater samples will be collected from the DPT tooling at the corresponding location.

Figure 36 shows the soil sampling locations for the SRWA needed to vertical characterize the SWRA. Approximately 3 DPT borings (SRWA-13 to SRWA-15) will be used to confirm and vertically and horizontally delineate cPAH, TPH, and metal concentrations and to provide PCB data. Surface soil samples will also be collected from these locations and will be selectively analyzed for PCBs, TBT, pesticides, and dioxins and furans. These locations are identified in the Upland SAP (Appendix C).

5.5.2.3 AST

Three DPT borings (Figure 36) will provide data needed to better define this area of contamination. The borings will form triangle around former AST-1 boring location. Soil samples will be collected based on PID and olfactory observations to define the extent of TPH impacts. Grab groundwater samples will be collected from the DPT tooling at each DPT location to provide data to better assess potential petroleum impacts to groundwater.

5.5.2.4 Shop Floor Drain

One DPT boring will be advanced immediately downgradient (Figure 36) of the floor drain and MW-1 to provide data to more fully characterize the petroleum and metals impacts in this immediate area. Soil samples will be collected every 2-ft to water depth. A grab groundwater sample will be collected from the DPT tooling.

5.5.2.5 Stormwater Pond

One DPT boring will be advanced immediately downgradient (Figure 36) of the stormwater pond to assess whether the stormwater pond has impacted soil or groundwater in this immediate area with metals present in the pond sediment and water. Soil samples will be collected every 2-ft to water depth. A grab groundwater sample will be collected from the DPT tooling.

5.5.2.6 Wooded Hillside Area Along Turn Point Road

The wooded hillside area south of the OPALCO pad area, the stormwater pond, and the shop building has not been investigated. No recognized environmental conditions were noted in the Phase I ESA (WE 2017) or subsequent investigation activities were conducted in this area. This area will be visually inspected for potential dumping and sources of soil and groundwater contamination. Any observations from the inspection that require follow-up investigation or sampling will be assessed at that time.

5.5.3 Sediment Data

At this time, only a limited number of surface sediment samples (22) have been collected for this location, and no data quality review has been completed. While these data provide a useful starting point for identifying a preliminary list of Contaminants of Potential Concern (COPCs), the dataset is not sufficiently robust to definitively establish the nature and extent of the contamination, or to allow identification of or elimination of other potential sources of the contamination; this therefore precludes definitive identification of Potential Cleanup Units. While the chemistry data indicate chemical exceedances of regulatory criteria, no biological testing of the sediments for toxicity or bioaccumulation potential has been conducted, which could confirm or override chemical concerns. All samples collected were restricted to surface sediments only (top 10 centimeter [cm]) and were generally within the

immediate vicinity of Jensen's marina. Although dioxins/furans were evaluated at the north end of the travel lift and at the base of the historical western railway, they represent a data gap in other marine areas.

Several samples collected in intertidal areas (SRWA-1, SRWA-2, SRWA-3, SRWA-4, SRWA-5, and SRWA-6) were evaluated only as part of the upland dataset (WE, 2018d). These samples should also be included in the aquatic dataset and evaluated against marine sediment quality standards.

Historical wasting of debris and other material onto the uplands and directly into the water, and erosion of soils and material from the uplands via stormwater events, are visually evident as potential sources. WE established (WE, 2018a; WE, 2018b) that contamination exists in the upland soils; therefore, past or ongoing discharges to intertidal and subtidal sediments through groundwater flux may be a source, but have not been investigated. The presence of chemical contamination at depth, especially along the shoreline, can be inferred, but will require investigation to confirm. Accordingly, in addition to a quality review of the data, we recommend supplemental characterization of intertidal and subtidal sediments employing a mix of surface grabs and cores to establish the nature and extent of COPCs and to estimate the volume of material that may need to be remediated. The effort would also include the standard suite of biological toxicity tests. It is expected that sampling may require multiple mobilizations; therefore, SAP addendums may be prepared if supplemental sampling efforts are required.

Due to the extent of debris observed throughout intertidal elevations out to at least shallow subtidal depths, and also within the boathouse areas, debris expected to interfere with the collection of sediment grab samples and cores. The actual distribution and concentration of debris represents a logistical data gap.

Finally, the current segregation of upland data from aquatic data represents a data gap along the land/water interface. Integration of these data sets will present a more complete understanding of the nature and extent of COPCs across the land/water interface.

As part of the future remedial investigation, a supplemental sediment characterization is anticipated to address identified data gaps and refine the nature and extent of both debris and sediment contamination at the site. A sub-bottom profile survey is proposed prior to the initial sediment sampling effort to inform final selection of sample locations. Subsequently, surface sediment grab samples (sample depth of 0 – 10 cm) are proposed at seven (7) sampling stations and core samples (sample depth of 0 – 6 ft) are proposed at twelve (12) sampling stations located within the study area (Figure 37). We propose to reoccupy 10 previous sampling locations and sample nine new sampling locations around Jensen's. This effort is expected to:

- Delineate the nature and extent of debris throughout sampling areas.
- Establish vertical contamination profiles in areas where surface sediments exceed SQS.
- 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.

5.5.4 Tissue Data

Although tissue concentrations for fish and shellfish have been collected at other Puget Sound sites, no similar data have been collected at Jensen's. Previous sediment characterizations at the project site did not include bioaccumulation or toxicity testing, which could be useful in gauging the present level of risk to human and ecological health. As part of the supplemental sediment characterization, studies that could evaluate the bioavailability of selected COPCs include bioaccumulation studies and/or tissue sampling, which could be incorporated into a benthic survey. Data collected could be compared with tissue concentrations at other sites and inform decision-making regarding the need for additional collections; however, it is anticipated that final site conditions will meet SMS for non-bioaccumulative COPC, which is considered to be sufficiently protective. Bioaccumulative COPCs will be compared to natural background concentrations. If subsequent site evaluation suggests that SMS (non-bioaccumulative COPCs) or natural background (bioaccumulative COPCs) cannot be achieved, supplemental tissue analysis may be necessary.

5.5.5 Surface Water Data

A single outfall pipe was observed on the Project site, but there is no evidence of discharge or seepage. No other point source outfalls have been identified as discharging to the embayment where Jensen's Shipyard is located. Marine water quality throughout the San Juan archipelago is generally considered to be good, although no water quality studies have been conducted for this embayment associated with the marina operation of other shoreline activities outside of the project site property. Anticipated maintenance improvements to the marina and potential moorage space reconfigurations are expected to require establishment of baseline water quality parameters as part of the regulatory process, so although this is technically a data gap, it is a minor one. The need for collection of surface water quality data will be discussed with Ecology as part of the identification of required studies for remedial investigation or regulatory process.

5.5.6 Sediment Transport Data

Sediment transport and sedimentation rates in Shipyard Cove, particularly around the Project site, also represent a known data gap. Shipyard Cove is entirely open to Puget Sound, so tides, currents, and wind-generated waves are expected to be dynamic forces, which influence deposition and distribution of surface sediments. However, the Project site is generally sheltered from the east, west, and south by the shoreline, the adjacent Shipyard Cove Marina, and Brown Island. The Project site is exposed primarily to wind and wave energy coming from the north, which is expected to occur only during episodic events. Given the shallow depth of the embayment and the amount of regular boat activity, it is likely that propwash is an important factor in sediment transport and redistribution, particularly in the vicinity of the boat lift at Jensen's and the barge landing site on the adjacent property.

Wind-wave analysis is anticipated as part of the marina redevelopment planning process. This analysis will provide information about the magnitude and dominant direction of wind-generated waves and currents. As part of the supplemental sediment characterization effort, grain-size and contaminant patterns in surface samples will be evaluated, but at this time no additional studies are proposed to measure bedload velocity. If, in consultation with Ecology, additional characterization of sediment deposition and transport are determined to be necessary, potential studies could include investigating propwash scour, numeric modeling to predict sediment movement, placement of current meters to measure current velocity along the sediment bed, and deployment of sediment traps to measure sedimentation rates.

5.5.7 Regulated Building Materials

Building materials in the structures on-site may be sources of contamination to surface soil. A regulated building materials survey will be performed for all of the structures. The survey of the old boat building structure will be performed prior to other investigation tasks near the SRWA to assess whether any changes to the sampling program are warranted based on the building materials survey.

5.5.8 Historic and Cultural Resources

The San Juan archipelago is very well known to have been utilized by native peoples. The presence of known or unknown cultural resources along this area of shoreline is a critical, but anticipated data gap that will require a literature review and survey. A site-wide cultural resources evaluation is anticipated as part of this RI.

5.5.9 Climate Change Vulnerability

The PoFH evaluated SLR and shoreline resiliency in the 2020 Master Plan (L-E and RM 2020). The 100-year SLR estimate for the project site ranges from 1.9 to 2.4 feet (under low and high greenhouse gas scenarios) with 50% probability. The RIFS will describe how remedial alternatives may be affected by changes to the seismic stability of the shoreline, sea level rise, tidal pumping, and increased storm intensity.

6. FIELD INVESTIGATIONS, DATA COLLECTION, AND OTHER INVESTIGATIONS AND ANALYSES

6.1 Soil and Groundwater Investigation

The soil and groundwater investigation will be performed using standard operating procedures that are consistent with MTCA and EPA requirements. Details of the sampling and analytical methods for soil and groundwater are provided in the Uplands Sampling and Analysis Plan (Upland SAP).

Twenty (20) borehole and three (3) surface sample locations are proposed to address data gaps throughout the site (Figure 36). The majority of these boreholes will be completed using direct-push drilling equipment, although hand augers may be advanced in shallow borehole areas with limited access. Three of these borehole locations are proposed to be completed as monitoring wells along the shoreline of the BLWA. Soil samples will be collected from multiple depth intervals at each borehole and sample locations will include areas with elevated PID readings or other olfactory evidence of contamination. Many of these soil samples will be archived and may be analyzed depending on the results of other soil sample analyses. The subset of soil COIs to be analyzed at each borehole is based on previous data and nearby sources as indicated in the Upland SAP.

Groundwater grab samples will be collected from temporary wells at some direct push location to provide an indication of groundwater quality. The three (3) new groundwater monitoring wells, as well as the existing monitoring wells, will be sampled and tested. The subset of groundwater COIs to be analyzed at each temporary or permanent well is based on previous data and nearby sources as indicated in the Upland SAP. The permanent monitoring wells will be sampled during a negative tide cycle at a predetermined lag time from low tide. A tidal study will be performed for a subset of the permanent monitoring wells to establish the appropriate lag time at which to sample each well such that the groundwater in the well at the time of sampling is close to its lowest elevation during the tidal cycle. Groundwater monitoring wells will be sampled for four consecutive quarters.

6.2 Sediment Investigation

The sediment remedial investigation will generally follow guidance provided in the current SCUM. Sampling procedures and collection will follow current Puget Sound Estuary Program (PSEP) protocols. Details of the sampling and analytical methods are included in the In-Water Sampling and Analysis Plan (In-Water SAP). If supplemental sediment 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); however, debris is expected to interfere with the collection of sediment grab samples and cores. Prior to initiating sediment sample collection, a sub-bottom profile survey using a high-resolution, low frequency sub-bottom sonar is proposed to measure the distribution and concentration of debris. These data will be used to identify specific locations where sediment grab samples and cores may be collected.

To meet the remedial investigation objectives, surface sediment grab samples (sample depth of 0 – 10 cm) are proposed at seven (7) sampling stations and core samples (sample depth of 0 – 6 ft) are proposed at twelve (12) sampling stations located within the study area (Figure 37). We propose to reoccupy 10 previous sampling locations and sample nine new sampling locations around Jensen's. Samples will be analyzed for known contaminants of potential concern (COPCs) and conventional sediment parameters. Should samples exceed the numerical chemical concentration criteria identified in

WAC 173-204-320, samples for potential bioassays may be collected during a future sampling event to evaluate sediment toxicity against biological effects criteria. Should the sediment sampling suggest that the final site conditions cannot achieve SMS, then supplemental tissue analyses may be conducted as a subsequent phase of the remedial investigation.

6.3 Other Investigations and Analyses

Prior to initiation of major site-disturbing activities, a site-wide cultural resources evaluation will be performed by a qualified cultural resources consultant to inform inadvertent discovery plans, remedial investigation activities, interim actions, and site cleanup.

Finally, Ecology requires that a climate change vulnerability analysis be performed; therefore, the RIFS will describe how remedial alternatives may be affected by changes to the seismic stability of the shoreline, sea level rise, tidal pumping, and increased storm intensity.

7. DATA MANAGEMENT AND ANALYSIS

This section provides an overview of the QA/QC checks, which consist of measurements performed in the field and laboratory. Details of the upland data management and analysis methods are provided in the Quality Assurance Project Plan (Upland QAPP), Attachment A of the Upland SAP (CRETE 2021). Details of the sediment data management and analysis methods are provided in the Quality Assurance Project Plan (In-Water QAPP), Attachment A of the In-Water SAP (L-E 2021).

Guidelines for minimum samples for field QA/QC sampling and laboratory analysis are summarized in Table 7-1.

Table 7-1. Guidelines for Minimum QA/QC Samples for Field Sampling and Laboratory Analysis.

Media	Field		Laboratory				
	Field Duplicate	Rinsate Blank	Matrix Duplicate ^a	Matrix Spike	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	1 in 20
Soil	1 in 20 ^d	1 in 20	1 in 20	1 in 20	1 in 20	1 in 20	1 in 20
Groundwater	1 in 20 ^d	1 in 20	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.

7.1 Overview of In-Water Data Analyses

The full quality assurance program is detailed in the In-Water SAP and QAPP. Sediment samples will be collected from locations identified in Section 6. The QC samples specified in Table 7-1 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.

7.2 Overview of Upland Data Analyses

The full quality assurance program is detailed in the Upland QAPP. Soil and groundwater samples will be collected from upland locations identified in Section 6. The QC samples specified in Table 7-1 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.

7.3 Overview of Data Validation and Quality Assurance Methods

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.

All chemistry and conventional data will undergo a 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 will 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 will 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.

8. DEVELOPMENT OF PROPOSED CLEANUP STANDARDS AND SITE BOUNDARIES

8.1 Methods to Develop Proposed Cleanup Standards

SLs were developed in this RIWP to select COIs for further evaluation during the RI. The RI/FS report will further evaluate these COIs to develop COCs and Indicator Hazardous Substances, consistent with MTCA. Table 8-1 provides a brief description of these terms and how they are and will be used during the RI/FS process.

Table 8-1. Selection of Hazardous Substances to Be Evaluated

Term	How List is Formed
Constituent of Interest (COI)	Greater than 5% detection frequency and at least one detected value over the SL. Plus compounds anticipated to be present but not previously analyzed. Documented in this RIWP.
Constituent of Concern (COC)	Detected exceedances of SLs where RI data verify exposure pathway is complete. Soil COIs selected based on protection of groundwater will be evaluated using empirical groundwater data. To be documented in RI/FS report.
Indicator Hazardous Substance	COCs for which effectiveness of remedial alternatives evaluated in the FS will be evaluated. Subject of long-term monitoring, if part of remedy. To be documented in the RI/FS report.

8.1.1 Groundwater

Groundwater SLs (Table 8-2) are based on protection of surface water (marine aquatic life and human health via fish consumption) and on protection of site users via indoor air (from volatilization and inhalation). Where relevant, the SLs have been adjusted upward based on PQLs or natural background concentrations. The data collected in the RI will be used to confirm or narrow the final groundwater COI list to the Site groundwater COCs.

8.1.1.1 Groundwater Non-Potability

Groundwater potability was reviewed for applicability of human consumption of groundwater as a potential exposure pathway. Site groundwater satisfies the MTCA non-potability criteria, and therefore, human consumption of groundwater is not an exposure pathway of concern. Protection of drinking water is not applicable to this Site because the shallow groundwater is not potable. It is expected to remain non-potable in the future under MTCA and local regulations because:

- Neither the Site nor groundwater in its vicinity is a current source of drinking water.
- Under WAC 173-340-720(2)(b), neither the Site nor groundwater in its vicinity is a potential future source of drinking water because groundwater contains natural background levels of specific conductivity above the state and local secondary maximum contaminant level of 0.7 milliSiemens/centimeter (mS/cm) (WAC 246-290-310(3)(a) and San Juan County code 8.06.260.
- Site groundwater will not migrate into groundwater that is a current or potential source of drinking water
- A domestic supply well would not be placed in the vicinity of the Site (WAC-173-340-720(2)(d)). State and local codes prohibit the construction of drinking water wells in the vicinity of the Site via WAC 246-290-130(1) which requires drinking water supplies to come from the highest quality source (which at the Site is the municipal water supply system) and via WAC 290-135(2)(b) which specifies a minimum 100-foot drinking water well setback from surface water, roads, utilities, and buildings.

8.1.1.2 Total Petroleum Hydrocarbons

The TPH SL for groundwater will be further evaluated during the RI. The NWTPH-Dx analysis for diesel-range organics (DRO) and oil-range organics (ORO) is subject to interference from naturally occurring organic material in the soil matrix, from the presence of polar organic TPH biodegradation byproducts, and from sea water intrusion. This interference will be assessed by collecting non-TPH impacted background groundwater samples that could quantify interference by naturally occurring organic material or sea water intrusion. All groundwater samples that are analyzed for NWTPH-Dx, will be analyzed both with and without silica gel cleanup; no acid cleanup will be performed on any NWTPH-Dx groundwater samples. Silica gel cleanup is commonly used to remove these types of interference. NWTPH-Dx sample chromatograms will also be evaluated versus standard chromatograms so assess the types of material that are removed by silica gel cleanup. Depending on the results of this analysis, the appropriate NWTPH-Dx analytical method and the potential use of a TPH background groundwater concentration will be evaluated. Additional sample locations may need to be added to the RI program to fully assess background conditions.

8.1.2 Soil

Soil SLs (Table 8-3) are protective of direct human contact and surface water (marine aquatic life and human fish consumers in the event that soil leaches to groundwater and the groundwater discharges to adjacent surface water bodies). The soil SL for non-polar organic COIs that addresses soil leaching to groundwater was calculated using the MTCA default fraction organic carbon.

During the RI, multiple lines of evidence related to exposure pathways and additional empirical data will be used to confirm or narrow the list of final soil COIs to the Site COCs.

8.1.2.1 Terrestrial Ecological Evaluation

A preliminary simplified TEE was performed for the Site. The following is a scored Simplified TEE according to WAC 173-340-7492(2)(a)(ii). Approximately 2.5-acres of contiguous, undeveloped land (up to 1.5-acres at the site, but only up to 1 acre bounding site to the east). Per Table 749-1:

1. Points per contiguous, undeveloped acreage: 9 points
2. The area is industrial or commercial (zoned as rural industrial). 3 points
3. Low to intermediate habitat quality of the site. 2 points
4. Undeveloped land is unlikely to attract wildlife. 2 points
5. Dioxins and furans soil detections. 1 point
6. Summation of Items 2 through 5: 8 points. This score is not higher than Item 1 score and therefore the simplified TEE may be ended under WAC 173-340-7492 (2)(a)(ii).

The preliminary simplified TEE indicated that substantial wildlife exposure was unlikely; therefore, potential TEE exposures were not incorporated into the soil SLs. The final TEE will be presented in the RI/FS, incorporating data collected during the RI.

8.1.3 Sediment

Initial in-water sediment SLs are based on primarily marine benthic criteria, which are protective of human health. Sediment cleanup standards will be established for each contaminant of concern (CoC) on the site. The methods to develop proposed cleanup standards will generally follow guidance provided in the current SCUM. After the Remedial Investigation field work is complete, final sediment

cleanup objectives (SCO) and final cleanup screening levels (CSL) will be established for each CoC. The sediment cleanup level for each CoC will then be established at the SCO, the CSL, or a level in between.

The final SCO will be the highest value of natural background, practical quantitation limits, or risk-based value for each CoC. The risk-based value for comparison to natural background and PQL is the lowest of one of the following:

- a. The SCO benthic criteria.
- b. The SCO human health criteria, which includes:
 - i. 10^{-6} risk level for individual carcinogens.
 - ii. 10^{-5} risk level for multiple carcinogens or exposure pathways.
 - iii. Hazard quotient of 1 for individual non-carcinogens.
 - iv. Hazard index of 1 for multiple non-carcinogens.
- c. The higher ecological trophic level species criteria.
- d. Other applicable laws.

The final CSL will be the highest of one of regional background, practical quantitation limits, or risk-based value for each CoC.

- a. The CSL benthic criteria.
- b. The CSL human health criteria, which includes:
 - i. 10^{-5} risk level for individual or multiple carcinogens and exposure pathways.
 - ii. Hazard quotient of 1 for individual non-carcinogens.
 - iii. Hazard index of 1 for multiple non-carcinogens.
- c. The higher ecological trophic level species criteria.
- d. Other applicable laws.

The sediment cleanup level or sediment cleanup standard for each CoC will initially be established at the SCO. If it is not technically possible to achieve and maintain the cleanup level at the SCO or if the cleanup will result in net adverse environmental impacts the cleanup level will be adjusted upwards of the SCO but no higher than the CSL.

8.2 Methods to Establish Site Boundaries Based on Proposed Cleanup Standards

After the proposed cleanup standards for each CoC have been developed, the site boundaries can be finalized. The methods to establish site boundaries will generally follow guidance provided in the current SCUM. Maps will be prepared that clearly identify areas of the site that exceed the SCO, CSL, and site-specific sediment cleanup levels for each CoC.

Initial surface sediment data suggests that sediment contamination is generally contained within the central shoreline and shallow subtidal areas of the Project site. Existing data show that surface sediments along Jensen's lease boundary do not exceed SMS criteria. Because no obvious transport mechanisms have been identified that would cause exchange of potential contaminants between Jensen's and adjacent properties, there is no obvious rationale to expand the study area beyond the immediate Marina Footprint. For this reason, the proposed study area boundary is defined by the Marina Footprint, which also encompasses areas where surface sediment exceedances of SMS criteria were measured, and subtidal areas at the outer extent of Jensen's existing marina infrastructure (Figure 1). Subsequent sediment characterization efforts are anticipated to focus both on evaluating the depth of contamination and further refining the horizontal distribution of chemical contaminants.

9. PROJECT ADMINISTRATION

The Project Coordinator for the Port of Friday Harbor is:

Todd Nicholson
Executive Director, Port of Friday Harbor
204 Front Street
Friday Harbor, WA 98250
360-378-2688
toddn@portfridayharbor.org

The Project Manager for Leon Environmental, LLC is:

Peter Leon
Principal Scientist, Leon Environmental, LLC
8047 Burke Ave. N
Seattle, WA 98103
206-948-5366
peter@leon-environmental.com

The Site Manager assigned by Ecology is:

John Evered
Senior Aquatic Toxicologist, Washington Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600
360-407-7071
john.evered@ecy.wa.gov

10. 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.

The existing travel lift pier required to haul vessels in and out of the water is at immanent risk of failure. The creosote-treated piling that support the structure are in an advanced state of decay and the ecology-block shoreline revetment is failing. Several piles have already failed and substantial deterioration is visually evident in many others. The existing revetment is being undermined and upland soils are beginning to spill into the intertidal zone. The PoFH implemented temporary emergency maintenance work in 2020, which resulted in jacketing the existing travel lift pier piling. This temporary emergency action is intended to extend the life of the travel lift pier by approximately 5-years, after which the travel lift pier will be decommissioned and operations transferred to another location at Jensen's. The travel lift pier is located in an area where preliminary surface sediment sampling (WE, 2018c) detected several COPCs that exceed regulatory criteria (TBT, PCBs, metals, PAHs, dioxins/furans). The required infrastructure replacement provides a timely and cost-effective opportunity to reduce site risks by addressing known COPCs.

Additionally, a substantial amount of the existing subtidal marina infrastructure is in a similar state of disrepair as the travel lift pier. Creosote-treated piling are in an advanced state of decay, including several that have already failed. Many of the walkways are supported by degraded open-cell Styrofoam floats. The PoFH is currently developing plans to complete substantial maintenance and redevelopment of the existing marina infrastructure.

To inform an interim action associated with required decommissioning of the travel lift pier, priority investigations include integration of the upland and aquatic data sets, additional sediment sampling to define the nature and extent of contamination, and completion of a cultural resources assessment. In addition to the sediment sampling that would facilitate travel lift decommissioning, completion of marina redevelopment plans may also require an expedited wind-wave analysis.

We do not anticipate that the remaining work plan elements must be expedited with the same degree of urgency. We proposed to develop a detailed Work Plan Schedule in consultation with Ecology, with a focus on the availability and schedule for MTCA funding.

10.1 Remedial Investigation Schedule

Summer/fall 2020 – MTC building remedial investigation sampling

Summer 2022 – Cultural resources evaluation

Summer 2022 – Uplands remedial investigation sampling

Summer 2023 – In-water remedial investigation sampling

10.2 Remedial Investigation/Feasibility Study Deliverables Schedule

The initial project schedule described in the AO Scope of Work is summarized below.

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

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Tables

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Appendix A

Statistical Evaluation of Soil and Groundwater Data

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Table A. Statistical Summary - 2018 Upland Soil Sample Results - Jensen's Shipyard

Sample ID	# Samples	# Detections	# Non Decton	Detect Frequency	Max Detected Value	Shop Floor Drain-1 3.5ft	Shop Floor Drain-2 3.5ft	OPALCO Pad 1-4in	OPALCO-2 2-6in	OPALCO-2 5ft	OPALCO-3 2-6in	OPALCO-3 4ft	OPALCO-4 2-6in	OPALCO-4 5ft	SYC-1 2-6in	SYC-1 2ft	SYC-2 2-6in	SYC-2 2ft	SYC-3 2-6in	SYC-3 3ft	SYC-4 2-6in	SYC-4 2ft
Date	1/24/2018 1/24/2018 1/24/2018 7/31/2018																					
TPH (mg/kg)																						
NWTPH-Gx Volatile Range	10	2	8	20%	84	ND(<3.0)	ND(<3.0)	ND(<3.0)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NWTPH-Dx Diesel Range	68	16	52	24%	8000	190	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)
NWTPH-Dx Oil-Range	68	30	38	44%	10000	ND(<50)	ND(<50)	130	ND(<50)	ND(<50)	ND(<50)	ND(<50)	ND(<50)	ND(<50)	120	ND(<50)	130	ND(<50)	70	ND(<50)	140	ND(<50)
EPA-8021 Benzene	11	0	11	0%	ND	ND(<0.03)	ND(<0.03)	ND(<0.03)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EPA-8021 Toluene	11	0	11	0%	ND	ND(<0.05)	ND(<0.05)	ND(<0.05)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EPA-8021 Ethylbenzene	11	0	11	0%	ND	ND(<0.05)	ND(<0.05)	ND(<0.05)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EPA-8021 Xylenes	11	0	11	0%	ND	ND(<0.20)	ND(<0.20)	ND(<0.20)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (EPA-6020/7471) (mg/kg)																						
Arsenic	63	62	1	98%	150	2.2	1.9	7.1	4.8	3.2	7.1	4.1	5.5	3.3	4	4.2	4.2	4.2	6.3	3.9	6.9	4.6
Cadmium	63	28	35	44%	2.6	ND(<0.50)	ND(<0.50)	2.2	0.92	ND(<0.19)	1.1	ND(<0.19)	ND(<0.19)	ND(<0.19)	ND(<0.19)	ND(<0.19)	0.21	ND(<0.19)	0.4	ND(<0.19)	0.32	ND(<0.19)
Chromium	63	62	1	98%	78	19	12	40	17	16	30	16	18	15	24	21	21	22	29	14	22	22
Copper	63	62	1	98%	9300	56	29	1,100	68	45	1,300	44	120	34	42	26	48	37	99	33	140	63
Lead	63	62	1	98%	3400	2.9	1.9	530	54	2.1	990	4.5	50	2.2	19	6.6	46	8.3	57	2.9	63	51
Mercury	63	48	15	76%	13	ND(<0.02)	0.021	0.15	0.026	ND(<0.02)	0.34	0.025	0.67	ND(<0.02)	0.026	0.026	0.036	0.022	0.063	ND(<0.02)	0.27	0.23
Zinc	63	62	1	98%	3800	100	29	2,300	2,600	250	720	39	74	31	74	54	87	46	1,000	34	140	76
PCBs (EPA-8082) (mg/kg)																						
Total PCBs	7	2	5	27%	0.35	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.10)	ND(<0.10)	ND(<0.10)	ND(<0.10)	ND(<0.10)	NA	NA	NA	NA	NA	NA	NA	NA
Dioxins and Furans (EPA-1613B) (ug/kg)																						
Chlorinated dibenzo-p-dioxins TEQ	1	1	0	100%	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-Volatile Organic Compounds (SVOCs) (EPA-8270 SIM) (mg/kg)																						
Naphthalene	55	6	49	11%	0.14	NA	NA	NA	ND(<0.02)	ND(<0.02)	0.04	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
2-Methylnaphthalene	55	9	46	16%	1.20	NA	NA	NA	ND(<0.02)	ND(<0.02)	0.032	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
1-Methylnaphthalene	55	7	48	13%	0.91	NA	NA	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Acenaphthylene	55	12	43	22%	0.26	NA	NA	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Acenaphthene	55	3	52	5%	0.13	NA	NA	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Fluorene	55	2	53	4%	0.13	NA	NA	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Phenanthrene	55	26	29	47%	1.20	NA	NA	NA	0.034	ND(<0.02)	0.24	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Anthracene	55	19	36	35%	0.37	NA	NA	NA	ND(<0.02)	ND(<0.02)	0.044	ND(<0.02)	0.024	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Fluoranthene	55	32	23	58%	2.20	NA	NA	NA	0.072	ND(<0.02)	0.34	ND(<0.02)	0.059	ND(<0.02)	0.02	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.031	ND(<0.02)	0.045	0.049
Pyrene	55	32	23	58%	1.90	NA	NA	NA	0.055	ND(<0.02)	0.21	ND(<0.02)	0.041	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.03	ND(<0.02)	0.04	0.048
Benzo[A]Anthracene	55	23	32	42%	1.20	NA	NA	NA	ND(<0.02)	ND(<0.02)	0.095	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.022	0.024
Chrysene	55	19	36	35%	1.30	NA	NA	NA	ND(<0.02)	ND(<0.02)	0.16	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.024	0.03
Benzo[B]Fluoranthene	55	27	28	49%	1.40	NA	NA	NA	0.039	ND(<0.02)	0.17	ND(<0.02)	0.057	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.054	0.043
Benzo[K]Fluoranthene	55	1	54	2%	0.28	NA	NA	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Benzo[A]Pyrene	55	28	27	51%	1.10	NA	NA	NA	0.022	ND(<0.02)	0.061	ND(<0.02)	0.024	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.025	0.027
Indeno[1,2,3-Cd]Pyrene	55	27	28	49%	0.80	NA	NA	NA	ND(<0.02)	ND(<0.02)	0.045	ND(<0.02)	0.035	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.026	0.021
Dibenz[A,H]Anthracene	55	12	43	22%	0.20	NA	NA	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Benzo[G,H,I]perylene	55	30	25	55%	0.95	NA	NA	NA	ND(<0.02)	ND(<0.02)	0.06	ND(<0.02)	0.041	ND(<0.02)	0.025	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.043	0.026
Total cPAH Equivalent (TEQ)	55	32	23	58%	1.45	NA	NA	NA	0.030	ND(<0.02)	0.096	ND(<0.02)	0.036	ND(<0.02)	0.015	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.037	0.038

^a - Cleanup level dependent on BTEX concentrations

^b - indicates sum of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene

^c - indicates cleanup level is dependant on Chromium(VI) concentrations.

^d - indicates Method B direct contact cleanup level

ND - indicates analyte was not detected at level above reporting limit (shown in parentheses)

NA - indicates sample was not analyzed for the constituent

BOLD - indicates that the concentration in the sample exceeds the MTCA Method A or Method B target cleanup levels

Table A. Statistical Sum

Sample ID	MW-4 2-6in	MW-4 11ft	MW-5 2-6in	MW-5 10ft	MW-6 2-6in	MW-6 40ft	BLWA-1 0-3in	BLWA-3 2-6in	BLWA-3 2ft	BLWA-4 2-6'	BLWA-4 5ft	BLWA-5 2-6in	BLWA-5 2ft	BLWA-6 2-6in	BLWA-6 2ft	BLWA-6 5ft	BLWA-6 10ft	BLWA-7 2-6in	BLWA-7 2ft	BLWA-7 5ft	BLWA-8 2-6in
Date	7/31/2018	7/31/2018	7/31/2018	7/31/2018	7/31/2018	7/31/2018	1/24/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018
TPH (mg/kg)																					
NWTPH-Gx Volatile Range	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<3.0)	ND(<3.0)	NA	NA	NA	NA
NWTPH-Dx Diesel Range	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	160	ND(<25)	ND(<25)	ND(<25)	ND(<25)	91	ND(<25)	95	350	1,400	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)
NWTPH-Dx Oil-Range	120	ND(<50)	96	ND(<50)	ND(<50)	ND(<50)	470	ND(<50)	ND(<50)	81	ND(<50)	180	ND(<50)	260	710	940	ND(<50)	180	ND(<50)	ND(<50)	56
EPA-8021 Benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.03)	ND(<0.03)	NA	NA	NA	NA
EPA-8021 Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.05)	ND(<0.05)	NA	NA	NA	NA
EPA-8021 Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.05)	ND(<0.05)	NA	NA	NA	NA
EPA-8021 Xylenes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.20)	ND(<0.20)	NA	NA	NA	NA
Metals (EPA-6020/7471) (mg/kg)																					
Arsenic	7.9	8.4	4.9	2.4	4	3	12	3.5	3	5.2	3.9	10	3.1	9.7	150	3.7	4.6	13	3.7	NA	5.1
Cadmium	0.79	ND(<0.23)	0.7	ND(<0.22)	ND(<0.19)	ND(<0.2)	1.3	0.2	ND(<0.2)	0.43	ND(<0.19)	0.81	ND(<0.19)	1.2	2.6	ND(<0.19)	ND(<0.19)	1.8	ND(<0.19)	NA	0.48
Chromium	43	64	39	18	19	14	35	28	15	21	17	29	15	31	78	18	11	30	21	NA	19
Copper	590	31	140	14	28	16	6,700	180	32	680	86	1,100	28	9,300	3,500	84	20	2100	50	NA	1100
Lead	390	3.4	120	2.1	13	1.5	700	150	3	150	540	270	3.2	760	3,400	560	1.9	340	3	NA	470
Mercury	0.22	ND(<0.02)	0.1	ND(<0.02)	0.027	ND(<0.02)	0.81	0.032	0.028	0.17	0.18	0.36	0.038	1.1	0.31	0.11	ND(<0.02)	0.92	ND(<0.02)	NA	0.18
Zinc	620	45	190	26	65	23	950	99	29	260	110	390	31	1,400	3,800	72	47	630	39	NA	350
PCBs (EPA-8082) (mg/kg)																					
Total PCBs	0.1	ND(<0.10)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dioxins and Furans (EPA-1613B) (ug/)																					
Chlorinated dibenzo-p-dioxins TEQ	0.0217	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-Volatile Organic Compounds (SV)																					
Naphthalene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	0.031	ND(<0.02)	0.14	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)
2-Methylnaphthalene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	0.093	ND(<0.02)	0.13	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.45	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)
1-Methylnaphthalene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	0.039	ND(<0.02)	0.095	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.91	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)
Acenaphthylene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.095	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.031	ND(<0.02)	0.14	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.031	ND(<0.02)	NA	ND(<0.02)
Acenaphthene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.13	ND(<0.02)	0.027	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)
Fluorene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.13	ND(<0.02)	0.042	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)
Phenanthrene	0.15	ND(<0.02)	0.031	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.1	ND(<0.02)	0.12	0.025	0.86	ND(<0.02)	0.35	ND(<0.02)	0.71	ND(<0.02)	0.091	ND(<0.02)	NA	0.07
Anthracene	0.045	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.17	ND(<0.02)	0.027	0.022	0.24	ND(<0.02)	0.27	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.058	ND(<0.02)	NA	ND(<0.02)
Fluoranthene	0.24	ND(<0.02)	0.096	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	1	ND(<0.02)	0.17	0.14	0.79	ND(<0.02)	1.2	0.066	ND(<0.02)	ND(<0.02)	0.34	ND(<0.02)	NA	0.13
Pyrene	0.17	ND(<0.02)	0.088	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	1.9	ND(<0.02)	0.14	0.086	0.79	ND(<0.02)	0.86	0.081	ND(<0.02)	ND(<0.02)	0.25	ND(<0.02)	NA	0.12
Benzo[A]Anthracene	0.095	ND(<0.02)	0.048	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.82	ND(<0.02)	0.067	0.036	0.45	ND(<0.02)	0.5	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.081
Chrysene	0.092	ND(<0.02)	0.053	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	1	ND(<0.02)	ND(<0.02)	0.098	0.59	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.13
Benzo[B]Fluoranthene	0.17	ND(<0.02)	0.09	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.83	ND(<0.02)	0.16	0.14	0.6	ND(<0.02)	1.4	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.59	ND(<0.02)	NA	0.18
Benzo[K]Fluoranthene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)
Benzo[A]Pyrene	0.076	ND(<0.02)	0.05	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.33	ND(<0.02)	0.065	0.037	0.38	ND(<0.02)	0.46	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.16	ND(<0.02)	NA	0.083
Indeno[1,2,3-Cd]Pyrene	0.058	ND(<0.02)	0.039	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.17	ND(<0.02)	0.068	0.036	0.28	ND(<0.02)	0.42	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.22	ND(<0.02)	NA	0.078
Dibenz[A,H]Anthracene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.064	ND(<0.02)	0.024	ND(<0.02)	0.091	ND(<0.02)	0.13	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.066	ND(<0.02)	NA	0.028
Benzo[G,H,I]perylene	0.07	ND(<0.02)	0.048	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.17	ND(<0.02)	0.08	0.041	0.34	ND(<0.02)	0.43	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.25	ND(<0.02)	NA	0.093
Total cPAH Equivalent (TEQ)	0.111	ND(<0.02)	0.070	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	0.529	ND(<0.02)	0.098	0.061	0.529	ND(<0.02)	0.706	0.015	ND(<0.02)	ND(<0.02)	0.250	ND(<0.02)	NA	0.122

^a - Cleanup level dependent on BTEX concentra
^b - indicates sum of naphthalene, 1-methylnaph
^c - indicates cleanup level is dependant on Chro
^d - indicates Method B direct contact cleanup le
ND - indicates analyte was not detected at level
NA - indicates sample was not analyzed for the c
BOLD - indicates that the concentration in the s

Table A. Statistical Sum

Sample ID	BLWA-8 2ft	BLWA-8 5ft	BLWA-9 2-6in	BLWA-9 2ft	BLWA-9 5ft	AST-1 2ft	MW-1 12ft	MW-1 15ft	MW-2 6in	MW-2 7ft	FDA-1 2ft	FDA-2 0-6in	FDA-3 2.5ft	UST-1 5ft	UST-2 3ft	SRWA-1 3-6in	SRWA-2 3-6in	SRWA-3 0-6in	SRWA-4 6in	SRWA-4 3.5ft
Date	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	7/30/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	8/1/2018	8/1/2018
TPH (mg/kg)																				
NWTPH-Gx Volatile Range	NA	NA	NA	NA	NA	NA	32	ND(<3.0)	NA	NA	NA	NA	NA	ND(<3.0)	ND(<3.0)	NA	NA	84	NA	NA
NWTPH-Dx Diesel Range	ND(<25)	ND(<25)	61	ND(<25)	ND(<25)	8,000	ND(<25)	ND(<25)	32	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	ND(<25)	180	91	3,900	79	ND(<25)
NWTPH-Dx Oil-Range	290	98	160	ND(<50)	ND(<50)	10,000	ND(<50)	ND(<50)	160	ND(<50)	ND(<50)	ND(<50)	420	ND(<50)	ND(<50)	1,100	220	940	190	ND(<50)
EPA-8021 Benzene	NA	NA	NA	NA	NA	ND(<0.03)	ND(<0.03)	ND(<0.03)	NA	NA	NA	NA	NA	ND(<0.03)	ND(<0.03)	NA	NA	ND(<0.03)	NA	NA
EPA-8021 Toluene	NA	NA	NA	NA	NA	ND(<0.05)	ND(<0.05)	ND(<0.05)	NA	NA	NA	NA	NA	ND(<0.05)	ND(<0.05)	NA	NA	ND(<0.05)	NA	NA
EPA-8021 Ethylbenzene	NA	NA	NA	NA	NA	ND(<0.05)	ND(<0.05)	ND(<0.05)	NA	NA	NA	NA	NA	ND(<0.05)	ND(<0.05)	NA	NA	ND(<0.05)	NA	NA
EPA-8021 Xylenes	NA	NA	NA	NA	NA	ND(<0.20)	ND(<0.20)	ND(<0.20)	NA	NA	NA	NA	NA	ND(<0.20)	ND(<0.20)	NA	NA	ND(<0.20)	NA	NA
Metals (EPA-6020/7471) (mg/kg)																				
Arsenic	6.2	NA	5.7	3.3	NA	3.3	3.4	2.1	7.2	6.2	3.5	8.7	3.5	NA	NA	30	14	17	54	7.7
Cadmium	0.23	NA	0.96	ND(<0.19)	NA	ND(<0.2)	ND(<0.2)	ND(<0.2)	2.3	0.67	ND(<0.5)	ND(<0.5)	ND(<0.5)	NA	NA	0.54	ND(<0.5)	ND(<0.5)	0.39	ND(<0.22)
Chromium	23	NA	25	18	NA	17	18	12	27	12	41	21	22	NA	NA	29	18	21	35	24
Copper	170	NA	2900	49	NA	40	32	23	2,100	24	16	79	29	NA	NA	2,400	1,100	690	2,000	35
Lead	200	NA	310	11	NA	27	4.4	1.8	230	29	6.4	52	190	NA	NA	920	1,000	90	1,800	15
Mercury	0.12	NA	1.5	0.048	NA	0.037	ND(<0.02)	ND(<0.02)	0.64	0.024	0.028	ND(<0.02)	0.16	NA	NA	13	6.3	0.54	11	0.098
Zinc	110	NA	690	92	NA	100	30	24	540	37	30	270	220	NA	NA	840	330	580	450	64
PCBs (EPA-8082) (mg/kg)																				
Total PCBs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.35	NA	NA
Dioxins and Furans (EPA-1613B) (ug/)																				
Chlorinated dibenzo-p-dioxins TEQ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-Volatile Organic Compounds (SV)																				
Naphthalene	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	NA	NA	NA	NA	0.12	0.0071	ND(<0.10)	ND(<0.02)	ND(<0.02)
2-Methylnaphthalene	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	NA	0.4	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	NA	NA	NA	NA	0.0067	0.0041	1.2	ND(<0.02)	ND(<0.02)
1-Methylnaphthalene	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	NA	0.78	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	NA	NA	NA	NA	0.0052	0.0052	0.9	ND(<0.02)	ND(<0.02)
Acenaphthylene	ND(<0.02)	NA	0.13	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.033	ND(<0.02)	NA	NA	NA	NA	NA	0.095	0.077	ND<0.00002)	0.16	ND(<0.02)
Acenaphthene	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	NA	NA	NA	NA	0.012	ND(<0.00002)	ND<0.00002)	ND(<0.02)	ND(<0.02)
Fluorene	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	NA	NA	NA	NA	ND(<0.12)	ND(<0.12)	ND(<0.12)	ND(<0.02)	ND(<0.02)
Phenanthrene	0.029	NA	0.13	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.1	0.021	NA	NA	NA	NA	NA	0.25	0.13	0.62	0.24	ND(<0.02)
Anthracene	ND(<0.02)	NA	0.076	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.066	ND(<0.02)	NA	NA	NA	NA	NA	0.11	0.053	ND	0.1	ND(<0.02)
Fluoranthene	0.073	NA	0.52	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.29	0.075	NA	NA	NA	NA	NA	0.67	0.21	0.62	0.71	ND(<0.02)
Pyrene	0.052	NA	0.4	ND(<0.02)	NA	1.3	ND(<0.02)	ND(<0.02)	0.18	0.072	NA	NA	NA	NA	NA	0.65	0.21	0.57	0.73	ND(<0.02)
Benzo[A]Anthracene	0.035	NA	0.32	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.05	NA	NA	NA	NA	NA	0.4	0.11	0.21	0.54	ND(<0.02)
Chrysene	0.032	NA	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.045	NA	NA	NA	NA	NA	0.53	0.12	0.34	0.5	ND(<0.02)
Benzo[B]Fluoranthene	0.055	NA	1.2	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.38	0.06	NA	NA	NA	NA	NA	0.81	0.2	0.43	0.59	ND(<0.02)
Benzo[K]Fluoranthene	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	NA	NA	NA	NA	NA	0.28	ND(<0.11)	ND(<0.00002)	ND(<0.02)	ND(<0.02)
Benzo[A]Pyrene	0.029	NA	0.61	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.064	0.048	NA	NA	NA	NA	NA	0.52	0.14	0.22	0.5	ND(<0.02)
Indeno[1,2,3-Cd]Pyrene	0.028	NA	0.8	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.11	0.035	NA	NA	NA	NA	NA	0.4	0.12	0.15	0.32	ND(<0.02)
Dibenz[A,H]Anthracene	ND(<0.02)	NA	0.2	ND(<0.02)	NA	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.035	ND(<0.02)	NA	NA	NA	NA	NA	0.11	ND(<0.10)	ND(<0.00002)	0.098	ND(<0.02)
Benzo[G,H,I]perylene	0.035	NA	0.95	ND(<0.02)	NA	0.46	ND(<0.02)	ND(<0.02)	0.12	0.04	NA	NA	NA	NA	NA	0.57	0.19	0.17	0.41	ND(<0.02)
Total cPAH Equivalent (TEQ)	0.043	NA	0.863	ND(<0.02)	NA	0.015	ND(<0.02)	ND(<0.02)	0.119	0.065	NA	NA	NA	NA	NA	0.725	0.186	0.304	0.661	ND(<0.02)

^a - Cleanup level dependent on BTEX concentra
^b - indicates sum of naphthalene, 1-methylnaph
^c - indicates cleanup level is dependant on Chro
^d - indicates Method B direct contact cleanup le
ND - indicates analyte was not detected at level
NA - indicates sample was not analyzed for the e
BOLD - indicates that the concentration in the s

Table A. Statistical Sum

Sample ID	SRWA-5 2-6in	SRWA-5 3.5 ft	SRWA-5 5ft	SRWA-6 2-6in	SRWA-6 3ft	SRWA-7 2-6in	SRWA-7 3ft	MW-3 2-6in	MW-3 5.5ft
Date	8/1/2018	8/1/2018	8/1/2018	8/1/2018	8/1/2018	8/1/2018	8/1/2018	8/1/2018	8/1/2018
TPH (mg/kg)									
NWTPH-Gx Volatile Range	NA	NA	NA	NA	NA	NA	NA	NA	NA
NWTPH-Dx Diesel Range	ND(<25)	ND(<25)	ND(<25)	120	ND(<25)	170	40	ND(<25)	ND(<25)
NWTPH-Dx Oil-Range	72	ND(<50)	ND(<50)	640	ND(<50)	690	230	280	ND(<50)
EPA-8021 Benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
EPA-8021 Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
EPA-8021 Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
EPA-8021 Xylenes	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (EPA-6020/7471) (mg/kg)									
Arsenic	12	4.2	5.1	16	5	9.1	4.3	13	5.6
Cadmium	0.32	1.5	ND(<0.23)	0.64	ND(<0.21)	2.6	0.38	0.74	ND(<0.21)
Chromium	20	11	20	36	20	25	19	29	28
Copper	420	43	16	220	11	920	63	400	82
Lead	940	21	3.6	1,200	11	160	110	190	25
Mercury	0.33	0.04	ND(<0.02)	2.8	ND(<0.02)	0.23	0.1	1.3	0.16
Zinc	460	58	55	1,100	32	400	140	310	110
PCBs (EPA-8082) (mg/kg)									
Total PCBs	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dioxins and Furans (EPA-1613B) (ug/)									
Chlorinated dibenzo-p-dioxins TEQ	NA	NA	NA	NA	NA	NA	NA	0.132	NA
Semi-Volatile Organic Compounds (SV)									
Naphthalene	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.036	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
2-Methylnaphthalene	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.022	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
1-Methylnaphthalene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Acenaphthylene	0.037	ND(<0.02)	ND(<0.02)	0.26	ND(<0.02)	ND(<0.02)	ND(<0.02)	0.022	ND(<0.02)
Acenaphthene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Fluorene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Phenanthrene	0.14	0.057	ND(<0.02)	1.2	ND(<0.02)	0.074	0.091	0.071	ND(<0.02)
Anthracene	0.051	ND(<0.02)	ND(<0.02)	0.37	ND(<0.02)	0.024	0.023	0.026	ND(<0.02)
Fluoranthene	0.34	0.13	ND(<0.02)	2.2	ND(<0.02)	0.15	0.3	0.15	0.033
Pyrene	0.33	0.12	ND(<0.02)	1.9	ND(<0.02)	0.16	0.29	0.14	0.028
Benzo[A]Anthracene	0.18	0.065	ND(<0.02)	1.2	ND(<0.02)	ND(<0.02)	0.17	0.076	ND(<0.02)
Chrysene	0.19	ND(<0.02)	ND(<0.02)	1.3	ND(<0.02)	ND(<0.02)	0.18	0.11	ND(<0.02)
Benzo[B]Fluoranthene	0.24	ND(<0.02)	ND(<0.02)	1.3	ND(<0.02)	ND(<0.02)	0.23	0.15	0.042
Benzo[K]Fluoranthene	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Benzo[A]Pyrene	0.17	0.06	ND(<0.02)	1.1	ND(<0.02)	0.065	0.16	0.081	ND(<0.02)
Indeno[1,2,3-Cd]Pyrene	0.12	0.042	ND(<0.02)	0.62	ND(<0.02)	0.079	0.11	0.071	ND(<0.02)
Dibenz[A,H]Anthracene	0.035	ND(<0.02)	ND(<0.02)	0.2	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)
Benzo[G,H,I]perylene	0.15	0.05	ND(<0.02)	0.68	ND(<0.02)	0.13	0.15	0.1	0.022
Total cPAH Equivalent (TEQ)	0.230	0.074	ND(<0.02)	1.446	ND(<0.02)	0.077	0.215	0.114	0.018

^a - Cleanup level dependent on BTEX concentra
^b - indicates sum of naphthalene, 1-methylnaph
^c - indicates cleanup level is dependant on Chro
^d - indicates Method B direct contact cleanup le
ND - indicates analyte was not detected at level
NA - indicates sample was not analyzed for the c
BOLD - indicates that the concentration in the s

Table B. Statistical Summary -Full List VOC and SVOC - Soil Sample Results - Jensen's Shipyard

Sample ID		# Samples	# Detections	# Non Dectio	Detect Frequency	Max Value	Shop Floor Drain-1	Shop Floor Drain-2	OPALCO Pad	BLWA-1	BLWA-2	FDA-1	FDA-2	FDA-3	UST-1	UST-2	SRWA-1	SRWA-2	SRWA-3	
Date							1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	1/24/2018	
Volatile Organic Compounds (VOCs) (EPA-8260)																				
Dichlorodifluoromethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)	
Chloromethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Vinyl Chloride	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Bromomethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Chloroethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Carbon Tetrachloride	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Trichlorofluoromethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Carbon Disulfide	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Acetone	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.05)
1,1-Dichloroethene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Methylene Chloride	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.02)
Acrylonitrile	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.05)
Methyl T-Buyl Ether	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Trans-1,2-Dichloroethene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,1-Dichloroethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
2-Butanone	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.05)
Cis-1,2-Dichloroethene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
2,2-Dichloropropane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Bromochloromethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Chloroform	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,1,1-Trichloroethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,1-Dichloropropene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,2-Dichloroethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Trichloroethene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,2-Dichloropropane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Dibromomethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Bromodichloromethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Trans-1,3-Dichloropropene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
4-Methyl-2-Pentanone	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.05)
Cis-1,3-Dichloropropene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,1,2-Trichloroethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
2-Hexanone	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.05)
1,3-Dichloropropane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Tetrachloroethylene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Dibromochloromethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,2-Dibromoethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.005)
Chlorobenzene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,1,1,2-Tetrachloroethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Styrene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Bromoform	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Isopropylbenzene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,1,2,2-Tetrachloroethane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,2,3-Trichloropropane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)

Table B. Statistical Summary -Full List VOC and SVOC - Soil Sample Results - Jensen's Shipyard

Sample ID		# Samples	# Detections	# Non Dectio	Detect Frequency	Max Value	Shop Floor Drain-1	Shop Floor Drain-2	OPALCO Pad	BLWA-1	BLWA-2	FDA-1	FDA-2	FDA-3	UST-1	UST-2	SRWA-1	SRWA-2	SRWA-3	
Bromobenzene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
N-Propyl Benzene	mg/kg	2	1	1	50%	0.017	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.017
2-Chlorotoluene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,3,5-Trimethylbenzene	mg/kg	2	1	1	50%	0.240	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.24
4-Chlorotoluene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
T-Buyl Benzene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,2,4-Trimethylbenzene	mg/kg	2	1	1	50%	0.610	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.61
S-Butyl benzene	mg/kg	2	1	1	50%	0.033	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.033
P-Isopropyltoluene	mg/kg	2	1	1	50%	0.033	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.033
1,3-Dichlorobenzene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,4-Dichlorobenzene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
N- Butylbenzene	mg/kg	2	1	1	50%	0.055	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.055
1,2-Dichlorobenzene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,2-Dicholorbenzene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,2-Dibromo 3-Chloropropane	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.05)
1,2,4-Trichlorobenzene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Hexochlorobutadiene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
Naphthalene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)
1,2,3-Trichlorobenzene	mg/kg	2	0	2	0%	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.01)

Table B. Statistical Summary -Full List VOC and SVOC - Soil Sample Results - Jensen's Shipyard

Sample ID		# Samples	# Detections	# Non Decton	Detect Frequency	Max Value	Shop Floor Drain-1	Shop Floor Drain-2	OPALCO Pad	BLWA-1	BLWA-2	FDA-1	FDA-2	FDA-3	UST-1	UST-2	SRWA-1	SRWA-2	SRWA-3
<u>Semi-Volatile Organic Compounds (SVOCs) (EPA-8270/8270 SIM)</u>																			
Pyridine	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.20)	ND(<0.20)	ND(<0.20)
N-Nitrosodimethylamine	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.10)
Phenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.12)
Aniline	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.17)	ND(<0.17)	ND(<0.23)
Bis(2-Choloroethyl) Ether	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.11)
2-Chlorophenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.10)
1,3-Dichlorobenzene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.11)
1,4-Dichlorobenzene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.12)
Benzyl alcohol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.11)	ND(<0.11)	ND(<0.14)
1,2-Dichlorobenzene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.10)
2-Methylphenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.13)
Bis(2-Chloroisopropyl)Ether	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.12)	ND(<0.12)	ND(<0.16)
3&4-Methylphenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.13)	ND(<0.13)	ND(<0.17)
N-Nitroso-Di-N-Propylamine	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.15)	ND(<0.15)	ND(<0.20)
Hexachlorethane	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.11)
Nitrobenzene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.10)
Isophorone	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.10)
2-Nitrophenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.25)	ND(<0.25)	ND(<0.25)
2-4-Dimethylphenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.10)
Benzoic Acid	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<1.0)	ND(<1.0)	ND(<1.0)
Bis(2-Chloroethoxy)Methane	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.10)
2,4-Dichlorophenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.10)
1,2,4-Trichlorobenzene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.12)
Naphthalene	mg/kg	4	2	2	50%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.12	0.0071	ND(<0.10)
4-Chlororaniline	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.20)	ND(<0.20)	ND(<0.26)
2,6-Dichlorophenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.13)
Hexachlorobutadiene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.18)
4-Chloro-3-Methylphenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.11)
2-Methylnaphthalene	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0067	0.0041	1.2
1-Methylnaphthalene	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0052	0.0052	0.9
Hexochlorocyclopentadiene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.50)	ND(<0.50)	ND(<0.50)
2,4,6-Trichlorophenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.11)
2,4,5-Trichlorophenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.12)	ND(<0.12)	ND(<0.17)
2-Chloronaphthalene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.10)
2-Nitroaniline	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.25)	ND(<0.25)	ND(<0.25)
Acenaphthylene	mg/kg	4	2	2	50%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.095	0.077	ND<0.00002)
Dimethylphtalate	mg/kg	4	2	2	50%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.29	0.64	ND(<0.14)
2,6-Dinitrotoluene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.25)	ND(<0.25)	ND(<0.25)
Acenaphthene	mg/kg	4	1	3	25%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.012	ND(<0.00002)	ND<0.00002)
3-Nitroaniline	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.25)	ND(<0.25)	ND(<0.25)
2,4-Dinitrophenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.25)	ND(<0.25)	ND(<0.25)
4-Nitrophenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.50)	ND(<0.50)	ND(<0.50)
Dibenzofuran	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.14)
2,4-Dinitrotoluene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.25)	ND(<0.25)	ND(<0.25)

Table B. Statistical Summary -Full List VOC and SVOC - Soil Sample Results - Jensen's Shipyard

Sample ID		# Samples	# Detections	# Non Dectio	Detect Frequency	Max Value	Shop Floor Drain-1	Shop Floor Drain-2	OPALCO Pad	BLWA-1	BLWA-2	FDA-1	FDA-2	FDA-3	UST-1	UST-2	SRWA-1	SRWA-2	SRWA-3
2,3,4,6-Tetrachlorophenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.25)	ND(<0.25)	ND(<0.25)
Diethylphthalate	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.14)
Fluorene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.12)	ND(<0.12)	ND(<0.12)
4-Chlorophenyl-Phenylether	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.13)	ND(<0.13)	ND(<0.17)
4-Nitroaniline	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.25)	ND(<0.25)	ND(<0.32)
4,6-Dinitro-2-Methylphenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.15)	ND(<0.15)	ND(<0.29)
N-Nitrosodiphenylamine	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.11)	ND(<0.11)	ND(<0.15)
Azobenzene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.15)
4-Bromophenyl-Phenylether	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.13)
Hexachlorobenzene	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.50)	ND(<0.50)	ND(<0.10)
Pentachlorophenol	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.10)	ND(<0.10)	ND(<0.10)
Phenanthrene	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.25	0.13	0.62
Anthracene	mg/kg	4	2	2	50%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11	0.053	ND
Carbazole	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.20)	ND(<0.20)	ND(<0.27)
Di-N-Butylphthalate	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.13)	ND(<0.13)	ND(<0.13)
Fluoranthene	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.67	0.21	0.62
Pyrene	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.65	0.21	0.57
Butylbenzylphthalate	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.12)	ND(<0.12)	ND(<0.16)
3,3-Dichlorobenzidine	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.51)	ND(<0.51)	ND(<0.68)
Benzo[A]Anthracene	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4	0.11	0.21
Chrysene	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.53	0.12	0.34
Bis(2-ethylhexyl)phthalate	mg/kg	4	1	3	25%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.13)	ND(<0.13)	0.21
Di-N-Octylphthalate	mg/kg	4	0	4	0%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND(<0.12)	ND(<0.12)	ND(<0.16)
Benzo[B]Fluoranthene	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.81	0.2	0.43
Benzo[K]Fluoranthene	mg/kg	4	1	3	25%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.28	ND(<0.11)	ND(<0.00002)
Benzo[A]Pyrene	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.52	0.14	0.22
Indeno[1,2,3-Cd]Pyrene	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4	0.12	0.15
Dibenz[A,H]Anthracene	mg/kg	4	1	3	25%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11	ND(<0.10)	ND(<0.00002)
Benzo[G,H,I]perylene	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.57	0.19	0.17
Total cPAH Equivalent (TEq)	mg/kg	4	3	1	75%		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.7253	0.1862	0.3044

^a - Cleanup level dependent on BTEX concentrations

^b - indicates sum of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene

^c - indicates cleanup level is dependant on Chromium(VI) concentrations.

ND - indicates analyte was not detected at level above reporting limit (shown in parentheses)

NA - indicates sample was not analyzed for the constituent

BOLD - indicates that the concentration in the sample exceeds the MTCA Method A or Method B target cleanup levels

TEq - Toxicity Equivalency to benzo(a)pyrene, calculated by multiplying result by appropriate TEF. For ND values, the TEF was multiplied by one half the reporting limit

TEF - Toxicity Equivalency Factor (WAC 173-340-900 table 708.2)

**Table C. Statistical Summary - 2020 Soil Analytical Results
IOSA/Marine Trade Center (MTC) Development Area - Port of Friday Harbor**

Sample ID	Sample Depth (feet bgs)	NWTPH-Dx (mg/kg)			Metals (mg/kg)						
		DRO	ORO	Total	Arsenic	Cadmium	Copper	Lead	Mercury	Nickel	Zinc
<i>Test Pit Samples Collected October 19, 2020</i>											
IOSA-TP1-1-1020	1	NA	NA	NA	2.4	<1	11.1	5.01	<1	15.4	27.5
IOSA-TP2-1-1020	1	NA	NA	NA	2.51	<1	9.72	5.78	<1	7.4	16.4
IOSA-TP3-1-1020	1	NA	NA	NA	2.84 ca	<1	60.9	56.4	<1	11.9	208
IOSA-TP3-3-1020	3	NA	NA	NA	1.85	<1	13.7	4.29	<1	10.9	23
IOSA-TP4-1-1020	1	NA	NA	NA	2.33	<1	18.5	12.2	<1	10.5	70.8
IOSA-TP5-1-1020	1	NA	NA	NA	2.88 ca	<1	56.9	248	<1	13.9	287
IOSA-TP5-3-1020	3	NA	NA	NA	2.58 ca	<1	30.1	46.4	<1	15.9	95.1
IOSA-TP5-5-1020	5	<50	<250	<250	3.92	<1	37	80.7	<1	13.6	115
IOSA-TP6-1-1020	1	NA	NA	NA	2.4	<1	33.9	241	<1	9.43	182
IOSA-TP6-3-1020	3	NA	NA	NA	3.67 ca	<1	15.1 J	3.21	<1	16.6	19.6 J
IOSA-TP7-1-1020	1	NA	NA	NA	2.03	<1	19.8	20.8	<1	9.81	34.7
IOSA-TP8-1-1020	1	NA	NA	NA	2.21	<1	12.9	8.14	<1	9.04	40.2
Summary Statistics											
# Samples		1	1	1	12	12	12	12	12	12	12
# Detections		0	0	0	8	0	11	12	0	12	11
# Non Detections		1	1	1	4	12	1	0	12	0	1
% Detections		0%	0%	0%	67%	0%	92%	100%	0%	100%	92%
Max Detection Value		ND	ND	ND	3.9	ND	61	248	ND	16.6	287

NOTES:

Bold indicates a detected concentration

NA - Not analyzed

ND - Not detected

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate

Appendix B
2018 Sediment Data Summary

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Appendix C

**Upland Sampling and Analysis Plan
Upland Quality Assurance Project Plan
Upland Health and Safety Plan**

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Appendix D

In-Water Sampling and Analysis Plan In-Water Quality Assurance Project Plan In-Water Health and Safety Plan

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