

**Remedial Investigation / Feasibility Study
Work Plan
Tru-Grit Facility
Tacoma, Washington**

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Prepared for

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EXECUTIVE SUMMARY

This Remedial Investigation (RI) and Feasibility Study (FS) Work Plan has been prepared for CanAm Minerals, Inc. (CanAm) for application to the Tru-Grit Abrasives, Inc. (Tru-Grit) facility located at 1110 East Alexander Avenue in Tacoma, Washington. The facility is located adjacent to the Blair Waterway at the Port of Tacoma (Figure 1). This work plan was prepared for submittal to the Washington State Department of Ecology (Ecology) in accordance with the provisions of Agreed Order (AO) No. DE-8978. The purpose of this work plan is to provide a detailed approach to evaluating the nature and extent of contamination in the Blair Waterway resulting from Tru-Grit operations and potential upland areas that may provide an ongoing discharge source to the waterway.

Tru-Grit is a storage and distribution facility of a granular abrasive material used in composite roofing and sandblast grit. Current operations at the site include receipt of grit material by barge; offloading of the material via a ship-to-shore conveyance system; and storage, processing, and packaging of the grit material.

Previous investigations have identified grit material in the marine sediment surrounding the pier where barges transporting grit to the facility are offloaded. Chemical testing of the grit and sediment identified copper and zinc in the sediment at concentrations exceeding Washington State Sediment Management Standards (SMS), resulting in the site being placed on the Ecology Hazardous Sites List.

Potentially affected media include soil, groundwater, and marine surface water and sediment where ecological receptors may be exposed to the contaminants. Preliminary screening levels for groundwater, soil, and sediment have been developed in accordance with applicable regulations under the Washington Administrative Code.

Investigation of releases and potential source areas include upland soil samples to evaluate potential ongoing sources of contaminants and investigation of marine sediments to evaluate historical releases. Groundwater will also be evaluated to determine if copper and zinc may be leaching to surface water via groundwater.

The work plan includes procedures for preparation of an FS. The FS will include development of remedial action objectives, screening of cleanup alternatives, evaluation of cleanup alternatives, a disproportionate cost analysis, and recommendation of a remedial action alternative. A schedule for completion of the RI/FS is also presented.

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LIST OF ABBREVIATIONS AND ACRONYMS

AO	Agreed Order
ARARs	Applicable or Appropriate Requirements
BGS	Below Ground Surface
BMP	Best Management Practices
CanAm	CanAm Minerals, Inc.
CBNT	Commencement Bay Nearshore/Tideflats
CLARC	Cleanup Levels and Risk Calculations (Ecology)
cm	Centimeters
COC	Constituents of Concern
CSL	Cleanup Screening Levels
DCA	Disproportionate Cost Analysis
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management (Ecology)
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
ft	Foot
HPAH	High Molecular Weight Polycyclic Aromatic Hydrocarbon
ISGP	Industrial Stormwater General Permit
LPAH	Low Molecular Weight Polycyclic Aromatic Hydrocarbon
mg/kg	Milligrams per kilograms
MLLW	Mean Lower Level Water
MTCA	Model Toxics Control Act
NGVD29	National Geodetic Vertical Datum of 1929
PCB	Polychlorinated Biphenyls
Port	Port of Tacoma
PMI	Port Maritime Industrial
PSL	Primary Screening Levels
QA/QC	Quality Assurance/Quality Control
RAO	Remedial Action Objective
RCW	Revised Code of Washington
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
S10	Shoreline Port Industrial
SMS	Sediment Management Standards
SQS	Sediment Quality Standards
SWPPP	Stormwater Pollution Prevention Plan
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
TOTE	Totem Ocean Trailer Express
TPU	Tacoma Public Utilities
Tru-Grit	Tru-Grit Abrasives, Inc.
WAC	Washington Administrative Code
WQEO	Water Quality Enforcement Order

1.0 INTRODUCTION

This document presents a work plan to conduct a Remedial Investigation (RI) and Feasibility Study (FS) for CanAm Minerals, Inc. (CanAm) at the Tru-Grit Abrasives, Inc. (Tru-Grit) facility located adjacent to the Blair Waterway in Tacoma, Washington (Figure 1). The purpose of this work plan is to provide a detailed approach to evaluating the nature and extent of contamination in the Blair Waterway resulting from Tru-Grit operations and potential upland areas that may provide an ongoing discharge source to the waterway.

Tru-Grit is a storage and distribution facility of a granular abrasive material used in composite roofing and sandblast grit. The Tru-Grit facility is operated by CanAm. The property where the facility is located is owned by the Port of Tacoma (Port) and CanAm leases the property from the Port. Previous investigations have identified grit material in the marine sediment surrounding the pier where barges transporting grit to the facility are offloaded. Chemical testing of the grit and sediment identified copper and zinc in the sediment at concentrations exceeding Washington State Sediment Management Standards (SMS), resulting in the site being placed on the Washington State Department of Ecology (Ecology) Hazardous Sites List with a priority rank of 1 out of 5 for potential human health and/or environmental risk, with a ranking of 1 being the highest risk.

In July 2012, an Agreed Order (AO; No. DE-8978) between CanAm and Ecology was signed. This work plan was prepared for submittal to Ecology in accordance with the provisions of the AO, and was developed to meet the general requirements for an RI and FS as defined by the Washington Model Toxics Control Act (MTCA) Cleanup Regulation [Washington Administrative Code (WAC) 173-340-350]. This work plan describes the RI activities to be performed; the FS to be developed; and the planned schedule for data collection, evaluation, and reporting. As required by the AO, this work plan includes a sampling and analysis plan [SAP, including quality assurance and quality control (QA/QC) measures, Appendix A] and a health and safety plan (Appendix B).

2.0 BACKGROUND

The property at which the Tru-Grit facility is situated is located at 1110 East Alexander Avenue in Tacoma, Washington. The property is rectangular in shape with the long axis oriented in a northwest to southeast direction parallel to the Blair Waterway (the southwest side of the property extends approximately 130 ft into the waterway). Tru-Grit occupies approximately the northwestern $\frac{1}{3}$ of the property (herein referred to as the Facility); Orion Marine Group currently occupies the remaining $\frac{2}{3}$ of the property. The Facility and adjacent properties and leaseholds are shown on Figure 2.

The site, as described in AO No. DE-8978, is defined by the extent of contamination caused by the release of hazardous substances at the site, and is not limited to lease area or property area boundaries. The site includes areas where hazardous substances have been deposited, stored, disposed of, placed, or otherwise have come to be located. The actual boundaries of the site will be determined during the RI process. For the purposes of this document, property refers to the tax parcel occupied by both the Tru-Grit and the Orion Marine Group operational areas, facility refers solely to the Tru-Grit operational area, and site refers to the cleanup site that may or may not encompass areas outside the facility.

2.1 CURRENT SITE FEATURES AND USES

Current facility features include a maintenance building on the southwest side of the facility, a pier that supports a ship-to-shore conveyor system, an outdoor processing operation, and a concrete block containment area for raw grit material. The facility is paved except for a weed strip of land between the building and the shoreline. The facility elevation is approximately 10 feet (ft) National Geodetic Vertical Datum of 1929¹ (NGVD29) or approximately 16.32 ft mean lower low water (MLLW). Topography at the facility is flat up to the shoreline, which drops off as a steep riprap slope toward the waterway. Facility features are shown on Figure 3.

The facility property is currently zoned Port Maritime and Industrial (PMI) and Shoreline Port Industrial (S10). Current operations at the facility include storage and handling of granular slag material, which is sold to roofing manufacturers and sandblasters under the name, Tru-Grit Roofing Granules. The granular slag was produced by a copper smelter near Anyox (Granby Bay), British Columbia, Canada between 1914 and 1935. Approximately 5 million tons of slag was produced and disposed of into and alongside Granby Bay. About 80 percent of the slag is above the high tide line. The slag remained untouched until about 1982, when the Province of British Columbia leased the site to CanAm's Canadian affiliate to reclaim the slag as a resource. The only access to Anyox is by water; therefore, the granular

¹ NGVD29 Datum is 6.32 ft higher than mean lower level water (MLLW); 10 ft NGVD29 equates to 16.32 ft MLLW.

slag is transported on barges. Prior to leaving Canada, the slag is washed and wet-screened to remove the fine components and oversized material; only slag of a size suitable for roofing granules and sandblasting is sent by barge to the Tru-Grit facility. For the purposes of this document, the Tru-Grit granular slag material is referred to as grit.

A front-end loader and a ship-to-shore conveyance system are used to unload the barges when they arrive at the facility. Figures showing details of the conveyance system are included in Appendix C. The grit is transported by the conveyor system to a stacking conveyor, which places the grit onto an outdoor storage pile. The storage pile is contained within walls of solid concrete blocks (commonly known as Ecology blocks) stacked together to an approximate height of 8 ft. For a brief period between 2005 and 2007, a small amount of grit was temporarily stored on the Orion Marine portion of the property (for 2 week intervals following each barge offloading). In 2007, Tru-Grit purchased a taller stacker that allowed all offloaded material to be stored within the Ecology block containment area.

For processing, the grit is removed from this pile by a front-end loader and placed into a hopper. The grit is then passed through a dryer and a screening device to separate grit for manufacture of roofing material. The remaining grit material not conforming to the roofing manufacturer's specifications is packaged and sold as sandblast grit. After passing through the dryer and screening device, the grit material is stored in a load out bin or packaged into bags for sale and transport. From the load out bin, the grit is loaded into trucks, weighed, and sent to the customer.

The gases from the drying and screening operations are collected and passed through a baghouse to remove particulates. The baghouse catch is bagged and sent to a landfill for disposal. The baghouse catch has been tested and approved for disposal as solid waste.

A 250-gallon aboveground diesel tank is located adjacent to the northern corner of the maintenance building. The diesel fuel is used for fueling ancillary equipment such as forklifts at the site. The tank has a secondary containment tray and is located in a paved area. No staining is present on the pavement adjacent to the tank or in the secondary containment tray.

2.2 HISTORICAL PROPERTY DEVELOPMENT AND OPERATIONS

This section describes the historical operations conducted at the property at which Tru-Grit is located. Historical operations conducted on adjacent property are also described. The description of historical operations is based on information gathered from various historical reports, agency databases, and information provided by CanAm.

2.2.1 FACILITY PROPERTY

The Tru-Grit facility began operating in the northwestern portion of the property in approximately 1990 and Orion Marine Group, a maritime construction company, has occupied the southeastern portion of the property since about 2009. Prior to 2009, the southeastern (i.e. the Orion portion of the property) portion of the property was leased by Jesse Engineering and BJ Painting. Jesse Engineering is a steel pipe fabrication company. Little is known about BJ Painting; however, it appears to have provided marine-related painting services. The property may have been unoccupied during the mid-1980s because city directories from that period do not list a business at the property address. Prior to 1980, the property was listed at 1112 East Alexander Avenue and housed a shipbuilding and marine construction operation. The shipbuilding operation appears to have had several owners, including A.H. Powers and Martinolich, and dates back to approximately the mid-1960s (Brown and Caldwell 2009; Tacoma Public Library website 2012a,b). A photograph of the property from 1971 shows the Martinolich operation. In the photograph, the current Tru-Grit maintenance building appears to be present along the shoreline. Two additional buildings behind the maintenance building are also visible in the photographs, but appear to have been demolished since. The photograph also shows that the large building, presumably used to assemble the ships, and launching rails were located on the Orion Marine portion of the property. This ship assembly building is still present as part of the Orion Marine operation.

2.2.2 ADJACENT PROPERTIES

The site property is bordered to the northwest by Totem Ocean Trailer Express (TOTE), a roll-on/roll-off container terminal and to the east and south by an L-shaped property operated by Graymont Western, a producer of lime and precipitated calcium carbonate products.

2.2.2.1 Totem Ocean Trailer Express

The TOTE facility, which is located at 500 Alexander Avenue, encompasses approximately 43 acres of paved asphalt. Necessary facilities and structures located on the TOTE property include the cargo-loading pier, dryout shed, vessel warehouse, maintenance shop, lubricant and waste oil tanks, vehicle yard, refrigerated trailer parking, waste staging containment, Roloc shop, and layup pier. Approximately two to three shipping vessels are present at the TOTE facility each week during normal operations and are usually located at the layup pier near the north end of the property (RETEC 2007).

Industrial activities and potential pollutant sources present at the TOTE facility include a dry-out shed with a 3,000-gallon spill-containment tank, maintenance of yard hustlers and equipment, a lube and waste oil berm with storage tanks, maintenance and refueling of refrigerated trailers, maintenance and

repair of Roloc boxes, loading and unloading of dry bulk materials and liquids, and outdoor storage of materials and products (RETEC 2007).

Stormwater from the TOTE facility is directed to a stormwater collection system equipped with oil water separators that discharges to the Blair Waterway. Historically, Outfall 4 at the TOTE facility had elevated copper and zinc in discharge effluent. Stipulations of their stormwater discharge permit forced TOTE to ultimately treat and infiltrate stormwater from the Outfall 4 catchment area instead of discharge it directly to the waterway. The treatment was installed in 2011. TOTE has occupied the facility since 1984 (Port of Tacoma website 2012). Prior to TOTE's occupancy of the property, other shipping industries may have occupied the site. Aerial photographs from the City of Tacoma's Government Made Easy (GovME) website were reviewed. Per the GovME aerial photograph review, various large ships were docked at the property in 1950 and 1973 (GovME website 2012). The aerial photographs from 1931 and 1940 show what appear to be floating logs (GovME website 2012), indicating that the property may have been used for transport, storage, or processing of lumber during that time.

2.2.2.2 Graymont Western

The Graymont Western facility is located at 1220 Alexander Avenue. In addition to producing and storing lime and precipitated calcium carbonate products, petroleum products are also stored in aboveground storage tanks at the facility. Lime is stockpiled at this facility, and structures and facilities for lime production are located on the property. The Graymont Western facility has a history of petroleum hydrocarbon contamination to soil and groundwater and is located hydraulically upgradient of the site. During the World War II era, the property now occupied by Graymont Western was part of the U.S. Naval Station in Tacoma and contained a dump with unknown contents, which is identified on U.S. Navy maps from 1952 (Brown and Caldwell 2009). This property's use for lime production and storage dates back to at least 1963 when it was occupied by Pacific Lime, Inc. In approximately 1974, the property was occupied by Domtar Chemicals, Inc., but returned to use as a lime production and storage facility in approximately 1984 when it was occupied by Continental Lime, Inc. In approximately 2007, the property was occupied by Graymont Western U.S., Inc. (Brown and Caldwell 2009).

2.3 FUTURE SITE USES

The Port was contacted regarding potential future uses of the site (Hooton 2012). Its response indicated that the Port intends future land use to be consistent with the PMI zoning of the property. Additionally, the Port does not currently have plans for maintenance dredging in the Blair Waterway near the site (Hooton 2012).

2.4 ENVIRONMENTAL SETTING

This section describes the geologic and hydrogeologic setting for the property (upland area) and the adjacent marine area. Information is also provided about the terrestrial ecological setting. Information in this section was gathered from historical reports, publically available maps and resources, and site observations.

2.4.1 UPLAND AREA

The upland area comprises the area landward from the ordinary high water mark. The following subsections discuss the geology, hydrogeology, and surface water drainage patterns in upland areas.

2.4.1.1 Geology

The site property lies within the present-day Puyallup River delta complex, which makes up the Port of Tacoma tideflats. The delta is bounded on the southwest and northeast by steeply sloping hillsides composed of consolidated glacial and interglacial deposits. The delta soils are a layered sequence of silts and fine to medium sands deposited by alluvial and estuarine processes. The tideflats (shoreline to lower low water line) previously extended outward to about the current position of the mouth of the Blair Waterway. The area inland from the previous shoreline had numerous channels and embayments. Bortleson et al. (1980) shows the pre-development configuration of tidal sloughs and estuary channels before filling and development of the tideflats.

Prior to development of the Port of Tacoma, the 1877 shoreline in the vicinity of the Blair waterways was located about $\frac{1}{8}$ to $\frac{1}{4}$ mile southeast of the site (Bortleson et al. 1980). Wapato Creek likely entered the delta near the south end of the existing Blair Waterway. With the development of the area, the Blair Waterway along with the other waterways within the Port of Tacoma, were created by dredging in the mid-20th century. Dredged materials and imported fill were generally placed in the tidelands, nearshore, and upland areas to establish the current topography.

Specific geologic conditions in the vicinity of the site include a surficial fill unit (imported fill underlain by dredge fill), comprised of sands with silt and silty sand, which extends from the surface to an approximate elevation of 0.0 ft MLLW. The fill unit is underlain by native interbedded silt and sand units typical of delta deposits. Delta deposits extend to depths greater than -215 ft MLLW (GeoEngineers 2008).

2.4.1.2 Hydrogeology

Groundwater is present in the surficial fill unit as an unconfined groundwater zone. In this unit, groundwater flow is generally from the center of the peninsula toward the Blair Waterway and the

Hylebos Waterway, with groundwater discharge to the waterways. Groundwater flow in the surficial fill unit is strongly influenced by the pattern and drainage direction of pre-filling tideflat drainages (Bortleson et al. 1980). Water levels measured at the TOTE terminal indicated groundwater at the site is located at an elevation of approximately 9 ft MLLW (GeoEngineers 2008), or 2.7 ft NGVD29, which is approximately 7 ft below ground surface (BGS).

Native silt layers in the delta deposits restrict vertical flow and divide groundwater zones. Groundwater within the delta deposits occurs in semi-confined and confined conditions in the sand units with interbedded silt layers restricting vertical flow. Groundwater elevations in the shallow portions of the delta deposits are influenced by tidal conditions.

2.4.1.3 Surface Water Drainage

No natural surface water features are present on the upland portion of the site property. Prior to commencing plant operations, Tru-Grit paved the entire facility (with the exception of a weedy strip on the waterway side of the maintenance building) and installed a stormwater collection system. The stormwater collection system collects water from the entire facility with the exception of the unpaved areas. Stormwater is collected in a series of catch basins. Historically, stormwater from the catch basins was piped and infiltrated into a small, riprap-lined infiltration pond located on the south side of the maintenance building. The settling pond had an overflow swale that would allow stormwater to discharge to the shoreline in the event the basin was overtopped; however, one of the plant operators who has worked at the site since the plant began operating has indicated that the basin has never overtopped even during the biggest storm events (Streight, D., 2012, personal communication). The settling pond is still present but water from the stormwater collection system is no longer directed there. Instead, stormwater is directed to a series of holding tanks that sit on top of the settling pond and are connected to an evaporation system. The approximate location of the settling pond is shown on Figure 3.

Drainage from the northeast side of the building roof is directed to the paved area which drains to the catch basin system. Drainage from the southwest side of the roof is discharged to the strip of ground between the building and the shoreline via roof drains where it either infiltrates to the subsurface or flows over land to the shoreline.

No stormwater collection system is present on the Orion Marine portion of the property. A current employee of Orion Marine reported that rainwater ponds up and infiltrates. Also, a brief inspection of the Orion Marine portion of the property did not reveal any storm drains.

2.4.1.4 Terrestrial Ecological Setting

The site is approximately 0.8 acres in size. The only undeveloped portion of the site is a narrow vegetated strip (approximately 0.04 acres) between the building and the shoreline. The remainder of the site is paved or covered by buildings. No other undeveloped land is located within 500 ft of the site. In accordance with WAC 173-340-7491(1)(c)(i), sites that contain less than 1.5 acres of contiguous undeveloped area are excluded from having to conduct a terrestrial ecological evaluation. The Ecology Terrestrial Ecological Exclusion form is included as Appendix D.

2.4.2 MARINE ENVIRONMENT

The shoreline along the site property and adjacent properties is armored with riprap that extends from the top of the bank (approximately 14 ft MLLW) into the intertidal zone to approximately 3 ft MLLW. During a September 17, 2012 site visit, numerous groundwater seeps were evident at the base of the riprap slope providing evidence of groundwater flow toward the waterway. Below the riprap, the intertidal zone is comprised of a sand beach with large rock material interbedded sporadically. The beach slopes gradually from an elevation of approximately 3 ft MLLW to approximately -4 ft MLLW. The bathymetry then steepens with a mudline elevation ranging between approximately -4 ft MLLW to the current dredge depth, which is approximately -52 ft MLLW.

The marine environment in the Blair Waterway is influenced by semi-diurnal tidal cycles with a mean tidal range of 8.1 ft (Tetra Tech 1985). Discharge of the Puyallup River to the southwest influences the depositional nature and grain size of sediments in the Blair Waterway. Documentation of sediment deposition rates in the Blair Waterway could not be located for this report; however, a Port engineer involved with dredging projects indicated deposition is the primary process affecting sediments in the Blair Waterway (Hooton 2012).

3.0 PREVIOUS INVESTIGATIONS AND PERMIT HISTORY

This section presents the results of previous investigations and permit activities including chemical characterization of the grit used at the site, the stormwater permit and inspection history, and a prior sediment investigation.

3.1 CHEMICAL CHARACTERIZATION OF GRIT MATERIAL

Chemical testing of the total metals content of the grit material was conducted when the Tru-Grit facility began operations in the early 1990s. The results of these tests are shown in Table 1. The U.S. Environmental Protection Agency (EPA) Method 1311 Toxicity Characteristic Leaching Procedure (TCLP) was also conducted on the grit material. The results of this procedure are shown in Table 2. In addition, bioassay tests were conducted on the grit using the Canadian saltwater stickleback test and the Washington State-prescribed bioassay test for dangerous waste determination (Ecology Method 80-12). The results of the test indicate that the material does not designate as hazardous waste; results of bioassay testing are provided in Table 3. Based on the metals testing, copper and zinc are the primary metals of concern in the grit.

3.2 STORMWATER PERMITS

As previously described in Section 2.2.1.3, most site stormwater is collected and conveyed to a series of settling tanks where it is pumped to an evaporation system. Prior to the installation of the settling tanks, stormwater was conveyed to an infiltration pond that was located beneath the current settling tank. The infiltration pond had an overflow (a grassy swale leading to the shoreline); however, the pond reportedly never overflowed. The only site drainage that does not appear to discharge to the settling basin is from the southwest side of the maintenance roof, which discharges to the vegetated strip of ground between the building and the shoreline via roof drains where it either infiltrates or flows over land to the shoreline.

Because of the industrial nature of the operation at the Tru-Grit facility and its Standard Industrial Classification (SIC) code, the site is required to operate under the State of Washington National Pollutant Discharge Elimination System Industrial Stormwater General Permit (ISGP). The ISGP requires that the site maintain a stormwater pollution prevention plan (SWPPP) and abide by applicable stormwater best management practices (BMPs) to protect the water quality of stormwater discharging from the site. According to the records available through the Ecology PARIS database, a Notice of Intent application for coverage of the site was received by Ecology on November 5, 1993. The site was first issued its ISGP permit number SO3-001497 with an effective date of November 16, 1993. Following revisions to the

ISGP by Ecology on October 21, 2009, the site was issued a new ISGP permit number WAR-001497 effective January 1, 2010. The site SWPPP has gone through multiple revisions over the years to reflect ISGP modifications and changes to site stormwater-related operations. The SWPPP was most recently updated on June 17, 2010 per the conditions of the revised permit. With the planned move of the facility operations to its new location at 3701 Taylor Way in Tacoma, Washington, a new SWPPP was prepared on August 23, 2012 per the most recent version of the ISGP effective July 1, 2012.

Under the State's ISGP, Ecology conducts site inspections to verify that the SWPPP is available at the site, that it is being used, and that the BMPs defined in the SWPPP are adequate. The Tru-Grit SWPPP has included BMPs associated with preventing releases of grit. However, as documented in the AO, Ecology observed that grit had migrated away from the storage areas to other portions of the site on four separate occasions between 2004 and 2012. During one of the inspection on January 23, 2007, Ecology observed that grit had migrated to adjacent properties (specifically TOTE). Also during the 2007 inspection, Ecology noted that the grit was present on the land surrounding the conveyor and also along the over-water pier, indicating that the grit is released to the environment during the off-loading process. On January 8, 2007, Ecology issued Water Quality Enforcement Order (WQEO) No. 4003 to Tru-Grit, which after an appeal settlement required that site stormwater quality be monitored and reported, that all exposed grit be swept from the facility (both on site and on impacted adjacent properties), and that all stored grit be covered. The WQEO also required Tru-Grit to comply with the Ecology Toxics Cleanup Program requirements for removal and disposal of contaminated sediment associated with the release of the grit. This specification led Ecology to require an investigation of the sediment surrounding the pier in 2008. A summary of the 2008 investigation is presented in the following section.

3.3 PREVIOUS SEDIMENT INVESTIGATION

Previous sediment investigations in the marine area surrounding the pier and in other portions of the Blair Waterway include historical investigations conducted during the Commencement Bay Nearshore/Tideflats (CBNT) RI, the 2008 sediment investigation conducted by Landau Associates for CanAm, and various other sediment investigations for which data have been submitted to the Ecology Environmental Information Management (EIM) system.

3.3.1.1 Commencement Bay Nearshore/Tideflats

During the CBNT RI (Tetra Tech 1985), sediment samples were collected in eight problem areas throughout Commencement Bay, including the Blair Waterway. In comparison to the other problem areas, the Blair Waterway was relatively uncontaminated but still contained chemical concentrations above the reference sites in Carr Inlet. Additionally, sediment toxicity was observed in the Blair

Waterway sediment in an area that stretched from the Lincoln Avenue Drain to the former 11th Street Bridge (See Figure 1). The largest potential problem area in the Blair Waterway was identified as being adjacent to the Lincoln Avenue Drain. Two smaller potential problem areas were identified just north and south of the Lincoln Avenue Drain. Concentrations of high molecular weight polycyclic aromatic hydrocarbon (HPAH) and low molecular weight polycyclic aromatic hydrocarbon (LPAH) compounds, metals such as copper and lead, phenols, polychlorinated biphenyls (PCBs), and phthalate esters were detected in the Blair Waterway (Tetra Tech 1985).

3.3.1.2 Environmental Information Management Data

A review was conducted of available EIM data from the Ecology website (2012). The following sediment quality data were identified during the review:

- The 1984 Commencement Bay RI Main Sediment Quality Survey detected concentrations of metals such as copper and zinc, LPAHs, HPAHs, phenols, and volatile organic compounds in sediment located near the site.
- The 1991 Port of Tacoma RI/Natural Resources Damages Assessment data detected concentrations of metals including copper and zinc, HPAHs, LPAHs, phthalate esters, and phenols in the sediment located near the site.
- The 1994 Port of Tacoma Blair Bridge data recorded concentrations of metals, including copper and zinc, HPAHs, phenols, and phthalate esters in sediment located near the site.

3.3.1.3 2008 Sediment Investigation

In May 2008, Landau Associates collected sediment samples from the marine area adjacent to the Tru-Grit facility. Previous analysis of raw grit material at the Tru-Grit facility indicated that concentrations of only copper and zinc exceeded the SMS and, therefore, during the 2008 investigation, the sediments samples were evaluated for the presence of copper and zinc only. However, Ecology collected split samples during the investigation and analyzed for arsenic in addition to copper and zinc.

The results of the investigation indicated that grit material was present in the sediment around the end of the pier where the offloading operation takes place. Figure 3 shows the locations of samples collected during the 2008 investigation and Table 4 presents the analytical results. Two of the five surface samples (G-1 and G-5) collected around the end of the pier had zinc concentrations exceeding the sediment quality standards (SQS) and one surface sample (G-5) had zinc and copper concentrations exceeding the cleanup screening levels (CSL), which are less stringent than the SQS. In addition, visible grit was present in what was initially supposed to be a background sample (G-B1). Analytical results from G-B1 indicated zinc concentrations exceeding the CSL. G-B1 was collected approximately 130 ft northwest of the end of the pier. A second background sample (G-B2) was collected approximately 560 ft southeast of the pier (note that this sample is outside of the area shown on Figure 3). No visible grit was

evident in G-B2; however, sample results showed zinc concentrations above the SQS, the sample also contained elevated concentrations of arsenic, which is not characteristic of Tru-Grit's material. The results from G-B2 likely indicate elevated concentrations of zinc in the Blair Waterway due to past industrial activities that are unrelated to Tru-Grit (Landau Associates 2009).

4.0 PRELIMINARY CONCEPTUAL SITE MODEL

This section presents a preliminary conceptual site model that identifies the primary contaminants of concern at the site and their likely source, potentially affected media, migration pathways, and contaminant exposure routes to human or ecological receptors. A schematic of the conceptual site model presented below is provided on Figure 4.

4.1 LAND AND WATER USE

The site is located along the Blair Waterway, which is currently and has historically been used for industrial and commercial purposes. Zoning at the site is PMI and S10, both of which are industrial.

The areas on and adjacent to the site are used by workers, but public access points are not located on or near the site. Public recreational users may travel in the Blair Waterway by watercraft using public access points located elsewhere (e.g., marinas located in the Foss Waterway and Hylebos Waterway).

Groundwater at the site is not used for drinking nor is it likely to be used for drinking in the future because of its proximity to marine water. Potable water is supplied to the site and adjacent properties via the City of Tacoma Public Utilities department (TPU).

4.2 POTENTIAL CONTAMINANT SOURCES AND CONTAMINANTS OF CONCERN

The potential source of contamination at the site is the grit material and, based on previous chemical characterization of the grit material, the primary contaminants of concern are copper and zinc. Laboratory analysis of the grit material has shown copper and zinc to be present in the grit material at concentrations up to 2,590 milligrams per kilogram (mg/kg; copper) and 8,930 mg/kg (zinc). While these concentrations are not expected to have human health implications based on MTCA Method B cleanup levels for direct contact, both metals may be toxic to marine organisms.

4.3 POTENTIAL SOURCE AREAS AND RELEASES

Potential source areas where copper and zinc associated with the grit material may have been released to the environment include both marine and upland areas where grit handling and storage operations have occurred. Additionally, areas where windblown fines from handling, processing, and storage operations may have been deposited are potential source areas. These areas include paved areas on the TOTE terminal and rooftops at the site. Each source area is discussed specifically below:

- **Barge Offloading Area.** Grit is offloaded at the end of the pier and then conveyed along the pier to the shore. During barge offloading, grit material may be spilled into the waterway from the barge or by the ship-to-shore conveyor system.

- **Material Storage Areas.** Grit material is stored on paved areas of the site and, therefore, is not in contact with soil. However, between 2005 and 2007, some grit was temporarily (2-week period) stored on an unpaved area of the Orion Marine site where it was in contact with soil. Some trackout onto the Orion Marine side of the property can be seen in aerial photographs taken when grit was temporarily stored there. However, neither area where the grit is or was stored discharged stormwater to the Blair Waterway because stormwater from both areas either infiltrates or is directed to an evaporation system.
- **Material Processing.** The material processing area is paved and spillage of material in those areas is shoveled and swept regularly. However, the processing operations generate dust that has the potential to migrate to areas that discharge stormwater to the waterway such as rooftops and adjacent paved properties.
- **Rooftops.** Airborne fines may migrate to the roof of the Tru-Grit facility maintenance building. Rainwater collected on the roof drains to a vegetated area where grit material could be washed down to the soil and eventually migrate to the Blair Waterway shoreline. Grit material that came to be located on the soil could also present a leaching pathway to groundwater.
- **Adjacent Property Stormdrain System.** Airborne fines also have the potential to migrate to the adjacent TOTE Terminal property. Stormwater runoff at the TOTE terminal previously discharged to the Blair Waterway via an outfall. Although the outfall is no longer in use, discharge from the outfall may have impacted marine sediment in the past.
- **Stormwater Infiltration Pond.** The former stormwater pond on the site infiltrated stormwater directly to the subsurface, which could present a leaching pathway to groundwater.

4.4 CONTAMINANT MIGRATION PATHWAYS AND MEDIA OF POTENTIAL CONCERN

Potential contaminant migration pathways include air deposition, direct discharge of material to sediment, stormwater runoff, erosion, and leaching from soil to groundwater. These pathways have the potential to affect marine sediment, upland surface soil, and groundwater. Each pathway and media are further described below.

4.4.1 CONTAMINANT MIGRATION PATHWAYS

- **Direct Discharge.** Grit material is spilled directly into the waterway from the barge or offloading structures.
- **Air Deposition.** Fines generated during the processing operation or historically generated from uncovered storage areas may have migrated through the air and deposited on adjacent surfaces where further migration to the marine sediments may be possible due to stormwater runoff. This is primarily a concern for the roof of the Tru-Grit maintenance building and the TOTE terminal pavement because they are adjacent to the processing operation.
- **Stormwater Runoff.** Stormwater runoff may carry grit fines from the maintenance building roof to the soil in the vegetated strip located between the maintenance building and the shoreline. Previously, stormwater runoff from the TOTE terminal may have carried grit fines deposited on the pavement by wind to marine sediment via Outfall 4 (shown on Figure 4).

Other areas, such as the Orion Marine facility and the access road, do not have stormwater discharge systems and rainwater is reported to infiltrate; therefore, discharge of materials via stormwater from these areas is not a complete pathway.

- **Erosion.** Soil eroded from the vegetated strip between the maintenance building and the shoreline has the potential to carry grit fines or soil containing fine grit material to the waterway.
- **Leaching from soil to groundwater.** In areas where grit is in direct contact with soil, contaminants associated with the grit may leach to stormwater and then migrate through the soil to groundwater as the stormwater infiltrates the underlying soil. Areas where grit has been in contact with soil include former stockpile areas at Orion Marine, the former stormwater infiltration pond at the Tru-Grit facility, and the vegetated strip between the Tru-Grit maintenance building and shoreline. As discussed in Section 4.4.2, leaching of metals to groundwater is not expected to be a significant migration pathway.
- **Groundwater discharge to marine surface water.** Groundwater at the site is shallow and likely flows toward the Blair Waterway. Groundwater is expressed as seeps along the shoreline. Although it is unlikely that significant concentrations would make their way to marine surface water through groundwater, the groundwater to marine surface water pathway must be considered in the overall conceptual site model.
- **Truck track out.** Truck trackout at the entrance to the facility may occur but appears to be limited to less than 30 ft based on aerial photograph review. Trackout does not appear to extend to Alexander Avenue.

4.4.2 AFFECTED MEDIA

- **Marine Sediment.** Marine sediment could be affected by direct discharge of grit from barge offloading activities, discharge of stormwater carrying grit to the waterway (historically from Outfall 4), erosion of soil in unpaved areas where grit may have come in contact with stormwater, and discharge of impacted groundwater to the waterway.
- **Upland Surface Soil.** While it is unlikely that the concentrations of copper and zinc in soil would present a human health risk, soil is considered an affected medium because of the potential for leaching of metals to groundwater.
- **Groundwater.** Groundwater has the potential to be affected by metals leaching from soil; however, metals typically exhibit limited leaching characteristics from soil to groundwater under normal conditions. The three-phase partitioning model² uses conservative assumptions to establish contaminant concentrations in soil protective of groundwater. If contaminant concentrations in soil exceed the concentrations established using the model, then groundwater samples will need to be collected to evaluate if contaminants are leaching to groundwater. Previous leaching tests of the raw material suggest that its leaching potential is low and groundwater is not expected to be impacted; however, the soil leaching to groundwater pathway should still be considered in the overall investigation.

² MTCA requires use of a fixed-parameter, three-phase partitioning model to evaluate contaminant concentrations in soil for groundwater protection (WAC 173-340-747(3)(a)).

4.5 EXPOSURE PATHWAYS AND RECEPTORS

The site is currently used for industrial purposes and exposure pathways are primarily limited to the workers of Tru-Grit and tenants on the adjacent properties and leaseholds. Construction workers and site visitors could also be exposed to contaminants at the site on a more limited basis. Contaminant concentrations at the site are not expected to be high enough to cause concern for human health; however, this exposure pathway must still be evaluated as part of the overall investigation.

In addition to humans, marine organisms may be exposed to grit material that makes its way into the waterway. Marine organisms are particularly sensitive to copper and zinc and are expected to be the primary drivers for cleanup levels at the site. The following sections describe potential exposure pathways and receptors in more detail for each potentially affected medium.

4.5.1 SOIL

Human direct contact (i.e., ingestion and dermal exposure) with soil by construction and site maintenance workers is considered an exposure pathway. However, as previously mentioned, concentrations of copper and zinc in soil are not expected to present a health risk for human contact. Erosion of contaminated soil and/or leaching of contaminants from soil to groundwater and subsequent migration to marine surface waters and/or sediment may expose benthic or aquatic biota to the contaminants of concern.

4.5.2 GROUNDWATER

- Groundwater is a media transfer pathway associated with hazardous substances in shallow groundwater migrating to marine surface water and/or sediment where benthic and aquatic biota could be exposed.
- As mentioned, potable water is currently provided by TPU, which obtains the water from a water reservoir along the Green River (primarily) and also from groundwater wells several miles from the Blair Waterway. Groundwater beneath the site is not used for drinking water and groundwater should not be considered potable due to the proximity to marine waters as outlined in WAC 173-340-720(2)(d). Therefore, the risk associated with the potential exposure to groundwater via human ingestion is not considered.

4.5.3 MARINE SURFACE WATER AND SEDIMENT

- Exposure of benthic organisms to contaminants released to the biologically active zone of sediment [the upper 10 centimeters (cm) below the mudline] may result in the uptake of contaminants in these organisms. Also, the physical nature of the grit may represent an unfavorable environment for benthic organisms.
- Exposure of aquatic organisms to contaminants released from the site to surface water may result in the uptake of contaminants in these organisms.

5.0 PRELIMINARY SCREENING LEVELS

Preliminary screening levels (PSLs) have been developed for media of potential concern identified in Section 4.5 (i.e., soil, groundwater, surface water, and sediment). PSLs for soil and groundwater that are adequately protective of human health and the environment were developed in accordance with MTCA requirements. PSLs for soil, groundwater, and sediment are presented in Tables 5, 6, and 7, respectively. Although surface water is a potentially affected medium, it is addressed through the development of groundwater PSLs that are protective of surface water rather than developing surface water PSLs directly.

MTCA provides three approaches for establishing cleanup levels: Method A, Method B, and Method C. The Method A approach is appropriate for sites that have few hazardous constituents. The Method B approach is applicable to all sites. The Method C approach is applicable for specific site uses and conditions. The Method B and Method C approaches use applicable state and federal laws and risk equations to establish cleanup levels. However, the Method B approach establishes cleanup levels using exposure assumptions and risk levels for unrestricted land uses, whereas the Method C approach uses exposure assumptions and risk levels for restricted land uses. MTCA also requires that cleanup levels developed using MTCA Method B and Method C approaches not be set at levels below the practical quantitation limit (PQL) or natural background. In general, the Method C approach was used for the development of the soil PSLs and the Method B approach was used for the development of groundwater PSLs. Sediment PSLs were developed based on site-specific constituents of concern (COCs) and application of MTCA and SMS requirements.

5.1 GROUNDWATER

Because human ingestion of constituents in groundwater is not a potential exposure pathway, as described in Section 4.5.2, cleanup levels were not developed for site groundwater. However, cleanup levels protective of marine surface water were developed because site groundwater discharges directly to the Blair Waterway. Groundwater sampling has not been conducted at the site. Therefore, PSLs were developed for COCs in the grit material (copper and zinc). MTCA Method B marine surface water PSLs were developed in accordance with WAC 173-340-730(3) for copper and zinc. Groundwater and surface water PSLs protective of marine surface water are shown in Table 5.

5.2 SOIL

Soil PSLs were developed only for copper and zinc, which are the COCs in the grit material. The PSLs were developed to be protective of human health and groundwater and are provided in Table 6.

Soil PSLs protective of human health were developed using applicable human health risk assessment procedures specified in WAC 173-340-708. These procedures include development of PSLs based on the reasonable maximum exposure to occur at the site. As discussed in Section 4.1, the future uses of the site include only industrial marine dependent uses consistent with the site zoning; therefore, soil PSLs protective of human health in an industrial exposure scenario were developed based on the requirements under WAC 173-340-745 for industrial land use.

Under WAC 173-340-745, Method C soil cleanup levels must be as stringent as:

- Concentrations established under applicable state and federal laws
- Concentrations protective of direct human contact with soil
- Concentrations protective of groundwater.

These criteria were considered during development of the soil PSLs.

Except for the Toxic Substances Control Act (TSCA), there are no soil PSLs established under applicable state or federal laws. TSCA establishes cleanup levels for PCBs; however, PCBs are not a COC at the site, therefore, TSCA cleanup levels are not applicable. Standard MTCA Method C soil PSLs protective of direct human contact were determined in accordance with WAC 173-340-745(5) using the Ecology Cleanup Levels and Risk Calculations (CLARC) database (Ecology website 2012). These cleanup levels are shown in Table 6.

Soil PSLs protective of groundwater were determined using the fixed-parameter, three-phase partitioning model in accordance with WAC 173-340-747(4). Because groundwater is not a current or likely future source of drinking water and because it discharges to marine surface water, groundwater PSLs were developed based on marine surface water cleanup levels protective of human health and aquatic organisms in accordance with WAC 173-340-730. The three-phase model provides a conservative estimate of the concentration of a contaminant in soil that is protective of groundwater. Soil PSLs protective of groundwater as marine surface water are shown in Table 6. To develop a single soil cleanup level for each constituent, the lowest protective criterion was selected as the cleanup level, as indicated by shaded values in Table 6. In the case of both copper and zinc, the chosen values are driven by protection of groundwater as marine surface water.

Groundwater and upland soil at the site have not yet been tested. If testing during the RI indicates that COCs in soil exceed their respective screening levels protective of groundwater, then groundwater samples will also be collected from seeps along the shoreline. If COC concentrations in the seep samples are less than the respective groundwater PSLs, then an empirical demonstration will be made, in accordance with WAC 173-340-747(9), that contaminant concentrations in soil are not causing exceedances of the groundwater cleanup levels, and development of a soil criterion protective of groundwater is not necessary. In this case, PSLs for soil may be revised during the RI.

5.3 SEDIMENT

Sediment PSLs were developed according to MTCA and SMS requirements. Two SMS criteria are promulgated by Ecology as follows:

- The marine SQS (WAC 173-204-320), the concentration below which effects to biological resources and human health are unlikely
- The sediment CSL (WAC 173-204-520), the concentration above which more than minor adverse biological effects may be expected.

The SQS and CSL values have been developed for a suite of analytes that includes metals, polycyclic aromatic hydrocarbons (PAHs) and other semivolatile organic compounds, PCBs, and ionizable organic compounds. The SQS are the most stringent SMS numeric criteria and represent the goal for sediment cleanups. The suite of SMS analytes and the associated SQS and CSL are listed in Table 7, as are dry weight equivalents to these criteria. The sediment data, including conventionals, will be presented comparing carbon-normalized results to the SMS criteria and, in a separate table, the dry weight-normalized results will be compared to the dry weight equivalents to the SMS criteria.

6.0 REMEDIAL INVESTIGATION

The RI will focus on areas of concern where grit may have been released to the environment. These areas were outlined in Section 4.4.2 and are described in more detail below. This section describes the planned scope of the investigation in each area. A detailed description of the field activities is presented in the attached SAP (Appendix A).

6.1 PERMIT REQUIREMENTS

Remedial investigation activities to be completed on this site require a nationwide permit (NWP) 6, administered through the U.S. Army Corps of Engineers (USACE). This permit may be applied for through the Joint Aquatic Resources Permit Application (JARPA). Prior to beginning work, the USACE requires that a Pre-Construction Notification (PCN) be submitted, which is also covered under the JARPA.

Hydraulic projects conducted in state waters require a hydraulic project approval (HPA), administered by the Washington State Department of Fish and Wildlife (WDFW) under the Revised Code of Washington (RCW) Chapter 77.55. However, projects associated with a remedial action pursuant to an AO are exempt from most state permits including an HPA. Though, MTCA does require compliance with the substantive requirements of permits that would normally be required.

6.2 AREAS OF CONCERN

The 2008 investigation at the facility determined that the area directly under and near the ship-to-shore conveyance system contained raw grit material (Landau Associates 2009). At the western end of the ship-to-shore conveyance system, this raw grit material was present in a sufficient quantity to increase the copper and zinc concentrations in the sediment to levels above the CSL. In addition to spillage from the offloading operation, upland source areas have been identified, as discussed in Section 4.0. In accordance with the results of the previous investigation and identified source areas, the following three areas of concern have been identified:

- Upland Area
- Beach Area
- Blair Waterway.

The purpose of the RI is to delineate the lateral and vertical extent of the contamination, and to determine if there are ongoing sources of contamination to sediment.

6.2.1 UPLAND AREA

The upland area includes the portion of the site that extends northeast of the shoreline to the property line. The area where grit material may have been released to the environment in the upland area is the unpaved, vegetated area located between the shoreline and the maintenance building, the stretch of weedy vegetation between Tru-Grit and the TOTE property, the former stormwater infiltration pond and its stormwater overflow swale, the gravel driveway adjacent to the entrance to the facility, and the unpaved parking area on the Orion Marine portion of the property (Figure 2) (from both the former location of the overflow grit stockpile and at the temporary opening from the Tru-Grit facility to the overflow stockpile). Runoff from the maintenance building rooftop drains directly to the vegetated area between the maintenance building and shoreline. Grit fines may be deposited on the roof of the building via wind and have the potential to be transported by stormwater runoff. If the upland area soil contains elevated zinc or copper, erosion may represent an ongoing source of contamination. Additionally, depending on the concentrations in soil, there may be a potential for the COCs to leach to groundwater.

Grit fines may be deposited to the northwest of the maintenance building, on the stretch of weedy vegetation between the Tru-Grit facility and the TOTE property. However, this area is very narrow and Tru-Grit plans to clean and scrape this strip prior to vacating the property. A visual inspection will be conducted of this area after the cleaning is complete to verify that any grit has been removed.

The former stormwater infiltration pond is no longer in use. However, grit that may have been carried there historically by stormwater could present a potential for the COCs to leach to groundwater.

Trackout from the facility onto the gravel driveway at the entrance to the facility is evident in several aerial photographs. The trackout appears to extend approximately 30 ft from the facility entrance.

Grit was temporarily stored on the Orion Marine portion of the property for 2-week intervals from 2005 to 2007. Potential grit material around the temporary opening from the Tru-Grit facility to the overflow stockpile can be seen in aerial photographs from 2005. Stormwater from the Orion Marine portion of the property reportedly does not run off or discharge to the waterway. However, there may be a potential for the COCs to leach to groundwater.

6.2.2 BEACH AREA

The beach area includes an intertidal area below the riprap slope of the shoreline adjacent to the Tru-Grit site and the area in the vicinity of the TOTE terminal and Outfall 4. Outfall 4 is located at the southwest corner of the TOTE terminal parking lot, as shown on Figure 4, and previously discharged stormwater from the TOTE terminal to the Blair Waterway. Elevated copper and zinc concentrations were documented in stormwater discharges from this location. Currently stormwater at TOTE terminal is diverted to rain gardens, where it infiltrates the ground surface; however, the beach area may have been

impacted during previous stormwater discharges. Under the pier is a portion of the beach where grit material may have fallen or been blown off from the conveyance system during ship-to-shore transfer. There is also the potential for grit to be distributed laterally along the shore due to current and wave action.

6.2.3 BLAIR WATERWAY

The 2008 sediment investigation determined that subtidal sediment contamination resulted from grit spilled during offloading activities. The known affected area includes the area around the end of the pier. Other suspected areas include the area northwest of the pier where sample GB-1 was collected, the areas around the barge, and areas between GB-1, the barge/conveyor system, and the shoreline. The locations of the pier, sample GB-1, and the barge are shown on Figure 3.

6.3 UPLAND AREA INVESTIGATION

Detailed explanations of the sampling program and the procedures for QA/QC are presented in the SAP (Appendix A).

6.3.1 SOIL

Tru-Grit no longer plans to operate at the facility; prior to departure, Tru-Grit plans to sweep paved areas and clean the storm drain system. In addition, Tru-Grit plans to scrape the weedy strip between the facility and the TOTE terminal and the entrance to the facility where trackout occurred. These areas will be visually inspected for the presence of grit, once the cleaning is complete.

Upland surface soil that may have been in contact with grit material and cannot be cleaned or scraped may have the potential to provide an ongoing contaminant source to the Blair Waterway via erosion and/or leaching to groundwater. Effective sediment remediation depends on accurately defining continuing sources of contamination before evaluating or implementing sediment cleanup actions that may be compromised by further contamination; therefore, surface soil samples will be collected from the Orion Marine facility and the weedy strip between the maintenance building and waterway and submitted for chemical analysis.

Surface soil samples will be collected from two locations in the unpaved portion of the Tru-Grit facility (between the maintenance building and the shoreline), at locations adjacent to the existing roof drains at either end of the building. A sample will not be collected near the central roof drain because riprap consisting of quarry spall-sized rocks, extends from the shoreline to the edge of the building. No surface soil is present for sampling in this area, and results from the two samples in the upland area are expected to be representative of potential impacts from the roof drains.

One surface soil sample will be collected from the overflow area near the edge of the former stormwater infiltration pond. The pond area itself is covered by the stormwater holding tanks and surface soil is not accessible for sampling.

Three surface soil samples will be collected from unpaved areas at the Orion Marine facility where grit was temporarily stored and where grit may have been inadvertently tracked by equipment moving the grit. Proposed surface soil sample locations are shown on Figure 3, though the final locations will be based on visual inspection of soils in the field for potential grit material.

The surface soil samples will be collected from the upper 6 inches of soil using hand implements and submitted to a laboratory for analysis for copper and zinc.

6.4 GROUNDWATER

Two groundwater samples will be collected from seeps along the shoreline to make compliance determinations for the groundwater to surface water and/or sediment pathway. Numerous seeps were noted along the shoreline at low tide during a September 17, 2012 site visit. Final determination of the seeps to be sampled will be made in the field during sample collection.

Seep samples will be collected using a peristaltic pump and analyzed for dissolved metals by EPA Method 6010. During collection, seep water will be monitored for conductivity, to evaluate if seep water represents upland groundwater discharge, seawater that has infiltrated the upland area during higher tide cycles, or a mixture of the two. Samples will be field-filtered using a 0.45-micron filter and preserved with nitric acid in accordance with dissolved metals sampling protocols (EPA 2000).

6.5 BEACH AREA INVESTIGATION

Five sediment samples will be collected from the beach area to determine if beach sediment has been impacted by stormwater runoff or erosion from areas that received grit fines in the past. The proposed sampling locations are adjacent to Outfall 4 and three locations adjacent to the unpaved, vegetated strip at the Tru-Grit site. One sample will also be collected from under the pier, where grit material may have been spilled directly on the beach during offloading activities. A final sample will be collected to the southeast of the pier, to evaluate if grit material has spread laterally along the shoreline. The proposed beach sediment sampling locations are shown on Figure 3.

Sediment samples from the beach area will consist of grab samples. Grab samples will be collected from the upper 10 cm and are intended to evaluate the horizontal extent of grit material in surface sediments and contamination within the sediment biologically active zone. Sediment will be visually evaluated in the field for the presence of grit. If grit is present in the surface sample one additional sample will be collected 0.5 ft beneath the surface sample to define the vertical extent of

contamination. The grab samples will be collected by hand at low tide. All of the beach area sediment samples will be analyzed for copper and zinc. However, because the focus of the RI is to evaluate the nature and extent of contamination resulting from site activities and because copper and zinc may be associated with other non-related site sources, such as ASARCO slag, the sediment samples will also be analyzed for arsenic. Arsenic was detected in the 2008 sediment samples and in the raw grit material but only at low concentrations. ASARCO slag material is known to contain high levels of arsenic and historically, the ASARCO slag had a number of uses at the Port of Tacoma, including ballast in log yards and sandblasting (the property was formerly used as a ship yard where sandblasting might have occurred). Because marine environments have the tendency to distribute contaminants via currents, wave action and tidal action, copper and zinc may be present in sediment adjacent to the Tru-Grit facility but the source may not be grit material. As a way to distinguish copper and zinc (and grit material) related to Tru-Grit's activities from other sources in the waterway, analysis of the sediment samples for arsenic is proposed.

6.6 BLAIR WATERWAY AREA INVESTIGATION

Sediment samples will be collected from 19 locations within the Blair Waterway. Because the only facility activities that may have caused a release to the subtidal sediments in the waterway are the offloading activities and the ship-to-shore conveyance system, the proposed sampling locations are in the vicinity of the pier where the offloading activities occurred and the ship-to-shore conveyance system was located. The proposed Blair Waterway area sediment sampling locations are shown on Figure 3. The sampling locations were distributed over an approximately 60,000-square foot area to determine the lateral extent of grit material. In addition, if grit material is observed at planned sampling locations farthest from the pier, additional step-out samples will be added until no grit material is observed. The step-out samples will be collected at 50-ft intervals.

Background samples will be collected at two locations and used in conjunction with the 2007 background sample to evaluate background levels of copper and zinc in Blair Waterway sediments. The background samples will be collected from the opposite side of the waterway across from the Tru-Grit site and approximately 1,050 ft down waterway (toward Commencement Bay). Figure 5 shows the proposed background sample locations.

Sediment samples collected from the waterway area will consist of grab samples and sediment cores. Grab samples will be collected at each location from the upper 10 cm and are intended to evaluate contamination within the sediment biologically active zone. Cores will be collected only at locations where grit is observed in the grab samples. Additionally, one core will be collected at the former GS-5 location where previous testing indicated copper and zinc impacts from grit; a grab sample will not be collected from this location because analytical data from the upper 30 cm of sediment already exists. Core

depths will be up to 7 ft and are intended to evaluate the vertical extent of grit material in the sediment. The grab samples will be collected mechanically with a power-grab sampler from a water craft. Core samples will be collected using a vibrocore deployed from a water craft.

Initial cores from the most likely contaminated areas (those nearest the pier) will be processed at the end of the day they are collected. Early processing of these cores will be used to determine the appropriate minimum core length required to accurately define the vertical extent of grit material in sediment. Sedimentation rates are unknown; therefore, the initial core length will be 7 ft, a conservative depth.

During processing of the cores, two samples (in addition to the aforementioned surface grab sample) will be collected for chemical testing. One sample will be collected from the portion of the core with the highest apparent grit content (based on visual observation). The second sample will be collected from 0.5 ft below where grit is visible to define the vertical extent of contamination. The remaining portions of the core will be divided into 1-ft lengths and processed for archiving at the laboratory. Additional samples may be collected from the cores for archiving purposes based on observations by the field staff. Analysis of these samples will be determined based on the results of the initial sample analyses.

All of the sediment samples collected from the waterway area will be analyzed for copper, zinc, and arsenic. At Ecology's request, two of the sediment grab samples containing the most grit material will be tested for the full SMS suite of chemicals and the additional conventional parameters, excluding sulfides and ammonia. A full list of parameters, analytical methods and the recommended practical quantitation limits is presented in Appendix A.

7.0 FEASIBILITY STUDY

The purpose of the FS is to develop and evaluate cleanup action alternatives for the site. The FS will:

- Identify applicable or relevant and appropriate requirements (ARARs) for site cleanup
- Identify media and locations where remedial action is needed
- Develop remedial action objectives (RAOs)
- Develop, screen, and evaluate cleanup alternatives
- Identify a preferred alternative.

The following sections provide additional discussion of details for each of the above bullets.

7.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

In accordance with MTCA, all cleanup actions must comply with applicable state and federal laws [WAC 173-340-710(1)]. MTCA defines applicable state and federal laws to include legally applicable requirements and those requirements that are relevant and appropriate. Collectively, these requirements are referred to as ARARs. The starting point for ARARs is the MTCA cleanup levels and regulations that address implementation of a cleanup under MTCA (Chapter 173.105D RCW; Chapter 173-340 WAC). Other potential ARARs may include the following:

- Washington State Sediment Management Standards (Chapter 173-204 WAC)
- State Water Pollution Control Act (Chapter 90.48 RCW).
- EPA National Recommended Water Quality Criteria – Section 304 Clean Water Act
- EPA Water Quality Standards (National Toxics Rule) – 40 CFR 131
- Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 RCW).
- Washington Pollution Control Act and the implementing regulations, Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC)
- Washington Hazardous Waste Management Act and the implementing regulations, Dangerous Waste Regulations (Chapter 173-303 WAC), to the extent that any dangerous wastes are discovered or generated during the cleanup action
- The federal Clean Water Act, with respect to in-water work associated with dredging or sediment capping
- Washington's Shoreline Management Act, with respect to construction activities conducted near the shoreline during the cleanup action
- Endangered Species Act (ESA), due to listing of Puget Sound Chinook and the potential listing of coastal/Puget Sound bull trout
- Washington Clean Air Act (Chapter 70.94 WAC)

- Occupational Safety and Health Act (OSHA), 29 CFR Subpart 1910.120
- Washington Industrial Safety and Health Act (WISHA).

The FS will identify ARARs if a cleanup action is needed. In addition, the FS will identify likely permits required for implementation of the cleanup action.

7.2 DELINEATION OF MEDIA REQUIRING REMEDIAL ACTION

The RI process will determine if soil and sediment results exceed preliminary cleanup levels and, if so, identify the locations of the exceedances. Based on any exceedances and the established points of compliance, the FS will identify the areas that require remedial action.

7.3 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

The RAOs identify the goals that must be achieved by a cleanup alternative in order to achieve cleanup standards and provide adequate protection of human health and environment. The RAOs must address all affected media and a cleanup alternative must achieve all RAOs to be considered a viable cleanup action. RAOs will be developed for portions of the site requiring remedial action.

The RAOs will be action-specific and/or media-specific. Action-specific RAOs are based on actions required for environmental protection that are not intended to achieve a specific chemical criterion. Media-specific RAOs are based on the cleanup levels. The RAOs will specify the COCs, the potential exposure pathways and receptors, and acceptable contaminant levels or range of levels for each exposure pathway, as appropriate.

The extent to which each alternative meets the RAOs will be determined by applying the specific evaluation criteria identified in the MTCA and SMS regulations. The site cleanup is being overseen by Ecology.

7.4 SCREENING OF CLEANUP ALTERNATIVES

Cleanup alternatives will be developed for portions of the site that require cleanup action. Initially, general remediation technologies will be identified for the purpose of meeting RAOs. Remediation technologies will be screened for site specific feasibility. The remediation technologies will then be compiled into three cleanup alternatives.

Specific remedial action technologies are the engineering components of a general remediation technology and process options are those specific processes within each specific technology. Specific remedial action technologies and representative process options will be selected for evaluation based on documented successful use for sediment. Cleanup alternatives will be developed from the general and

specific remedial technologies and process options consistent with Ecology's expectations identified in WAC 173-340-370 using best professional judgment and guidance documents as appropriate [e.g., *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988) and *Draft Sediment Cleanup Users Manual II* (Ecology 2012)]. During the development of cleanup alternatives, both the current and planned future land use will be considered.

7.5 EVALUATION OF CLEANUP ALTERNATIVES

MTCA requires that cleanup alternatives be compared to a number of criteria as set forth in WAC 173-340-360 to evaluate the adequacy of each alternative in achieving the intent of the regulations, and as a basis for comparing the relative merits of the developed cleanup alternatives. Consistent with MTCA, the alternatives will be evaluated with respect to compliance with threshold requirements, permanence, and restoration timeframe and the results of the evaluation will be documented in the RI/FS reports.

7.5.1 THRESHOLD REQUIREMENTS

As specified in WAC 173-340-360(2)(a), all cleanup actions are required to meet the following threshold requirements:

- Protection of human health and the environment
- Compliance with cleanup standards specified under MTCA
- Compliance with applicable state and federal laws
- Provisions for compliance monitoring.

7.5.2 REQUIREMENT FOR PERMANENT SOLUTION TO THE MAXIMUM EXTENT PRACTICABLE

WAC 173-340-200 defines a permanent solution as one in which cleanup standards can be met without further action being required at the original site or any other site involved with the cleanup action, other than the approved disposal site for any residue from the treatment of hazardous substances. Ecology recognizes that permanent solutions may not be practicable for all sites. To determine whether a cleanup action is permanent to the "maximum extent practicable," MTCA requires that disproportionate cost analysis [DCA; WAC 173-340-360(3)(b)] be used. In accordance with WAC 173-340-360(3)(f), the following criteria are used to evaluate and compare each cleanup action alternative when conducting a DCA:

- **Overall protectiveness** of human health and the environment, including the degree to which site risks are reduced, the risks during implementation, and the improvement of overall environmental quality

- **Long-term effectiveness**, including the degree of certainty that the alternative will be successful, the long-term reliability, the magnitude of residual risk, and the effectiveness of controls required to manage treatment residues and remaining waste
- **Management of short-term risks**, including the protection of human health and the environment during construction and implementation
- **Permanent reduction in toxicity, mobility, and volume of hazardous substances**, including the reduction or elimination of hazardous substance releases and sources of releases
- **Implementability**, including consideration of whether the alternative is technically possible; the availability of necessary offsite facilities, services, and materials; administrative and regulatory requirements; scheduling, size, and complexity of construction; monitoring requirements; access for construction, operations, and monitoring; and integration with existing facility operations
- **Cleanup costs**, including capital costs and operation and maintenance costs
- **Consideration of public concerns**, which will be addressed through public comment on the cleanup action plan.

Procedures that will be used for conducting a DCA are described in Section 7.6.

7.5.3 REQUIREMENT FOR A REASONABLE RESTORATION TIMEFRAME

WAC 173-340-360(4)(b) specifies that the following factors be considered in establishing a “reasonable” timeframe:

- Potential risks to human health and the environment
- Practicability of achieving a shorter restoration timeframe
- Current use of the site, surrounding areas, and associated resources that are, or may be, affected by releases from the site
- Potential future use of the site, surrounding areas, and associated resources that are, or may be, affected by releases from the site
- Availability of alternate water supplies
- Likely effectiveness and reliability of institutional controls
- Ability to control and monitor migration of hazardous substances from the site
- Toxicity of the hazardous substances at the site
- Natural processes that reduce concentrations of hazardous substances and have been documented to occur at the site or under similar site conditions.

7.5.4 REQUIREMENT FOR CONSIDERATION OF PUBLIC CONCERNS

The draft final RI/FS report will be issued for public comment, which will provide the public an opportunity to express any concerns. Those concerns will be addressed in a responsiveness summary

prepared by Ecology and, if appropriate, the RI/FS report will be modified in response to the public concerns.

7.6 DISPROPORTIONATE COST ANALYSIS PROCEDURES

As described in Section 7.5.2, MTCA requires that cleanup actions be permanent to the maximum extent practicable and requires that a DCA be used when the cleanup alternatives being considered are not permanent as defined under WAC 173-340-200. Evaluation of the practicability of a given alternative is a comparative evaluation of whether the incremental increase in cost associated with increasingly protective cleanup actions is substantial and disproportionate to the incremental increase in environmental benefit. In the DCA, cleanup alternatives are arranged from most to least permanent based on the criteria specified in WAC 173-340-360(3)f and described in Section 7.5.2. Costs are disproportionate to benefits if the incremental costs of the more permanent alternative exceed the incremental benefits achieved by the lower cost alternative [WAC 173-340-360(3)(e)(i)]. Alternatives that exhibit disproportionate costs are considered “impracticable.” Where the benefits of two alternatives are equivalent, MTCA specifies that Ecology select the least costly alternative [WAC 173-340-360(3)(e)(ii)(C)].

7.7 RECOMMENDATION OF REMEDIAL ACTION ALTERNATIVES

This section of the FS will recommend a remedial action alternative based on the results of the comparative evaluation. The recommended alternative will meet the minimum requirements for cleanup actions: protect human health and the environment, comply with cleanup standards, comply with applicable state and federal laws, provide for compliance monitoring, use permanent solutions to the extent practicable, provide for a reasonable timeframe, and consider public concerns.

8.0 SCHEDULE AND REPORTING

The AO establishes the RI/FS schedule and reporting requirements, which are summarized below:

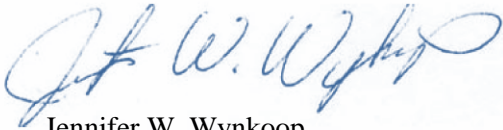
- A final RI/FS Work Plan will be submitted to Ecology within 30 days of receiving Ecology's comments on the draft.
- RI field work will begin within 30 days after receipt of Ecology approval of the final RI/FS Work Plan or as soon as permits are available (from the time the sampling plan is approved, field work is expected to be completed within 6 months).
- Laboratory results will be provided to Ecology within 14 days of completion of data validation. Validation is typically completed within 1 month of receiving results.
- RI field work is expected to take approximately 3 to 4 months to complete; however, this schedule is heavily dependent on the availability of sampling vessels that are typically in high demand and must be scheduled several months in advance.
- A draft RI/FS Report will be submitted to Ecology within 60 days of receipt of the final RI laboratory data.
- A final RI/FS Report will be submitted to Ecology within 30 days of receiving Ecology's comments on the draft.
- Data will be submitted to EIM within 30 days of data validation.

If additional field RI activities are needed to adequately delineate the extent and magnitude of contamination at the site, the scope, schedule, and submittal requirements for this additional work will be developed by CanAm and submitted to Ecology for review and concurrence.

9.0 LIMITATIONS

This work plan has been prepared for the exclusive use of CanAm for specific application to the Tru-Grit Remedial Investigation/Feasibility Study project. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of CanAm and Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by CanAm and Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

LANDAU ASSOCIATES, INC.



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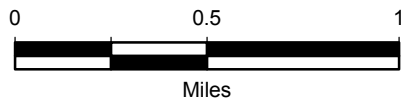
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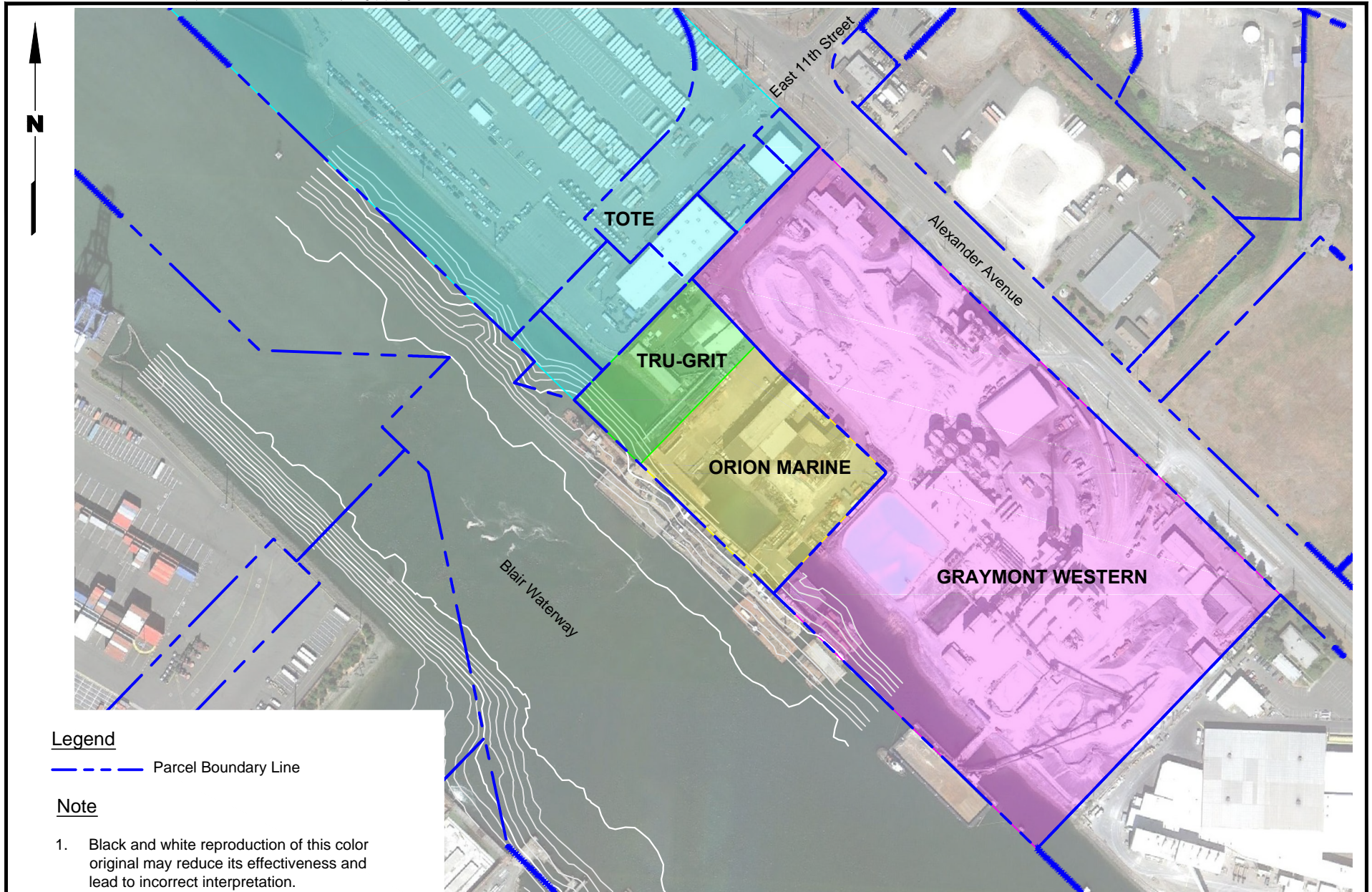
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Data Source: ESRI 2008

<p>Tru-Grit Facility Tacoma, Washington</p>	<p>Vicinity Map</p>	<p>Figure 1</p>
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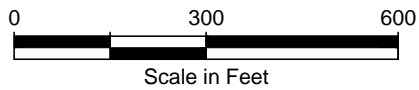
Legend

--- Parcel Boundary Line

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: Google Earth Pro 2010

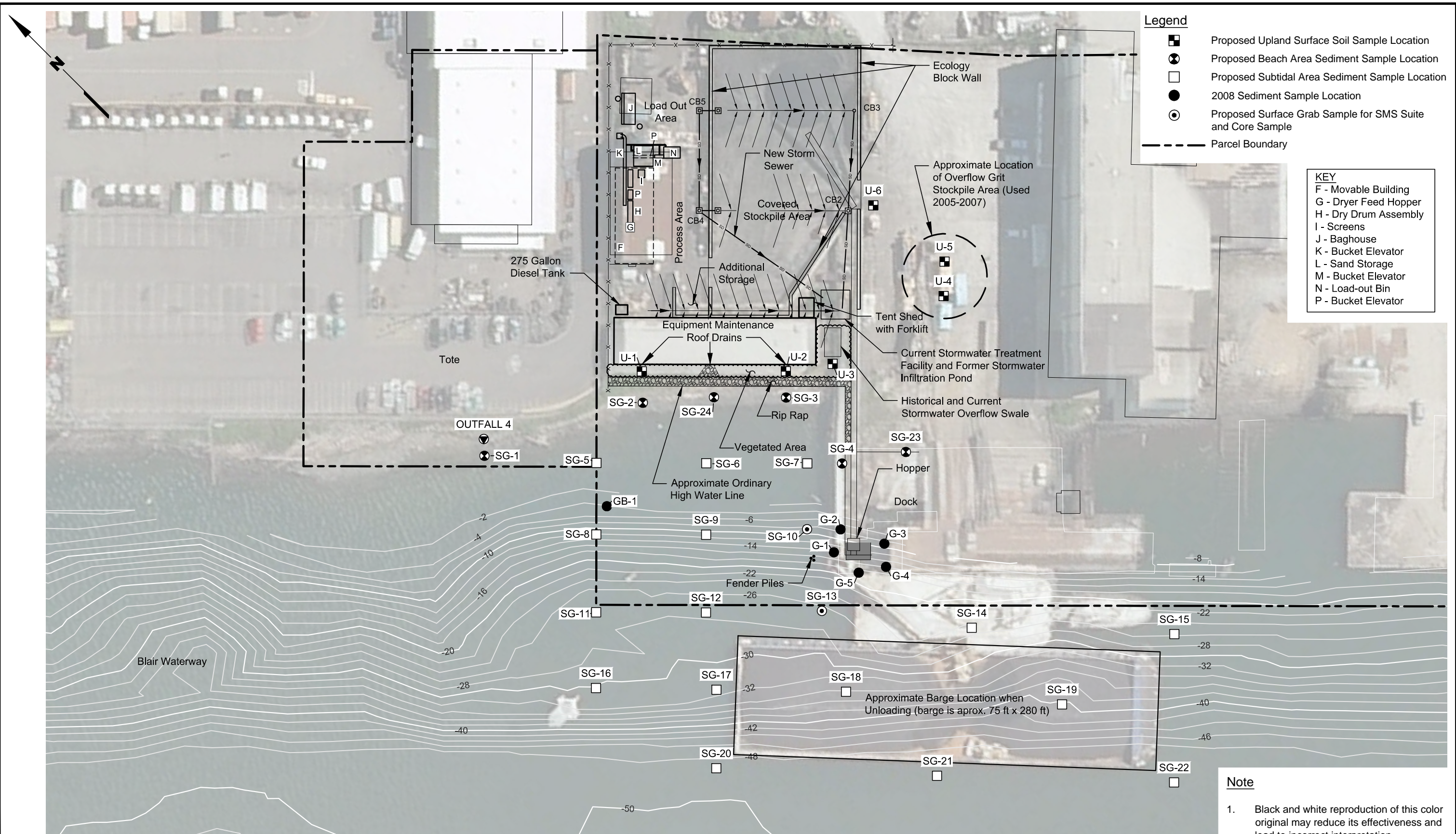


Tru-Grit Facility
Tacoma, Washington

Facility and Adjacent Properties

Figure
2

LANDAU ASSOCIATES, INC. | V:\2411008\010.013\3-A Plan.dwg (A) "Figure 3" 2/6/2013



Source: Google Earth Pro 2010; Aerial dated 04-30-2009

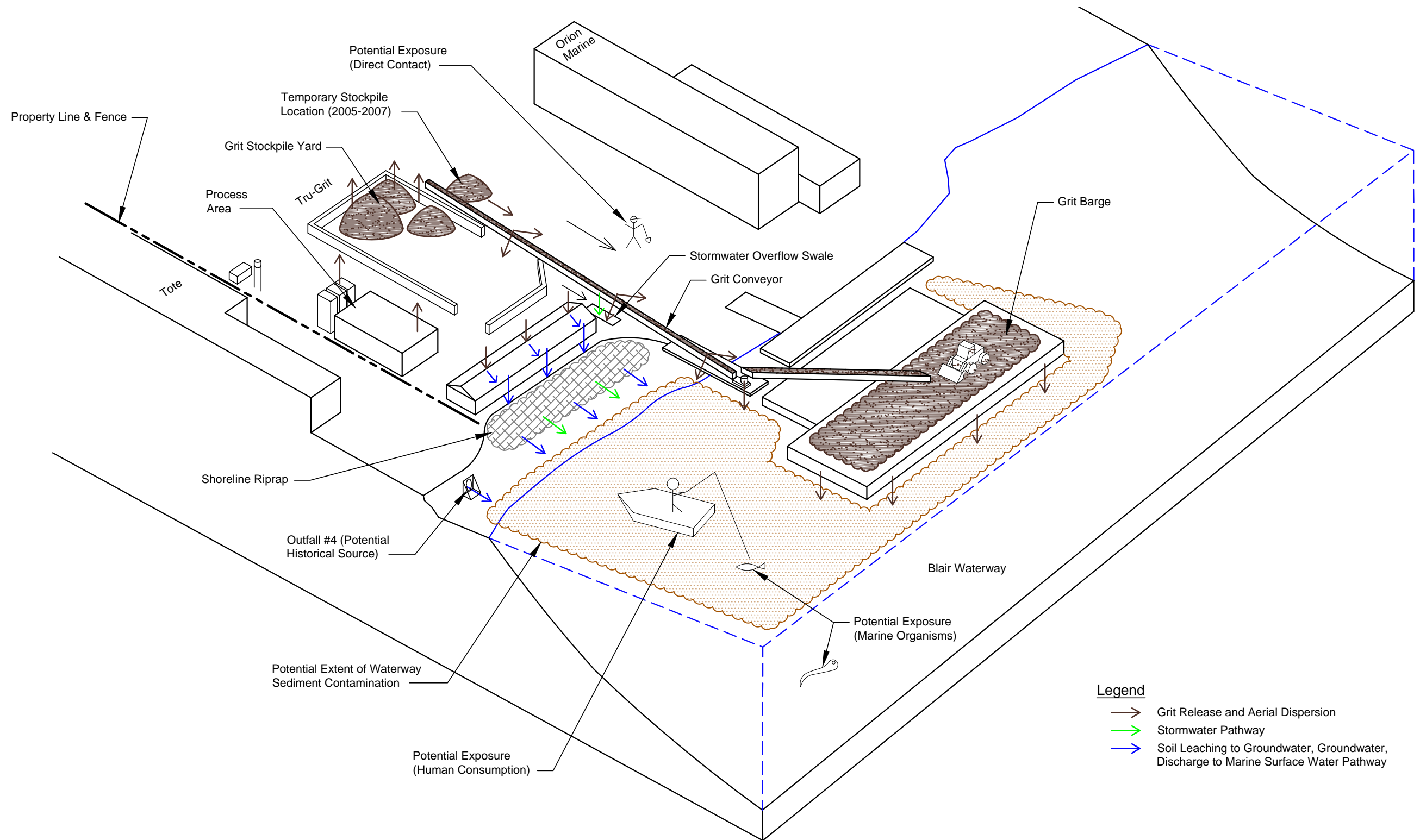


Tru-Grit Facility
Tacoma, Washington

**Site Plan
and Proposed Sampling Locations**

Figure
3





Not to Scale

Tru-Grit Facility
Tacoma, Washington

Conceptual Site Model

Figure
4



Legend

- Parcel Boundary Line
- Background Grab Sample Location

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: Google Earth Pro 2010



Tru-Grit Facility
Tacoma, Washington

Background Sample Locations

Figure
5

TABLE 1
TOTAL METALS CONTENT
GRANDBY BAY SLAG AND TRU-GRIT DRY MATERIAL(a)
TRU-GRIT FACILITY
TACOMA, WASHINGTON

Analyte	British Columbia Research		Sound Analytical		OCL Materials LTD
	Anyox slag (Tru-Grit Raw Material)		11/4/1991	11/4/1991	Apr-92
	Report Date 7/91		Tru-Grit	Black	Tru-Grit
	1	4	Material	Lustre (b)	Material
Aluminum	28,900	23,800	NA	NA	NA
Antimony	NA	NA	<1.0	<1.0	NA
Arsenic	<5	<5	<0.90	<0.90	<10
Barium	NA	NA	100	100	929
Beryllium	440	430	<0.090	<0.90	NA
Cadmium	<2.5	<2.5	<0.18	<0.18	<0.1
Chromium	94.8	74.4	27	27	29.5
Chromium (+6)	NA	NA	0.085	0.085	NA
Chromium (+3)	NA	NA	27	27	NA
Cobalt	NA	NA	60	60	180
Copper	2,590	2,330	1,000	1,000	2,280
Iron	329,000	337,000	NA	NA	NA
Lead	84.7	84.3	35	35	21
Mercury	<0.1	<0.1	<0.1	<0.1	<0.03
Molybdenum	NA	NA	27	27	7.7
Nickel	NA	NA	1.5	1.5	4.3
Selenium	4	2.9	<0.45	<0.45	<1
Silver	<5	<5	1.4	1.4	NA
Thallium	NA	NA	<0.72	<0.72	NA
Vanadium	NA	NA	37	37	NA
Zinc	8,380	8,930	3,900	3,900	8,270
Sodium	NA	NA	2,200	2,200	NA

NA = Not analyzed

(a) = Grandby Bay stockpile is the source of all materials analyzed.

(b) = Black Lustre is a Canadian trade name for Tru-Grit material.

**TABLE 2
LEACHATE HEAVY METAL CONTENT
TRU-GRIT FACILITY
TACOMA, WASHINGTON**

TCLP-Metals Analysis (Per 40 CFR 261.24)
Concentration Unit: mg/L in Leachate

	Result	PQL	DF	EPA#	Limit @	EPA Method
Arsenic (As)	ND	0.01	1	D004	5.0	6010B
Barium (Ba)	0.820	0.10	1	D005	100.0	6010B
Cadmium (Cd)	ND	0.01	1	D006	1.0	6010B
Chromium (Cr)	ND	0.01	1	D007	5.0	6010B
Lead (Pb)	ND	0.01	1	D008	5.0	6010B
Mercury (Hg)	ND	0.01	1	D009	0.2	7470A
Selenium (Se)	ND	0.10	1	D010	1.0	6010B
Silver (Ag)	ND	0.02	1	D011	5.0	6010B

mg/L= Milligram per Liter=PPM

TCLP Extraction Method= EPA 1311

DF=Dilution Factor

PQL= Practical Quantitation Limit

Actual Detection Limit= PQL X DF

ND= Below the actual Detection Limit or non-detected

EPA#= The EPA Hazardous Waste Number

Limit@= The "EPA Acceptable Land Disposal Limit"

***= The concentration exceeds the TCLP Limit (if marked)

Sediment Quality Standards
WAC 173-204-320 (a)

Maximum Level,
WAC 173-204-420 (a);
and
Screening Level/Minimum
WAC 173-204-520 (a)

**TABLE 3
BIOASSAY DATA
TRU-GRIT FACILITY
TACOMA, WASHINGTON**

Bioassay Testing Services (Tacoma)
Trout Bioassay 3/90
Ecology 173-303 Method 80-12

Concentration	Mortality
100 mg/L	0/30
1,000 mg/L	5/30

British Columbia Research*
Threespined Stickleback Bioassay 4/93
Saltwater Test

Concentration wt/wt %	% Survival			
	24 hr	48 hr	72 hr	96 hr
22 (a)	100	100	100	100
10	100	100	100	100
4.4	100	100	100	100
1	100	100	100	100

(a) Saltwater Supernatant Analysis
From 22% Concentration Bioassay Tank
(for select metals)

Analyte	Concentration
Copper	<0.05 mg/L
Chromium	<5 mg/L
Zinc	0.02 mg/L

* Reference Toxicant for stickleback 96hLC50 phenol 17.8n and 18.7 mg/L,
which compares well with rainbow trout phenol toxicity in fresh water 10-15 mg/L

TABLE 4
2008 SEDIMENT INVESTIGATION RESULTS
TRU-GRIT FACILITY
TACOMA, WASHINGTON

Landau Sample ID	Ecology Sample ID	Sample Description	Copper		Zinc		Arsenic
			Landau (ARI) Results	Ecology Results	Landau (ARI) Results	Ecology Results	Ecology Results
G-1	G-1	End of Conveyor Pier	303	280	762	914	19.9
C-1(15-25)	C-1A	15-25 centimeter depth at G-1	N/A	700	N/A	1590	24.3
C-1(25-35)	C-1B	25-35 centimeter depth at G-1	N/A	314	N/A	957	44.7
G-2	G-2	End of Conveyor Pier	117	72.4	228	180	24.9
G-3	G-3	End of Conveyor Pier	221	180	296	285	55.2
G-4	G-4	End of Conveyor Pier	151	140	217	200	17.5
G-5	G-5	End of Conveyor Pier	1350	1390	2970	3400	8.9
G-B1	G-B1	190' North of conveyor pier	N/A	391	N/A	1250	7.94
C-B1 (15-25)	CB-1A	15-25 centimeter depth at G-B1	N/A	332	N/A	1140	11.6
C-B1 (25-40)	CB-1B	25-40 centimeter depth at G-B1	N/A	55.4	N/A	86	13
G-B2	G-6	Background- 560' upstream on Blair Waterway	231	229	629	665	185
C-B2 (10-25)	C-2A	10-25 centimeter depth at G-B2	N/A	353	N/A	1120	34.5
C-B2 (25-40)	C2-B	25-40 centimeter depth at G-B2	N/A	1340	N/A	4210	90.5
Sediment Quality Standards (SQS)			390	390	410	410	57
Clean up Screening Level (CSL)			390	390	960	960	93

Bold = Exceedance of sediment quality standards (SQS).

Box = Exceedance of cleanup level (CSL).

**TABLE 5
PRELIMINARY GROUNDWATER SCREENING LEVELS
TRU-GRIT FACILITY
TACOMA, WASHINGTON**

Constituents	State and Federal ARARs (a)					MTCA Method B (a)	Practical Quantitation Limit (PQL)(c)	Proposed Preliminary Screening Level (d)
	State Marine Chronic Aquatic Life Washington WQS WAC 173-201A	Federal Marine Chronic Aquatic Life Clean Water Act Section 304	Federal Marine Chronic Aquatic Life NTR 40 CFR 131	Federal Human Health Consumption of Organisms Clean Water Act Section 304	Federal Human Health Consumption of Organisms NTR 40 CFR 131	Human Health MTCA Method B Surface Water Equation 173-340-730 (Non-Carcinogen)		
Metals (µg/L)								
Copper	3.1 (b)	3.1 (b)	2.4	--	--	2,900	2	2.4
Zinc	81 (b)	81 (b)	81 (b)	26,000	--	17000	10	81

Shaded cell indicates basis for proposed screening level.
 "---" = Indicates no criterion is available.

Notes:

- (a) Unless otherwise noted, all federal and state ARARs and MTCA C Cleanup Screening Levels for surface water were identified from Ecology's online CLARC database (Ecology website 2012b).
- (b) The surface water criterion is based on the dissolved fraction.
- (c) The PQL is based on Analytical Resource Inc. laboratory's limit of quantitation for EPA Method 6010C (October 2, 2012)
- (d) Proposed screening level is based on lowest water quality standard indicated by shading.

NTR = National Toxics Rule
 WQS = Water Quality Standard
 MTCA = Model Toxics Control Act

ARAR = Applicable or Relevant and Appropriate Requirements
 CLARC = Cleanup Screening Levels and Risk Calculation

**TABLE 6
PRELIMINARY SOIL SCREENING LEVELS
TRU-GRIT FACILITY
TACOMA, WASHINGTON**

Constituents	Preliminary Groundwater Cleanup Level Used in Three-Phase Model ($\mu\text{g/L}$)	MTCA Method C Soil Direct Contact Industrial Land Use Non-Carcinogen	MTCA Method C Protective of Groundwater as Surface Water (a)	Soil Background Levels (b)	Practical Quantitation Limit (PQL) (c)	Proposed Preliminary Screening Level
Metals (mg/kg)						
Copper	2.4	140,000	1.1	36	0.2	36
Zinc	81	1,100,000	101	85	1.0	101

Shaded cell indicates basis for proposed screening level.

Notes:

- (a) Calculated using fixed parameter three-phase partitioning model, WAC 173-340-747(4) and the preliminary groundwater cleanup level shown in column 2.
- (b) From Ecology's Natural Background Soil Metals Concentrations in Puget Sound (Ecology 1994). Used 90th percentile for Puget Sound unless noted otherwise.
- (c) The PQL is based on Analytical Resource Inc. laboratory's limit of quantitation for EPA Method 6010C (October 2, 2012)

TABLE 7
PRELIMINARY SEDIMENT SCREENING LEVELS
TRU-GRIT FACILITY
TACOMA, WASHINGTON

Constituents	Sediment Quality Standards (SQS) Chapter 173-204 WAC (a)	Cleanup Screening Levels (CSL) Chapter 173-204 WAC (b)	SQS Dry Weight Equivalent (c)	CSL Dry Weight Equivalent (c)	Recommended Practical Quantitation Limits
Conventionals					
Total Organic Carbon (%)	0.1	0.1	0.1	10 (d)	--
Metals					
	mg/kg - dry weight	mg/kg - dry weight	mg/kg - dry weight	mg/kg - dry weight	mg/kg dry weight
Arsenic	57	93	57	93	19
Cadmium	5.1	6.7	5.1	6.7	1.7
Chromium	260	270	260	270	87
Copper	390	390	390	390	130
Lead	450	530	450	530	150
Mercury	0.41	0.59	0.41	0.59	0.14
Silver	6.1	6.1	6.1	6.1	2
Zinc	410	960	410	960	137
Nonionizable Organic Compounds					
Aromatic Hydrocarbons					
	(mg/kg -OC)	(mg/kg -OC)	µg/kg dry weight	µg/kg dry weight	µg/kg dry weight
Total LPAH					
	370	780	5200	5200	--
Naphthalene	99	170	2100	2100	700
Acenaphthylene	66	66	1300	1300	433
Acenaphthene	16	57	500	500	167
Fluorene	23	79	540	540	180
Phenanthrene	100	480	1500	1500	500
Anthracene	220	1200	960	960	320
2-Methylnaphthalene	38	64	670	670	223
Total HPAH					
	960	5300	12000	17000	--
Fluoranthene	160	1200	1700	2500	567
Pyrene	1000	1400	2600	3300	867
Benzo[a]anthracene	110	270	1300	1600	433
Chrysene	110	460	1400	2800	467
Total benzofluoranthenes	230	450	3200	3600	1067
Benzo[a]pyrene	99	210	1600	1600	533
Indeno[1,2,3-c,d]pyrene	34	88	600	690	200
Dibenzo[a,h]anthracene	12	33	230	230	77
Benzo[g,h,i]perylene	31	78	670	720	223
Other SVOC					
	(mg/kg -OC)	(mg/kg -OC)	µg/kg dry weight	µg/kg dry weight	µg/kg dry weight
1,2-Dichlorobenzene	2.3	2.3	35.0	50.0	35
1,4-Dichlorobenzene	3.1	9.0	110.0	110.0	37
1,2,4-Trichlorobenzene	0.81	1.8	31.0	51.0	31
Hexachlorobenzene	0.38	2.3	22.0	70.0	22
Dimethyl phthalate	53	53	71	160	24
Diethyl phthalate	61	110	200	1200	67
Di-n-butyl phthalate	220	1700	1400	5100	467
Butyl benzyl phthalate	4.9	64	63	900	21
Bis[2-ethylhexyl]phthalate	47	78	1300	3100	433
Di-n-octyl phthalate	58	4500	6200	6200	2067
Miscellaneous					
	(mg/kg -OC)	(mg/kg -OC)	µg/kg dry weight	µg/kg dry weight	µg/kg dry weight
Dibenzofuran	15	58	540	540	180
Hexachlorobutadiene	3.9	6.2	11.0	120.0	11
N-nitrosodiphenylamine	11	11	28	40	28

TABLE 7
PRELIMINARY SEDIMENT SCREENING LEVELS
TRU-GRIT FACILITY
TACOMA, WASHINGTON

Constituents	Sediment Quality Standards (SQS) Chapter 173-204 WAC (a)	Cleanup Screening Levels (CSL) Chapter 173-204 WAC (b)	SQS Dry Weight Equivalent (c)	CSL Dry Weight Equivalent (c)	Recommended Practical Quantitation Limits
Pesticides/PCBs	(mg/kg -OC)	(mg/kg -OC)	µg/kg dry weight	µg/kg dry weight	µg/kg dry weight
Total PCBs	12	65	130	1000	6
Ionizable Organic Compounds	(mg/kg -OC)	(mg/kg -OC)	µg/kg dry weight	µg/kg dry weight	µg/kg dry weight
Phenol	420	1200	420	1200	140
2-Methylphenol	63	63	63	63	63
4-Methylphenol	670	670	670	670	223
2,4-Dimethylphenol	29	29	29	29	29
Pentachlorophenol	360	690	360	690	120
Benzyl alcohol	57	73	57	73	57
Benzoic acid	650	650	650	650	217

(a) Marine sediment quality standards set forth in WAC 173-204-320, unless otherwise indicated.

(b) Marine sediment cleanup screening criteria set forth in WAC 173-204-520, unless otherwise indicated.

(c) Dry weight equivalent criteria are based on the Puget Sound Apparent Effect Threshold Values (Barrick et al. 1988)

Sampling and Analysis Plan

**Sampling and Analysis Plan
Remedial Investigation / Feasibility Study
Work Plan
Tru-Grit Facility
Tacoma, Washington**

February 6, 2013

Prepared for

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TABLES

<u>Table</u>	<u>Title</u>
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A-2	Sample Size, Containers, and Analytical Methods
A-3	Recommended Sample Preparation Methods, Cleanup Methods, Analytical Methods, and Practical Quantitation Limits for Sediments
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1.0 INTRODUCTION

This sampling and analysis plan (SAP) describes the procedures for conducting field activities during the remedial investigation (RI) and feasibility study (FS) at the Tru-Grit Facility (facility), located at 1110 Alexander Avenue and bordering the Blair Waterway in Tacoma, Washington. This SAP is Appendix A to the main document: *Site Work Plan, Remedial Investigation/Feasibility Study, Tru-Grit Facility, 1110 Alexander Avenue Tacoma, Washington* (Work Plan; Landau Associates 2012). The primary objective of this SAP is to provide sampling, sample handling, and analytical testing methodologies consistent with accepted procedures such that the data collected will be adequate for using in characterizing sediment and upland conditions.

This SAP was prepared consistent with the requirements of the Washington Administrative Code (WAC) Chapter 173-340-820, the Sediment Management Standards (SMS; WAC 173-204; Ecology 1995), and the Sediment Sampling and Analysis Plan Appendix (Ecology 2008). This SAP provides field, sampling, and analytical procedures to be use during the RI.

2.0 OBJECTIVES AND DESIGN OF INVESTIGATION

This section establishes the objectives of the sediment and upland investigation, gives a brief overview of the design of the investigation, and provides an explanation of chemical analyses that will be performed as part of this investigation.

2.1 OBJECTIVE

As noted in Section 1.0, the goal of the RI is to determine the lateral and vertical extent of contamination at the facility and to determine if there are ongoing sources of sediment contamination in upland areas. This information will be used to develop, evaluate, and select appropriate cleanup actions in the FS.

2.2 SAMPLING STANDARDS

Sampling will be undertaken to address the analytical requirements set forth in the SMS (WAC 173-204). The current Washington State Department of Ecology (Ecology) guidance document *Sediment Sampling and Analysis Plan Appendix* (Ecology 2008) was used to develop this SAP and to ensure that SMS requirements are achieved. To address the SMS requirements, a subset of the sediment samples collected during this investigation will be analyzed for the full suite of 47 SMS chemicals and the additional conventional sediment variables. The remaining sediment and soil samples will be analyzed for copper, zinc, and arsenic to delineate the lateral and vertical extent of contamination.

Sediment sample results are compared against two sets of criteria. The marine sediment quality standard (SQS; WAC 173-204-320) and the sediment cleanup screening level criteria (CSL; WAC 173-204-520). The SQS is the concentration below which effects to biological resources and human health are unlikely, where as the CSL is the concentration above which more than minor adverse biological effects may be expected. Sediment criteria are presented in Table 7 of the Work Plan.

Upland soil samples will be compared against preliminary screening levels (PSLs) presented in Table 6 of the work plan. PSLs were developed in accordance with MTCA (WAC 173-340).

2.3 OVERALL SAMPLING DESIGN

As noted in the Work Plan, previous investigation at the facility determined that the area directly under and near the ship-to-shore conveyance system at the Tru-Grit facility contained raw grit material (Landau 2009). At the southwestern end of the ship-to-shore conveyance system, the grit material was present in a sufficient quantity to increase the copper and zinc concentrations in the sediment to levels above the CSL in one location (G-5). Results of the previous investigation were indicative of localized

impacts at the site resulting from release of grit material to the waterway but also of area-wide impact to sediment from past industrial operations at multiple facilities. Although arsenic is not a contaminant of concern at the site, sampling for arsenic will be conducted to differentiate site contamination from area-wide impacts. In accordance with the results of the previous investigation, as well as the main goal of the current RI, the following three areas of concern have been identified:

- The upland area
- The intertidal (beach) area
- The subtidal waterway.

2.4 SAMPLE STATION LOCATIONS

Sampling locations are shown on Figure A-1 and A-2, and include 5 upland area soil samples, 4 beach sediment samples, and 20 sediment grab samples and cores in the subtidal waterway (including background samples). Sample locations were chosen based on information from the previous sediment investigation and possible contaminant sources and pathways.

3.0 FIELD INVESTIGATION PROCEDURES

Planned field investigation activities associated with the RI/FS include collecting surface samples from the upland and beach areas and collection of surface grab and sediment core samples from the subtidal waterway.

3.1 SITE RECONNAISSANCE AND UTILITY LOCATE

A site reconnaissance and utility locate will be conducted prior to investigation activities to identify underwater obstructions (e.g., underwater cables) to planned sediment coring, sediment grab samples, or anchoring required to accomplish these activities. If necessary, exploration locations will be relocated to accommodate obstructions.

3.2 UPLAND AND BEACH INVESTIGATION

Within the beach and the upland areas, discrete soil samples will be collected. Of these samples, six will come from within the beach area and six samples from within the upland area. Sample locations are identified in Figure A-1. Sample locations will be identified in the field using a hand-held global positioning system (GPS); GPS coordinates for each sample location are provided in Table A-1. Field coordinates will be recorded on the sample collection form or in the GPS unit. At each discrete sampling location, a soil punch, hand corer, hand auger or other hand implement will be used to excavate soil to the appropriate maximum sampling depth. The maximum sampling depth for upland soil is 6 inches. The maximum sampling depth for surface sediment grab samples is 10 centimeters (cm). Individual soil and sediment samples will be collected from large enough areas to ensure that adequate sample volume is collected. Using a decontaminated stainless steel trowel, any vegetation will first be removed from the sample area. All soil or sediment within the sample area, to a depth of 6 inches or 10 cm, respectively, will be removed and placed in a stainless steel bowl. Thorough homogenization in the bowl, with a stainless steel spoon, will ensure sample representativeness. The corer, spoons, and steel tape will be thoroughly decontaminated before each use by an Alconox[®] wash and scrub followed by a deionized water rinse. Wash and rinse water will be disposed of on the ground at least 10 ft from any sample location.

Two groundwater samples will be collected from seeps along the shoreline. Numerous seeps were noted along the shoreline at low tide during a September 17, 2012 site visit. Final determination of the location of the two samples will be made in the field during sample collection. Samples will be collected at a tide elevation of +2.5 ft or lower.

Groundwater samples will be collected using a peristaltic pump and will be field-filtered using a 0.45 micron filter and preserved with nitric acid in accordance with dissolved metals sampling protocols (EPA 2000). Dedicated tubing will be used for each sample, thus decontamination of equipment will not be necessary. Field parameters including pH, temperature, dissolved oxygen, oxygen reduction potential, and turbidity will be measured during sample collection. Seep water will also be monitored for conductivity, to evaluate if seep water represents upland groundwater discharge, or seawater that has infiltrated the upland area during higher tide cycles.

3.3 SEDIMENT INVESTIGATION

Sampling locations will be identified using a GPS or differentially corrected global positioning system (DGPS), if available. Actual sample coordinates will be recorded on the sample collection forms or in the GPS unit. Table A-1 presents a list of sample locations, their GPS coordinates, and approximate depth to the mudline.

3.3.1 SHALLOW SEDIMENT INVESTIGATION

Surface grab sediment samples will be collected with a stainless steel power-grab sediment sampler. The sampler will be decontaminated between grab samples. Once collected, overlying water will be removed with a siphon. Sediment samples will be collected and homogenized only if the following conditions are met:

- Water above the sediment has equal or less turbidity than ambient water conditions. Excess turbidity is indicative of sample disturbance during collection.
- The power-grab sampler is not overfilled, resulting in the loss of finer grained sediment. If the sampler is overfilled, weights will be removed, and the sample attempted from a new, nearby [within 10 feet (ft)], location.
- The sediment sampler did not close incompletely due to obstructions (e.g., woody debris), resulting in erosion or disturbance of the sediment surface.
- The sampler experiences complete penetration. If this does not occur, weights will be added to the sampler and the sample attempted from a new, nearby (within 10 ft), location. If three attempts fail to reach the penetration depth, the final sample will be collected and the conditions noted in the field log.

Only shallow sediment grabs that meet the above standards will be collected. Prior to collection and homogenization, a photograph will be taken of the full power-grab sampler that includes a scale and the sample name and date. Sediment will be characterized in the field sample collection form. This characterization will include color, odor, sheen, grain size, and a soil description consistent with the Unified Soil Classification System (USCS). To determine if grit is present, approximately 1 ounce of

sediment will be rinsed through an ASTM International No. 200 sieve to remove fines. Because grit material is processed to remove significant fines prior to transport by barge to the Tru-Grit facility, further sieving is unlikely to remove significant grit material. Sediment remaining in the sieve after rinsing will be placed under a microscope or hand lens for identification of grit material within the sample.

Sediment will be collected from the benthic zone (top 10 cm of the sediment) from an area large enough to ensure adequate sample volume and excluding portions that are touching the power-grab sampler. This collected sediment will exclude large, unrepresentative material (e.g., shells, woody debris). Sediment will be homogenized in decontaminated stainless steel bowls, using a decontaminated stainless steel spoon. After sufficient homogenization, sediment will be placed into laboratory supplied containers and placed on ice. Unused sediment will be contained for later disposal.

3.3.2 DEEP SEDIMENT INVESTIGATION

Deeper sediments will be collected using vibrocore sediment coring methods, using the following steps:

- Actual tide level will be confirmed at a surveyed location on or near the site at least three times during the sampling day, and compared to listed tides. If these are in exact agreement throughout the first day, this step can be eliminated during later sampling.
- Water depth will be measured using a weighted line.
- The actual mudline at the sample location will be calculated (this may be slightly different than the expected mudline at the sample location based on mapped bathymetry).
- A minimum penetration depth of 100 cm (~3.3 ft) will be achieved.
- Collected cores will be allowed to settle until the overlying water is almost clear and the recovery length will be measured.
- Cores that have over 75 percent recovery length will be saved and numerically decompacted during processing.
- Cores that have under 75 percent recovery length will be returned to the collection site and a new core will be collected in the nearby (within 10 ft) vicinity. If refusal is encountered prior to full penetration, the vibrocore will be repositioned and a new core will be attempted. If refusal is met during the third such attempt, this core will be collected and noted in the field log.
- Cores will be drained of overlying water, capped, and labeled with the sample number, date, and surface direction. Cores will be stored on ice overnight in a secure location, or will be transported to the lab for storage each night.

3.3.2.1 Core processing

Core processing will be accomplished at the laboratory, after sample collection is complete. Length intervals to be sampled are discussed in Section 6.5 of the work plan. Core processing will be accomplished using the following steps:

- Care will be taken to avoid spills and plastic sheeting will cover all laboratory surfaces during processing.
- Cores will be cut open lengthwise using sheet metal sheers, leaving the caps on the core to maintain core-tube integrity.
- The outer sediment surface (that was touching the liner) will be removed with a decontaminated stainless steel spoon and disposed of.
- The core will be split in half lengthwise, using a decontaminated stainless steel spatula.
- All interval measurements will be adjusted according to the percent retention (length of sediment sample retrieved/penetration depth of core tube) of the sediment collected within each individual core tube. For example, if 6 ft of sediment were retrieved from a core with a penetration depth of 8 ft, the retention ratio was 0.75 or 75 percent. The resulting intervals to be sampled would then be adjusted for 75 percent sediment retention.
- A photograph will be taken of the individual sediment layers that include the sample name, the layer depth range, processing date and original surface direction.
- Sediment will be characterized in the sample collection form. This characterization will include color, odor, grain size, and a soil description consistent with the USCS. This description will also include any oil sheen, biological activity (e.g., shells, worms, etc.), debris, or other distinguishing features and the depth at which these occur.
- Sediment will be collected from each individual layer, excluding sediment portions that are touching core walls, and homogenized in decontaminated stainless steel bowls using a decontaminated stainless steel spoon.
- An aliquot of sample from each layer will be placed under a microscope and examined for the presence of grit. The approximate percentage of grit in the sample will be noted in the field log. As needed, magnified photographs of the sediment may be taken to document the presence or absence of grit material.
- After sufficient homogenization, sediment will be placed into laboratory supplied containers and placed on ice. Enough volume (0.5 inch headspace) will be left in archived sample containers to accommodate expansion of the sample during freezing.

3.3.3 DECONTAMINATION

All field sampling equipment, including vibrocore heads, stainless steel bowls and spoons, and sample core tubes will be decontaminated in the following manner:

- Rinsed with clean site water
- Scrubbed with Alconox
- Rinsed with clean site water.

Equipment used during core processing at the laboratory will be rinsed with clean tap water initially, and the final rinse will be with de-ionized water.

3.3.4 LABELING

Sample identification will adhere to the following format: Sampling Type and location (e.g., U-1 for upland samples, SG-1 for sediment grab or BSG-1 for background sediment grab, SC-1 for sediment core, respectively), followed by the depth range for core samples [e.g., SC-1(2-3) for core sample one from a depth of between 2 and 3 ft).

3.3.5 SAMPLE CUSTODY

The primary objective of sample custody is to create an accurate, written record that can be used to trace the possession and handling of samples so that their quality and integrity can be maintained from collection until completion of all required analyses. Adequate sample custody will be achieved by means of approved field and analytical documentation. Such documentation includes the chain-of-custody record that is initially completed by the sampler and is, thereafter, signed by those individuals who accept custody of the sample. A sample is in custody if at least one of the following is true:

- It is in someone's physical possession
- It is in someone's view
- It is secured in a locked container or otherwise sealed so that tampering will be evident
- It is kept in a secured area, restricted to authorized personnel only.

Sample control and chain-of-custody in the field and during transportation to the laboratory will be conducted in general conformance with the procedures described below:

- As few persons as possible will handle samples.
- Sample bottles will be obtained new or pre-cleaned from the laboratory performing the analyses.
- The sample collector will be personally responsible for the completion of the chain-of-custody record and the care and custody of samples collected until they are transferred to another person or dispatched properly under chain-of-custody rules.
- The coolers in which the samples are transported will be accompanied by the chain-of-custody record identifying their contents. The original record and laboratory copy will accompany the shipment. The other copy will be forwarded to Landau Associates along with sample collection forms.

When samples are transferred, the individuals relinquishing and receiving the samples will sign the chain-of-custody form in the appropriate space and record the date and time of transfer.

A designated sample custodian at the laboratory will accept custody of the samples and certify that the sample identification numbers match those on the chain-of-custody record. The custodian will then enter sample identification number data into a log that will be maintained by the laboratory.

All documentation and other project records will be safeguarded to prevent loss, damage, or alteration. If an error is made on a document, corrections will be made by drawing a single line through the error and entering the correct information. The erroneous information will not be obliterated. Corrections will be initialed and dated and, if necessary, a footnote explaining the correction will be included. Errors will be corrected by the person who made the entry, whenever possible.

3.3.6 RESIDUAL WASTE MANAGEMENT

Contaminated sediments that are not immediately returned to the site location will be disposed in 55-gallon drums at a designated site, awaiting analytical results. Each drum will be labeled identifying the contents and the approximate extent that the drum is filled, the accumulation start date, and the explorations from which the sediment was generated. The client will assume responsibility of disposing of site waste appropriately.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

This section describes the quality assurance/quality control (QA/QC) procedures in support of the RI at the Tru-Grit facility. This section will establish the project team organization and responsibilities, the quality assurance objectives, laboratory analytical methods, QA/QC requirements and corrective actions for this project.

4.1 PROJECT TEAM ORGANIZATION AND RESPONSIBILITIES

The project team organizational structure was developed based on the requirements of the field and laboratory activities. The key positions/contractors and associated responsibilities are described below:

- **Consultant Project Manager:** Responsible for implementation of all aspects of the project plans. Specific responsibilities include review and approval of revisions to RI documentation, overseeing that all technical procedures are followed, reporting of deviations from the Ecology-approved project plans to the Ecology project coordinator and overseeing that data collected will satisfy the quality assurance objectives.
- **Ecology Project Coordinator:** Responsible for overseeing implementation of all aspects of the project plans. Specific responsibilities include review and approval of revisions to RI documentation, overseeing that all technical procedures are followed, and overseeing that data collected will satisfy the quality assurance objectives.
- **Analytical Laboratory:** Responsible for providing sample bottles, performing chemical analyses per the SAP and reporting of data as required by the SAP.
- **Field Sampling Personnel:** Responsible for implementing sampling procedures as specified in the project plans, notifying the consultant project manager of any deviations from the project plans.

4.2 QUALITY ASSURANCE OBJECTIVES

The Quality Assurance (QA) objectives for this project are to develop and implement procedures that will ensure collection of representative data of known, acceptable, and defensible quality. The data quality parameters used to assess the acceptability of the data are representativeness, comparability, precision, accuracy, bias, and completeness.

- Representativeness expresses the degree to which data accurately and precisely represent an actual condition or characteristic of a population. Representativeness can be achieved by selecting appropriate sampling locations and by using appropriate sampling methods.
- Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this work, comparability of data will be established through the use of standard analytical methodologies with analytical limits of quantitation (LOQs) that can meet screening level criteria to the extent practicable and by utilizing standard reporting formats.

- Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average values. Analytical precision is measured through matrix spike/matrix spike duplicate (MS/MSD) and/or through laboratory control sample/laboratory control sample duplicate (LCS/LCSD) for organic analysis and through laboratory duplicate samples for inorganic analyses. The quantitative relative percent difference (RPD) for laboratory duplicates, MS/MSD and field duplicates will be used to assess sampling and analytical precision.
- Accuracy is an expression of the degree to which a measured or computed value represents the true value. Field accuracy is controlled by adherence to sample collection procedures as outlined in this SAP.
- Bias is the systematic or persistent distortion of a measured process that causes errors in one direction. Bias of the laboratory results will be evaluated based on analysis of method blanks and matrix spike samples.
- Completeness is a measure of the proportion of data obtained from a task sampling plan that is determined to be valid. It is calculated as the number of valid data points divided by the total number of data points requested.

4.3 LABORATORY ANALYTICAL METHODS

Soil samples from the upland and beach areas will be analyzed for copper and zinc using U.S. Environmental Protection Agency (EPA) Method 6010. If groundwater samples are collected during a second phase of investigation, they will be analyzed for copper and zinc by EPA Method 6010. Two sediment samples will be analyzed for the full suite of 47 SMS chemicals and the additional conventional sediment variables. The remaining sediment and soil samples will be analyzed for copper, zinc, and arsenic to delineate the lateral and vertical extent of contamination. Sample containers, preservation, and holding times are provided in Table A-2. Sample analytical methods and practical quantitation limits for sediments are presented in Table A-3. Analytical methods and quantitation limit goals for upland soil and groundwater samples are provided in Table A-4.

4.4 FIELD AND LABORATORY QUALITY CONTROL PROCEDURES

Field and analytical laboratory quality control samples will be collected to evaluate data precision, accuracy, representativeness, completeness, bias, and comparability of the analytical results for the RI. The quality control samples and the frequency at which they will be collected and/or analyzed are described below. Acceptance criteria for laboratory quality control samples are presented in Table A-5 for sediments and in Table A-6 for soil and water.

4.4.1 BLIND FIELD DUPLICATES

A blind field duplicate will be collected at a frequency of at least 1 per 20 sediment samples per chemical analysis and not less than one field duplicate. The blind field duplicate will consist of a split sample collected at a single sample location, after homogenization of the sample. Blind field duplicate sample results will be used to evaluate data precision. Acceptance criteria for blind field duplicate samples are 20% relative percent difference (RPD) for water and 35% RPD for soil and sediment.

4.4.2 LABORATORY MATRIX SPIKE/ MATRIX SPIKE DUPLICATE

A minimum of one laboratory MS/MSD will be analyzed per 20 samples, or one MS/MSD sample per batch of samples if fewer than 20 samples will be performed for all analyses. These analyses will be performed to provide information on accuracy and to verify that extraction and concentration levels are acceptable. The laboratory spikes will follow EPA guidance for MS and MSDs.

4.4.3 LABORATORY DUPLICATES

A minimum of one laboratory duplicate per 20 samples, or one laboratory duplicate sample per batch of samples if fewer than 20 samples are contained in a batch, will be analyzed for metals. These analyses will be performed to provide information on the precision of chemical analyses. The laboratory duplicate will follow EPA guidance in the method.

4.4.4 LABORATORY METHOD BLANKS

A minimum of one laboratory method blank per 20 samples, one every 12 hours, or one per batch of samples analyzed (if fewer than 20 samples are contained in a batch) will be analyzed for all parameters to assess possible laboratory contamination. Dilution water will be used whenever possible. Method blanks will contain all reagents used for analysis. The generation and analysis of additional method, reagent, and glassware blanks may be necessary to verify that laboratory procedures do not contaminate samples.

4.4.5 LABORATORY CONTROL SAMPLE

A minimum of one LCS per 20 samples, or one LCS per sample batch if fewer than 20 samples are contained in a batch, will be analyzed for all parameters.

4.4.6 SURROGATE SPIKES

All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined by the analytical methods.

4.5 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

QA/QC for chemical testing includes laboratory instrument and analytical method QA/QC. Instrument QA/QC monitors the performance of the instrument and method QA/QC monitors the performance of sample preparation procedures. The analytical laboratory will be responsible for instrument and method QA/QC. QA/QC procedures to be performed by the laboratory will be in accordance with methods specified in Table A-3.

When an instrument or method control limit is exceeded, the laboratory will contact the project manager immediately. The laboratory will be responsible for correcting the problem and will reanalyze the samples within the sample holding time if sample reanalysis is appropriate.

4.6 CORRECTIVE ACTIONS

Corrective actions will be needed for two categories of nonconformance:

- Deviations from the methods or QA requirements established in this document
- Equipment or analytical malfunctions.

Corrective action procedures to be implemented based on detection of unacceptable data are developed on a case-by-case basis. Such actions may include one or more of the following:

- Altering procedures in the field or laboratory
- Using a different batch of sample containers
- Performing an audit of field or laboratory procedures
- Reanalyzing samples (if holding times allow)
- Resampling and analyzing
- Evaluating sampling and analytical procedures to determine possible causes of the discrepancies
- Accepting the data without action, acknowledging the level of uncertainty
- Rejecting the data as unusable.

During field operations and sampling procedures, the field personnel will be responsible for conducting and reporting required corrective actions. A description of any action taken will be entered in the daily field notebook. The project manager will be consulted immediately if field conditions are such that conformance with this SAP is not possible.

During laboratory analysis, the laboratory QA officer will be responsible for taking required corrective actions in response to equipment malfunctions. If an analysis does not meet data quality objectives outlined, corrective action will follow the guidelines in the noted EPA analytical methods and

the EPA guidelines for data validation for organics and inorganics analyses (EPA 1999, 2004). At a minimum, the laboratory will be responsible for monitoring the following:

- Calibration check compounds must be within performance criteria specified in the EPA method or corrective action must be taken prior to initiation of sample analysis. No analyses may be performed until these criteria are met.
- Before processing any samples, the analyst should demonstrate, through analysis of a reagent blank that interferences from the analytical system, glassware, and reagents are within acceptable limits. Each time a set of samples is extracted or there is a change in reagents, a reagent blank should be processed as a safeguard against chronic laboratory contamination. The blank samples should be carried through all stages of the sample preparation and measurement steps.
- Method blanks should, in general, be below instrument detection limits. If contaminants are present, then the source of contamination must be investigated, corrective action taken and documented, and all samples associated with a contaminated blank reanalyzed. If, upon reanalysis, blanks do not meet these requirements, Landau Associates will be notified immediately to discuss whether analyses may proceed.
- Surrogate spike analysis must be within the specified range for recovery limits for each analytical method utilized or corrective action must be taken and documented. Corrective action includes: 1) reviewing calculations, 2) checking surrogate solutions, 3) checking internal standards, and 4) checking instrument performance. Subsequent action could include recalculating the data and/or reanalyzing the sample if any of the above checks reveal a problem. If the problem is determined to be caused by matrix interference, reanalysis may be waived if so directed following consultation with Landau Associates. If the problem cannot be corrected through reanalysis, the laboratory will notify Landau Associates prior to data submittal so that additional corrective action can be taken, if appropriate.
- If the recovery of a surrogate compound in the method blank is outside the recovery limits, the blank will be reanalyzed along with all samples associated with that blank. If the surrogate recovery is still outside the limits, Landau Associates will be notified immediately to discuss whether analyses may proceed.
- If quantitation limits or matrix spike control limits cannot be met for a sample, Landau Associates will be notified immediately to discuss corrective action required.
- If holding times are exceeded, all positive and undetected results may need to be qualified as estimated concentrations. If holding times are grossly exceeded, Landau Associates may determine the data to be unusable.

If analytical conditions are such that nonconformance is indicated, Landau Associates will be notified as soon as possible so that any additional corrective actions can be taken. The laboratory project manager will then document the corrective action by a memorandum submitted to Landau Associates. A narrative describing the anomaly; the steps taken to identify and correct the anomaly; and any recalculation, reanalyses, or re-extractions will be submitted with the data package in the form of a cover letter.

4.7 DATA VERIFICATION AND VALIDATION

All RI data will be verified and validated to determine the results are acceptable and meet the quality objectives. Prior to submitting a laboratory report, the laboratory will verify that all the data are consistent, correct, and complete, with no errors or omissions.

Validation of the data will be performed by Landau Associates following the guidelines in the appropriate sections of the EPA Contract Laboratory Program *National Functional Guidelines for Organic and Inorganic Data Review* (EPA 1999, 2004) and will include evaluations of the following:

- Chain-of-custody records
- Holding times
- Laboratory method blanks
- Surrogate recoveries
- Laboratory MS/MSD
- Blank spikes/LCS
- Laboratory duplicates
- Corrective action records
- Completeness
- Overall assessment of data quality.

In the event that a portion of the data is outside the data quality objective limits or the EPA guidance (EPA 1999, 2004), or sample collection and/or documentation practices are deficient, corrective action(s) will be initiated. Corrective action will be determined by the field coordinator and Landau Associates' QA officer in consultation with the Landau Associates project/task manager and may include any of the following:

- Rejection of the data and resampling
- Qualification of the data
- Modified field and/or laboratory procedures.

Data qualification arising from data validation activities will be described in the data validation report, rather than in individual corrective action reports.

4.8 DATA MANAGEMENT PROCEDURES

All laboratory analytical results, including QC data, will be submitted electronically to Landau Associates. Electronic format will include a scanned PDF of the original laboratory data package and comma separated value (CSV) files that will be downloaded directly to an Excel spreadsheet and/or to the

project database. The laboratory data package should include a case narrative along with analytical and quality control results. Following validation of the data, any qualifiers will be added to the Excel spreadsheets and project database. All survey data will be provided electronically in a format that can be downloaded into an Excel spreadsheet. All field data will be entered into an Excel spreadsheet and verified to determine all entered data is correct and without omissions and errors. Following receipt of all RI data and all survey data, water level measurements, field parameters, and analytical results will be formatted electronically and uploaded to Ecology's Environmental Information Management (EIM) system.

5.0 HEALTH AND SAFETY

A project health and safety plan for implementation of field activities described in the Work Plan and this SAP is provided in Appendix C of the main document. All Landau Associates employees will follow the procedures described in this plan. Landau Associates subcontractors will either adopt this plan or prepare their own plan that is at least as protective as this plan.

6.0 REFERENCES

Ecology. 2008. *Sediment Sampling and Analysis Plan Appendix*. Publication No. 03-09-043. Washington State Department of Ecology. February.

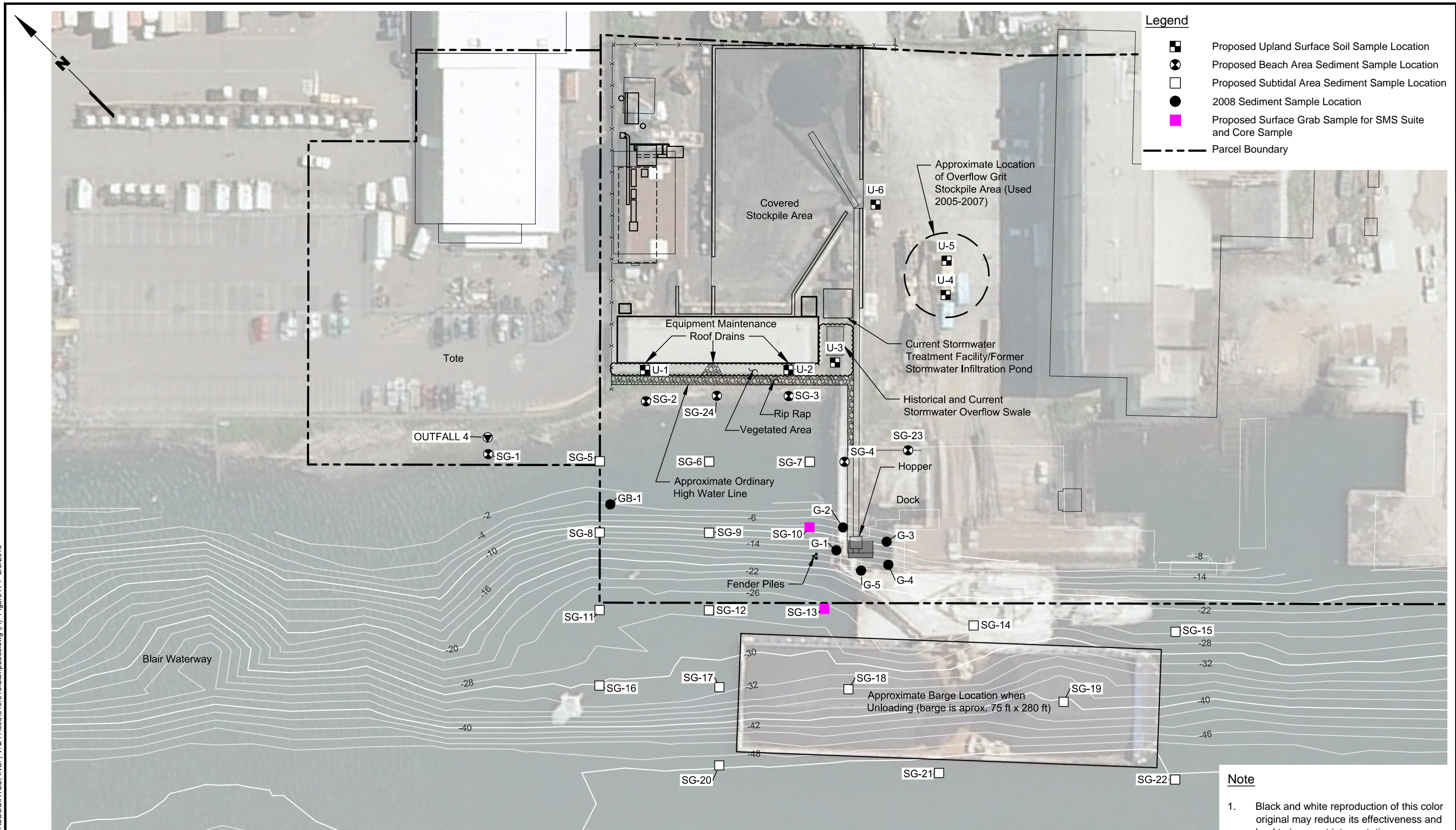
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EPA. 2000. *Collecting Water Quality Samples for Dissolved Metals in Water*. U.S. Environmental Protection Agency, Region 6. January 13.

EPA. 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*. EPA-540/R-99-008. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. Washington, D.C. October.

Landau Associates. 2009. Report: *Tru-Grit Facility Sediment Sampling and Analysis Results Tacoma, Washington*. Prepared for CanAm Minerals, Inc. July 22.

LANDAU ASSOCIATES, INC. | V:\2411008\010.013\SampLocs.dwg (A) Figure A-1* 2/6/2013





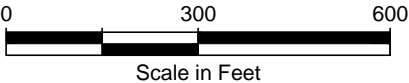
Legend

- Parcel Boundary Line
- Background Grab Sample Location

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: Google Earth Pro 2010



Tru-Grit Facility
Tacoma, Washington

Background Sample Locations

Figure
A-2

TABLE A-1
SEDIMENT SAMPLE LOCATIONS AND ELEVATIONS
TRU-GRIT FACILITY
TACOMA, WASHINGTON

Sample Location	Northing (a)	Easting (a)	Elevation (b)
SG-1	712778.7	1168493.7	Beach
SG-2	712732.1	1168591.5	Beach
SG-3	712670.1	1168660.7	Beach
SG-4	712614.1	1168657.1	Beach
SG-5	712724.9	1168542.8	at or above MLLW
SG-6	712675.3	1168594.0	at or above MLLW
SG-7	712629.7	1168641.0	at or above MLLW
SG-8	712691.6	1168510.6	at or above MLLW
SG-9	712642.0	1168561.7	-11.1
SG-10	712599.1	1168611.2	-8.6
SG-11	712655.4	1168475.5	-27.0
SG-12	712605.8	1168526.6	-27.4
SG-13	712554.5	1168581.3	-26.5
SG-14	712479.0	1168643.7	-23.1
SG-15	712384.8	1168735.3	-25.7
SG-16	712620.1	1168441.3	-30.2
SG-17	712565.1	1168496.7	-31.6
SG-18	712505.8	1168556.2	-34.2
SG-19	712402.6	1168651.2	-40.2
SG-20	712528.6	1168461.2	-49.6
SG-21	712425.6	1168560.7	-51.0
SG-22	712315.8	1168668.3	-50.4
SG-23	712590.7	1168692.1	Beach
SG-24	712702.7	1168627.1	Beach
BSG-1	712242.7	1168110.6	-45.1
BSG-2	713348.9	1167715.4	-47.8
G-5	712555.6	1168615.7	-18.3
U-1	712747.2	1168605.3	aprox. 14
U-2	712682.4	1168672.5	aprox. 14
U-3	712664.9	1168697.6	aprox. 14
U-4	712646.4	1168780.0	aprox. 16
U-5	712662.1	1168795.9	aprox. 16
U-6	712720.4	1168788.0	aprox. 16

(a) Washington State Plane North Zone coordinate system [North America Datum (NAD) 83]

(b) Feet Mean Lower Low Water

TABLE A-2
SAMPLE SIZE, CONTAINERS, AND ANALYTICAL METHODS
TRU-GRIT FACILITY
TACOMA, WASHINGTON

Sample Type	Container	Preservation	Maximum Holding Time
Metals	8 oz - WMG with teflon-lined lid	Cool, 4° C	6 months, 28 days for mercury
Volatiles	2 oz - WMG with teflon-lined lid	Cool, 4° C	14 days, 6 months (b)
Semivolatiles	8 oz - WMG with teflon-lined lid	Cool, 4° C	14 days (a), 1 year (b)
PCBs	8 oz - WMG with teflon-lined lid	Cool, 4° C	14 days (a), 1 year (b)
Pesticides	8 oz - WMG with teflon-lined lid	Cool, 4° C	14 days (a), 1 year (b)
TOC	4 oz - WMG with teflon-lined lid	Cool, 4° C	28 days, 6 months (b)
Total Solids	4 oz - WMG with septa lid	Cool, 4° C	14 days, 6 months (b)

PCBs = Polychlorinated Biphenyls

TOC= Total Organic Carbon

WMG = Wide Mouth Glass

oz = ounces

° C = degrees Celsius

EPA = U.S. Environmental Protection Agency

(a) Holding time shown is from sample collection to extraction; holding time from extraction to analysis is 40 days.

(b) Holding time shown is from sample collection to extraction if sample is frozen.

TABLE A-3
RECOMMENDED SAMPLE PREPARATION METHODS, CLEANUP METHODS,
ANALYTICAL METHODS, AND PRACTICAL QUANTITATION LIMITS FOR SEDIMENTS
TRU-GRIT FACILITY
TACOMA, WASHINGTON

Chemical	Recommended Sample Preparation Methods (a)	Recommended Sample Cleanup Methods (b)	Recommended Analytical Methods (c)	Recommended PQLs (d,e)
				(mg/kg dry weight)
Metals				
Arsenic	PSEP/3050B	--	6010B/6020/7061A	19
Cadmium	PSEP/3050B	--	6010B/6020/7131A	1.7
Chromium	PSEP/3050B	--	6010B/6020/7191	87
Copper	PSEP/3050B	--	6010B/6020	130
Lead	PSEP/3050B	--	6010B/6020	150
Mercury	-- (f)	--	7471A/245.5	0.14
Nickel	PSEP/3050B		6010B/6020	47
Silver	PSEP/3050B	--	6010B/6020	2
Zinc	PSEP/3050B	--	6010B/6020	137
				(µg/kg dry weight or as listed)
Nonionizable Organic Compounds				
LPAH Compounds				
Naphthalene	3540C/3550B/3545	3640A/3660B	8270C/1625C	700
Acenaphthylene	3540C/3550B/3545	3640A/3660B	8270C/1625C	433
Acenaphthene	3540C/3550B/3545	3640A/3660B	8270C/1625C	167
Fluorene	3540C/3550B/3545	3640A/3660B	8270C/1625C	180
Phenanthrene	3540C/3550B/3545	3640A/3660B	8270/1625C	500
Anthracene	3540C/3550B/3545	3640A/3660B	8270C/1625C	320
2-Methylnaphthalene	3540C/3550B/3545	3640A/3660B	8270C/1625C	223
HPAH Compounds				
Fluoranthene	3540C/3550B/3545	3640A/3660B	8270C/1625C	567
Pyrene	3540C/3550B/3545	3640A/3660B	8270C/1625C	867
Benz[a]anthracene	3540C/3550B/3545	3640A/3660B	8270C (h) / 1625C	433
Chrysene	3540C/3550B/3545	3640A/3660B	8270C (h) / 1625C	467
Total benzofluoranthenes (g)	3540C/3550B/3545	3640A/3660B	8270C (h) / 1625C	1067
Benzo[a]pyrene	3540C/3550B/3545	3640A/3660B	8270C (h) / 1625C	533
Indeno[1,2,3-cd]pyrene	3540C/3550B/3545	3640A/3660B	8270C (h) / 1625C	200
Dibenz[a,h]anthracene	3540C/3550B/3545	3640A/3660B	8270C (h) / 1625C	77
Benzo[ghi]perylene	3540C/3550B/3545	3640A/3660B	8270C/1625C	223
Chlorinated Benzenes				
1,2-Dichlorobenzene	3540C/3550B/3545	3640A/3660B	8270C (h) / 1625C	35
1,4-Dichlorobenzene	3540C/3550B/3545	3640A/3660B	8270C (h) / 1625C	37
1,2,4-Trichlorobenzene	3540C/3550B/3545	3640A/3660B	8270C (h) / 1625C	31
Hexachlorobenzene	3540C/3550B/3545	3640A/3660B	8270C (h) / 1625C	22
Phthalate Esters				
Dimethyl phthalate	3540C/3550B/3545	3640A/3660B	8270C/1625C	24
Diethyl phthalate	3540C/3550B/3545	3640A/3660B	8270C/1625C	67
Di-n-butyl phthalate	3540C/3550B/3545	3640A/3660B	8270C/1625C	467
Butyl benzyl phthalate	3540C/3550B/3545	3640A/3660B	8270C/1625C	21
Bis[2-ethylhexyl]phthalate	3540C/3550B/3545	3640A/3660B	8270C/1625C	433
Di-n-octyl phthalate	3540C/3550B/3545	3640A/3660B	8270C/1625C	2067
				(µg/kg dry weight or as listed)
Miscellaneous Extractable Compounds				
Dibenzofuran	3540C/3550B/3545	3640A/3660B	8270C/1625C	180
Hexachlorobutadiene	3540C/3550B/3545	3640A/3660B	8270C/1625C	11
N-nitrosodiphenylamine	3540C/3550B/3545	3640A/3660B	8270C/1625C	28
PCBs				
PCB Aroclors®	3540/3550	3620B/3640A/3660B	8082	6

TABLE A-3
RECOMMENDED SAMPLE PREPARATION METHODS, CLEANUP METHODS,
ANALYTICAL METHODS, AND PRACTICAL QUANTITATION LIMITS FOR SEDIMENTS
TRU-GRIT FACILITY
TACOMA, WASHINGTON

Chemical	Recommended Sample Preparation Methods (a)	Recommended Sample Cleanup Methods (b)	Recommended Analytical Methods (c)	Recommended PQLs (d,e)
Volatile Organic Compounds				
Ionizable Organic Compounds				
Phenol	3540C/3550B/3545	3640A/3660B	8270C/1625C	140
2-Methylphenol	3540C/3550B/3545	3640A/3660B	8270C/1625C	63
4-Methylphenol	3540C/3550B/3545	3640A/3660B	8270C/1625C	223
2,4-Dimethylphenol	3540C/3550B/3545	3640A/3660B	8270C/1625C	29
Pentachlorophenol	3540C/3550B/3545	3640A/3660B	8270C/1625C	120
Benzyl alcohol	3540C/3550B/3545	3640A/3660B	8270C/1625C	57
Benzoic acid	3540C/3550B/3545	3640A/3660B	8270C/1625C	217
Conventional Sediment Variables				
Grain size	-- (j)	--	Plumb (1981)	1%
TOC	-- (j)	--	9060	0.10%

Protocol, Appendix A (PSWQA, 1996) Krone 1998

73 ug TBT/Kg Bulk

.05 ug TBT/L pour water

EPA - U.S. Environmental Protection Agency

GPC - gel permeation chromatography

HPAH - high molecular weight polycyclic aromatic hydrocarbon

LAET = Lowest Apparent Effects Threshold

LPAH - low molecular weight polycyclic aromatic hydrocarbon

NCASI = National Council for Air and Stream Improvement, Inc.

Ni = Nickel

PCB - polychlorinated biphenyl

PCDD = polychlorinated dibenzo-p-dioxins

PCDF = polychlorinated dibenzofurans

PQL = Practical Quantitation Limits

PSEP - Puget Sound Estuary Program

RA/FA =

Sb = Antimony

TOC = total organic carbon

VOC = Volatile Organic Compounds

mg/L = milligrams per liter

mL = milliliter

ng/kg = nanograms per kilogram

µg/kg = micrograms per kilogram

(a) Recommended sample preparation methods are:

- PSEP (1997a)

- Method 3050B and 3500 series - sample preparation methods from SW-846 (EPA 1996) and subjected to changes by EPA updates.

(b) Recommended sample cleanup methods are:

- Sample extracts subjected to GPC cleanup follow the procedures specified by EPA SW-846 Method 3640A. Special care should be used during GPC to minimize loss of analytes.

- If sulfur is present in the samples (as is common in most marine sediments), cleanup procedures specified by EPA SW-846 Method 3660B should be used.

- All PCB extracts should be subjected to sulfuric acid/permanganate cleanup as specified by EPA SW-846 Method 3665A.

- Additional cleanup procedures may be necessary on a sample-by-sample basis. Alternative cleanup procedures are described in PSEP (1997b) and EPA (1986).

(c) Recommended analytical methods are:

- Method 6000, 7000, 8000, and 9000 series - analytical methods from SW-846 (EPA 1986) and updates.

- The SW-846 and updates are available from the web site at: <http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm>.

- Method 1613 - analytical method from EPA-821/B-94-005 (EPA 1994c).

- Method 1624C/1625C - isotope dilution method.

- NCASI analytical methods.

- Plumb (1981) - EPA/U.S. Army Corps of Engineers Technical Report EPA/CE-81-1

- PSEP (1986).

- Acid volatile sulfide method for sediment (EPA 1991).

(d) To achieve the recommended PQLs for organic compounds, it may be necessary to use a larger sample size (approximately 100 g), a smaller final extract volume for gas chromatography/mass spectrometry analyses (0.5 mL), and one of the recommended sample cleanup methods, as necessary, to reduce interference, using different analytical methods with better sensitivity. Detection limits are on a dry-weight basis unless otherwise indicated. For sediment samples with low TOC, it may be necessary to achieve even lower detection limits for certain analytes in order to compare the TOC-normalized concentrations with applicable numerical criteria.

(e) The recommended PQLs are based on a value equal to one third of the 1988 dry weight LAET value (Barrick et al 1988) except for the following chemicals:

1,2-dichlorobenzene, 1,2,4-trichlorobenzene, hexachlorobenzene, hexachlorobutadiene, n-nitrosodiphenylamine, 2-methylphenol, 2,4-dimethylphenol, and benzyl alcohol, for which the recommended maximum detection limit is equal to the full value of the 1988 dry weight LAET.

(f) The sample digestion method for mercury is described in the analytical method (Method 7471A, September 1994).

(g) Total benzofluoranthenes represent the sum of the b, j, and k isomers.

(h) Selected ion monitoring may improve the sensitivity of method 8270C and is recommended in cases when detection limits must be lowered to human health criteria levels or when TOC levels elevate detection limits above ecological criteria levels. See PSEP organics chapter, appendix B—Guidance for Selected Ion Monitoring (PSEP 1997b).

(i) Sample preparation methods for VOCs analyses are described in the analytical methods.

(j) Sample preparation methods for sediment conventional analyses are described in the analytical methods.

**TABLE A-4
 QUANTITATION LIMIT GOALS FOR SOIL AND GROUNDWATER
 TRU-GRIT FACILITY
 TACOMA, WASHINGTON**

Analyte	Analytical Method (a)	SOIL		WATER	
		Reporting Limits (b)	Units	Reporting Limits (b)	Units
METALS					
Copper	EPA-6010	ND(<0.2)	mg/kg	ND(<2.0)	µg/L
Zinc	EPA-6010	ND(<0.6)	mg/kg	ND(<10)	µg/L

ND = Not Detected.

(a) Analytical methods are from SW-846 (EPA 1986) and updates, unless otherwise noted.

(b) Reporting limit goals are based on current laboratory data and may be modified during the investigation process as methodology is refined. Laboratory reporting will be based on the lowest standard on the calibration curve. Instances may arise where high sample concentrations, nonhomogeneity of samples, or matrix interferences preclude achieving the desired reporting limits.

**TABLE A-5
LABORATORY QC SAMPLE ACCEPTANCE CRITERIA
SEDIMENT**

Analyte Description	CAS Number/ Method	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC Units	LCSRPD - Precision	LCSRPD Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
Metals (ICP)	6010B													
Arsenic	7440-38-2	80	120	%	20	%	80	120	%	20	%	--	--	--
Cadmium	7440-43-9	80	120	%	20	%	80	120	%	20	%	--	--	--
Chromium	7440-47-3	80	120	%	20	%	80	120	%	20	%	--	--	--
Copper	7440-50-8	80	120	%	20	%	80	120	%	20	%	--	--	--
Lead	7439-92-1	80	120	%	20	%	80	120	%	20	%	--	--	--
Silver	7440-22-4	75	120	%	20	%	75	120	%	20	%	--	--	--
Zinc	7440-66-6	80	120	%	20	%	80	120	%	20	%	--	--	--
Organochlorine Pesticides (GC)	8081A													
DCB Decachlorobiphenyl	2051-24-3	--	--	--	--	--	--	--	--	--	--	40	158	%
Tetrachloro-m-xylene	877-09-8	--	--	--	--	--	--	--	--	--	--	49	123	%
Hexachlorobenzene	118-74-1	10	188	%	37	%	10	188	%	30	%	--	--	--
Hexachlorobutadiene	87-68-3	37	119	%	39	%	37	119	%	30	%	--	--	--
TOC (Puget Sound)	9060_PSEP													
Total Organic Carbon	7440-44-0	27.8	170	%	35	%	50	140	%	35	%	--	--	--
Percent Moisture	Moisture													
Percent Solids	STL00234	80	120	%	--	--	--	--	--	--	--	--	--	--
Percent Moisture	STL00177	80	120	%	--	--	--	--	--	--	--	--	--	--
Total Solids	STL00291	80	120	%	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds (GC/MS)	8270C													
2-Fluorophenol	367-12-4	--	--	--	--	--	--	--	--	--	--	36	145	%

TABLE A-5
LABORATORY QC SAMPLE ACCEPTANCE CRITERIA
SEDIMENT

Phenol-d5	4165-62-2	--	--	--	--	--	--	--	--	--	--	38	149	%
2,4,6-Tribromophenol	118-79-6	--	--	--	--	--	--	--	--	--	--	28	143	%
Nitrobenzene-d5	4165-60-0	--	--	--	--	--	--	--	--	--	--	38	141	%
2-Fluorobiphenyl	321-60-8	--	--	--	--	--	--	--	--	--	--	42	140	%
Terphenyl-d14	1718-51-0	--	--	--	--	--	--	--	--	--	--	42	151	%
Phenol	108-95-2	66	126	%	26	%	70	140	%	26	%	--	--	--
1,4-Dichlorobenzene	106-46-7	62	132	%	32	%	75	125	%	32	%	--	--	--
Benzyl alcohol	100-51-6	42	147	%	60	%	55	125	%	60	%	--	--	--
1,2-Dichlorobenzene	95-50-1	68	118	%	60	%	75	125	%	60	%	--	--	--
2-Methylphenol	95-48-7	56	121	%	25	%	75	130	%	25	%	--	--	--
3 & 4 Methylphenol	15831-10-4	61	126	%	27	%	75	130	%	27	%	--	--	--
2,4-Dimethylphenol	105-67-9	58	133	%	60	%	65	140	%	60	%	--	--	--
Benzoic acid	65-85-0	10	130	%	60	%	20	175	%	60	%	--	--	--
1,2,4-Trichlorobenzene	120-82-1	63	128	%	28	%	70	125	%	28	%	--	--	--
Naphthalene	91-20-3	64	129	%	26	%	75	125	%	26	%	--	--	--
Hexachlorobutadiene	87-68-3	59	134	%	60	%	75	125	%	60	%	--	--	--
2-Methylnaphthalene	91-57-6	65	125	%	27	%	75	125	%	27	%	--	--	--
Dimethyl phthalate	131-11-3	65	125	%	60	%	60	160	%	60	%	--	--	--
Acenaphthylene	208-96-8	69	129	%	28	%	75	125	%	28	%	--	--	--
Acenaphthene	83-32-9	65	130	%	27	%	75	125	%	27	%	--	--	--
Dibenzofuran	132-64-9	70	125	%	60	%	75	125	%	60	%	--	--	--
Diethyl phthalate	84-66-2	64	129	%	26	%	60	155	%	26	%	--	--	--
Fluorene	86-73-7	68	128	%	31	%	75	125	%	31	%	--	--	--
N-Nitrosodiphenylamine	86-30-6	88	153	%	60	%	75	125	%	60	%	--	--	--
Hexachlorobenzene	118-74-1	61	136	%	60	%	75	125	%	60	%	--	--	--
Pentachlorophenol	87-86-5	29	124	%	68	%	55	125	%	68	%	--	--	--

**TABLE A-5
LABORATORY QC SAMPLE ACCEPTANCE CRITERIA
SEDIMENT**

Phenanthrene	85-01-8	65	125	%	28	%	75	125	%	28	%	--	--	--
Anthracene	120-12-7	73	123	%	27	%	75	125	%	27	%	--	--	--
Di-n-butyl phthalate	84-74-2	69	124	%	60	%	55	145	%	60	%	--	--	--
Fluoranthene	206-44-0	61	121	%	36	%	70	125	%	36	%	--	--	--
Pyrene	129-00-0	54	134	%	31	%	75	125	%	31	%	--	--	--
Butyl benzyl phthalate	85-68-7	65	140	%	60	%	55	145	%	60	%	--	--	--
Benzo[a]anthracene	56-55-3	64	124	%	27	%	75	125	%	27	%	--	--	--
Chrysene	218-01-9	71	126	%	26	%	75	125	%	26	%	--	--	--
Bis(2-ethylhexyl) phthalate	117-81-7	64	144	%	60	%	55	145	%	60	%	--	--	--
Di-n-octyl phthalate	117-84-0	58	148	%	31	%	55	145	%	31	%	--	--	--
Benzo[fluoranthene]	56832-73-6	57	137	%	31	%	75	125	%	31	%	--	--	--
Benzo[a]pyrene	50-32-8	68	128	%	30	%	75	125	%	30	%	--	--	--
Indeno[1,2,3-cd]pyrene	193-39-5	59	139	%	29	%	75	125	%	29	%	--	--	--
Dibenz(a,h)anthracene	53-70-3	57	142	%	30	%	75	125	%	30	%	--	--	--
Benzo[g,h,i]perylene	191-24-2	57	142	%	28	%	75	125	%	28	%	--	--	--
Polychlorinated Biphenyls (PCBs) by Gas Chromatography	8082													
Tetrachloro-m-xylene	877-09-8	--	--	--	--	--	--	--	--	--	--	45	135	%
DCB Decachlorobiphenyl	2051-24-3	--	--	--	--	--	--	--	--	--	--	50	140	%
PCB-1016	12674-11-2	40	140	%	20	%	40	140	%	20	%	--	--	--
PCB-1232	11141-16-5	50	150	%	30	%	50	150	%	30	%	--	--	--
PCB-1242	53469-21-9	57	128	%	20	%	57	128	%	20	%	--	--	--
PCB-1254	11097-69-1	65	132	%	20	%	65	132	%	20	%	--	--	--
PCB-1260	11096-82-5	60	130	%	20	%	60	130	%	20	%	--	--	--

**TABLE A-5
LABORATORY QC SAMPLE ACCEPTANCE CRITERIA
SEDIMENT**

Mercury (CVAA)	7471A													
Mercury	7439-97-6	80	120	%	20	%	80	120	%	20	%	--	--	--

**TABLE A-6
LABORATORY QC SAMPLE ACCEPTANCE CRITERIA
SOIL AND WATER**

Analyte Description	CAS Number/ Method	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units
Soil - Metals (ICP)	6010B										
Arsenic	7440-38-2	80	120	%	20	%	80	120	%	20	%
Barium	7440-39-3	80	120	%	20	%	80	120	%	20	%
Cadmium	7440-43-9	80	120	%	20	%	80	120	%	20	%
Chromium	7440-47-3	80	120	%	20	%	80	120	%	20	%
Lead	7439-92-1	80	120	%	20	%	80	120	%	20	%
Selenium	7782-49-2	80	120	%	20	%	80	120	%	20	%
Silver	7440-22-4	75	120	%	20	%	75	120	%	20	%
Soil - Mercury (CVAA)	7471A										
Mercury	7439-97-6	80	120	%	20	%	80	120	%	20	%
Water - Metals (ICP/MS)	6020										
Arsenic	7440-38-2	80	120	%	20	%	80	120	%	20	%
Barium	7440-39-3	80	120	%	20	%	80	120	%	20	%
Cadmium	7440-43-9	80	120	%	20	%	80	120	%	20	%
Chromium	7440-47-3	80	120	%	20	%	80	120	%	20	%
Lead	7439-92-1	80	120	%	20	%	80	120	%	20	%
Selenium	7782-49-2	80	120	%	20	%	80	120	%	20	%
Silver	7440-22-4	80	120	%	20	%	80	120	%	20	%
Water - Mercury (CVAA)	7470A										
Mercury	7439-97-6	80	120	%	20	%	80	120	%	20	%

Health and Safety Plan



WORK LOCATION PERSONNEL PROTECTION AND SAFETY EVALUATION FORM

**Attach Pertinent Documents/Data
Fill in Blanks As Appropriate**

Job No.: 241008
 Prepared by: Kristin Hooper Reviewed by: Christine Kimmel
 Date: September 12, 2012 Date: October 5, 2012

A. WORK LOCATION DESCRIPTION

1. **Project Name:** Tru Grit Facility
2. **Location:** 1110 Alexander Avenue, Tacoma, Washington
3. **Anticipated Activities:** Collection of soil and sediment samples. Sediment sampling in subtidal areas will be conducted by boat using a power-grab sampler and vibrocore. Sediment sampling in shoreline areas will be conducted with hand implements at low tide. Upland soil samples will be collected using hand implements. Groundwater sampling.
4. **Size:** Approximately 5 acres
5. **Surrounding Population:** Industrial
6. **Buildings/Homes/Industry:** Industrial properties and shipping
7. **Topography:** Level
8. **Anticipated Weather:** Variable weather, wind, rain, sun; Temperature, 30-70 °F
9. **Unusual Features:** Portion of property is upland and a portion is over water.
10. **Site History:** The facility stores and distributes a granular slag grit material, which is sold to roofing manufacturers and sandblasters under the name Tru-Grit Roofing Granules. Slag material is brought to the facility by barge from Canada. Once the barged material reaches the Tacoma site, a front-end loader and a ship-to-shore conveyance system are used to unload the barges when they arrive at the Tru-grit facility. The granular slag is transported by the conveyor system to a stacking conveyor, which places the slag onto an outdoor storage pile.

B. HAZARD DESCRIPTION

1. **Background Review:** Complete Partial
If partial, why?
2. **Hazardous Level:** B C D Unknown

Justification: Existing data regarding site conditions and media handling procedures to minimize contact.

3. Types of Hazards: (Attach additional sheets as necessary)

- A. Chemical Inhalation Explosive
 Biological Ingestion O2 Def. Skin Contact

Describe: Accidental inhalation, ingestion or absorption of chemicals of potential concern during exploratory and sampling activities. Soil, groundwater and/or sediment potentially contaminated with metals (copper and zinc).

- B. Physical Cold Stress Noise Heat Stress Other

Describe: Exposure to weather extremes. Potential drowning during over water activities.

- C. Radiation

Describe:

4. Nature of Hazards:

- Air Describe: Potential for airborne dust to be generated during sampling.
- Soil Describe: Potential for contact with or ingestion of contaminated soil and sediment.
- Surface Water Describe: Drowning exposure during over water activities.
- Groundwater Describe: Potential for contact with or ingestion of contaminated groundwater.
- Other Describe:

5. Chemical Contaminants of Concern N/A

Contaminant	PEL (ppm)	I.D.L.H. (ppm)	Source/Quantity Characteristics	Route of Exposure	Symptoms of Acute Exposure	Instruments Used to Monitor Contaminant
Copper	1 mg/m ³	100 mg/m ³	Present in soil, surface water and sediment	Inhalation, ingestion, skin and eye contact	Irritation of eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis	Dust control
Zinc	15 mg/m ³	500 mg/m ³	Present in soil, surface water and sediment	Inhalation	Metal fume fever; chills, muscle ache, nausea, fever, dry throat, cough; lassitude; metallic taste; headache; blurred vision; low back pain; vomit; malaise; chest tight; difficulty breathing; rales; decreased pulmonary function	Dust control

Notes:

6. Physical Hazards of Concern N/A

Hazard	Description	Location	Procedures Used to Monitor Hazard
Drowning	Potential for drowning while sampling via boat.	On the water	Coast Guard approved and non-altered personal floatation devices will be worn at all times while on the water. The buddy system (field team working in pairs) will be observed.
Slips, trips, and falls		Any area	Alert observation of surroundings. Keep work area organized and free of debris.
Pinch points	Working around sampling equipment.	On sampling vessel	Be aware of potential pinch points, make eye contact with operator, and don't wear loose clothing.

7. Work Location Instrument Readings N/A

Location: _____

Percent O₂: _____

Percent LEL: _____

Radioactivity: _____

PID: _____

FID: _____

Other: _____

Other: _____

Other: _____

Other: _____

Other: _____

Location: _____

Percent O₂: _____

Percent LEL: _____

Radioactivity: _____

PID: _____

FID: _____

Other: _____

Other: _____

Other: _____

Other: _____

Other: _____

Location: _____

Percent O₂: _____

Percent LEL: _____

Radioactivity: _____

PID: _____

FID: _____

Other: _____

Other: _____

Other: _____

Other: _____

Other: _____

Location: _____

Percent O₂: _____

Percent LEL: _____

Radioactivity: _____

PID: _____

FID: _____

Other: _____

Other: _____

Other: _____

Other: _____

Other: _____

8. Hazards Expected In Preparation For Work Assignment N/A

Describe:

C. PERSONAL PROTECTIVE EQUIPMENT

1. Level of Protection

A B C D

Location/Activity:

A B C D

Location/Activity: Upgrade to Level C if Action Levels are exceeded (Attachment A)

2. Protective Equipment (specify probable quantity required)

Respirator N/A

SCBA, Airline

Full-Face Respirator

Half-Face Respirator (Cart. HEPA)

(Only if upgrade to Level C)

Escape mask

None

Other:

Other:

Head & Eye N/A

Hard Hat- Hard hat is only needed when working around the sampling equipment with a swing radius or overhead pulley system.

Goggles

Face Shield

Safety Eyeglasses

Other:

Foot Protection N/A

Neoprene Safety Boots with Steel Toe/Shank

Disposable Overboots

Other: Steel-toed work boots.

Clothing N/A

Fully Encapsulating Suit

Chemically Resistant Splash Suit

Apron, Specify:

Tyvek Coverall (Only if upgrade to Level C)

Saranex Coverall

Other: Coast Guard approved Personnel Flotation Device (over water work area only).

Other: Dedicated field clothing; long sleeves and pants, rain gear, as needed to avoid splash, safety vest.

Hand Protection N/A

Undergloves; Type:

Gloves; Type: Nitrile

Overgloves; Type:

None

Other:

3. **Monitoring Equipment** N/A

CGI

PID

O² Meter

FID

Rad Survey

Other: HAM meter

Detector Tubes (optional)

Type:

D. DECONTAMINATION

PERSONAL DECONTAMINATION

Required

Not Required

If required, describe:

Wash hands and face with water and soap before each break. Minimize hand to mouth actions while on site. Use disposal nitrile gloves and change gloves frequently.

EQUIPMENT DECONTAMINATION

Required

Not Required

If required, describe and list equipment:

Sediment sampling device(s) will be decontaminated between exploration locations using an alconox wash. Non-dedicated sampling equipment will be decontaminated between sampling intervals using a three-step process:

- Remove visual contamination and wash with a mixture of Alconox soap and clean site or tap water
- Rinse with clean site or tap water
- Rinse with deionized water (upland area only)

E. PERSONNEL

	Name	Work Location Title/Task	Medical Current	Fit Test Current
1.	Jennifer Wynkoop	Project Manager	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.	Lauren Knickrehm	Project Engineer/Task Manager	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3.	Steven Shaw	Staff	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4.			<input type="checkbox"/>	<input type="checkbox"/>
5.			<input type="checkbox"/>	<input type="checkbox"/>
6.			<input type="checkbox"/>	<input type="checkbox"/>
7.			<input type="checkbox"/>	<input type="checkbox"/>
8.			<input type="checkbox"/>	<input type="checkbox"/>
9.			<input type="checkbox"/>	<input type="checkbox"/>
10.			<input type="checkbox"/>	<input type="checkbox"/>

Site Safety Coordinator: Steven Shaw

F. ACTIVITIES COVERED UNDER THIS PLAN

Task No.	Description	Preliminary Schedule
1	Soil sampling, sediment sampling via boat.	Fall 2012

G. SUBCONTRACTOR'S HEALTH AND SAFETY PROGRAM EVALUATION

N/A

Name and Address of Subcontractor:: Unknown

EVALUATION CRITERIA

Item	Adequate	Inadequate	Comments
Medical Surveillance Program	<input type="checkbox"/>	<input type="checkbox"/>	
Personal Protective Equipment Availability	<input type="checkbox"/>	<input type="checkbox"/>	
Onsite Monitoring Equipment Availability	<input type="checkbox"/>	<input type="checkbox"/>	
Safe Working Procedures Specification	<input type="checkbox"/>	<input type="checkbox"/>	
Training Protocols	<input type="checkbox"/>	<input type="checkbox"/>	
Ancillary Support Procedures (if any)	<input type="checkbox"/>	<input type="checkbox"/>	
Emergency Procedures	<input type="checkbox"/>	<input type="checkbox"/>	
Evacuation Procedures Contingency Plan	<input type="checkbox"/>	<input type="checkbox"/>	
Decontamination Procedures Equipment	<input type="checkbox"/>	<input type="checkbox"/>	
Decontamination Procedures Personnel	<input type="checkbox"/>	<input type="checkbox"/>	

GENERAL HEALTH AND SAFETY PROGRAM EVALUATION: Adequate Inadequate

Additional Comments:

Evaluation Conducted By: _____

Date: _____

EMERGENCY FACILITIES AND NUMBERS

Hospital: Tacoma General Hospital
315 Martin Luther King Junior Way
Tacoma, WA 98405

Directions: Attachment B

Telephone: (253) 403-1000

Emergency Transportation Systems (Fire, Police, Ambulance) – 911

Emergency Routes – Map (Attachment B)

Emergency Contacts:

	Offsite	Onsite
Jennifer Wynkoop	253-926-2493	206-617-3117 (cell)
Lauren Knickrehm	253-926-2493	520-405-8864 (cell)
Christine Kimmel	425-778-0907	206-786-3801 (cell)

In the event of an emergency, do the following:

1. Call for help as soon as possible. Call 911. Give the following information:
 - WHERE the emergency is – use cross streets or landmarks
 - PHONE NUMBER you are calling from
 - WHAT HAPPENED – type of injury
 - WHAT is being done for the victim(s)
 - YOU HANG UP LAST – let the person you called hang up first.

2. If the victim can be moved, paramedics will transport to the hospital. If the injury or exposure is not life-threatening, decontaminate the individual first. If decontamination is not feasible, wrap the individual in a blanket or sheet of plastic prior to transport.

**HEALTH AND SAFETY PLAN
APPROVAL/SIGN OFF FORMAT**

I have read, understood, and agreed with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing.

_____ Name	_____ Signature	_____ Date
_____ Name	_____ Signature	_____ Date
_____ Name	_____ Signature	_____ Date
_____ Name	_____ Signature	_____ Date
_____ Name	_____ Signature	_____ Date
_____ Steven Shaw Site Safety Coordinator	_____ Signature	_____ Date
_____ Christine Kimmel Landau Health and Safety Manager	_____ Signature	_____ Date
_____ Jennifer Wynkoop Project Manager	_____ Signature	_____ Date

Personnel Health and Safety Briefing Conducted By:

_____ Name	_____ Signature	_____ Date
---------------	--------------------	---------------

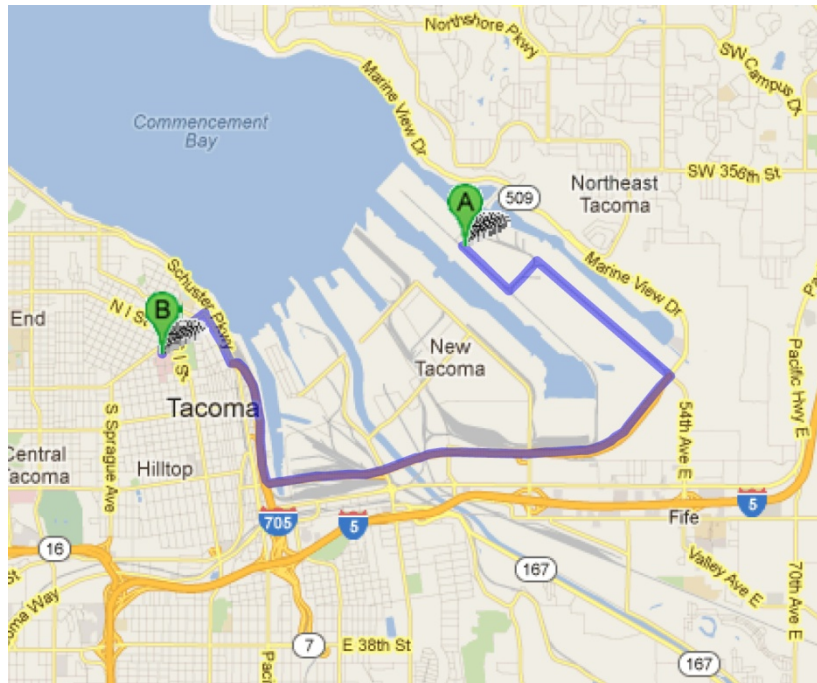
ATTACHMENT A

ACTION LEVELS FOR RESPIRATORY PROTECTION

Monitoring Parameter	Reading	Level of Protection
----------------------	---------	---------------------

ATTACHMENT B

MAP AND DIRECTIONS TO HOSPITAL



A 1110 Alexander Ave E, Tacoma, WA 98421

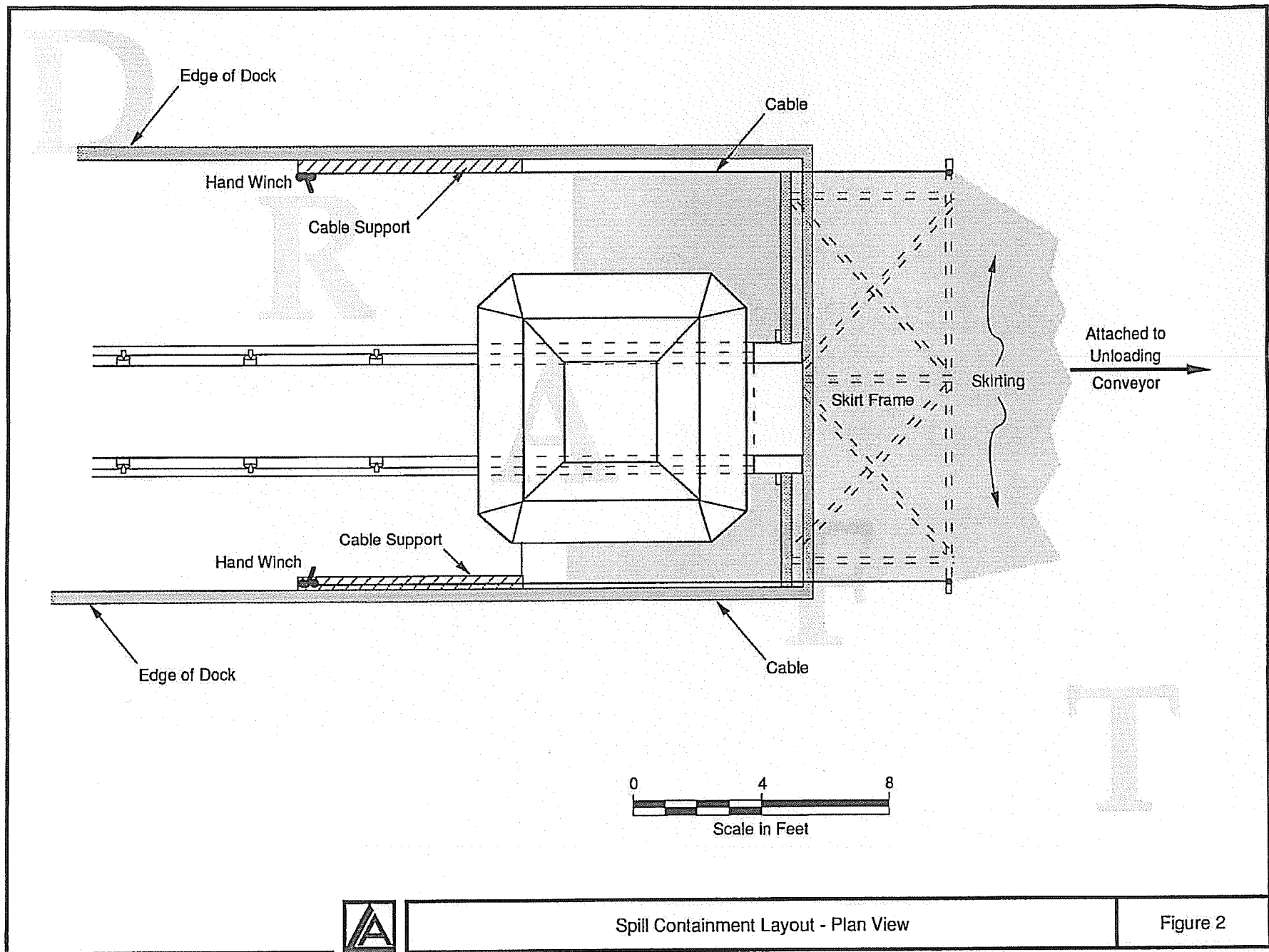
- | | | |
|----|-------------------------------------------------------------------------------------------------|---------------------------|
| 1. | Head southeast on Alexander Ave E toward Lincoln Ave
About 1 min | go 0.6 mi
total 0.6 mi |
| | 2. Take the 1st left onto Lincoln Ave
About 1 min | go 0.3 mi
total 0.9 mi |
| | 3. Take the 1st right onto Taylor Way
About 4 mins | go 1.5 mi
total 2.4 mi |
| | 4. Turn right onto WA-509 S/S Frontage Rd
Continue to follow WA-509 S
About 5 mins | go 3.8 mi
total 6.2 mi |
| | 5. Merge onto I-705 N via the ramp to Schuster Pkwy/Ruston
About 1 min | go 1.2 mi
total 7.4 mi |
| | 6. Turn right onto S Stadium Way
About 1 min | go 0.5 mi
total 7.9 mi |
| | 7. Turn left onto Division Ave
About 2 mins | go 0.5 mi
total 8.3 mi |
| | 8. Turn left onto Martin Luther King Jr Way
Destination will be on the right | go 410 ft
total 8.4 mi |

B hospital

Tacoma General Hospital
 315 Martin Luther King Junior Way
 Tacoma, WA 98405
 (253) 403-1000
 Emergency: 911

Ship-To-Shore Conveyor System Diagram

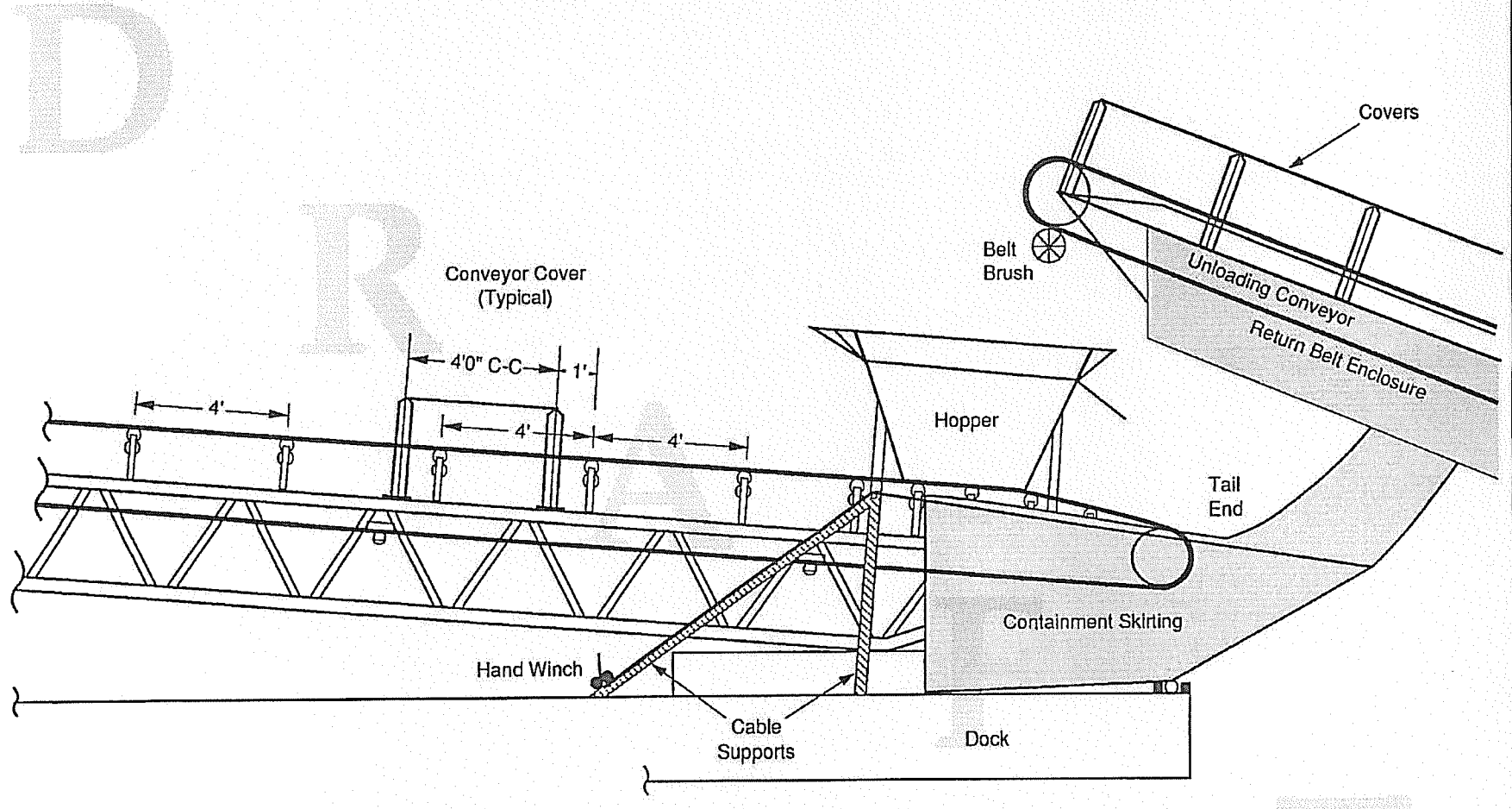
F-2



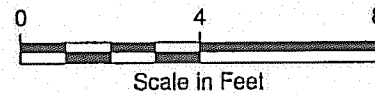
Spill Containment Layout - Plan View

Figure 2

F-3



Note: See skirt details, Figures 4 and 5.
See cover details, Figure 7.

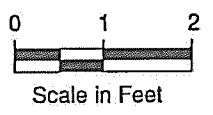
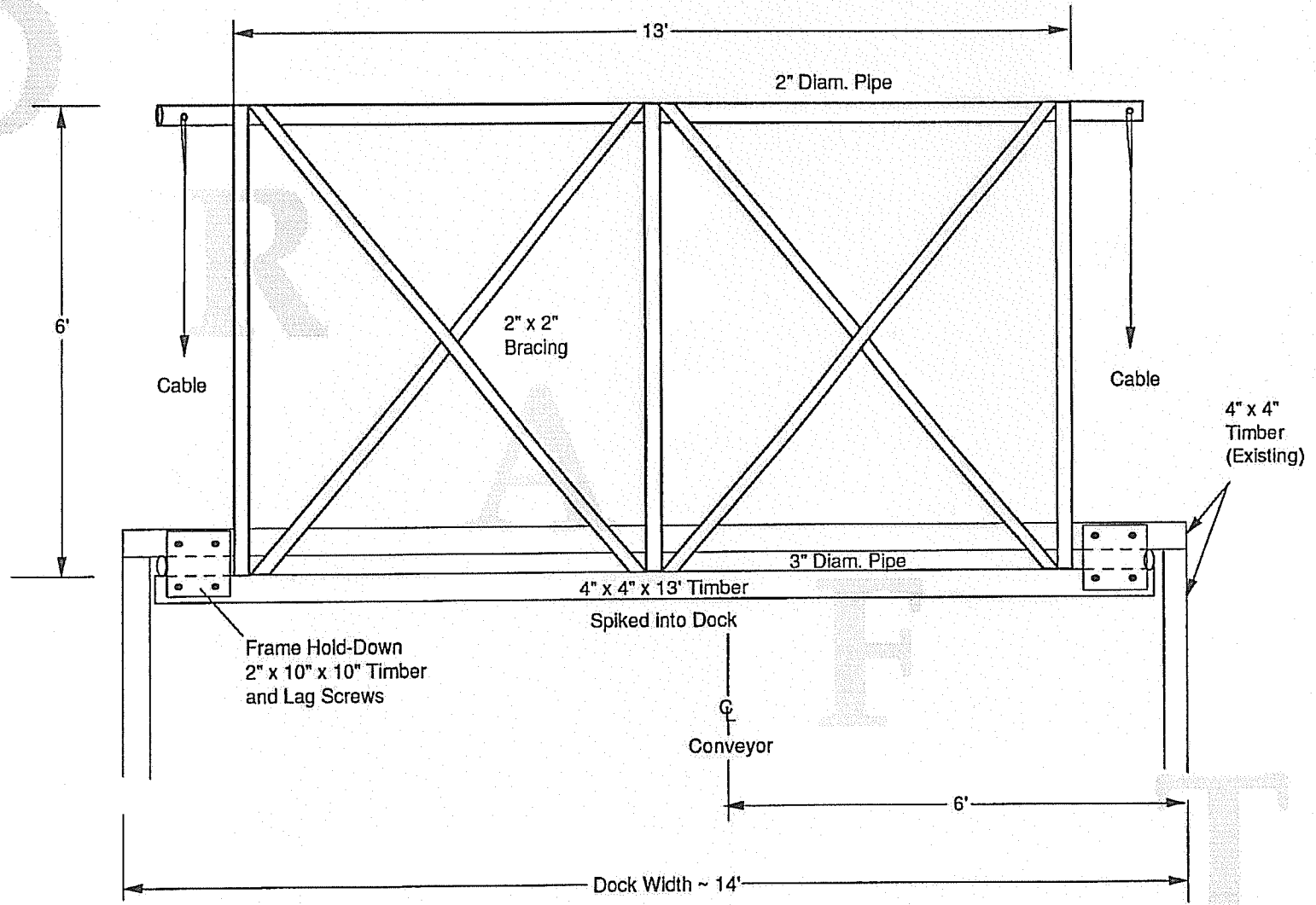


Conveyor Cover and Tail End Spill Containment - Profile

Figure 3

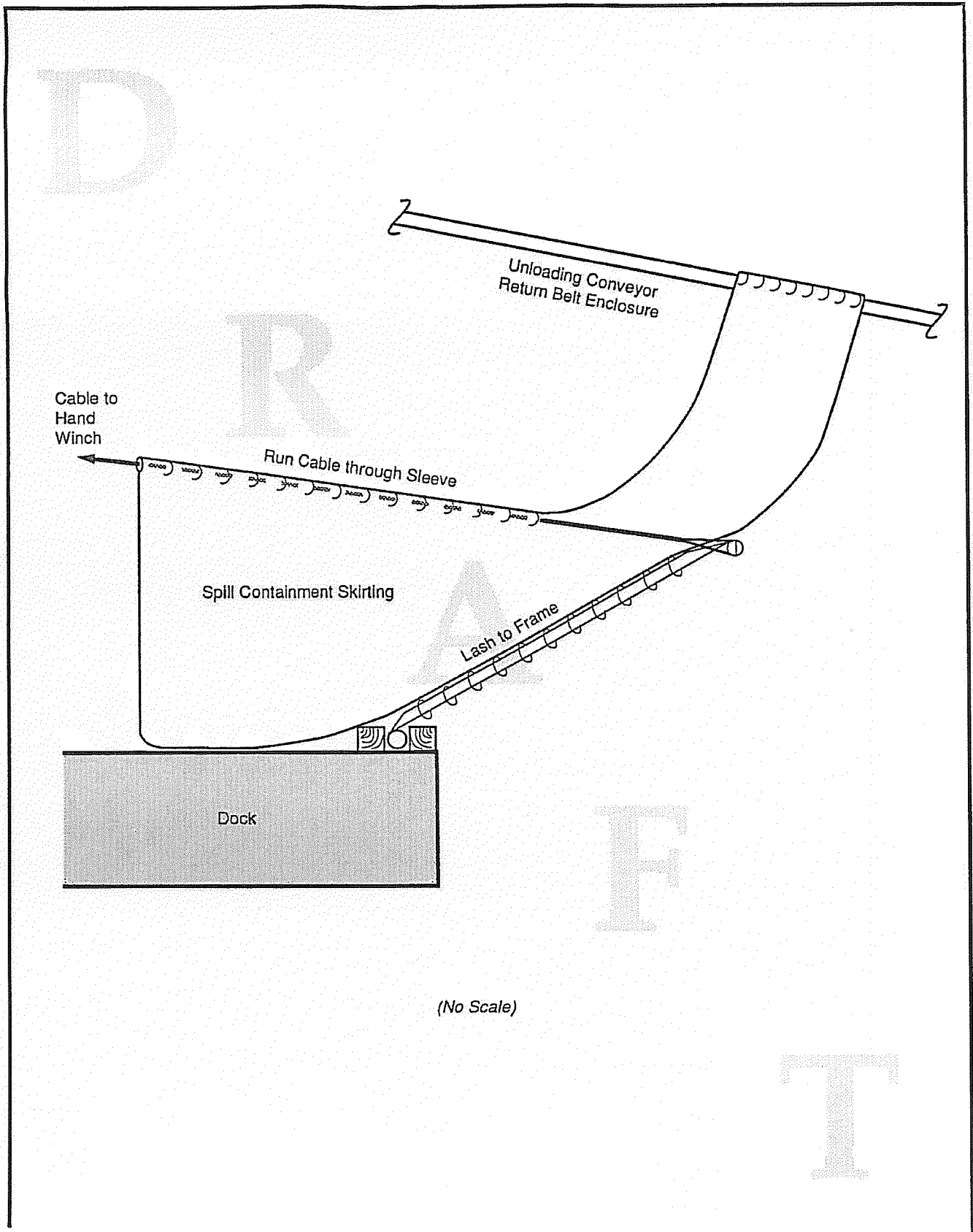
D

H-4



Skirt Frame Plan View

Figure 4



241001.20 Tru-Grip/Specs 10/93



Spill Containment Skirt Details
Side View

Figure 5

Eye Bolt Slots

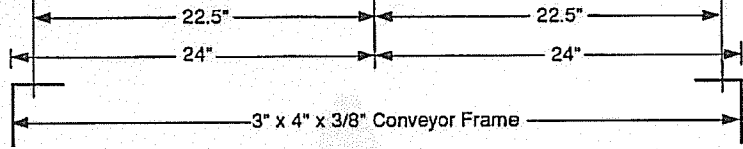
A - A

11/16" Diam. Center Hole
11/16" End Slots

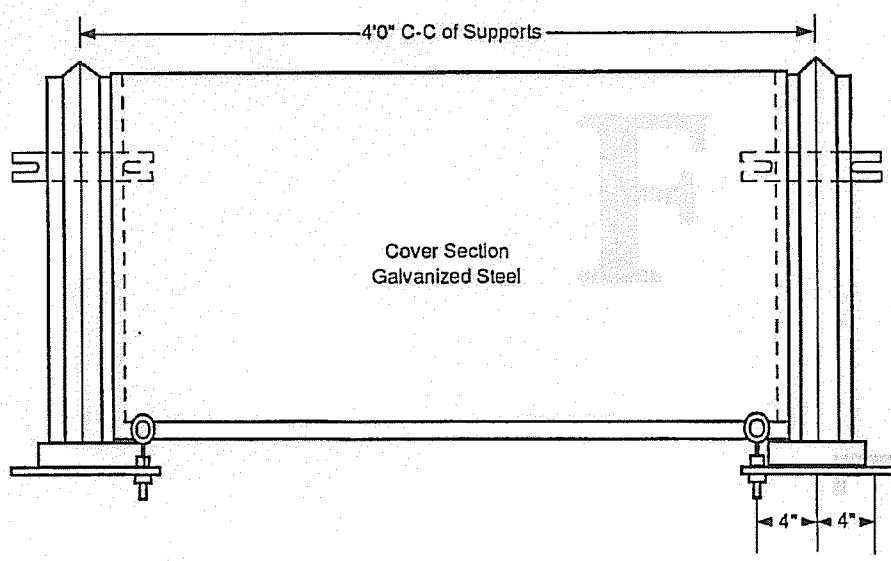
25-7/8" Inside Radius
of Support Band

Mounting Foot
with Hinge

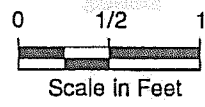
Hold Down
Bolts with
Quick
Opening
Wing Nuts



End View



Profile

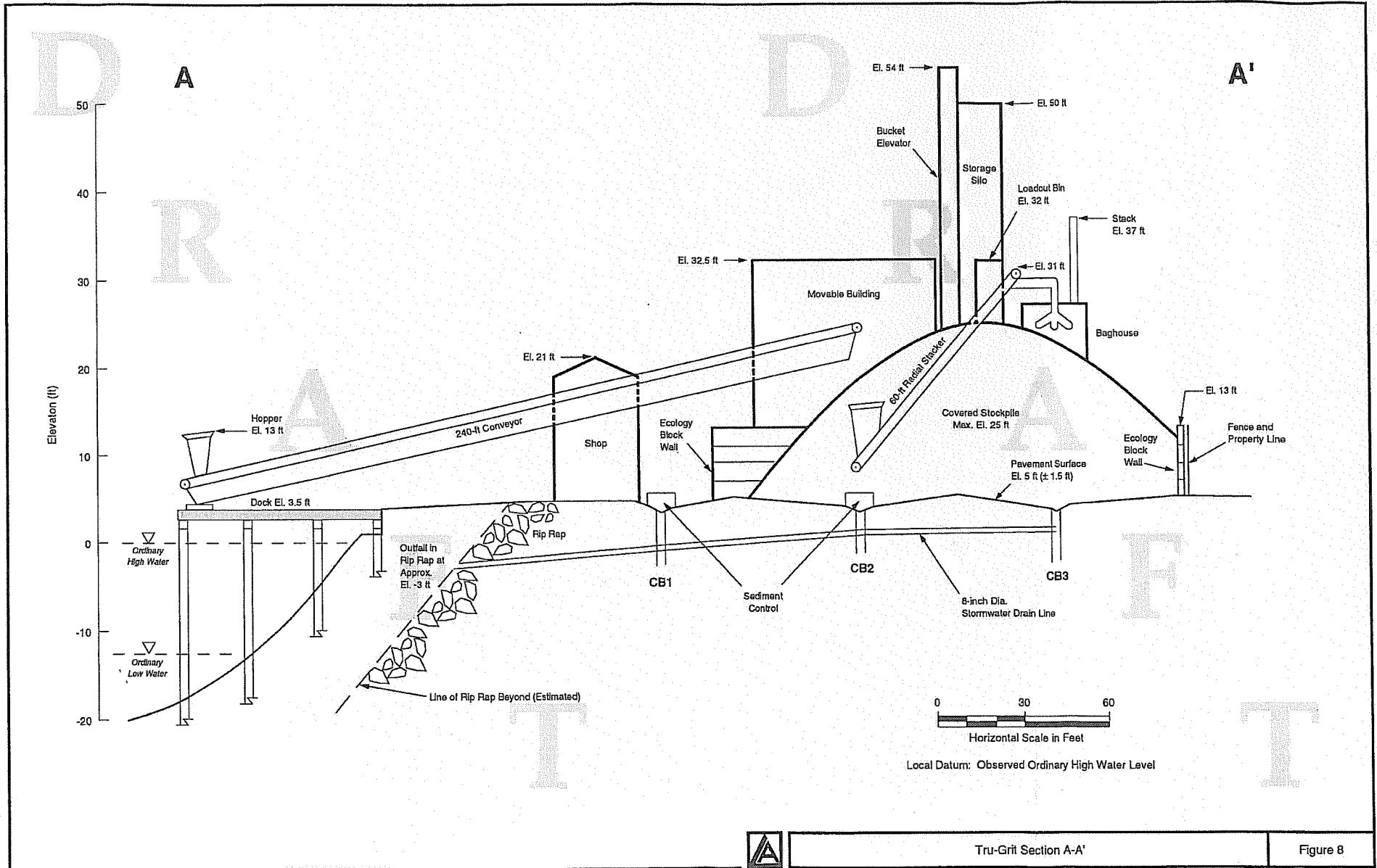


241001.20 Tiv-Ctrl/Specs 10/93



Conveyor Covers by Transco Industries

Figure 7



24.0001.130 Tru-Grit/Spica 10/93



Tru-Grit Section A-A'

Figure 8

Terrestrial Ecological Exclusion Form

Terrestrial Ecological Evaluation Process - Primary Exclusions

Documentation Form

Exclusion #	Exclusion Detail	Yes or No?	Are Institutional Controls Required If The Exclusion Applies?
1	Will soil contamination be located at least 6 feet beneath the ground surface and less than 15 feet?	Yes / No	Yes
	Will soil contamination located at least 15 feet beneath the ground surface?	Yes / No	No
	Will soil contamination located below the conditional point of compliance?	Yes / No	Yes
2	Will soil contamination be covered by buildings, paved roads, pavement, or other physical barriers that will prevent plants or wildlife from being exposed?	Yes / No	Yes
3	Is there less than 1.5 acres of contiguous undeveloped land on the site, or within 500 feet of any area of the site affected by hazardous substances other than those listed in the table of Hazardous Substances of Concern ?	<input checked="" type="radio"/> Yes / No	Other factors determine
	And Is there less than 0.25 acres of contiguous undeveloped land on or within 500 feet of any area of the site affected by hazardous substances listed in the table of Hazardous Substances of Concern ?	<input checked="" type="radio"/> Yes / No	
4	Are concentrations of hazardous substances in the soil less than or equal to natural background concentrations of those substances at the point of compliance	Yes / No	No

[\[Exclusions Main\]](#) [\[TEE Definitions\]](#) [\[Simplified or Site-Specific?\]](#) [\[Simplified Ecological Evaluation\]](#) [\[Site-Specific Ecological Evaluation\]](#) [\[WAC 173-340-7493\]](#)

[\[TEE Home\]](#)