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 REPORT – UPLAND AREA

Prepared for
The Port of Friday Harbor
Friday Harbor, WA

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

August 1, 2025

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Abbreviations and Acronyms

µg/kg	micrograms per kilogram
ADA	American With Disability Act
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
DDD	Dichlorodiphenyldichloroethane
DDT	Dichlorodiphenyltrichloroethane
DMMP	Dredged Material Management Program
Ecology	Department of Ecology
FDA	Former Dumping Area
FS	Feasibility Study
ft bgs	feet below ground surface
IOSA	Islands' Oil Spill Association
Jensen	Albert Jensen and Sons Boatyard and Marina
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
RI	Remedial Investigation
SCO	sediment cleanup objective
SCUM	Sediment Cleanup User's Manual
SGC	silica gel cleanup
Shipyard Cove	Shipyard 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	*Washington Administrative Code*
WDNR	Washington State Department of Natural Resources

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 Albert Jensen and Sons Inc. (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 goal of this project is to clean up the historical contamination at Jensen's and to revitalize and expand existing uses at this industrial facility, which serves as a community and economic hub. The mandate from the Friday Harbor community is to honor the Site's history and its central role in shaping the Friday Harbor community, while providing: environmental restoration; commercial boatyard services; and a platform to provide the economic opportunity local businesses need to thrive.

This RI Report has been prepared to satisfy requirements of the Agreed Order and Washington Administrative Code (WAC) Sections 173-340-350(6) and 173-204-550(6). The Order requires the PoFH to address both upland and in-water Site contamination. This RI Report documents the nature and extent of contamination in the upland portion of the Site. A separate RI Report will document the nature and extent of contamination in the sediment portion of the Site. The respective information will be used to develop the FS Report and DCAP for both the uplands and sediment in accordance with WAC 173-340-356 through 173-340-390.

1.1 Site Description and Background

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 1-1). For the purpose of performing the RI/FSs, and development of DCAPs, the division between upland and sediment portions of the Site is the High Tide Line (HTL). Based on available tidal records, the HTL is defined based on the highest astronomical tide: 9.2 feet Mean Lower-Low Water (MLLW; Figure 1-2).

The PoFH purchased the Site from Albert Jensen and Sons, Inc. with the intent to address existing environmental concerns. The Site encompasses an upland area of approximately 4.8 acres 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. The Port also owns and operates Shipyard Cove Marina and a barge ramp, which are located immediately to the northwest of Jensen's. The Port operates Jensen's and Shipyard Cove Marina as a single facility that it refers to as Jensen's Shipyard Cove Facility. Residential properties with private docks extend along the shoreline to the northeast of Jensen's.

1.2 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:
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1.3 Vulnerable Populations and Overburdened Communities

The Site is not located within a likely vulnerable population or overburdened community as it does not satisfy any of the test criteria outlined in Ecology guidance (Ecology 2024a):

1. The Site is not located in a census tract that ranks a 9 or 10 on the Environmental Health Disparities Index from the Washington State Department of Health's EHD Map[1]
2. The Site is not located in a census tract that is at or above the 80th Washington state percentile of the Demographic Index from the U.S. Environmental Protection Agency's EJ Screen[2]
3. The Site is not located in a census tract that is at or below the 80th Washington state percentile of the Supplemental Demographic Index from the U.S. Environmental Protection Agency's EJ Screen

1.4 Report Organization

In accordance with the Agreed Order and WAC 173-204-550(6), the remaining sections of this report provide the following:

- Section 2 – summary of relevant Site history and land uses
- Section 3 – summary of previous environmental investigations
- Section 4 – identification of applicable exposure pathways, and proposed cleanup standards for the upland portion of the Site
- Section 5 – a conceptual Site model (CSM) for the uplands portion of the Site
- Section 6 – summary of the nature and extent of upland contamination
- Section 7 – RI conclusions

[1] https://fortress.wa.gov/doh/wtnibl/WTNIBL/Map/EHD
[2] EPA's online EJ Screen tool was not active at time of this draft report. The tool was accessed through this non EPA link: https://pedp-ejscreen.azurewebsites.net/

2. SITE HISTORY AND LAND USE

2.1 Historical Ownership and Land Use

Over a century of industrial uses have contributed to legacy contamination 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.

According to Ecology (Ecology 2024), the San Juan Historical Society reports that in the early 1940s a local entrepreneur started a shipyard business employing 15 men year-round who built wooden boats for fishing, towing and other uses. A large part of the business focused on hauling local fishing boats out of the water and lined up along the beach for winter maintenance and repairs. The business repaired, serviced and returned boats to the water one at a time until all were ready for the start of fishing season. During World War 2, the shipyard held a contract to build military barges. The Site also contained a log dump for San Juan Island logging industry. Logs would be branded on the end, dumped into the water and formed into log booms to be towed to lumber mills around Puget Sound.

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.

Images from the San Juan Historical Society which depict prior Site facilities are provided in Figures 2-1 and 2-2.

Figure 2-1. Overview of historic Site facility uses (Ecology 2024).

Figure 2-2. Prior Site facility uses, facing north, looking over Shipyard Cove (Ecology 2024).

2.2 Current Conditions and Land Use

Jensen's is partially developed and is still used as a boat maintenance facility and shipyard (Figure 2-3). Based on the needs of the Friday Harbor community, the Port plans to maintain and expand current facility operations.

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. While this RI is focused on the upland portion of the Site, the following sections provide a brief summary of the current conditions and land use in each of these areas for context. Further details concerning the sediment portion of the Site will be presented in the sediment area RI.

2.3.1 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. The Port is in the process of removing the travel lift pier and replacing it with a new haul out pier located in the adjacent Shipyard Cove Marina section of the Port's larger Jensen's Shipyard Cove Facility. The Port may propose this work as an Interim Action under the Order in the future.

The marine services currently 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 and ongoing releases from the degraded structures (e.g., visible sheen associated with the creosote pilings) have been observed. The Port is working to address these issues as work under the Order proceeds. For example, the Port installed sleeves around the boat lift pier pilings, which are reducing the extent to which piling creosote is exposed to marine waters.

The shoreline along the active boatyard area is characterized by vertical structures and steep berms. The boat lift consists of two piers supported by creosote-treated piling (the boat lift pier), ecology blocks, and a concrete wall. A deteriorating overwater dock and the main walkway pier are located immediately east of the existing boat pullout area. The shoreline at this location 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 vegetation except for sparce, non-native species.

The Port plans to continue implementing Site improvements that are consistent with the existing boatyard uses, including improving paved working areas to expand upon existing uses.

2.3.2 Marina

Jensen's continues to operate an active marina that occupies the deeper intertidal and subtidal areas of the Site. The existing marina consists of approximately 30 slips, shown on Figure 2-1.

The original marina included: a concrete floating breakwater; a system of solid-decking floats built primarily from treated-wood and open-cell Styrofoam float boxes; creosote-treated wood piles and dolphins; an elevated pier and wave wall constructed of creosote-treated wood; treated-wood and metal ramps connecting the float and elevated pier system; covered multi-slip moorage and an individual boathouse built with metal roofs and side walls; and a main walkway pier constructed of treated-wood.

Marina infrastructure underwent extensive repair and replacement under federal, state, and local emergency authorizations in 2021 after a winter storm drastically damage an already failing marina. The Port obtained 'after-the-fact' permits for this repair and replacement work after the most critical marina infrastructure was restored. Of the original marina infrastructure, only the original main walkway pier and portions of the concrete breakwater remains. Nearly all of the permitted reconstruction work is complete. In addition to the original main walkway pier, current marina structures include a new system of floats and floating finger piers consisting of steel piles and fully grated floats, and various standalone piles and dolphins. Replacement covered moorage has been completed using steel frames and transparent polycarbonate roofing. The permitted replacements for the original covered moorage was built without side walls and features clear roofs to allow light penetration.

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 former boathouse areas, there appears to be some debris present on the seafloor, including tires that can be observed from the marina floats. The Port intends to remove much of this debris as mitigation for subsequent permitted actions throughout the larger Jensen's Shipyard Cove Facility.

2.3.3 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 located near the shoreline east of the current boatyard area was removed by the Port in 2023, shown on Figure 2-1. 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 (Figure 2-1). 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 (Figure 2-1), 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. These observations are generally consistent with the images Ecology obtained from the San Juan Historical Society, which are provided as Figures 2-1 and 2-2 (Ecology 2024).

3. UPLAND FIELD INVESTIGATIONS

3.1 Investigation Areas

The Site has been divided into the following key subareas for the purposes of conducting past remedial investigation activities. The general location of each area may be found on Figure 2-1. Further details of each area are provided in the discussion of the Site CSM (Section 6).

- **Ship Rail Work Area**: The ship rail work area (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.
- **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.
- **Former Debris Dumping Area**: The former dumping area (FDA) is located to the east of the SRWA along the shoreline.
- **Former Above Ground Storage Tank**: It is suspected that an Above Ground Storage Tank (AST) was formerly located south of the central former shop building. There is no documentation regarding the size or contents of the former AST.
- **Shop Floor Drain**: The shop building includes a 3-inch diameter floor drain near the northwest corner of the building. The drain was used to dispose of liquids from the machine shop.
- **Stormwater Pond**: The stormwater detention pond is located in the southwest portion of the property, west of the shop building.
- **Former Orcas Power and Light Company Pad**: A former Orcas Power and Light Company (OPALCO) storage area is located in the western portion of the Site. The pad is the building foundation of an OPALCO building that burnt down.
- **Wooded Hillside Area Along Turn Point Road**: The wooded hillside area is south of the OPALCO pad area, the stormwater pond, and the shop building.

3.2 Previous Investigations

Previous environmental investigations related to the upland portion of the Site are summarized below. This work has included soil, groundwater, and stormwater pond solids sampling. Additional data and information were acquired from publicly available information sources, as 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

3.2 2022 to 2024 Investigation Activities

In accordance with the RI Work Plan (Leon and CRETE 2022), additional environmental investigations were conducted to fill identified data gaps. Field logs and analytical reports for these investigations are provided in Appendices A, and B. A summary of available soil and groundwater data, including results from prior investigations, is provided on Tables 3-1 through 3-6. Six sampling stations within the SRWA fall below the HTL. For completeness, the data is included in the Upland RI dataset, but is presented separately on Table 3-7.

3.2.1 Upland Soil Sampling

The following soil sampling activities were performed in July 2022 to further characterize the nature and extent of contamination in selected areas of the Site, in accordance with the RI Work Plan. Direct push soil borings were completed in accordance with the methods described in the RI Work Plan (Leon and CRETE 2022). Sampling locations are shown on Figure 3-1. Selected soil samples from each boring were retained for laboratory analysis. The analytical suite selected for each sample was based on the sample location relative to known impacts, and Property history (potential impacts). Soil samples were analyzed by Friedman and Bruya, Inc., and Frontier Analytical Laboratory (dioxin/furans only) for the following:

- Metals by EPA Method 6020
- Polychlorinated Biphenyl Aroclors® (PCBs) by EPA Method 8082A
- Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) by EPA Method 8270E and EPA Method 8270E-SIM
- Diesel- and oil-range Total Petroleum Hydrocarbons (TPH) by NWTPH-Dx extended
- Organochlorine Pesticides by EPA Method 8081B
- Dioxins and Furans by EPA Method 1613
- Organotin Compounds by EPA Method 8270E-SIM

Boat Lift Work Area
Four borings (BLWA-10, -11 -12, -13) were performed to further characterize subsurface conditions in the BLWA.

Ship Rail Work Area
Seven borings (SWRA-8, -9, -10, -11, -12, -14, -15) were completed to 10 feet bgs to better define metals, TPH, and PAH impacts observed along the eastern and southeastern portion of the SRWA.

Above Ground Storage Tank Area
Three borings (AST-2, AST-3, AST-4) were completed to depths ranging approximate 5 to 15 feet bgs near the former AST to refine the extent of TPH impacts.

Shop Floor Drain and Outfall
One boring (SFD-4) was advanced to 15 feet bgs in an area downgradient of the floor drain and MW-1 to further characterize petroleum and metals impacts in close proximity to the drain.

3.2.2 Monitoring Well Installation and Sampling

Three new groundwater monitoring wells (MW-7, MW-8, and MW-9) were installed at the Site (Figure 3-1). Each well location boring was continuously logged to record lithology and determine appropriate screen depth. Wells were screened with a 10-foot screen, with screened depth based on field determination of water table elevation at location. Soil samples were collected at each monitoring well

boring in accordance with the procedures described in the RI Work Plan (Leon and CRETE 2022); as -briefly summarized above for the other completed soil borings. Well completion details are provided in Table 3-1.

Groundwater samples were analyzed by Friedman and Bruya, Inc., Brooks Applied Laboratory and Analytical Resources LLC. Brooks Applied Laboratory provided analysis of total and dissolved metals by EPA Method 1638 which uses inductively coupled plasma dynamic reaction cell mass spectrometry (ICP-DRC-MS) modified using a Closed-Vessel Hotblock Digestion sample preparation. This method allows for low detection limits even with dilution. Groundwater analyses included the following:

- Metals by EPA Methods 6020B and 1638
- PCBs by EPA Method 8082A
- cPAHs by EPA Method 8270D and EPA Method 8270-SIM
- Diesel- and oil-range TPH by NWTPH-Dx extended
- Organochlorine Pesticides by EPA Method 8081B
- Dioxins and Furans by EPA Method 1613
- Organotin Compounds by EPA Method 8270E-SIM

3.2.3 Tidal Study

A tidal study was completed in August 2022 to accomplish the following objectives:

- Determine if the Site monitoring wells are tidally influenced.
- If tidally influenced, estimate tidal lag times for each monitoring well to determine when groundwater sampling should be performed relative to low tide.
- Define net groundwater flow conditions

The tidal study was conducted from August 5-16, 2022 during a time period including negative and non-negative low tides, allowing for observation across a full tidal response. Six monitoring wells and the nearest NOAA-monitored tidal station (ID# 94469880 in Friday Harbor, WA) were used to measure tidal variations. The wells were selected based on distance from the shoreline (within 100 feet of surface water) and to provide coverage from east to west through the Site.

Calculated tidal efficiencies (i.e., magnitude of the tidal fluctuation of groundwater at a monitoring well expressed as a percentage of the tidal fluctuation in the adjacent water body) ranged from 2 percent at well MW-3 (within the SRWA), to 17 percent at MW-7 (near top of bank within the BLWA). While measured tidal efficiencies were relatively low for all wells, the wells near the top of bank within the BLWA (MW-7, -8 and -9) exhibited the most significant tidal influence (efficiencies ranging 8 to 17 percent). These wells also exhibited the greatest specific conductivity showing influence of marine water. The net groundwater flow direction was determined to be to the north towards the Salish Sea (Figure 3-1). The methods and results of the tidal study are provided in Appendix C.

3.2.4 Data Quality Review

A data quality assurance review was completed for the analyses performed for the 2022 to 2024 investigation activities. The following sections summarize the conclusions of this review.

Sample custody, preservation, holding times, and completeness

The samples were properly preserved and sample custody was maintained from sample collection to receipt at the laboratory. Samples were analyzed within the required method holding times with the following exceptions:

- Soil sample SRWA-11 0-2.5’ for EPA Method 8270E.
- Groundwater sample MW8-0623 for EPA Method 8270E-SIM

Laboratory reports were complete and contained results for the samples and analyses requested on the chain-of-custody forms.

Laboratory reporting limits

Laboratory reporting limits were acceptable for the respective laboratory methods.

Method blank analysis

Method blanks were analyzed at the required frequency. In general method blanks did not contain levels of target analytes above the laboratory reporting limits. The following samples were flagged with "B" qualifier for detection of target analyte in associated method blanks:

- Groundwater sample from July 2022 (BLWA-11) for benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno[1,2,3-cd]pyrene
- Groundwater sample from June 2023 (DUP02-0623) for Dibutyltin ion
- Groundwater samples from June 2023 (MW8-0623, MW4-0623, DUP02-0623, MW9-0623) for 234678-HPCDD and OCDD
- Groundwater sample from September 2022 (MW8) for Phenanthrene
- Groundwater samples from April 2023 (MW1-0423, MW2-0423, MW3-0423, MW4-0423, MW5-0423, MW6-0423, MW7-0423, MW8-0423, MW9-0423, DUP01-0423, DUP03-0423) for OCDD

Matrix spike analysis

Matrix spike/matrix spike duplicate (MS/MSD) percent recoveries and relative percent difference (RPD) were within the control limits specified by the laboratory, or method. Matrix spike and matrix spike duplicates failed for analyses of several metals and pesticides, however the laboratory control samples passed acceptance criteria, or analytes were not detected and therefore resulting data are acceptable.

Laboratory duplicate analysis

The relative percent difference (RPD) values or difference values for laboratory duplicate samples met the control limits specified by the laboratory or method.

Field duplicate analysis

Field duplicates were collected at the frequency specified in the QAPP (Leon and CRETE 2022). The RPD for field duplicates were less than 50 percent for all analyses.

Laboratory Data Validation

The laboratory QA/QC data and assigned qualifiers were within acceptable ranges of tolerance, and the analytical data are acceptable for use as described by the data quality objectives.

4. CONCEPTUAL SITE MODEL

This section presents the CSM for the Site which summarizes the physical site characteristics, contaminant sources, fate and transport of contamination, exposure pathways, and potential receptors.

4.1 Habitat Features

The 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. Topography of the upland area is shown in Figure 2-1. The shoreline along the active boatyard area is characterized by either vertical structures or steep berms. The eastern side of the property, especially waterward of the former boat building structure, is less developed. The shoreline is composed of fill and debris (e.g., concrete rubble, metal, plastic, wire, treated and untreated wood) with contaminated soils known to exist in the active boatyard areas.

The undeveloped portions of the 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).

4.2 Geology and Hydrogeology

Surface soil in the central portion of the Site (inland of the BLWA and SRWA) generally consists of silty sand or sand-silt mixtures that extend approximately 10 to 15 ft bgs. Closer to the shoreline, soils are coarser, consisting predominantly of sand and gravel. Surface soil in the eastern portion of the Site consists of a shallow layer of sands and gravel (up to approximately 3 ft bgs) that is underlain by silty sand and sand-silt mixtures. Based on boring logs, small areas of silts and clays have also been identified. Geologic cross sections are presented in Figures 4-1 through 4-6.

Based on the results of the tidal study, groundwater is tidally influenced and the prevailing flow of groundwater is to the north towards the Salish Sea (Figure 3-2).

4.3 Physical Conditions and Potential Sources

There are no current releases or ongoing sources of contamination at the Site. Marina operations, including boat maintenance, continue to occur at the Site under best management practices to control potential releases to the environment. The following sections describe physical conditions and potential historical sources for upland subareas.

4.3.1 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 which is the likely historical source of contamination in the SRWA. Potential sources of metals include paint stripping operations, and possibly impacted fill used to develop the SRWA. TPH-DRO and cPAH may be associated with historical boat maintenance and drainage of boat bilge water (Shannon & Wilson 2019). Due to topography (the SRWA is at a generally lower elevation), it may have also collected stormwater runoff, soils and debris eroded from adjacent upland areas. There are currently no active operations within the SWRA.

4.3.2 Boat Lift Work Area

The 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 a small fill area that projects into the water, a bermed area with an outfall, the boat pullout, an old overwater deck, and the marina pier. Potential sources of metals, TPH-DRO, and cPAHs in this area are similar to those of the SRWA and include paint stripping, paint applications, draining boat bilges, use of treated wood, and possibly impacted fill materials (Shannon and Wilson 2019). Boat maintenance operations are currently conducted in these areas, with best management practices to minimize the potential for contaminant releases.

4.3.3 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. Debris observed during investigation activities 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 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.

4.3.4 Former Above Ground Storage Tank

A former AST may have been located south of the central former shop building. There is no documentation regarding the size or contents of the former AST. Soil sampling results suggest that the AST may have contained a heavier fuel such as heating oil.

4.3.5 Shop Floor Drain

The shop building was described as a machine shop building in previous Site documents, indicating potential 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. Prior investigations indicate 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-DRO, copper, lead PAHs, tetrachloroethene and a few other VOCs.

4.3.6 Former Orcas Power and Light Company Pad

The former OPALCO storage area is located in the western portion. 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.

4.4 Fate and Transport of Contamination

Release and transport mechanisms by which Site contamination may reach potential receptors include the following:

- Stormwater infiltration and leaching of contaminants from vadose zone soil (primarily the upper 2 feet of soil) to groundwater.
  Groundwater transport to surface water – The hydraulic gradient is toward Shipyard Cove with discharge to the Cove through groundwater flux below the low water level of the Cove.
- Erosion of bank soil and sediment to intertidal and/or subtidal sediments.

4.5 Potential Receptors

Ecological and human receptors could be directly or indirectly exposed to contaminants in soil, sediment, and surface water as follows:

- Ecological – See Section 5.1.3 for Terrestrial Ecological Evaluation Exemption
- Ecological – Organisms using the Site for habitat, including benthic invertebrates, fish, birds, and mammals
  - Direct exposure – Contact with or ingestion of pore water, surface water, or sediment
  - Indirect exposure – Consumption of benthic invertebrates or fish
- Human – People using Site for recreation or food, including fishermen (tribal and recreational) and kayakers
  - Direct exposure – Incidental ingestion or dermal contact with sediment, soil, or surface water
  - Indirect exposure – Consumption of seafood
- Human – Workers performing Site improvements
  - Direct contact with or ingestion of soil – Direct contact (incidental ingestion and dermal contact) could occur in areas where soil is exposed, such as on the bank, or where soil could become exposed during construction.
  - Direct contact with or ingestion of groundwater – Direct contact (incidental ingestion and dermal contact) could occur in areas where groundwater becomes exposed during construction.

These receptors and pathways are evaluated in Section 5.1.

5. PRELIMINARY CLEANUP STANDARDS

This section identifies exposure pathways applicable to the Site uplands and preliminary cleanup levels (PCULs) for upland soil and groundwater.

5.1 Upland Soil Exposure Pathways

5.1.1 Human Health

Boat owners, trespassers, and other public users of the property may be exposed to surface soil through incidental contact or dust. Boatyard workers may be exposed to surface soil through incidental contact or dust. Site construction workers may be exposed to soil and groundwater during earthwork activities, such as utility installation or cleanup action construction, due to incidental contact or dust.

Exposures for each of these scenarios are anticipated to be incidental but the exposure pathway is complete. Personal protective equipment used by boatyard workers may help mitigate exposure. Similarly, construction workers will use personal protective equipment during earthwork to protect from

the types and concentrations of contaminants that are present. Preliminary cleanup levels developed for the Site (Table 4-1) address these exposure pathways.

5.1.2 Ecological Health

The Site consists of riparian and intertidal habitat that bird species are expected to utilize. Bird species would be exposed to chemicals through incidental ingestion and direct contact with Site soil while consuming prey. Similarly, semi-aquatic terrestrial mammals like raccoon, muskrat, and river otter may be present on Site or in the vicinity are also expected to be exposed to chemicals through incidental ingestion of and direct contact with Site soils. No bird or mammal surveys have been performed at the Site.

5.1.3 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).

The Site includes 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. Detections of dioxins/furans, PCBs, DDx, in soil:	1 point
6. Summation of Items 2 through 5:	8 points

The calculated score (8 points) is not higher than Item 1 score and therefore the simplified TEE may be ended under WAC 173-340-7492 (2)(a)(ii). While the simplified TEE indicated that substantial wildlife exposure was unlikely, TEE criteria for industrial or commercial sites have been included in this RI and are presented on Table 4-1.

5.2 Highest Beneficial Use of Site Groundwater

The WAC 173-340-720(1)(a) states that, “Groundwater cleanup levels shall be based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future Site use conditions.” It is proposed that groundwater within the Site is classified as non-potable in accordance with WAC 173-340-720(2), as follows:

- 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.

In summary, groundwater is not currently used as a drinking water source and is not suitable for future use as a potential source because of existing saline conditions. In addition, pumping of groundwater may cause further saline water intrusion into the groundwater zones beneath the Site. Based on this evaluation, the highest beneficial use of groundwater is protection of surface water.

5.3 Upland Soil and Groundwater PCULs

Based on the consideration of exposure pathways, soil PCULs include the following criteria obtained from the January 2025 version of the MTCA CLARC Tables:

- MTCA Method B Direct Contact values cancer and non-cancer endpoints
- Criteria protective of vadose zone soil leaching to marine surface water via groundwater
- Criteria for simplified TEEs for industrial/commercial land use

The selected PCUL for each chemical analyte represents the most stringent value of the MTCA B Direct Contact and soil leaching pathway criteria, adjusted as needed based on natural background concentrations and/or practical quantitation limits (PQLs). For this Site, Ecology has requested that the groundwater to surface water pathway be assessed using groundwater data. Therefore, leaching pathway criteria were used for vadose soil only. The protection of surface water is based on evaluation of groundwater data instead of saturated zone soil. TEE criteria for industrial/commercial sites have been incorporated into this RI, however, as stated above, the simplified TEE indicated substantial wildlife exposure is unlikely. In addition, TEE criteria are generally less stringent than the other two criteria that have been identified for this Site (Table 5-1).

Based on proposed classification of groundwater as non-potable (Section 4.1), the proposed PCULs for groundwater are protective of transport of contaminated groundwater to surface water, and include:

- State and federal criteria for protection of human health (marine surface water)
- State and federal criteria for protection of aquatic life (marine surface water)

Groundwater PCULs are summarized on Table 5-2.

5.3 Points of Compliance

Points of compliance for uplands soils, uplands groundwater are identified to inform this RI and will be used to evaluate remedial alternatives in the FS. In this RI, the soil point of compliance for protection of groundwater is throughout the Site. The protection of direct contact exposure is throughout the Site to a depth of 15 feet bgs. The point of compliance in groundwater is throughout the Site.

6. NATURE AND EXTENT OF CONTAMINATION

This section describes the nature and extent of contamination in upland soil and groundwater and the development of Site Indicator Hazardous Substances (IHSs).

6.1 Soil and Groundwater Contaminants of Interest

Indicator hazardous substances (IHSs) are defined by WAC 173-340-200 as a subset of hazardous substances present during any phase of remedial action for the purpose of characterizing the site or establishing cleanup requirements for that site. For the purposes of the RI/FS for this Site, the IHSs are the contaminants for which the effectiveness of remedial alternatives will be evaluated in the FS. For this RI, the first step in developing IHSs was to first develop a list of Constituents of Interest (COIs). COIs were selected based on having at least one detected value exceeding the most stringent PCUL.

The identified soil COIs (Table 6-1) are:

- cPAH Total Toxic Equivalent Concentration (TEQ)
- Dioxins/Furans
- Metals
    - Arsenic
    - Cadmium
    - Chromium
    - Copper
    - Lead
    - Mercury
    - Zinc
- Pesticides
    - Dichlorodiphenyldichloroethane (DDD)
    - Dichlorodiphenyltrichloroethane (DDT)
- TPH-Dx
- Total PCB Aroclors
- Tributyltin (TBT)

Groundwater COIs (Table 6-2) are:

- cPAH Total Toxic Equivalent Concentration (TEQ)
- Dioxins/Furans
- Metals
    - Arsenic
    - Cadmium
    - Chromium
    - Copper
    - Lead
    - Mercury
    - Nickel
    - Zinc
- Tributyltin (TBT)

6.2 Indicator Hazardous Substances

IHSs in the upland area were determined based on frequency and magnitude of PCUL exceedances of COIs in uplands soil and groundwater. Tables 3-2 through 3-6 provide a summary of Site upland soil and groundwater COIs, including the following parameters for each detected constituent by media:

- Number of sampled locations and number of samples
- Number of detections
- Detection frequency (number of detections / total number of samples)
- Maximum detected concentration
- Frequency of exceedance (number of exceedances / total number of samples)
- Maximum magnitude of exceedance (maximum detected concentration / screening level)

6.2.1 Metals

Extensive soil and groundwater sampling and analysis for metals has been performed. Copper is the most prevalent metal COI in soil and groundwater. Copper exceeds the PCUL for the protection of marine surface water (adjusted to background concentration of 36 milligrams per kilogram [mg/kg]) in at 39 locations, with exceedances mostly focused within the BLWA and SRWA. At five of these locations, surface soil (0 to 1 ft bgs) has concentrations of copper exceeding MTCA Method B criteria for protection of human health (3,200 mg/kg) with concentrations ranging 3,500 to 8,800 mg/kg. Copper also exceeds TEE criteria for industrial Sites (220 mg/kg) in surface soil at 12 of these locations. Arsenic, mercury, and zinc show a similar pattern with soil and groundwater impacts (predominantly exceedances of the PCULs for protection of marine surface water) concentrated in surface soils within the BLWA and SRWA. Nickel exhibits a similar pattern in Site groundwater (PCUL exceedances focused in/near the BLWA and SRWA), however there are no exceedances in available soil data.

Cadmium exceeds the soil PCUL for protection of marine surface water (1.1 mg/kg) at eight locations within the BLWA and SRWA. There are also three additional exceedances in surface soil near the shop floor drain and OPALCO Pad. Chromium exceeds TEE criteria (135 mg/kg) for chromium at just one location in surface soil near the shop floor drain; there are no exceedances of the other PCULs for chromium. Lead exceeds the PCUL based on industrial site TEE criteria (220 mg/kg) at 16 locations, and leaching pathway criteria for protection of surface water at just 3 locations. The exceedance frequency of cadmium, chromium and lead in Site groundwater are much lower than other metals (exceedances in 5 percent or less of the total number of samples). The exceedances of these metals in soil and groundwater are observed to be co-located with other metals. Therefore, cadmium, chromium and lead have not been retained as IHSs for the RI/FS. All other metals have been retained. Available soil and groundwater data for all metals is summarized in Tables 3-2 and 3-6, respectively. The distribution in soil and groundwater of retained IHSs (arsenic, copper, mercury, nickel, and zinc) is illustrated in Figures 6-1 through 6-5.

6.2.2 Petroleum

TPH-G has been analyzed in 18 soil samples, but has only been detected at 1 location (BLWA-10) at a concentration (7 mg/kg) below the most stringent PCUL (100 mg/kg). Benzene, toluene, ethylbenzene, and xylenes (BTEX) have not been detected at the Site. TPH-Dx (sum of diesel and oil range TPH) has been analyzed in 81 samples. TPH-Dx was detected at concentrations exceeding the most stringent PCUL (2,000 mg/kg) in soil at three locations and only in soil up to 5 ft bgs (Table 3-2). TPH-Dx also exceeds the PCUL in one sample that was collected directly from the shop floor drain (SFD-3); these data reflect

concentrations in drain solids, not soil. TPH-Dx has not been detected at concentrations above applicable PCULs in Site groundwater (Table 3-6). TPH-Dx has been retained as an IHS. The distribution of TPH-Dx in soil and groundwater is illustrated in Figure 6-6.

6.1.3 Polychlorinated Biphenyls

PCB Aroclor data have been collected at 11 locations within the BLWA and SRWA. Soil at seven of these locations, at depths up to 5 ft bgs, exceed the PCUL based on MTCA Method B for protection of human health (Table 6-5). There were no detections of PCBs in groundwater (Table 3-3). Given PCBs in surface soil are co-located with metals exceeding both direct-contact and leaching pathway PCULs, they have not been retained as IHSs for the RI/FS.

6.1.4 Dioxins/Furans

Dioxins/furans data have been collected at six locations within the BLWA and SRWA. Dioxin and furan concentrations [evaluated as total 2,3,7,8-TCDD equivalence (TEQ)] exceeded direct-contact and leaching pathway PCULs (both adjusted to the PQL; Table 3-3). Dioxins/furans were also detected at concentrations above the PCUL (adjusted to the PQL) in Site groundwater (Table 6-4). Similar to metals, the impacts are focused in the BLWA and SRWA. Because elevated concentrations of dioxin/furans are co-located with metals, they have not been retained as an IHS.

6.1.5 Polycyclic Aromatic Hydrocarbons

Extensive soil sampling and analysis for PAHs has been performed. CPAH TEQ exceeds applicable PCULs in both soil and groundwater (Tables 6-4 and 6-6). CPAH TEQ exceedances are widespread in soil up to 5 ft bgs, with vadose zone impacts focused in the BLWA and SRWA (Table 3-4 and Figure 6-7). CPAHs have not been detected at concentrations above the PCULs in groundwater (Table 3-6). The pattern of distribution in soil is similar to that for metals and therefore cPAHs has not been retained as a Site IHS.

6.1.6 Pesticides

Soils at eight locations within the BLWA and SRWA have been analyzed for full suite of pesticides. DDD and DDT were detected above PCULs for protection of marine surface water at only two locations (Table 3-5). Neither compound was detected in groundwater. Therefore, DDx has not been retained as a Site IHS.

6.1.6 Tributyltin

Soils at seven locations within the BLWA and SRWA have also been analyzed for organotins. Tributyltin (TBT) has been detected above the soil PCUL for the protection of marine surface water (adjusted to the PQL) at six of these locations (Table 3-3). TBT has also been detected in groundwater in the BLWA at concentrations exceeding the PCUL. TBT is commonly associated with boat maintenance (e.g., anti-fouling paint) and therefore has been retained as a Site IHS. The distribution in soil and groundwater is illustrated in Figure 6-7.

7. REMEDIAL INVESTIGATION CONCLUSIONS

The Site has had over 100 years of industrial uses that contributed to legacy contamination. Historical shipyard activities represent the primary source of contamination, including the application and removal of antifouling paints, mechanical, and general maintenance work both over water and land, and treatment of wooden boats using pesticides. A former underground gasoline storage tank, a machine shop used for hazardous chemical storage, a small dump area, and a marine railway also represent historical sources.

Based on the investigation activities described in this report, the proposed IHSs for the Site are metals (i.e., arsenic, copper, mercury, nickel, zinc), TPH-Dx (soil only), and TBT. The IHSs will be used to develop and evaluate the effectiveness of remedial alternatives in the FS, however, the FS will also consider the extent of all COIs at the Site. Based on the results summarized in this RI, chemicals exceeding PCULs in uplands soil and groundwater generally coincide with boat maintenance areas (i.e., BLWA, SRWA). In these areas, the highest concentrations contaminants are found within the top 1 foot of soil (Figures 6-1 through 6-7). Based on this, stormwater infiltration and leaching of contaminants (particularly metals) from vadose zone soil (primarily the upper 1 foot of soil) to groundwater is a key transport pathway to evaluate in the FS. To further illustrate this, Table 7-1 shows the observed distribution of copper and zinc in soil and groundwater in representative locations in the BLWA. TPH-Dx has only been observed at concentrations exceeding the PCUL in vadose zone soils. However, it has not been detected in groundwater and its presence in soil is isolated to a couple locations in the BLWA and SRWA where draining of bilge water and other boat maintenance may have occurred and several locations close to the shop building where storage of lubricants and other materials may have occurred.

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Tables

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Figures

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Appendix A

Boring and Monitoring Well Logs

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Appendix B

Analytical Laboratory Reports

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Appendix C

Tidal Study

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