TECHNICAL MEMORANDUM

LANDAU ASSOCIATES
ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

TO: Mohsen Kourehdar, Washington State Department of Ecology

cc: Don Bache, Port of Olympia

FROM: Larry Beard, P.E. and Christine Kimmel, L.G. CBK

DATE: September 20, 2012

RE: SAMPLING AND ANALYSIS ADDENDUM
2012 SEDIMENT PERFORMANCE MONITORING
CASCADE POLE SITE
OLYMPIA, WASHINGTON

The Port of Olympia (Port) has entered into an Agreed Order (Agreed Order No. DE 00TCPSR-753) with the Washington State Department of Ecology (Ecology) to remediate the former Cascade Pole Site Sediments Operable Unit (Figure 1). The Ecology-selected cleanup action included excavation of contaminated sediments, containment of the contaminated sediments in an upland cell, containment of shoreline soil and sediment within a sheetpile barrier, institutional controls, shoreline improvements, and a compliance monitoring program. In-water cleanup activities at the site were completed by February 2002 and post-construction sediment compliance monitoring was conducted in April 2002 and September 2003 and summarized in the *Post-Construction Sediment Compliance Monitoring Report* (Landau Associates 2002).

Following completion of the sediment interim action, the Port and Ecology amended the Agreed Order to address additional site cleanup activities consisting of: 1) design and construction of a new groundwater treatment system, 2) capping of the remainder of the upland portion of the site, 3) long-term sediment monitoring, and 4) long-term groundwater monitoring. Amendment No. 1 to the Agreed Order requires the Port to conduct performance sediment quality monitoring every 5 years, commencing in 2007. The first 5-year post-construction sampling event occurred in October 2007 and is summarized in the *2007 Sediment Quality Monitoring Report* (Landau Associates 2008).

This 2012 Sampling and Analysis Addendum to the *Compliance Monitoring Plan* consists of performance monitoring, and includes methods for sample and processing procedures, laboratory analysis, and data analysis and reporting. As specified in the Agreed Order Amendment, the scope of work for performance monitoring consists of collecting 15 sediment core samples from inside the multiple benefits line (MBL) and five surface sediment samples from outside the MBL for chemical testing. The samples are to be tested for polycyclic aromatic hydrocarbons (PAH), dibenzofuran, dioxins, and total organic carbon (TOC). The Agreed Order Amendment also specifies that the sampling locations, sampling protocols, and quality assurance/quality control (QA/QC) used for the 2002 sediment sampling event be applied to future performance monitoring events. All sampling station positioning, sample collection and handling, field documentation, analytical procedures, and QA/QC procedures will be conducted in accordance with the monitoring procedures included in Section 5 of the existing *Compliance Monitoring Plan* (Landau Associates 2001a), which is included as Attachment 1, with only a minor modification to the location of sample processing. The existing *Health and Safety Plan* for the site (Landau Associates 2001b), included as Attachment 2, will be used for field activities.

SEDIMENT MONITORING METHODS

Samples will be collected from interior backfill locations within the MBL, in order to confirm the long-term effectiveness of the cleanup action, as well as locations immediately outside of the MBL, in order to evaluate whether surface sediment quality immediately outside of the MBL has changed appreciably since the cleanup action was implemented. Refer to Section 5 of the *Compliance Monitoring Plan* for details. An overview is presented below.

Sampling Locations

All proposed sampling locations represent the same locations that were sampled during previously conducted sediment quality monitoring activities (Figure 2) and include 15 backfill (coring) locations within the backfill MBL (CP-01 through CP-15) and 5 surface grab locations outside of the MBL (CP-16 through CP-20). Position coordinates and mudline elevations for the sample locations are provided in Table 1. Prior to sample collection, the sampling coordinates will be verified using Global Positioning System (GPS) and hand measurement calculations will be utilized to verify mudline elevations. The sample locations will be recorded.

Sampling Schedule

Sampling is scheduled to occur over a 3-day period during early October 2012. The analytical testing of the samples will be conducted on a normal turn-around-time of 3 weeks and will be available toward early November 2012. Within 2 weeks of final receipt of the data from the laboratory, the data will be reviewed and validated prior to submittal of the data to the Ecology website. Toward late November 2012 (44 to 5 weeks post-sampling), a draft summary report of the sediment sampling procedures and data evaluation will be submitted to Ecology for review and comment.

Sediment Collection

All samples will be collected from a research vessel owned and operated by Research Support Services, Inc. (RSS) of Bainbridge Island, Washington. Station positioning will be conducted in accordance with Section 5.4 of the *Compliance Monitoring Plan*. Landau Associates' staff will be present on the vessel to direct sampling activities and handle the samples.

Sample collection and handling will be conducted in accordance with Section 5.5 of the *Compliance Monitoring Plan*. Sediment will be collected from interior backfill locations inside the MBL by coring, using a vibracore device, at a 6-inch interval from the interior of the backfill. The interior backfill core samples will be collected from 1 to 1.5 ft above the interface, with a maximum depth for the top of the sample of 5 ft below the post-construction sediment surface. The actual total lengths of the sediment cores will depend on the thickness of the overlying backfill, which is expected to be 2 ft thick or greater (Table 1). The depth to the dredge interface is anticipated to be 2 to 5 ft below the current backfill and mudline (Table 1). Ten-ft-long aluminum core tubes will be used to collect core lengths, approximately 5 to 8 ft in length, to account for potential variability in the depth of the dredge interface. Sediment will be collected from locations outside the MBL using a power grab sampler or similar device at a 0- to 10-centimeter (cm) interval from the sediment surface (also known as the predominant biologically active zone).

Samples will be documented in the field in accordance with Section 5.6 of the *Compliance Monitoring Plan*, as shown in Table 1. The Port-contracted laboratory, Analytical Resources, Inc. (ARI), will provide an enclosed space for core processing with electrical power and water sources.

Sample Analysis

Sample analysis will be conducted in accordance with Section 5.7 of the *Compliance Monitoring Plan*. The required testing addresses the 15 backfill samples and 5 surface sediment samples. These samples will be analyzed for PAHs, dibenzofuran, dioxins, and TOC as shown in Table 2. Data quality objectives, QC procedures, and QA criteria will be ensured according to the quality assurance plan (Section 7 of the *Compliance Monitoring Plan*). QA/QC samples will consist of two field duplicates and one matrix spike/matrix spike duplicate analyzed for all analytical parameters.

DATA ANALYSIS AND REPORTING

A report of the sediment performance monitoring activities will be prepared to document sampling methods, field observations, chemical testing procedures and results, and data quality. The report will use the same format as the *Post-Construction Sediment Compliance Monitoring Report*. It will document the sediment monitoring activities including sampling methods, field observations, chemical testing procedures and results, and data quality. Data analysis will be conducted in accordance with Section 5.8 of the *Compliance Monitoring Plan*. The chemical testing data will be tabulated, compared to the cleanup levels and cleanup action levels, and evaluated. A figure summarizing the results of the monitoring activities will also be included in the report.

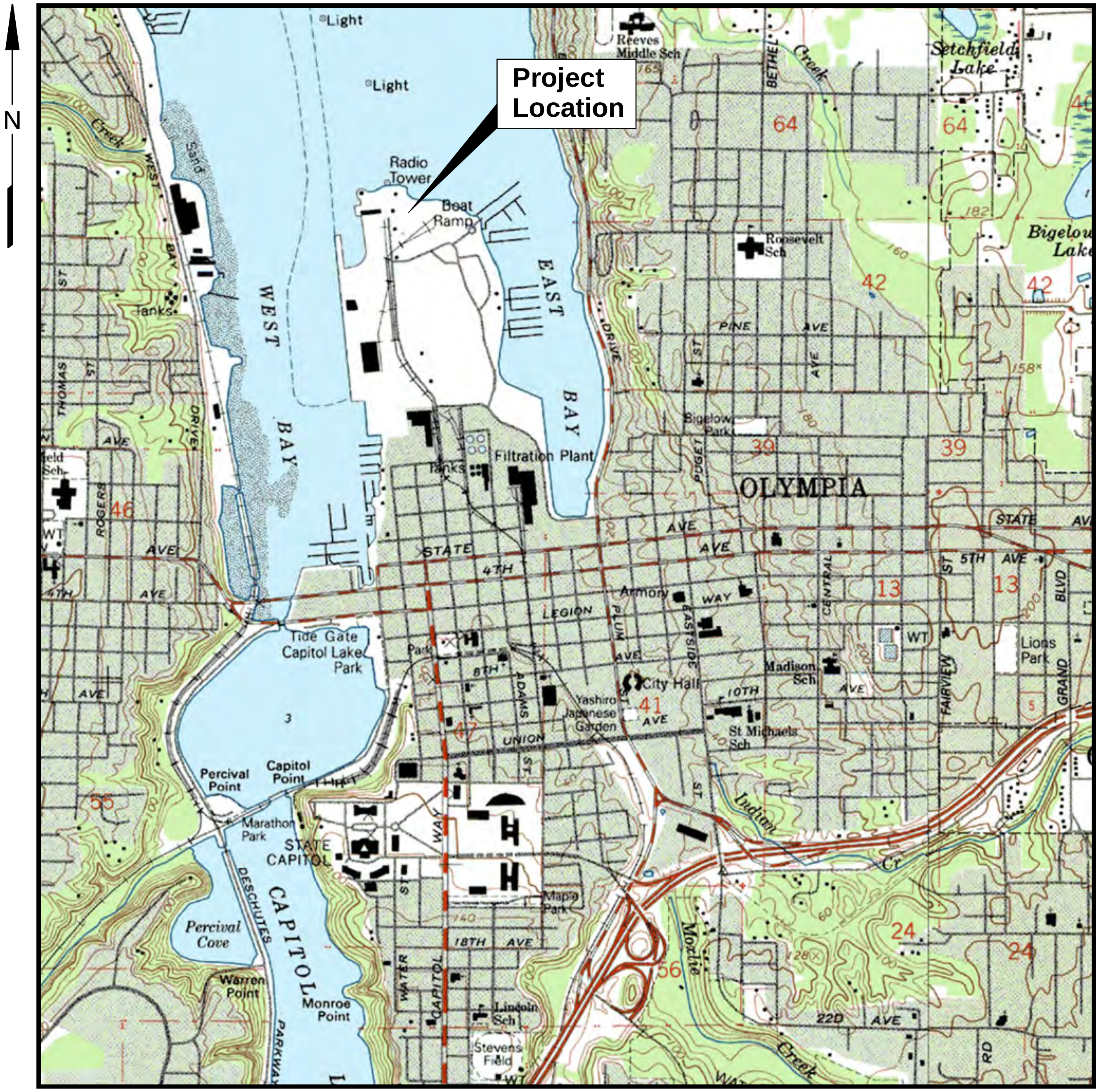
REFERENCES

Landau Associates. 2008. *2007 Sediment Quality Monitoring Report*, *Cascade Pole Site*, *Olympia*, *Washington*. Prepared for the Port of Olympia. March 11.

Landau Associates. 2002. *Post-Construction Sediment Compliance Monitoring Report*, *Cascade Pole Site, Olympia*, *Washington*. Prepared for the Port of Olympia. December 18.

Landau Associates. 2001a. *Compliance Monitoring Plan, Sediments Remedial Action, Cascade Pole Site, Olympia, Washington*. Prepared for the Port of Olympia. April 5

Landau Associates. 2001b. *Health and Safety Plan, Sediments Remediation, Cascade Pole Site, Port of Olympia, Washington*. April 14.



Map from DeLorme Street Atlas USA, 2002

Port of Olympia/SAP Tech Memo | V:\021\032\D\SAP Tech Memo\Fig1.cdr (A) 9/25/2007

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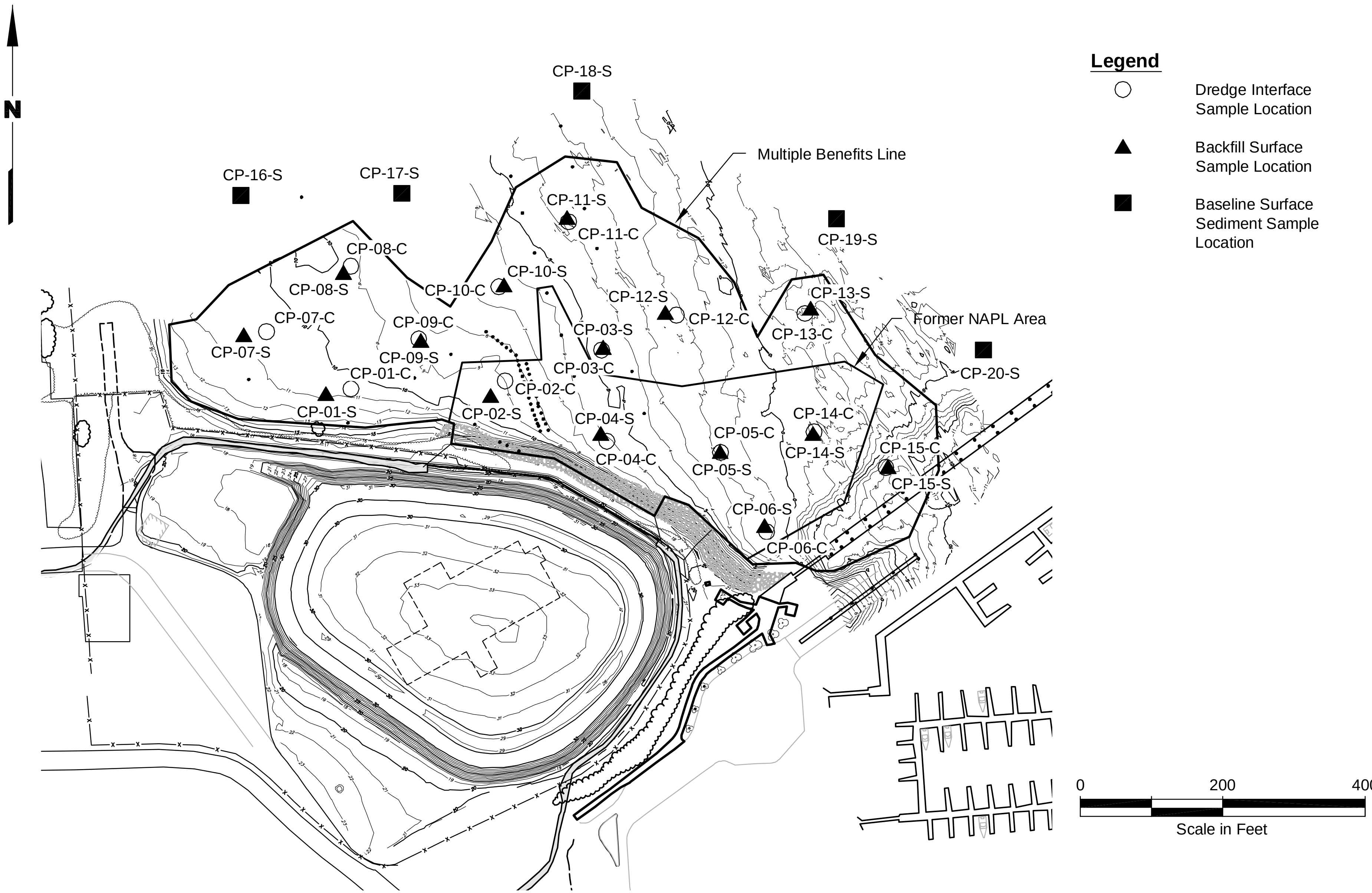
Cascade Pole Site Olympia, Washington	**Vicinity Map**	Figure 1

Port of Olympia/SAP Tech Memo | V:\021\032\D\SAP Tech Memo\Fig2.dwg (A) "Figure 2" 9/19/2007



Source: Bathymetric Contours based on Survey by Magedorn, Inc. on September 13, 2002

Cascade Pole Site Olympia, Washington	**Sampling Locations for Sediment Quality Monitoring**	Figure 2

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TABLE 1
SEDIMENT CONFIRMATIONAL MONITORING STATION COORDINATES
CASCADE POLE SITE

Elevations and GPS Coordinates for Sampling Locations

	Sample Location	Elevation (MLLW)	Northing (a)	Easting (a)
Surface Sediment Samples				
	CP-01-S	8.90	638,194.85	1,041,848.30
	CP-02-S	8.67	638,192.05	1,042,079.70
	CP-03-S	3.15	638,259.62	1,042,237.61
	CP-04-S	4.75	638,138.70	1,042,234.34
	CP-05-S	0.35	638,113.53	1,042,401.89
	CP-06-S	-6.08	638,009.46	1,042,464.39
	CP-07-S	9.47	638,277.41	1,041,733.20
	CP-08-S	8.02	638,364.98	1,041,873.01
	CP-09-S	7.10	638,269.24	1,041,981.48
	CP-10-S	5.15	638,347.17	1,042,098.55
	CP-11-S	2.47	638,441.77	1,042,187.05
	CP-12-S	-4.40	638,308.66	1,042,324.71
	CP-13-S	-8.90	638,314.61	1,042,528.95
	CP-14-S	-7.62	638,138.75	1,042,532.33
	CP-15-S	-14.00	638,092.36	1,042,637.72
	CP-16-S	6.72	638,476.41	1,041,728.87
	CP-17-S	5.00	638,479.25	1,041,955.04
	CP-18-S	0.20	638,622.99	1,042,207.52
	CP-19-S	-4.97	638,443.64	1,042,565.29
	CP-20-S	-12.30	638,259.18	1,042,771.63
Subsurface Sediment Samples				
	CP-01-C	8.00	638,204.72	1,041,883.51
	CP-02-C	7.00	638,215.76	1,042,099.96
	CP-03-C	2.67	638,259.07	1,042,235.51
	CP-04-C	3.57	638,131.14	1,042,242.84
	CP-05-C	-0.53	638,115.34	1,042,402.36
	CP-06	-4.47	638,004	1,042,467
	CP-07-C	8.30	638,285	1,041,765
	CP-08-C	6.70	638,377	1,041,883
	CP-09-C	4.93	638,275	1,041,979
	CP-10-C	3.15	638,348	1,042,091
	CP-11-C	-0.65	638,439	1,042,189
	CP-12-C	-2.80	638,308	1,042,340
	CP-13-C	-9.25	638,311	1,042,521
	CP-14	-8.87	638,144	1,042,534
	CP-15	-16.60	638,094	1,042,634

(a) Washington State Plane South Zone NAD 83

TABLE 2
SEDIMENT SAMPLE PREPARATION METHODS, CLEANUP METHODS, ANALYTICAL METHODS, AND DETECTION LIMITS

Chemical	Sample Preparation Methods(a)	Sample Cleanup Methods(b)	Analytical Methods(c)	Detection Limits(d) (µg/kg dry weight)
Dioxins	--- (e)	--- (e)	8290	1 – 10 ng/kg
POLYNUCLEAR AROMATIC HYDROCARBON COMPOUNDS				
LPAH Compounds				
Naphthalene	3540/3550	3640/3660	8270	10
Acenaphthylene	3540/3550	3640/3660	8270	10
Acenaphthene	3540/3550	3640/3660	8270	10
Fluorene	3540/3550	3640/3660	8270	10
Phenanthrene	3540/3550	3640/3660	8270	10
Anthracene	3540/3550	3640/3660	8270	10
2-Methylnaphthalene	3540/3550	3640/3660	8270	10
HPAH Compounds				
Fluoranthene	3540/3550	3640/3660	8270	10
Pyrene	3540/3550	3640/3660	8270	10
Benz(a)anthracene	3540/3550	3640/3660	8270	10
Chrysene	3540/3550	3640/3660	8270	10
Total benzofluoranthenes(f)	3540/3550	3640/3660	8270	10
Benzo(a)pyrene	3540/3550	3640/3660	8270	10
Indeno(1,2,3-cd)pyrene	3540/3550	3640/3660	8270	10
Dibenz(a,h)anthracene	3540/3550	3640/3660	8270	10
Benzo(ghi)perylene	3540/3550	3640/3660	8270	10
Benzo(ghi)perylene	3540/3550	3640/3660	8270	10
Benzo(ghi)perylene	3540/3550	3640/3660	8270	10
Miscellaneous Compounds				
Pentachlorophenol	3540/3550	3640/3660	8270	10
Dibenzofuran	3540/3550	3640/3660	8270	10
Conventional Sediment Variables				
Total organic carbon (TOC)	---	--	9060	0.1%

EPA = U.S. Environmental Protection Agency
HPAH = high molecular weight polycyclic aromatic hydrocarbon
LPAH = low molecular weight polycyclic aromatic hydrocarbon
GPC = gel permeation chromatography
PSEP = Puget Sound Estuary Program

(a) Recommended sample preparation methods are PSEP (1997a,b); method 3500 series - sample preparation methods from SW-846 (EPA 1986) and updates.
(b) Recommended cleanup methods are:
- All sample extracts should be subjected to GPC cleanup in accordance with procedures specified by EPA SW-846 method 3640. 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 sediment), cleanup procedures specified by EPA SW-846 method 3660 should be used.
- Additional cleanup procedures may be necessary on a sample-by-sample basis. Alternative cleanup procedures are described in PSEP (1997a,b) and EPA (1986).

(c) Recommended analytical methods are:
- Method 6000, 7000, 8000, and 9000 series - analytical methods from SW-846 (EPA 1986) and updates.
- Plumb (1981) - EPA/U.S. Army Corps of Engineers Technical Report EPA/CE-81-1.
- PSEP (1997).

(d) To achieve the recommended detection limits for organic compounds, it may be necessary to use a larger sample size (approximately 100 g), a smaller extract volume for gas chromatography/mass spectrometry analyses (0.5 mL), and one of the recommended sample cleanup methods, as necessary, to reduce interference. 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 sample preparation and sample cleanup method for dioxins is described in the analytical method [method 8290, SW-846 (EPA 1986) and updates].
(f) Total benzofluoranthenes represent the sum of the b, j, and k isomers.

ATTACHMENT 1

Compliance Monitoring Plan

Compliance Monitoring Plan

Sediments Remedial Action
Cascade Pole Site
Olympia, Washington

April 5, 2001

Prepared for

The Port of Olympia
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1.0 INTRODUCTION

1.1 BACKGROUND

The Port of Olympia (Port) has entered into an Agreed Order (Agreed Order No. DE 00TCPSR-753) with the Washington State Department of Ecology (Ecology) to remediate the former Cascade Pole Site Sediments Operable Unit (SOU). The Ecology – selected cleanup action for the Cascade Pole SOU includes excavation of contaminated sediments, containment of the contaminated sediments in an upland cell, containment of shoreline soil and sediment within a sheet pile barrier, institutional controls, shoreline improvements, and a compliance monitoring program (see Section 1.5 for more details). This Compliance Monitoring Plan (Plan) provides specific details for implementing the compliance monitoring program and addresses three important aspects of the cleanup action: 1) protection of human health and the environment during cleanup activities; 2) performance of the remedial action in meeting cleanup standards; and 3) confirmation of the long-term effectiveness of the cleanup action. The Plan has been prepared on behalf of the Port to meet the requirements of the Agreed Order between the Port and Ecology under the Model Toxics Control Act (MTCA; WAC 173-340), and is consistent with MTCA compliance monitoring requirements [WAC 173-340-400 (4)(a)].

The remainder of this section provides a brief site description, summarizes previous site investigations and evaluations, reviews existing conditions, describes the cleanup action conceptual plan, and presents the cleanup action levels. Subsequent sections of this plan describe the compliance monitoring objectives, planned compliance monitoring activities, quality assurance/quality control (QA/QC) procedures, data evaluation methods, and corrective actions for surface water, stormwater, and sediment criteria exceedances (if any).

1.2 SITE DESCRIPTION

The former Cascade Pole Company (CPC) wood-treatment site is located approximately 1 mile north of downtown Olympia, at the northern end of the peninsula that extends into Budd Inlet (Figure 1). The Port owns the property, adjacent parcels, and adjacent in-waterway sediments. The SOU is comprised of the intertidal and subtidal sediments that lie north and east of the former wood-treatment site. Figure 2 shows the relationship of the SOU to the upland portion of the site and other features (e.g., the East Bay Waterway), as well as the property boundaries and navigational channels in the vicinity of the SOU. A detailed history of the site can be found in the Cascade Pole Remedial Investigation/ Feasibility Study report (Landau Associates 1993).

1.3 PREVIOUS SITE INVESTIGATIONS/EVALUATIONS

A number of investigations and evaluations have been performed for the SOU to characterize the nature and extent of contamination, develop and evaluate remedial alternatives to address sediment contamination, and obtain information needed for design of the final cleanup action. The most significant investigations and evaluations performed to date for the SOU consist of the sediments remedial investigation (RI), the sediments feasibility study (FS), and the pilot dredging study. A brief summary of these studies is presented in the following sections.

1.3.1 REMEDIAL INVESTIGATION/FEASIBILITY STUDY

The sediments RI, completed in 1993 (Landau Associates 1993a), confirmed the presence of contaminants in the SOU that are associated with historical wood-treatment activities at the site. The lateral distribution of the highest levels of wood treatment-related contamination is primarily to the east of the former wood-treatment plant (and historical log pond), with some spreading north, northeast, and northwest. The vertical distribution of the contamination in this area is such that the highest concentrations were found in the depth intervals of 10-55 cm and 55-100 cm (0.33 to 1.8 ft and 1.8 to 3.3 ft) below the surface of the sediment. The vertical extent of wood treatment-related contamination generally was found to be limited by the presence of an underlying silt and clay layer.

The contamination in the sediment exists primarily as sorbed chemicals, with some occurrences of non-acqueous phase liquid (NAPL). The NAPL appears to be limited to an area generally northeast of the former wood treatment plant.

The SOU FS (Landau Associates 1993b) developed and evaluated seven alternatives for sediment remediation. The FS is relevant in that Ecology's preferred remedy for the SOU was developed on the basis of the FS alternatives. The FS should be reviewed for a detailed description of the alternatives.

1.3.2 PILOT DREDGING STUDY

A dredging pilot study was conducted during August and September 1998 under a Nationwide Permit 38 authorized by the U.S. Army Corps of Engineers (USACE) (Port of Olympia Permit No. 98-2-00677). The purpose of the pilot study was to evaluate environmental controls to support the design and implementation of a full-scale sediment cleanup effort at the Cascade Pole site that is protective of human health and the environment.

The remainder of this section summarizes a number of conclusions from the pilot dredging study that may be relevant to the compliance monitoring program. The pilot dredging study report (Landau

Associates 1999) should be reviewed for a more complete description of pilot dredging study activities and results. The results of the pilot dredging study included the following observations and conclusions:

1.3.2.1 NAPL Observation

- NAPL was observed in the area previously identified as having NAPL present, although large volumes of NAPL were not released during pilot dredging activities.
- NAPL observed during land-based excavation typically occurred in thin seams of higher permeability sediment or as minor sheen generated in the vicinity of the temporary haul roads.
- NAPL observed during marine dredging occurred as extensive sheen on the water surface with localized areas of greater product accumulation.

1.3.2.2 Effectiveness of Environmental Controls

- Oil absorbent booms were generally effective in controlling the minor sheen generated during land-based excavation.
- The Gunderboom (a structural aquatic containment system that utilizes an oleophilic and hydroscopic curtain to contain suspended particulates and oil-based materials, while allowing unrestricted water movement) was effective in containing NAPL and suspended sediment within the marine dredging area.
- Oil skimmers, absorbent booms, or other product recovery equipment during marine dredging in the NAPL area to minimize recontamination of dredged areas during low tides.

1.3.2.3 Water Quality

- Only limited water is likely to be generated during sediment dredging, provided significant free water is not entrained during the excavation or marine dredging process.
- Elutriate test results indicate that return water quality will likely be acceptable for direct discharge to surface water provided turbidity and NAPL sheen can be adequately addressed.
- Elutriate test results indicate that if dredge water in the sediment containment cell does not adequately infiltrate, treatment using oil/water separation and gravity settling, possibly followed by sand or multimedia filtration, should be adequate to achieve existing site National Pollutant Discharge Elimination System (NPDES) criteria.
- Analytical results did not indicate any water quality impacts outside the Gunderboom in the marine dredging area or at any location in the vicinity of the land-based excavation area.
- Dissolved oxygen levels may exceed water quality criteria during full scale dredging, but these are ambient conditions previously observed in Budd Inlet and are unrelated to dredging activities.

1.3.2.4 Field Sampling

- Analytical results indicate that some recontamination of the backfill surface will occur, although careful project implementation should result in recontamination levels below the cleanup criteria.

1.4 EXISTING SEDIMENT QUALITY

The following sections summarizes the nature and extent of the sediment contamination and the physical characteristics of sediments within the SOU.

1.4.1 NATURE AND EXTENT OF SEDIMENT CONTAMINATION

The sediment remediation limits were developed based on the extent of NAPL-impacted sediment and sediment exceeding the sediment ecological and human health criteria, as described in the cleanup action plan (CAP) (Ecology 2000). The total area encompassed by these overlapping criteria was established by Ecology and is referred to as the site multiple benefits action area, which is delineated by the multiple benefits line (MBL). The area within the MBL is approximately 6.1 acres, with the depth of contaminated sediments exceeding the cleanup action levels extending up to 5 ft below the existing sediment surface. The estimated total volume of sediment exceeding the cleanup action levels is 32,000 yd^3.

1.4.2 SEDIMENT PHYSICAL CHARACTERISTICS

Previous investigations of the SOU distinguished three geologic units: 1) recent deposits that consist of fill and recently deposited intertidal sediments, 2) marine sediments that comprise the upper aquitard, and 3) alluvial sands that comprise the lower aquifer. Dredging and excavation associated with sediments remediation will involve only the fill and recent intertidal sediment deposits that overlie the upper aquitard.

Based on data from the sediments RI, the recent deposits range in thickness from 0.3 ft to greater than 13 ft in the east and west areas of the SOU, respectively. The recent deposits consist of varying amounts of sand, silty sand, sandy silt, silt, clayey silt, and silty clay, with shells, shell fragments, and wood debris. At most of the RI sampling locations, the upper layer of recent deposits typically consists of black to olive-black, organic silt and clayey silt.

The thicker recent deposits in the western shoreline area consist primarily of layered silty sand, sand, and silt. As discussed in the RI, these recent deposits are interpreted to be predominantly fill or wave-transported material originating from fill. The thickest deposits appear to be associated with the area bounded by fill dikes constructed in the 1930s that extended north from the northern shoreline. The deposits thin to the east and grade to predominantly gray to olive-gray silt. Where recent deposits are predominantly silt, they are interpreted to be a combination of dredged fill and recently deposited intertidal sediments.

1.5 CLEANUP ACTION CONCEPTUAL DESIGN

The conceptual design for the cleanup of the SOU is based on the preferred cleanup alternative defined by Ecology in the CAP. Ecology developed this alternative by combining elements from the various alternatives considered in the FS to arrive at a practicable overall remedy which is protective of human health and the environment. The primary components of the cleanup action are as follows:

- Excavate or dredge NAPL and contaminated marine sediments exceeding cleanup goals within the MBL
- Contain dredged sediments within an upland containment cell constructed at the site
- Containment of shoreline contaminated sediments with a sheet pile barrier wall tied to the existing slurry cutoff wall
- Provide for shoreline restoration and protective features
- Implement institutional controls to prevent human contact with sediment exceeding human health cleanup levels subsequent to SOU cleanup
- Implement a compliance monitoring program.

The Port will own, operate, and maintain the site cleanup action during and following remedial construction activities. The following is a brief summary of the conceptual design for each of the first five components of the cleanup, as well as a description of shoreline restoration and protection measures which have been incorporated into the remedy.

1.5.1 SEDIMENT EXCAVATION/DREDGING

Contaminated sediments in the intertidal and subtidal areas of the SOU will be excavated or dredged and removed from the marine environment. The excavated or dredged areas will be backfilled with uncontaminated sand or sand and gravel from offsite sources to reestablish the previous sediment surface grades.

Planned minimum dredge depths range from 1 to 5 ft below the existing sediment surface. Sediments located within the higher surface elevations of the site (greater than about +7 ft MLLW) will be excavated and backfilled using terrestrial construction equipment such as excavators, front-end loaders, and dump trucks. In the lower site elevations (less than about +2 ft MLLW), the sediments will be dredged by mechanical marine dredging methods using a clamshell bucket (or similar equipment). Portions of the site between about +2 and +7 ft MLLW could either be excavated with land-based equipment or dredged with marine-based equipment.

Environmental controls during dredging will include a Gunderboom (or equivalent), oil skimmers, and oil absorbent materials (e.g., pads and booms). A Gunderboom will be used to contain dredging-generated turbidity and floating NAPL during marine dredging. Oil skimmers and oil absorbent materials will be deployed during marine dredging of the NAPL area to minimize the potential for recontamination of clean surfaces.

Oil absorbent booms and/or pads will be used around the perimeter of the land-based intertidal excavation area. The land-based excavation areas will be backfilled as the work proceeds so that sediment in the work area is not easily eroded or re-distributed during tidal cycles and depressions that could entrap fish are not left in the sediment surface.

1.5.2 UPLAND SEDIMENT CONTAINMENT CELL

Excavated and dredged sediments will be placed in an upland containment cell located on the former wood-treatment facility adjacent to, and upland of, the sediments. The containment cell, constructed within the northeast portion of the uplands operable unit, consists of an earth berm constructed with material previously stockpiled on the site. The cell was designed with a storage capacity of approximately 60,000 yd^3. This cell volume is intended to accommodate the estimated 32,000 yd^3 of contaminated sediments (*in situ* volume), plus provisions for overdredging, material bulking, and construction cleanup.

1.5.3 SHORELINE CONTAINMENT STRUCTURE

Contaminated fill, sediments, and residual NAPL have been identified immediately outside of the existing sheet pile wall, extending down to the aquitard and into the sediments beyond the shoreline. Due to stability issues associated with deep excavation in front of the existing sheet pile wall, containment of these nearshore contaminated materials is planned. Containment of the shoreline contaminated sediments will be accomplished with a sheet pile cutoff wall which will be keyed into the existing slurry wall on each end and the underlying aquitard. The new sheet pile wall will also facilitate excavation of contaminated soil and sediments inside and to the north of the containment structure, without threatening the structural integrity of the existing sheet pile wall. The shoreline containment structure and the shoreline excavation and backfilling activities are designed to result in no net loss of intertidal habitat in the containment structure area. The excavated shoreline along the outside of the shoreline containment structure will be reconstructed with sand and gravel backfill materials and covered with riprap slope protection, similar to existing conditions.

1.5.4 Shoreline Restoration and Protection Features

This section describes conceptual design features which have been incorporated into the overall cleanup action with the intent of restoring, and in some cases improving, shoreline areas that may be impacted by remedial dredging or from past activities at the site. Following removal of coarse debris and underlying soil, the westernmost shoreline will be graded to flatten the beach slopes and add intertidal area. The beach slopes will then be covered with a layer of clean granular fill. These design features for the western shoreline area will provide beneficial habitat that will resemble the conditions that might have occurred under natural depositional processes in this area. In addition, a below-grade erosion barrier will be constructed to provide erosion protection for the existing slurry wall in the event of extreme storm activity.

Along the outside face of the shoreline containment structure, the excavated shoreline area will be backfilled with sand and gravel and covered with riprap erosion protection. The interstitial voids of the riprap will be filled with a finer-grained granular material to improve the substrate diversity in this area.

The excavated soil and riprap removed from the eastern shoreline area will be replaced with similar materials, restoring the shoreline to its original configuration. The riprap voids in this area will also be filled with finer-grained granular material to improve the substrate diversity. The riprap slope will be graded to tie into the shoreline containment erosion protection material. Following the remedial earthwork activities, the shoreline area will be revegetated with native plant species.

1.5.5 Institutional Controls

The site has posted signs and will remain fenced, with restricted access until completion of the cleanup. Following the remedial construction, the Port will restrict property use from interfering with the ongoing performance of the cleanup action (e.g., maintain the shoreline containment wall, maintain the sediment containment cell). Future site use will also be restricted (e.g., restricted boat access and no harvesting of shellfish) until constituents of concern in the SOU are at concentrations that will not pose an adverse risk to human health.

1.6 CLEANUP ACTION LEVELS

The sediment cleanup action levels for the site were developed by Ecology and are based on the State of Washington Sediment Management Standards (SMS) minimum cleanup levels (MCUL) in WAC 173-204-520, a dioxin action level, and a human health action level for carcinogenic polycyclic aromatic hydrocarbons (cPAHs). The chemical MCUL represents the minimum cleanup levels for surface sediments, below which minor adverse effects in marine biological resources have been observed. The dioxin cleanup level is a biological-based action level that was developed by Ecology based on the amount of accumulation of dioxin in fish egg tissue. Due to the lack of data regarding marine fish species, the available data on fresh water fish species from the literature were used to develop the dioxin cleanup action level. The cPAH human health-based cleanup level was calculated based on an excess cancer risk of approximately $1x10^{-4}$. The sediment cleanup levels for the SOU are presented in Table 1.

The MBL delineates the remediation area that has been identified as exceeding the cleanup action levels. The remaining areas of the SOU will be subjected to institutional controls until human health-based cleanup levels are achieved throughout the site for both cPAH and dioxin through natural recovery.

2.0 COMPLIANCE MONITORING OBJECTIVES

The MTCA requires compliance monitoring for all cleanup actions, as described in WAC 173-340-410. Compliance monitoring is conducted for the following three purposes:

- **Protection monitoring**: to confirm that human health and the environment are adequately protected during construction and the operation and maintenance of the cleanup action

- **Performance monitoring**: to confirm that the cleanup action has attained cleanup standards and any other performance standards

- **Confirmational monitoring**: to confirm the long-term effectiveness of the cleanup action once the cleanup standards and other performance standards have been attained.

This section provides a conceptual description of planned compliance monitoring activities. Monitoring for protection of human health will be addressed in detail in the project health and safety plans (HASPs). Monitoring for protection of the environment, and performance and confirmational monitoring are addressed in detail in this Plan.

2.1 PROTECTION MONITORING

Monitoring for protection of human health addresses worker safety for activities related to construction, operation, and maintenance of the cleanup action and, as described above, will be addressed through project HASPs. The project HASPs will address potential physical and chemical hazards associated with site activities, consistent with the requirements of WAC 173-340-810. Anticipated potential physical hazards include working in proximity to heavy equipment, working over water, and heat stress. Anticipated potential chemical hazards include exposure to site contaminants through various exposure pathways (i.e., direct contact, ingestion, and inhalation).

Monitoring for protection of the environment addresses environmental receptors that may be exposed to physical or chemical hazards at levels that may cause adverse effects. For this project, the primary receptors of concern are aquatic organisms in the marine environment in the site vicinity. Protection monitoring will include monitoring surface water quality during excavation, dredging, backfilling activities, and monitoring stormwater runoff from the upland containment cell. Potential adverse chemical impacts include exposure of aquatic organisms to contaminants present in site sediment, through direct contact with *in situ* sediment, suspended sediment, suppressed oxygen levels, and dissolved constituents or NAPL released to surface water during dredging. Potential adverse physical impacts include exposure of aquatic organisms to excessive turbidity resulting from sediment removal activities.

Monitoring for protection of the environment will consist of surface water quality measurements and visual observations during sediment removal, backfilling, and any other construction activities that have the potential to cause releases to the aquatic environment. Monitoring will provide direct feedback on the effectiveness of the engineering controls used to protect the environment. Environmental protection monitoring will consist of real time monitoring for turbidity, pH, dissolved oxygen, temperature impacted biota, and visible sheen during both marine and land-based dredging. Based on the results of the pilot dredging study, the presence of contamination in the water column resulting from dredging activities correlates directly to elevated turbidity (Landau Associates 1999). As a result, turbidity will be the primary monitoring parameter used for evaluating dredging activities.

Stormwater compliance monitoring will be performed to confirm that stormwater discharges to Budd Inlet from the Cascade Pole site will comply with existing and proposed discharge limitations. Existing limitations are based on the NPDES waste discharge permit substantive requirements, which were prepared to reduce discharge of water-borne pollutants in the groundwater treatment effluent stream, to the maximum extent practicable. Proposed discharge criteria for stormwater from post-construction "clean" areas are based on WAC 173-201A surface water quality standards, which were developed to protect characteristic water uses, human health, and ecological receptors.

2.2 PERFORMANCE MONITORING

Performance monitoring will be conducted during, and subsequent to, construction of the cleanup action. Performance monitoring conducted during construction will be limited to verifying that the lateral and vertical extent of sediment removal specified in the CAP is achieved. Land surveying, bathymetric soundings, and visual observation (in the NAPL area) will be used to verify sediment removal adequacy. Specific procedures for verification surveying are presented in the construction quality assurance plan (Exhibit D of the Contract Documents).

Chemical testing, as part of performance monitoring, will be conducted after construction because it is not technically feasible to obtain analytical results from chemical testing prior to backfilling in advance of the incoming tide. Chemical testing will be conducted to determine whether cleanup action levels have been attained throughout the site to provide a basis for long-term performance and confirmation monitoring; it is not intended that additional excavation or dredging be performed if cleanup action levels are exceeded (Landau Associates 2001). Sediment core samples will be collected at the interface between the excavation bottom and the clean backfill to determine if contaminants above the cleanup action levels remain below the excavated surface. Sediment core samples will also be collected from within the clean backfill material to monitor potential movement of contamination if cleanup action levels are exceeded at the excavation surface. Additionally, surface sediment grab samples will be collected from affected sediment beyond the MBL to monitor natural recovery. Sediment samples will be tested for dibenzofuran, PAH, dioxins, and total organic carbon (TOC).

Performance monitoring will be considered complete for those portions of the site where sediment analytical results comply with site cleanup action levels within the predominant biologically active zone. For those areas of the site where cleanup action levels are not achieved during the initial round of performance monitoring, periodic monitoring will be conducted to track the progress of natural recovery and/or ensure that residual contamination will not degrade the predominant biologically active zone. Specific monitoring procedures, sampling density, and sampling frequency are presented in Section 5.0.

2.3 CONFIRMATIONAL MONITORING

Confirmational monitoring will be conducted in areas where sediment below the predominant biologically active zone exceeds site cleanup action levels following sediment removal. Confirmational monitoring will consist of periodic collection and analysis of sediment core samples from clean fill material overlying the excavated areas to verify that contamination has not migrated upward to the extent that human health or the environment are threatened. Sediment samples will be analyzed for those parameters that previously exceeded cleanup action levels at a given location. Specific procedures and sampling frequency for confirmational monitoring are presented in Section 5.0.

3.0 SURFACE WATER MONITORING

Surface water quality measurements and visual observations will be conducted during sediment removal and any other construction activities that have the potential to cause releases to the aquatic environment. Surface water quality data will be used to evaluate the effectiveness of the engineering controls used to protect the environment. Surface water monitoring will consist of real time monitoring for turbidity, pH, dissolved oxygen, temperature impacted biota, and visible sheen during sediment excavation and dredging activities, and construction of the shoreline containment structure. Turbidity, an indicator of potential contamination during dredging activities, will be the primary monitoring parameter used for dredging decisions. The ambient dissolved oxygen in Budd Inlet is low during summer; therefore, dredging decision criteria associated with dissolved oxygen are correlated to incremental reduction below background levels rather than to absolute concentrations.

Water quality monitoring will be more frequent during marine dredging than during land-based sediment excavation, based on the results of the pilot dredging study. Monitoring frequency will be reduced as dredging progresses, provided that early data indicate surface water quality is being adequately protected.

Ecology has specified a 300-ft mixing zone for short-term water quality impacts resulting from sediment removal (Kourehdar 2001). Ecology has also specified that water quality monitoring be implemented at a distance of 150 ft from the active sediment removal activities to provide sufficient time to implement corrective actions prior to exceeding water quality criteria at the mixing zone boundary. For marine dredging, the mixing zone will be measured from the boundary of the Gunderboom containment area. For land-based excavation, sediment transport and handling, and related activities the mixing zone will be measured from the outer boundary of the excavation or backfilling activities.

Cleanup construction is subject to an additional water quality monitoring condition imposed by the Nationwide 38 Permit issued by the USACE for in-water work conducted prior to July 15. No mixing zone is allowed for in-water work performed in this time period within the Gunderboom. As a result, water quality monitoring for work conducted inside the Gunderboom will be conducted immediately outside (within 20 ft) of the Gunderboom prior to July 15. Exceedance of water quality standards immediately outside the Gunderboom for this time period will be addressed in the same manner as an exceedance at the mixing zone boundary for the remainder of this project.

Two different types of surface water quality monitoring will be performed: 1) intensive monitoring, and 2) routine monitoring. Intensive monitoring will be performed during the first week of intertidal excavation and marine dredging activities, and at any time thereafter, if it is determined that the water quality criteria have been exceeded at a distance of 150 ft or more from the active area. The components of the two monitoring strategies are outlined in the following sections. Routine monitoring will be performed following the first week of excavation and dredging activities if the results from the intensive monitoring demonstrate that the water quality criteria have not been exceeded at the 150 ft monitoring boundary. Surface water samples will be collected for chemical analyses during the initial phase of the water quality monitoring, and if turbidity criteria are exceeded at the mixing zone boundary.

3.1 INTENSIVE SURFACE WATER QUALITY MONITORING

Surface water quality monitoring will be conducted every day for the first week of full production for both land-based excavation and marine dredging activities. Intensive monitoring will also be performed if a new method of excavation or dredging is introduced as a corrective measure, or as warranted by unanticipated site conditions. Surface water quality monitoring will be conducted onsite before, during, and after remedial activities. Water quality monitoring will be conducted before the remedial activities occur, in order to determine baseline water quality for comparison. Water quality will also be monitored during the remedial activities, at a frequency of once every two hours during both excavation/dredging and backfilling activities. Water quality monitoring at the reference (background) location will be performed at the same frequency as the onsite monitoring, for comparison. If it is determined that the water quality criteria have been exceeded during the monitoring period, corrective actions will be taken and the frequency of the monitoring will be maintained. Conversely, the monitoring frequency will be reduced if no adverse effects are observed during the first week of remedial activities.

3.2 ROUTINE SURFACE WATER QUALITY MONITORING

Routine surface water quality monitoring will be performed in the same manner as intensive monitoring, with the exception of sampling frequency. Routine water quality monitoring will be conducted only 1 day per week, during excavation and dredging activities that have demonstrated no ongoing water quality impacts during the intensive monitoring period. If it is determined that the water quality criteria have been exceeded during the routine monitoring, or if a spill or release occurs, corrective actions will be taken and the frequency of the monitoring may increase, subject to review and concurrence of Ecology regarding the corrective measures and the monitoring frequency.

3.3 MONITORING LOCATIONS

The Ecology-designated mixing zone has been established at 300 ft from in-water activities. This mixing zone will apply to all in-water activities, except as described below for work prior to July 15. Gunderboom placement will enclose marine dredging activities and the NAPL area. The MBL will be used as the outer bound of the active area for measuring the mixing zone boundary, for areas contained by the Gunderboom. The basis for measuring the active area for land-based excavations conducted outside the Gunderboom will be the outermost extent of construction activity. Monitoring for excavation and backfilling activities conducted "in the dry" will be conducted during inundations of the work area by the next incoming tide.

Prior to July 15, or another date agreed to by the Port, NMFS, Washington Department of Fish and Wildlife (DFW), and Ecology, the mixing zone will be limited to immediately outside the Gunderboom, for those activities conducted within the Gunderboom containment, to comply with the terms and conditions of the Nationwide 38 permit.

Surface water monitoring will be conducted along a horizontal transect perpendicular to, and down current of, the remedial activities, and along a transect of similar dimensions and depth at a reference (background) location within Budd Inlet which is away from the potential influence from remedial activities.

Surface water quality monitoring will be performed at each location where dredging activities take place. At each onsite location where remedial activities take place, water quality parameters will be measured at a minimum of 3 to 5 points along a transect of approximately 200 to 400 ft in length (as needed for coverage), within 150 ft surrounding the perimeter of excavation/dredging activities as depicted on Figure 3. At the reference location, water quality parameters will also be measured at a minimum of 3 points along a transect of approximately 300 ft in length.

The water quality monitoring for both onsite locations and the reference location will be conducted at multiple depths. At each location, monitoring will be conducted within 1.5 ft from the surface and at mid-depth (approximately one-half of the total water depth). At locations where the water depth is greater than 10 ft, a third measurement will be taken 3 ft above the sediment surface.

If water quality criteria are exceeded at the 150 ft transect, a second transect at the mixing zone boundary (300 ft) will be monitored using a similar frequency as that described for the 150 ft transect. If water quality criteria are exceeded at the mixing zone boundary, water quality samples will be collected for chemical testing as described in the following section.

3.4 WATER QUALITY MEASUREMENTS

The following water quality parameters will be measured during all water quality monitoring activities:

- turbidity
- dissolved oxygen

- pH
- temperature.

These water quality parameters will be directly measured using a hand-held Horiba U-10 Water Quality Checker instrument, or equivalent. The instrument will be calibrated before each measurement session following the auto-calibration procedure referenced in the instrument's instruction manual. The instrument will be thoroughly washed with distilled water and properly stored after each measurement session.

Water quality monitoring data will be properly documented in a field notebook. A sketch of the sampling transect in relation to the dredging activities and shoreline features will be recorded in the field log following each sampling event. Each sampling location will be determined using a differential global positioning system (DGPS) instrument and the sampling location documented in state plane coordinates.

In addition, any observations of impacted biota and/or visible sheen on the water surface will be recorded. The size, location, and potential source of impacted biota and/or visible sheen will be determined and photo-documented as needed. Any indication of impacted biota or visible sheen will be reported to Ecology and National Marine Fisheries Service (NMFS), and if determined to result from project activities, will be subject to immediate corrective action.

A limited number of surface water quality samples will be collected and analyzed for chemical constituents of concern. Two samples from a single location will be collected at the mixing zone boundary prior to the start of dredging to establish background conditions. Samples will be collected from the two depth intervals that exhibit the highest turbidity readings from the selected monitoring location. The samples will be tested for PAH, TSS, and dioxins/furans using the analytical procedures described in Section 4.2 for stormwater monitoring.

Additional surface water quality samples will be collected for chemical analyses if turbidity water quality criteria are exceeded at the mixing zone boundary and the exceedance is determined to be associated with dredged/excavated sediment. The samples will be collected at the location exhibiting the greatest turbidity exceedance, and will be collected from the two depth zones that exhibit the greatest turbidity exceedance. No more than one set of water quality samples will be collected for chemical testing in association with an identified release within a 24-hour period. Corrective actions will be implemented to address any releases that result in exceedance of water quality criteria beyond the mixing zone boundary, as described in Section 3.7. Laboratory testing for PAH will be expedited for the first criteria exceedance that occurs (1-week turn around). Quality assurance/quality control (QA/QC) procedures will be followed as described in Section 7.0.

3.5 SAMPLE IDENTIFICATION

Each water quality measurement or sample will have a sample identification number, using an identification scheme with the following elements:

- Location (i.e., E, D, or R for excavation, dredging, and reference, respectively)
- Date and time of measurement (e.g., 072101-1330)
- Point along horizontal transect (e.g., A, B, C, etc.)
- Measurement depth (e.g., 1.0 ft)

The format for the sample identification number is: Location-Date-Time-Horizontal Transect Point-Depth. For example, the sample identification for water quality measurements collected during dredging activities on July 18, 2001, along transect point B at 2:00 pm at a depth of 4.5 ft would be: D-071801-1400-B-4.5.

3.6 WATER QUALITY ACCEPTANCE CRITERIA

Water quality measurements will be compared to both the corresponding initial onsite background measurements, and to the reference location measurements. Turbidity will be the primary monitoring parameter used for dredging decisions. Described below are the water quality criteria as set forth in Chapter 173-201A WAC. These criteria are the water quality standards for surface waters of the State of Washington.

According to WAC 173-201A-030 (3)(vi) for Class B waters, when background turbidity is 50 NTU or less, turbidity shall not exceed 10 NTU over the background turbidity. When the background turbidity is more than 50 NTU, turbidity shall not have more than a 20 percent increase. By the same guidelines, pH shall be within the range of 7.0 to 8.5, with a human-caused variation within the above range of less than 0.5 units [WAC 173-201A-030 (3)(v)].

As discussed earlier, the ambient dissolved oxygen in Budd Inlet is low during summer and, as such, any dredging decision criteria associated with dissolved oxygen must be correlated to incremental reduction below the background levels, rather than to absolute concentrations. According to WAC 173-201A-030 (3)(ii)(B), the dissolved oxygen concentration should exceed 5.0 mg/L. When natural conditions occur, causing the dissolved oxygen to be depressed near or below 5.0 mg/L, natural dissolved oxygen levels may be degraded by up to 0.2 mg/L by human-caused activities. However, due to the overall benefit of this project and the naturally occurring low surface water oxygen levels in Budd Inlet, after July 15, DO levels will have an allowable degradation increment of 2 mg/L below natural DO levels to facilitate timely project completion. Prior to July 15, or another date agreed to by the Port, NMFS, DFW, and Ecology, DO levels will have an allowable degredation increment of (Criteria Pending) mg/L below natural DO levels to comply with the terms and conditions of the Nationwide 38 permit.

If water quality monitoring parameters are exceeded during sediment removal or backfilling activities, appropriate corrective actions will be taken. In addition, if a visible plume is observed outside of the Gunderboom containment system, but within the 300-ft mixing zone and is likely to result in a water quality exceedance, corrective actions will be taken. Monitoring frequency may be temporarily increased until data indicate that releases are being adequately controlled.

Results from surface water chemical testing will require several weeks to receive and validate. Therefore, analytical results will not be used to identify corrective actions. Analytical results will be compared to the water quality criteria in Table 3 for stormwater discharge to the marine stormwater system, and reported in the construction documentation report along with other water quality data.

3.7 CORRECTIVE ACTIONS

If water quality monitoring parameters are exceeded during sediment removal or backfilling activities, appropriate corrective actions will be taken. Corrective actions could include modification of sediment dredging or handling procedures, modification of backfilling procedures, implementation or modification of engineering controls, suspension of the activity causing the exceedance until water quality criteria are achieved, or allowance of a short-term water quality exceedance (e.g., if the exceedance is minor and the result of turbidity from clean backfill). Unless the appropriate corrective action is obvious and immediate action required (e.g., repairing a breach in the Gunderboom containment system), the corrective action applied to a given water quality exceedance will be selected in consultation with Ecology. The NMFS will also be consulted for any water quality exceedances that occur before July 15, or any indications of distressed chinook salmon. Allowance of a short-term water quality exceedance will require the review and approval of Ecology.

4.0 STORMWATER MONITORING

Stormwater monitoring requirements for the Cascade Pole site fall into two general categories: construction monitoring and long-term monitoring. Construction monitoring requirements will apply during the implementation of construction activities associated with the sediments cleanup action. Long-term monitoring will replace construction monitoring after the temporary cover is constructed over the upland containment cell.

During construction activities, stormwater will be collected and treated by two different systems; both systems will discharge to Budd Inlet. Some of the stormwater in the containment cell will infiltrate through the sediment and underlying soil to groundwater, where it will be collected by the four groundwater extraction wells at the perimeter of the containment cell. Water collected by these extraction wells, and other extraction wells within the slurry wall, will be treated in the existing groundwater treatment plant and discharged to Budd Inlet via the Lacey, Olympia, Tumwater, Thurston County Partnership (LOTT) outfall (Figure 4). Stormwater collected by the catch basins outside the containment cell or in the infiltration/underdrain trenches at the base of the containment cell will be treated in a temporary water treatment system during the construction period. Effluent from the temporary water treatment system will also be discharged to Budd Inlet, via the Port's surface water drainage system and the City of Olympia's stormwater outfall. Effluent from the Contractor's water treatment system will be subject to the same NPDES permit requirements as the Port's existing groundwater treatment system.

Stormwater collected after the temporary cover is constructed over the upland containment cell will be handled in a variety of ways and discharged to Budd Inlet at two locations. Water that originally entered the containment cell as stormwater or as pore water in the sediments will continue to infiltrate to groundwater beneath the containment cell after the temporary cover is in place. As during the construction phase, extracted groundwater will be handled by the existing groundwater treatment system.

Post-construction stormwater drainage is divided into three drainage areas (Area 1, Area 2, and Area 3) for stormwater management purposes, as shown on Figure 4. "Clean" stormwater runoff from Area 1 (the top of the covered containment cell) will be discharged to Budd Inlet via the existing 12-inch diameter marina outfall; stormwater from Area 1 can also be diverted to bermed locations in Area 2 (unpaved area west of the containment cell) and Area 3 (unpaved area south of the containment cell) for containment and infiltration or treatment. Potentially contaminated stormwater collected in Areas 2 and 3 will be contained and infiltrated or, as the available treatment capacity allows, treated by the existing groundwater treatment system (Figure 4).

Monitoring will be conducted to confirm that stormwater discharges to Budd Inlet comply with applicable regulations. Discharges to Budd Inlet via the Port's surface water drainage system and the

LOTT outfall will be monitored in accordance with the requirements established by the existing NPDES substantive requirements issued for the remediation of contaminated groundwater at the Cascade Pole site. Discharges to Budd Inlet via the marina outfall will comply with the water quality standards for Class B surface waters in the State of Washington described by WAC 173-201A, and presented in Table 3 for those constituents that will be monitored for this project.

4.1 SAMPLING APPROACH

This section describes the sampling approach that will be used to monitor compliance with the applicable stormwater discharge criteria, including sampling locations, sampling schedules, methods for sample collection and handling, and field documentation. Stormwater discharge sampling requirements are summarized in Table 2.

4.1.1 SAMPLING LOCATIONS

Stormwater samples associated with construction and long-term monitoring requirements will be collected from three locations:

- Final effluent line on the existing groundwater treatment system prior to the tie-in to the LOTT discharge line
- Final effluent line on the temporary water treatment system prior to the tie-in to the Port's surface water drainage system
- Conveyance ditch, pipe, or manhole from Area 1 prior to the tie-in to the existing marina stormwater system near the boat launch.

Additionally, samples collected from the influent lines on the existing and temporary water treatment systems will be collected and analyzed for PCP to confirm that the NPDES permit requirement of 99.5 percent PCP removal is maintained.

4.1.2 SAMPLING SCHEDULE

As required under the existing NPDES substantive requirements for treatment system discharges, discharge flow from the existing groundwater treatment system and the temporary water treatment system will be monitored continuously by a flow meter. Water samples from the treatment systems will be collected and analyzed weekly, in accordance with the NPDES permit.

Periodic sampling and analyses of stormwater for pollutants in areas where stormwater does not come into contact with industrial activities, storage of raw materials or products, or suspected contaminated media are not necessary, nor is such monitoring required by the provisions of Ecology's

NPDES permits. The potential need for voluntary sampling and analysis of stormwater discharge to Budd Inlet from Area 1 during long-term operation and maintenance of the containment cell is summarized below.

One stormwater sample will be collected from the conveyance ditch or pipe from Area 1 upon completion of the temporary containment cell cover to confirm that stormwater from this area is not impacted by cross contamination during cover construction or by the contaminated materials beneath the cover. Additional stormwater samples from Area 1 runoff will only be collected if the confirmation sample excludes surface water quality criteria, or as warranted by observations made during visual inspections of the temporary and final cover of the containment cell and the associated drainage system. These inspections will be conducted at least semiannually.

Water quality sampling and analyses of Area 1 stormwater will be performed as needed to characterize discharge water quality under the following circumstances:

- If the initial confirmation sample does not meet surface water quality criteria, a second sample will be collected and tested to address the deficiency
- If evidence of pollutants is observed during the visual inspections of the containment cell and the associated stormwater drainage system
- If the Port and Ecology determine that some unanticipated event at the site has resulted in a significant potential exposure of stormwater runoff to chemical constituents of concern
- If future construction activities in Area 1 result in significant disturbances of the temporary or final containment cell cover.

4.1.3 FIELD DOCUMENTATION

Observations made during stormwater sample collection and other relevant information on field activities will be documented in the field on appropriate forms and in field notebooks at the time of sampling. A sample collection form will be completed at the time each sample is collected to document the sample. Sample container labels, which will be completed and affixed to each sample container, will identify the sample number/location, the date and time of collection, analysis required, the sampling personnel, and the project name. In addition, each sample container will be labeled and recorded on a chain-of-custody record. The chain-of-custody record will follow the sample from collection through transfer, analysis, and disposal. This procedure is designed to maintain the integrity of the sample, as well as to properly account for the sample at all stages of storage, transport, analysis, and through disposal. Specific sample handling and custody procedures are described in Section 7.0 of this Plan.

4.2 SAMPLE ANALYSIS

This section describes the analytical procedures and reporting requirements for the stormwater samples collected at the Cascade Pole site. The proposed chemical analyses of stormwater samples include PAH, pentachlorophenol (PCP), tetrachlorophenol (TCP), dioxins, copper, pH, dissolved oxygen (DO), temperature, total suspended solids (TSS), and total dissolved solids (TDS); however, not all of the analyses identified above will be performed on each stormwater sample. The proposed analyses for samples collected at the various locations are summarized in Table 2. The analytes were selected based on discharge requirements established by the NPDES substantive requirements for groundwater remediation discharge from the Cascade Pole site and Class B surface water quality standards described in WAC 173-201A. WAC 173-201A does not identify surface water quality standards for PAH or dioxins; therefore, federal surface water quality standards were used for these constituents. Dioxins will be analyzed during the first round of sampling from the tie-in to the marina stormwater system and will be eliminated from subsequent analyses if dioxins are not detected or detected at concentrations significantly below the surface water standard (1.4×10^{-8} μg/L).

Some parameters, including pH, DO, and temperature, will be measured using field instruments at the time of sample collection. The remaining analytes will be tested in a state-approved laboratory using the following analytical methods:

- Total PAH: EPA Method 610 using the HPLC option with UV and fluorescence detection
- PCP and TCP: EPA Method 604 using capillary columns DB1 and DB1301 with an ECGC detector and derivation using diazomethane
- Copper: EPA Method 200.7
- TSS: EPA Method 160.2
- TDS: EPA Method 160.1
- Dioxins: EPA Method 8290.

The analytical methods and detection limits required for sample analyses are summarized in Table 2 with the general sampling requirements for stormwater samples.

4.3 DATA ANALYSIS AND INTERPRETATION

Stormwater monitoring data collected in the field and analyzed in the laboratory will be compared to the discharge limits established by: 1) the NPDES permit for the tie-in to the LOTT stormwater system, and 2) the surface water quality requirements described in WAC 173-201A for Budd Inlet for the tie-in to the marina stormwater system. PCP, PAH, turbidity, pH, and temperature are the analytes that would have the greatest potential for impacting stormwater quality from Area 1; therefore, these are the proposed analytes for stormwater samples from this area. Although dioxin concentrations are not expected to significantly impact stormwater, dioxin will be included as an analyte during the first round of sampling from the tie-in to the marina stormwater system to confirm this assumption.

Discharge limits for the tie-ins to the LOTT and marina stormwater systems are summarized in Table 3. If the reported data are not within the limitations presented in Table 3, corrective actions will be taken as discussed in Section 4.4.

4.4 CORRECTIVE ACTIONS

If data results indicate that stormwater discharge is not in compliance with the limitations identified in Section 4.3, (i.e., the existing groundwater treatment system, the temporary water treatment system, or Area 1) Ecology will be informed immediately and a corrective action plan developed and implemented. Corrective action could include modification or repair to the existing treatment system(s), repair of cap or pipe sections, or other appropriate actions. The corrective action plan will be subject to the review and concurrence of Ecology.

5.0 SEDIMENT MONITORING

This section describes the field activities related to sediment quality monitoring for the site compliance monitoring program. Sediment samples will be collected and analyzed to determine the concentration of constituents of concern at the dredged surface and backfill material interface (dredge interface), at the surface of the post-placement backfill material, and at the sediment surface beyond the MBL. Sediment samples will be collected in general accordance with the Puget Sound Estuary Program (PSEP) protocols (1997a). Descriptions are provided in this section for the overall sampling approach, proposed station locations, sampling platforms, station positioning, sampling methods, chemical and conventional analyses, decontamination procedures, sample handling and storage, field documentation procedures, and procedures for disposal of sediment samples.

5.1 SAMPLING APPROACH

Sediment monitoring will serve three objectives: 1) to verify the performance of the cleanup action in attaining cleanup action levels; 2) to confirm the long-term effectiveness of the cleanup action; and 3) monitor the progress of natural recovery. Subsurface sediment cores and surface sediment grab samples will be collected to meet these objectives.

5.1.1 PERFORMANCE MONITORING

Sediment quality performance monitoring will be conducted to determine the concentration of constituents of concern at the dredged interface, at the surface of the post-placement backfill material, and at the sediment surface beyond the MBL. The sediment quality performance monitoring will be initiated within 4 weeks after completion of all sediment removal, backfilling, and related cleanup activities, or at a time that is mutually agreed to between the Port and Ecology.

Sediment cores will be collected at 15 locations within the sediment removal area to determine sediment quality at the dredge interface (Figure 5). Sediment will be collected from the following three intervals for each core: 1) the dredge interface to 1 ft below; 2) a 6-inch interval (depending on backfill thickness) from the interior of the backfill; and 3) the backfill surface (0 to 10 cm predominant biologically active zone).

The dredge interface sample will be analyzed for sediment constituents of concern (PAH, dibenzofurans, and dioxins), grain size, and TOC at all 15 locations (Table 4). The analytical results will be evaluated to determine if the cleanup action levels were met during dredging/excavation at the dredge interface. The sediment chemistry will provide a basis for determining whether long-term confirmation monitoring is needed, but will not be used as a basis for additional dredging/excavation.

The sample collected from the interior of the backfill material overlying the dredge interface will be archived for all 15 locations (Table 4). These samples will be analyzed at locations where the dredge interface sample exceeds one or more of the cleanup action levels to provide a baseline for subsequent confirmational monitoring, as described in the following section. These samples will only be analyzed for constituents of concern that exceed their cleanup action level in the underlying interface sample and for TOC (if applicable).

Surface sediment samples from 10 of the 15 sampling locations within the MBL, and 5 locations beyond the MBL, will be analyzed for the constituents of concern and TOC to evaluate post-remediation surface sediment quality (Figure 5; Table 4). Locations where the surface sediment sample exceeds cleanup action levels (if any) will be incorporated into a long-term performance monitoring program to evaluate the effectiveness of natural recovery in achieving cleanup action levels. Sampling frequency for long-term performance monitoring (if needed) will be the same as described in the next section for confirmational sampling. Long-term performance monitoring will be limited to TOC and those constituents of concern that exceed their respective cleanup action level, on a location-by-location basis. A plan for long-term performance monitoring (if needed) will be developed after initial performance monitoring, and will be subject to the review and approval of Ecology.

5.1.2 CONFIRMATIONAL MONITORING

Confirmational monitoring will be conducted at locations where the sediment at the dredge interface exceeds one or more of the cleanup action levels. Confirmational monitoring will consist of collection and analysis of a 6-inch sediment core sample from the interior of the backfill material overlying the subject dredge interface locations and a surface sediment sample (0 to 10 cm). At locations where backfill is 1 ft thick, the interior core sample will be collected from the center of the backfill. At locations where the backfill is 2 or more ft thick, the interior core sample will be collected from 1 to 1.5 ft above the interface, with a maximum depth for the top of the sample of 5 ft below the post-construction sediment surface.

Sediment confirmation core samples will be analyzed for those parameters that previously exceeded cleanup action levels at the subject location. Surface sediment samples will be archived (frozen) and will only be analyzed if the core sample exceeds one or more of the cleanup action levels.

5.2 SAMPLING LOCATIONS

A total of 20 sediment sampling locations are proposed for performance and confirmation monitoring (Figure 5). Fifteen sampling locations (CP-01 to CP-15) are inside the MBL and five locations surround the perimeter of the MBL. Locations were selected to represent the various excavation/dredge depths and methods used for the cleanup, as well as to provide adequate spatial coverage of the cleanup site and surrounding area.

5.2.1 PERFORMANCE MONITORING

Performance monitoring will consist of collecting sediment cores from the 15 locations within the sediment removal area, to determine sediment quality at the dredge interface. In addition, sediment grab samples will be collected from the five locations outside of the MBL to assess baseline conditions. The proposed station locations are presented in Figure 5, and Table 5 presents the target coordinates.

5.2.2 CONFIRMATIONAL MONITORING

Confirmational monitoring will consist of collecting sediment cores from any of the 15 locations where the sediment at the dredge interface exceeds one or more of the cleanup action levels. Additionally, sediment grab samples will be collected from any of the five locations outside of the MBL where the sediment concentrations exceed one or more of the cleanup action levels.

5.3 SAMPLING SCHEDULE

The sediment quality performance monitoring will be initiated within 4 weeks after completion of all sediment removal, backfilling, and related cleanup activities, or at a time that is mutually agreed to between the Port and Ecology.

If needed, confirmational monitoring will be conducted on an annual basis for up to 5 years, and will be terminated at any location where concentrations for all constituents of concern are below the cleanup action levels for two consecutive monitoring events. After 5 years, the compliance monitoring data will be evaluated in consultation with Ecology to determine the need for further compliance monitoring, and to establish the scope and frequency for further compliance monitoring, if needed. The Port may propose modifications to the compliance monitoring program prior to completion of the 5-year monitoring period, subject to the review and concurrence of Ecology.

5.4 STATION POSITIONING

The objectives of station positioning are to accurately (± 3m) determine and record the positioning of the sampling locations. Station locations will be surveyed using a DGPS with the use of a known survey control point. All station coordinates will be reported in Washington State Plane coordinates (NAD 83 horizontal datum). Target coordinates for sediment sampling locations are presented in Table 5.

Sampling locations accessible by boat will be surveyed using a Trimble 4000 DGPS or equivalent. The Trimble 4000 includes a roving receiver unit on board the vessel (on the boom) and a reference (Coast Guard) station unit. The Trimble unit on board the vessel will receive radio broadcasts of GPS signals from satellites. The reference station will also receive these signals and transmit its DGPS coordinates from the shore to the vessel. The reference station is used to localize the coordinates and achieve the required accuracy.

To ensure the accuracy of the system, a survey control point (i.e., check point) will be land-surveyed to a known point such as a pier face, dock, piling, or similar structure that is accessible by the sampling vessel. At the beginning and end of each day, the vessel will be stationed at the check point, a DGPS position reading will be taken, and the reading will be compared with the known land-survey coordinates. The two position readings should agree within 3 m.

When the sampler is deployed, actual northing and easting display coordinates are recorded electronically. Actual sample location coordinates are determined when the sampler is on the bottom and the cable is taut and perpendicular to the water surface. Station coordinates will be recorded in field logs at the time of sample collection.

5.4.1 VERTICAL POSITION CONTROL

Vertical position control will be checked by using the depth sounder on the sampling vessel. A lead line (or weighted tape) will be used to measure from the water surface to the mudline as a check and to provide a correction factor (if necessary) for readings from the vessel's depth sounder. Adjustments to depth readings due to tidal stages will be made using tidal prediction software. Vertical datum will be reported relative to MLLW (0.0 ft) Cascade Pole Datum.

5.5 SAMPLE COLLECTION AND HANDLING

This section presents the methodology for the collection of subsurface (cores) and surface (grabs) sediment samples, as well as the subsequent processing, subsampling, and handling of samples for chemical analysis.

5.5.1 SEDIMENT CORE COLLECTION

Sediment cores will be collected at 15 locations within the dredged area as part of performance monitoring, as described in Section 5.1.1. Sediment will be collected from the following three intervals for each core: 1) the dredge interface to 1 ft below; 2) a 6-inch core from a location within the interior of the backfill (depth interval depending on backfill thickness, as previously described in Section 5.12); and 3) the backfill surface (0 to 10 cm predominant biologically active zone). Confirmational monitoring, if required, will consist of collection and analysis of a 6-inch sediment core sample from the interior of the backfill material (depth interval depending on backfill thickness, as previously described) overlying the subject dredge interface locations and a surface sediment sample.

Sediment cores will be collected from a sampling vessel according to the following procedures:

1. The sampling vessel will be maneuvered to the target station coordinates.
2. The vibracore and a decontaminated core tube with core catcher in place will be deployed.
3. Continuous core samples will be collected until a penetration depth of 3 ft beyond the dredge interface (up to 8 ft) or until refusal is met.
4. The location and depth of penetration will be measured and recorded.
5. The sample core tube will be extracted, and the vibracore assembly will be retrieved aboard the vessel.
6. The core sample will be evaluated at the visible ends of the core tube to verify adequate retention of sediment in the core tube. If acceptability criteria (Section 5.5.1.1) are met, the core tube will be capped, labeled, and prepared for transport to the processing facility.
7. Core tubes will be capped with aluminum foil or pre-cleaned expansion plugs, to prevent contamination or loss of sample.
8. The core tube will be marked with the Station ID, collection time, retention amount, penetration depth, and clear indication of which end is "up" (sediment surface at top).
9. Core tubes will be kept cool during storage and transit to the processing facility.

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.

5.5.1.1 Sediment Core Sample Acceptability Criteria

After the sampler has been retrieved, the sediment core will be carefully inspected before being accepted.

The following acceptability criteria must be satisfied:

- Sediment retention is at least 65 percent of the penetration depth
- Sample core appears undisturbed and intact without any evidence of obstruction or blocking within tube or core catcher
- The sample was not exposed to any contamination during handling.

If a sample does not meet these criteria, it will be rejected.

5.5.1.2 Sediment Core Processing

Sediment core samples will be processed at a shore-based location. Sediment cores will be characterized by a qualified geologist, engineer, or scientist; subsampled and composited for discrete depth intervals;, homogenized; and allocated to sample containers for chemical and physical testing. Detailed procedures for processing subsurface samples are as follows:

1. The sediment core will be extracted by cutting the core tube open or by extrusion, depending on the coring method chosen.
2. Using a large stainless-steel spatula (cleaned and decontaminated), slice lengthwise through the center of the sediment, carefully splitting the core in half.
3. Document the subsurface sample in accordance with the procedures identified in Section 5.6. Photograph the core with a label identifying the station number and date.
4. Subsample the core intervals in accordance with Section 5.1.1, collecting sediment from the center of the core that has not been smeared by, or been in contact with, the inner core tube surface. Place each subsample in a separate, pre-cleaned stainless-steel mixing bowl.
5. Homogenize the sediment with a spoon or heavy-duty, variable-speed drill with stainless-steel stirring paddle until the sediment appears uniform in color and texture.
6. Distribute homogenized sediment to appropriate pre-cleaned sample containers according to the sample requirements identified in Table 6 and ensure that sample labels are completely filled out and properly affixed to the containers.
7. Clean the exterior of all sample containers and store them in coolers at approximately 4°C away from the immediate work area.

8. Thoroughly decontaminate any processing equipment in contact with sediment by following the procedure in Section 5.5.4.

9. Verify that all logbook entries are complete.

10. Proceed to the next core tube available for processing.

5.5.2 GRAB SAMPLES

Standardized procedures for sediment collection and processing for the Puget Sound area have been developed by PSEP (1997a). Surface sediment samples from five locations outside of the MBL at the Cascade Pole site will be collected using a van Veen grab sampler, or similar device. The grab sampler will be operated by a minimum crew of three; two field technicians will handle deployment and retrieval of the sampler while the vessel operator controls the hydrowire winch. The sampling device will be attached to the hydrowire using a swivel to eliminate line twist. The general procedure for collecting sediment samples is as follows:

1. Make logbook entries, as necessary, throughout the sampling process to ensure thorough record keeping.

2. Maneuver the sampling vessel to the proposed sampling location using the positioning procedures described in Section 5.4.

3. Open the sampler jaws for deployment.

4. Signal the winch operator to lift the sampler and guide the sampler overboard until it is clear of the vessel.

5. Lower the sampler through the water column to the bottom at approximately 0.3 m/s.

6. Record the location and note the angle of the hydrowire relative to the vessel when the grab sampler hits bottom.

7. Signal the winch operator to retrieve the sampler and raise it at approximately 0.3 m/s.

8. Guide the sampler aboard the vessel and place it on the support frame on the deck; use care to avoid unnecessary jostling that might disturb the integrity of the sample.

9. Examine the sample relative to the following sediment acceptance criteria:

   - The sample does not contain foreign objects
   - The sampler is not over-filled with sediment so that the sediment surface presses against the top of the sampler
   - Full closure of sampler
   - No leakage has occurred, as indicated by overlying water on the sediment surface
   - No sample disturbance has occurred, as indicated by limited turbidity in the overlying water

- No winnowing has occurred, as indicated by a relatively flat undisturbed surface
- The minimum penetration depth (15 cm) has been achieved.

10. Siphon off any standing water from the surface of the sediment using a hose primed with site water. Be careful during siphoning not to disturb the integrity of the sediment surface.

11. Collect the upper 10 cm of sediment from the sampler using a stainless-steel scoop or equivalent implement. Take care not to include any material that has been in contact with any interior surface of the grab sampler. Place sediment into a pre-cleaned appropriate-sized high-density polyethylene (HDPE) bucket or stainless-steel mixing bowl.

12. Document the description of the surface sample in accordance with the procedures identified in Section 5.6.

13. Thoroughly rinse the interior of the sampler until all loose sediment has been washed off.

14. Repeat the sampling process until sufficient sediment volume is obtained to satisfy the sampling requirements for the station. Collect successive grab samples within a radius of 10 ft of the initial sampling location.

15. Homogenize the bulked sediment with a spoon or heavy-duty, variable-speed drill with stainless-steel stirring paddle until the sediment appears uniform in color and texture.

16. Distribute homogenized sediment to appropriate sample containers according to the sample requirements identified in Table 6 and ensure that sample labels are completely filled out and properly affixed to the containers.

17. Clean the exterior of all sample containers and store them in a cooler at approximately 4°C and placed away from the immediate work area aboard the vessel.

18. Thoroughly decontaminate the sampler by following the procedure in Section 5.5.4.

19. Verify that all logbook entries are complete.

20. Proceed to the next sampling location.

Conditions encountered during field activities may require modification of the general procedures outlined above. Modifications of the procedures will be at the discretion of the project manager and field coordinator after consultation with the QA coordinator and the vessel operator. No modifications to the scope of work or the intent of the monitoring plan are anticipated.

5.5.3 WASTE SEDIMENT HANDLING

Waste sediment from rejected cores or grab samples and extra sediment not needed for analysis will be returned to the approximate sampling location where it was originally collected. Care will be taken when disposing of rejected or waste sediment to not contaminate other core collection locations. Samples exhibiting sheens or other obvious signs of contamination will be placed in a container and properly disposed of at an upland facility.

5.5.4 FIELD DECONTAMINATION PROCEDURES

Potential for cross contamination will be minimized by sequencing sediment sampling from areas of suspected lower concentrations to areas of potentially high concentrations, to the extent practicable. Sediment sampling equipment that may come into contact with the sediment sample will be decontaminated between sample locations and depth intervals using a field decontamination protocol based on accepted guidelines (Ecology 1995a). Field sampling equipment such as core barrels will be cleaned with pressurized soapy water and rinsed before loading on the sampling vessel. Tubes and core barrels will be capped at each end with heavy foil to prevent contamination in transit. Equipment for reuse will be decontaminated aboard the vessel according to the following procedure:

1. Spray seawater over the equipment to dislodge and remove any remaining sediments.
2. Scrub surfaces of equipment that contact sample material with brushes using an Alconox solution.
3. Rinse and scrub equipment with clean tap water.
4. Rinse equipment a final time with deionized water to remove tap water impurities.

If obvious signs of oily contamination are observed during sampling, solvent rinses will be used if the procedures described above are found to be inadequate.

5.5.5 SAMPLE IDENTIFICATION

Each sediment sample will have a unique sample identification number, using an alpha-numeric identification scheme with the following elements:

- Project (CP: Cascade Pole)
- Location Number (1-20)
- Sample depth (S: surface; F: fill material; D: dredge interface)
- Monitoring event (P: performance; C1 to C5: confirmational with event number).

The format for the sample identification number is: Project-Location number-Sample depth-Monitoring event. For example, the sample identification for sediment quality measurements collected at Station 7 from the dredge interface during the second annual confirmational monitoring event would be: CP-07-D-C2.

5.5.6 SAMPLE CONTAINERS AND LABELS

Pre-cleaned sample containers will be purchased from a supplier or provided by the analytical laboratory. Sediment samples that will be used for chemical analyses will be placed in clean, wide-mouth polyethylene or glass jars with Teflon lids and a certified cleaning certificate. All sample containers will be filled leaving approximately 0.5 inches of headspace to prevent the jars from breaking during storage. The types of sample containers to be used and sample volume are presented in Table 6. Each jar will be sealed, affixed with a completed label, and stored in coolers at approximately 4°C.

Sample labels will be made of waterproof material and be self-adhering; an indelible pen will be used to fill out each label. Each sample label will contain the project number, sample identification, preservation technique, analyses, date and time of collection, and initials of the person(s) preparing the sample.

5.5.7 SAMPLE HANDLING AND STORAGE

Sample containers will be packed in coolers with ice or frozen blue-ice packs or in secure refrigerated storage to maintain a temperature of approximately 4°C during storage and transport to the analytical laboratory. All samples will be maintained under chain-of-custody procedures at all times, as outlined in Section 7.2.2.2. Requirements for transporting samples are presented in Section 7.2.2.3.

5.6 FIELD DOCUMENTATION

A complete record of sediment collection field activities will be maintained. Documentation will include:

- Record keeping by field personnel of primary field activities
- Record keeping of all samples collected for analysis
- Use of sample labels and COC tracking forms for all samples collected for analysis.

The field coordinator and personnel providing QA/QC oversight will maintain field logbooks. The field logbooks will provide a description of the sampling activities, conferences associated with field sampling activities, sampling personnel, weather conditions, and a record of any modifications to the procedures and plans identified in this Plan. The field logbooks will consist of bound, numbered pages. All entries will be made with indelible ink pens. The field logbooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

Information to be collected for sediment samples includes bottom depth, sampler penetration depth, and information on sediment characteristics (e.g., sediment type, color, and odor). After sample collection, the following information will be recorded on the field log sheet:

- Date, time, and name of person logging sample
- Names of crew members and their tasks
- Weather conditions
- Sample location number
- Project designation
- Depth of water at the location
- Penetration depth
- Physical observations (e.g., presence of debris; biological activity; color; presence of sheens; apparent grain size; odor; and any other distinguishing characteristics)
- Equipment used for sampling
- Sediment core logs will be recorded by a qualified geologist or scientist that include a physical description in accordance with the Unified Soil Classification System (USCS) of the sediment profile, including:
    - Vertical distribution of visible contamination
    - Description of layering
    - Depth to apparent dredge interface
    - Depth to apparent oxic/anoxic boundary
    - Description of sediment
        Lithology
        Sorting
        Color
        Structure
        Relative density or consistency
        Relative moisture content
    - Remarks
    - Name of sample observer
    - Name and affiliation of any oversight personnel.

5.7 SAMPLE ANALYSIS

As described in Section 5.1.1, performance monitoring of sediment quality will involve the collection of sediment core samples from three different intervals: 1) the dredge interface to 1 ft below; 2) a 6-inch interval (depth depending on backfill thickness) from the interior of the backfill; and 3) the backfill surface (0 to 10 cm biologically active zone).

The dredge interface sample will be analyzed for constituents of concern (PAHs, dibenzofuran, and dioxins) and TOC at all 15 locations (Table 4).

The sample collected from the interior of the backfill material overlying the dredge interface will be archived (frozen) for all 15 locations. These samples will be analyzed at locations where the dredge interface sample exceeds one or more of the cleanup action levels, to provide a baseline for subsequent confirmational monitoring. These samples will only be analyzed for constituents of concern that exceed their cleanup action level in the underlying interface sample and for TOC (if applicable).

Surface sediment samples from 10 of the 15 sampling locations within the MBL, and five locations beyond the MBL, will be analyzed for the constituents of concern, grain size, and TOC to evaluate post-remediation surface sediment quality (Figure 5).

Sediment confirmation core samples will be analyzed for those parameters that previously exceeded cleanup action levels at the subject location. Surface sediment samples will be archived and will only be analyzed if the core sample exceeds one or more of the cleanup action levels.

Specific analytical methods and quality assurance procedures for the chemical testing discussed above are provided in the Quality Assurance Project Plan (QAPP) (Section 7.0).

Field QA/QC samples will also be collected for sediment core samples including duplicates, field equipment wipe blanks and rinsate blanks, and field transfer blanks. Details regarding field collected QA/QC samples are presented in Section 7.2.4.

5.8 DATA ANALYSIS AND INTERPRETATION

Chemical analysis results will be compared to the cleanup action levels listed in Table 1. If one or more of the cleanup action levels are exceeded, further analysis and monitoring may be required as described in Section 5.2. Results of the sediment quality analysis will be presented in the sediments remediation construction documentation report.

5.9 CORRECTIVE ACTIONS

The corrective action for locations with sediment that exceed the cleanup action levels is to initiate a confirmational monitoring program. As stated in Section 5.3, if needed, confirmational monitoring will be conducted annually for up to 5 years, or two consecutive monitoring periods with sediment concentrations below the cleanup action levels. After 5 years, the compliance monitoring data will be evaluated in consultation with Ecology to determine the need for any further action.

Corrective actions required with respect to data quality are discussed in Section 7.2.6.

6.0 DATA REPORTING

The data reporting for the various components of the compliance monitoring will generally be in the form of technical memoranda for each medium and monitoring event. The following sections describe the data reporting requirements and frequency particular to each type of monitoring.

6.1 SURFACE WATER MONITORING

Surface water data collected as part of the protective monitoring program will be collected during the course of the cleanup action. Field reports will be prepared on a weekly basis to report the water quality monitoring data results. The field reports will include a description of the data collection effort, the data results, observations made during data collection, problems encountered, and corrective actions taken. Upon completion of the cleanup activities, the water quality data results for the protective monitoring program will be presented in the construction documentation reports.

6.2 STORMWATER MONITORING

Stormwater data will be collected as part of the NPDES permit monitoring program as described in Section 4.0. The stormwater quality monitoring data results will be submitted in conjunction with data for the Port's ongoing groundwater treatment system.

6.3 SEDIMENT MONITORING

Sediment data collected in fulfillment of the performance monitoring program will be reported within 6 weeks of receiving final data results from the analytical laboratories. The sediment data technical memorandum will include a description of the data collection effort, the data results, observations made during data collection, problems encountered, corrective actions taken, comparison to cleanup action levels, and recommendations for the confirmational program (i.e., locations). Confirmational monitoring results will be reported on an annual basis. All sediment quality data will be submitted to Ecology electronically in SEDQUAL format.

7.0 QUALITY ASSURANCE PROJECT PLAN

This QAPP establishes QC procedures and QA criteria to meet the data quality objectives set forth for the compliance monitoring plan to be conducted at the Cascade Pole site. This QAPP was developed in accordance with Ecology's SMS (Ecology 1995b) and accompanying Ecology guidance documents (Ecology 1995a); PSEP guidance documents (PSEP 1986, 1997b, c) and EPA guidance documents (EPA 1998a, b). QC procedures and QA criteria are described in Sections 7.2 and 7.3, respectively.

7.1 DATA QUALITY OBJECTIVES

The data quality objective (DQO) for the compliance monitoring plan is to obtain the types and quantity of data identified in Sections 3.0, 4.0, and 5.0 in a manner such that the data is of known, appropriate, and sufficient quality to support their intended use, which is to determine if the quality of environmental media (sediment, surface water, and stormwater) achieve the applicable criteria, and to provide a basis for long-term compliance monitoring requirements. To accomplish this goal, project data should be technically sound, statistically valid, and properly documented, having been evaluated against established criteria for the principal data quality indicators (DQIs) (i.e., precision, accuracy, representativeness, completeness, and comparability) as defined in EPA guidance (1998a). Data should also be comparable with data collected during previous site investigations.

7.1.1 SAMPLE COLLECTION AND HANDLING

The collection, transportation, and handling of samples will be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to release of samples. Stormwater will be collected, and all other samples will be transferred following collection, in containers prepared and supplied by a state-approved laboratory.

When transferring samples, the individuals relinquishing and receiving the samples will sign and date the chain-of-custody record. The chain-of-custody record will accompany each shipment. Custody seals are not deemed necessary when the samples are in continuous possession of technical or laboratory personnel. Custody seals will be used for samples that are shipped via courier service, in which case the method of shipment, courier name, and other pertinent shipping information will be entered on the chain-of-custody record.

7.2 QUALITY CONTROL PROCEDURES

This section describes the procedures that will be implemented to: 1) ensure sample integrity from the time of sample collection to the time of analysis in the laboratory; 2) obtain the appropriate chemical and physical data; 3) collect field and laboratory quality control samples; 4) monitor performance of the laboratory and field measurement systems; 5) correct any deviations from the methods or QA requirements established in this compliance monitoring plan; and 6) report and validate the data.

7.2.1 SAMPLE COLLECTION

Sample locations and sample collection methods are identified in detail in previous sections of this report. This section describes the procedures for sample collection required to meet the DQOs described in Section 7.1.

7.2.1.1 Sample Documentation

Sample data and other relevant field information or field activities will be documented in the field on appropriate forms (see Appendix A) and/or in field notebooks at the time of sampling. Sample container labels will be completed as described in previous sections and affixed to each sample container. Each sample container will be labeled and recorded on a chain-of-custody record as described below. Documentation procedures for sampling are provided in previous sections.

7.2.1.2 Equipment Decontamination

Sampling equipment will be properly decontaminated prior to collection of each sample to avoid cross contamination between samples. Decontaminated sampling equipment will be handled in a manner that minimizes contact with potentially contaminated surfaces. Specific procedures for sampling equipment decontamination associated with sediment sampling are presented in Section 5.5.4.

7.2.1.3 Field Quality Control Samples

Field QC samples will be collected to identify potential problems resulting from sample collection and/or sample processing in the field and to evaluate data precision as discussed in Section 7.3.1. Field QC samples will include field duplicate samples and field blanks. The procedures for collecting these samples and the frequency at which the samples will be collected are described in detail in Section 7.2.4.

7.2.1.4 Field Equipment Calibration

Field instruments will be properly operated, calibrated, and maintained by qualified personnel according to the manufacturer's guidelines and recommendations. Documentation of routine and special preventive maintenance and calibration information will be maintained in the appropriate field or laboratory logbook, and will be available upon request. Each maintenance and calibration logbook entry will include the date and initials of the individual performing the activity.

7.2.2 SAMPLE HANDLING

This section describes the QA/QC procedures for sample handling following sample collection.

7.2.2.1 Sample Preservation and Storage

The minimum sediment sample sizes, acceptable containers, storage temperatures, preservatives, and maximum holding times for physical/chemical analyses are presented in Table 6.

7.2.2.2 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 which is initially completed by the sampler, and is thereafter signed by those individuals who accept custody of the sample. A sample will be considered to be in custody if it is:

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

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

Field Custody Procedures

The following field custody procedures will be followed:

- As few persons as possible will handle samples

- Sample bottles will be purchased directly from the manufacturer by Landau Associates or 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 collected samples until they are transferred to another person, or dispatched properly under chain-of-custody rules

- The site field coordinator will oversee implementation of the field custody procedures during the fieldwork and, in the event of noncompliance, will determine if corrective action is required.

Sample Shipment Custody Procedures

The following sample shipment custody procedures will be followed:

- The coolers in which the samples are shipped will be accompanied by the chain-of-custody record identifying their contents. The original record and laboratory copy will accompany the shipment (sealed inside the shipping container). The other copy will be distributed as appropriate to Landau Associates' QA personnel.

- Shipping containers will be sealed with custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information will be entered in the "Remarks" section of the chain-of-custody record and traffic report.

- If sent by mail, the package will be registered with return receipt requested. If sent by common carrier, a bill of lading will be used. Freight bills, postal services receipts, and bills of lading will be retained as part of the sample documentation.

Transfer of Custody

The sample collector will sign the chain-of-custody in the first signature space. When samples are transferred, the individuals relinquishing and receiving the samples will sign the chain-of-custody record and document the date and time of transfer. The only exception to this is the shipment of samples via commercial carriers. Because sample containers are sealed with the chain-of-custody record inside prior to delivery to the carrier, the custody signature will be that of the individual taking possession of the samples from the carrier at its final destination. Each person taking custody will observe whether the shipping container is correctly sealed and in the same condition as noted by the previous custodian; deviations will be noted on the appropriate section of the chain-of-custody record.

Project documentation of sample custody will be verified by Landau Associates' QA officer during regular review of the data validation package.

Laboratory Custody Procedures

A designated sample custodian at the laboratory will accept custody of the shipped samples, verify the integrity of the custody seals, 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 bound logbook, which is arranged by a project code and station number. If containers arrive with broken custody seals, the laboratory will note this on the chain-of-custody record and will immediately notify Landau Associates' QA officer. The laboratory will maintain sample security and custody as appropriate and as outlined in the laboratory's QAPP.

7.2.2.3 Sample Packaging and Shipping

The transportation and handling of samples will be accomplished in a manner that not only protects the integrity of the samples, but also prevents any detrimental effects due to the possible hazardous nature of samples. Regulations for packaging, marking, labeling, and shipping hazardous materials are promulgated by the U.S. Department of Transportation in the Code of Federal Regulations (CFR), 49 CFR 173.6 and 173.24.

Prior to shipping, samples will be placed on sealed, reusable ice packs or double-bagged ice in coolers following collection. At the end of each day, samples sent to the analytical laboratory will be inventoried. A picnic cooler will be used as a shipping container. In preparation for shipping samples, the drain plug will be taped shut, and a large plastic bag will be used as a liner for the cooler. When appropriate, approximately 1 inch of packing material will be placed in the bottom of the liner.

The sample bottles will be placed in the cooler containing ice or frozen gel packs. Samples will be packaged carefully to avoid breakage or cross contamination using sufficient packing material and will be shipped to the offsite analytical laboratory at proper temperatures (4ºC). The chain-of-custody accompanying the samples to the laboratory will be placed inside a separate plastic bag and taped inside the cooler lid.

The cooler will be taped shut with strapping tape. Custody seals will be placed on the cooler. Samples will be transported to the laboratory within 24 hours of collection. The cooler will either be shipped to the laboratory by an overnight carrier or hand-delivered by Landau personnel.

7.2.3 SAMPLE ANALYSIS AND TESTING

Analytical testing for chemical concentrations will be performed for the surface water, stormwater, and sediment samples. Laboratory chemical analyses will be conducted by a state-certified analytical laboratory.

Standard EPA sample preparation, cleanup, and analytical methods will be used for chemical analyses. Additionally, PSEP and Ecology's Sediment Sampling and Analysis Plan Appendix (SSAPA) (Ecology 1995a) recommended guidelines for the measurement of organics and conventional parameters in sediments will also be followed (PSEP 1986, 1997b). Sample preparation methods, cleanup methods, and analytical methods are summarized in Tables 2 and 8. The laboratory QAPPs and standard operating procedures (SOP) shall provide data quality procedures according to the protocols for the analytical method and cleanup steps, and at a level sufficient to meet the sampling program DQOs.

7.2.4 FIELD AND LABORATORY QUALITY CONTROL SAMPLES

Field and analytical laboratory control samples will be collected to evaluate data precision, accuracy, representativeness, completeness, and comparability of the analytical results for this investigation. A summary of the QC samples and the frequency at which they will be collected and/or analyzed is described in the following subsections.

7.2.4.1 Blind Field Duplicates

A blind field duplicate will be collected at a frequency of at least 1 per 20 samples per sample type (i.e., sediment core samples, sediment grab samples, surface water, stormwater) per chemical analysis, not including QC samples, but not less than one field duplicate per sampling event (any continuous sampling period not interrupted by more than 2 days) for sediment sampling. The blind field duplicate will consist of a split sample collected at a single sample location. For sediment samples, the duplicate sample will be homogenized by mixing in a stainless steel bowl, split into duplicate sample containers, and submitted blind to the laboratory as discrete samples. For water samples, the samples will be collected by alternating the stream of water from the sampling vessel between the sample containers for the primary and split sample, and submitted blind to the laboratory; alternatively, the samples can be collected consecutively if collected directly in the sample container. Blind field duplicate sample results will be used to evaluate data precision.

7.2.4.2 Field Equipment Blanks

Field equipment blanks will consist of wipe blanks and/or rinsate blanks and will be collected at a frequency of at least 1 per 20 samples per sample type (for sediment core samples and sediment grab samples only) per chemical analysis, not including QC samples, but not less than one field equipment blank per sampling event (any continuous sampling period not interrupted by more than two days). The selection of the appropriate field equipment blank (wipe or rinsate) will be made at the time an analytical laboratory is chosen.

Field equipment wipe blanks will be performed on sediment sampling equipment, for dibenzofuran and PAHs, to evaluate the effectiveness of sampling equipment decontamination procedures and the potential for equipment or field cross contamination. The wipe samples will be collected using ashless filter paper. Field equipment wipe blanks will be collected by wiping the surfaces of the sampling equipment that actually contacted the samples collected. No wipe blanks will be collected from dedicated or disposable field equipment.

Field equipment rinsate blanks will be collected for all analyses (except TOC and dioxin) associated with sediment core samples and grab samples to evaluate the effectiveness of sampling equipment decontamination procedures and the potential for equipment or field cross contamination. The rinsate blanks will consist of deionized distilled water passed through activated carbon (supplied by the analytical laboratory) passed over and/or through decontaminated sampling equipment. Equipment surfaces exposed during actual sampling will be rinsed and collected in the appropriate sample containers. No rinsate blanks will be collected from dedicated or disposable field equipment.

7.2.4.3 Laboratory Matrix Spike

A minimum of 1 laboratory matrix spike per 20 samples (for sediment only), not including QC samples, or 1 matrix spike sample per batch of samples if fewer than 20 samples are obtained, will be analyzed for dibenzofuran, PAH, dioxins, and TOC. 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 matrix and blank spikes.

7.2.4.4 Laboratory Matrix Spike Duplicate

A minimum of 1 laboratory matrix spike duplicate per 20 samples (for sediment only), not including QC samples, or 1 matrix spike duplicate sample per batch of samples if fewer than 20 samples are obtained, will be analyzed for dibenzofuran, PAH, and dioxins. These analyses will be performed to provide information on the precision of chemical analyses. The laboratory spikes will follow EPA guidance for matrix and blank spike duplicates.

7.2.4.5 Laboratory Duplicates

A minimum of 1 laboratory duplicate per 20 samples, not including QC samples, or 1 laboratory duplicate sample per batch of samples if fewer than 20 samples are obtained, will be analyzed for the same constituents as the samples, less conventional parameters. These analyses will be performed to provide information on the precision of chemical analyses. The laboratory duplicate will follow EPA guidance in the method.

7.2.4.6 Laboratory Triplicates

A minimum of 1 laboratory triplicate per 20 samples, not including QC samples, or 1 laboratory triplicate sample per batch of samples if fewer than 20 samples are obtained, will be analyzed for TOC.

7.2.4.7 Laboratory Method Blanks

A minimum of 1 laboratory method blank per 20 samples, one every 12 hours, or 1 per batch of samples analyzed (if fewer than 20 samples are analyzed) 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.

7.2.4.8 Laboratory Control Sample

A minimum of 1 laboratory control sample per 20 samples, not including QC samples, or 1 laboratory control sample per sample batch if fewer than 20 samples are obtained, will be analyzed for all parameters.

7.2.4.9 Surrogate Spikes

All project samples analyzed for PCP, dibenzofuran, PAH, and/or dioxins will be spiked with appropriate surrogate compounds as defined by the analytical methods.

7.2.4.10 Laboratory Certified Reference Material

A minimum of 1 certified reference material sample per 50 samples, not including QC samples, will be analyzed for PCP (if analyzed), dibenzofuran, PAH, and TOC.

7.2.5 PERFORMANCE AND SYSTEM AUDITS

Internal performance and/or system audits will be conducted, as necessary, to monitor performance of the analytical laboratory and field measurement systems. Performance audits consist of quantitative data independently obtained for comparison with routinely obtained data in a measurement system. System audits consist of direct observations of work being performed (sampling activities and laboratory operations), and inspection of equipment use, calibration, and maintenance to verify adherence to QA/QC requirements.

System audits of both field and analytical laboratory activities may be conducted by a Landau Associates representative during sediment sampling activities. Preferably, the audits will be conducted by individuals that have no direct responsibilities for the activities being audited.

A field system audit would consist of direct observation of fieldwork during various sediment sampling activities. The laboratory system audit would be performed at the analytical laboratory and would consist of direct observation of the chemical analysis operations including inspection of equipment use, calibration, and maintenance to verify adherence to QA/QC requirements.

7.2.6 CORRECTIVE ACTIONS

Corrective actions will be needed for two categories of nonconformance:

- Deviations from the methods or QA requirements established in this compliance monitoring plan
- 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
- 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 with no 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 action. A description of any such action taken will be entered in the daily field notebook. If field conditions are such that conformance with this monitoring plan is not possible, the project manager and/or field coordinator will be consulted immediately. The field coordinator will consult with Landau Associates' QA officer, who may authorize changes or exceptions to the QA/QC portion of the monitoring plan as necessary and appropriate. Any corrective action or field condition resulting in a revision of this QA/QC portion of the monitoring plan will be communicated to Ecology for review and concurrence.

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 goals outlined in this monitoring plan, corrective action will follow the guidelines in the EPA analytical methods noted in this monitoring plan and the EPA guidelines for data validation for organics and inorganics analyses. At a minimum, the laboratory QA officer 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' QA officer 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' QA officer. If the problem cannot be corrected through reanalysis, Landau Associates' QA officer will be notified by the laboratory 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' QA officer 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' QA officer will be notified immediately to discuss corrective action required.

- If holding times are exceeded, all positive and nondetected results may need to be qualified as estimated concentrations. If holding times are grossly exceeded, the Landau Associates' QA officer may determine the data to be unusable.

If analytical conditions are such that nonconformance with this monitoring plan is indicated, Landau Associates' QA officer 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' QA officer. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and any recalculation, reanalysis, or re-extractions will be submitted with the data package in the form of a cover letter.

7.2.7 DATA REDUCTION, QUALITY EVALUATION, AND REPORTING

Analytical reports from the laboratory for this monitoring program will be accompanied by sufficient backup data and QC results, to enable reviewers to determine the quality of the data. Landau Associates' QA officer is responsible to the project manager for conducting checks for internal consistency, transmittal errors, laboratory protocols, and for adherence to the QC elements specified in this monitoring plan.

The offsite analytical laboratories will provide deliverables that will include the following:

- Case narrative, including adherence to prescribed protocols, nonconformity events, corrective measures, and/or data deficiencies

- Sample analytical results

- Surrogate recoveries

- Matrix spike/matrix spike duplicate results

- Blank spike/blank spike duplicate results

- Laboratory duplicates

- Blank results
- Sample custody (including signed, original chain-of-custody records)
- Analytical responsibility
- Initial and continuing calibration data
- Quantitation reports.

A data quality evaluation will be performed on all analytical laboratory data associated with this project. The quality evaluation will be performed in accordance with the appropriate sections of the *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review* (EPA 1994a,b) and the *Data Validation Guidance Manual for Selected Sediment Variables* (PTI 1989) and will include evaluations of the following:

- Chain-of-custody records
- Holding times
- Field blanks
- Laboratory method blanks
- Surrogate recoveries
- Laboratory matrix spikes and matrix spike duplicates
- Blank spikes
- Laboratory duplicates
- Field duplicates
- Audit/corrective action records
- Completeness
- Overall assessment of data quality.

Section 7.3 presents statistical tests and criteria used to determine data precision, accuracy, and completeness. In the event that a portion of the data does not meet the criteria specified in Section 7.3 or in the *U.S. EPA Contract Laboratory National Functional Guidelines for Organic and Inorganic Data Review* (EPA 1994a,b), or sample collection and/or documentation practices are deficient, corrective action(s) will be initiated. Corrective action, as described in Section 7.2.6, will be determined by the field coordinator and Landau Associates' QA officer in consultation with the project manager and may include any of the following:

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

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

7.3 QUALITY ASSURANCE CRITERIA

This section describes the DQIs and the associated QA criteria that will be used to ensure the data meet the DQOs identified in Section 7.1. As defined in the EPA guidance (EPA 1998a), DQIs are quantitative statistics and qualitative descriptors used in interpreting the degree of acceptability or utility of the data. The principal DQIs include the PARCC parameters (i.e., precision, accuracy, representativeness, comparability, and completeness). Secondary DQIs include quantitation limits, sensitivity, repeatability, reproducibility, recovery, and memory effects. Acceptance criteria for the DQIs and the quantitation limits have been established to set quantitative goals for the quality of data generated in the analytical measurement process. These criteria are presented below and in Table 9.

7.3.1 PARCC PARAMETERS/LIMITS

The statistical tests and target control limits (the range within which project data of acceptability should fall) for the PARCC parameters are described below. The target control limits will be used to evaluate data acceptability and are considered to be QC goals for data acceptance.

7.3.1.1 Precision

Precision is a measure of mutual agreement among individual measurements of the same property under prescribed conditions. Precision is best expressed in terms of the coefficient of variation (COV) or relative percent difference (RPD). QA/QC sample types that test precision include field and laboratory duplicates and matrix or blank spike duplicates.

The estimate of precision of duplicate measurements will be expressed as an RPD and as COV for triplicate measurements (Table 9), which are calculated as follows:

$$RPD = \left| \frac{D_1 - D_2}{(D_1 + D_2)/2} \right| x\,100$$

where: D_1 = first sample value

D_2 = second sample value (duplicate)

$$COV = \left| \frac{STDEV\ (n_1, n_2, n_3)}{Mean\ (n_1, n_2, n_3)} \right| x\ 100$$

where: n_1= first sample value

n_2= second sample value

n_3= third sample value

The target control limits for RPDs and COVs are presented in Table 9. The RPDs and COVs will be routinely calculated and compared with these control limits. For replicate anlayses for which no control limits are specified in Table 9, the control limits will be 35 percent. If replicate sample values are within 5 times the quantitation limit, then the control limit interval will be plus or minus two times the quantitation limit.

7.3.1.2 Accuracy

Accuracy is the degree of agreement of a measurement (or an average of measurements of the same property) X, with an accepted reference or true value T, usually expressed as the difference between the two values (X-T), the difference as a percentage of the reference or true value (100 (X-T)/T), or as a ratio (X/T). Accuracy is a measure of the bias in a system and is expressed as the percent recovery of spiked (matrix, surrogate spike, or laboratory control spike) samples:

$$\begin{matrix} Percent \\ Recovery \end{matrix} = \frac{(Spiked\ Sample\ Result - Unspiked\ Sample\ Result)}{Amount\ of\ Spike\ Added}\ x\ 100$$

The target control limits for percent recovery are presented in Table 9. The percent recovery will be routinely calculated and checked against these control limits.

7.3.1.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an actual condition or characteristic of a population. Representativeness can be evaluated using replicate samples, representative sampling locations, and blanks. Representativeness for the compliance monitoring sampling will be accomplished using appropriate selection of sampling location and collection of field equipment blanks for nondedicated sampling equipment and analyzing method blanks to verify that the analytical results are representative of the sampled item and not influenced by cross-contamination.

7.3.1.4 Completeness

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. The QA objective for completeness during this project will be 95 percent as listed in Table 9. Completeness will be routinely determined and compared to this control criteria.

7.3.1.5 Comparability

Comparability is an expression of the confidence with which one data set can be compared to another. QA procedures in this document will provide for measurements that are consistent and representative of the media and conditions measured. All sampling procedures and analytical methods used for compliance monitoring sediment sampling activities will be consistent to provide comparability of results for samples and split samples. Data collected under this compliance monitoring program also will be calculated, qualified, and reported in units specified by the quantitation limits as listed in Table 8. These units have been selected to provide for comparability of the data with previously generated relevant site data and pertinent criteria.

7.3.2 DETECTION LIMITS

The detection limits for each chemical analysis described in Section 7.2.3 are targeted to be lower than the cleanup action levels. Target detection limits, where appropriate, are listed in Table 5.2 and 8. The detection limits listed are goals only, insofar as instances may arise where high sample concentrations, nonhomogeneity of samples, or matrix interferences preclude achieving the desired quantitation limit and associated QC criteria. In such instances, the laboratory will report the reasons for deviations from these detection limits.

8.0 REFERENCES

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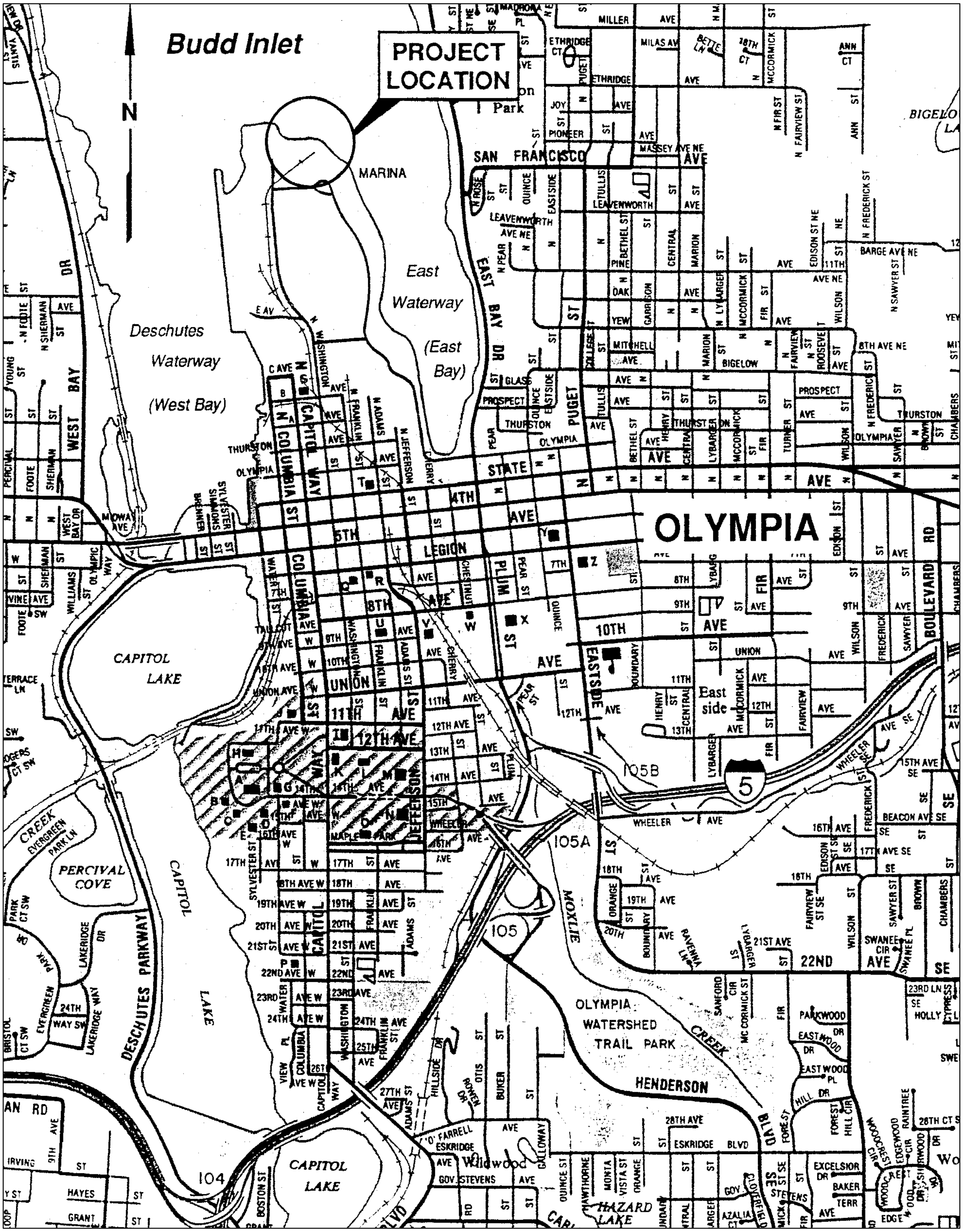
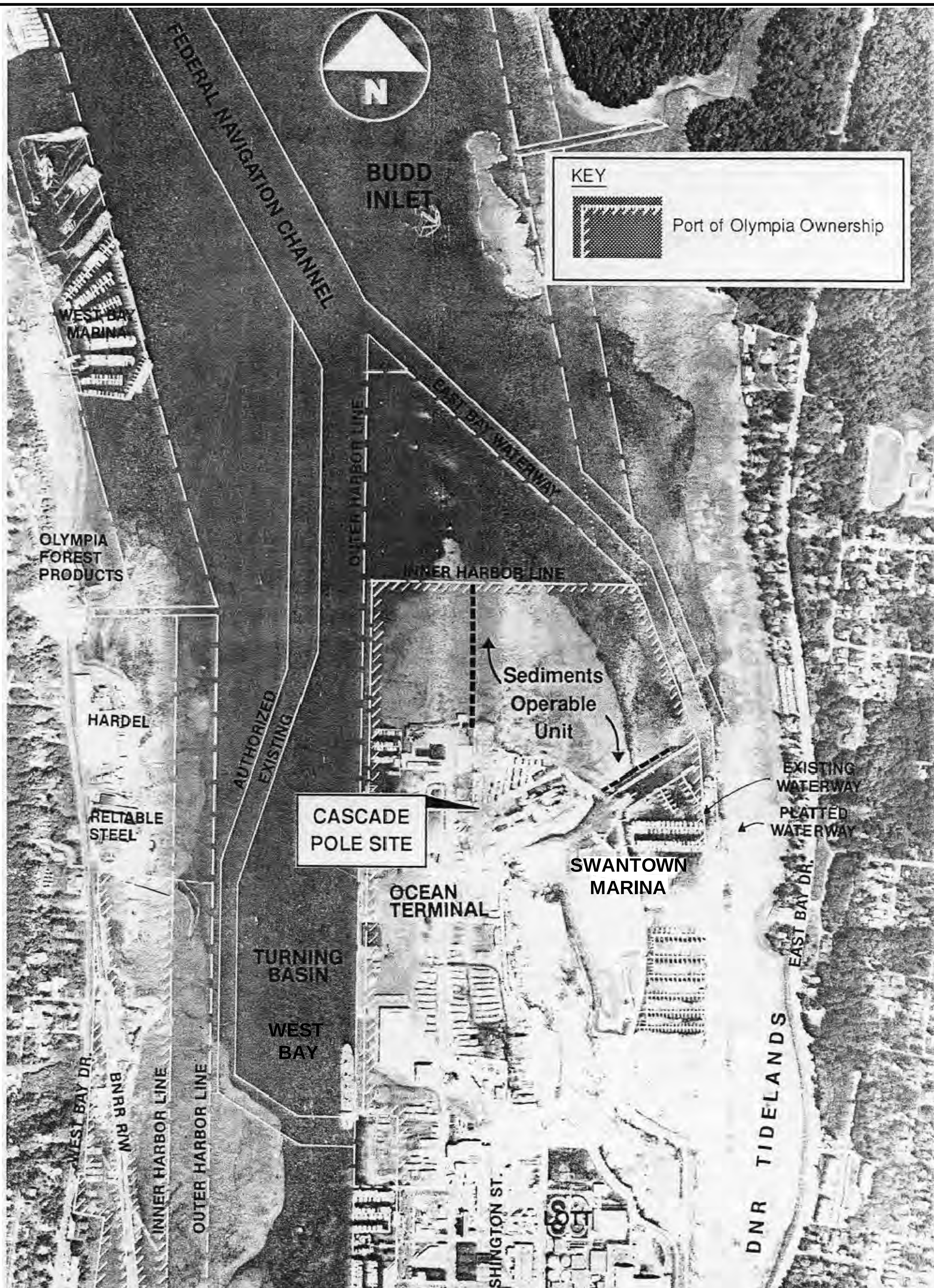


Landau Associates

Cascade Pole Site
Port of Olympia, Washington

Vicinity Map

Figure
1



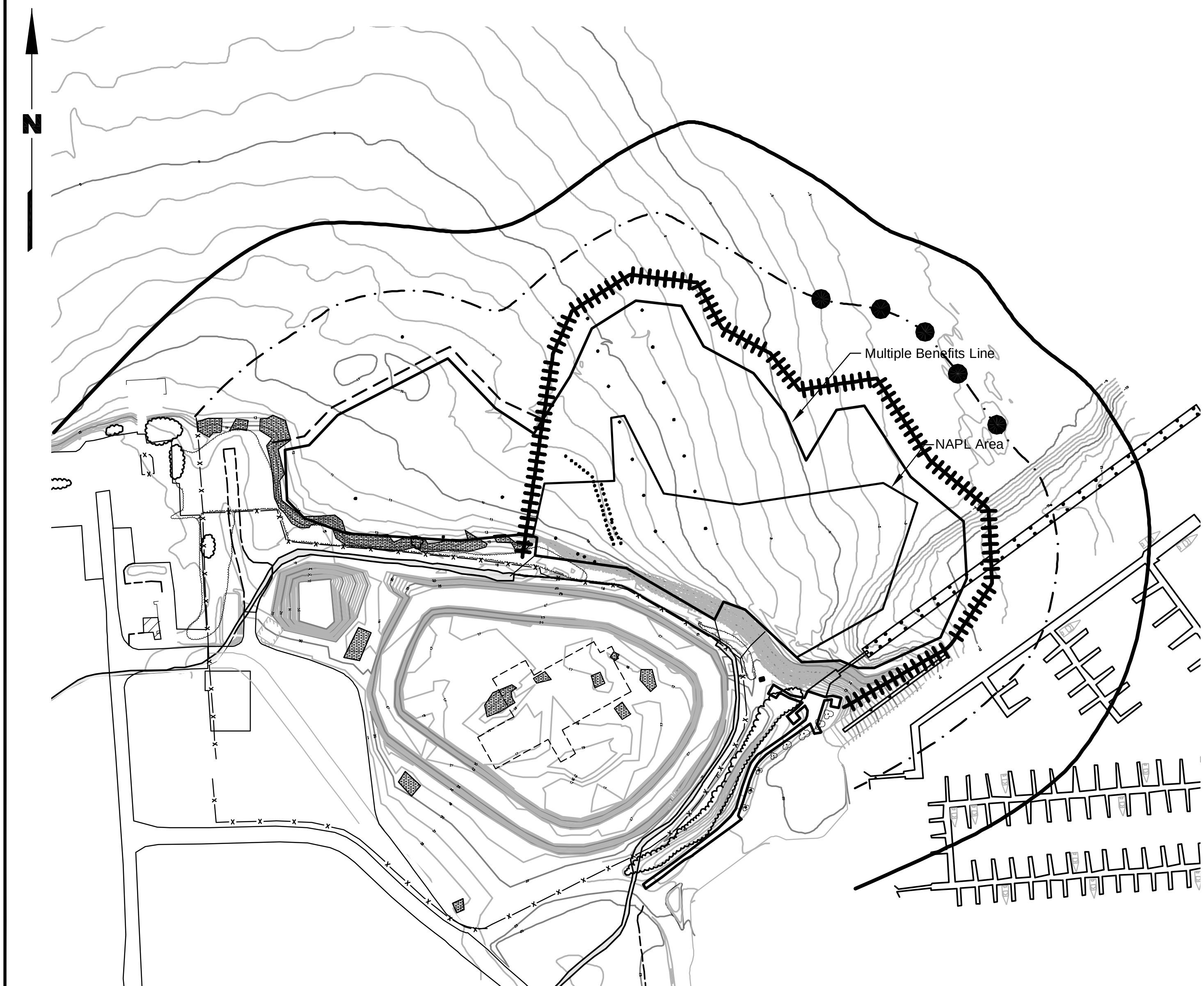
Port of Olympia/CPC Site/Sediments EDR | V:\021\015\190\D\Fig2NEW.dwg (A) "Figure 2" 9/26/2007

Landau Associates

Cascade Pole Site
Port of Olympia, Washington

Site Boundaries

Figure
2

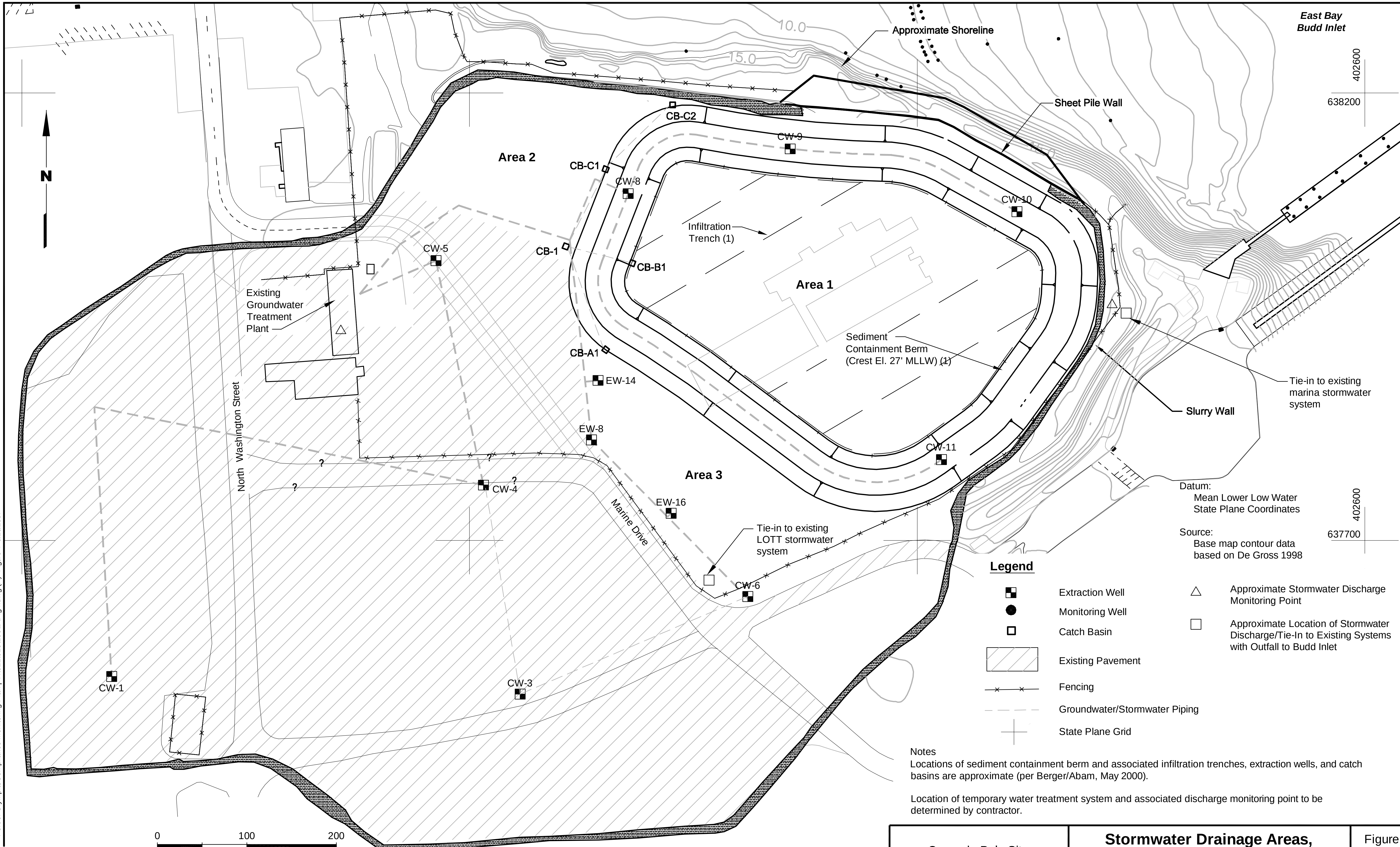


Landau Associates

Port of Olympia
Cascade Pole Site

Conceptual Plan for Surface Water Quality Monitoring

Figure 3



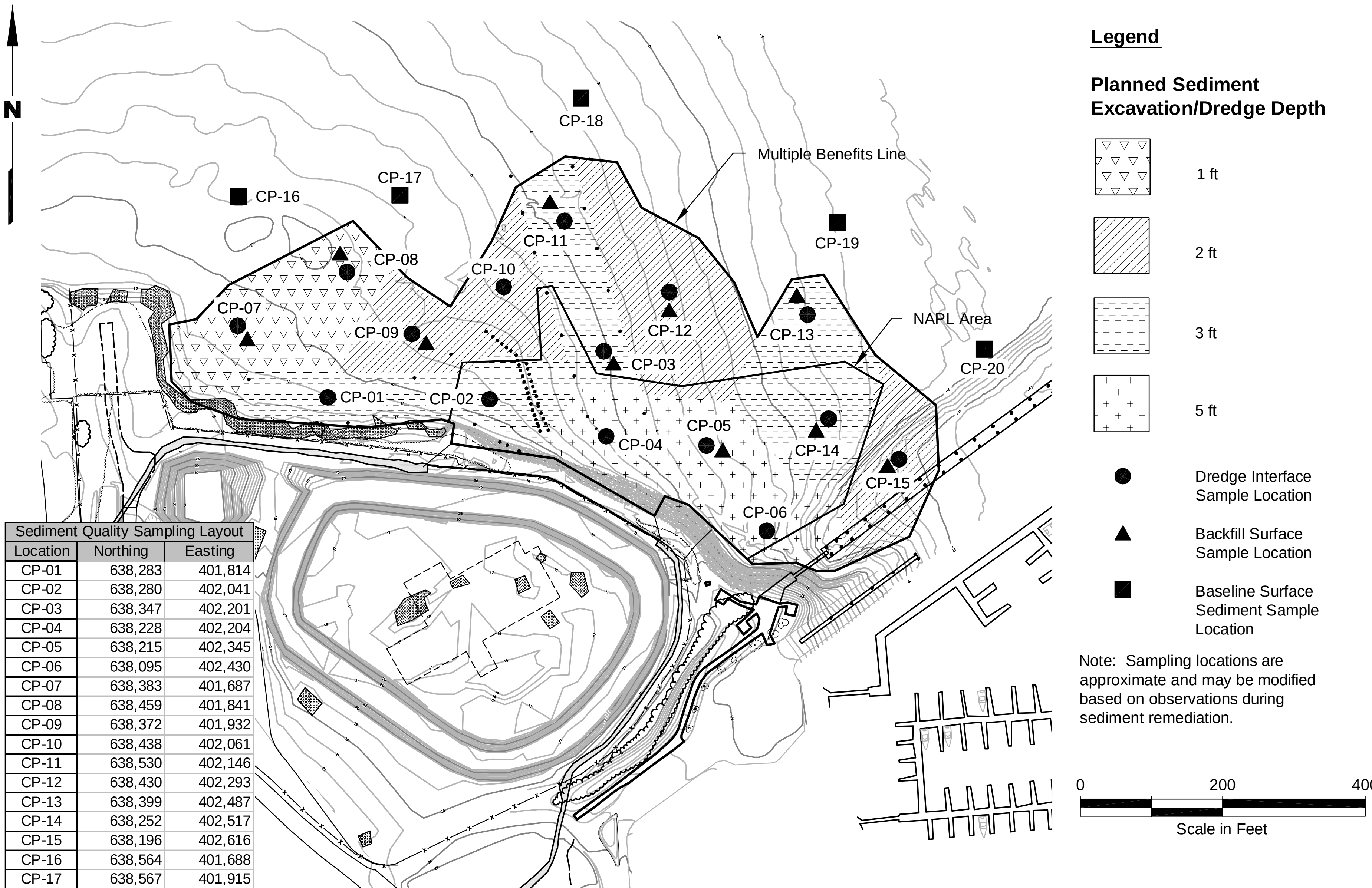
Notes
Locations of sediment containment berm and associated infiltration trenches, extraction wells, and catch basins are approximate (per Berger/Abam, May 2000).

Location of temporary water treatment system and associated discharge monitoring point to be determined by contractor.

Port of Olympia/Compliance Monitoring Plan | V:\021\015\190\D\Fig4.dwg (A) "Figure 4" 9/26/2007

Landau Associates

Cascade Pole Site Port of Olympia, Washington	**Stormwater Drainage Areas, Collection System, Outfall, and Monitoring Locations**	Figure 4



Sediment Quality Sampling Layout		
Location	Northing	Easting
CP-01	638,283	401,814
CP-02	638,280	402,041
CP-03	638,347	402,201
CP-04	638,228	402,204
CP-05	638,215	402,345
CP-06	638,095	402,430
CP-07	638,383	401,687
CP-08	638,459	401,841
CP-09	638,372	401,932
CP-10	638,438	402,061
CP-11	638,530	402,146
CP-12	638,430	402,293
CP-13	638,399	402,487
CP-14	638,252	402,517
CP-15	638,196	402,616
CP-16	638,564	401,688
CP-17	638,567	401,915
CP-18	638,703	402,169
CP-19	638,528	402,529
CP-20	638,350	402,735

Datum: Cascade Pole Coordinate System

Landau Associates

Port of Olympia
Cascade Pole Site

Proposed Sampling Locations for Sediment Quality Monitoring

Figure 5

TABLE 1
SEDIMENT CLEANUP ACTION LEVELS

Parameter	Units	Cleanup Action Level
Dioxins	ng/kg TEQ dry weight	80
PAHs		
Naphthalene	mg/kg OC	170
Acenaphthylene	mg/kg OC	66
Acenaphthene	mg/kg OC	57
Fluorene	mg/kg OC	79
Phenanthrene	mg/kg OC	480
Anthracene	mg/kg OC	1200
2-Methylnaphthalene	mg/kg OC	64
LPAH (a)	mg/kg OC	780
Fluoranthene	mg/kg OC	1200
Pyrene	mg/kg OC	1400
Benzo(a)anthracene	mg/kg OC	270
Chrysene	mg/kg OC	460
Total benzofluoranthenes (b)	mg/kg OC	450
Benzo(a)pyrene	mg/kg OC	210
Indeno(1,2,3-c,d)pyrene	mg/kg OC	88
Dibenzo(a,h)anthracene	mg/kg OC	33
Benzo(g,h,i)perylene	mg/kg OC	78
HPAH (c)	mg/kg OC	5300
Miscellaneous Compounds		
Pentachlorophenol	µg/kg dry weight	690
Dibenzofuran	mg/kg OC	80

TEQ = Toxicity equivalents
OC = Organic carbon normalized

(a) The LPAH criterion represents the sum of the following “low molecular weight polynuclear aromatic hydrocarbon” compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds listed.

(b) The total benzofluoranthenes criterion represent the sum of the concentration of the “B,” “J,” and “K” isomers.

(c) The HPAH criterion represents the sum of the following “high molecular weight polynuclear aromatic hydrocarbon” compounds: fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.

TABLE 2
STORMWATER SAMPLING REQUIREMENTS

Stormwater Sample Location	Monitoring Parameter	Frequency	Method of Collection	Method of Analysis	Detection Limit
Existing Groundwater Treatment System (Effluent)	Discharge flow	Continuous	Recording flow meter	NA	NA
	Total PAH	Weekly	24-hour composite (a)	SW 846 8270C(b)	10 ppb (c)
	Pentachlorophenol	Weekly	24-hour composite	SW 846 8041	0.1 ppb
	Tetrachlorophenol	Weekly	24-hour composite	SW 846 8041	0.1 ppb
	Copper	Weekly	24-hour composite	EPA Method 200.7	2 ppb
	pH	Weekly	Grab	Field Probe	NA
	Dissolved oxygen	Weekly	Grab	Field Probe	NA
	Temperature	Weekly	Grab	Field Probe	NA
	Total suspended solids	Weekly	24-hour composite	EPA 160.2	1 ppm
	Total dissolved solids	Weekly	Grab	EPA 160.1	1 ppm
Existing Groundwater Treatment System (Influent) (d)	Pentachlorophenol	Weekly	24-hour composite (a)	EPA Method 604 (b)	0.1 ppb
Temporary Water Treatment System (Effluent)	Discharge flow	Continuous	Recording flow meter	NA	NA
	Total PAH	Weekly	24-hour composite (a)	SW 846 8270(b)	10 ppb (c)
	Pentachlorophenol	Weekly	24-hour composite	SW 846 8041	0.1 ppb
	Tetrachlorophenol	Weekly	24-hour composite	SW 846 8041	0.1 ppb
	Copper	Weekly	24-hour composite	EPA 6010/7000	2 ppb
	pH	Weekly	Grab	Field Probe	NA
	Dissolved oxygen	Weekly	Grab	Field Probe	NA
	Temperature	Weekly	Grab	Field Probe	NA
	Total suspended solids	Weekly	24-hour composite	EPA 160.2	1 ppm
	Total dissolved solids	Weekly	Grab	EPA 160.1	1 ppm
Temporary Water Treatment System (Influent) (d)	Pentachlorophenol	Weekly	24-hour composite (a)	SW 846 8041	0.1 ppb
Area 1 Conveyance Ditch/Pipe	Total PAH	Periodically (e)	Grab	SW 846 8270(b)	10 ppb (c)
	Pentachlorophenol	Periodically (e)	Grab	SW 846 8041	0.1 ppb
	Turbidity	Periodically (e)	Grab	Field Probe	NA
	pH	Periodically (e)	Grab	Field Probe	NA
	Temperature	Periodically (e)	Grab	Field Probe	NA
	Dioxins	Periodically (e)	Grab	EPA Method 8290	10 ppq

(a) A composite sample means a set of eight individual grab samples taken a minimum of 2 hours apart within a 24-hour period.
(b) Including analyses of naphthalene, acenaphthene, phenanthrene, fluoranthene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, benzo(ghi)perylene, acenaphthylene, fluorene, anthracene, pyrene, chrysene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Use HPLC option with fluorescence detection.
(c) Detection limit for individual PAH compounds.
(d) Influent samples used to confirm 99.5% reduction in PCP concentrations, as required by NPDES permit.
(e) Samples collected as needed. See text for details.
NA = Not applicable.

TABLE 3
STORMWATER DISCHARGE LIMITATIONS

Stormwater Discharge Location	Regulated Parameter	Monthly Average	Daily Maximum	Other Limitations
Tie-In to LOTT Stormwater System	Total PAH	150 µg/L	300 µg/L	NA
	Pentachlorophenol	6.5 µg/L	13 µg/L	99.5% treatment system removal efficiency
	Tetrachlorophenol	219 µg/L	440 µg/L	NA
	pH	7.0-8.5 (a)	NA	NA
Tie-In to Marina Stormwater System	Total PAH	NA	300 µg/L	NA
	Pentachlorophenol	NA	7.9 µg/L	NA
	Turbidity	NA	The greater of [Background + 10 NTU] and [1.2*Background]	NA
	pH	NA	7.0-8.5	NA
	Temperature	NA	19 ºC	NA
	Dioxins (b)	NA	$1.4x10^{-8}$ µg/L	NA

(a) pH is to be within the identified range at the point of discharge at all times.
(b) Dioxins will not be analyzed after the first sampling event if dioxins are not detected on detected at a concentration significantly
for comparison to water quality criteria.
lower than the surface water quality standard. Individual dioxin and dibenzofuran congeners will be converted to a 2,3,78 TCDD Toxicity Equivalency Quotient (TEQ)
NA = Not applicable.

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	Pentachlorophenol	NA	7.9 µg/L	NA
	Turbidity	NA	The greater of [Background + 10 NTU] and [1.2*Background]	NA
	pH	NA	7.0-8.5	NA
	Temperature	NA	19 ºC	NA
	Dioxins (b)	NA	1.4×10^{-8} µg/L	NA

(a) pH is to be within the identified range at the point of discharge at all times.
(b) Dioxins will not be analyzed after the first sampling event if dioxins are not detected on detected at a concentration significantly
for comparison to water quality criteria.
lower than the surface water quality standard. Individual dioxin and dibenzofuran congeners will be converted to a 2,3,78 TCDD Toxicity Equivalency Quotient (TEQ)
NA = Not applicable.

TABLE 4
PROPOSED CHEMICAL ANALYSES FOR SEDIMENT MONITORING

Sample ID	Sample Type	Sample Interval	Dibenzofuran	PAH	Dioxins	TOC
Performance Monitoring						
CP-01A	core	surface	A	A	A	A
CP-01B	core	backfill	A	A	A	A
CP-01C	core	dredge interface	X	X	X	X
CP-02A	core	surface	A	A	A	A
CP-02B	core	backfill	A	A	A	A
CP-02C	core	dredge interface	X	X	X	X
CP-03A	core	surface	X	X	X	X
CP-03B	core	backfill	A	A	A	A
CP-03C	core	dredge interface	X	X	X	X
CP-04A	core	surface	A	A	A	A
CP-04B	core	backfill	A	A	A	A
CP-04C	core	dredge interface	X	X	X	X
CP-05A	core	surface	X	X	X	X
CP-05B	core	backfill	A	A	A	A
CP-05C	core	dredge interface	X	X	X	X
CP-06A	core	surface	A	A	A	A
CP-06B	core	backfill	A	A	A	A
CP-06C	core	dredge interface	X	X	X	X
CP-07A	core	surface	X	X	X	X
CP-07B	core	backfill	A	A	A	A
CP-07C	core	dredge interface	X	X	X	X
CP-08A	core	surface	X	X	X	X
CP-08B	core	backfill	A	A	A	A
CP-08C	core	dredge interface	X	X	X	X
CP-09A	core	surface	X	X	X	X
CP-09B	core	backfill	A	A	A	A
CP-09C	core	dredge interface	X	X	X	X
CP-10A	core	surface	A	A	A	A
CP-10B	core	backfill	A	A	A	A
CP-10C	core	dredge interface	X	X	X	X
CP-11A	core	surface	X	X	X	X
CP-11B	core	backfill	A	A	A	A
CP-11C	core	dredge interface	X	X	X	X
CP-12A	core	surface	X	X	X	X
CP-12B	core	backfill	A	A	A	A
CP-12C	core	dredge interface	X	X	X	X
CP-13A	core	surface	X	X	X	X
CP-13B	core	backfill	A	A	A	A
CP-13C	core	dredge interface	X	X	X	X
CP-14A	core	surface	X	X	X	X
CP-14B	core	backfill	A	A	A	A
CP-14C	core	dredge interface	X	X	X	X
CP-15A	grab	surface	X	X	X	X
CP-15B	core	backfill	A	A	A	A
CP-15C	core	dredge interface	X	X	X	X
CP-16A	core	surface	X	X	X	X
CP-17A	grab	surface	X	X	X	X
CP-18A	grab	surface	X	X	X	X
CP-19A	grab	surface	X	X	X	X
CP-20A	grab	surface	X	X	X	X
Confirmational Monitoring (a)						
CP-XXA	core	surface	X (b)	X (b)	X (b)	X (b)
CP-XXB	core	backfill	X (b)	X (b)	X (b)	X (b)
CP-XXC	grab	dredge interface	X (b)	X (b)	X (b)	X (b)

TABLE 4
PROPOSED CHEMICAL ANALYSES FOR SEDIMENT MONITORING

Sample ID	Sample Type	Sample Interval	Dibenzofuran	PAH	Dioxins	TOC
Field QA/QC Samples						
CP-XXX2	grab	(blind field duplicate (c))	X	X	X	X
CP-XXX2	core	(blind field duplicate (c))	X	X	X	X
CP-WB1	grab	(wipe blank (d))	X	X	X	
CP-RB1	grab	(rinsate blank (d))	X	X	X	
CP-WB2	core	(wipe blank (d))	X	X	X	
CP-RB2	core	(rinsate blank (d))	X	X	X	

surface: 0 to 10 cm below mudline, biologically active zone
backfill: 0.5 to 1.0 foot interval of sediment from center of backfill material
dredge interface: 0.0 to 1.0 foot interval below the dredge interface
X: Sample to be analyzed for listed constituent
A: Archive sample for analysis of the given constituent. These samples will only be analyzed for the constituents of concern that exceed their cleanup action level in the underlying interface sample and for TOC.

(a) Confirmational monitoring will only be conducted at locations where the sediment at the dredge interface exceeds one or more of the cleanup action levels during the performance monitoring event.
(b) Sediment confirmation core samples will only be analyzed for those parameters that exceeded cleanup action levels during the performance monitoring event.
(c) Blind field duplicates will be collected at a frequency of at least one per 20 samples per sample type (i.e., sediment core samples, sediment grab samples) per chemical analysis.
(d) Equipment wipe and/or rinsate blanks will be collected at a frequency of at least one per 20 samples per sample type (i.e., sediment grab samples, sediment core samples) per chemical analysis.

TABLE 5
TARGET COORDINATES
FOR SEDIMENT MONITORING LOCATIONS

SEDIMENT STATIONS

Sample Location	Coordinates (Cascade Pole Datum) Northing	Easting
Dredge Interface Sediment Sample Locations		
CP-01	638,283	401,814
CP-02	638,280	402,041
CP-03	638,347	402,201
CP-04	638,228	402,204
CP-05	638,215	402,345
CP-06	638,095	402,430
CP-07	638,383	401,687
CP-08	638,459	401,841
CP-09	638,372	401,932
CP-10	638,438	402,061
CP-11	638,530	402,146
CP-12	638,430	402,293
CP-13	638,399	402,487
CP-14	638,252	402,517
CP-15	638,196	402,616
Baseline Surface Sediment Sample Locations		
CP-16	638,564	401,688
CP-17	638,567	401,915
CP-18	638,703	402,169
CP-19	638,528	402,529
CP-20	638,350	402,735

TABLE 6
SEDIMENT SAMPLE CONTAINERS, STORAGE TEMPERATURE, AND HOLDING TIMES

Sample Type	Minimum Sample Size/Container(a)	Storage Temperature and Preservative	Maximum Holding Time
Dioxins	50 g/G,T	Cool, 4° C	30 days (b)
PAH	50-100 g/G,T (c)	Cool, 4°C Freeze, -18°C	14 days (b) 1 year
Dibenzofuran	50-100 g/G,T (c)	Cool, 4°C Freeze, -18°C	14 days (b) 1 year
Pentachlorophenol (PCP)	50-100 g/G,T (c)	Cool, 4°C Freeze, -18°C	14 days (b) 1 year
Total organic carbon	25 g/P,G	Cool, 4°C Freeze, -18°C	14 days 6 months

(a) P = linear polyethylene; G = borosilicate glass; T = polytetrafluorethylene (PTFE, Teflon)-lined cap.
(b) Holding time to extraction. After extraction holding time is 40 days to analysis (45 days to analysis for dioxins).
(c) Can be stored in the same sample container.

TABLE 7
SUMMARY OF PROPOSED SEDIMENT CHEMICAL TESTING

Sample ID	Sample Type	Sample Interval	PCP	PAH	Dioxins	TOC
Performance Monitoring						
1A	core	0 to 10 cm (backfill surface)	X	X	X	X
1B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
1C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
2A	core	0 to 10 cm (backfill surface)	X	X	X	X
2B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
2C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
3A	core	0 to 10 cm (backfill surface)	X	X	X	X
3B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
3C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
4A	core	0 to 10 cm (backfill surface)	(A)	(A)	(A)	(A)
4B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
4C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
5A	core	0 to 10 cm (backfill surface)	X	X	X	X
5B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
5C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
6A	core	0 to 10 cm (backfill surface)	X	X	X	X
6B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
6C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
7A	core	0 to 10 cm (backfill surface)	(A)	(A)	(A)	(A)
7B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
7C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
8A	core	0 to 10 cm (backfill surface)	X	X	X	X
8B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
8C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
9A	core	0 to 10 cm (backfill surface)	X	X	X	X
9B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
9C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
10A	core	0 to 10 cm (backfill surface)	(A)	(A)	(A)	(A)
10B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
10C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
11A	core	0 to 10 cm (backfill surface)	(A)	(A)	(A)	(A)
11B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
11C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
12A	core	0 to 10 cm (backfill surface)	X	X	X	X
12B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
12C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
13A	core	0 to 10 cm (backfill surface)	(A)	(A)	(A)	(A)
13B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
13C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
14A	core	0 to 10 cm (backfill surface)	X	X	X	X
14B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
14C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
15A	grab	0 to 10 cm	X	X	X	X
16A	core	0 to 10 cm (backfill surface)	X	X	X	X
16B	core	0.5 to 1.0 ft (center of backfill)	(A)	(A)	(A)	(A)
16C	core	0 to 1.0 ft (from dredge interface)	X	X	X	X
17A	grab	0 to 10 cm	X	X	X	X
18A	grab	0 to 10 cm	X	X	X	X
19A	grab	0 to 10 cm	X	X	X	X
20A	grab	0 to 10 cm	X	X	X	X

TABLE 7
SUMMARY OF PROPOSED SEDIMENT CHEMICAL TESTING

Sample ID	Sample Type	Sample Interval	PCP	PAH	Dioxins	TOC
Confirmational Monitoring						
#A (a)	core	0 to 10 cm (backfill surface)	(A)	(A)	(A)	(A)
#B (a)	core	0.5 to 1.0 ft (center of backfill)	X (b)	X (b)	X (b)	X (b)
#A (a)	grab	0 to 10 cm	X (b)	X (b)	X (b)	X (b)

Notes:

X: Analyze for the given constituent

(A): Archive sample for analysis of the given constituent. These samples will only be analyzed for the constituents of concern that exceed their cleanup action level in the underlying interface sample and for TOC.

(a) Confirmational monitoring will only be conducted at locations where the sediment at the dredge interface exceeds one or more of the cleanup action levels.

(b) Sediment confirmation core samples will only be analyzed for those parameters that previously exceeded cleanup action levels.

TABLE 8
SEDIMENT SAMPLE PREPARATION METHODS, CLEANUP METHODS, ANALYTICAL METHODS, AND DETECTION LIMITS

Chemical	Sample Preparation Methods(a)	Sample Cleanup Methods(b)	Analytical Methods(c)	Detection Limits(d) (µg/kg dry weight)
Dioxins	--- (e)	--- (e)	8290	1 – 10 ng/kg
POLYNUCLEAR AROMATIC HYDROCARBON COMPOUNDS				
LPAH Compounds				
Naphthalene	3540/3550	3640/3660	8270	10
Acenaphthylene	3540/3550	3640/3660	8270	10
Acenaphthene	3540/3550	3640/3660	8270	10
Fluorene	3540/3550	3640/3660	8270	10
Phenanthrene	3540/3550	3640/3660	8270	10
Anthracene	3540/3550	3640/3660	8270	10
2-Methylnaphthalene	3540/3550	3640/3660	8270	10
HPAH Compounds				
Fluoranthene	3540/3550	3640/3660	8270	10
Pyrene	3540/3550	3640/3660	8270	10
Benz(a)anthracene	3540/3550	3640/3660	8270	10
Chrysene	3540/3550	3640/3660	8270	10
Total benzofluoranthenes(f)	3540/3550	3640/3660	8270	10
Benzo(a)pyrene	3540/3550	3640/3660	8270	10
Indeno(1,2,3-cd)pyrene	3540/3550	3640/3660	8270	10
Dibenz(a,h)anthracene	3540/3550	3640/3660	8270	10
Benzo(ghi)perylene	3540/3550	3640/3660	8270	10
Benzo(ghi)perylene	3540/3550	3640/3660	8270	10
Benzo(ghi)perylene	3540/3550	3640/3660	8270	10
Miscellaneous Compounds				
Pentachlorophenol	3540/3550	3640/3660	8270	10
Dibenzofuran	3540/3550	3640/3660	8270	10
Conventional Sediment Variables				
Total organic carbon (TOC)	---	--	9060	0.1%

EPA = U.S. Environmental Protection Agency
HPAH = high molecular weight polycyclic aromatic hydrocarbon
LPAH = low molecular weight polycyclic aromatic hydrocarbon
GPC = gel permeation chromatography
PSEP = Puget Sound Estuary Program

(a) Recommended sample preparation methods are PSEP (1997a,b); method 3500 series - sample preparation methods from SW-846 (EPA 1986) and updates.

(b) Recommended cleanup methods are:
- All sample extracts should be subjected to GPC cleanup in accordance with procedures specified by EPA SW-846 method 3640. 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 sediment), cleanup procedures specified by EPA SW-846 method 3660 should be used.
- Additional cleanup procedures may be necessary on a sample-by-sample basis. Alternative cleanup procedures are described in PSEP (1997a,b) and EPA (1986).

(c) Recommended analytical methods are:
- Method 6000, 7000, 8000, and 9000 series - analytical methods from SW-846 (EPA 1986) and updates.
- Plumb (1981) - EPA/U.S. Army Corps of Engineers Technical Report EPA/CE-81-1.
- PSEP (1997).

(d) To achieve the recommended detection limits for organic compounds, it may be necessary to use a larger sample size (approximately 100 g), a smaller extract volume for gas chromatography/mass spectrometry analyses (0.5 mL), and one of the recommended sample cleanup methods, as necessary, to reduce interference. 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 sample preparation and sample cleanup method for dioxins is described in the analytical method [method 8290, SW-846 (EPA 1986) and updates].

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

TABLE 9
SUMMARY OF QUALITY ASSURANCE CRITERIA

Analysis	Units	Target Quantitation Limit (a)	Precision Control Limits (a)		Accuracy Control Limits (a)			Completeness
			MS/MSD RPD (%)	Duplicates RPD (%)	MS/MSD Recovery (%)	Surrogate Recovery (%)	LCS Recovery (%)	
Polynuclear Aromatic Hydrocarbons	µg/kg (dry weight)	10	≤50	-- (b)	50-150	-- (c)	-- (c)	95%
Pentachlorophenol	µg/kg (dry weight)	2	≤50	-- (b)	50-150	-- (c)	-- (c)	95%
Dibenzofuran	µg/kg (dry weight)	10	≤50	-- (b)	50-150	-- (c)	-- (c)	95%
Dioxins	ng/kg (dry weight)	1-10	≤50	-- (b)	50-150	-- (c)	-- (c)	95%
Total Organic Carbon	% (dry weight)	0.1	NA	35 (f)	65-135	NA	65-135	95%

MS/MSD = Matrix spike/matrix spike duplicate
LCS = Laboratory control sample
RPD = Relative percent difference
NA = Not applicable

(a) Target detection limits, and precision and accuracy control limits are specified in Tables 5, 11, 12, and 13 of the *Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards* (chapter 173-204 WAC) (Ecology 1995a).
(b) Control limits not specified.
(c) The most current control limits established by the laboratory will be used.
(d) Target detection limit for TBT is a guideline level as recommended in Appendix A of the *Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water, Sediment, and Tissue Samples* (PSEP 1997a).
(e) If sample value is within 5 times the quantitation limit, then control limits shall be +/- twice the quantitation limit.
(f) 35 percent relative standard deviation (RSD).

ATTACHMENT 2

Health and Safety Plan

Health and Safety Plan

Sediments Remediation
Cascade Pole Site
Port of Olympia, Washington

April 6, 2001

Updated September 13,2012

Prepared for

Port of Olympia
915 Washington Street NE
Olympia, WA 98501

Prepared by

LANDAU ASSOCIATES, INC.

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1.0 INTRODUCTION

This Health and Safety Plan presents the protocols that will be required to provide for the health and safety of Landau Associates employees during the sediment removal and upland containment activities to be conducted by the Port of Olympia (Port) under the terms of an Agreed Order (Agreed Order No. DE 00TCPSR-753) with the Washington State Department of Ecology (Ecology). These activities will be performed at the site of the former wood treatment plant operated most recently by the Cascade Pole Company (CPC) at the Port of Olympia (Figure 1). This Health and Safety Plan (HASP) is prepared for submittal to Ecology on behalf of the Port.

This plan presents a description of existing site conditions and the project health and safety organization, and also includes safety rules and procedures, criteria for hazard and risk analysis, description of levels of personal protection and required equipment, air monitoring procedures, emergency response information, training requirements, and requirements for routine health care and health monitoring.

1.1 SITE BACKGROUND

The general areas impacted by the proposed sediment removal and upland containment activities include the fenced upland area inside the northeast half of the slurry wall and the intertidal and subtidal area bounded by the multiple benefits line (MBL), as shown on Figure 2. Landau Associates and its subconsultants are under contract with the Port to prepare design specifications and drawings for the proposed cleanup action at the site. A contractor, as yet to be identified by the Port, will be responsible for implementing the removal and upland containment of contaminated sediments within the MBL. Sediment removal and upland containment activities will be conducted concurrently, and HASP covers all work activities. Field activities covered by this HASP may include:

- Sediment excavation and backfilling using terrestrial construction equipment
- Sediment dredging using marine-based equipment
- Onsite sediment transportation and placement in containment cell
- Construction of interim containment cell cover
- Construction of a shoreline containment structure, including shoreline excavation and backfilling, and placement of a sheet pile cutoff wall
- Shoreline restoration and protective activities, including removal of existing debris, excavation, backfilling, and grading
- Sampling of storm drain effluents and in-line sampling of water from treatment systems

- Sampling of surface water
- Groundwater extraction well installation
- Sampling of intertidal and subtidal sediments
- Installation and operation of a temporary groundwater treatment system.

This HASP does not cover site activities that are limited to walking across any Exclusion Zone designated in this plan when the activities noted above are not in progress in that Exclusion Zone, and if the activities in progress in any other Exclusion Zone do not represent a reasonable risk of exposure.

Former wood treating operations at the site included use of both creosote and pentachlorophenol (PCP) wood preservatives. The primary identified chemical contaminants of concern at the site are the polycyclic aromatic hydrocarbon (PAH) constituents of creosote (many of which are suspected human carcinogens), PCP, and other phenolic compounds. Analyses for dioxins/furans, volatile organic compounds (e.g., benzene, toluene, xylenes), and other potential contaminants at the site have shown some detectable concentrations of these chemicals, but the detected concentrations are generally at levels of lesser concern than the PAH and PCP. Dioxins and furans are currently regarded as suspect human carcinogens; however, precautions described in this HASP that will be taken on this site during work activities will minimize the potential for exposure to these constituents.

Table 1 provides a contaminant and media-specific summary of the applicable sediment and surface water chemical data for the activity areas, collected during the sediments remedial investigation (RI), and also presents health-based exposure information. It should be noted that the symptoms listed as a result of exposure are generally associated with acute (short-term) exposures to high concentrations of a constituent. Such symptoms may not be associated with the lower level exposure that would be the most likely exposure scenario during site work. Lack of these symptoms does not indicate that exposure is not occurring. Also, symptoms of exposure are not available for many of the constituents. Therefore, use of prescribed protective equipment and monitoring instruments in accordance with this plan is required in order for exposure to these constituents to be kept as low as possible.

1.2 HEALTH AND SAFETY PLAN APPLICABILITY AND ADHERENCE

All individuals employed by Landau Associates and performing field work under the Agreed Order must read, understand, and comply with this HASP. All field participants must read the plan prior to undertaking any field activities. If any information presented in this plan is unclear, the reader should contact the appropriate Site Safety Officer for clarification prior to participating in any field activity. Once the information has been read and understood, the individual must sign the Acknowledgment Form [Form 1 (Appendix A)], which will then be placed in the job file.

Similarly, all subcontractors or subconsultants for Landau Associates must prepare their own HASP that is at least as protective as this plan, or they may adopt this plan as their own. If a subcontractor or subconsultant adopts this plan as their own, they do so at their sole risk. Failure to comply with the requirements of the plan are grounds for immediate dismissal. Copies of an acknowledgment form similar to that provided as Form 1 must be provided to the Landau Associates Site Health and Safety Officer prior to the commencement of field activities.

This plan is flexible, and allows unanticipated site-specific problems to be addressed, while providing adequate and suitable worker protection. The plan may be modified at any time, based on the judgment of the respective Site Safety Officer or the Project Safety Officer, as appropriate. Minor changes to the plan regarding day-to-day activities (e.g., location of decontamination station, etc.) may be made by the Site Safety Officer. Substantive changes to procedures (e.g., monitoring frequency, etc.) must also receive the concurrence of both the Site Safety Officer and the respective Project Safety Officer (changes that involve levels of protection or action levels will be relayed to Ecology or the Washington Department of Labor and Industries, if time allows; otherwise, such changes will be documented in the monthly reports to Ecology). Any modification will be presented to the onsite team during a safety briefing and posted in a designated area (e.g., at site mobilization location) using Form 2 (Modification to Health and Safety Plan).

Activities conducted as part of this investigation will be conducted without creating health and safety risks for nearby workers or the public. All onsite personnel will be attentive to the potential for release of contaminated materials associated with field activities and will immediately bring all such matters to the attention of the appropriate Site Safety Officer. Decontamination procedures and other elements of the field procedures (e.g., access to/from work areas by heavy equipment) have been developed to be protective of both worker and public health and safety.

1.3 RESPONSIBLE INDIVIDUALS

Safety during the field investigations will be the responsibility of the Landau Associates project manager and the designated Site Safety Officer. The Site Safety Officer, or his/her designee, will be present at the site at all times during field activities related to the investigation. Safety-related responsibilities are presented on Figure 3.

Coordination of all onsite activities by Landau Associates, their respective subcontractors, and the will be required on a daily and continuing basis. The Port will make all direct contacts with its tenants. Mr. Don Bache, Cascade Pole Site Manager for the Port, will be the primary contact for such coordination. Any one of these individuals (Project Manager, Project Safety Officer, Site Safety Officer, or the Port of Olympia Cascade Pole Site Manager) may temporarily suspend the field investigation if there appears to be a threat to onsite worker or community health or safety.

2.0 SITE ORGANIZATION AND OPERATION

The areas of the site to be impacted by the cleanup action and the type of activities involved are diverse. Additionally, the distribution of contamination at the site is nonuniform in nature. These factors preclude the use of a single work zone boundary. The upland area roughly includes the fenced area within the slurry wall. The two work areas within the Sediments Operable Unit (SOU) consist of the non-aqueous phase liquid (NAPL) area and the remainder of the area within and slightly beyond the MBL, as shown on Figure 2.

Figure 2 depicts work areas at the site and identifies the initial levels of protection to be used when working in each work area (see Section 5.2 for discussion of level of protection). The designated level of protection for each work area may be downgraded (C to D) if monitoring data obtained prior to or during work activities indicate that such a downgrade is appropriate. Conversely, the level of protection must be upgraded if monitoring conducted during work activities so indicates (see Section 6.0 for site monitoring and action levels). Figure 2 should be regarded only as an indication of the general area where the work area boundaries lie; actual boundaries may vary slightly with work activity requirements and will be flagged once defined.

2.1 WORK ZONES

Each work area will consist of an Exclusion Zone, a Contamination Reduction Zone, and a Support Zone:

Exclusion Zone: The outer perimeter of each work area depicted on Figure 2 defines the outer perimeter of the Exclusion Zone for that work area, except for the upland work area, Area 1. The paved portion of Area 1 contains the site Contamination Reduction Zone and Support Zone. Only authorized field personnel will be allowed in each Exclusion Zone. The initial level of protection required in the Exclusion Zone is noted on Figure 2 and as noted above, may be adjusted as conditions change. Levels of protection are discussed in more detail in Section 5.0.

Contamination Reduction Zone: All personnel and equipment will leave the Exclusion Zone through a Contamination Reduction Zone. Both personnel and equipment decontamination will occur in this zone to prevent the transfer of contaminants to the Support Zone (decontamination procedures are specified in Section 3.2.3). The transition from the Exclusion Zone to the Contamination Reduction Zone is shown schematically on Figure 4. A more detailed flow chart of personnel decontamination is shown on Figure 5.

Support Zone: Located adjacent to the Contamination Reduction Zone, the Support Zone is where all personnel will suit-up in specified personal protective equipment before entering the work area defined by the Exclusion Zone. The Support Zone includes "clean" equipment storage and personnel resting and eating facilities.

Each zone in each work area will be established on an activity-by-activity basis prior to initiation of work and will be clearly delineated (marked by tape or fencing). The only work area where clear delineation of zones may not be possible is in the SOU. If sediments are to be collected from a boat, the Contamination Reduction and Support Zones will be established at the docking location.

2.2 SITE SECURITY

The area in which field activities will occur is a restricted-access industrial area. There are two roads (North Washington Street and Marine Drive) for public access to the marina and public areas at the northern areas of the Port (Figure 2) and some activities may be conducted along these roads. For work activities that are conducted in areas with public access, the work area will be blocked off and posted and, if necessary, traffic associated with public access will be re-routed. Public access to work areas outside the site fence will be controlled through daily coordination with the Port. The Port also will coordinate with its tenants regarding log yard operations and activities.

3.0 SAFETY RULES AND PROCEDURES

Safety is the responsibility of every individual involved in project efforts. Whether in the office or in the field, properly followed procedures are essential for personal safety and to minimize injuries or accidents involving equipment. Potential hazards while working at the site include, but are not limited to:

- Exposure to toxic and/or hazardous chemicals
- Physical hazards from use of drilling, sampling, and testing equipment, including use of boats for sediment and surface water sampling
- Physical hazards from use of excavation, dredging, or other heavy construction, and road traffic
- Physical hazards from working conditions (e.g., heat stress, hypothermia).

3.1 SAFETY RULES

All personnel working in the field will follow the rules and procedures listed below:

- All personnel will conduct themselves in a professional manner at all times.
- No personnel will be admitted into an operational Exclusion Zone without safety equipment in proper working condition and requisite training.
- All personnel must comply with the established safety procedures. Anyone working onsite for or under contract with Landau Associates who does not comply with this HASP may be immediately dismissed from the site.
- Working while under the influence of intoxicants, narcotics, or controlled substances is prohibited. A physician should be consulted prior to taking prescription drugs, if the potential for contact with toxic substances exists.
- Firearms, ammunition, fireworks, and explosives are prohibited.
- Climbing or standing on machinery (other than drill rigs or service trucks) or equipment is prohibited unless authorized by the Site Safety Officer.
- Long hair must be contained inside a hard hat. Facial hair that interferes with proper operation and fit of respiratory protection gear is not allowed.
- A team system will be used within an Exclusion Zone. During site operations, each worker is a safety backup for his/her team partner(s) and should make all personnel aware of dangerous situations that may develop.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in an Exclusion Zone.
- Smoking or consumption of food and beverages is allowed only within designated areas in the Support Zones.
- Disposable clothing will be used whenever necessary and appropriate to minimize the risk of cross-contamination.

- The number of personnel and the amount of equipment in contaminated areas will be minimized to allow for efficient site operations.
- Samples will be collected only by trained and authorized personnel.
- Contact with contaminated or potentially contaminated material should be avoided. Efforts will be made to stage site activity upwind of investigative equipment, activities, and materials.
- Proper decontamination procedures must be followed before leaving an Exclusion Zone and the site, unless medical emergencies dictate otherwise (Section 3.2.3.2). All decontamination residual materials, and any other potentially contaminated materials, will be handled properly and kept onsite or at a designated secure stockpile area.
- Caution will be observed when proceeding on foot and around heavy equipment or traffic.
- Only approved work clothes or equipment will be allowed within the Exclusion Zones.
- Exchange of personal protective equipment will not be allowed.
- All field activities will comply with OSHA 29 CFR 1926 (Construction Industry Standards) and 29 CFR 1910 (General Industry Standards) as appropriate.

3.2 SAFETY PROCEDURES

3.2.1 LEAVING THE SUPPORT ZONE TO ENTER SITE

- Prior to beginning cleanup action activities, review site information updates. These updates will be provided by the Site Safety Officer and will provide important information concerning:
    - Expected hazards
    - Special conditions
    - Sampling procedures
    - Location of phones
    - Emergency medical information
    - Level of personal protection required.
- Finish eating and extinguish smoking materials prior to suiting-up.
- Attend safety briefing and worker question and answer period, if applicable.
- Check safety gear and equipment. Suit-up as required to begin activities.
- Measure and delineate Exclusion Zone (unless established previously).

3.2.2 ACTIVITIES IN EXCLUSION ZONE

- All activities will be conducted at a minimum of Level D - (modified) (Section 5.0).

- For activities capable of creating airborne contamination (vapors or particulates) such as soil sampling or drilling, levels of personal protection will be adjusted according to results of work zone air monitoring (Section 6.0).
- Whenever possible, personnel will be stationed upwind of field activities capable of creating airborne contamination.
- Physical dust control methods will be utilized when necessary (i.e., wetting, covering with plastic).
- If any physical discomfort is experienced (e.g., abnormalities, nausea, lightheadedness), immediately stop work, tell the other team members, and leave the area.
- If any personal protective equipment fails, immediately leave the area.
- One person must never be left alone in an Exclusion Zone.
- Use maximum care in handling samples. If the sampling site is not accessible using gear available (i.e., water too high, slippery or steeply sloped surface, holes, etc.), confer with the Project Manager and/or Site Safety Officer, as appropriate, to arrange an alternate sampling site or appropriate equipment/procedures to obtain samples safely.
- Immediately wipe off spills and dirt from sampling containers.

3.2.3 SITE EXIT DECONTAMINATION

All personnel and equipment must be properly decontaminated before entering a Support Zone from an Exclusion Zone. All contaminated equipment and materials will leave only through the Contamination Reduction Zone or will be contained onsite; any potentially contaminated materials to be stockpiled will be kept in designated, secure locations.

3.2.3.1 Routine Decontamination Procedures

A decontamination area will be set up in the Contamination Reduction Zone at the border of each Exclusion Zone. Prior to leaving the Exclusion Zone:

- Portable sampling equipment will be washed or placed in/on plastic for vehicle transport to equipment decontamination area
- Drilling rig auger flights will be placed on a trailer for transport to the decontamination area
- Soil will be brushed and/or washed off heavy equipment and trucks moving to the decontamination area to minimize transport of potentially contaminated materials from the Exclusion Zone.

In the Contaminant Reduction Zone, sampling, drilling, excavation, dredging, and other equipment will be decontaminated as follows:

- Sampling equipment will be decontaminated as outlined in the applicable Sampling and Analysis Plan (SAP).
- All heavy equipment must be thoroughly decontaminated prior to leaving the site, with particular care taken in decontaminating those parts of the heavy equipment that have come into direct contact with contaminants, such as tracks, tires, shovels, grapples, and scoops. High-pressure hot water cleaning will be used for these, aided by physical scrubbing with disposable brushes, when necessary, to loosen caked materials. All portions of the equipment including the undercarriage, chassis, and cab also will be inspected and cleaned as necessary.
- Any vehicle used for transportation in an Exclusion Zone will be equipped with seat covers that can be easily wiped down. All such vehicles must be decontaminated prior to leaving the Exclusion Zone. Decontamination will include at minimum vacuuming soil from the vehicle interior, wet wiping the interior, and high pressure washing and scrubbing of the exterior.
- Personal protective equipment will be removed and washed and/or containerized prior to leaving the Contaminant Reduction Zone.

Certain parts of contaminated respirators, such as the harness assembly or cloth components, are difficult to decontaminate. If grossly contaminated, they will be discarded. Rubber components will be soaked in soap and water and scrubbed with a brush. Respirators will be sanitized by rinsing in a detergent solution followed by a clear rinse, then hung to dry.

Figure 2 depicts the location of decontamination stations at the site. The main decontamination station will be located at the gate area. All heavy equipment will be pressure washed and scrubbed at this point. All personnel and equipment will undergo the appropriate level of decontamination and exit at this point. In order to minimize the spread of contaminated sediment, a satellite decontamination station will be established at the docking area. The satellite station at the docking area will be equipped for equipment and personnel decontamination appropriate for entry into the area adjacent to the docking location.

3.2.3.2 Emergency Decontamination

In case of an emergency, gross decontamination procedures will be speedily implemented if possible. If a life-threatening injury occurs and the injured person cannot undergo decontamination procedures without incurring additional injuries or risk, he or she will be transported, wrapped in plastic sheeting if time allows and if consistent with the injury. The medical facility will be: 1) informed that the injured person has not been decontaminated and, 2) given information regarding the most probable contaminants.

3.2.4 DISPOSAL OF CONTAMINATED FLUIDS AND MATERIALS

All equipment and materials used for decontamination or personal protection will be cleaned or collected for appropriate disposal. All non-disposable equipment will be decontaminated onsite. Disposables will be containerized. Contaminated liquids will be collected in storage tanks or containers and stockpiled in a secure location. Storage and/or disposal will be conducted in accordance with the applicable SAP.

3.2.5 HOUSEKEEPING

Work areas will be kept as clean and orderly as possible at all times. Ordinary refuse will be placed in suitable rubbish bins or trash containers at the site. The storage or introduction of extraneous materials will be minimized in the Exclusion Zone to minimize the decontamination load and reduce possibilities for cross-contamination.

3.2.6 VISITORS

All visitors to the site must sign in at the Port offices and must be granted admission to the site by the Port and the Site Safety Officer. Authorized visitors will only be allowed to observe operations from the Support Zone or beyond, and must obey all instructions of the Site Safety Officer and/or the Port representative. Exceptions to this are Ecology, Washington Department of Labor and Industries, and Port representatives who establish that they possess training and fit testing that meet the requirements of this plan. Ecology and Washington Department of Labor and Industries representatives must also possess appropriate health and safety equipment at the time of the visit, and have a HASP at least as stringent as this plan, or adopt this plan as their own.

4.0 ANALYSIS OF SITE HAZARDS AND RISKS

4.1 BASIS FOR ANALYSIS

Results of previous investigations of the area identified the types and levels of contaminants of concern. Maximum concentrations of constituents detected in area soil, sediments, and groundwater are summarized in Table 1, along with occupational exposure criteria, if available, and potential exposure pathways of concern.

4.2 SUSPECTED HAZARDOUS SUBSTANCES

There is a potential for field personnel to become exposed to contaminants in the defined work areas. Dermal, inhalation, and incidental ingestion exposures are possible. The general risk of exposure on the site is moderate to high; the risk of exposure in the sediments work area is also moderate to high.

Current soil, sediment, and groundwater contamination could lead to dermal contact during sampling and sediment removal and placement activities. Dermal protection as defined in Section 5.2 will, therefore, be required for all such activities. Volatilization of a few identified contaminants could pose risk of inhalation exposures. Some of the known contaminants onsite, such as the PAH, adhere to soil. Therefore, airborne particles from mechanical or wind resuspension of surface materials could also create risks of inhalation (and incidental ingestion) exposures. Action levels and the associated respiratory protection for potential inhalation exposures will be based initially on the levels of protection specified on Figure 1 and will be adjusted thereafter based on ambient monitoring data to be collected during field activities (Section 6.0).

4.3 SPECIAL HAZARDS/SAFETY

4.3.1 WATER OPERATIONS

The proposed sediment and surface water sampling activities conducted from a boat and marine-based dredging activities will be accomplished within a relatively protected water body. Consequently, the potential hazards associated with wind, waves, and swell are not expected to be significant. However, as with all water operations, there is an inherent water/drowning hazard and all personnel involved in these activities must be aware of situations that could result in someone falling or being knocked overboard. Personnel involved in off-shore work must be made aware of any overhead and suspended equipment, constriction and pinch points, and cables or other objects presenting slip, trip, or fall hazards. Communication with the shore will be maintained at all times, either visually from the shore or by using radios or portable telephones. All boat personnel will wear life jackets at all times on the water. All shipboard activities will comply with U.S. Coast Guard requirements.

4.3.2 HAZARDS ASSOCIATED WITH STORMWATER SAMPLING

Cleanup activities may involve sampling materials from existing storm sewer lines. These storm lines will be sampled without entry into manholes, which would be considered a confined space. This HASP does not cover confined space entry. If manhole entry becomes necessary, a confined space entry procedure will be prepared and appended to this HASP prior to the activity.

5.0 PERSONAL SAFETY EQUIPMENT

5.1 LEVELS OF PROTECTION

Levels of protection have been defined by the EPA in 29 CFR 1910.120:

- Level A requires use of a fully-encapsulating suit and full face piece pressure demand self-contained breathing apparatus (SCBA) with a supplied air escape pack for the highest level of respiratory, skin, and eye protection. Level A is not anticipated at this site, and therefore is not discussed further.
- Level B requires maximum respiratory protection by the use of supplied air or a positive pressure SCBA. A supplied air escape pack is required while in Level B. Chemical-resistant clothing for dermal protection is selected on the basis of anticipated hazards. Level B is not anticipated at this site, and therefore is not discussed further.
- Level C requires an air purifying respirator that is specific to the contaminants of concern. The degree of dermal protection is dependent on anticipated hazards and provided by chemical-resistant clothing.
- Level D is the basic work uniform, described in Section 5.2, as modified for work at this site.

There are numerous variations and modifications possible with each level of protection. Personal protection action levels for site project activities are discussed in Section 6.0.

5.2 REQUIRED EQUIPMENT

Figure 2 illustrates work areas identified for specific levels of protection based on previous site investigations. The level designated for each work area indicates the level of protection that should be initially used in that area. Air monitoring results may indicate that a downgrading (or upgrading) in level of protection is appropriate. Although limited volatilization of some low molecular weight PAH (LPAH) may occur, volatilization is not a significant concern for most of the site contaminants. Furthermore, the wet conditions associated with the dredging and placement of sediments significantly reduces dust generation and the potential for inhalation of contaminated particulate matter. Therefore, the consistent use of an air purifying respirator is not expected to be necessary.

Although Level C protection is not initially required, all Landau Associates personnel and other persons operating under this HASP will have the appropriate protective equipment available onsite in case an upgrade is necessary. Two types of modified Level D protection, identified as Level D1 and Level D2 in this report, are presented for use in areas where notably different levels of contamination have been observed. Level D2 protection is generally recommended for work in all areas. Level D1 protection is recommended in Areas 1 and 2 when handling sediments from the NAPL area (Area 2). In these work areas, Level D is considered appropriate for nonintrusive activities unless air monitoring indicates that an upgrade is necessary. The following sections define Level D and Level C protective equipment.

5.2.1 LEVEL D1 – (MODIFIED)

- One-piece disposable Saranex coveralls, which are resistant to PAH compounds and PCP, will be used. Coveralls will be taped at wrists and ankles if wet or excessively dusty conditions are expected
- PVC inner-disposable gloves
- Neoprene and/or nitrile outer gloves
- Neoprene steel-toed and steel-shank, chemically resistant, impermeable outer boots
- Hard hat (with splash shield if liquid splashes or sprays are likely to be encountered)
- Safety glasses with side shields (for intrusive work only).

5.2.2 LEVEL D2 – (MODIFIED)

- Disposable coveralls (Tyvek)
- PVC inner-disposable gloves
- Neoprene and/or nitrile outer gloves
- Neoprene steel-toed and steel-shank, chemically resistant, impermeable outer boots
- Hard hat (with splash shield if liquid splashes or sprays are likely to be encountered)
- Safety glasses with side shields (for intrusive work only).

If an area is upgraded to Level C protection, Level D may only be worn in that work area after the Site Safety Officer has made a determination that continued exposure to hazardous materials is unlikely and that exposure will not approach the threshold limit value/permissible exposure level (TLV/PEL).

5.2.3 LEVEL C

- All Level D (modified) equipment described above (including all equipment identified for intrusive work)
- Half-face air purifying respirator equipped with organic vapor/HEPA cartridges. If contaminated liquid splashes or sprays are likely to be encountered, full-face air purifying respirators equipped with organic vapor/HEPA cartridges will be used.

6.0 SITE MONITORING AND ACTION LEVELS

Air monitoring near the breathing zone will be conducted, as outlined below, for volatile and semivolatile constituents and for particulate matter to determine the appropriate level of respiratory protection (based on action levels provided in Table 2). Background readings will be taken 50 ft upwind of site activities. The personal protective equipment requirement applies to the area within a 30-ft radius of where the contaminants are measured.

In addition to monitoring for determination of respiratory hazard, monitoring will also be conducted, as noted below, for combustible gases and hydrogen sulfide.

6.1 VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS

Substances that are most hazardous from a chronic inhalation standpoint are those that are relatively volatile, highly toxic (i.e., low TLV or PEL), and have an odor threshold much higher than the TLV. If a substance has an odor threshold higher than the TLV, it is considered to have poor warning properties because its odor would not be detected until after the acceptable airborne concentration (TLV or PEL) has been exceeded. Some volatile organic compounds (i.e., benzene, toluene, and xylenes) were detected at low levels in site sediments in a pre-RI investigation; however, the low concentrations and limited extent of contamination do not warrant active monitoring of these compounds during the current cleanup action. LPAH compounds are expected to have the greatest potential for impacting human health via the inhalation pathway. The designated Site Safety Officer will have a photoionization detector (TIP meter) onsite at all times that intrusive activities are conducted and will establish background readings well upwind of any excavation, spoils pile, or borehole. TIP readings will be taken frequently during intrusive work. A table showing the relative response to different chemical constituents at different lamp energies will be kept with each TIP for field reference.

While monitoring with the TIP, any consistent readings in the breathing zone that are more than 3 ppm above the upwind background level for more than 5 minutes, or any readings in the breathing zone greater than 10 ppm other than a momentary peak will be the action level for donning half-face air purifying respirators equipped with organic vapor/particulate cartridges. Cartridges will be replaced after each day of use or immediately upon any indication of "break through," whichever is less.

Any readings consistently greater than 10 ppm above background or greater than 50 ppm other than for a brief peak, or any peak reading greater than 100 ppm in the breathing zone, will be the action level for exiting the area.

6.2 AIRBORNE PARTICULATE CONTROL

A hand-held aerosol monitor will be used to monitor the breathing zone for airborne particulates that may be generated by dredging, sampling, or other construction activities. Monitoring will be conducted frequently during intrusive work, and more often if dusty conditions develop. The total suspended particulate (TSP) action level (dust concentration at which respiratory protection must be worn) is 27.6 mg/m^3. This action level was determined by calculating a composite TSP level that would keep exposure of identified contaminants, assuming the maximum proportional levels for each contaminant, below a critical composite TLV. This method and supporting calculations are described in Appendix B. The major contaminants contributing to this action level are the PAH.

6.3 COMBUSTIBLE GAS

Methane is generated by the decomposition of organic matter, and may be present as a result of decomposition of buried wood waste or from decomposition of fill material placed at the site. An MSA Model 361 oxygen, combustible gas, and hydrogen sulfide detector, or an equivalent direct reading instrument, will be used to monitor combustible gas and vapor concentrations during drilling and well installation activities.

The MSA 361 is calibrated to pentane and is checked by introducing a calibration gas of 0.75 percent pentane and 17 percent oxygen, in nitrogen. This mixture can also be used to check the oxygen detector. The instrument should read between 47 and 50 percent LEL (Lower Explosive Limit), and between 16 and 18 percent oxygen. The user should note that the instrument is calibrated to pentane and may respond differently to other gases.

The LEL concentrations (the lowest concentration at which a gas becomes explosive in air) is between 1 and 7 percent for most "combustible" organic vapors and gases. This corresponds to a concentration of 10,000-70,000 ppm by volume in air (the LEL concentration of pentane, for example, is 1.5 percent or 15,000 ppm in air. Consequently, 25 percent of LEL, specified as the action level, is equivalent to 3,750 ppm). At such concentrations, most flammable gases can be detected by the sense of smell. Methane is a notable exception.

Methane is odorless, tasteless, colorless, and extremely flammable. Therefore, high combustible gas readings in the absence of distinctive odors strongly suggest the presence of methane.

Photoionization detectors such as the Photovac TIP, which can detect organic vapors in ppm concentrations, respond very poorly to methane, if at all. Even a low LEL reading on the MSA 361 represents a gas concentration on the order of hundreds of ppm. Consequently, a detectable combustible gas reading (in percent LEL) on the MSA 361 in the absence of a detectable reading on the TIP is further evidence suggesting the presence of methane.

An action level of 20 percent LEL is commonly established for emergency evacuation of confined-space work environments. If an LEL value of 20 percent or greater is obtained at the mouth of the hole, the Site Safety Officer should temporarily cease drilling operations and allow the hole to vent. If the hole has penetrated a localized pocket of gas, levels may drop, and drilling can proceed, with caution and vigilant monitoring. If levels remain high, the hole may be purged with carbon dioxide gas, which is heavier than air, or with solid carbon dioxide (dry ice). If subsequent combustible gas levels at the surface no longer indicate the presence of an explosion hazard, work may continue with frequent monitoring and extreme caution. Note: continuous use of the MSA 361 in a carbon dioxide atmosphere will quickly contaminate the oxygen detector. The MSA 361 should be used only intermittently in an atmosphere containing carbon dioxide.

It is not appropriate to designate a single "cease operations" action level for methane gas encountered during drilling operations. The Site Safety Officer must be sufficiently knowledgeable to assess the situation, taking into account all of the factors discussed above. As a general rule, however, any readings greater than 10 percent LEL at depth are cause for increased monitoring activity. If combustible gas levels reach 20 percent LEL a foot or so above the mouth of the hole or casing, the Site Safety Officer should temporarily cease operations and carefully assess the situation. Conditions may call for preventive or corrective measures, such as purging the hole or general site ventilation.

6.4 HYDROGEN SULFIDE

An additional cause for concern when methane gas is venting from the borehole is that it may "purge" other much more acutely toxic gases associated with decomposition of fill material, such as hydrogen sulfide, out of the borehole along with it. Hydrogen sulfide may also be released from dredged or excavated sediment. Hydrogen sulfide is not expected to be of concern in sediment sampling.

Hydrogen sulfide concentrations may be monitored on the MSA 361 directly in ppm, concurrently with combustible gas measurements. Calibration of the hydrogen sulfide detector must be checked prior to each day of use by introducing a 10 ppm or 40 ppm hydrogen sulfide calibration gas. Instrument readings should be 9-12 ppm or 36-44 ppm, respectively.

The 8-hour, time-weighted average TLV for hydrogen sulfide is 10 ppm and the 15-minute short-term exposure limit (STEL) is 15 ppm. The Immediately Dangerous to Life and Health (IDLH) level is approximately 300 ppm.

If hydrogen sulfide concentrations greater than 10 ppm are detected at the mouth of the borehole, the monitoring frequency will be increased and/or the MSA 361 can be set up to run continuously at the driller's operating position.

At concentrations of a few ppm in the breathing zone, the odor nuisance would be such that site personnel would probably voluntarily put on air purifying respirators. Such use of air purifying respirators is acceptable, but once air purifying respirators are put on, hydrogen sulfide concentrations must be monitored continuously.

If concentrations in the breathing zone exceed 10 ppm for more than 15 minutes, or at any time exceed 25 ppm, work will be temporarily halted until hydrogen sulfide levels subside.

Air purifying respirators equipped with organic vapor/acid gas cartridges are very effective in removing hydrogen sulfide but are not approved for such use due to the potential for the sudden buildup of IDLH concentrations. The use of cartridge type air purifying respirators in an atmosphere containing hydrogen sulfide at concentrations in excess of the 8-hour TLV or STEL is permitted only for escape. Entry into any atmosphere containing greater than 10 ppm hydrogen sulfide (15 ppm STEL) requires use of a pressure demand supplied air respirator with escape provisions, which is not covered by this HASP.

7.0 EMERGENCY RESPONSE

7.1 REPORTING/NOTIFICATION PROCEDURES

In the case of any emergency, the Site Safety Officer is to be notified immediately. If the situation is life threatening and notification of the Site Safety Officer would delay emergency response, field personnel may initiate the appropriate emergency contacts prior to notifying the Site Safety Officer. The Site Safety Officer will then initiate contacts as follows:

1. Call appropriate emergency services numbers (ambulance, fire, etc.) if not already done. Provide the following information:
   - Name and location of person reporting
   - Location of accident/incident
   - Name and affiliation of injured party
   - Description of injuries
   - Status of medical aid effort
   - Details of any chemicals involved
   - Summary of the accident, including the suspected cause and the time it occurred
   - Temporary control measures taken to minimize further risk.

   Note: This information is not to be released under any circumstances to parties other than those listed in Table 3 and bona fide emergency response team members.

2. Call appropriate site coordinator (Table 3) and provide information noted in 1 above.
3. Call appropriate Project Manager (Table 3) and provide information noted in 1 above.
4. The appropriate Site Safety Officer will complete a written accident/incident report using Form 3, within 24 hours, sending copies to each of the project managers.

Resources to be used in cases of emergency include:

- **List of Emergency Contacts**: Table 3 includes both the appropriate emergency services (top of table) and the appropriate project contacts (bottom of table).
- **Nearest Phone**: As of the date of this plan, telephones are located at the East Bay Marina, Port offices, and on the dock on the west side (Figure 2). Landau Associates will also have a cellular phone in their possession or in their vehicle at any time they are onsite.
- **Onsite Emergency Equipment**: An Industrial First Aid Kit, a 20-lb type ABC portable fire extinguisher, and an eyewash kit will accompany each field vehicle.
- **Offsite Emergency Services**: Phone numbers for offsite emergency services are listed in Table 3. Copies of this table must be located in each vehicle.

After the required emergency contacts are made, the Port and the appropriate Project Manager should be promptly notified by the Site Safety Officer.

- Hospital Route: St. Peters Hospital is located near the site and should be utilized whenever care beyond standard first aid is required. Figure 6 shows the route to the hospital. Onsite field personnel should become familiar with this route prior to field activities. Driving time from the site to St. Peters Hospital is estimated to be about 5 to 15 minutes, depending on traffic conditions.

7.2 NON-LIFE THREATENING EMERGENCIES

7.2.1 INJURIES

In emergency situations which are not life-threatening (e.g., a broken leg), normal decontamination procedures should be followed when possible. However, decontamination procedures may be modified according to the specific circumstances. Outer protective clothing should be removed if doing so would not cause delays or aggravate the injury. Respirators should only be removed: 1) if the victim has stopped breathing, or 2) after the victim has been removed from a breathing hazard area.

Bodily injuries which occur as a result of an accident during operations at the site will be handled in the following manner:

- The victim will be administered to by an individual who holds current first-aid and/or CPR certification, as necessary
- The local first-aid squad/rescue unit and the local hospital (St. Peters Hospital, Olympia) will be notified as appropriate, depending on the nature of the emergency.

7.2.2 HEAT-RELATED ILLNESSES

It is anticipated that site activities will take place during summer and autumn months, when temperatures average 55-60^{o}F. Heat-related illnesses can occur at any time when protective clothing is worn, especially during warm weather. Workers wearing semi-permeable or impermeable encapsulating clothing should be monitored for heat stress through regular checks of heart rate and by more comprehensive monitoring when the temperature in the work area is above 55-60^{o}F. A pulse rate in excess of 150 beats per minute may indicate heat exhaustion, although this rate will vary among workers. All personnel should know what their baseline pulse rate is before working in elevated temperatures, so as to monitor themselves. The Site Safety Officer will be trained in monitoring, treating, and recognizing the signs of heat stress. Unless the victim is obviously contaminated, decontamination should be minimized and treatment begun immediately.

7.2.3 COLD STRESS

Field work will likely be conducted during summer and autumn months; however, site personnel may be subject to low temperatures, rain, and winds. In these conditions, field teams must be prepared to wear proper protective clothing and to recognize symptoms of cold stress.

Cold stress can be manifested as both hypothermia and frostbite:

- Hypothermia is a cold-induced decrease in the core body temperature that can increase the safety hazards associated with investigation activities that require maximum attentiveness and manual dexterity. Hypothermia produces shivering, numbness, drowsiness, muscular weakness, and, if severe enough, death.
- Frostbite results from the constriction of blood vessels in the extremities, decreasing the supply of warming blood to these areas. This drop in blood supply may result in the formation of ice crystals in the tissues, causing tissue damage. The symptoms of frostbite are white or grayish skin, blisters, or numbness.

Site personnel should review the information provided in their first aid training for response to cold stress problems.

7.2.4 FLU-LIKE SYMPTOMS

Any site personnel experiencing flu-like symptoms should notify the Site Safety Officer. Such symptoms may be sufficient cause for ceasing operations until the work area is evaluated and a "return to operations" order given by the Site Safety Officer.

7.3 FIRE

Fire extinguishers (ABC-type) will be kept in each vehicle and drilling rig. This equipment will be used only to respond to small fires. In the event of major fires, explosions, or fire/explosion hazard conditions, all personnel will immediately evacuate the area. The Site Safety Officer will evaluate the need for further evacuation and/or emergency services.

7.4 SITE EVALUATION AND EVACUATION

The Site Safety Officers will be responsible for determining if circumstances exist which require further evaluation and/or evacuation. The Site Safety Officers should always assume worst case conditions until proven otherwise. Specific evacuation procedures and warning signs and signals will be covered in the health and safety training session prior to beginning work.

Two levels of evacuation may be considered:

- Withdrawal from the immediate work area onsite

- Evacuation of the surrounding area.

7.4.1 WITHDRAW FROM WORK AREA

Withdrawal to a safe upwind location will be required under the following circumstances:

- Detection of volatile organics and/or toxic gases at concentrations above action levels for the level of protection being worn (Section 6.0)
- Occurrence of a minor accident -- field operations will resume after first-aid and decontamination procedures have been administered
- Malfunction or failure of protective equipment, clothing, or respirator.

An air horn will be stationed at each work area and at the gate decontamination area, and will be used to signal site personnel in the following manner:

Blasts	Meaning
1 long (L)	Evacuate the Exclusion Zone(s)
2 short (S)	Localized problem (not dangerous to site personnel). All site personnel move to Contamination Reduction Zone for further instructions
L/S/L/S	Need help at work location
2 long	All clear: resume work

The following hand signals will be used by site personnel to communicate within the work zone if respiratory protection is being used:

- Thumbs up - Okay
- Thumbs down - Not okay
- Hands on wrist - Exit Exclusion Zone
- Hands on throat - Cannot breathe.

7.4.2 EVACUATION OF SURROUNDING AREA

There are no foreseeable conditions, based on current knowledge of the site, that would require evacuation of the surrounding area. The Cascade Pole Site Manager, in consultation with the Site Safety Officer and, as appropriate, the Project Manager, will be responsible for determining if circumstances exist for area-wide evacuation, and should always assume reasonable worst case conditions until proven otherwise. Fire and police departments must be contacted in such cases. If evacuation is necessary, it will be implemented with the assistance of the appropriate emergency response personnel (Table 3).

Procedures for reporting accidents/incidents are provided in Section 7.1. They will be performed in the order indicated.

8.0 TRAINING

All personnel performing onsite investigation tasks will have completed formal health and safety training, which complies with 29 CFR 1910.120 and WAC 296-62-3040 (certificates of successful completion of training will be maintained in job files), and will verify on-the-job training for those tasks they are assigned to perform. At least one member of each field team will be trained in CPR and first aid. All operations will be reviewed and all unfamiliar operations will be rehearsed prior to performing the actual procedure.

9.0 ROUTINE HEALTH CARE AND MONITORING

All persons working in an Exclusion Zone must have a medical evaluation to determine their baseline medical status prior to any site work. Follow-up examinations are appropriate if exposures are known or suspected to have occurred. Documentation of medical evaluations for all site workers will be maintained by the Site Safety Officer.

10.0 BIBLIOGRAPHY

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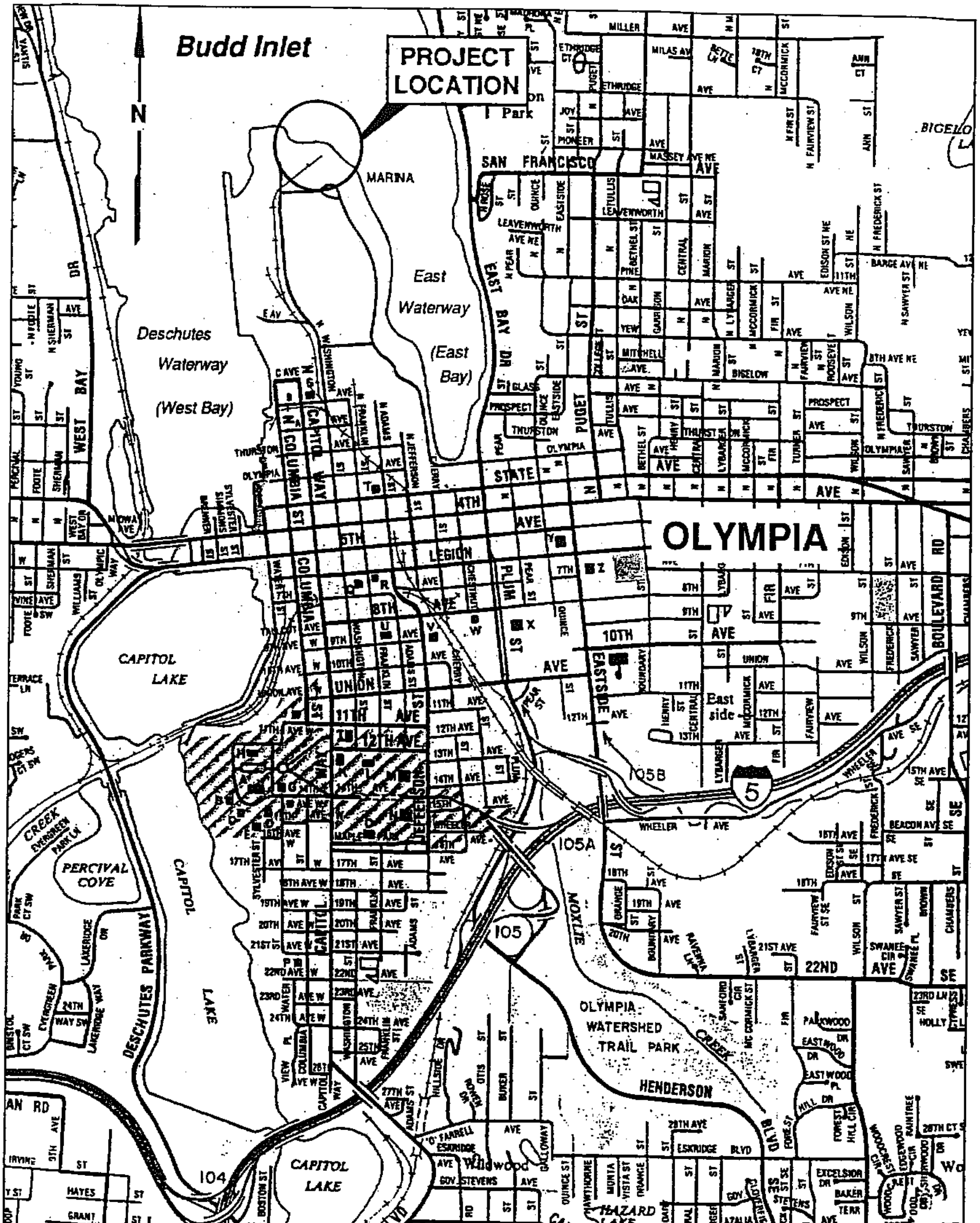


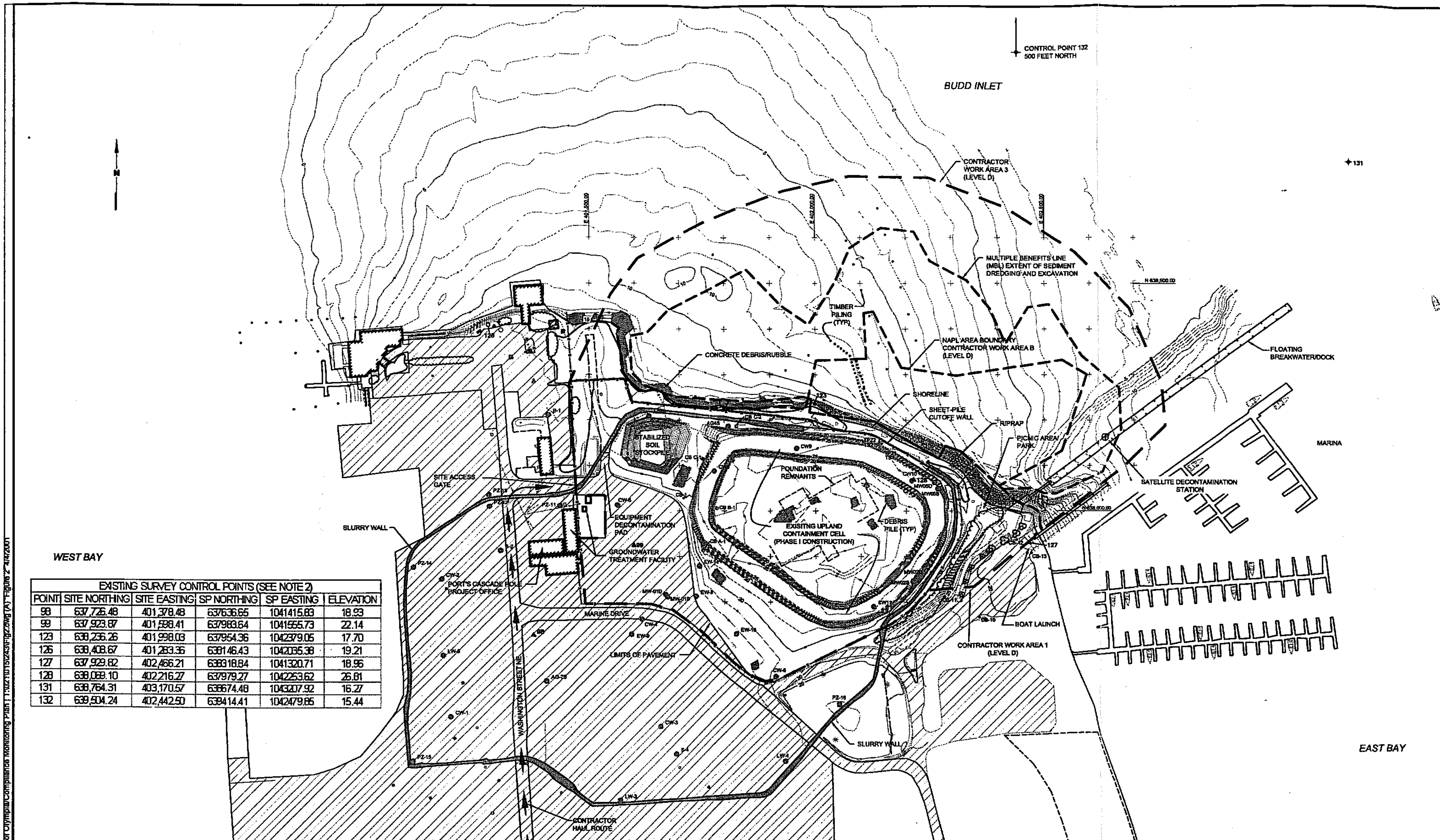
Landau Associates

Cascade Pole Site
Port of Olympia, Washington

Vicinity Map

Figure
1

Port of Olympia/CPC Site/SWPP | T:\021015\200\Figures\SWPP\Fig1.dwg (A) "Figure 1" 4/4/2001



EXISTING SURVEY CONTROL POINTS (SEE NOTE 2)					
POINT	SITE NORTHING	SITE EASTING	SP NORTHING	SP EASTING	ELEVATION
98	637,726.48	401,378.48	637636.65	1041415.83	18.93
99	637,923.87	401,598.41	637983.64	1041555.73	22.14
123	638,236.26	401,998.03	637954.36	1042379.05	17.70
126	638,408.67	401,283.36	638146.43	1042035.38	19.21
127	637,929.82	402,466.21	638318.84	1041320.71	18.96
128	638,069.10	402,216.27	637979.27	1042253.62	26.81
131	638,764.31	403,170.57	638674.48	1043207.92	16.27
132	639,504.24	402,442.50	639414.41	1042479.85	15.44

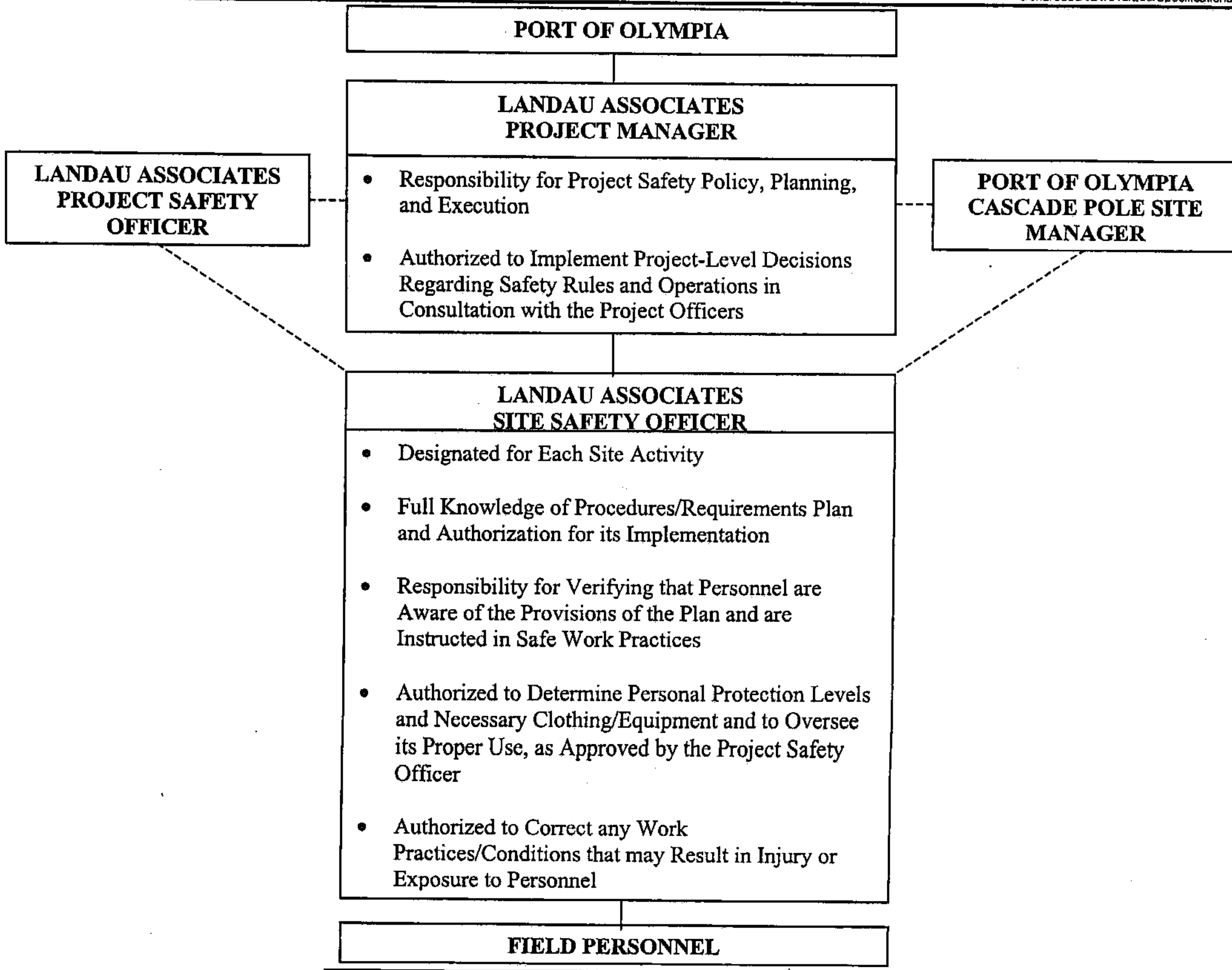
0 200 4000
Scale in Feet

Landau Associates

Cascade Pole Site
Port of Olympia, Washington

Site Plan

Figure 2



Landau Associates

Port Of Olympia
Olympia, Washington

Responsible Individuals

Figure 3

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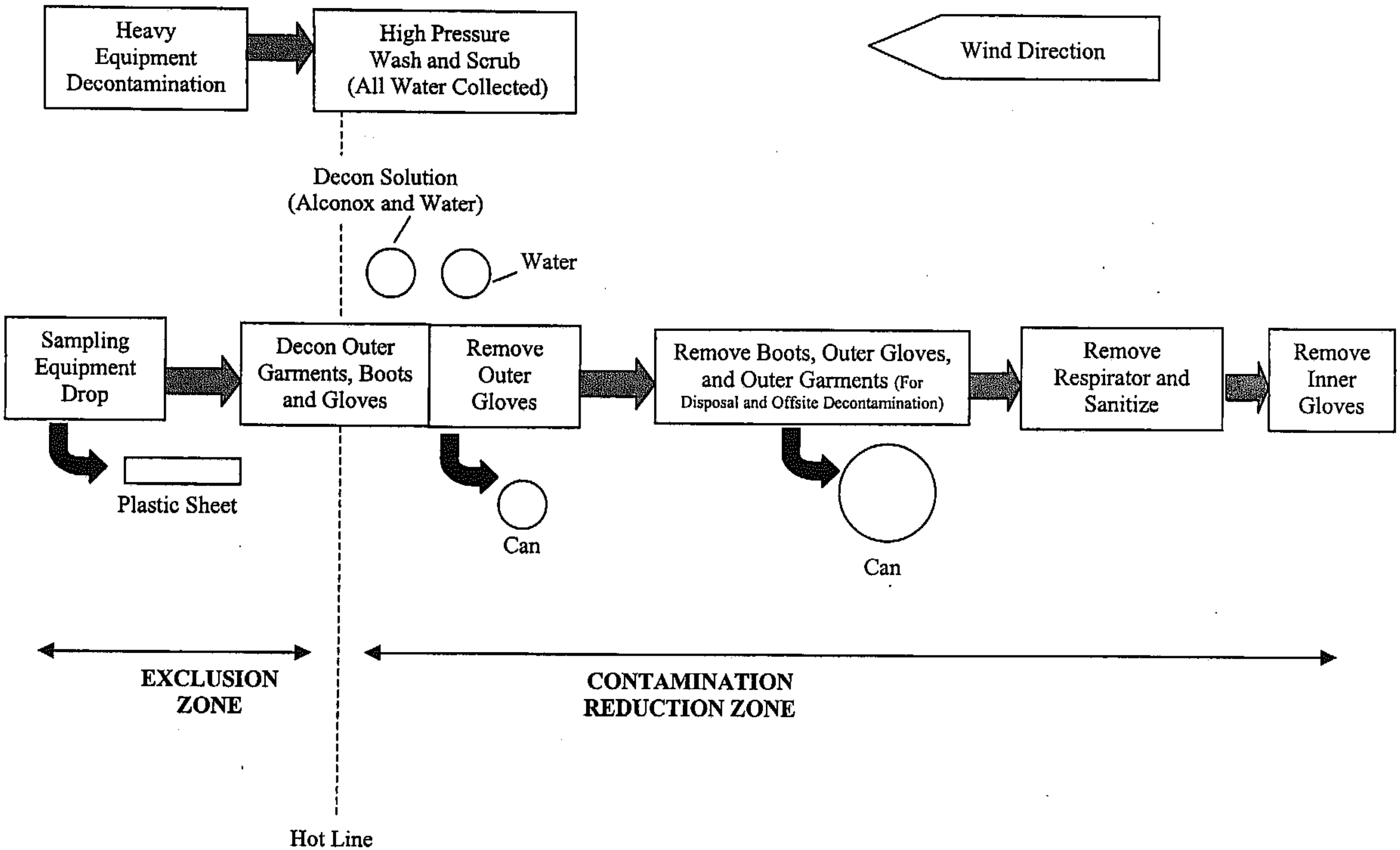
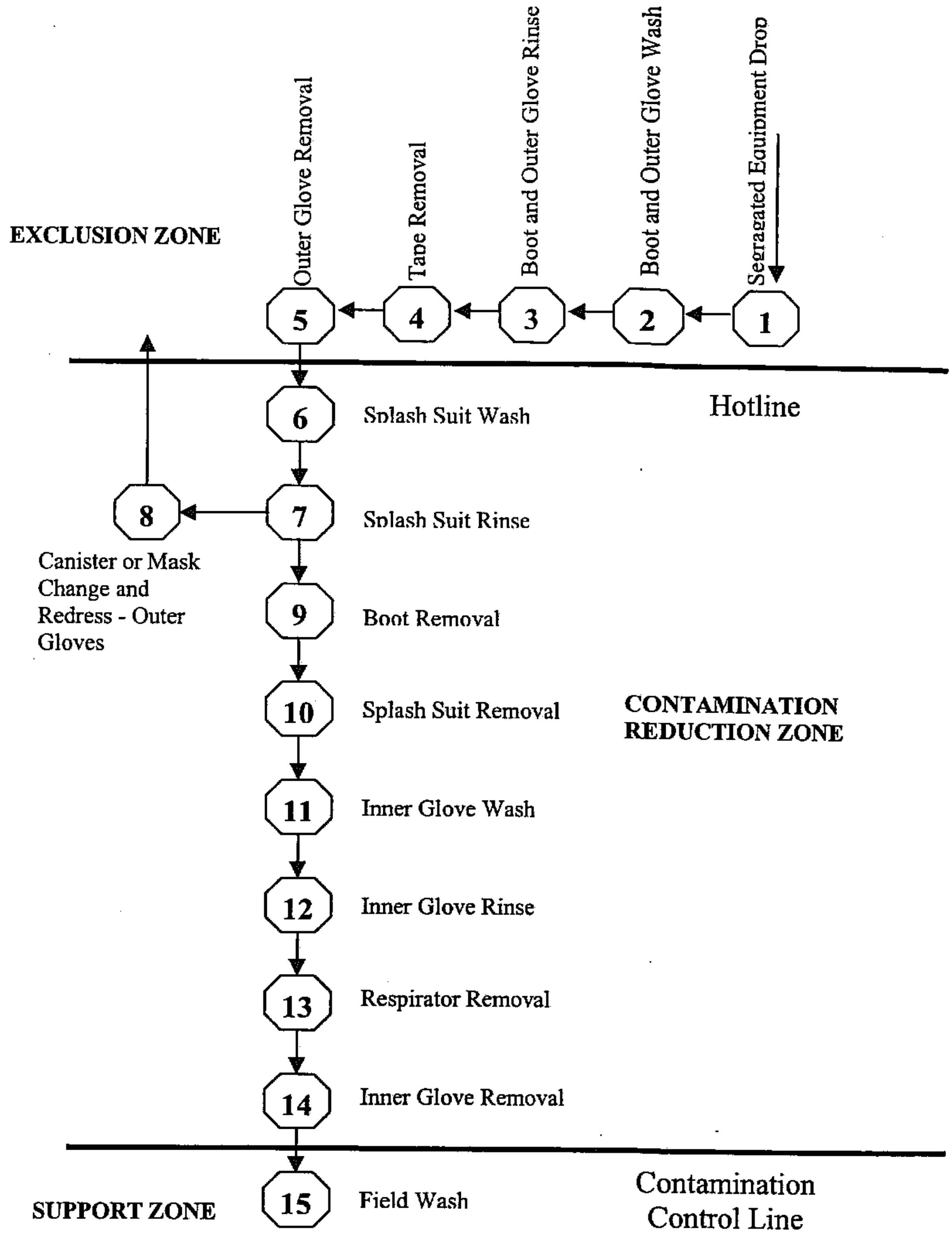


Landau Associates

Port of Olympia Olympia, Washington	**Schematic of Transition from Exclusion Zone to Contamination Reduction Zone**	Figure 4



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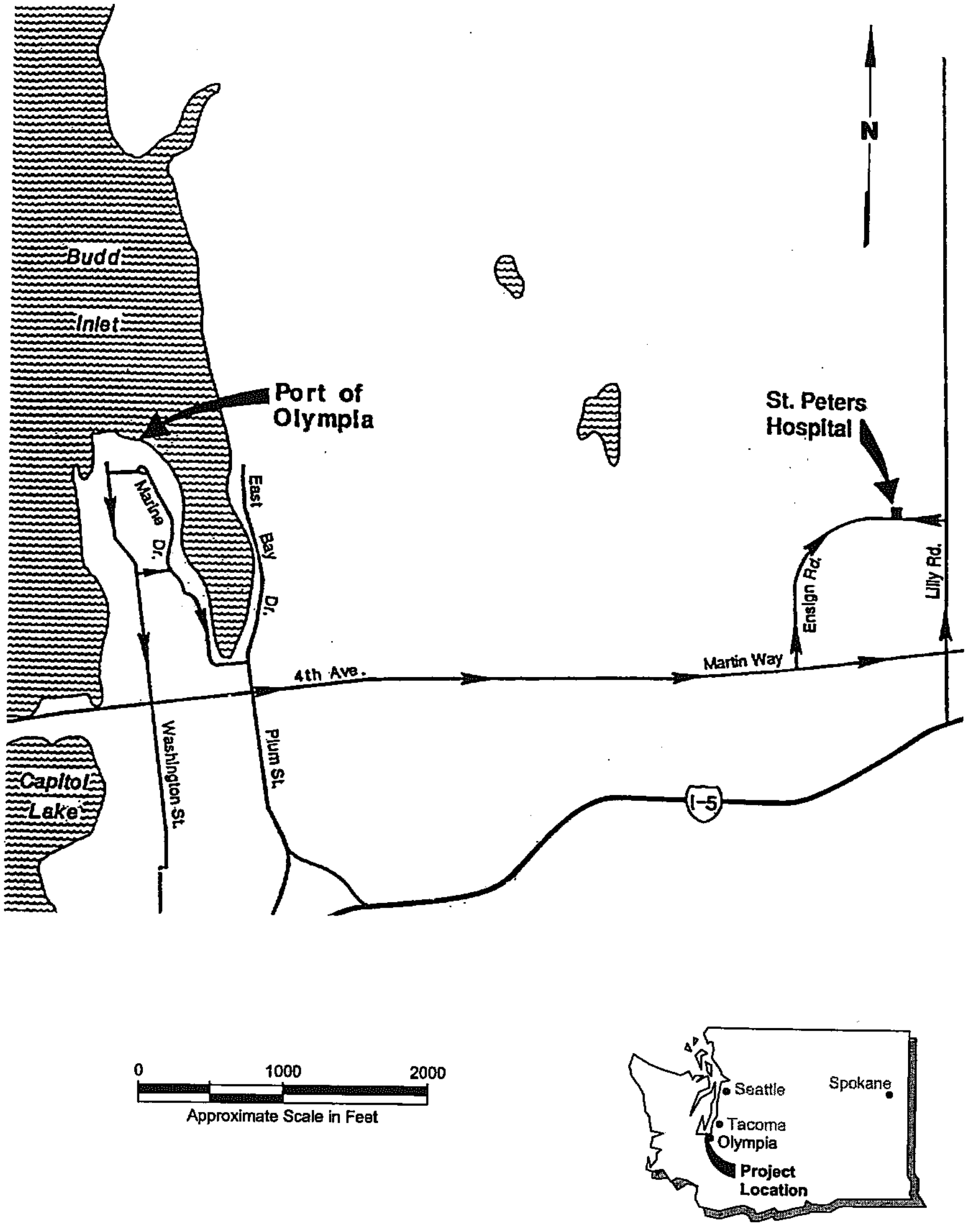
Landau Associates

Port of Olympia
Olympia, Washington

Figure
5



Source:

Landau Associates	Cascade Pole Site Port of Olympia, Washington	Route to Hospital	Figure 6

TABLE 1
SITE EXPOSURE ASSESSMENT
CASCADE POLE SITE, OLYMPIA, WASHINGTON[a]

Chemical Constituent	NAPL Area Sediment (ug/kg)	NAPL Area Surface Water (ug/L)	Outside NAPL Area Sediment (ug/kg)	Outside NAPL Area Surface Water (ug/L)	TLV[b]/PEL[c] (ppmv)	TLV[b]/PEL[c] (mg/m^3)	IDLH[d] (ppmv)	Exposure Routes[e]	Symptoms of Exposure[f]
PAH									
Acenaphthene	150,000	6.3	2,600	ND				Ing, Abs, Con	Eye, Skin, and Upper Respiratory Irritation
Acenaphthylene	14,000	ND [g]	550	ND				Ing, Abs, Con	NA
Anthracene	240,000	0.96	3,000	ND		0.2/0.2[i]		Ing, Abs, Con	Eye Irritation
Fluorene	120,000	3.8	2,100	ND				Ing, Abs, Con	NA
Naphthalene	190,000	0.73	4,700	ND	10/10	52/50	250	Ing, Inh, Abs, Con	Nausea, Headache, Convulsions, Eye and Skin Irritation
Phenanthrene	230,000	7.9	7,200	ND		0.2/0.2[i]		Ing, Abs, Con	Skin Photosensitization
2-Methylnaphthalene	150,000	NA [h]	1,500	NA				Ing, Abs, Con	NA
Benzo(a)anthracene	110,000	0.89	2,400	ND				Ing, Abs, Con	NA
Benzo(a)pyrene	36,000	0.42	1,600	ND		0.2/0.2[i]		Ing, Abs, Con	NA
Benzo(b)fluoranthene	54,000	0.49	3,400	ND				Ing, Abs, Con	NA
Benzo(g,h,i)perylene	13,000	0.28	690	ND				Ing, Abs, Con	NA
Benzo(k)fluoranthene	14,000	0.31	2,900	ND				Ing, Abs, Con	NA
Chrysene	77,000	0.96	2,600	ND		0.2/0.2[i]		Ing, Abs, Con	NA
Dibenz(a,h)anthracene	990	ND	270	ND				Ing, Abs, Con	NA
Fluoranthene	350,000	8.3	9,600	ND				Ing, Abs, Con	NA
Indeno(1,2,3-cd)pyrene	13,000	0.21	740	ND				Ing, Abs, Con	NA
Pyrene	140,000	6.3	6,500	ND		0.2/0.2[i]		Ing, Abs, Con	Skin Irritation
Chlorinated Phenols									
2-Chlorophenol	2,300	ND	ND	ND				Ing, Inh, Abs, Con	Eye, Skin, and Upper Respiratory Irritation
2,4-Dichlorophenol	420	ND	630	ND				Ing, Inh, Abs, Con	Eye, Skin, and Upper Respiratory Irritation
2,4,5-Trichlorophenol	19	ND	17	ND				Ing, Inh, Abs, Con	Eye, Nose, Throat Irritation; Weakness, Nausea
2,4,6-Trichlorophenol	ND	ND	16	ND				Ing, Inh, Abs, Con	Eye, Nose, Throat Irritation; Weakness, Nausea
Tetrachlorophenol	150	ND	31	ND				Ing, Inh, Abs, Con	Eye, Nose, Throat Irritation; Weakness, Nausea
Pentachlorophenol	220	ND	240	ND		0.5/0.5	2.5 (mg/m^3)	Ing, Inh, Abs, Con	Eye, Nose, Throat Irritation; Weakness, Nausea
Total Dioxins/Furans (TEQ)	1.29	2.6E-04	0.384	2.2E-05				Ing, Abs, Con	Eye Irritation, Allergic Dermatitis

Notes:

(a) Source for data: Remedial Investigation Report (Landau Associates 1993).
(b) TLV = Threshold Limit Value, as defined by the American Conference of Governmental Industrial Hygienists (1996).
(c) PEL = Permissable Exposure Limit, as defined by the Occupational Safety and Health Administration (1997).
(d) IDLH = Immediately Dangerous to Life and Health concentration, as defined by the National Institute for Occupational Safety and Health (1997).
(e) Exposure Route Codes:
  Inh = Inhalation
  Ing = Ingestion
  Con = Skin and/or eye contact
  Abs = Skin absorption.
(f) Sources: Sax and Lewis (1989); Lenga (1985)
(g) ND = Not detected.
(h) NA = Not available.
(i) TLV and PEL for coal tar pitch volatiles (benzene soluble fraction) includes anthracene, benzo(a)pyrene, phenanthrene, acridine, chrysene, and pyrene.

TABLE 2

ACTION LEVELS FOR PERSONAL PROTECTION

AT THE CPC/PORT OF OLYMPIA SITE

Monitoring Parameter	Reading[a]	Level of Protection
Particulate[b]	0-26.7 mg/m^3 over background[c]	Level D (modified)
	26.7-267 mg/m^3 over background	Level C - Half-face air purifying respirator equipped with organic vapor and HEPA cartridges; full-face respirators with organic vapor and HEPA cartridges are required if contaminated liquid splashes or sprays are likely to be encountered
Organic Vapors[d]	0-3 ppm over background (5 minutes)	Level D (modified)
	3-10 ppm over background	Level C - Half-face air purifying respirator equipped with organic vapor and HEPA cartridges; full-face respirators with organic vapor and HEPA cartridges are required if contaminated liquid splashes or sprays are likely to be encountered
	>50 ppm over background	Leave the work area
	>100 ppm over background (instantaneous)	Leave the work area
Combustible Gases[e]	10 percent LEL[f]	Proceed with caution
	20 percent LEL[f]	Evacuate drilling area and allow drilled hole to vent
Hydrogen Sulfide[e]	0-3 ppm	Level D (modified)
	3-25 ppm	Proceed with caution
	25 ppm (or 10 ppm for more than 15 minutes)	Leave the work area

(a) Readings are sustained readings over at least a one minute duration unless otherwise noted.

(b) Hand-held aerosol monitor.

(c) Background readings obtained 50 feet upwind of site activity.

(d) Determine using a photoionization or other appropriate organic vapor detector.

(e) Combustible gas meter.

(f) LEL = Lower Explosion Limit. This reading is specific to a specific monitoring position (refer to Section 6.3 for details).

TABLE 3

EMERGENCY SERVICES

Service	Name/Location	Phone No.
Ambulance	---/---	911
Fire	Fire alarms throughout Port or 911 (Figure 1)	911
Police	---/---	911
Hospital	St. Peters Hospital Lilly Road Olympia, Washington	456-7289

CONTACT INFORMATION

Port of Olympia		
Don Bache Cascade Pole Site Manager	360-528-8062*	Olympia, WA
Landau Associates		
Larry Beard Project Manager	425-778-0907*	Edmonds, WA
~~Julie Wilson~~ ~~Health and Safety~~	~~503-443-6010~~	~~Lake Oswego, OR~~
Chris Kimmel Health and Safety	425-778-0907	Edmonds, WA

* Numbers listed are office telephones; home numbers will also be provided in each field vehicle.

APPENDIX A

Sample Forms

FORM 1

CERTIFICATION

All field members are required to read and familiarize themselves with the contents of this Health & Safety Plan and acknowledge their agreement to comply with the provisions of the plan through the entry of a signature and date on the section below.

By my signature, I certify that:

- I have read,
- I understand, and
- I will comply with this site health and safety plan for upland and offshore work associated with the sediments remedial action at the former Cascade Pole site.

Printed Name	Signature	Date	Affiliation
Victoria R. England	[signature]	8/26/02	Landau Assoc.

Personnel health and safety briefing conducted by:

Name ____________ Signature ____________ Date ____________

Plan prepared by/reviewed by:

Name ______/______ Signature ______/______ Date ______/______

FORM 2

MODIFICATION TO HEALTH AND SAFETY PLAN

PORT OF OLYMPIA/CPC SITE

DATE ___/___/___

Modification: ____

Reasons for Modification: ____________________________________

Site Personnel Briefed: ____________________________________

Name: ________________________ Date: ________________________

Name: ________________________ Date: ________________________

Name: ________________________ Date: ________________________

Name: ________________________ Date: ________________________

Name: ________________________ Date: ________________________

Name: ________________________ Date: ________________________

Name: ________________________ Date: ________________________

Name: ________________________ Date: ________________________

<u>APPROVALS</u>

Site Safety Officer: ____________________________________

Manager: ____

Others: ____

FORM 3

EMPLOYEE EXPOSURE/INJURY INCIDENT REPORT

(Use additional page if necessary)

Date: ______________________ Time: ______________________

Name: ______________________ Employer: ______________________

Site Name and Location: ______________________

Site Weather (clear, rain, snow, etc.): ______________________

Nature of Illness/Injury: ______________________

Symptoms: ______________________

Action Taken: Rest ________ First Aid ________ Medical ________

Transported by: ______________________ Witnessed by: ______________________

Hospital's Name: ______________________

Treatment: ______________________

Comments: ______________________

What was the person doing at the time of the accident/incident? ______________________

Personal Protective Equipment Worn: ______________________

Cause of Accident/Incident: ______________________

What immediate action was taken to prevent recurrence? ______________________

Additional comments: ______________________

____

____

Employee's Signature: ______________________

Date ______________________

Supervisor's Signature: ______________________

Date ______________________

Site Safety Representative's Signature: ______________________

Date ______________________

Landau Associates
Environmental and Geotechnical Services

Air Monitoring Log

Project Name ______________________ Project No. ______________________

Location ______________________ Date ______________________

______________________ Landau Rep. ______________________

Client ______________________ Weather ______________________

Meter Number 1, Type __________ Calibrated __________ Checked __________

Meter Number 2, Type __________ Calibrated __________ Checked __________

Meter Number 3, Type __________ Calibrated __________ Checked __________

Meter Number 4, Type __________ Calibrated __________ Checked __________

Meter	Time	Background Reading	Drillers Breathing Zone	Samplers Breathing Zone	Other Reading	Comments

APPENDIX B

Particulate Action Level Calculation

PARTICULATE ACTION LEVEL CALCULATION

When more than one compound is detected in air, the TLV for the single compound does not provide adequate protection to the worker. Therefore, a "mixture equivalent number" must be considered. If the chemicals have the same effect on the body, then the concentrations may be added using the following formula:

$$\frac{Con_1}{TLV_1} + \frac{Con_2}{TLV_2} + \ldots + \frac{Con_n}{TLV_n} \leq 1$$

If the total is less than one, or unity, then the exposure is assumed to be below an acceptable limit.

The concentrations (mg/Kg) are converted to a decimal fraction expression (Con/1,000,000). A proportional description of the amount of each contaminant that would be found in a given unit of total soil/sediment may be expressed as $\frac{Con}{1,000,000} \times (\text{total soil/sediment mass})$. If the "total soil/sediment mass" becomes suspended as particulate (Con_{TSP}), the proportion of contaminants remains constant and may be expressed as $\frac{Con}{1,000,000} \times (Con_{TSP})$. (Note: Contaminants generally occur in higher concentrations in the "fines" fraction of soil, which is the most suspendable fraction. Thus, soil/sediment concentrations were increased by a factor of 10 to compensate.)

This proportional expression of contaminant concentration in total suspended particulate (TSP) may be substituted in the mixture equivalent number of equations as follows:

$$\frac{\frac{Con_1}{1,000,000}(Con_{TSP})}{TLV_1} + \ldots + \frac{\frac{Con_n}{1,000,000}(Con_{TSP})}{TLV_n} \leq 1$$

Solving the equation for Con_{TSP} gives:

$$Con_{TSP} \leq \frac{1}{\frac{\frac{Con_1}{1,000,000}}{TLV_1} + \ldots + \frac{\frac{Con_n}{1,000,000}}{TLV_n}}$$

Using the maximum contaminant values previously identified, the maximum critical airborne TSP concentration (Con_{TSP}) is calculated to be 276 mg/m^3. The constituents contributing to this value are those with TLV values on Table 1 (main text). These constituents include napthalene, pentachlorophenol, and polycyclic aromatic hydrocarbons (phenanthrene, anthracene, pyrene, chrysene, and benzo(a)pyrene as coal tar pitch volatiles).

This Con_{TSP} value is high, and would not be expected to be approached during field activities. To account for potential toxicity of the many constituents detected onsite for which TLV values are not available, an additional safety factor of 10 will be used in setting the site action level. Therefore, an action limit of 27.6 mg/m^3 will be established for this site, which will keep the TLV level expected to be well below specified limits for all identified contaminants and their mixture. This value is considered conservative because:

1. It assumes that all contaminants are present in the airborne particulate proportional to the maximum sediment concentrations detected at the site during the sediments RI
2. It assumes an equivalent and additive intake and effect on the body for all contaminants