WORK PLAN
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
FORMER SHELL OIL TANK FARM

SEPTEMBER 1, 2009

FOR
WASHINGTON STATE DEPARTMENT OF ECOLOGY ON BEHALF OF PORT OF ANACORTES

GeoEngineers

Work Plan
Remedial Investigation/Feasibility Study
Former Shell Oil Tank Farm
File No. 5147-012-01

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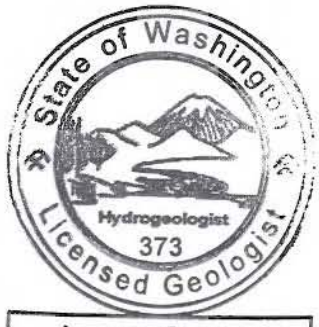

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1.0 INTRODUCTION

This document presents a Work Plan for the Remedial Investigation/Feasibility Study (RI/FS) at the former Shell Oil Tank Farm located between 13th Street and 14th Street on Q Avenue in Anacortes, Washington (Figure 1). The Port of Anacortes (Port) is performing the RI/FS in accordance with Agreed Order DE-08TCPHQ-5474. In addition to the former tank farm and associated structures located on the property between 13th and 14th Streets, subsurface fuel supply lines for both gasoline and diesel ran northeast from the former Tank Farm towards Fidalgo Bay (Figure 2). For the purposes of this Work Plan, the former Tank Farm and associated historic fuel supply lines are collectively referred to as the Site. The Site is listed on the Washington State Department of Ecology (Ecology) Site Database as Facility Site ID 4781157.

The Port has owned the Tank Farm portion of the Site (Tank Farm) since 1929 and leased it to the Shell Oil Company (Shell) and various petroleum product distributors from approximately 1930 to 1986. The Tank Farm and associated structures were removed from the Site when Shell vacated the property. Previous environmental investigations conducted at the Site have detected petroleum hydrocarbons, lead and cadmium in subsurface soils and groundwater at concentrations that exceed Model Toxics Control Act (MTCA) Method A cleanup levels. The Site is one of several sites located near Fidalgo Bay that are being investigated and cleaned up under Ecology's Puget Sound Initiative.

As part of the Scope of Work defined in the Agreed Order, the Port is required to prepare and submit a RI/FS Work Plan for the Site. The activities described in this Work Plan will be completed to characterize the nature and extent of contamination at the Site and to provide sufficient information to select a cleanup action. This Work Plan provides details for implementation of the RI/FS including evaluation of existing Site soil and groundwater data, identification of potential data gaps for completion of the RI/FS, description of the proposed field investigation, data analysis program, anticipated schedule, and reporting.

This Work Plan was prepared in general accordance with the requirements defined by the MTCA Regulation (WAC 173-340-350) for submittal to Ecology. Appendices to this Work Plan include historical site layout drawings and aerial photographs (Appendix A); Sampling and Analysis Plan (Appendix B); Quality Assurance Project Plan (Appendix C); Health and Safety Plan (Appendix D); and the Public Participation Plan prepared by Ecology for the Site (Appendix E).

2.0 BACKGROUND INFORMATION

This section presents background information on the Site, including soil and groundwater conditions; historical, current, and future Site uses; previous environmental investigations; data gaps; and identifies contaminants of potential concern (COPCs).

2.1 PROPERTY DESCRIPTION

The former Tank Farm is located between 13th and 14th Streets on Q Avenue in Anacortes, Washington (Figure 1). The former Tank Farm property is generally flat, surfaced with crushed rock, and has been

used as a parking lot for vehicles and boat trailers since the late 1980s. The historic fuel supply lines leave the former Tank Farm along the east side of the Site, ran north along Q Avenue for about half of a block, and turned east towards Fidalgo Bay. The terminus of the fuel supply lines was a historical pier in the vicinity of "B"–Dock. The trace of the historic fuel supply lines is located beneath currently asphalt-paved roadways. All aboveground structures associated with historical facility operations have been removed; underground structures at the former Tank Farm have reportedly been removed. It is not known whether the historic fuel supply lines remain beneath the ground surface.

Adjacent properties include a McDonald's restaurant to the west that was constructed in the 1970s. The McDonald's property was the site of a Shell automotive service station from the mid-1940s to 1966. The property south of the Tank Farm (across 14th Street) was a transformer storage facility for Puget Sound Power and Light from the 1940s until 1970, when the current power station was constructed. A Safeway grocery store is located north of the Site, across 13th Street. Parking lots and commercial buildings on Port property and the Cap Sante Boat Haven are located east-northeast of the Site across Q Street (Figure 2).

2.1.1 Soil Conditions

The former Tank Farm Site is surfaced with gravel-size crushed rock. Soil beneath the crushed rock surface consists of dredged fill material composed mainly of loose to medium dense silty sand with scattered shell fragments. The dredged fill material in some locations is interbedded with layers of gravel, silt and clay of variable thicknesses to approximately seven feet below the ground surface (bgs). The fill is underlain by approximately nine feet of native, loose to medium dense silty gravelly sand with scattered interbeds of soft silt (Hart Crowser, 1987; GeoEngineers, 2008a). The native sand is underlain by a hard silt which was encountered at a depth of 16 feet bgs at MW-1 (Figure 4).

The subsurface soil conditions along the historic fuel supply lines east of Q Avenue are similar and consist of dredged fill material overlying native marine sediment and glacial deposits. The fill generally consists of gravelly sand with varying amounts of silt overlying silty, fine to medium sand. The thickness of the fill material ranges from about 5 to 12 feet. The native soil underlying the dredged fill material consists of sandy silt to at least 30 feet bgs (Landau, 2007; Floyd/Snider, 2005).

2.1.2 Groundwater Conditions

In November 2007, groundwater was encountered in test pits at the west edge of the former Tank Farm Site at approximately 7 feet bgs (GeoEngineers, 2008a). Previous investigations at the Site encountered groundwater at depths ranging from about 5 to 9 feet bgs, with an average depth of approximately 6 feet bgs. Based on the Port's experience at the nearby Cap Sante Marine (CSM) site, groundwater flow at the Site is likely to the east toward Fidalgo Bay. Tide-related groundwater fluctuations at the former Tank Farm area of the Site are expected to be minimal (several tenths of a foot or less) based on the results of a tidal study conducted at the CSM site in 2007 (Landau, 2007) and the distance to the shoreline.

Based on measurements in several existing monitoring wells at the CSM site, depths to groundwater in the vicinity of the historic fuel supply lines in the eastern part of the Site are expected to range from 4 to 6 feet bgs. The 2007 CSM tidal study results indicate that groundwater levels within about 100 feet of the shoreline fluctuate by approximately 0.5 to 1.0 foot during tide cycles. Groundwater flow direction east of Q Avenue is to the east-southeast and is not expected to change significantly between low tide and high tide

2.2 SITE USE HISTORY

The Tank Farm area was originally a portion of the Fidalgo Bay tide flats, which were filled to the current grade (up to the former bulkhead just east of Q Avenue shown in Figure 2) between 1925 and 1929. The property was acquired by the Port in 1929 and leased to Shell Oil Company in 1930 for use as a bulk fuel storage and distribution facility that primarily handled gasoline and diesel-range fuels. The approximate locations of the historical pump house, fill stand, UST, ASTs and associated product supply lines are shown in Figure 3. The Site operated as a bulk fuel storage facility under Shell and various bulk product distributors until 1987. Operations on the property ended in 1987 and the bulk terminal was reportedly decommissioned, including removal of all tanks, associated piping, and site structures.

The Shell site layout drawing from 1930 is included in Appendix A. According to the Shell engineering drawing, the original facility layout included three 25,000 gallon aboveground storage tanks (ASTs) in the south portion of the Site, and one 2,000 gallon underground storage tank (UST) located north of the ASTs (Figure 3). Two of the ASTs stored gasoline and the third contained diesel fuel. The contents of the UST are not well documented. Historic fuel supply lines (Figures 2 and 3) connected the ASTs and pump house to a historical pier/fuel float located east of the Tank Farm across Q Avenue. Historically, gasoline and diesel were pumped from the pier via the fuel supply lines to the bulk fuel facility for storage and distribution. Two 12,500-gallon ASTs and apparently one 4,000-gallon UST were installed in the early 1950s (Hart Crowser, 1987). It is possible that the 4,000-gallon UST was installed as a replacement for the 2,000-gallon UST. The precise locations of the two newer ASTs are unknown; however, a total of four ASTs are visible in the 1966 and 1979 aerial photographs in the same area as the three ASTs shown on the 1930 site layout drawing (Appendix A). Gasoline, diesel and stove oil were reportedly stored in the ASTs. Dry cleaning solvent, and subsequently diesel, were reportedly stored in the 4,000-gallon UST. Dry cleaning solvents and petroleum products were distributed from the Site based on interviews of several distributors who had historically operated at the Site (Hart Crowser, 1987).

Prior to 1947, the area east of Q Avenue (east of the former Tank Farm) consisted of tide flats (GeoEngineers, 2008b). From 1930 to approximately 1947, the historic fuel supply lines were hanging from joists, as shown in Shell's 1930 layout plan. In the late 1940s to early 1950s, the area east of Q Avenue was filled with dredged material from the adjacent federal waterway, and a second bulkhead was constructed farther to the east near the current shore of Fidalgo Bay (Figure 4). It appears that the fuel supply lines east of Q Avenue were re-configured as underground lines during the filling activities in the late 1940s and early 1950s.

2.3 FUTURE SITE USE

The current and anticipated future use of the former Tank Farm portion of the Site is as a vehicle and boat trailer parking lot. The alignment of the historic fuel supply lines east of Q Avenue is an asphalt-paved road that provides access to the CSM Site and Cap Sante Boat Haven. There currently are no plans to change the use or condition of this access road in the future.

2.4 PREVIOUS INVESTIGATIONS

Four previous environmental investigations have been completed at the Site, as described below. Historical field evidence of petroleum contamination on and surrounding the Site is also discussed in the sections below. Soil and groundwater analytical results from these studies are presented in Tables 1 and 2, respectively. Previous soil and groundwater sampling locations, and locations where evidence of petroleum-impacted soil or groundwater has been observed or detected are presented on Figures 4 and 5.

Sampling locations and data for an apparently isolated area of cadmium-impacted soil also are presented in these Tables and Figures.

2.4.1 Preliminary Environmental Site Assessment -1987, Hart Crowser

A Preliminary Environmental Site Assessment was conducted by Hart Crowser in May 1987 (Hart Crowser, 1987). During this investigation, field indications of possible petroleum contamination (surface staining, elevated photoionization detector (PID) measurements, and/or petroleum-like odors) were encountered at three surface locations on the property (Figure 4; Appendix A). In addition, one area of an unidentified white powder was noted at the surface (Figure 4; Appendix A). Investigation activities included the installation of monitoring wells MW-1 and MW-2 (Figure 4; Appendix A), sampling of soils during well installation, and groundwater sampling from the wells. MW-1 was installed near a former warehouse sump, and MW-2 was installed near the UST. Soil and groundwater were analyzed for base/acid/neutral extractable organic compounds, total oil and grease, benzene, toluene, xylenes, and/or total lead.

Port records indicate that following the investigation, an unknown volume of soil was excavated from one or more of the areas with surface staining that were described in the 1987 Hart Crowser report. Based on the Hart Crowser report, it is likely that petroleum-impacted soil was removed from the stained area on the east side of the Site that is shown in Figure 4.

Hart Crowser's historical research identified a former 4,000-gallon UST at the site that was reportedly installed in the early 1950s. Shell's 1930 layout drawing shows a 2,000-gallon capacity UST at the Site in 1930. It is not known where the 4,000-gallon UST was installed, but it is likely that the UST was installed in the same general vicinity as the 2,000-gallon UST. The 4,000-gallon UST was reportedly used to store and dispense dry cleaning solvent until 1960; it was also used to store diesel fuel from 1974-1975. The 4,000-gallon tank had been removed at the time of the report writing (HartCrowser, 1987).

Site operators sold packaged products in small containers from approximately 1965 to 1985. These items consisted of drums, pails, and small containers of various oils, greases, and solvents, and products other than gasoline, diesel, and lube oils (HartCrowser, 1987).

Based on field screening with a PID, soil at MW-1 did not show signs of petroleum-related soil contamination; soil at MW-2 showed diesel-range petroleum contamination from the ground surface to a depth of 10 feet bgs. Diesel-range hydrocarbons were detected at a concentration of 3,300 milligrams per kilogram (mg/kg) in the soil sample from 5.0 to 6.5 feet bgs in MW-2. This concentration exceeded the MTCA Method A cleanup level of 2,000 mg/kg.

Benzene, toluene, and xylenes were detected at concentrations less than MTCA Method A cleanup levels in the groundwater sample from MW-1. Diesel-range hydrocarbons were detected in the groundwater sample from MW-2, but the concentration was not accurately quantified by the testing method that was used. Total lead was detected in the groundwater samples from MW-1 and MW-2 at concentrations exceeding the MTCA Method A cleanup level.

2.4.2 Limited Due Diligence Investigation – 2005, Floyd|Snider

Floyd Snider conducted a Limited Due Diligence Investigation at the Former Shell Tank Farm Site and the CSM Site in 2005. Soil and/or groundwater samples were collected from a total of 14 direct-push borings. Seven of the borings were located on the former Tank Farm (SHL-01 through SHL-07), and five of the borings were located east of Q Street within approximately 60 feet of the historic fuel supply line

alignment (CSM-01 through CSM-03, CSM-12 and CSM-13; Figures 4 and 5). The remaining two sampling locations were not relevant to the subject Site. Soil samples generally were collected at three depth intervals at each location: 0 to 4 feet bgs, 4 to 8 feet bgs, and 8 to12 feet bgs. Selected soil samples were analyzed for benzene, ethylbenzene, toluene and xylenes (BETX), total petroleum hydrocarbons (TPH) using the hydrocarbon identification method, gasoline-, diesel-, and heavy oil-range hydrocarbons. Groundwater samples were analyzed for BETX, gasoline-, diesel- and heavy oil–range hydrocarbons. Acid wash/silica gel cleanup was not used by the laboratory in the analysis of diesel- and heavy oil-range hydrocarbons.

Results of this investigation indicated that gasoline- and diesel-range hydrocarbons were present in soil located in the center and northeast portions of the Tank Farm (SHL-02 and SHL-05) at concentrations greater than MTCA Method A cleanup levels. Soil contamination was encountered in these borings at depths ranging between 4 and 9.5 feet bgs. Diesel-range hydrocarbons were detected in groundwater at concentrations exceeding the cleanup level where the historic fuel supply lines are shown in the 1930 drawing to have exited the tank farm (SHL02) and at the location of the former ASTs (SHL04).

Downgradient of the Tank Farm (about 60 feet east of Q Avenue), petroleum hydrocarbons were detected in two borings at concentrations exceeding Method A soil cleanup levels. Diesel- and oil-range hydrocarbons were detected approximately 10 feet north of the historic fuel supply lines in CSM12 at a depth of 10 to 11 feet bgs. Gasoline- and diesel-range hydrocarbons were detected approximately 70 feet north of the historic supply lines from 10.5 to 11.5 feet bgs in CSM13. The soil contamination was associated with organic-rich soil (silty wood debris). It is possible that the non-petroleum organic material may have contributed to the elevated petroleum detections. Diesel- and heavy oil-range hydrocarbons were detected in a groundwater sample obtained from CSM12.

2.4.3 2007 City of Anacortes Storm Line Replacement

The City of Anacortes (City) re-routed a 12-inch-diameter storm drain line across the western portion of the Tank Farm in November and December 2007. The storm drain line was originally located in 13th Street between Commercial Avenue and Q Avenue and was re-routed to address a non-functioning section of the storm drain that discharged into the Cap Sante Boat Haven. As a result of the utility work, an independent remedial action was completed on the Site that consisted of excavating soil from approximately 280 feet of trench along the west edge of the Site during installation of the new storm drain line (Figure 6).

Prior to trench excavation, four test pits (TP-1 to TP-4) were completed along the west edge of the Site to evaluate the potential presence of petroleum hydrocarbons, VOCs, PAHs, PCBs, and metals in soil along the storm drain re-route alignment. Acid wash/silica gel cleanup was used by the laboratory in the analysis of TPH-Dx. The test pits were completed to depths of approximately 8 feet bgs, the estimated maximum depth of the storm line trench. Soil analytical results were reported by GeoEngineers (2008a) and are included in Table 1.

Soil analytical results were compared to MTCA Method A cleanup levels; the only MTCA exceedance was a single cadmium detection. Cadmium was detected at a concentration of 6.4 mg/kg (MTCA cleanup level is 2 mg/kg) in one soil sample (TP-1-6.0, GeoEngineers, 2008a) collected at the Site. Based on the results of the other test pit sampling results, the cadmium-impacted soil represented by TP-1-6.0 is likely to be limited in extent. Cadmium was not detected in a sample obtained two feet below the location of the cadmium exceedance and in three other samples collected along the storm drain re-route alignment.

GeoEngineers also observed excavations in 13th Street (east-west storm drain alignment) north and west of the Site that were completed in December 2007 and January 2008 for installation of the storm drain line and two manholes. Field evidence of petroleum-contaminated soil was observed in the excavations for Manhole No. 2 and Manhole No. 3 at depths of 6 to 7 feet bgs and 9 to 11 feet bgs, respectively. Field evidence of petroleum-contaminated soil was not observed in the section of storm drain trench that extended from the northwest corner of the Site to Manhole No. 2, which is located in approximately the center of 13th Street. No soil samples were analyzed from the 13th Street utility corridor. Because of the limited nature of the December 2007 field activities, it was not determined whether the observed contamination in the 13th Street utility corridor was related to the Site or was a separate and distinct release.

Apparent petroleum contamination has been observed by the City at two utility locations:

- An oily sheen was reported by the City to frequently be observed in a City storm drain beneath the center of 13th Street, just west of Q Avenue (Figure 5). No analytical testing was performed.
- Soil with petroleum odors and an oily appearance was encountered near the east end of the fuel supply lines (Figure 5) by the City during soil excavation to maintain a storm drain line. The excavation was abandoned due to the degree of contamination observed. No analytical testing was performed.

In addition to the storm drain line observations described above, the Port has frequently observed a petroleum sheen coming from the riprap to the north of the T-Dock at the Fidalgo Bay shoreline (Figure 5).

2.4.4 Cap Sante Marine Investigation – 2007, Landau

Landau completed an RI at the CSM site in 2007. The RI included several borings at locations near the east end of the Former Shell Tank Farm Site in the vicinity of the historic fuel supply line alignment (SB-10, SB-13, and SB-14; Figure 4). The purpose of these soil borings was to delineate the southern extent of the petroleum-impacted soil and groundwater south of the former Cap Sante USTs (note that the CSM USTs are not related to the Shell Tank Farm Site operations). Soil borings SB-10, SB-13 and SB-14 were located near an area where a petroleum sheen and odors were observed during City storm drain maintenance construction activities. Soil samples were analyzed for BETX, gasoline-, diesel- and heavy oil-hydrocarbons, VOCs, PAHs, and lead. Acid/silica gel cleanup was used for the diesel- and heavy oil-range analyses.

At SB-13, the concentration of total cPAHs exceeded the MTCA Method A cleanup level in the samples collected from 0.5 to 1.5 feet bgs and 5 to 6 feet bgs. Gasoline-range hydrocarbons were detected at a concentration exceeding the cleanup level in the 8 to 9 foot bgs sample from boring SB-14. No significant contaminant concentrations were detected in samples from boring SB-10 (Landau, 2007).

2.4.5 Summary of Soil and Groundwater Quality Conditions

Figures 4 and 5 depict historical sampling results for soil and groundwater, as well as historical indications of contamination based on field observations. Contaminants of potential concern identified in soil during previous investigations at the Site at concentrations exceeding preliminary cleanup levels (MTCA Method A) included: gasoline-, diesel- and heavy oil-range petroleum hydrocarbons, cPAHs, and cadmium (Table 1). The cadmium detection is likely an isolated exceedance at the southwest corner of the Tank Farm. The petroleum-related exceedances in soil were found near the former UST(s), fill stand, pumphouse, and near the historic fuel supply lines in the northeast portion of the Site. The petroleum

contamination at the Tank Farm part of the Site was encountered at depths ranging from 4 to 9.5 feet bgs. Surficial oily soil identified in the 1987 Hart Crowser investigation at the Tank Farm was reportedly excavated. The excavated materials are thought to comprise less than 10 cubic yards in volume.

Field screening evidence of petroleum-impacted soil was encountered at depths ranging from 6 to 11 feet bgs in two City manhole excavations located north and west of the Tank Farm in 13th Street. An oily sheen was frequently observed in a City utility line located about 50 feet west of Q Avenue in 13th Street.

Petroleum-related exceedances were found at four locations east of Q Avenue within about 70 feet of the historic fuel supply lines and at depths ranging from 0.5 to 11.5 feet bgs. It is not known whether the exceedances in SB-13 and SB-14 are related to the historic fuel supply lines because a soil sample collected between these borings and the fuel supply lines did not have soil exceedances.

Field screening evidence of petroleum-impacted soil was encountered by the City during an excavation to evaluate a storm drain line east of Q Avenue in 2007. This excavation was approximately 40 feet south of the historic fuel supply lines.

Contaminants of potential concern that were identified in groundwater during historic investigations at the Site at concentrations exceeding preliminary cleanup levels (MTCA Method A) included diesel- and heavy oil-range petroleum hydrocarbons and total lead (Table 2; Figure 5). Diesel- and/or heavy oil-range hydrocarbons were present in groundwater near the former ASTs, adjacent to the historic fuel supply lines in the northeast portion of the Tank Farm, and about 60 feet east of Q Avenue adjacent to the historic fuel supply lines. Total lead was detected in two monitoring wells located in the eastern third of the Tank Farm portion of the Site. The total lead exceedances in the two wells were from 1987 groundwater samples analyzed using an outdated analytical method. The turbidity of the water samples was not described in the investigation report and the results may be biased high due to turbidity (Hart Crowser, 1987).

The two groundwater monitoring wells that were installed at the site in 1987 were not found during the 2005 investigation. There are no currently accessible monitoring wells at the Site based on a review of previously completed studies.

2.5 DATA GAP ASSESSMENT

The purpose of the remedial investigation is to further delineate the nature and extent of hydrocarbon contamination encountered at the Site and to fill in data gaps that are present based on a review of previous investigations described above. Based on evaluation of existing data, the following data gaps have been identified.

The primary data gaps for the Former Shell Tank Farm portion of the Site **are as follows:**

- **Identification of the location/possible presence of the 4,000-gallon UST.**
- **Potential connection to contamination observed in 13th Street:** Evidence of hydrocarbon contamination has been observed in 13th Street (GeoEngineers, 2008a) and it is not known whether this contamination is associated with releases on the Site.
- **Extent of contamination at MW-02, SHL02, and SHL-05:** The extent of soil hydrocarbon contamination identified in soil borings MW-02, SHL02, and SHL05 has not been fully delineated.

- **East edge of Tank Farm:** Soil conditions along the east boundary of the Tank Farm and along the historic fuel supply line exiting the Tank Farm have not been fully evaluated.
- **Previous excavation:** An excavation of oily soil near MW-2 reportedly occurred in 1987; however, no confirmation soil sample results were obtained. The exact area and dimensions of the remedial excavation are not known.
- **Surface observations within the former Tank Farm:** Three areas with surface soil staining and an area with an unknown white powder were observed in 1987. These areas with surface indications of potential contamination have not been sampled.
- **Historical areas of concern within the former Tank Farm**: Soil in areas with a high potential for historic petroleum releases, including the pump house and fill stand areas, have not been fully characterized.
- **Fuel oxygenates:** Previous soil and groundwater samples have not been analyzed for fuel oxygenates [methyl tert-butyl ether (MTBE), ethylene dibromide (EDB), 1,2-dichloroethane (EDC)] in accordance with MTCA. Fuel oxygenates are a potential contaminant of concern based on historical storage and distribution of gasoline at the Site.
- **Dry cleaning solvents:** The Site has not been evaluated for the potential presence of halogenated volatile organic compounds (HVOCs). HVOCs may be present due to historical storage and distribution of dry cleaning solvents at the Site.
- **Cadmium:** The cadmium exceedance in soil at the southwest corner of the Tank Farm (TP-1) has not been fully delineated (GeoEngineers, 2008a).
- **Groundwater at the former Tank Farm:**
    - **Limited suite of analytes:** Groundwater at the former Tank Farm has only been analyzed for petroleum hydrocarbons and BETX. Two samples collected in 1987 were analyzed for total lead, oil and grease, but the analytical methods that were used are outdated. The potential presence of HVOCs and fuel oxygenates in groundwater have not been evaluated.
    - **No functional monitoring wells:** Groundwater is known to have concentrations of diesel-range hydrocarbons and possibly lead that exceed cleanup levels; however, there are no functional monitoring wells on Site. The locations/possible presence of monitoring wells MW-1 and MW-2 have not been identified.
- **Soil conditions along the historic fuel supply lines:** Soil samples were analyzed at only one boring location along the historic fuel supply lines (CSM-12). Soil conditions east of Q Avenue along the historic fuel supply lines have not been fully evaluated.
- **Contamination near east end of historic fuel supply lines:** The extent of soil contamination detected in soil borings SB-13 and SB-14 has not been fully delineated. The nature and extent of subsurface hydrocarbon contamination observed (odor) in the vicinity of the City's 2007 excavation to evaluate a non-functioning storm drain line has not been evaluated.
- **Groundwater near the historic fuel supply lines:**
    - **Limited suite of analytes:** Groundwater conditions east of Q Avenue along the historic supply lines have only been evaluated at one location (CSM12) and the sample was analyzed for BETX and petroleum hydrocarbons only.

- **No monitoring wells:** Concentrations of diesel- and heavy oil-range hydrocarbons exceeded cleanup levels in the groundwater sample from CSM12 east of Q Avenue. No monitoring wells are present in the vicinity of this exceedance.
- **Groundwater conditions near east end of historic fuel supply lines:** No groundwater samples have been collected near the soil exceedances detected in SB-13 and SB-14 and the oily soil observed in the 2007 City excavation.

2.6 SITE CONTAMINANTS OF POTENTIAL CONCERN

Contaminants of potential concern (COPCs) for Site soil and groundwater include contaminants previously detected at levels exceeding MTCA Method A cleanup levels, and contaminants associated with historic storage and distribution of petroleum products and dry cleaning solvents. COPCs for the Site include the following constituents:

- Gasoline-, diesel- and oil-range hydrocarbons;
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) including benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene);
- Naphthalenes (naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene);
- VOCs including BETX and the fuel oxygenates MTBE, EDB, and EDC;
- HVOCs (dry cleaning solvents) including PCE, TCE, 1,1,1-trichloroethane (1,1,1-TCA), trichlorofluoromethane (TCFM), carbon tetrachloride, and breakdown products of PCE/TCE including dichloroethenes (DCE) and vinyl chloride (VC);
- Lead and cadmium; and
- Polychlorinated biphenyls (PCBs).

PCBs are included on the COPC list to satisfy the requirement of MTCA Table 830-1. There is no evidence that PCBs are present at the Site at concentrations exceeding cleanup levels. There is no indication of waste oil historically having been stored at the Site (waste oils can be sources of PCBs and metals).

3.0 REMEDIAL INVESTIGATION

The RI will evaluate new and existing soil and groundwater data from the Site to delineate the nature and extent of contamination. Additional data will be collected, as needed, to complete the characterization of the Site for the purpose of developing and evaluating cleanup action alternatives and selecting a cleanup action. Although cleanup levels will be developed for soil and groundwater as part of the FS (discussed further in Section 4.0), preliminary soil and groundwater cleanup levels are established during the RI to evaluate the nature and extent of contamination and to select analytical methods with reporting limits at or below the cleanup levels to the extent possible. The preliminary cleanup levels developed for this RI/FS have been compared with existing soil and groundwater data to determine where data gaps exist. This section presents preliminary cleanup levels, the rationale for the preliminary cleanup levels, and the activities associated with the soil and groundwater investigations.

The RI field activities will be conducted in two phases to support contaminant delineation at the Site, as follows:

- Phase I: Supplemental soil data will be collected during Phase I of the RI. Soil borings will be advanced at 30 locations at the former Tank Farm, in the adjacent public right-of-ways, and east of Q Avenue in the vicinity of the historic fuel supply lines (Figure 6). The borings will be completed using a direct-push drilling rig to characterize soil conditions and obtain soil samples for field screening and chemical analyses. The soil field screening and chemical analytical results will be used to further delineate the extent of subsurface soil contamination at the former Tank Farm and in the vicinity of the historic fuel lines. Additional "step-out" borings may be completed in the vicinity of new borings where evidence of contamination is encountered to evaluate the extent of contamination.
- Phase II: Following the completion of Phase I activities, groundwater monitoring wells will be installed at approximately six to nine locations based on the results of the soil investigation described above and discussions with Ecology. Groundwater samples will be collected from the wells and analyzed for the COPCs described in Section 2.6. Groundwater flow direction will be evaluated by measuring groundwater depths in the wells and calculating groundwater elevations.

3.1 PRELIMINARY CLEANUP LEVELS

In accordance with MTCA, development of preliminary cleanup levels includes identifying potential exposure pathways for human and environmental impacts based on the planned land use. The Site is currently zoned commercial and future zoning is not anticipated to change. As discussed previously, the former Tank Farm is currently used as a parking area. The Port plans to continue using the Site for boat trailer parking.

3.1.1 Preliminary Soil Cleanup Levels

Access to the property is currently allowed for the general public. Based on current and likely future zoning and Site use, preliminary soil cleanup levels will be based on unrestricted land use. Therefore, preliminary cleanup levels were developed using MTCA Method A and Method B cleanup levels. During the FS, cleanup levels and/or risk-based remediation levels for specific land uses and associated institutional controls may be considered as a component of cleanup alternative development and evaluation. Preliminary soil cleanup levels are presented in Table 3.

The cleanup levels were selected from the following regulatory criteria:

- MTCA Method A Soil Cleanup Levels – Unrestricted Land Use
- MTCA Method B Soil Cleanup Levels – Soil Direct Contact/Ingestion and Surface Water Protection

Based on the proximity of the Site to surface water and because groundwater is assumed to be unsuitable for use as drinking water, MTCA Method B soil cleanup levels have been developed for protection of surface water using MTCA's fixed-parameter three-phase partitioning model calculations (MTCASGL workbook) (WAC 173-340-747(4)(b). Default assumptions provided in MTCA (assuming unsaturated soil) were used in the model, and parameter values were taken directly from CLARC for Koc, Kd, and H.

In addition to the criteria listed above, Washington State soil background concentrations for metals (Ecology, 1994) and method reporting limits were considered in accordance with WAC 173-340-709, WAC 173-340-705(6), and WAC 173-340-707.

In general, the lowest applicable soil criteria were identified as the preliminary soil cleanup levels. The following exceptions were considered:

- **Background:** If the lowest regulatory criterion is less than the background concentration, the preliminary soil cleanup level was set at the background concentration.
- **Method Reporting Limit:** If the lowest regulatory criterion is less than the method reporting limit, the preliminary soil cleanup level was set at the method reporting limit, unless the method reporting limit is less than the background concentration. In that case, the preliminary soil cleanup level was set at the background concentration. Method reporting limits are included in Tables 3 and 4 for site COPCs.

The Port plans to continue using the Site for boat trailer parking. The ground surface of the former Tank Farm portion of the Site will be maintained as a gravel surface for parking. The alignment of the fuel supply lines east of the former Tank Farm is asphalt-paved and is anticipated to remain paved in the future. Based on the commercial nature of the Site and the lack of habitat, it is unlikely that the COPCs detected in soil will pose an unacceptable risk to terrestrial ecological receptors. A preliminary review of the terrestrial ecological evaluation (TEE) forms was conducted [*Terrestrial Ecological Evaluation Process – Primary Exclusions Documentation Form* and *Terrestrial Ecological Evaluation Process-Simplified Evaluation Documentation Form*, (Ecology, 2008)]. Based on that review it appears that the Site may qualify for a TEE exclusion based on the criteria described in WAC 173-340-7491. If the site does not qualify for the TEE exclusion, a simplified TEE will be completed based on the criteria in WAC 173-340-7492(2)(a)(ii): land use at the Site and surrounding area makes substantial wildlife exposure unlikely based on completion of Table 749-1. The TEE exclusion evaluation or simplified TEE will be documented in the RI/FS.

3.1.2 Preliminary Groundwater Cleanup Levels

Groundwater at or potentially affected by the Site is not used for drinking water at this time. Based on the availability of municipal water supply and the proximity to marine surface water, groundwater at the Site is not a reasonable future source of drinking water. Therefore, based on the proximity of the Site to surface water (Fidalgo Bay), preliminary groundwater cleanup levels have been developed for protection of surface water.

Preliminary groundwater cleanup levels were selected from available state and federal surface water criteria according to WAC 173-340-730(3). The most conservative (lowest) published values were selected from the following regulatory criteria:

- MTCA Method A Cleanup Levels Groundwater WAC 173-340-720(3) and Chapter 173-340 WAC Table 720-1.
- Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A).
- National Recommended Water Quality Criteria (Section 304 of the Clean Water Act).
- National Toxics Rule (40 CFR Part 131.36).
- MTCA Method B Surface Water Cleanup Levels (WAC 173-340-730[3][b][iii]).

In addition to the criteria listed above, Washington State groundwater background concentrations for metals (PTI, 1989) and method reporting limits were considered in accordance with WAC 173-340-709 and WAC 173-340-705(6), and WAC 173-340-707.

For each analyte, the lowest published regulatory criterion for surface water was identified as the preliminary groundwater cleanup level. If no surface water criteria existed, then the MTCA Method A cleanup level was used. The following exceptions were considered:

- **Background:** If the lowest published regulatory criterion is less than the background concentration, the preliminary groundwater cleanup level was set at the background concentration.
- **Method Reporting Limit:** If the lowest published regulatory criterion is less than the method reporting limit, the preliminary groundwater cleanup level was set at the method reporting limit, unless the method reporting limit is less than the background concentration. In that case, the preliminary groundwater cleanup level was set at the background concentration.

Preliminary cleanup levels for groundwater are shown in Table 4.

3.2 GEOPHYSICAL SURVEY

Documentation for the removal of a 4,000-gallon UST at the tank farm was not identified during our review of historical records and reports. It is uncertain whether or not this UST is still present on the Site. Similarly, there is no record of whether monitoring wells MW-1and MW-2 have been removed or decommissioned. A geophysical survey will be completed to evaluate whether the UST and monitoring wells remain at the Site. Geophysical methods including ground penetrating radar and electromagnetic surveying will be utilized to search for the UST and wells..

3.3 SOIL INVESTIGATION

A direct-push soil investigation will be completed as Phase I of the RI to address data gaps described in section 2.5. The proposed locations of 30 soil borings (GEI-1through GEI-15 and GEI 15A through GEI-29) are shown on Figure 6. The rationale for the boring locations and depths proposed for obtaining soil samples are summarized in Table 5. We anticipate that additional borings may be added during RI field activities based on soil field screening observations that indicate contamination is present. The additional borings would be "stepped out" at approximately 15- to 25-foot intervals from the original boring locations where contamination is encountered. If necessary, the additional borings would be completed as needed to delineate areas of contamination that would not otherwise be fully delineated with the 25 proposed boring locations shown on Figure 6. Borings will be completed to a depth of approximately 12 feet bgs; however, if there is significant field evidence of VOC- or hydrocarbon-impacted soil at 12 feet bgs, the boring will be continued until no significant field screening evidence of contamination is observed. Soil samples will be submitted to an Ecology-certified laboratory for analysis of selected COPCs, as summarized in Table 5.

The Sampling and Analysis Plan (SAP) discusses procedures for utility locates, traffic control, drilling, and soil sample collection (Appendix B). The Quality Assurance Project Plan (QAPP) includes QA procedures (Appendix C). The Health and Safety Plan (HASP) includes health and safety procedures for RI fieldwork (Appendix D).

The following sections describe the rationale for soil sampling locations at the former Tank Farm and along the historic fuel supply lines, respectively.

3.3.1 Former Shell Tank Farm Area

The proposed soil sample locations were selected in an effort to address data gaps, meet RI objectives and provide adequate delineation of impacted soils at the former Tank Farm. Information obtained from previous Site investigations was accounted for during selection of the proposed soil boring locations. Rationale for the proposed sample locations is summarized in Table 5.

Data Objectives

RI data objectives for soil characterization at the former Tank Farm include:

- Delineation of previous COPCs detected at concentrations above the MTCA Method A cleanup levels.
- Evaluation of soil samples for selected COPCs that were not anlazyed during previous studies.
- Evaluation of data gaps, including characterization of soil in areas not previously explored. Evaluation of areas where chemical products were stored and handled is emphasized.

Proposed Sampling and Data Collection

Sixteen borings (GEI-1 to GEI-15A) will be completed to an approximate depth of 12 feet bgs at the former Tank Farm. Two soil samples from each boring will generally be submitted for chemical analysis: one from the unsaturated zone (defined as approximately 0 to 6 feet bgs) and one from the saturated zone (defined as interval between approximately 6 and 10 feet for purpose of soil sample collection). These depths are estimates based on historical groundwater observations. Soil samples submitted for analysis will be obtained from a depth interval approximately 1-foot thick (e.g. 4 feet to 5 feet unsaturated; 7 feet to 8 feet saturated). In general, samples with the highest apparent concentrations of COPCs based on field screening will be submitted for chemical analysis. If field screening does not indicate evidence of contamination within the unsaturated zone, a soil sample will be collect near the top of the water table for analysis. The saturated zone sample will generally be collected in the upper portion of the saturated zone. A third sample from each boring will be collected at a depth below 10 feet bgs and held for potential analysis. If soils in the vadose or saturated zones have any unusual visual characteristics, a soil sample will be collected for analysis.

Two samples from each boring will be analyzed for BETX, gasoline-, diesel- and heavy oil-range hydrocarbons and lead, except for the borings planned specifically for delineation of cadmium (GEI-12 and GEI-13). The following COPCs will be analyzed at selected locations described in Table 5:

- **cPAHs/naphthalenes:** cPAHs and naphthalenes will be analyzed at ten locations on the Tank Farm that appear to have elevated concentrations of hydrocarbons based on field screening. Potential follow-up testing for cPAHs and naphthalenes may be completed at locations where diesel- and/or oil-range petroleum hydrocarbon exceed the preliminary cleanup levels.
- **VOCs:** Soil samples collected from six borings near the former UST(s) and ASTs will be analyzed for VOCs (HVOCs and fuel oxygenates) based on reported storage of dry cleaning solvents at the Site and fuel oxygenate additives in accordance with MTCA Table 830-1.
- **Cadmium:** Soil samples from four borings located approximately 10 to 15 feet north and south of the 2007 cadmium soil exceedance will be tested for cadmium.
- **PCBs:** Soil samples collected from one boring with field screening evidence of elevated hydrocarbon contamination will be analyzed for PCBs in accordance with MTCA Table 830-1.

3.3.2 Historic Fuel Supply Line Area

The proposed soil sample locations were selected in an effort to address data gaps, meet RI objectives and provide adequate delineation of impacted soils along the historic fuel supply lines. Information obtained from previous Site investigations was accounted for during selection of the proposed soil boring locations. Rationale for the proposed sample locations is summarized in Table 5.

Data Objectives

RI data objectives for soil characterization along the historic fuel supply lines include:

- Evaluate soil conditions east of Q Avenue along the historic fuel supply lines, including further delineation of hydrocarbon contamination encountered in borings CSM12 and CSM13.
- Delineate the extent of soil contamination detected in soil borings SB-13 and SB-14, and observed in the 2007 exploratory utility excavation completed by the City near the east end of the historic fuel supply lines.
- Evaluation of soil samples for selected COPCs that were not anlazyed during previous studies.

Proposed Sampling and Data Collection

Fourteen direct-push borings (GEI-16 to GEI-29) will be completed to approximately 12 feet bgs at locations east of Q Avenue and in the general vicinity of the historic fuel supply lines. Consistent with the Tank Farm area sampling, two soil samples from each boring will generally be submitted for chemical analysis (unsaturated zone and saturated zone). The unsaturated zone sample interval will be selected based on field observations of potential contamination. The saturated zone sample will generally be collected in the upper portion of the saturated zone. A third sample (below 10 feet) will be collected at each boring location and held for potential analysis.

Two samples from each boring will be analyzed for BETX, gasoline-, diesel- and heavy oil-range hydrocarbons and lead. The following COPCs will be analyzed at selected locations described in Table 5.

- **cPAHs/naphthalenes:** cPAHs and naphthalenes will be analyzed at four locations near the previous cPAH exceedance at SB-13 and three locations near previous borings CSM-12 and CSM-13 . Follow-up testing for cPAHs and naphthalenes may be completed at locations where diesel- and/or oil-range petroleum hydrocarbon exceed the preliminary cleanup levels.
- **VOCs:** Soil samples from one boring located adjacent to the 2007 City excavation where oily soil was observed (south of historic fuel supply lines) will be analyzed for fuel oxygenates to satisfy requirements for MTCA Table 830-1.
- **PCBs:** Soil samples collected from one boring with field screening evidence of elevated hydrocarbon contamination will be analyzed for PCBs in accordance with MTCA Table 830-1.

3.4 GROUNDWATER INVESTIGATION

A groundwater investigation will be completed as Phase II of the RI to address data gaps described in section 2.5. The groundwater monitoring well locations will be selected at locations that will provide information on groundwater quality in the vicinity of soil contamination identified during Phase I of the RI. It is anticipated that monitoring wells will be installed at approximately four to five locations at the Tank Farm area and three to four locations east of Q Avenue in the historic fuel supply line area. The final number and location of monitoring wells, and proposed anlaytes, will be determined after results of

the Phase I soil RI are reviewed. Proposed monitoring well locations and groundwater analytes will be submitted to Ecology in a RI Work Plan Supplement prior to conducting the groundwater investigation.

The Sampling and Analysis Plan (SAP) includes procedures for well installation, well development, water level monitoring, and groundwater sample collection (Appendix B). The Quality Assurance Project Plan (QAPP) includes QA procedures (Appendix C). The Health and Safety Plan (HASP) includes health and safety procedures for RI fieldwork (Appendix D).

Data Objectives

RI data objectives for characterizing groundwater at the Site include:

- Define the full extent of groundwater contamination;
- Provide hydrogeologic information including groundwater depths, elevations, velocity and flow direction;
- Evaluation of soil permeability by completing three slug tests;
- Evaluation of data gaps, including characterization of groundwater in areas not previously explored during previous studies; and
- Evaluation of groundwater samples for selected COPCs that were not anlazyed during previous studies.

Proposed Sampling and Data Collection

Two-inch diameter monitoring wells will be installed to depths of approximately 12 to 15 feet at the Site. It is anticipated that approximately four to five wells will be installed on the former Tank Farm area and approximately three to four wells will be installed in the historic fuel supply line area east of Q Avenue to characterize groundwater conditions.

A round of groundwater samples will be obtained from all the wells and submitted to an Ecology-certified laboratory for analysis of BETX, gasoline-, diesel- and heavy oil-range hydrocarbons, cPAHs and naphthalenes and lead. Groundwater samples from one well located in or downgradient from the potential source area for HVOCs will be tested for HVOCs. Groundwater samples from one well located in or downgradient of the cadmium exceedance in soil will be tested for cadmium. Groundwater sampling locations and analytes will be documented in a RI Work Plan Supplement.

4.0 FEASIBILITY STUDY

The RI/FS will develop cleanup levels for the Site and evaluate hazardous substances in soil and groundwater by comparing analytical results to appropriate cleanup levels. Soil and groundwater cleanup criteria will be developed and used in accordance with MTCA. If the RI data do not exceed cleanup levels, the FS will be limited to establishment of cleanup levels and points of compliance. If the RI soil and/or groundwater data do exceed cleanup levels, then the FS will develop and evaluate cleanup action alternatives for contaminated media so that cleanup actions may be selected. The FS will:

- Develop cleanup levels and points of compliance and, as necessary, establish remediation levels;
- Delineate affected media where evaluation of remedial action is appropriate;
- Develop remedial action objectives;
- Screen and evaluate specific cleanup alternatives and recommend a preferred alternative; and

- Be presented in a written report along with the results of the RI (the RI/FS report).

The following sections provide the details of the FS process that will be completed, if necessary, for the Site.

4.1 Establishment of Cleanup Levels, Points of Compliance, and Remediation Levels

Cleanup standards, including cleanup levels and points of compliance, will be developed for soil and groundwater in accordance with MTCA requirements. Exposure pathways and receptors will be identified as part of cleanup level development. As needed, remediation levels may also be established for specific cleanup alternatives.

Cleanup levels for soil will be protective of human health, terrestrial ecological receptors and groundwater based on current and likely future uses of the property. The point of compliance for soil will also be established.

Cleanup levels for groundwater will be based on protection of marine surface water. Groundwater at or potentially affected by the Site is not a current or reasonable future source of drinking water. It is expected that information developed during the RI will be used to demonstrate that groundwater at the property meets the requirements of WAC 173-340-720 for non-potable groundwater. A groundwater point of compliance will be developed. The point of compliance is likely to be conditional, located at or near the groundwater/surface water interface.

4.2 Delineation of Media Requiring Remedial Action

The RI process will determine if soil and groundwater sample results exceed cleanup levels and, if so, identify the locations of the exceedances. Based on any exceedances and the established points of compliance, the FS will identify the extent or volume of soil or groundwater that requires remedial action.

4.3 Development of Remedial Action Objectives

Remedial action objectives (RAOs) that define the goals of the cleanup that must be achieved to adequately protect human health and the environment will be developed for each medium and area identified as requiring remedial action. These RAOs will be action-specific and/or media-specific. Action-specific RAOs are based on actions required for environmental protection that are not intended to achieve a specific chemical criterion. Media-specific RAOs are based on developed cleanup levels. The RAOs will specify the COCs, the potential exposure pathways and receptors, and acceptable contaminant levels or range of levels for each exposure pathway, as appropriate.

4.4 Applicable or Relevant and Appropriate Requirements

In addition to the cleanup standards developed through the MTCA process and presented in Section 3.1, other regulatory requirements must be considered in the selection and implementation of the cleanup action. MTCA requires the cleanup standards to be "at least as stringent as all applicable state and federal laws" [WAC 173-340-700(6)(a)]. Besides establishing minimum requirements for cleanup standards, applicable state and federal laws may also impose certain technical and procedural requirements for performing cleanup actions. These requirements are described in WAC 173-340-710.

MTCA defines applicable state and federal laws to include legally applicable requirements and those requirements that are relevant and appropriate (ARARs). The primary ARARs will be the MTCA

cleanup levels and regulations that address implementation of a cleanup under MTCA. Other potential ARARs may include the following:

- Washington Pollution Control Act and the implementing regulations: Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC).
- Washington Hazardous Waste Management Act and the implementing regulations: Dangerous Waste Regulations (Chapter 173-303 WAC), to the extent that any dangerous wastes are discovered or generated during the cleanup action.
- Washington's Shoreline Management Act with respect to construction cleanup activities conducted within 200 feet of the shoreline.
- Archeological and Historical Preservation – The Archeological and Historical Preservation Act (16 USCA 496a-1) would be applicable if any subject materials are discovered during site grading and excavation activities.
- Health and Safety – Site cleanup-related construction activities would need to be performed in accordance with the requirements of the Washington Industrial Safety and Health Act (RCW 49.17) and the federal Occupational Safety and Health Act (29 CFR 1910, 1926). These applicable regulations include requirements that workers are to be protected from exposure to contaminants and that excavations are to be properly shored.

The FS will identify ARARs that are applicable to the Site cleanup.

4.5 SCREENING OF CLEANUP ALTERNATIVES

Cleanup alternatives will be developed for each medium of concern. Initially, general remediation technologies will be identified for the purpose of meeting RAOs for each medium. General remediation technologies consist of specific remedial action technologies and process options and will be considered and evaluated based on the media type and the properties of any contaminant(s). These may include institutional controls, containment or other engineering controls, removal, in situ treatment, and natural attenuation.

Specific remedial action technologies are the engineering components of a general remediation technology. Examples include horizontal barriers, groundwater extraction, groundwater treatment, in situ oxidation, in situ bioremediation, and capping. Process options are those specific processes within each specific technology. For example, groundwater treatment technology could include process options such as air stripping, activated carbon, and UV/chemical oxidation. Several specific technologies may be identified for each general remediation technology and multiple process options may exist within each specific technology.

Specific remedial action technologies and representative process options will be selected for evaluation based on documented development or documented successful use for the particular medium and COPCs. Cleanup alternatives will be developed from the general and specific remedial technologies and process options consistent with Ecology expectations identified in WAC 173-340-370 using best professional judgment and guidance documents as appropriate.

During the development of cleanup alternatives, both the current and planned future land use will be considered. For example, where property is already developed, containment alternatives may be given preferential consideration over soil cleanup alternatives that would be more disruptive to Site use/structures.

If the RI identifies localized hot spots of contaminants in soil, active cleanup alternatives such as excavation or in situ treatment alternatives may be appropriate for those limited areas. If there are portions of the property with large volumes of materials with relatively low concentrations of hazardous substances, cleanup alternatives including engineering controls or monitored natural attenuation will be developed. Current and planned future property uses will be considered during development of cleanup alternatives.

4.6 EVALUATION OF CLEANUP ALTERNATIVES

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

5.0 PUBLIC PARTICIPATION

Under the terms of the Agreed Order, a Public Participation Plan (PPP) will be prepared by Ecology for the project that summarizes the RI/FS activities to be conducted at the Site (Appendix E). The PPP will be provided to the public to present the opportunity for the public to learn about and provide input on the remedial investigation and remedial alternatives as required under MTCA (WAC) 173-340-600.

6.0 SCHEDULE AND REPORTING

The Agreed Order establishes the RI/FS schedule and reporting requirements; however, the anticipated schedule for major project milestones shown in the Agreed Order is outdated (the submittal date for the draft RI/FS Work Plan is listed as October 23, 2008).

The draft RI/FS Work Plan was submitted by the Port to Ecology on January 23, 2009. The proposed schedule for the remaining project milestones is shown in the table below. Current plans call for starting the RI field investigation in fall 2010/winter 2011. After receipt of the Phase I RI soil analytical results, a Work Plan supplement for the Phase II RI (groundwater monitoring well installation and groundwater sampling) will be prepared and submitted to Ecology for approval. Following completion of all field activities and receipt of the analytical data, a RI/FS report will be prepared and submitted to Ecology. All sampling data will be submitted to Ecology in both printed and electronic formats in accordance with Ecology's Toxics Cleanup Program Policy 840. Ecology review periods are assumed to be 30 days for draft documents and 15 days for draft final and final documents. Schedule durations are presented for planning purposes; final schedule will be determined by Ecology based on project progress and other factors including site access. Documents become final upon written approval by Ecology.

PROJECT MILESTONES	SCHEDULE
Submittal of Draft RI/FS Work Plan	January 23, 2009
Submittal of Final RI/FS Work Plan	September 1, 2009
Field Investigation	Fall 2010/Winter 2011
Submittal of Draft RI/FS Report	Spring/Summer 2011
Submittal of Final RI/FS Report	Summer/Fall 2011
Submittal of Draft Cleanup Action Plan	Winter 2012
Submittal of Final Cleanup Action Plan	Spring 2012

7.0 REFERENCES

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8.0 LIMITATIONS

We have prepared this Remedial Investigation/Feasibility Study Work Plan for use by the Port of Anacortes during the RI/FS at the Former Shell Oil Tank Farm Site. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

TABLE 1
HISTORICAL SOIL ANALYTICAL RESULTS
FORMER SHELL OIL TANK FARM
ANACORTES, WASHINGTON

Study	Sample ID	Date Sampled	Interval (feet bgs)		Total Petroleum Hydrocarbons [1] (mg/kg)			Volatile Organic Compounds [3] (mg/kg)					PCBs [4] (mg/kg)	Metals [5] (mg/kg)				
			Upper	Lower	Gas	Diesel	Heavy Oil	Benzene	Toluene	Ethylbenzene	Xylenes	Other VOCs		Arsenic	Cadmium	Chromium III	Lead	Mercury
Hart Crowser, 1987	MW-1 S-4*	4/21/1987	10	11.5	--	20 U	20 U	--	--	--	--	--	--	--	--	--	10 U	--
Hart Crowser, 1987	MW-2 S-2*	4/22/1987	5	6.5	--	**3,300**	--	--	--	--	--	--	--	--	--	--	10 U	--
Floyd Snider, 2005	SHL01-S1	8/24/2005	8	8.5	26 UJ	7.6 U	21	0.064 UJ	0.13 UJ	0.13 UJ	0.26 UJ	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL02-S1	8/24/2005	4	5	**1,600 J**	**22,000**	1,200 U	0.036 UJ	0.071 UJ	0.67 J	0.4 J	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL02-S2	8/24/2005	5	6	**1,100 J**	510	720	0.024 UJ	0.048 UJ	0.66 J	0.36 J	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL02-S3	8/24/2005	8	9.5	**2,200 J**	**5,100**	620 U	0.04 UJ	0.1 J	1.8 J	0.001 J	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL03-S2	8/24/2005	5.5	6.2	58 J	11	20	0.027 UJ	0.053 UJ	0.11 J	0.064 J	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL04-S2	8/24/2005	9.5	10.5	21 UJ	110	150	0.053 UJ	0.11 UJ	0.11 UJ	0.21 UJ	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL05-S1	8/24/2005	2	3.5	13 UJ	120	11 U	0.032 UJ	0.065 UJ	0.065 UJ	0.13 UJ	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL05-S2	8/24/2005	4.4	6.2	**2,100 J**	1,100	64 U	0.037 UJ	0.074 UJ	1.7 J	1.1 J	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL05-S3	8/24/2005	8	10	84 J	180	92	0.029 UJ	0.057 UJ	0.057 UJ	0.11 UJ	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM01-S1[2]	8/24/2005	4	5	--	180	1,300	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM02-S1[2]	8/24/2005	8	8.7	--	87	330	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM03-S1[2]	8/24/2005	4	5	--	85	280	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM03-S2	8/24/2005	8	9	15 UJ	32 U	140	0.037 UJ	0.074 UJ	0.074 UJ	0.15 UJ	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM12-S1 [2]	8/26/2005	5	6	--	110 U	440	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM12-S2	8/26/2005	10	11	34 UJ	**800**	**1,900**	0.084 U	0.17 UJ	0.17 UJ	0.34 UJ	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM13-S2	8/26/2005	10.5	11.5	**110 J**	**16,000**	1,100 U	0.095 U	0.19 UJ	0.19 UJ	0.38 UJ	--	--	--	--	--	--	--
GeoEngineers, 2008a	TP-1-6.0	11/30/2007	6	6.5	3 U	50 U	1,300	0.01 U	0.01 U	0.01 U	0.02 U	ND	0.1 U	8.1	**6.4**	21	28	0.02
GeoEngineers, 2008a	TP-1-8.0	11/30/2007	7.5	8	--	--	--	--	--	--	--	--	--	--	1 U	--	--	--
GeoEngineers, 2008a	TP-2-4.0	11/30/2007	4	4.5	3 U	25 U	50 U	0.01 U	0.01 U	0.01 U	0.02 U	ND	0.1 U	5 U	1 U	31	5.2	0.02 U
GeoEngineers, 2008a	TP-3-8.0	11/30/2007	7.5	8	3 U	25 U	50 U	0.01 U	0.01 U	0.01 U	0.02 U	ND	0.1 U	5.4	1 U	32	5.8	0.03
GeoEngineers, 2008a	TP-4-2.0	11/30/2007	2	2.5	3 U	25 U	50 U	0.01 U	0.01 U	0.01 U	0.02 U	ND	0.1 U	5 U	1 U	11	5 U	0.02 U
Landau, 2007b	SB-10	5/24/2007	0	0.5	3.0 U	8.9	160	0.0005 U	0.0005 U	0.0005 U	0.0005 U	ND	--	--	--	--	2	--
Landau, 2007b	SB-10	5/24/2007	1	2	3.1 U	5.3 U	17	0.0006 U	0.0006 U	0.0006 U	0.0006 U	ND	--	--	--	--	2 U	--
Landau, 2007b	SB-10	5/24/2007	5	6	3.4 U	24	220	0.0007 U	0.0007 U	0.0007 U	0.0012	D	--	--	--	--	7	--
Landau, 2007b	SB-13	5/25/2007	0.5	1.5	4.3 U	21	170	0.0008 U	0.0008 U	0.0008 U	0.0008 U	ND	--	--	--	--	9	--
Landau, 2007b	SB-13	5/25/2007	1.5	3	4.2 U	5.4 U	11 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	ND	--	--	--	--	5 U	--
Landau, 2007b	SB-13	5/25/2007	5	6	23	100	230	0.0019 U	0.0019 U	0.0019 U	0.0019 U	ND	--	--	--	--	26	--
Landau, 2007b	SB-14	5/25/2007	0.5	1.5	5.1 U	5.3 U	11	0.0012 U	0.0012 U	0.0012 U	0.0012 U	ND	--	--	--	--	2	--
Landau, 2007b	SB-14	5/25/2007	8	9	**650**	48	120	0.074 U	0.074 U	0.074 U	0.074 U	D	--	--	--	--	3	--
Landau, 2007b	SB-14	5/25/2007	9	10	11 U	11	60	0.0013 U	0.0013 U	0.0013 U	0.0013 U	ND	--	--	--	--	6	--
Method A, Unrestricted Land Use (mg/kg)					30/100 [8]	2,000	2,000	0.03	7	6	9	varies	1	20	2	2,000	250	2
Method B, unrestricted land use (mg/kg)					--	--	--	18	6,400	8,000	16,000	varies	0.5	0.67	80	120,000	--	24

TABLE 1
HISTORICAL SOIL ANALYTICAL RESULTS
FORMER SHELL OIL TANK FARM
ANACORTES, WASHINGTON

Study	Sample ID	Date Sampled	Interval (feet bgs)		Non-Carcinogenic Polycyclic Aromatic Hydrocarbons [6] (mg/kg)									Carcinogenic Polycyclic Aromatic Hydrocarbons [6] (mg/kg)							
			Upper	Lower	Naphth-alenes	Acenaph-thylene	Acenaph-thene	Fluorene	Phenan-threne	Anthra-cene	Fluor-anthene	Pyrene	Benzo (g,h,i) perylene	Benzo(a) anthracene	Chrysene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Benzo(a) pyrene	Indeno (1,2,3-cd)pyrene	Dibenz(a,h) anthracene	Total cPAHs (TEQ) [7]
Hart Crowser, 1987	MW-1 S-4*	4/21/1987	10	11.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hart Crowser, 1987	MW-2 S-2*	4/22/1987	5	6.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL01-S1	8/24/2005	8	8.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL02-S1	8/24/2005	4	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL02-S2	8/24/2005	5	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL02-S3	8/24/2005	8	9.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL03-S2	8/24/2005	5.5	6.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL04-S2	8/24/2005	9.5	10.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL05-S1	8/24/2005	2	3.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL05-S2	8/24/2005	4.4	6.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	SHL05-S3	8/24/2005	8	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM01-S1 [2]	8/24/2005	4	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM02-S1 [2]	8/24/2005	8	8.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM03-S1 [2]	8/24/2005	4	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM03-S2	8/24/2005	8	9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM12-S1 [2]	8/26/2005	5	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM12-S2	8/26/2005	10	11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Floyd Snider, 2005	CSM13-S2	8/26/2005	10.5	11.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GeoEngineers, 2008a	TP-1-6.0	11/30/2007	6	6.5	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.03	0.03	0.07	0.02 U	0.06	0.04	0.02	0.04	0.03	0.03	0.06
GeoEngineers, 2008a	TP-1-8.0	11/30/2007	7.5	8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GeoEngineers, 2008a	TP-2-4.0	11/30/2007	4	4.5	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
GeoEngineers, 2008a	TP-3-8.0	11/30/2007	7.5	8	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
GeoEngineers, 2008a	TP-4-2.0	11/30/2007	2	2.5	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Landau, 2007b	SB-10	5/24/2007	0	0.5	0.0062 U	0.0062 U	0.0062 U	0.0062 U	0.011	0.0062 U	0.0062 U	0.013	0.019	0.0094	0.039	0.018	0.0062 U	0.014	0.0062 U	0.0062 U	0.0171
Landau, 2007b	SB-10	5/24/2007	1	2	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	ND
Landau, 2007b	SB-10	5/24/2007	5	6	0.010	0.0064 U	0.014	0.012	0.028	0.0064 U	0.052	0.048	0.016	0.019	0.039	0.027	0.0071	0.018	0.0071	0.0064 U	0.0244
Landau, 2007b	SB-13	5/25/2007	0.5	1.5	0.0092	0.0066 U	0.0066 U	0.0066 U	0.042	0.0072	0.110	0.170	0.036	0.073	0.110	0.160	0.057	0.082	0.029	0.0072	**0.1179**
Landau, 2007b	SB-13	5/25/2007	1.5	3	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	ND
Landau, 2007b	SB-13	5/25/2007	5	6	0.069	0.023	0.031	0.043	0.170	0.044	0.480	0.420	0.087	0.140	0.160	0.170	0.069	0.120	0.066	0.017	**0.173**
Landau, 2007b	SB-14	5/25/2007	0.5	1.5	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	ND
Landau, 2007b	SB-14	5/25/2007	8	9	0.016	0.0065 U	0.0078	0.0065 U	0.014	0.0065 U	0.030	0.026	0.0065	0.0072	0.010	0.0091	0.0065 U	0.0065	0.0065 U	0.0065 U	0.009205
Landau, 2007b	SB-14	5/25/2007	9	10	0.029	0.0078	0.012	0.021	0.130	0.025	0.260	0.200	0.044	0.060	0.073	0.072	0.038	0.062	0.034	0.0078	0.08391
Method A, Unrestricted Land Use (mg/kg)					5	--	--	--	--	--	--	--	--	--	--	--	--	0.1	--	--	0.1
Method B, unrestricted land use (mg/kg)					1,600	--	4,800	3,200	--	24,000	3,200	2,400	--	--	--	--	--	0.137	--	--	0.137

Notes:

[1] Analyzed by Ecology Methods NWTPH-Gx and NWTPH-Dx with silica gel cleanup.

[2] TPH-G and volatile analyses were not performed.

[3] Volatile organic compounds analyzed by EPA Method 8260.

[4] PCBs = Polychlorinated biphenyls. PCBs analyzed using EPA Method 8082.

[5] Metals analyzed using EPA Method 6010 or EPA Method 7471.

[6] Polycyclic aromatic hydrocarbons (PAHs) analyzed by EPA Method 8270 SIM.

[7] Calculated using the toxicity equivalency (TEQ) methodology specified in WAC 173-340-708(8). cPAHs that were not detected were assigned a value of one-half the detection limit for these calculations.

[8] If benzene and the total of ethylbenzene, toluene, and xylenes are greater than 1% of the gasoline concentration, then the MTCA Method A cleanup level is 30 mg/kg.

* These samples were not analyzed with current EPA Methods so results should be considered estimates. Results listed for Heavy Oil are for "total oil and grease."

Concentrations in **bold** exceed MTCA Method A cleanup levels.

J = Sample exceeded allowable holding time at analytical laboratory.

U = Not detected above MRL

ND = not detected above MRL

D = detected above the method reporting limit (any of the following VOCs: methylene chloride, acetone, carbon disulfide, 2-butanone, 1,2,4-trimethylbenzene, isopropylbenzene, n-propylbenzene, sec-butylbenzene, 4-isopropyltoluene, n-butylbenzene, n-hexane.)

bgs = below ground surface

ppm = parts per million

mg/kg = milligrams per kilogram

"--" = not analyzed.

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TABLE 2
HISTORICAL GROUNDWATER ANALYTICAL RESULTS
FORMER SHELL OIL TANK FARM
ANACORTES, WASHINGTON

Study	Sample ID	Date Sampled	Total Petroleum Hydrocarbons [1] (µg/L)			Volatile Organic Compounds [2] (µg/L)				Total Lead [3] (ug/L)
			Gas	Diesel	Heavy Oil	Benzene	Toluene	Ethylbenzene	Xylenes	
Hart Crowser, 1987	MW-1*	4/23/1987	--	--	--	3	24	--	49	**40**
Hart Crowser, 1987	MW-2*	4/23/1987	--	--	--	1 U	1 U	--	1 U	**100**
Floyd Snider, 2005	SHL01-W1	8/24/2005	250 U	250 U	500 U	1.4	1 U	1 U	1 U	--
Floyd Snider, 2005	SHL02-W1	8/24/2005	670	**5,600**	1,000 U	1 U	1 U	1 U	1 U	--
Floyd Snider, 2005	SHL03-W1	8/24/2005	500	250 U	500 U	1 U	1 U	1 U	1.6	--
Floyd Snider, 2005	SHL04-W1	8/24/2005	520	**7,200**	1,000 U	1 U	1 U	1 U	1	--
Floyd Snider, 2005	SHL05-W1	8/24/2005	250 U	250 U	500 U	1 U	1 U	1 U	1 U	--
Floyd Snider, 2005	SHL06-W1	8/26/2005	250 U	250 U	500 U	1 U	1 U	1 U	1 U	--
Floyd Snider, 2005	SHL07-W1	8/26/2005	250 U	250 U	500 U	1 U	1 U	1 U	1 U	--
Floyd Snider, 2005	CSM01-W1	8/24/2005	250 U	260	500 U	1 U	1 U	1 U	1 U	--
Floyd Snider, 2005	CSM02-W1	8/24/2005	250 U	330	500 U	1 U	1 U	1 U	1 U	--
Floyd Snider, 2005	CSM03-W1	8/24/2005	250 U	370	500 U	1 U	1 U	1 U	1 U	--
Floyd Snider, 2005	CSM12-W1	8/26/2005	250 U	**1,900**	**5,000**	1 U	1 U	1 U	1 U	--
Floyd Snider, 2005	CSM13-W1	8/26/2005	250 U	250 U	500 U	1 U	1 U	1 U	1 U	--
Method A, Table Value (µg/L)			800/1,000 [4]	500	500	5	1,000	700	1,000	15
Method B, Standard Formula Value (µg/L)			--	--	--	0.8	640	800	1,600	--

Notes:

[1] Analyzed by Ecology Methods NWTPH-Gx and NWTPH-Dx with silica gel cleanup.

[2] Volatile organic compounds analyzed by EPA Method 8021.

[3] Metals analyzed using EPA Method 6010.

[4] If benzene and the total of ethylbenzene, toluene, and xylenes are greater than 1% of the gasoline concentration, then the MTCA Method A cleanup level is 800 µg/L.

Concentrations in **bold** exceed MTCA Method A cleanup levels.

U = Not detected above the Method reporting Limit

ug/L = micrograms per liter

* These samples were not analyzed with current EPA Methods so results should be considered estimates.

-- = Not analyzed

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TABLE 3
PRELIMINARY SOIL CLEANUP LEVELS
FORMER SHELL OIL TANK FARM
ANACORTES, WASHINGTON

Analytes	Units	Soil Criteria					Analytical Laboratory Criteria [5]		Preliminary Soil Cleanup Level [6]
		Washington State Background[1]	MTCA Method A Unrestricted Land Use[2]	Soil, Method B, Carcinogen, Standard Formula Value, Direct Contact (ingestion only), unrestricted land use	Soil, Method B, Non-carcinogen, Standard Formula Value, Direct Contact (ingestion only), unrestricted land use	MTCA Method B Protection of Surface Water[4]	Reporting Limits	Analytical Method	
Total Petroleum Hydrocarbons									
Gasoline-Range	mg/kg	--	30/100	--	--	--	3	NW-TPH-Gx	30/100
Diesel-Range	mg/kg	--	2,000	--	--	--	25	NW-TPH-Dx	2,000
Oil-Range	mg/kg	--	2,000	--	--	--	50	NW-TPH-Dx	2,000
Metals									
Cadmium	mg/kg	1	--	--	80	1.20	1	6010B ICP	1.2
Lead	mg/kg	24	250	--	--	1,600	5	6010B ICP	250
Volatile Organic Compounds									
Benzene	mg/kg	--	--	18	320	0.13	0.03 / 0.01	EPA 8021 / 8260B	0.13
Ethylbenzene	mg/kg	--	--	--	8,000	18	0.05 / 0.01	EPA 8021 / 8260B	18
Toluene	mg/kg	--	--	--	6,400	109	0.05 / 0.01	EPA 8021 / 8260B	109
Xylenes	mg/kg	--	9.0	--	16,000	--	0.2 / 0.01	EPA 8021 / 8260B	9
Methyl tert-butyl ether (MTBE)	mg/kg	--	--	560	69,000	--	0.01	EPA 8260B	560
Ethylene Dibromide (EDB)	mg/kg	--	--	0.012	--	--	0.005	EPA 8260B	0.012
1,2-Dichloroethane (EDC)	mg/kg	--	--	11	1,600	0.179	0.01	EPA 8260B	0.179
Tetrachloroethylene (PCE)	mg/kg	--	--	2	800	0.0042	0.01	EPA 8260B	0.01
Trichloroethylene (TCE)	mg/kg	--	--	11	24	0.044	0.01	EPA 8260B	0.044
1,1,1-Trichloroethane	mg/kg		--	--	7,200	13,957	0.01	EPA 8260B	13,957
Vinyl Chloride	mg/kg	--	--	0.03	--	0.015	0.01	EPA 8260B	0.015
Trichlorofluoromethane (freon)	mg/kg	--	--	--	24,000	--	0.01	EPA 8260B	24,000
Carbon tetrachloride	mg/kg	--	--	7.70	56	0.015	0.01	EPA 8260B	0.015
Polycyclic Aromatic Hydrocarbons									
1-Methylnaphthalene	mg/kg	--	--	--	--	--	0.02	EPA 8270D SIM	--
2-Methylnaphthalene	mg/kg	--	--	--	3,200	--	0.02	EPA 8270D SIM	3,200
Naphthalene	mg/kg	--	--	--	1,600	140	0.02	EPA 8270D SIM	140
Benzo(a)anthracene	mg/kg	--	--	--	--	0.13	0.02	EPA 8270D SIM	0.13
Benzo(a)pyrene	mg/kg	--	--	0.137	--	0.35	0.02	EPA 8270D SIM	0.137
Benzo(b)fluoranthene	mg/kg	--	--	--	--	0.43	0.02	EPA 8270D SIM	0.43
Benzo(k)fluoranthene	mg/kg	--	--			0.43	0.02	EPA 8270D SIM	0.43
Chrysene	mg/kg	--	--	--	--	0.14	0.02	EPA 8270D SIM	0.14
Dibenz(a,h)anthracene	mg/kg	--	--	--	--	0.65	0.02	EPA 8270D SIM	0.65
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	--	--	1.30	0.02	EPA 8270D SIM	1.3
Total cPAHs (TEQ)	mg/kg	--	--	0.137		--	0.02	EPA 8270D SIM	0.137
Polychlorinated Biphenyls									
Total PCBs	mg/kg	--	1.0	0.50	--	$6.8X10^{-4}$	0.1	8082 Low Level	0.1

Notes:

[1] Natural Background Soil Metals Concentrations in Washington State, Puget Sound Region. October 1994.

[2] MTCA Method A Soil Cleanup Levels [WAC 173-340-745(3) and Chapter 173-340 WAC Table 745-1].

[3] MTCA Method B Soil Cleanup Levels; Direct Contact/Ingestion ([WAC 173-340-745(5)(b)(iii)(B)].

[4] Surface water criteria used in calculation is lowest value from the surface water ARARs (Table 4).

[5] Reporting limits obtained from CCI Analytical.

[6] Preliminary Soil Cleanup Level is the lowest soil criteria as indicated by shading; adjusted based on Washington State background. Additional adjustments were made based on reporting limits or minimum levels per WAC 173-340-720(7)(c).

[7] The arsenic MTCA Method A cleanup value is included because the value is based on background concentrations (Table 740-1, footnote b).

Shading indicates value was selected as the Applicable Soil Cleanup Level.

-- Cleanup levels not developed for constituent.

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TABLE 4

PRELIMINARY GROUNDWATER CLEANUP LEVELS

FORMER SHELL OIL TANK FARM
ANACORTES, WASHINGTON

Analytes	Units	Groundwater Criteria		Surface Water Criteria							Analytical Laboratory Criteria[1]		
				Ch. 173-201A WAC[5]	Section 304 of the Clean Water Act[6]		40 CFR Part 131[7]		WAC 173-340-730 [8]				
		Washington State Groundwater Background Concentrations[3]	Method A Cleanup Levels for Groundwater[4]	Surface Water ARAR Protection of Aquatic Life - Marine/Chronic	Surface Water ARAR Protection of Aquatic Life - Marine/Chronic	Surface Water ARAR Protection of Human Health for Consumption of Organisms	Surface Water ARAR Protection of Aquatic Life - Marine/Chronic	Surface Water ARAR Protection of Human Health for Consumption of Organisms	Surface Water ARAR MTCA Method B Carcinogen Standard Formula Value	Surface Water ARAR MTCA Method B Non-Carcinogen Standard Formula Value	Reporting Limit	Analytical Method	Preliminary Groundwater Cleanup Level[2]
Petroleum Hydrocarbons													
TPH-G	µg/L	--	800/1,000	--	--	--	--	--	--	--	50	NWTPH-G	800/1,000
TPH-D	µg/L	--	500	--	--	--	--	--	--	--	130	NW-TPH-Dx	500
TPH-O	µg/L	--	500	--	--	--	--	--	--	--	250	NW-TPH-Dx	500
Metals *(Total or Dissolved)*													
Cadmium	µg/L	2	--	9.3	8.8	--	9	--	--	20	5	EPA 6020/200.8 ICP-MS	8.8
Lead	µg/L	10	--	8.1	8.1	--	8	--	--	--	3	EPA 6020/200.8 ICP-MS	10
Volatile Organic Compounds													
Benzene	µg/L	--	--	--	--	51	--	71	23	2,000	1	EPA 8021 / 8260B	23
Toluene	µg/L	--	--	--	--	15,000	--	200,000	--	19,000	1	EPA 8021 / 8260B	15,000
Ethylbenzene	µg/L	--	--	--	--	2,100	--	29,000	--	6,900	1	EPA 8021 / 8260B	2,100
Xylenes	µg/L	--	1,000	--	--	--	--	--	--	--	3	EPA 8021 / 8260B	1,000
Methyl tert-butyl ether (MTBE)	µg/L	--	20	--	--	--	--	--	--	--	2.0	EPA 8260B (5 mL purge)	20
Ethylene Dibromide (EDB)	µg/L	--	0.01	--	--	--	--	--	--	--	2.0	EPA 8260B (5 mL purge)	2.0
1,2-Dichloroethane (EDC)	µg/L	--	--	--	--	37	--	99	59	43,000	2.0	EPA 8260B (5 mL purge)	37
Tetrachloroethene	µg/L	--	--	--	--	3.3	--	8.9	0.39	840	2.0	EPA 8260B (20 mL purge)	0.39
Trichloroethene	µg/L	--	--	--	--	30	--	81	6.7	71	2.0	EPA 8260B (5 mL purge)	6.7
cis-1,2-Dichloroethene	µg/L	--	--	--	--	--	--	--	--	--	2.0	EPA 8260B (5 mL purge)	--
1,1,1-Trichloroethane	µg/L	--	--	--	--	--	--	--	--	420,000	2.0	EPA 8260B (5 mL purge)	420,000
Vinyl Chloride	µg/L	--	--	--	--	2.4	--	530	3.7	6,600	0.2	EPA 8260B (5 mL purge)	2.4
Trichlorofluoromethane (freon)	µg/L	--	--	--	--	--	--	--	--	--	2.0	EPA 8260B (5 mL purge)	--
Carbon tetrachloride	µg/L	--	--	--	--	1.6	--	4.4	2.7	97	2.0	EPA 8260B (5 mL purge)	1.6
Polycyclic Aromatic Hydrocarbons													
1-Methylnaphthalene	µg/L	--	--	--	--	--	--	--	--	--	0.02	EPA 8270D	--
2-Methylnaphthalene	µg/L	--	--	--	--	--	--	--	--	--	0.02	EPA 8270D	--
Naphthalene	µg/L	--	--	--	--	--	--	--	--	4,900	0.02	EPA 8270D	4,900
Benzo(a)anthracene	µg/L	--	--	--	--	0.018	--	0.031	0.030	--	0.02	EPA 8270D	0.018
Benzo(a)pyrene	µg/L	--	0.10	--	--	0.018	--	0.031	0.030	--	0.02	EPA 8270D	0.018
Benzo(b)fluoranthene	µg/L	--	--	--	--	0.018	--	0.031	0.030	--	0.03	EPA 8270D	0.018
Benzo(k)fluoranthene	µg/L	--	--	--	--	0.018	--	0.031	0.030	--	0.03	EPA 8270D	0.018
Chrysene	µg/L	--	--	--	--	0.018	--	0.031	0.030	--	0.02	8270M GC/MS Low Level	0.018
Dibenz(a,h)anthracene	µg/L	--	--	--	--	0.018	--	0.031	0.030	--	0.03	8270M GC/MS Low Level	0.018
Indeno(1,2,3-cd)pyrene	µg/L	--	--	--	--	0.018	--	0.031	0.030	--	0.02	EPA 8270D	0.018
Total cPAHs (TEQ)	µg/L	--	0.10	--	--	--	--	--	--	--	0.02	EPA 8270D	0.1
Polychlorinated Biphenyls													
Total PCBs	µg/L	--	0.10	0.03	0.03	0.000064	0.03	0.00017	0.00011	--	0.1	EPA 8082 Low Level	0.10

Notes:

[1] Reporting limits for CCI Analytical.

[2] Applicable Groundwater Cleanup Level is the lowest groundwater or surface water criteria as indicated by shading. Adjustments to these preliminary cleanup levels were made based on natural background and reporting limit considerations per WAC 173-340-720(7)(c).

[3] PTI, 1989. Background Concentrations of Selected Chemicals in Water, Soil, Sediments, and Air of Washington State.

[4] MTCA Method A Groundwater Cleanup Levels [WAC 173-340-720(3) and Chapter 173-340 WAC Table 720-1]. Applicable as surface water cleanup level for noncarcinogenic effects of petroleum mixtures per WAC 173-340-730(3)(b)(iii)(C).

[5] Chapter 173-201A WAC. Water Quality Standards for Surface Waters of the State of Washington [WAC 173-340-730(2)(b)(i)(A) and WAC 173-340-730(3)(b)(i)(A)].

[6] National Recommended Water Quality Criteria; published under Section 304 of the Clean Water Act [WAC 173-340-730(2)(b)(i)(B) and WAC 173-340-730(3)(b)(i)(B)].

[7] National Toxics Rule, 40 CFR Part 131.36 [WAC 173-340-730(2)(b)(i)(C) and WAC 173-340-730(3)(b)(i)(C)].

[8] MTCA Method B Surface Water Cleanup Levels, protection of human health - fish ingestion ([WAC 173-340-730(3)(b)(iii)].

-- Cleanup levels not developed for constituent.
Cleanup Levels (except background concentrations for metals) were obtained from the Washington State Department of Ecology Cleanup Levels and Risk Calculations (CLARC) On-Line Database.

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TABLE 5
PROPOSED SOIL SAMPLE ANALYSES AND LOCATION RATIONALE
FORMER SHELL OIL TANK FARM
ANACORTES, WASHINGTON

Area	Location	Boring	Approx. Total Depth of Boring (ft bgs)[1]	Sampling Depth Interval[2]		Analyses								Sampling Rationale
				Zone	Approx. Depth (feet bgs)	TPH-G, TPH-Dx	BETX	VOCs (HVOCs and fuel additives)[4]	cPAHs[5]	Naph-thalenes[5]	PCBs[3]	Lead	Cadmium	
						NWTPH-G, NWTPH-Dx	EPA 8021	EPA 8260	EPA 8270SIM	EPA 8270SIM	EPA 8082 Modified	EPA Methods 6000/70000		
tank farm	North edge of tank farm property along 13th Street	GEI-1	12	Unsaturated	0 to 6	x	x					x		Evaluate whether hydrocarbon contamination observed in 13th Street (GeoEngineers, 2008) is associated with releases at Tank Farm.
				Saturated	6 to 10	x	x					x		
tank farm		GEI-2	12	Unsaturated	0 to 6	x	x					x		
				Saturated	6 to 10	x	x					x		
tank farm	Approximately 50 feet south of 13th Street, on the west side of Q Avenue	GEI-3	12	Unsaturated	0 to 6	x	x		x	x		x		Delineate the extent of soil contamination observed in soil boring SHL02; investigate soil conditions along the historical fuel supply line where it exits the Tank Farm.
				Saturated	6 to 10	x	x		x	x		x		
tank farm	West side of Q Avenue, along southeastern tank farm boundary	GEI-4	12	Unsaturated	0 to 6	x	x		x	x		x		Evaluate whether hydrocarbon-contaminated soil remains in the area where excavation reportedly occurred in 1987; characterize soil on east edge of site; delineate the extent of contamination observed in boring MW-2
				Saturated	6 to 10	x	x		x	x		x		
tank farm		GEI-5	12	Unsaturated	0 to 6	x	x		x	x		x		
				Saturated	6 to 10	x	x		x	x		x		
tank farm		GEI-6	12	Unsaturated	0 to 6	x	x		x	x		x		
				Saturated	6 to 10	x	x		x	x		x		
tank farm	Between MW-1 and SHL-07, to north of former surface observations of oil and white material	GEI-7	12	Unsaturated	0 to 6	x	x	x	x	x		x		Delineate the extent of soil contamination observed in soil boring SHL02; evaluate the potential presence of hydrocarbons at location of surface staining observed in 1987.
				Saturated	6 to 10	x	x	x	x	x		x		
tank farm	West/southwest MW-1, within area of former surface oil observations and south of white material	GEI-8	12	Unsaturated	0 to 6	x	x	x	x	x		x		Evaluate the potential presence of hydrocarbons at location of surface staining observed in 1987.
				Saturated	6 to 10	x	x	x	x	x		x		
tank farm	Historical fill stand	GEI-9	12	Unsaturated	0 to 6	x	x	x	x	x		x		Evaluate potential soil contamination at historical fill stand; delineate contamination found in SHL-05; analyze for HVOCs based on historical storage of dry-cleaning solvents.
				Saturated	6 to 10	x	x	x	x	x		x		
tank farm	Adjacent to historical UST and SHL-05	GEI-10	12	Unsaturated	0 to 6	x	x	x	x	x		x		Analyze samples near former location of UST(s) and boring SHL-05 for HVOCs due to historical storage of dry-cleaning solvent.
				Saturated	6 to 10	x	x	x	x	x		x		
tank farm	Adjacent to historical pump house and MW-2	GEI-11	12	Unsaturated	0 to 6	x	x	x	x	x	x	x		Characterize the condition of soils near historical pump house; delineate the extent of soil contamination encountered in MW-2 and SHL05.
				Saturated	6 to 10	x	x	x	x	x	x	x		
tank farm	To east of ASTs, approximately 25 feet east of SHL-04	GEI-12	12	Unsaturated	0 to 6	x	x	x	x	x		x		Characterize the condition of soils near former ASTs, and delineate the extent of soil contamination encountered in MW-2 and SHL05. Analyze for HVOCs due to historical storage of dry-cleaning solvents at nearby UST.
				Saturated	6 to 10	x	x	x	x	x		x		
tank farm	On north, east, south, and west sides of TP-1	GEI-13	12	Unsaturated	0 to 6								x	Delineate previous cadmium exceedance at TP-1 (GeoEngineers, 2008).
				Saturated	6 to 10								x	
tank farm		GEI-14	12	Unsaturated	0 to 6								x	
				Saturated	6 to 10								x	
tank farm		GEI-15	12	Unsaturated	0 to 6								x	
				Saturated	6 to 10								x	
tank farm		GEI-15A	12	Unsaturated	0 to 6								x	
				Saturated	6 to 10								x	
historic fuel supply lines	Along historical bulkhead, downgradient (east) of Tank Farm and east of Q Avenue	GEI-16	12	Unsaturated	0 to 6	x	x					x		Evaluate whether contamination is present downgradient of Tank Farm east of Q Avenue and along supply lines (GEI-15, GEI-16, and GEI-17). The area east of Q Avenue is a dense utility corridor; boring locations will be moved as needed to avoid utilities.
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-17	12	Unsaturated	0 to 6	x	x					x		
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-18	12	Unsaturated	0 to 6	x	x					x		
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-19	12	Unsaturated	0 to 6	x	x					x		
				Saturated	6 to 10	x	x					x		
historic fuel supply lines	Approximately 30 feet north of supply lines, halfway between CSM-12 and CSM-13	GEI-20	12	Unsaturated	0 to 6	x	x		x	x		x		Evaluate soil conditions north of the supply lines where contamination was previously detected in borings CSM-12 and CSM-13.
				Saturated	6 to 10	x	x		x	x		x		
historic fuel supply lines	Northeast of CSM-13	GEI-21	12	Unsaturated	0 to 6	x	x		x	x		x		Evaluate soil conditions north of the supply lines where contamination was previously detected in boring CSM-13.
				Saturated	6 to 10	x	x		x	x		x		
historic fuel supply lines	Northwest of CSM-13	GEI-22	12	Unsaturated	0 to 6	x	x		x	x		x		
				Saturated	6 to 10	x	x		x	x		x		
historic fuel supply lines	Along west-east stretch of supply lines between Q Avenue and the shoreline	GEI-23	12	Unsaturated	0 to 6	x	x					x		Evaluate soil conditions along fuel supply lines.
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-25	12	Unsaturated	0 to 6	x	x					x		
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-26	12	Unsaturated	0 to 6	x	x		x	x		x		
				Saturated	6 to 10	x	x		x	x		x		
historic fuel supply lines	Directly west and approximately 70 feet west of 2007 City excavation at east end of supply lines - utility corridor	GEI-24	12	Unsaturated	0 to 6	x	x					x		Evaluate City utility corridor where 2007 field observations indicated hydrocarbon-contaminated soil.
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-27	12	Unsaturated	0 to 6	x	x	x	x	x	x	x		
				Saturated	6 to 10	x	x	x	x	x	x	x		
historic fuel supply lines	In vicinity of SB-13, SB-14, and area of 2007 City excavation	GEI-28	12	Unsaturated	0 to 6	x	x		x	x		x		Evaluate the extent of soil contamination detected in previous soil borings SB-13 and SB-14.
				Saturated	6 to 10	x	x		x	x		x		
historic fuel supply lines		GEI-29	12	Unsaturated	0 to 6	x	x		x	x		x		
				Saturated	6 to 10	x	x		x	x		x		

Notes appear on Page 2.

Notes:

ft bgs = Feet below ground surface
MTCA = Model Toxics Control Act
TPH-G = Gasoline-range total petroleum hydrocarbons
TPH-Dx = Diesel-range and heavy oil-range total petroleum hydrocarbons
BTEX = benzene, toluene, ethylbenzene, and xylenes
VOCs = volatile organic compounds - analyte list to consist of HVOCs (halogenated VOCs: PCE, TCE, VC, cis-1,2-DCE, and 1,1,1-TCA) and/or fuel additives (MTBE, EDB, EDC)
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
EDB = ethylene dibromide
EDC = ethylene dichloride (1,2-dichloroethane)
MTBE = methyl tertiary-butyl ether
PCE = tetrachloroethene
TCE = trichloroethene
VC = vinyl chloride
cis-1,2-DCE = cis-1,2-dichloroethene
1,1,1-TCA = 1,1,1-trichloroethane

1. If there is field evidence of hydrocarbon or VOC contamination at 12 feet, boring will proceed deeper than 12 feet until field screening observations indicate no significant evidence of contamination.

2. Depths are approximate. The groundwater table has been encountered at the tank farm between 4 and 9 feet bgs, with an average of 6 feet bgs. The unsaturated zone samples will be collected over a 1-foot interval within 0 to 6 feet bgs based on field observations of contamination. The saturated zone sample will be collected in the upper 3 to 4 feet of the saturated zone.

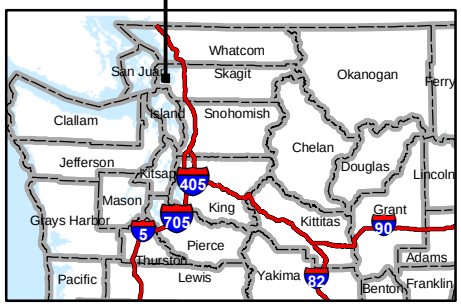
3. Although there is no evidence of waste oil being stored at the Site, selected soil samples will be analyzed to evaluate the potential presence of PCBs in accordance with MTCA Table 830-1 (presence of heavy oil-range petroleum hydrocarbons). PCBs will be analyzed in soil from one location on the Tank Farm and one location east of Q Avenue that appear to have elevated hydrocarbon concentrations. Locations are subject to change based on observed soil field screening.

4. VOCs list to include MTBE, EDB, and EDC. Selected soil samples in the vicinity of a reported dry cleaning solvent UST at the former tank farm will also be analyzed for PCE, TCE, cis-1,2-DCE, 1,1,1-TCA, VC, trichlorofluoromethane, and carbon tetrachloride.

5. cPAHs and naphthalenes will be analyzed at 9 locations on the Tank Farm that appear to have elevated levels of hydrocarbon contamination. Locations are subject to change based on soil field screening observations. Sufficient volume of soil will be collected from borings not specifically listed for cPAH/naphthalene analysis so that any soil sample with a TPH-Dx exceedance can be analyzed for cPAHs and naphthalenes.

General comments:

• Boring locations are shown on Figure 6.
• A third sample below 10 feet will be collected at each boring location and archived. Sufficient volume will be collected for TPH-Dx/PAHs/metals. If field observations indicate significant concentrations of petroleum hydrocarbons or VOCs (elevated vapors and/or moderate to heavy sheens) in the saturated zone interval, additional sample volume from this third interval w
be collected for TPH-G/BTEX/VOCs using 5035 methods.
• If white powder, hydrocarbon, or VOCs contamination is observed at any interval or boring location not prescribed in this table, a sample will be collected and analyzed for suspected contaminants.
• Contingent "step out" borings may be added as needed to delineate areas of contamination that would not otherwise be delineated based on the borings listed in this table.
• Extra volume for MS and MSD analyses will be collected for BTEX, VOCs, cPAHs/naphthalenes, PCBs, and metals analysis, at a rate of 1 per 20 samples, from sampling locations that are believed to exhibit low-level contamination, per the QAPP (Appendix C).



Lambert Conformal Conic
Washington State Plane North
North American Datum 1983

Data Sources: Interstates, state routes, and roads from TIGER 2000.
County boundaries, cities, and waterbodies from Department of Ecology.

N

Note: This drawing is for informational purposes.
It is intended to assist in showing features discussed in an attached document.

All locations are approximate.

0 1,000 2,000 Feet

VICINITY MAP

Former Shell Oil Tank Farm
Anacortes, Washington

GeoEngineers

FIGURE 1

Office: SEA Path: P:\SeattleProjects\5147012\GIS\5147012T00_F1.mxd Map Revised: December 30, 2008 EL

Fuel Supply Line Area

Tank Farm Area

Historical Fuel Supply Lines

0 100 200 Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communications

Reference: Roads from Skagit County. Point, line and polygon features digitized from figures 5.1 and 6.1 of November 2006 and Figure 2 of September 2005 by Floyd Snider. Imagery date - September 2007.Imagery date - September 2007. CSBH 1979 Aerial Photo from Floyd Snider.

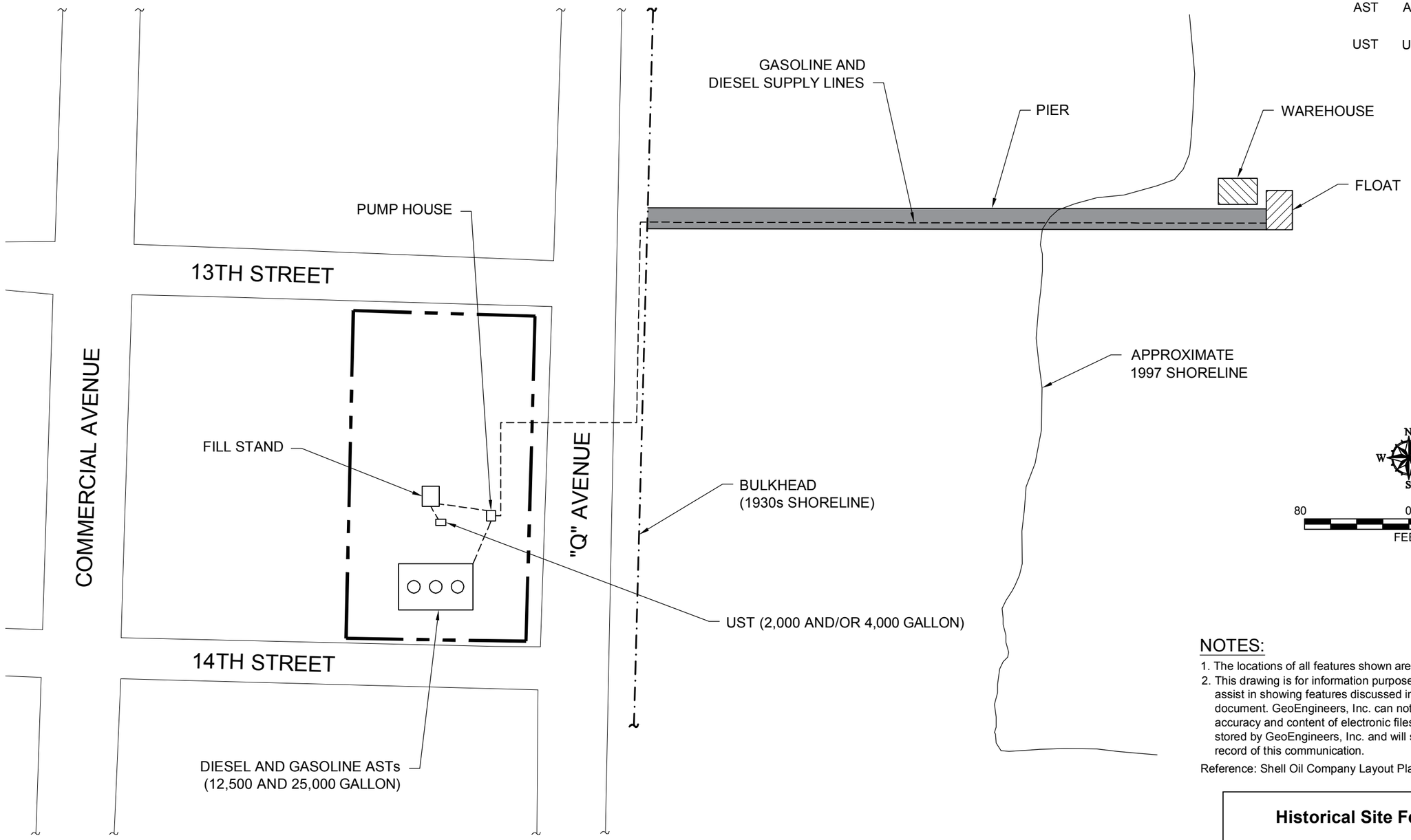
Site Map

Former Shell Oil Tank Farm and Historical Fuel Supply Lines Anacortes, Washington

GeoEngineers

Figure 2

Office: Seattle Path: W:\Seattle\Projects\5\5147012\GIS\5147012_F2.mxd Map Revised: 01/20/2009 EL



NOTES:

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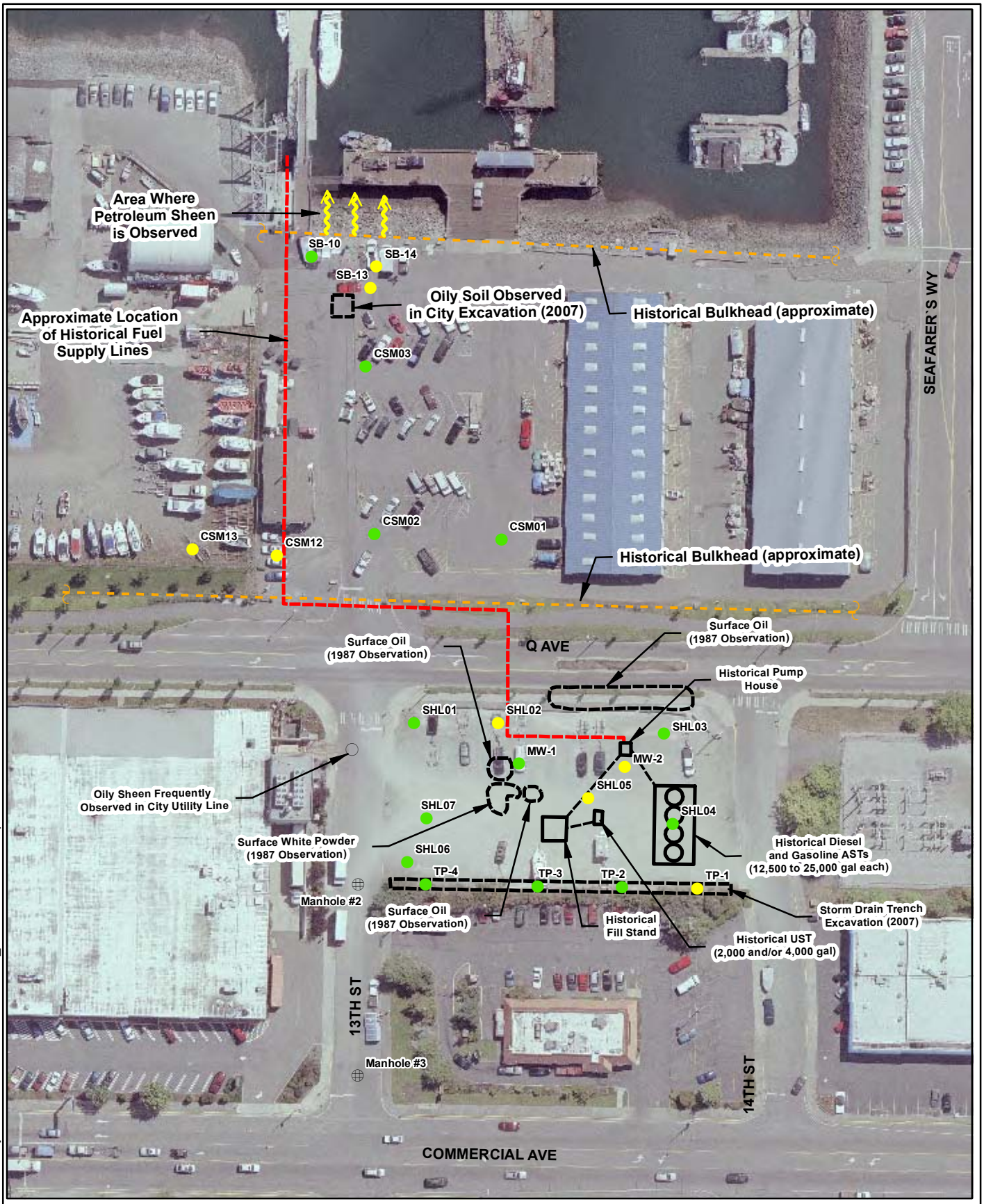
Reference: Shell Oil Company Layout Plan dated July 25, 1930 (Appendix A).

Historical Site Features (c. 1930)

Former Shell Oil Tank Farm
Anacortes, Washington

GeoEngineers | **Figure 3**

P:\15\15147012\00\CAD\15147012OO Fig 3.DWG\TAB:Fig 3 MODIFIED BY TMICHAUD ON JAN 09, 2009 - 11:58



Existing Sample Location (No Exceedances)
Existing Sample Location Exceeding MTCA Method A
Manholes
Historical Fuel Supply Line
Historical Product Line

MW = monitoring well (HartCrowser, 1987)
CSM or SHL = soil boring (FloydSnider, 2005)
TP = test pit (GeoEngineers, 2007)
SB = soil boring (Landau, 2007)

0 50 100 Feet

Notes:
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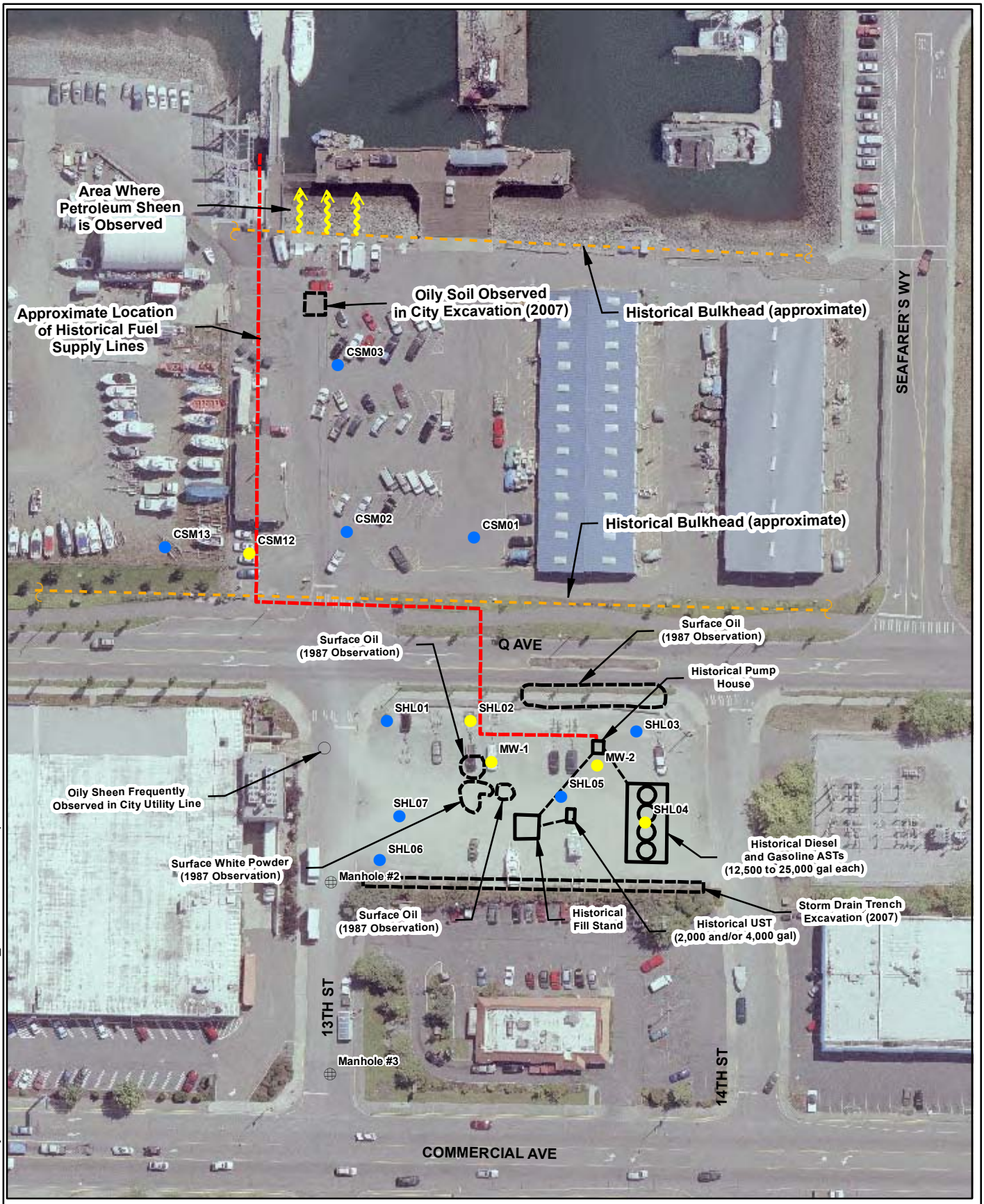
Historical Soil Sampling Results

Former Shell Oil Tank Farm
Anacortes, Washington

GeoEngineers

Figure 4

Office: Seattle Path: W:\Seattle\Projects\5\514701201_GIS\514701201_F4.mxd Map Revised: 01/20/2009, EL



Existing Sample Location (No Exceedances)
Existing Sample Location Exceeding MTCA Method A
Manholes
Historical Fuel Supply Line
Historical Product Line

MW = monitoring well (HartCrowser, 1987)
CSM or SHL = soil boring (Floyd Snider, 2005)

0 50 100 Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communications
Reference: Roads from Skagit County. Point, line and polygon features digitized from figures 5.1 and 6.1 of November 2006 and Figure 2 of September 2005 by Floyd Snider. Imagery date - September 2007. CSBH 1979 Aerial Photo from Floyd Snider.

Historical Groundwater Sampling Results

Former Shell Oil Tank Farm
Anacortes, Washington

GeoEngineers

Figure 5

Path: W:\Seattle\Projects\5\5147012\GIS\5147012_F5.mxd Map Revised: 01/20/2009, EL
Office: Seattle

Area Where Petroleum Sheen is Observed
SB-10
SB-14
GEI-28
GEI-29
GEI-26
SB-13
Oily Soil Observed in City Excavation (2007)
GEI-27
Historical Bulkhead (approximate)
Approximate Location of Historical Fuel Supply Lines
CSM03
GEI-25
GEI-24
GEI-22
GEI-23
CSM02
CSM01
CSM13
GEI-20
CSM12
GEI-21
Historical Bulkhead (approximate)
GEI-19
GEI-18
GEI-17
GEI-16
Q AVE
Surface Oil (1987 Observation)
GEI-3
GEI-4
GEI-5
GEI-6
Surface Oil (1987 Observation)
SHL01
SHL02
Historical Pump House
SHL03
GEI-2
GEI-11
Oily Sheen Frequently Observed in City Utility Line
MW-1
MW-2
GEI-7
Surface White Powder (1987 Observation)
GEI-8
GEI-12
SHL05
GEI-10
SHL07
GEI-9
SHL04
GEI-1
SHL06
Historical Diesel and Gasoline ASTs (12,500 to 25,000 gal each)
Surface Oil (1987 Observation)
GEI-14
GEI-13
GEI-15
Manhole #2
TP-4
TP-3
TP-2
TP-1
GEI-15A
Historical Fill Stand
Historical UST (2,000 and/or 4,000 gal)
Storm Drain Trench Excavation (2007)
14TH ST
13TH ST
Manhole #3

GEI-1 = Proposed Direct Push Boring
Existing Soil Sample Location (No Exceedances)
Existing Soil Sample Location Exceeding MTCA Method A
Manholes
Historical Fuel Supply Line
Historical Product Line

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communications
Reference: Roads from Skagit County. Point, line and polygon features digitized from figures 5.1 and 6.1 of November 2006 and Figure 2 of September 2005 by Floyd Snider. Imagery date - September 2007. CSBH 1979 Aerial Photo from Floyd Snider.

0 50 100 Feet

Proposed Soil Sample Locations

Former Shell Oil Tank Farm
Anacortes, Washington

GeoEngineers

Figure 6

Office: Seattle Path: W:\Seattle\Projects\5\5147012\GIS\5147012_F6.mxd Map Revised: 07/10/2009, EL, KS

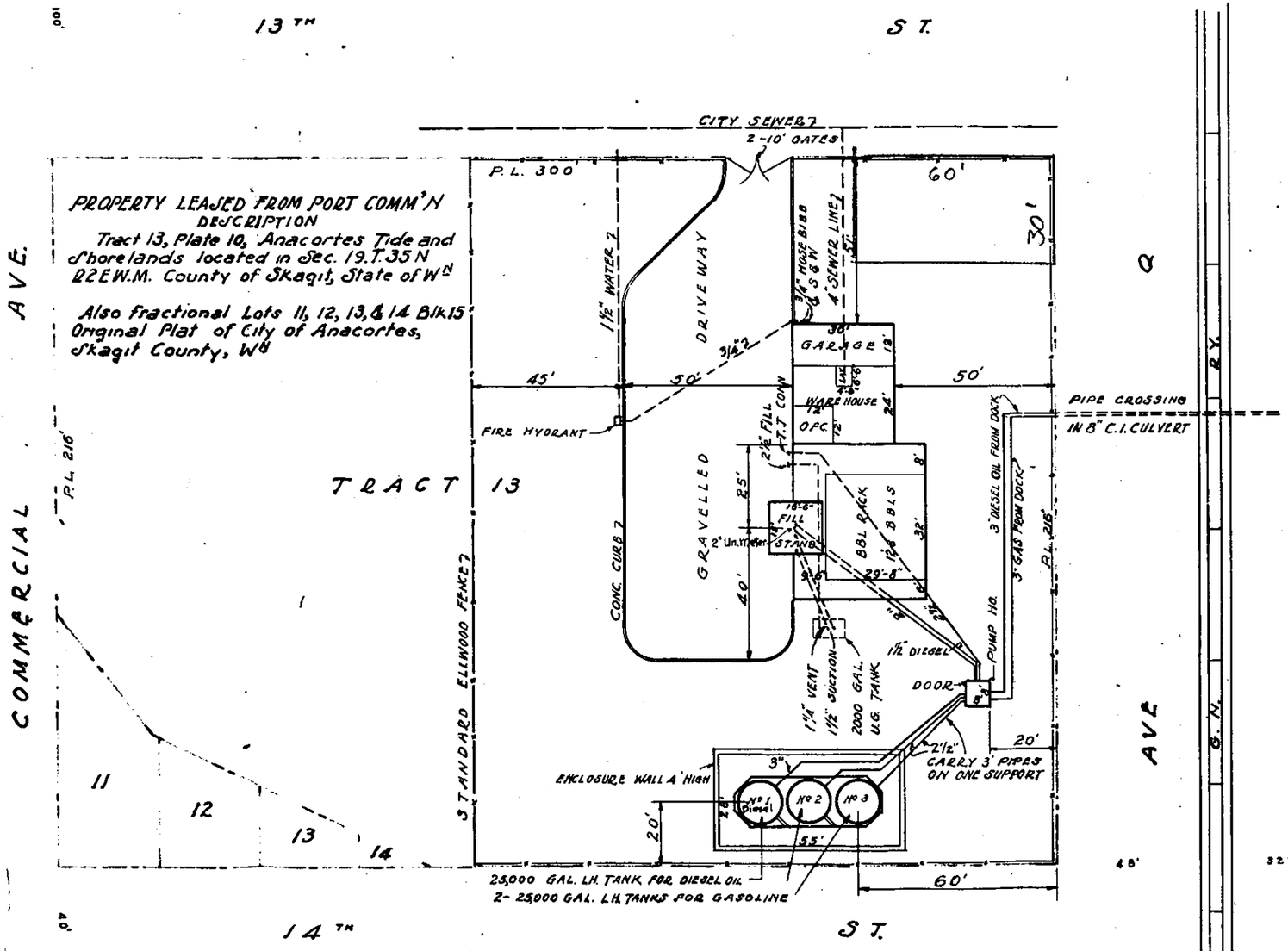
APPENDIX A
HISTORICAL SITE DRAWINGS AND AERIAL PHOTOGRAPHS

W.O.N.D.	FOREMAN	STARTED	COMPLETED	ESTIMATE	COST

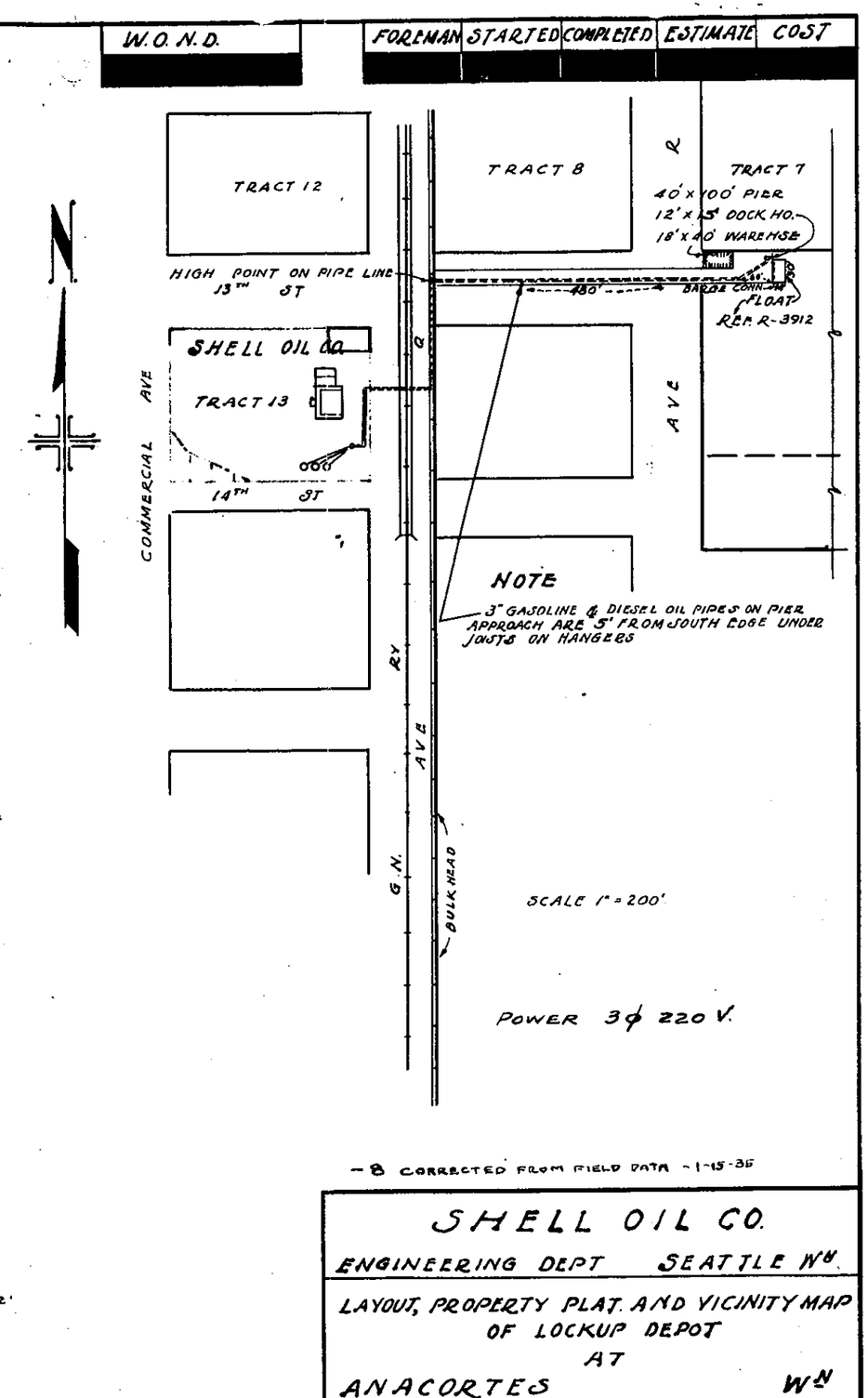
REFERENCE DWGS

COMBINATION BLDG (W.F.G.I.) K-4015, R-4016, R-4017
FILL STAND P-3183
PUMP HOUSE (W.F.G.I.) P-2853
PUMP MANIFOLD N-2084

1 - 3" DIESEL OIL LINE FROM DOCK.
1 - 1½" DIESEL OIL LINE TO FILL STAND
1 - 3" GASOLINE LINE DOCK TO PUMP HOUSE
1 - 2½" T.T. CONN. (GASOLINE) TO PUMP HOUSE
2 - 2½" SUCTION LINES TANKS TO PUMP HOUSE
1 - 2½" X 7 BYRON JACKSON CENT. PUMP ~ 3 H.P.
1 - WESTINGHOUSE MOTOR 3 P.H. 220V.



SCALE 1" = 40'



SCALE 1" = 200'

POWER 3φ 220 V.

-B CORRECTED FROM FIELD DATA - 1-15-36

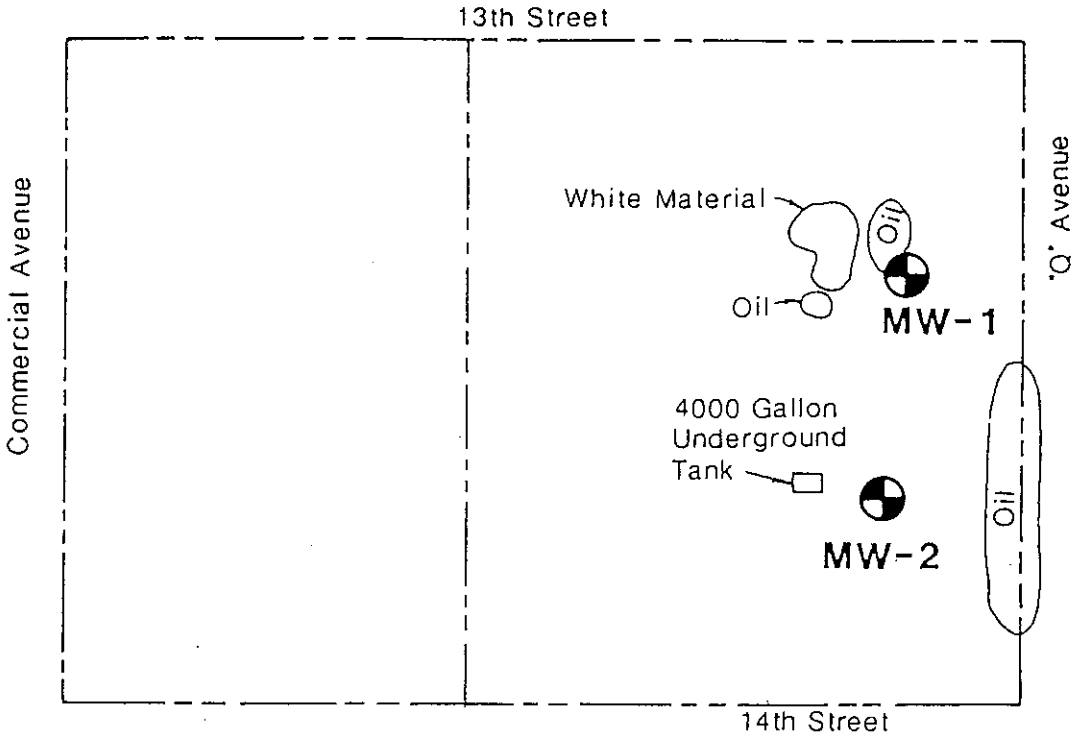
SHELL OIL CO.

ENGINEERING DEPT SEATTLE Wn

LAYOUT, PROPERTY PLAT AND VICINITY MAP OF LOCKUP DEPOT AT ANACORTES Wn

DATE 7-25-30	SCALE - AS NOTED
DRAWN BY S.K.H.	APPROVED
CHECKED BY K.R.A.G.	N-1831-B

Site and Exploration Plan



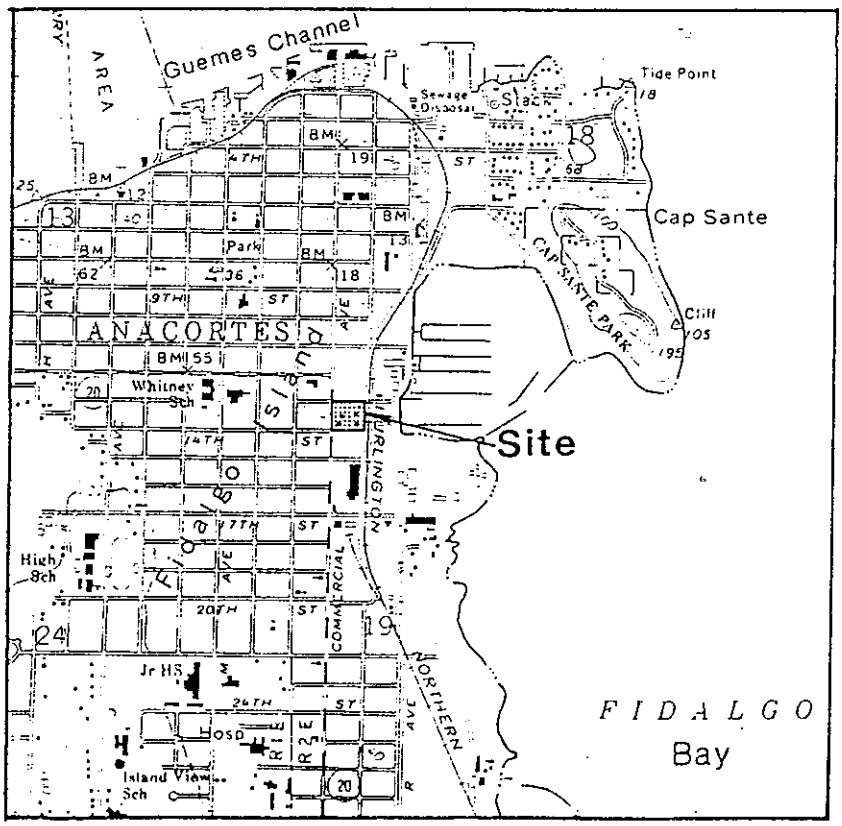
Note:

Base map provided buy Shell Oil Company entitled "Layout, Property Plat and Vicinity Map of Lockup Depot at Anacortes, dated 7/25/30.

MW-1
Monitoring Well Location and Number

0 60 120
Scale in Feet

Vicinity Map



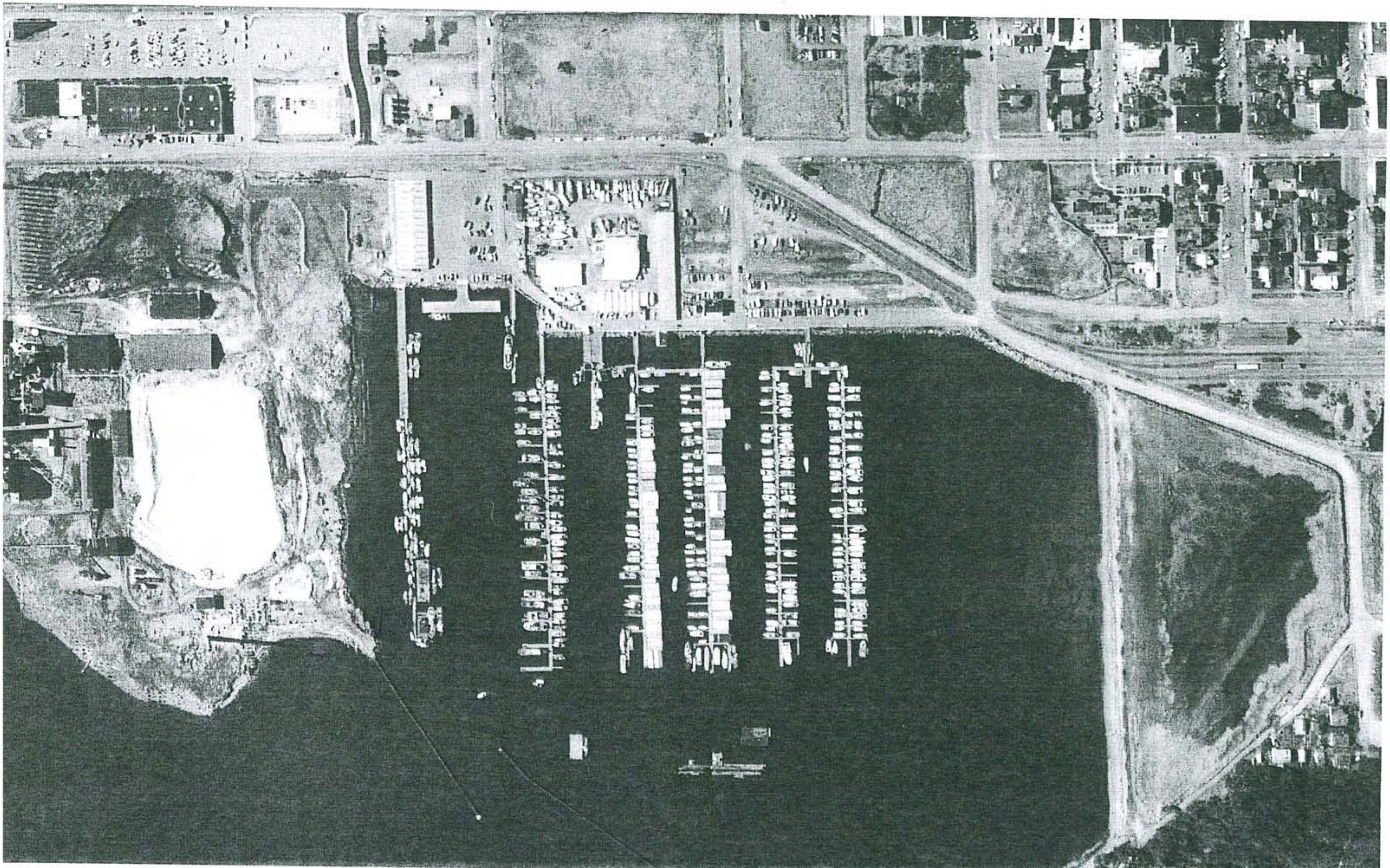
N

0 2000 4000
Scale in Feet

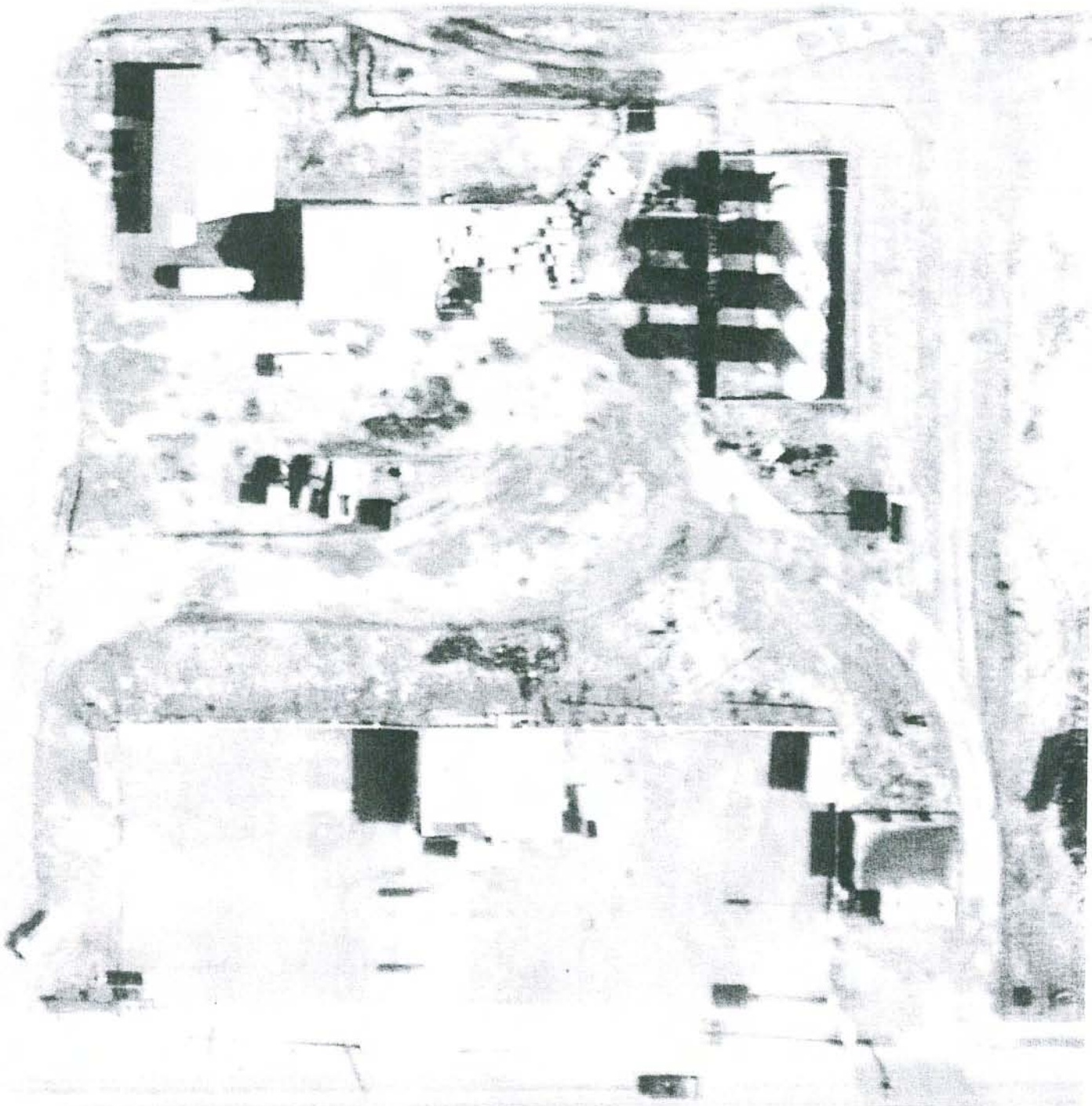
Base map prepared from 7.5-minute quadrangle of Anacortes North, Washington, dated 1973.

Hart Crowser, Inc.
J-1919 4/87
Figure 1

CSBH 1979.BITMAF




Negative #6107 Date: March 11, 1966
Copyright Northwest Air Photos



Negative #6109 Date: March 11 1966

GeoEngineers

APPENDIX B
SAMPLING AND ANALYSIS PLAN

APPENDIX B
SAMPLING AND ANALYSIS PLAN
FORMER SHELL OIL TANK FARM

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared for the former Shell Oil Tank Farm site (Site) as part of the Remedial Investigation/Feasibility Study (RI/FS) Work Plan (Work Plan). The RI is being conducted by the Port of Anacortes (Port) to satisfy requirements of an Agreed Order for the Site. Objectives of the RI are discussed in the Work Plan. The purpose of the sampling is to further delineate the nature and extent of soil and groundwater contamination at the Site and to fill data gaps identified during review of data from previous studies. Project quality assurance and quality control is discussed in the quality assurance project plan (QAPP; Appendix C of the Work Plan).

Approximately 60 soil samples will be collected for chemical analyses from 30 borings. As discussed in the Work Plan, additional "step-out" borings may be needed to further evaluate the extent of contamination. Approximately six to nine monitoring wells will be installed and groundwater samples will be collected from these wells.

Soil samples obtained for chemical analysis during this study will be submitted to an Ecology-certified laboratory for analysis of one or more of the following COPCs:

- Diesel- and heavy oil-range petroleum hydrocarbons by Washington State Department of Ecology (Ecology) Method NWTPH-Dx with silica gel/acid wash cleanup;
- Gasoline-range hydrocarbons by Ecology Method NWTPH-Gx;
- Benzene, toluene, ethylbenzene, and total xylenes (BTEX) by EPA Method 8021;
- Volatile organic compounds (VOCs) (including 1,1,1-trichloroethane (1,1,1-TCA), cis-1,2-dichloroethene (cis-1,2-DCE), vinyl chloride (VC), trichlorofluoromethane,carbon tetrachloride, tetrachloroethene (PCE),trichloroethene (TCE), ethylene dibromide (EDB), 1,2-dichloroethane (EDC), and methyl tert butyl ether (MTBE) by EPA Method 8260;
- Naphthalenes and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) by EPA Method 8270-SIM;
- Cadmium and lead using EPA Methods 6010/7060/7470/7471/7421; and
- Polychlorinated biphenyls (PCBs) by EPA Method 8082 (modified).

The specific soil analyses to be completed at each boring location are described in Table 5 of the Work Plan.

A round of groundwater samples will be obtained from all the wells and submitted to an Ecology-certified laboratory for analysis of BETX, gasoline-, diesel- and heavy oil-range hydrocarbons, cPAHs and naphthalenes and lead. Groundwater samples from one well located in or downgradient from the potential source area for HVOCs will be tested for HVOCs. Groundwater samples from one well located in or downgradient of the cadmium exceedance in soil will be tested for cadmium. Groundwater sampling locations and analytes will be documented in a RI Work Plan Supplement that will be submitted to Ecology for approval.

The analytical results obtained during the soil and groundwater investigations will be used to satisfy RI objectives and identify the potential need for remediation at the Site.

2.0 GENERAL SAMPLING PROCEDURES AND EQUIPMENT

This section specifies the field procedures, field quality assurance/quality control (QA/QC) protocol, and the chemical testing program to be implemented during the RI.

2.1 UNDERGROUND UTILITY LOCATE

Prior to drilling, an underground utility locate (public and private) will be conducted in the area of the proposed boring locations to identify any subsurface utilities and/or potential underground physical hazards. A public utility locate (one-call) will be performed, and a private utility locating company will be contracted to mark underground utilities in the vicinity of the proposed borings. An air knife (vacuum truck) may be used to clear soil from approximately the upper six to nine feet at selected boring locations, if utilities are not able to be clearly identified on Site. A hand auger will be used to attempt to collect soil samples from the upper six feet of borings where an air knife is used to clear drilling locations.

2.2 CONCRETE CORING

Borings located in areas with concrete paving will be cored prior to drilling as needed.

2.3 TRAFFIC CONTROL AND RIGHT OF WAY PERMITTING

Several proposed borings are located adjacent to the right of way for Q Avenue and 13th Street. On behalf of the Port, GeoEngineers will obtain Right-of-Way Permits from the City of Anacortes and prepare a traffic control plan as needed.

2.4 SURVEYING

Existing permanent or temporary benchmarks will be used to determine the elevation of monitoring wells installed for the RI.

2.4.1 Vertical Controls

Each monitoring well casing rim and ground surface elevation will be surveyed by GeoEngineers field personnel relative to the temporary or permanent benchmark. Elevations will be surveyed using a laser level, which has an accuracy of 0.01 feet. Elevations will be reported relative to the Port of Anacortes datum located at the Cap Sante Boat Haven.

2.4.2 Horizontal Controls

GeoEngineers field personnel will record the boring/monitoring well sampling locations, and other pertinent information, using hand-held Trimble GeoXT GPS units. GPS data collected in the field will be processed in the office using measurements from the nearest reference station to each collection point.

2.5 DIRECT PUSH BORING SOIL SAMPLING

Soil samples will be collected from borings advanced using direct-push drilling equipment. Continuous soil cores will be obtained from the direct-push borings using a 2.0 to 2.5-inch-diameter sampling rods with acetate liners. The drilling rods are driven with a pneumatic hammer in four foot intervals. Soil cuttings (unused soil core) from the borings will be placed in labeled 55-gallon drums. Drilling activities will be monitored continuously by a technical representative from GeoEngineers who will observe and classify the soil encountered and prepare a detailed boring log.

Soil samples obtained from the borings will be visually classified in general accordance with American Society of Testing and Materials (ASTM) D-2488. The samples also will be evaluated for the potential presence of hydrocarbon- and VOC contamination using field screening techniques that include water sheen tests and photoionization (PID) measurements. Observations of soil and groundwater conditions and soil field screening results for each exploration will be included in a boring log.

Soil samples will be obtained from the direct-push borings and submitted for chemical analysis. Samples will be selected for analysis based on field screening results and/or sample depth relative to groundwater depth. Samples selected for analysis will be placed in containers provided by the analytical laboratory. Each sample container will be securely capped, labeled, and placed in a cooler with ice immediately upon collection.

2.6 FIELD SCREENING

Soil samples will be field screened for evidence of possible hydrocarbon– and VOC contamination. Field screening results will be recorded on the field logs, and the results will be used as a general guideline to delineate areas of possible contamination. Screening results will be used to aid in the selection of soil samples to be submitted for chemical analysis. The following screening methods will be used: (1) visual screening; (2) water sheen screening; and (3) headspace vapor screening. Field screening results are site- and location-specific. The results may vary with temperature, moisture content, soil type and chemical constituent.

2.6.1 Visual Screening

The soil will be observed for unusual color and stains and/or odor indicative of possible contamination.

2.6.2 Water Sheen Screening

This is a qualitative field screening method that can help identify the presence or absence of petroleum hydrocarbons. A portion of the soil sample will be placed in a pan containing distilled water. The water surface will be observed for signs of sheen. The following sheen classifications will be used:

Classification	Identifier	Description
No Sheen	(NS)	No visible sheen on the water surface
Slight Sheen	(SS)	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly
Moderate Sheen	(MS)	Light to heavy sheen; may have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on the water surface
Heavy Sheen	(HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen

2.6.3 Headspace Vapor Screening

This is a semi-quantitative field screening method that can help identify the presence or absence of volatile chemicals. Volatile chemicals at this Site are anticipated in conjunction with petroleum hydrocarbons and/or dry cleaning solvents that may be present at the Site. A portion of the soil sample is placed into a resealable plastic bag for headspace vapor screening. Ambient air is captured in the bag; the bag is sealed and then shaken gently to expose the soil to the air trapped in the bag. Vapors present within the sample bag's headspace are measured by inserting the probe of a PID through a small opening in the bag. A PID measures the concentration of organic vapors ionizable by a 10.6 electron volt (eV) lamp in parts per million (ppm) and quantifies organic vapor concentrations in the range between 0.1 ppm

and 2,000 ppm (isobutylene equivalent) with an accuracy of 1 ppm between 0 ppm and 100 ppm. The maximum ppm value and the ambient air temperature will be recorded on the field log for each sample. The PID will be calibrated to 100 ppm isobutylene.

2.7 MONITORING WELL CONSTRUCTION

Drilling and construction of the monitoring wells will be conducted by a Washington State licensed driller in accordance with the *Minimum Standards for Construction and Maintenance of Wells* (Chapter 173-160 WAC; Ecology 2006). Installation of the monitoring wells will be observed by a GeoEngineers representative, who will maintain a detailed log of the materials and depths of the wells. Monitoring well borings will be drilled using a truck-mounted hollow-stem auger rig. The monitoring wells are anticipated to be installed to depths of approximately 12 to 15 feet bgs.

Wells will be constructed of 2-inch diameter, flush-threaded Schedule 40 polyvinyl chloride (PVC) casing with machine-slotted PVC screen (0.010-inch). The top of the well screens will be located approximately 5 feet above the observed groundwater level, or within 2 feet of the ground surface, whichever is deeper. The well screen intervals may be modified based on field screening results or variations in soil type. Screened intervals of approximately 10-feet length are anticipated.

Following placement of the well screen and casing in the borehole, a filter pack will be installed around the well screen. The filter pack will extend from the bottom of the well to a minimum of 1 foot above the top of the screen. Filter pack material will consist of commercially prepared 10-20 silica sand.

A bentonite seal at least 1 foot thick will be placed above the sand pack to about 1.5 ft bgs. The surface of each well will be completed with a concrete seal and surface pad extending from the top of the

bentonite seal to slightly above the ground surface. Locking steel flush-mount monuments will be cemented in place from the surface to a depth of about 1.5 ft bgs.

2.8 MONITORING WELL DEVELOPMENT

Each monitoring well will be developed to remove water introduced into the well during drilling (if any), stabilize the filter pack and formation materials surrounding the well screen, and restore the hydraulic connection between the well screen and the surrounding soil. The well screen will be gently surged with a decontaminated stainless steel bailer several times after installation. Development will continue until a minimum of 5 casing volumes of water have been removed and turbidity of the discharged water is relatively low. The goal of well development will be to reduce the turbidity content of the water to approximately 25 NTU. Up to 10 well volumes of water will be removed from the wells in an effort to attain the 25 NTU goal. The removal rate and volume of groundwater removed will be recorded during well development procedures. Water that is removed from the well during well development activities will be stored on Port property in labeled 30-gallon or 55-gallon drums, pending off-site disposal. Depths to water in the monitoring wells will be measured prior to development.

2.9 GROUNDWATER MONITORING AND SAMPLING

Groundwater levels will be measured in each monitoring well prior to sampling. Groundwater levels will be measured to the nearest 0.01 foot using an electric water level indicator. The water levels will be measured relative to the top of casing rim.

Groundwater samples will be obtained using low-flow/low-turbidity sampling techniques to minimize the suspension of sediment in the samples. Groundwater samples will be obtained from monitoring wells

using a peristaltic pump and disposable polyethylene tubing. Groundwater will be pumped at approximately 0.5 liter per minute using a peristaltic pump attached to tubing placed within the screened interval. A Horiba U-22 water quality measuring system with a flow-through-cell will be used to monitor the following water quality parameters during purging: electrical conductivity, dissolved oxygen, pH, salinity, total dissolved solids, turbidity, oxidation-reduction potential and temperature. Ambient groundwater conditions will have been reached once these parameters vary by less than 10 percent on three consecutive measurements. The stabilized field measurements will be documented in the field log (for subsequent use in the RI). Following well purging, the flow through cell will be disconnected and groundwater samples will be collected in laboratory-prepared containers. Samples to be analyzed for VOCs will be obtained using EPA guidance for using peristaltic pumps to collect VOC samples. EPA recommends using the "soda straw" method which involves allowing the flexible tubing to fill by either lowering it into the water column (A) or by filling it with suction applied to the pump head (B). For Method A, the tubing is removed from the well after filling and the sample is allowed to drain into the sample vial. For Method B, after running the pump and filling the tubing with sample, the pump speed is reduced and the flow direction is reversed to push the sample out of the tubing into the sample vials. The samples will be placed into a cooler with ice and logged on the chain-of-custody using the procedures described in the QAPP. Purge water will be stored in labeled 55-gallon drums on Port property for subsequent characterization and off-site disposal. Section 2.12 addresses the disposal of investigation-derived waste materials including purge water.

2.10 DECONTAMINATION

Drilling and sampling equipment will be decontaminated using the procedures described in the QAPP.

2.11 SAMPLE HANDLING

Sample handling procedures, including labeling, container and preservation requirements, and holding times are described in the QAPP.

2.12 DISPOSAL OF INVESTIGATION-DERIVED MATERIALS

2.12.1 Soil

Soil cuttings from borings completed during the RI will be placed in labeled and sealed 55-gallon drums. The drums will be stored temporarily at a secure location on Port property pending receipt of analytical results and offsite disposal at a permitted facility.

2.12.2 Groundwater and Decontamination Water

Purge water removed from the monitoring wells and decontamination water generated during all sampling activities will be stored on-site in labeled and sealed 55-gallon drums. The drums will be stored temporarily at a secure location on Port property pending receipt of analytical results and offsite disposal at a permitted facility.

2.12.3 Disposition of Incidental Waste

Incidental waste generated during sampling activities includes items such as gloves, plastic sheeting, paper towels and similar expended and discarded field supplies. These materials are considered de minimis and will be disposed of in a local trash receptacle or county disposal facility.

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APPENDIX C
QUALITY ASSURANCE PROJECT PLAN

APPENDIX C
QUALITY ASSURANCE PROJECT PLAN, FORMER SHELL OIL TANK FARM

This Quality Assurance Project Plan (QAPP) was developed for Remedial Investigation (RI) exploration activities at the former Shell Oil Tank Farm Site. The RI is being conducted by the Port of Anacortes (Port) to satisfy requirements of an Agreed Order for the Site. Objectives of the RI are discussed in the Remedial Investigation/Feasibility Study (RI/FS) Work Plan (Work Plan). Sampling procedures are outlined in the sampling and analysis plan (SAP) included as Appendix B. The QAPP serves as the primary guide for the integration of quality assurance (QA) and quality control (QC) functions into RI activities. The QAPP presents the objectives, procedures, organization, functional activities, and specific quality assurance and quality control activities designed to achieve data quality goals established for the project. This QAPP is based on guidelines specified in Washington Administrative Code (WAC) 173, Chapter 173-340-820 and Ecology Guidelines (EPA, 2004b).

Throughout the project, environmental measurements will be conducted to produce data that are scientifically valid, of known and acceptable quality, and meet established objectives. QA/QC procedures will be implemented so that precision, accuracy, representativeness, completeness, and comparability (PARCC) of data generated meet the specified data quality objectives.

1.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Descriptions of the responsibilities, lines of authority and communication for the key positions to quality assurance and quality control are provided below. This organization facilitates the efficient production of project work, allows for an independent quality review, and permits resolution of any QA issues before submittal.

1.1 PROJECT LEADERSHIP AND MANAGEMENT

The Project Manager's duties consist of providing concise technical work statements for project tasks, selecting project team members, determining subcontractor participation, establishing budgets and schedules, adhering to budgets and schedules, providing technical oversight, and providing overall production and review of project deliverables. Jim Roth (206-239-3243) is the Project Manager for activities at the Site. The Principal–in-Charge is responsible to Port of Anacortes for fulfilling contractual and administrative control of the project. John Herzog (206-239-3252) is the Principal-in Charge.

1.2 FIELD COORDINATOR

The Field Coordinator is responsible for the daily management of activities in the field. Specific responsibilities include the following:

- Provides technical direction to the field staff.
- Develops schedules and allocates resources for field tasks.
- Coordinates data collection activities to be consistent with information requirements.
- Supervises the compilation of field data and laboratory analytical results.
- Assures that data are correctly and completely reported.
- Implements and oversees field sampling in accordance with project plans.
- Supervises field personnel.
- Coordinates work with on-site subcontractors.

- Schedules sample shipment with the analytical laboratory.
- Monitors that appropriate sampling, testing, and measurement procedures are followed.
- Coordinates the transfer of field data, sample tracking forms, and log books to the Project Manager for data reduction and validation.
- Participates in QA corrective actions as required.

The Field Coordinator for RI exploration activities at the Site is Cindy Bartlett (425-861-6021).

1.3 QUALITY ASSURANCE LEADER

The GeoEngineers project Quality Assurance Leader is under the direction of Jim Roth and John Herzog, who are responsible for the project's overall QA. The Project QA Leader is responsible for coordinating QA/QC activities as they relate to the acquisition of field data. The QA Leader has the following responsibilities:

- Serves as the official contact for laboratory data QA concerns.
- Responds to laboratory data, QA needs, resolves issues, and answers requests for guidance and assistance.
- Reviews the implementation of the QAPP and the adequacy of the data generated from a quality perspective.
- Maintains the authority to implement corrective actions as necessary.
- Reviews and approves the laboratory QA Plan.
- Evaluates the laboratory's final QA report for any condition that adversely impacts data generation.
- Ensures that appropriate sampling, testing, and analysis procedures are followed and that correct quality control checks are implemented.
- Monitors subcontractor compliance with data quality requirements.

The Project QA Leader is Zanna Satterwhite (206-239-3231).

1.4 LABORATORY MANAGEMENT

The subcontracted laboratories conducting sample analyses for this project are required to obtain approval from the QA Leader before the initiation of sample analysis to assure that the laboratory QA plan complies with the project QA objectives. The Laboratory's QA Coordinator administers the Laboratory QA Plan and is responsible for QC. Specific responsibilities of this position include:

- Ensure implementation of the QA Plan.
- Serve as the laboratory point of contact.
- Activate corrective action for out-of-control events.
- Issue the final QA/QC report.
- Administer QA sample analysis.
- Ensure that the laboratory Method Detection Limits (MDLs) are equal to or less than the site-specific cleanup levels.
- Comply with the specifications established in the project plans as related to laboratory services.

- Participate in QA audits and compliance inspections.

The chemical analytical laboratory Quality Assurance Coordinator will be determined once an Ecology-accredited laboratory is chosen.

1.5 HEALTH AND SAFETY

A site-specific health and safety plan (HASP) will be used for RI field activities and is presented in Appendix D. The Field Coordinator will be responsible for implementing the HASP during sampling activities. The Project Manager will discuss health and safety issues with the Field Coordinator on a routine basis during the completion of field activities.

The Field Coordinator will conduct a tailgate safety meeting each morning before beginning daily field activities. The Field Coordinator will terminate any work activities that do not comply with the HASP. Companies providing services for this project on a subcontracted basis will be responsible for developing and implementing their own HASP.

2.0 DATA QUALITY OBJECTIVES

The quality assurance objective for technical data is to collect environmental monitoring data of known, acceptable, and documentable quality. The QA objectives established for the project are:

- Implement the procedures outlined herein for field sampling, sample custody, equipment operation and calibration, laboratory analysis, and data reporting that will facilitate consistency and thoroughness of data generated.
- Achieve the acceptable level of confidence and quality required so that data generated are scientifically valid and of known and documented quality. This will be performed by establishing criteria for precision, accuracy, representativeness, completeness, and comparability, and by testing data against these criteria.

The sampling design, field procedures, laboratory procedures, and QC procedures are set up to provide high-quality data for use in this project. Specific data quality factors that may affect data usability include quantitative factors (precision, bias, accuracy, completeness, and reporting limits) and qualitative factors (representativeness and comparability). The measurement quality objectives (MQO) associated with these data quality factors are summarized in Table C-1 and are discussed below.

2.1 ANALYTES AND MATRICES OF CONCERN

Samples of soil and groundwater will be collected during RI activities. Tables C-2 and C-3 summarize the analyses to be performed at the Site for soil and groundwater, respectively.

2.2 DETECTION LIMITS

Analytical methods have quantitative limitations at a given statistical level of confidence that are often expressed as the method detection limit (MDL). Individual instruments often can detect but not accurately quantify compounds at concentrations lower than the MDL, referred to as the instrument detection limit (IDL). Although results reported near the MDL or IDL provide insight to site conditions, quality assurance dictates that analytical methods achieve a consistently reliable level of detection known as the practical quantitation limit (PQL). The contract laboratory will provide numerical results for all analytes and report them as detected above the PQL or undetected at the PQL.

Achieving a stated detection limit for a given analyte is helpful in providing statistically useful data. Intended data uses, such as comparison to numerical criteria or risk assessments, typically dictate specific project target reporting limits (TRLs) necessary to fulfill stated objectives. Tables 3 and 4 in the RI/FS Work Plan report include specific TRLs. The reporting limits for site COPCs are presented in Tables C-2 and C-3 for soil and groundwater, respectively. These reporting limits were obtained from an Ecology-certified laboratory (CCI Analytical, Everett, WA). Other criteria include State of Washington (WAC 173-201) and federal Ambient Water Quality Criteria (AWQC). The analytical methods and processes selected will provide PQLs less than the TRLs under ideal conditions. However, the reporting limits presented in Tables 3 and 4 are considered targets because several factors may influence final detection limits. First, moisture and other physical conditions of soil affect detection limits. Second, analytical procedures may require sample dilutions or other practices to accurately quantify a particular analyte at concentrations above the range of the instrument. The effect is that other analytes could be reported as undetected but at a value much higher than a specified TRL. Data users must be aware that high non-detect values, although correctly reported, can bias statistical summaries and careful interpretation is required to correctly characterize site conditions

2.3 PRECISION

Precision is the measure of mutual agreement among replicate or duplicate measurements of an analyte from the same sample and applies to field duplicate or split samples, replicate analyses, and duplicate spiked environmental samples (matrix spike duplicates). The closer the measured values are to each other, the more precise the measurement process. Precision error may affect data usefulness. Good precision is indicative of relative consistency and comparability between different samples. Precision will be expressed as the relative percent difference (RPD) for spike sample comparisons of various matrices and field duplicate comparisons for water samples. This value is calculated by:

$$RPD\,(\%) = \frac{|D_1 - D_2|}{(D_1 + D_2)/2}\ X\ 100,$$

Where

D_1 = Concentration of analyte in sample.

D_2 = Concentration of analyte in duplicate sample.

The calculation applies to split samples, replicate analyses, duplicate spiked environmental samples (matrix spike duplicates), and laboratory control duplicates. The RPD will be calculated for samples and compared to the applicable criteria. Precision can also be expressed as the percent difference (%D) between replicate analyses. Persons performing the evaluation must review one or more pertinent documents (USEPA, October 1999; USEPA, October 2004a) that address criteria exceedances and courses of action. Relative percent difference goals for this effort is 30 percent in groundwater and 40 percent in soil for all analyses, unless the duplicate sample values are within five times the reporting limit.

2.4 ACCURACY

Accuracy is a measure of bias in the analytic process. The closer the measurement value is to the true value, the greater the accuracy. This measure is defined as the difference between the reported value versus the actual value and is often measured with the addition of a known compound to a sample. The

amount of known compound reported in the sample, or percent recovery, assists in determining the performance of the analytical system in correctly quantifying the compounds of interest. Since most environmental data collected represent one point spatially and temporally rather than an average of values, accuracy plays a greater role than precision in assessing the results. In general, if the percent recovery is low, non-detect results may indicate that compounds of interest are not present when in fact these compounds are present. Detected compounds may be biased low or reported at a value less than actual environmental conditions. The reverse is true when recoveries are high. Non-detect values are considered accurate while detected results may be higher than the true value.

Accuracy will be expressed as the percent recovery of a surrogate compound (also known as "system monitoring compound"), a matrix spike result, or from a standard reference material where:

$$Recovery\,(\%) = \frac{Sample\ Result}{Spike\ Amount}\ X\ 100$$

Persons performing the evaluation must review one or more pertinent documents (USEPA October 1999; USEPA October 2004a) that address criteria exceedances and courses of action. Accuracy criteria for surrogate spikes, matrix spikes, and laboratory control spikes are found in Table C-1 of this QAPP.

2.5 REPRESENTATIVENESS, COMPLETENESS AND COMPARABILITY

Representativeness expresses the degree to which data accurately and precisely represent the actual site conditions. The determination of the representativeness of the data will be performed by completing the following:

- Comparing actual sampling procedures to those delineated within the SAP and this QAPP.
- Comparing analytical results of field duplicates to determine the variations in the analytical results.
- Invalidating nonrepresentative data or identifying data to be classified as questionable or qualitative. Only representative data will be used in subsequent data reduction, validation, and reporting activities.

Completeness establishes whether a sufficient amount of valid measurements were obtained to meet project objectives. The number of samples and results expected establishes the comparative basis for completeness. Completeness goals are 90 percent useable data for samples/analyses planned. If the completeness goal is not achieved an evaluation will be made to determine if the data are adequate to meet study objectives.

Comparability expresses the confidence with which one set of data can be compared to another. Although numeric goals do not exist for comparability, a statement on comparability will be prepared to determine overall usefulness of data sets, following the determination of both precision and accuracy.

2.6 HOLDING TIMES

Holding times are defined as the time between sample collection and extraction, sample collection and analysis, or sample extraction and analysis. Some analytical methods specify a holding time for analysis only. For many methods, holding times may be extended by sample preservation techniques in the field. If a sample exceeds a holding time, then the results may be biased low. For example, if the extraction holding time for volatile analysis of soil sample is exceeded, then the possibility exists that some of the organic constituents have volatilized from the sample or degraded. Results for that analysis will be

qualified as estimated to indicate that the reported results may be lower than actual site conditions. Holding times are presented in Table C-4.

2.7 BLANKS

According to the *National Functional Guidelines for Organic Data Review* (USEPA, 1999), "The purpose of laboratory (or field) blank analysis is to determine the existence and magnitude of contamination resulting from laboratory (or field) activities. The criteria for evaluation of blanks apply to any blank associated with the samples (e.g., method blanks, instrument blanks, trip blanks, and equipment blanks)." Trip blanks are placed with samples during shipment; method blanks are created during sample preparation and follow samples throughout the analysis process.

Analytical results for blanks will be interpreted in general accordance with *National Functional Guidelines for Organic Data Review* and professional judgment.

3.0 SAMPLE COLLECTION, HANDLING AND CUSTODY

3.1 SAMPLING EQUIPMENT DECONTAMINATION

The drilling equipment will be decontaminated before beginning each exploration using a hot-water pressure washer. Reusable sampling/monitoring equipment (trowels, split-spoons, hand augers, etc.) that comes in contact with soil or groundwater will be decontaminated before each use. Decontamination procedures for this equipment will consist of the following: (1) wash with nonphosphate detergent solution (Liqui-Nox and distilled water), (2) rinse with distilled water, and (3) place the decontaminated equipment on clean plastic sheeting or in a plastic bag. Field personnel will limit cross-contamination by changing gloves between sampling events. Wash water used to decontaminate the sampling equipment will be stored on Port property in labeled 55-gallon drums for subsequent characterization and disposal.

In addition to the decontamination procedures described above, sampling equipment that has visible petroleum product staining will be decontaminated by steam cleaning and/or as follows:

- Wash with brush and Liqui-Nox soap.
- Rinse with potable water.
- Rinse with distilled water.

3.2 SAMPLE CONTAINERS AND LABELING

The Field Coordinator will establish field protocol to manage field sample collection, handling, and documentation. Soil and groundwater samples obtained during this study will be placed in appropriate laboratory-prepared containers. Sample containers and preservatives are listed in Table C-4.

Sample containers will be labeled with the following information at the time of collection:

- project name and number;
- sample name, which will include a reference to depth if appropriate; and
- date and time of collection.

The sample collection activities will be noted in the field log books. The Field Coordinator will monitor consistency between the SAP, sample containers/labels, field log books, and the chain-of-custody.

3.3 SAMPLE STORAGE

Samples will be placed in a cooler with "blue ice" or double-bagged "wet ice" immediately after they are collected. The objective of the cold storage will be to attain a sample temperature of 4 degrees Celsius. Holding times will be observed during sample storage. Holding times for the project analyses are summarized in Table C-4.

3.4 SAMPLE SHIPMENT

The samples will be transported and delivered to the analytical laboratory in the coolers. Field personnel will transport and hand-deliver samples that are being submitted to a local laboratory for analysis. Samples that are being submitted to an out-of-town laboratory for analysis will be transported by a commercial express mailing service on an overnight basis. The Field Coordinator will monitor that the shipping container (cooler) has been properly secured using clear plastic tape and custody seals.

3.5 CHAIN-OF-CUSTODY RECORDS

Field personnel are responsible for the security of samples from the time the samples are taken until the samples have been received by the shipper or laboratory. A chain-of-custody (COC) form will be completed at the end of each field day for samples being shipped to the laboratory. Information to be included on the COC form includes:

- Project name and number.
- Sample identification number.
- Date and time of sampling.
- Sample matrix (soil, water, etc.) and number of containers from each sampling point, including preservatives used.
- Depth of subsurface soil sample.
- Analyses to be performed.
- Names of sampling personnel and transfer of custody acknowledgment spaces.
- Shipping information including shipping container number.

The original COC record will be signed by a member of the field team and bear a unique tracking number. Field personnel shall retain carbon copies and place the original and remaining copies in a plastic bag, placed within the cooler or taped to the inside lid of the cooler before sealing the container for shipment. This record will accompany the samples during transit by carrier to the laboratory.

3.6 LABORATORY CUSTODY PROCEDURES

The laboratory will follow their standard operating procedures (SOPs) to document sample handling from time of receipt (sample log-in) to reporting. Documentation will include at a minimum, the analysts name or initial, time, and date.

3.7 FIELD DOCUMENTATION

Field documentation provides important information about potential problems or special circumstances surrounding sample collection. Field personnel will maintain daily field logs while on-site. The field logs will be prepared on field report forms or in a bound logbook. Entries in the field logs and associated sample documentation forms will be made in waterproof ink, and corrections will consist of line-out

deletions that are initialed and dated. Individual logbooks will become part of the project files at the conclusion of the RI field explorations.

At a minimum, the following information will be recorded during the collection of each sample:

- Sample location and description.
- Site or sampling area sketch showing sample location and measured distances.
- Sampler's name(s).
- Date and time of sample collection.
- Designation of sample as composite or discrete.
- Type of sample (soil or water).
- Type of sampling equipment used.
- Field instrument readings.
- Field observations and details that are pertinent to the integrity/condition of the samples (e.g., weather conditions, performance of the sampling equipment, sample depth control, sample disturbance, etc.).
- Preliminary sample descriptions (e.g., lithologies, noticeable odors, colors, field screening results).
- Sample preservation.
- Shipping arrangements (overnight air bill number).
- Name of recipient laboratory.

In addition to the sampling information, the following specific information also will be recorded in the field log for each day of sampling:

- Team members and their responsibilities.
- Time of arrival/entry on Site and time of Site departure.
- Other personnel present at the Site.
- Summary of pertinent meetings or discussions with regulatory agency or contractor personnel.
- Deviations from sampling plans, Site safety plans, and QAPP procedures.
- Changes in personnel and responsibilities with reasons for the changes.
- Levels of safety protection.
- Calibration readings for any equipment used and equipment model and serial number.

The handling, use, and maintenance of field log books are the field coordinator's responsibilities.

4.0 CALIBRATION PROCEDURES

4.1 FIELD INSTRUMENTATION

Equipment and instrumentation calibration facilitates accurate and reliable field measurements. Field and laboratory equipment used on the project will be calibrated and adjusted in general accordance with the manufacturer's recommendations. Methods and intervals of calibration and maintenance will be based on

the type of equipment, stability characteristics, required accuracy, intended use, and environmental conditions. The basic calibration frequencies are described below.

The photo or flame-ionization detector (PID/FID) used for vapor measurements will be calibrated daily, if required (based on the model used), for site safety monitoring purposes in general accordance with the manufacturer's specifications. If daily calibration is not required for a specific PID model, calibration of the PID will be checked to make sure it is up to date. The calibration results will be recorded in the field logbook.

The Horiba U-22 water quality measuring system and Hach DR/2010 spectrophotometer used for measuring monitored natural attenuation parameters (if used) will be calibrated prior to each monitoring event in general accordance with the manufacturer's specifications. The calibration results will be recorded in the field report.

4.2 LABORATORY INSTRUMENTATION

For analytical chemistry, calibration procedures will be performed in general accordance with the methods cited and laboratory standard operating procedures. Calibration documentation will be retained at the laboratory and readily available for a period of six months.

5.0 DATA REPORTING AND LABORATORY DELIVERABLES

Laboratories will report data in formatted hardcopy and digital form. Analytical laboratory measurements will be recorded in standard formats that display, at a minimum, the field sample identification, the laboratory identification, reporting units, qualifiers, analytical method, analyte tested, analytical result, extraction and analysis dates, and detection limit (PQL only). Each sample delivery group will be accompanied by sample receipt forms and a case narrative identifying data quality issues. Laboratory electronic data deliverables (EDD) will be established by GeoEngineers, Inc., with the contract laboratory. The data submittal will be consistent with Ecology Policy 840, EIM Data Submittal Requirements. Final results will be sent to the Project Manager.

Chromatograms will be provided for samples analyzed using Ecology Methods NWTPH-Dx and NWTPH-Gx. The laboratory will assure that the full height of all peaks appear on the chromatograms and that the same horizontal time scale is used to allow for comparisons to other chromatograms.

6.0 INTERNAL QUALITY CONTROL

Table C-5 summarizes the types and frequency of Quality Control samples to be collected during the RI, including both field QC and Laboratory QC samples.

6.1 FIELD QUALITY CONTROL

Field QC samples serve as a control and check mechanism to monitor the consistency of sampling methods and the influence of off-site factors on environmental samples. Off-site factors include airborne volatile organic compounds and potable water used in drilling activities.

Field Duplicates

In addition to replicate analyses performed in the laboratory, field duplicates also serve as measures for precision. Under ideal field conditions, field duplicates (referred to as splits), are created when a volume of the sample matrix is thoroughly mixed, placed in separate containers, and identified as different

samples. This tests both the precision and consistency of laboratory analytical procedures and methods, and the consistency of the sampling techniques used by field personnel.

One field duplicate will be collected for every twenty soil samples. Duplicate soil samples will be analyzed for diesel- and oil-range hydrocarbons. A groundwater field duplicate will be collected from one of the monitoring wells and analyzed for the suite of COPCs that is specified for that well.

Trip Blanks

Trip blanks accompany groundwater sample containers used for VOC analyses during shipment and sampling periods. Trip blanks will be analyzed on a one per cooler basis.

6.2 LABORATORY QUALITY CONTROL

Laboratory quality control procedures will be evaluated through a formal data validation process. The analytical laboratory will follow standard method procedures that include specified QC monitoring requirements. These requirements will vary by method but generally include:

- method blanks
- internal standards
- calibrations
- matrix spike/matrix spike duplicates (MS/MSD)
- laboratory control spikes/spike duplicates (LCS/LCSD)
- laboratory replicates or duplicates
- surrogate spikes

Laboratory Blanks

Laboratory procedures employ the use of several types of blanks but the most commonly used blank for QA/QC assessments are method blanks. Method blanks are laboratory QC samples that consist of either a soil like material having undergone a contaminant destruction process or HPLC water. Method blanks are extracted and analyzed with each batch of environmental samples undergoing analysis. Method blanks are particularly useful during volatiles analysis since VOCs can be transported in the laboratory through the vapor phase. If a substance is found in the method blank then one (or more) of the following occurred:

- Measurement apparatus or containers were not properly cleaned and contained contaminants.
- Reagents used in the process were contaminated with a substance(s) of interest.
- Contaminated analytical equipment was not properly cleaned.
- Volatile substances in the air with high solubility or affinities toward the sample matrix contaminated the samples during preparation or analysis.

It is difficult to determine which of the above scenarios took place if blank contamination occurs. However, it is assumed that the conditions that affected the blanks also likely affected the project samples. Given method blank results, validation rules assist in determining which substances in samples are considered "real," and which ones are attributable to the analytical process. Furthermore, the guidelines state, ". . . there may be instances where little or no contamination was present in the associated blank, but qualification of the sample is deemed necessary. Contamination introduced through dilution water is one example."

Calibrations

Several types of calibrations are used, depending on the method, to determine whether the methodology is 'in control' by verifying the linearity of the calibration curve and to assure that the sample results reflect accurate and precise measurements. The main calibrations used are initial calibrations, daily calibrations, and continuing calibration verification.

Matrix Spike/Matrix Spike Duplicates (MS/MSD)

Matrix spike/spike duplicate samples are used to assess influences or interferences caused by the physical or chemical properties of the sample itself. For example, extreme pH affects the results of SVOCs. Or, the presence of a particular compound may interfere with accurate quantitation of another analyte. MS/MSD data is reviewed in combination with other QC monitoring data to determine matrix effects. In some cases, matrix affects cannot be determined due to dilution and/or high levels of related substances in the sample. A matrix spike is evaluated by spiking a known amount of one or more of the target analytes ideally at a concentration of 5 to 10 times higher than the sample result. A percent recovery is calculated by subtracting the sample result from the spike result, dividing by the spiked amount, and multiplying by 100.

The samples for the MS and MSD analyses should be collected from a boring or sampling location that is believed to exhibit low-level contamination. A sample from an area of low-level contamination is needed because the objective of MS/MSD analyses is to determine the presence of matrix interferences, which can best be achieved with low levels of contaminants. Additional sample volume will be collected for these analyses. This MS/MSD sample will be a composite to achieve a level of representativeness and reproducibility in the data.

Laboratory Control Spikes/Spike Duplicates (LCS/LCSD)

Also known as blanks spikes, laboratory control spikes are similar to matrix spikes in that a known amount of one or more of the target analytes are spiked into a prepared media and a percent recovery of the spiked substances are calculated. The primary difference between a matrix spike and LCS is that the LCS spike media is considered "clean" or contaminant free. For example, HPLC water is typically used for LCS water analyses. The purpose of an LCS is to help assess the overall accuracy and precision of the analytical process including sample preparation, instrument performance, and analyst performance. LCS data must be reviewed in context with other controls to determine if out-of-control events occur.

Laboratory Replicates/Duplicates

Laboratories often utilize MS/MSDs, LCS/LCSDs, and/or replicates to assess precision. Replicates are a second analysis of a field collected environmental sample. Replicates can be split at varying stages of the sample preparation and analysis process, but most commonly occur as a second analysis on the extracted media.

Surrogate Spikes

The purposes of using a surrogate are to verify the accuracy of the instrument being used and extraction procedures. Surrogates are substances similar to, but not one of, the target analytes. A known concentration of surrogate is added to the sample and passed through the instrument, noting the surrogate recovery. Each surrogate used has an acceptable range of percent recovery. If a surrogate recovery is low, sample results may be biased low and depending on the recovery value, a possibility of false negatives may exist. Conversely, when recoveries are above the specified range of acceptance a possibility of false positives exist, although non-detected results are considered accurate.

7.0 DATA REDUCTION AND ASSESSMENT PROCEDURES

7.1 DATA REDUCTION

Data reduction involves the conversion or transcription of field and analytical data to a useable format. The laboratory personnel will reduce the analytical data for review by the Quality Assurance Leader and Project Manager.

7.2 FIELD MEASUREMENT EVALUATION

Field data will be reviewed at the end of each day by following the quality control checks outlined below and procedures in the SAP. Field data documentation will be checked against the applicable criteria as follows:

- Sample collection information.
- Field instrumentation and calibration.
- Sample collection protocol.
- Sample containers, preservation and volume.
- Field QC samples collected at the frequency specified.
- Sample documentation and chain-of-custody (COC) protocols.
- Sample shipment.

Cooler receipt forms and sample condition forms provided by the laboratory will be reviewed for out-of-control incidents. The final report will contain what effects, if any, an incident has on data quality. Sample collection information will be reviewed for correctness before inclusion in a final report.

7.3 FIELD QUALITY CONTROL EVALUATION

A field quality control evaluation will be conducted by reviewing field log books and daily reports, discussing field activities with staff, and reviewing field QC samples (trip blanks and field duplicates). Trip blanks will be evaluated using the same criteria as method blanks.

Precision for field duplicate soil samples will not be evaluated because even a well mixed sample is not entirely homogenous due to sampling procedures, soil conditions, and contaminant transport mechanisms.

7.4 LABORATORY DATA QUALITY CONTROL EVALUATION

The laboratory data assessment will consist of a formal review of the following quality control parameters:

- Holding times.
- Method blanks.
- Matrix spike/spike duplicates.
- Laboratory control spikes/spike duplicates.
- Surrogate spikes.
- Replicates.

In addition to these quality control mechanisms, other documentation such as cooler receipt forms and case narratives will be reviewed to fully evaluate laboratory QA/QC.

TABLE C-1
MEASUREMENT QUALITY OBJECTIVES
FORMER SHELL OIL TANK FARM
ANACORTES, WASHINGTON

		Check Standard (LCS) %R Limits[2,3]		Matrix Spike (MS) %R Limits[3]		Surrogate Standards (SS) %R Limits [1,2,3]	MS Duplicate Samples or Lab Duplicate RPD Limits[4]		Field Duplicate Samples RPD Limits[4]	
Laboratory Analysis	Reference Method	Soil	Water	Soil	Water	Soil/Water	Soil	**Water**	Soil	**Water**
Gasoline-range petroleum hydrocarbons	Ecology NWTPH-Gx	70%-130%	70%-130%	NA	NA	70%-130%	≤30%	≤30%	≤35%	≤20%
Diesel- and Heavy oil-range Hydrocarbons	Ecology NWTPH-Dx with silica gel/acid wash cleanup	50%-150%	50%-150%	NA	NA	50%-150%	≤40%	≤40%	≤35%	≤20%
BTEX	EPA 8021	70%-130%	70%-130%	70%-130%	70%-130%	70%-130%	≤30%	≤30%	≤35%	≤20%
VOCs	EPA 8260	70%-130%	70%-130%	70%-130%	70%-130%	70%-130%	≤30%	≤30%	≤35%	≤20%
cPAHs/Naphthalenes	EPA 8270SIM	70%-130%	70%-130%	70%-130%	70%-130%	70%-130%	≤30%	≤30%	≤35%	≤20%
PCBs	EPA 8082 Modified	70%-130%	70%-130%	70%-130%	70%-130%	70%-130%	≤40%	≤40%	≤35%	≤20%
Metals	EPA 6010/7060/7470/7471/7421	80%-120%	80%-120%	75%-125%	75%-125%	NA	≤20%	≤20%	≤35%	≤20%

Notes:

Method numbers refer to EPA SW-846 Analytical Methods or Washington State Department of Ecology (Ecology) recommended analytical methods.

[1] Individual surrogate recoveries are compound specific

[2] Recovery Ranges are estimates. Actual ranges will be provided by the laboratory when contracted.

[3] Percent Recovery Limits are expressed as ranges based on laboratory control limits. Limits will vary for individual analytes

[4] RPD control limits are only applicable if the concentration are greater than 5 times the method reporting limit (MRL). For results less than 5 times the MRL, the difference between the sample and duplicate must be less than 2X the MRL for soils and 1X the MRL for waters.

VOCs = Volatile Organic Compounds

BTEX = benzene, toluene, ethylbenzene, xylenes

cPAHs = carcinogenic polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

LCS = Laboratory Control Sample

MS/MSD = Matrix Spike/Matrix Spike Duplicate

RPD = Relative Percent Difference

NA = Not Applicable

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Table C-2
Methods of Analysis and Target Reporting Limits (Soil)
Former Shell Oil Tank Farm
Anacortes, Washington

Analyte	Analytical Method	Method Reporting Limit
Total Petroleum Hydrocarbons (mg/kg)		
TPH-GASOLINE	NWTPH-Gx	3
TPH-DIESEL RANGE	NWTPH-Dx with silica gel/acid wash cleanup	25
TPH-OIL RANGE	NWTPH-Dx with silica gel/acid wash cleanup	50
BTEX (mg/kg)		
BENZENE	EPA 8021	0.03
TOLUENE	EPA 8021	0.05
ETHYLBENZENE	EPA 8021	0.05
XYLENES	EPA 8021	0.2
Volatile Organic Compounds (mg/kg)		
BENZENE	EPA 8260	0.01
TOLUENE	EPA 8260	0.01
ETHYLBENZENE	EPA 8260	0.01
M+P XYLENE	EPA 8260	0.02
O-XYLENE	EPA 8260	0.01
METHYL T-BUTYL ETHER (MTBE)	EPA 8260	0.01
1,2-DICHLOROETHANE (EDC)	EPA 8260	0.01
1,2-DIBROMOETHANE (EDB)	EPA 8260	0.005
TETRACHLOROETHYLENE (PCE)	EPA 8260	0.01
TRICHLOROETHENE (TCE)	EPA 8260	0.01
1,1,1-TRICHLOROETHANE (1,1,1-TCA)	EPA 8260	0.01
CIS-1,2-DICHLOROETHENE (cis-1,2-DCE)	EPA 8260	0.01
VINYL CHLORIDE	EPA 8260	0.01
TRICHLOROFLUOROMETHANE (Freon)	EPA 8260	0.01
CARBON TETRACHLORIDE	EPA 8260	0.01
cPAHs/naphthalenes (mg/kg)		
NAPHTHALENE	EPA 8270 SIM	0.02
1-METHYLNAPHTHALENE	EPA 8270 SIM	0.02
2-METHYLNAPHTHALENE	EPA 8270 SIM	0.02
BENZO[A]ANTHRACENE	EPA 8270 SIM	0.02
CHRYSENE	EPA 8270 SIM	0.02
BENZO[B]FLUORANTHENE	EPA 8270 SIM	0.02
BENZO[K]FLUORANTHENE	EPA 8270 SIM	0.02
BENZO(A)PYRENE	EPA 8270 SIM	0.02
INDENO[1,2,3-CD]PYRENE	EPA 8270 SIM	0.02
DIBENZ[A,H]ANTHRACENE	EPA 8270 SIM	0.02
Polychlorinated Biphenyls (mg/kg)		
Total PCBs	EPA 8082 MOD	0.1
Metals (mg/kg)		
Cadmium	EPA 6010	1.0
Lead	EPA 6010	5.0

Notes:
BTEX = benzene, toluene, ethylbenzene, xylene
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
mg/kg = milligrams per kilogram

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Table C-3
Methods of Analysis and Target Reporting Limits (Groundwater)
Former Shell Oil Tank Farm
Anacortes, Washington

Analyte	Analytical Method	Method Reporting Limit
Total Petroleum Hydrocarbons (µg/L)		
TPH-GASOLINE	NWTPH-Gx	50
TPH-DIESEL RANGE	NWTPH-Dx with silica gel/acid wash cleanup	130
TPH-OIL RANGE	NWTPH-Dx with silica gel/acid wash cleanup	250
BTEX (µg/L)		
BENZENE	EPA 8021	1
TOLUENE	EPA 8021	1
ETHYLBENZENE	EPA 8021	1
XYLENES	EPA 8021	3
Volatile Organic Compounds (µg/L)		
BENZENE	EPA 8260	2
TOLUENE	EPA 8260	2
ETHYLBENZENE	EPA 8260	2
M+P XYLENE	EPA 8260	4
O-XYLENE	EPA 8260	2
METHYL T-BUTYL ETHER (MTBE)	EPA 8260	2
1,2-DICHLOROETHANE (EDC)	EPA 8260	2
1,2-DIBROMOETHANE (EDB)	EPA 8260	2
TETRACHLOROETHYLENE (PCE)	EPA 8260	2
TRICHLOROETHENE (TCE)	EPA 8260	2
1,1,1-TRICHLOROETHANE (1,1,1-TCA)	EPA 8260	2
CIS-1,2-DICHLOROETHENE (cis-1,2-DCE	EPA 8260	2
VINYL CHLORIDE	EPA 8260	0.2
TRICHLOROFLUOROMETHANE (Freon)	EPA 8260	2
CARBON TETRACHLORIDE	EPA 8260	2
cPAHs/naphthalenes (µg/L)		
NAPHTHALENE	EPA 8270 SIM	0.02
1-METHYLNAPHTHALENE	EPA 8270 SIM	0.02
2-METHYLNAPHTHALENE	EPA 8270 SIM	0.02
BENZO[A]ANTHRACENE	EPA 8270 SIM	0.02
CHRYSENE	EPA 8270 SIM	0.02
BENZO[B]FLUORANTHENE	EPA 8270 SIM	0.03
BENZO[K]FLUORANTHENE	EPA 8270 SIM	0.03
BENZO(A)PYRENE	EPA 8270 SIM	0.02
INDENO[1,2,3-CD]PYRENE	EPA 8270 SIM	0.02
DIBENZ[A,H]ANTHRACENE	EPA 8270 SIM	0.03
Polychlorinated Biphenyls (µg/L)		
Total PCBs	EPA 8082 MOD	0.1
Metals (µg/L)		
Cadmium	EPA 6010	5
Lead	EPA 7421	3

Notes:
BTEX = benzene, toluene, ethylbenzene, xylene
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
µg/L = micrograms per liter

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TABLE C-4
TEST METHODS, SAMPLE CONTAINERS, PRESERVATION & HOLDING TIME
FORMER SHELL OIL TANK FARM
ANACORTES, WASHINGTON

		Soil				Groundwater			
Analysis	**Method**	**Minimum Sample Size**	**Sample Containers**	**Sample Preservation**	**Holding Times**	**Minimum Sample Size**	**Sample Containers**	**Sample Preservation**	**Holding Times**
Gasoline Range Hydrocarbons	Ecology NWTPH-Gx	100 g*	4 or 8 oz glass widemouth with Teflon-lined lid and 5035 kit with methanol preserved vial	Cool 4°C	14 days	120 mL	3 - 40 mL VOA Vials	HCl - pH<2	14 days preserved 7 days unpreserved
Diesel- and Oil-Range Hydrocarbons	Ecology NWTPH-Dx with silica gel/acid wash cleanup	100 g	8 or 16 oz amber glass wide-mouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4 C, HCl to pH < 2	14 days to extraction 40 days from extraction to analysis
BTEX	EPA 8021	100 g*	4 or 8 oz glass widemouth with Teflon-lined lid and 5035 kit with methanol preserved vial	Cool 4°C	14 days	120 mL	3 - 40 mL VOA Vials	HCl - pH<2	14 days preserved 7 days unpreserved
VOCs	EPA 8260	100 g	4 or 8 oz glass widemouth with Teflon-lined lid and 5035 kit with methanol preserved vial and two dry vials	Cool 4°C	48 hours to freeze samples in laboratory then 14 days	120 mL	3 - 40 mL VOA Vials	HCl - pH<2	14 days preserved 7 days unpreserved
cPAHs and Naphthalenes	EPA 8270SIM	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction 40 days from extraction to analysis
PCBs	EPA 8082 Modified	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction 40 days from extraction to analysis
Metals**	EPA 6010/7060/7470/7471/7421	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	180 days/ 28 days for Mercury	500 mL	1 L poly bottle	HNO_3 - pH<2 (Dissolved metals preserved after filtration)	180 days (28 days for Mercury)

Notes:

Holding Times are based on elapsed time from date of collection

* For both soil and water the Gx and BTEX can be combined and do not require separate containers

**Metals to be analyzed are cadmium and lead. Groundwater samples to be analyzed for both total and dissolved metals.

BTEX = benzene, toluene, ethylbenzene, xylenes

VOCs = Volatile organic compounds (to include 1,1,1-trichloroethane (1,1,1-TCA), cis-1,2-dichloroethene (cis-1,2-DCE), vinyl chloride (VC), trichlorofluoromethane, carbon tetrachloride, tetrachloroethene (PCE), trichloroethene (TCE), ethylene dibromide (EDB), 1,2-dichloroethane (EDC), and methyl tert butyl ether (MTBE).

cPAHs = carcinogenic polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

HCl = Hydrochloric Acid

HNO_3 = Nitric Acid

oz = ounce

mL = milliliter

L = liter

g = gram

TABLE C-5
QUALITY CONTROL SAMPLES TYPE AND FREQUENCY
FORMER SHELL OIL TANK FARM
ANACORTES, WASHINGTON

Parameter	Field QC		Laboratory QC			
	Field Duplicates	Trip Blanks	Method Blanks	LCS	MS / MSD	Lab Duplicates
Gas Range Hydrocarbons	1/20 groundwater samples	NA	1/batch	1/batch	NA	1/batch
Diesel and Oil Range Hydrocarbons with silica gel/acid wash cleanup	1/20 groundwater samples and 1/20 soil samples	NA	1/batch	1/batch	NA	1/batch
BTEX	1/20 groundwater samples	1/cooler	1/batch	1/batch	1 set/batch	NA
VOCs	1/20 groundwater samples	1/cooler	1/batch	1/batch	1 set/batch	NA
cPAHs/naphthalenes	1/20 groundwater samples	NA	1/batch	1/batch	1 set/batch	NA
PCBs	1/20 groundwater samples	NA	1/batch	1/batch	1 set/batch	NA
Metals*	1/20 groundwater samples	NA	1/batch	1/batch	1 MS/batch	1/batch

Note:

An analytical lot or batch is defined as a group of samples taken through a preparation procedure and sharing a method blank, LCS, and MS/ MSD (or MS and lab duplicate

No more than 20 field samples can be contained in one batch.

LCS = Laboratory control sample

MS = Matrix spike sample

MSD = Matrix spike duplicate sample

VOCs = Volatile organic compounds (to include 1,1,1-trichloroethane (1,1,1-TCA), cis-1,2-dichloroethene (cis-1,2-DCE), vinyl chloride (VC), trichlorofluoromethane, carbon tetrachloride, tetrachloroethene (PCE), trichloroethene (TCE), ethylene dibromide (EDB), 1,2-dichloroethane (EDC), and methyl tert butyl ether (MTBE).

BTEX = benzene, toluene, ethylbenzene, xylenes

cPAHs = carcinogenic polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

*Metals to be analyzed are cadmium and lead.

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GeoEngineers

APPENDIX D
HEALTH AND SAFETY PLAN

GEOENGINEERS, INC.

SITE HEALTH & SAFETY PLAN (HASP)

RI/FS at Former Shell Oil Tank Farm Site

This HASP is to be used in conjunction with the GeoEngineers Safety Program Manual. Together, the written safety programs and this HASP constitute the site safety plan for this site. This plan is to be used by GeoEngineers personnel on this site and must be available on site. If the work entails potential exposures to other substances or unusual situations, additional safety and health information will be included and the plan will be approved by the GeoEngineers Health and Safety Manager. All plans are to be used in conjunction with current standards and policies outlined in the GeoEngineers Health and Safety Program Manual.

General Project Information

Project Name:	Former Shell Oil Tank Farm Remedial Investigation
Project Number:	005147-012-01
Type of Project:	Drilling Oversight, Soil and Groundwater Sampling, Monitoring Well Installation, Development and Sampling
Project Address:	East and West of Q Avenue between 13th Street and 14th Street Anacortes, Washington 98221
Start/Completion:	TBD
Subcontractors:	Applied Professional Services, Inc., Cascade Drilling, Inc., Analytical Resources, Inc., or CCI Analytical Laboratories, Inc.

Liability Clause - This Site Safety Plan is intended for use by GeoEngineers Employees only. It does not extend to the other contractors or subcontractors working on this site. If requested by subcontractors, this site safety plan may be used as a minimum guideline for those entities to develop safety plans or procedures for their own staff to work under. In this case, Form C-3 shall be signed by the subcontractor.

ORGANIZATION CHART

CHAIN of COMMAND	TITLE	NAME	TELEPHONE NUMBERS
1	Project Manager	Jim Roth	O: (206) 239-3243 C: (425) 681-0686
2	HAZWOPER Supervisor	Leah Alcyon, CIH	O: (206) 239-3254 C: (206) 226-2668
3	Field Engineer/Geologist	Zanna Satterwhite Cindy Bartlett	O: (206) 239-3231 C: (206) 499-7588 O: (425) 861-6021 C: (425) 736-5745
4	Site Safety and Health Supervisor (Site Safety Officer; SSO)	Cindy Bartlett and Zanna Satterwhite	See above
5	Client Assigned Site Supervisor	Port of Anacortes Connie Thoman	(360) 299-1818
6	Health and Safety Program	Leah Alcyon, CIH	O: (206) 239-3254

	Manager (HSM)		C: (206) 226-2668
N/A	Subcontractor(s)	Cascade Drilling	(425) 485-8908
		Port of Anacortes	
	Current Owner	Bob Elsner	(360) 299-1818

Site Safety and Health Supervisor -- The individual present at a hazardous waste site responsible to the employer and who has the authority and knowledge necessary to establish the site-specific health and safety plan and verify compliance with applicable safety and health requirements.

GeoEngineers employees often do not have stop work authority on projects controlled by other contractors; however, any GeoEngineers employee, regardless of job title, working in the field will be responsible for contacting the Project Manager if they observe practices on the job site that are serious safety violations that are not under their control. They will document the unsafe practices and will contact the site supervisor as identified by the client. If no one is on site, the Project Manager, once notified, will contact the client. This action establishes GeoEngineers commitment to site health and safety on all job sites as our duty of care to the public, contractors, and clients.

PERSONNEL TRAINING RECORDS

Name of Employee on Site	Level of HAZWOPER Training (24/ 40 hr)	Date of 8 Hr Refresher Training	Date of HAZWOPER Supervisor Training	First Aid/ CPR	Date of Other Trainings	Date of Respirator Fit Test
Zanna Satterwhite	40 hr	3/4/08	yes	7/2/2007		3/7/08
Cindy Bartlett	40 hr	8/15/08	yes	5/12/2008		N/A

EMERGENCY INFORMATION

Hospital Name and Address:

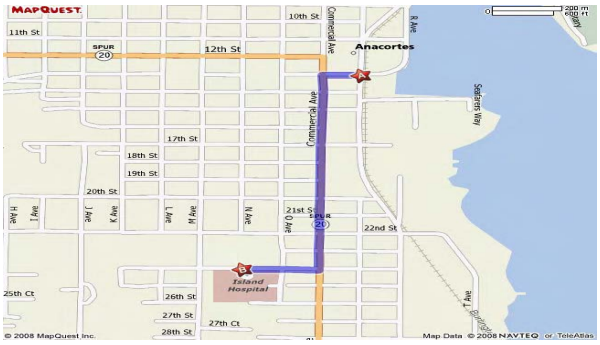
Island Hospital
1211 24th Street
Anacortes, WA 98221

Phone Numbers (Hospital ER): Phone: (360) 468-3185 /(360) 299-1300

Distance: 0.83 miles

Route to Hospital:

1. Start out going WEST on 13TH ST toward COMMERCIAL AVE.
2. Turn LEFT onto COMMERCIAL AVE.
3. Turn RIGHT onto 24TH ST.
4. End at 1211 24th St Anacortes, WA 98221-2557.



Ambulance: 9-1-1

Poison Control: Seattle (206) 253-2121; Other (800) 732-6985

Police: 9-1-1

Fire: 9-1-1

Location of Nearest Telephone: Cell phones are carried by field personnel.

Nearest Fire Extinguisher: Located in the GEI vehicle on site.

Nearest First-Aid Kit: Located in the GEI vehicle on site.

Standard Emergency Procedures

1. Get help -
   - send another worker to phone 911 (if necessary)
   - as soon as feasible, notify GeoEngineers' project manager
2. Reduce risk to injured person -
   - turn off equipment
   - move person from injury location (if possible)
   - keep person warm
   - perform CPR (if necessary)
3. Transport injured person to medical treatment facility (if necessary) -
   - by ambulance (if necessary) or GeoEngineers vehicle
   - stay with person at medical facility
   - keep GeoEngineers manager apprised of situation and notify human resources manager of situation

COMPREHENSIVE WORK PLAN

- Work with the Port to obtain a Right-of-Way Permit from the City of Anacortes, including preparation of a streamlined traffic control plan.
- Mark the locations of the proposed soil borings in the field.
- Coordinate a public utility locate (one-call) and a private utility locating company to mark underground utilities in the vicinity of the proposed borings. Drilling locations in the public right

of way may be cleared to five feet bgs by hand digging or air knife (vacuum truck) prior to drilling if utility locates are not definitive.

- Observe coring of surface concrete as necessary at proposed boring locations.
- Observe completion of approximately 25 direct-push borings to a depth of 12 feet below ground surface (bgs) by a Washington-licensed drilling company. Collect continuous 2-foot or 4-foot soil core samples during drilling for field screening and lithologic characterization.
- Record drilling activities and characterize soil types and field screening results on borehole logs; collect representative soil samples from target depth intervals for laboratory analysis.
- Observe completion of approximately 6 monitoring wells, to be installed with a hollow-stem auger rig.
- Develop monitoring wells.
- Collect water level measurements at monitoring wells.
- Sample monitoring wells using low-flow methods and a peristaltic pump.
- Soil and/or groundwater samples will be submitted for laboratory analysis of one or more of the following: gasoline-, diesel-, and motor oil-range total petroleum hydrocarbons (TPH); volatile organic compounds (VOCs), total metals (arsenic, cadmium, chromium, mercury, lead); carcinogenic polycyclic aromatic hydrocarbons (cPAHs); polychlorinated biphenyls (PCBs), and naphthalenes.

LIST OF FIELD ACTIVITIES

Check the activities to be completed during the project

X	Site reconnaissance
X	Exploratory borings
	Construction monitoring
	Surveying
	Test pit exploration
X	Monitor well installation
X	Monitor well development
X	Soil sample collection
X	Field screening of soil samples
X	Vapor measurements
X	Groundwater sampling
X	Groundwater depth and free product measurement
	Product sample collection
	Soil stockpile testing
	Remedial excavation
	Underground storage tank (UST) removal monitoring
	Remediation system monitoring
	Recovery of free product

HAZARD ANALYSIS

- *Note: A hazard assessment will be completed at every site prior to beginning field activities. Updates will be included in the daily log. This list is a summary of hazards listed on the form.*

Physical Hazards

X	Drill rigs and Concrete Coring
	Backhoe
	Trackhoe
	Crane
	Front End Loader
	Excavations/trenching (1:1 slopes for Type B soil)
	Shored/braced excavation if greater than 4 feet of depth
X	Overhead hazards/power lines
X	Tripping/puncture hazards
X	Unusual traffic hazard – Street traffic
X	Heat/ Cold, Humidity
X	Utilities/ utility locate

- Utility check list completed—there may be site specific procedures for preventing drilling or digging into utilities. Add these procedures to the standard GeoEngineers utility check list.
- Lifting hazards: use proper techniques, mechanical devices where appropriate.
- Terrain obstacles: the site is unpaved, but relatively flat. Workers will take care to maintain footing, and keep walking and work surfaces free of hazards and debris.
- Work areas will be marked with reflective cones, barricades and/or caution tape. The site is a vacant lot, with no perimeter fencing. During investigation activities, work zones will be constructed around operating machinery using barricades, caution tape, or temporary construction fencing. Personnel will wear high-visibility vests for increased visibility by vehicle and equipment operators.
- The drilling rig may be equipped with various winches, motors, and other machines. If present, they represent a general physical hazard from moving parts. Personnel will stand clear of machinery at all times unless specific instructions are given by the contractor or other person authority. Steel toe shoes or boots and hard hats will be worn at all times when on site. Appropriate guards will be in place during equipment use.
- Field personnel will be aware constantly of the location and motion of heavy equipment. A safe distance will be maintained between personnel and the equipment. Personnel will be visible to the operator at all times and will remain out of the swing and/or direction of the equipment apparatus. Personnel will approach operating heavy equipment only when they are certain the operator has indicated it is safe to do so.
- Heavy equipment and/or vehicles used on this site will not work within 20 feet of overhead utility lines without first ensuring that the lines are not energized. This distance may be reduced to 10 feet depending on the client and the use of a safety watch.
- Overhead Power Line Clearance Safety-Working equipment around overhead power lines requires distance and a spotter. Before a job begins, call the utility company and find out voltage

in lines. Have the equipment de-energized if possible. Ensure that the equipment remains de-energized by using some type of lockout and tag procedure, and ensure that the electrician uses grounding lines when they are required.

- Keep a safe distance from energized parts which is a minimum of 10 feet for 50 kV and under. The minimum distance will be more for higher voltages (above 50kV). The only exception is for trained and qualified electrical workers using insulated tools designed for high voltage lines.
- Don't operate equipment around overhead power lines unless you are authorized and trained to do so. If an object (scaffolds, crane, etc.) must be moved in the area of overhead power lines, appoint a competent worker whose sole responsibility is to observe the clearance between the power lines and the object. Warn others if the minimum distance is not maintained.
- Never touch an overhead line if it has been brought down by machinery or has fallen. Never assume lines are dead. When a machine is in contact with an overhead line, DO NOT allow anyone to come near or touch the machine. Stay away from the machine and summon outside assistance. Never touch a person who is in contact with a live power line.
- If you are in a vehicle that is in contact with an overhead power line, DON'T LEAVE THE VEHICLE. As long as you stay inside and avoid touching metal on the vehicle, you may avoid an electrical hazard. If you need to get out to summon help or because of fire, jump out without touching any wires or the machine, keep your feet together, and hop to safety.
- When mechanical equipment is being operated near overhead power lines, employees standing on the ground may not contact the equipment unless it is located so that the required clearance cannot be violated even at the maximum reach of the equipment.
- When working near overhead power lines, the use of nonconductive wooden or fiberglass ladders is recommended. Aluminum ladders and metal scaffolds or frames are efficient conductors of electricity.
    - Avoid storing materials under or near overhead power lines.
- Personnel will avoid tripping hazards, steep slopes, pit and other hazardous encumbrances. If it becomes necessary to work within 6 feet of the edge of a pit, slope, pier or other potentially hazardous area, appropriate fall protection measures will be implemented by the Site Safety and Health Supervisor in accordance with OSHA/DOSH regulations and the GeoEngineers Safety Program manual.
- Heat stress control measures must be implemented according to the GeoEngineers, Inc. program with water provided on site. See Additional Programs at end of this HASP.
- Excessive levels of noise (exceeding 85 dBA) are anticipated during drilling. Personnel potentially exposed will wear ear plugs or muffs with a noise reduction rating (NRR) of at least 25 dB whenever it becomes difficult to carry on a conversation 6 feet away from a co-worker or whenever noise levels become bothersome. (Increasing the distance from the source will decrease the noise level noticeably.)

Engineering Controls

	Trench shoring (1:1 slope for Type B Soils)
X	Locate work spaces upwind/wind direction monitoring
	Other soil covers (as needed)
	Other (specify _____

Chemical Hazards (potentially present at site)

Maximum Soil Chemistry (mg/kg)	
	Petroleum Products
0.069	Naphthalenes
1.8(E) ;0.1(T) ;1.1(X)	Aromatic hydrocarbons (ethylbenzene, toluene, xylenes [ETX])
2,200	Gasoline
22,000	Diesel fuel
	Waste oil
3,300	Other petroleum fuels (list) Heavy Oil
	Organic Compounds
ND	PCBs
Not analyzed	PCE, TCE
0.173 TEQ	PAHs (polycyclic aromatic hydrocarbons)
	Other
	Metals
28	Lead
6.4	Cadmium

Summary of Chemical Hazards

Compound/ Description	Exposure Limits/IDLH[b]	Exposure Routes	Toxic Characteristics[d]
Gasoline		Inhalation, skin, absorption, ingestion, direct dermal contact	Irritation to eyes, skin, mucus membranes, dermatitis, headache, exhaustion, blurred vision, dizziness, slurred speech, confusion, convulsions, liver or kidney damage.
Diesel Fuel—liquid with a characteristic odor	None established by OSHA, but ACGIH has adopted 100 mg/m^3 for a TWA (as total hydrocarbons)	Ingestion, inhalation, skin absorption, skin and eye contact	Irritated eyes, skin, and mucous membrane; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; and headache, and dermatitis

Compound/ Description	Exposure Limits/IDLH[b]	Exposure Routes	Toxic Characteristics[d]
Mineral Oil – As a mist	The current OSHA PEL for mineral oil mist is 5 mg/m^3 of air as an 8-hr TWA	If the oil is not a mist, then route of exposure is skin and eye contact	Exposure to oil mists can cause eye, skin, and upper respiratory tract irritation
Mineral based crankcase oil – may contain metals, gas, antifreeze and PAHs	It depends on the contaminants	Ingestion, inhalation, skin absorption, skin and eye contact	It depends on the contaminants.
Polycyclic aromatic hydrocarbons (PAH) as coal tar pitch volatiles	PEL 0.2 mg/m^3 TLV 0.2 mg/m^3 REL 0.1 mg/m^3 IDLH 80 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Dermatitis, bronchitis, potential carcinogen
Benzene	PEL 5 ppm IDLH 500 ppm	Inhalation, ingestion, skin absorption, and/or direct contact	Irritation of eyes, skin, nose, respiratory system, dizziness, headache, nausea, staggered gait, anorexia, exhaustion, dermatitis, bone marrow depression (leukemia).
Toluene	PEL 100 ppm IDLH 500 ppm	Inhalation, absorption, ingestion, direct contact	Irritation to eyes, nose, exhaustion, confusion, dizziness, headaches, dilated pupils, euphoria, anxiety, teary eyes, muscle fatigue, insomnia, paresthesia, dermatitis, liver and kidney damage.
Ethyl benzene	PEL 100 ppm IDLH 800 ppm	Inhalation, ingestion, direct contact	Irritation to eyes, skin, respiratory system, burning of skin, dermatitis.
Xylenes	PEL 100 ppm IDLH 900 ppm	Inhalation, skin absorption, ingestion, direct contact	Irritation to eyes, skin, nose, throat, dizziness, excitement, drowsiness, incoordination, staggering gait, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis.
MTBE	PEL 40 ppm	Ingestion, Inhalation, skin absorption, direct contact	Irritation to eyes, skin, nose, throat and lungs, aspiration, chemical pneumonia, nausea, vomiting, diarrhea, tremors, convulsions, loss of consciousness, headache, dizziness, loss of balance or coordination.

Compound/ Description	Exposure Limits/IDLH[b]	Exposure Routes	Toxic Characteristics[d]
Perchloroethylene (PCE)	PEL 100 ppm IDLH 150 ppm	Inhalation, absorption, ingestion, dermal contact	Irritation to eyes, nose, throat, nausea, flush face or neck, vertigo, dizziness, incoherence, headache, drowsiness, skin redness, liver damage.
Trichloroethylene (TCE)	PEL 100 ppm IDLH 1000 ppm	Inhalation, absorption, ingestion, dermal contact	Irritation to eyes, skin, headaches, vertigo, distorted vision, fatigue, giddiness, tremors, drowsiness, nausea, vomiting, dermatitis, cardiac arrhythmia, paresthesia.
Lead (and inorganic compounds as lead)	PEL 0.05 mg/m3 TLV 0.05 mg/m3 REL 0.05 mg/m3 IDLH 100 mg/m3	Inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion), insomnia, facial pallor, anorexia, weight loss, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremor, wrist and ankle paralysis, encephalopathy, kidney disease, irritated eyes, hypotension
Cadmium as dust	OSHA PEL 0.005 mg/m^3 IDLH 9 mg/m^3	respiratory system, kidneys, prostate, blood	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]

Groundwater Sampling: Splash hazard associated with groundwater extraction and sample collection. Possible corrosion hazard associated with sample preservatives. Wear protective clothing and eye protection and chemical-resistant gloves are required when handling samples.

Sample handling, packaging, and processing: skin contact with contaminated media and preservative acids. Wear modified Level D PPE.

Decontamination of equipment: inhalation or eye contact or skin contact with airborne mists or vapors, or contaminated liquids. Wear safety glasses; decontaminate clothing and skin prior to eating, drinking or other hand to mouth contact.

Biological Hazards and Procedures

Y/N	Hazard	Procedures
N	Poison Ivy or other vegetation	
N	Insects or snakes	
N	Used hypodermic needs or other infectious hazards	**Do not pick up or contact**
	Others	

Site personnel shall avoid contact with or exposures to potential biological hazards encountered.

Additional Hazards (Update in Daily Log)

Include evaluation of:

- *Physical Hazards* (equipment, traffic, tripping, heat stress, cold stress and others)
- *Chemical Hazards* (odors, spills, free product, airborne particulates and others present)
- *Biological Hazards* (snakes, spiders, other animals, discarded needles, poison ivy and others present)

AIR MONITORING PLAN

Work upwind if at all possible.

Check instrumentation to be used:

_____ TLV Monitor (flammability only, for methane and petroleum vapors)
__X__ PID (Photoionization Detector)
_____ Other (i.e., detector tubes): _____

Check monitoring frequency/locations: and type (specify: work space, borehole, breathing zone):

_____ 15 minutes - Continuous during soil disturbance activities or handling samples
_____ 15 minutes
_____ 30 minutes
__X__ Hourly (in breathing zone during excavations, drilling, sampling)

Action levels:

- The workspace will be monitored using a photoionization detector (PID). These instruments must be properly maintained, calibrated and charged (refer to the instrument manuals for details). Zero this meter in the same relative humidity as the area it will be used in and allow at least a 10-minute warm-up prior to zeroing. Do not zero in a contaminated area. The PID can be tuned to read chemicals specifically if there are not multiple contaminants on site. It can be tuned to detect one chemical with response factor entered into the equipment, but the PID picks up all volatile organic compounds (VOCs) present. Ionization potential (IP) of chemical has to be less than lamp (11.7/ 10.6eV) and PID does not detect methane. The ppm readout on the instrument is relative to the IP of isobutylene (calibration gas), so conversion must be made in order to estimate ppm of the chemical on-site.

- An initial vapor measurement survey of the site should be conducted to detect "hot spots" if contaminated soil is exposed at the surface. Vapor measurement surveys of the workspace should be conducted at least hourly or more often if persistent petroleum-related odors are detected. Additionally, if vapor concentrations exceed 5 ppm above background continuously for a 5-minute period as measured in the breathing zone, upgrade to Level C PPE or move to a noncontaminated area.
- Standard industrial hygiene/safety procedure is to require that action be taken to reduce worker exposure to organic vapors when vapor concentrations exceed ½ the TLV. Because of the variety of chemicals, the PID will not indicate exposure to a specific PEL and is therefore not a preferred tool for determining worker exposure to chemicals. If odors are detected, then employees will upgrade to respirator with Organic Vapor cartridges and will contact the Health and Safety Program Manager for other sampling options.

Air Monitoring Action Levels

Contaminant	Activity	Monitoring Device	Frequency of Monitoring Breathing Zone	Action Level	Action
Organic Vapors	Environmental Explorations and Sampling	PID	Start of shift; every 30 to 60 minutes and in event of odors	Background to 5 parts per million (ppm) in breathing zone	Use Level D or Modified Level D PPE
Organic Vapors	Environmental Explorations and Sampling	PID	Start of shift;; every 30 to 60 minutes and in event of odors	5 to 25 ppm in breathing zone	Upgrade to Level C PPE
Organic Vapors	Environmental Explorations and Sampling	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes	> 25 ppm in breathing zone	Stop work and evacuate the area. Contact Certified Industrial Hygienist (CIH) for guidance.

SITE CONTROL PLAN

An up-to-date site control plan will be developed before field activities begin to minimize employee exposure to hazardous substances and including the following: a site map is included with the Sampling and Analysis Plan. The hospital route map is included with this HASP.

TRAFFIC OR VEHICLE ACCESS CONTROL PLANS

GeoEngineers will work with the Port to obtain a Right-of-Way Permit from the City of Anacortes for borings performed near sidewalks and on roads, including preparation of a streamlined traffic control plan. Flagging and Traffic Control, if needed, will be performed by contractors to GeoEngineers. All persons contracting to perform flagging will have on site a current flagging card indicating that they are trained.

Traffic control procedures and devices must be used in accordance with Part VI of the Manual on Uniform Traffic Control Devices (MUTCD) and Washington Safety and Health Standard WAC 296-155-305. Where flaggers are needed, supervisor must ensure that each flagger has the qualifications, training and equipment necessary to perform assigned task in accordance with the MUTCD. Training must be updated every 3 years. At a minimum, flaggers must have a stop/slow paddle, high visibility clothing, safety shoes, and a hard hat, before approaching any right of way to control traffic.

SITE WORK ZONES

Exclusion zones will be established within approximately 10 feet around each boring or well during drilling/sampling. Only persons with the appropriate training will enter this perimeter while work is being conducted there.

A contamination reduction zone will be established just outside the exclusion zone for the decontamination of sampling equipment. Care will be taken to prevent the spread of contamination. Equipment and personnel decontamination are discussed in the following sections, and the following types of equipment will be available to perform these activities:

- Scrub brushes
- Spray rinse applicator
- Plastic garbage bags
- Container of Alconox/water solution and Alconox powder

Hot zone/exclusion zone (Approximately 10 to 15 feet around boring locations indicated on the site plan):

Method of delineation/ excluding non-site personnel	
	Fence
	Survey Tape
X	Traffic Cones
	Other Road Work Signs

BUDDY SYSTEM

Personnel on-site should use the buddy system (pairs), particularly whenever communication is restricted. If only one GeoEngineers employee is on-site, a buddy system can be arranged with subcontractor/contractor personnel.

SITE COMMUNICATION PLAN

Positive communications (within sight and hearing distance or via radio) should be maintained between pairs on-site, with the pair remaining in proximity to assist each other in case of emergencies. The team should prearrange hand signals or other emergency signals for communication when voice communication becomes impaired (including cases of lack of radios or radio breakdown). In these instances, consider suspending work until communication can be restored; if not, the following are some examples for communication:

a) Hand gripping throat: Out of air, can't breathe.
b) Gripping partner's wrist or placing both hands around waist: Leave area immediately, no debate.
c) Hands on top of head: Need assistance.
d) Thumbs up: Okay, I'm all right. or I understand.
e) Thumbs down: No, negative.

DECONTAMINATION PROCEDURES

All non-dedicated sampling equipment will be decontaminated with Alconox™ soap and rinsed with distilled water prior to collecting any samples for analysis.

Personal decontamination consists of removing outer protective tyvek clothing (if used), washing soiled boots, removing respirator (if used); hands and face will be washed in either a portable wash station or a bathroom facility in the support zone. Employees will perform decontamination procedures and wash prior to eating, drinking or leaving the site. All disposable personal protective clothing (i.e., nitrile gloves) will be bagged with other miscellaneous waste and discarded in the appropriate refuse receptacle in the contamination reduction zone.

Specify other site specific decontamination procedures:

Water and restroom facilities are located in the nearby Port Seafarer's Memorial Park and nearby retail stores (Safeway, McDonalds).

WASTE DISPOSAL OR STORAGE

PPE disposal (specify): To drums to be stored on-site pending characterization and disposal.

Drill cutting/soil disposal or storage:

x Port property, pending analysis and further action
x Secured (list method) Drums
____ Other (describe destination, responsible parties): _____

PERSONAL PROTECTIVE EQUIPMENT

PPE will consist of standard Level D equipment. Disposable PPE (gloves) will be placed into plastic trash bags and disposed as solid waste. Minimum level of protective equipment for these sites is Level D. After the initial and/or daily hazard assessment has been completed, select the appropriate protective gear (PPE) to preserve worker safety. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted prior to the start of site operations.

Air monitoring will be conducted for organic vapors and for establishing the level of respiratory protection.

- Half face combination organic vapor/HEPA or P100 cartridge respirators will be available on site to be used as necessary. P100 cartridges are to be used only if PID measurements are below the site action limit. P100 cartridges are used for protection against dust, metals and asbestos, while the combination organic vapor/HEPA cartridges are protective against both dust and vapor. Ensure that the PID or TLV will detect the chemicals of concern on site.
- Level D PPE will be worn at all times on site. Potentially exposed personnel will wash gloves, hands, face, and other pertinent items to prevent hand-to-mouth contact. This will be done prior to hand-to-mouth activities including eating, smoking, etc.
- Adequate personnel and equipment decontamination will be used to decrease potential ingestion and inhalation.

- Individual PELs or action limits are not expected to be exceeded given the planned activities. If soil conditions are damp, airborne dust is not likely to be an issue. If conditions are dry and dust is visible during site activities, personnel will use P100 cartridges on their respirators.

Check applicable personal protection gear to be used:

X Hardhat (if overhead hazards, or client requests)
X Steel-toed boots (if crushing hazards are a potential or if client requests)
X Safety glasses (if dust, particles, or other hazards are present or client requests)
X Hearing protection (if it is difficult to carry on a conversation 3 feet away)
X Rubber boots (if wet conditions)

Gloves (specify):

X Nitrile
____ Latex
____ Liners
____ Leather
____ Other (specify) _____

Protective clothing:

____ Tyvek (if dry conditions are encountered, Tyvek is sufficient)
____ Saranex (personnel shall use Saranex if liquids are handled or splash may be an issue)
X Cotton
X Rain gear (as needed)
X Layered warm clothing (as needed)

Inhalation hazard protection:

X Level D
____ Level C (respirators with organic vapor filters/ P100 filters)

Limitations of Protective Clothing

PPE clothing ensembles designated for use during site activities shall be selected to provide protection against known or anticipated hazards. However, no protective garment, glove, or boot is entirely chemical-resistant, nor does any PPE provide protection against all types of hazards. To obtain optimum performance from PPE, site personnel shall be trained in the proper use and inspection of PPE. This training shall include the following:

- Inspect PPE before and during use for imperfect seams, non-uniform coatings, tears, poorly functioning closures, or other defects. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Inspect PPE during use for visible signs of chemical permeation such as swelling, discoloration, stiffness, brittleness, cracks, tears, or other signs of punctures. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Disposable PPE should not be reused after breaks unless it has been properly decontaminated.

Respirator Selection, Use, and Maintenance

GeoEngineers has developed a written respiratory protection program in compliance with OSHA requirements contained in 29 CFR 1910.134. Site personnel shall be trained on the proper use, maintenance, and limitations of respirators. Site personnel that are required to wear respiratory protection shall be medically qualified to wear respiratory protection in accordance with 29 CFR 1910.134. Site personnel that will use a tight-fitting respirator must have passed a qualitative or quantitative fit test conducted in accordance with an OSHA-accepted fit test protocol. Fit testing must be repeated annually or whenever a new type of respirator is used. Respirators will be stored in a protective container.

Respirator Cartridges

If site personnel are required to wear air-purifying respirators, the appropriate cartridges shall be selected to protect personnel from known or anticipated site contaminants. The respirator/cartridge combination shall be certified and approved by NIOSH. A cartridge change-out schedule shall be developed based on known site contaminants, anticipated contaminant concentrations, and data supplied by the cartridge manufacturer related to the absorption capacity of the cartridge for specific contaminants. Site personnel shall be made aware of the cartridge change-out schedule prior to the initiation of site activities. Site personnel shall also be instructed to change respirator cartridges if they detect increased resistance during inhalation or detect vapor breakthrough by smell, taste, or feel although breakthrough is not an acceptable method of determining the change-out schedule. At a minimum, cartridges should be changed a minimum of once daily.

Respirator Inspection and Cleaning

The Site Safety and Health Supervisor shall periodically (i.e., weekly) inspect respirators at the project site. Site personnel shall inspect respirators prior to each use in accordance with the manufacturer's instructions. In addition, site personnel wearing a tight-fitting respirator shall perform a positive and negative pressure user seal check each time the respirator is donned to ensure proper fit and function. User seal checks shall be performed in accordance with the GeoEngineers respiratory protection program or the respirator manufacturer's instructions.

Facial Hair and Corrective Lenses

Site personnel with facial hair that interferes with the sealing surface of a respirator shall not be permitted to wear respiratory protection or work in areas where respiratory protection is required. Normal eyeglasses cannot be worn under full-face respirators because the temple bars interfere with the sealing surface of the respirator. Site personnel requiring corrective lenses will be provided with spectacle inserts designed for use with full-face respirators. Contact lenses should not be worn with respiratory protection.

ADDITIONAL ELEMENTS

HEAT STRESS PREVENTION

Site specific procedures for preventing heat stress include: provide shade, water, and frequent breaks.

The State of Washington and the State of California have regulations that provide specific requirements for handling employee exposure to heat stress. GeoEngineers' program complies with both sets of requirements and will be implemented in all areas where heat stress is identified as a potential health issue.

The Washington State requirements for preventing heat stress apply to outdoor work environments from May 1 through September 30, only when employees are exposed to outdoor heat at or above an applicable temperature listed in Table 1. To determine which temperature applies to each worksite, select the

temperature associated with the general type of clothing or personal protective equipment (PPE) each employee is required to wear.

Table 1. Outdoor Temperature Action Levels

All other clothing	89°
Double-layer woven clothes including coveralls, jackets and sweatshirts	77°
Nonbreathing clothes including vapor barrier clothing or PPE such as chemical resistant suits	52°

Keeping workers hydrated in a hot outdoor environment requires more water be provided than at other times of the year. GeoEngineers is prepared to supply at least one quart of drinking water per employee per hour. When employee exposure is at or above an applicable temperature listed in Table 1, Project Managers will ensure that:

- A sufficient quantity of drinking water is readily accessible to employees at all times; and
- All employees have the opportunity to drink at least one quart of drinking water per hour.

EMERGENCY RESPONSE

Indicate what site specific procedures you will implement.

- Personnel on-site should use the "buddy system" (pairs).
- Visual contact should be maintained between "pairs" on-site, with the team remaining in proximity to assist each other in case of emergencies.
- If any member of the field crew experiences any adverse exposure symptoms while on-site, the entire field crew should immediately halt work and act according to the instructions provided by the SSO.
- Wind indicators visible to all on-site personnel should be provided by the SSO to indicate possible routes for upwind escape. Alternatively, the SSO may ask on-site personnel to observe the wind direction periodically during site activities.
- The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated should result in the evacuation of the field team, contact of the project manager, and reevaluation of the hazard and the level of protection required.
- If an accident occurs, the SSO and the injured person are to complete, within 24 hours, an Accident Report for submittal to the project manager, the HSM and human resources. The project manager should ensure that follow-up action is taken to correct the situation that caused the accident or exposure.

A SAMPLING AND MONITORING PLAN FOR DRUMS AND CONTAINERS

N/A

SITE CONTROL MEASURES

Listed above in Site Control Plan.

SPILL CONTAINMENT PLANS (DRUM AND CONTAINER HANDLING)

N/A

STANDARD OPERATING PROCEDURES FOR SAMPLING, MANAGING, AND HANDLING DRUMS AND CONTAINERS

Drums and containers used during the cleanup shall meet the appropriate Department of Transportation (DOT), OSHA and U.S. Environmental Protection Agency (EPA) regulations for the waste that they contain. Site operations shall be organized to minimize the amount of drum or container movement. When practicable, drums and containers shall be inspected and their integrity shall be ensured before they are moved. Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled. Before drums or containers are moved, all employees involved in the transfer operation shall be warned of the potential hazards associated with the contents.

Drums or containers and suitable quantities of proper absorbent shall be kept available and used where spills, leaks or rupture may occur. Where major spills may occur, a spill containment program shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred. Fire extinguishing equipment shall be on hand and ready for use to control incipient fires.

ENTRY PROCEDURES FOR TANKS OR VAULTS (CONFINED SPACES)

N/A

PERSONNEL MEDICAL SURVEILLANCE

GeoEngineers' employees are not in a medical surveillance program as they do not fall into the category of "Employees Covered" in OSHA 1910.120(f)(2) which states a medical surveillance program is required for the following employees:

> (1) All employees who are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits or, if there is no permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year;
>
> (2) All employees who wear a respirator for 30 days or more a year or as required by state and federal regulations; and
>
> (3) All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation; and
>
> (4) Members of HAZMAT teams.

SANITATION

Washrooms are present in the adjacent Port Seafarer's Memorial Park and nearby retail facilities (i.e. McDonalds, Safeway grocery store).

LIGHTING

Field work will be conducted during daylight hours; if at dusk, street lights are present.

EXCAVATION, TRENCHING AND SHORING

N/A

OTHER PROGRAMS

None.

DOCUMENTATION TO BE COMPLETED FOR HAZWOPER PROJECTS

NOTE: The Field Log is to contain the following information:

Updates on hazard assessments, field decisions, conversations with subs, client or other parties.
Air monitoring/calibration results; personnel, locations monitored, activity at the time of monitoring
Actions taken
Action level for upgrading PPE and rationale
Meteorological conditions (temperature, wind direction, wind speed, humidity, rain, snow, etc.).

Required forms:

Field Log
Health and Safety Plan acknowledgment by GEI employees (Form C-2)
Contractors Health and Safety Plan Disclaimer (Form C-3)
Conditional forms available at GeoEngineers office: Accident Report

APPROVALS

1. Plan Prepared	Zanna Satterwhite		12/09/08
	Signature		Date
2. Plan Approval	Jim Roth		1/23/09
	PM Signature		Date
3. Health & Safety Officer	Leah Alcyon, CIH		1/23/09
	Health & Safety Program Manager		Date

FORM C-1
HEALTH AND SAFETY PRE-ENTRY BRIEFING

PORT OF ANACORTES - FORMER SHELL OIL
5147-012-01

Inform employees, contractors, and subcontractors or their representatives about:

The nature, level, and degree of exposure to hazardous substances they're likely to encounter, all site-related emergency response procedures, any identified potential fire, explosion, health, safety, or other hazards.

Conduct briefings for employees, contractors, and subcontractors, or their representatives as follows:

A pre-entry briefing before any site activity is started.

Additional briefings, as needed, to make sure that the site-specific HASP is followed.

Make sure all employees working on the site are: Informed of any risks identified and trained on how to protect themselves and other workers against the site hazards and risks

Update all information to reflect current sight activities and hazards.

> All personnel participating in this project must receive initial health and safety orientation. Thereafter, brief tailgate safety meetings will be held as deemed necessary by the Site Safety and Health Supervisor.
>
> The orientation and the tailgate safety meetings shall include a discussion of emergency response, site communications and site hazards.

Date	Topics	Attendee	Company Name	Employee Initials

FORM C-2
SITE SAFETY PLAN – GEOENGINEERS' EMPLOYEE ACKNOWLEDGMENT

PORT OF ANACORTES - FORMER SHELL OIL
5147-012-01

(All GeoEngineers' site workers complete this form, which should remain attached to the safety plan and filed with other project documentation).

I, _____, do hereby verify that a copy of the current Safety Plan has been provided by GeoEngineers, Inc., for my review and personal use. I have read the document completely and acknowledge a full understanding of the safety procedures and protocol for my responsibilities on site. I agree to comply with all required, specified safety regulations and procedures. I understand that I will be informed immediately of any changes that would affect site personnel safety.

Signed _____ Date _____

Range of Dates From: _____
To: _____

Signed _____ Date _____

Range of Dates From: _____
To: _____

Signed _____ Date _____

Range of Dates From: _____
To: _____

Signed _____ Date _____

Range of Dates From: _____
To: _____

Signed _____ Date _____

FORM C-3
SUBCONTRACTOR AND SITE VISITOR SITE SAFETY FORM
PORT OF ANACORTES - FORMER SHELL OIL
5147-012-01

I, _____, verify that a copy of the current site Safety Plan has been provided by GeoEngineers, Inc. to inform me of the hazardous substances on site and to provide safety procedures and protocols that will be used by GeoEngineers' staff at the site. By signing below, I agree that the safety of my employees is the responsibility of the undersigned company.

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

GeoEngineers

APPENDIX E
PUBLIC PARTICIPATION PLAN

Site Cleanup:

SHELL OIL TANK FARM SITE

Between 13th and 14th Streets, on Q Avenue
Anacortes, Washington

DRAFT PUBLIC PARTICIPATION PLAN

Prepared by:
Washington State Department of Ecology

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

April 2008

This plan is for you!

This public participation plan is prepared for the Shell Oil Tank Farm Site cleanup as part of the requirement of the Model Toxics Control Act (MTCA). The plan provides information about MTCA cleanup actions and requirements for public involvement, and identifies how Ecology and the Port of Anacortes will support public involvement throughout the cleanup. The plan is intended to encourage coordinated and effective public involvement tailored to the community's needs around the Shell Oil Tank Farm Site.

For additional copies of this document, please contact:

Washington State Department of Ecology
Sandra Caldwell, Public Involvement Specialist
Toxics Cleanup Program
PO Box 47600
Olympia, WA 98504-7600
(360) 407-7209
Email: saca461@ecy.wa.gov

If you need this publication in an alternate format, please call the Toxics Cleanup Program at (360) 407-7170. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call (877) 833-6341 (TTY).

Table of Contents

1.0: Introduction and Overview of the Public Participation Plan

This Public Participation Plan explains how you can become involved in improving the health of your community. It describes public participation opportunities that will be conducted during cleanup of a site on the Anacortes waterfront - the Shell Oil Tank Farm Site. These opportunities are part of a cooperative agreement between the Washington State Department of Ecology (Ecology) and the Port of Anacortes (Port). The current agreement, called an Agreed Order, is a legal document in which the Port and Ecology agree to decide on cleanup actions for the Shell Oil Tank Farm Site. The Site is generally located between 13th and 14th Streets, on Q Avenue, in Anacortes, Washington.

Cleanup actions and the public participation process that helps guide them are established in Washington's Model Toxics Control Act (MTCA).[1] Under MTCA, Ecology is responsible for providing timely information and meaningful chances for the public to learn about and comment on important cleanup decisions before they are made. The goals of the public participation process are:

- To promote understanding of the cleanup process so that the public has the necessary information to participate.
- To encourage involvement through a variety of public participation opportunities.

This Public Participation Plan provides a framework for open dialogue about the cleanup among community members, Ecology, cleanup site owners, and other interested parties. It outlines basic MTCA requirements for community involvement activities that will help ensure that this exchange of information takes place during the investigation and cleanup, which include:

- Notifying the public about available reports and studies about the Site.
- Notifying the public about review and comment opportunities during specific phases of the cleanup investigation.
- Providing appropriate public participation opportunities such as fact sheets to learn about cleanup documents, and if community interest exists, holding meetings to solicit input and identify community concerns.
- Considering public comments received during public comment periods.

[1] The Model Toxics Control Act (MTCA) is the hazardous waste cleanup law for the State of Washington. The full text of the law can be found in Revised Code of Washington (RCW), Chapter 70.105D. The legal requirements and criteria for public notice and participation during MTCA cleanup investigations can be found in Washington Administrative Code (WAC), Section 173-340-600.

In addition to these basic requirements, the plan may include additional site-specific activities to meet the needs of your community. Based upon the type of the proposed cleanup action, the level of public concern, and the risks posed by the Site, Ecology may decide that additional public involvement opportunities are appropriate.

These opportunities form the basis for the public participation process. The intent of this plan is to:

- Provide complete and current information to all interested parties.
- Let you know when there are opportunities to provide input.
- Listen to concerns.
- Address those concerns.

Part of the Puget Sound Initiative

The Shell Oil Tank Farm Site is one of several sites in the Anacortes area, and is part of a larger cleanup effort called the Puget Sound Initiative (PSI). Governor Chris Gregoire and the Washington State Legislature authorized the PSI as a regional approach to protect and restore Puget Sound. The PSI includes cleaning up 50-60 contaminated sites within one-half mile of the Sound. Some of these sites are grouped in several bays around the Sound for "baywide" cleanup efforts. As sites in the Anacortes area move forward into investigation and cleanup, information about them will be provided to the community as well as to interested people and groups.

Roles and Responsibilities

Ecology will lead public involvement activities, with support from the Port. Ecology maintains overall responsibility and approval authority for the activities outlined in this plan. The Port is responsible for cleanup at this Site. Ecology will ultimately oversee all cleanup activities, and ensure that contamination on this Site is cleaned up to concentrations that are established in state regulations and that protect human health and the environment.

Organization of this Public Participation Plan

The sections that follow in this plan provide:

- Section 2: Background information about the Shell Oil Tank Farm Site.
- Section 3: An overview of the local community that this plan is intended to engage.
- Section 4: Public involvement opportunities in this cleanup.

This Public Participation Plan addresses current conditions at the Site, but it is intended to be a dynamic working document that will be reviewed at each phase of the cleanup, and updated as needed. Ecology and the Port urge the public to become involved in the cleanup process.

2.0: Site Background

Site Description and Location

The Shell Oil Tank Farm is located between 13th and 14th Streets, on Q Avenue in Anacortes, Skagit County, Washington (see Figure 1). It is currently used for public vehicle and boat trailer parking, and is approximately 0.8 acre in size. The Site is defined by the extent of contamination that can be found in its soil and/or groundwater, which is currently unknown. Fidalgo Bay is located to the east of the Site, and the Cap Sante Marine cleanup site is located to the northeast of the Site.

Figure 1: The Shell Oil Tank Farm, shown in the above map just southwest of the arrow, is generally located between 13th and 14th Streets, on Q Avenue, on Fidalgo Bay, in Anacortes, WA.

General Site History and Contaminants

The Port purchased the Shell Oil Tank Farm in 1929. The Port leased the Site to Shell Oil and various other companies to distribute gasoline, diesel, oil and other chemical products. The Site consisted of three 25,000-gallon, two 12,500-gallon, and one 4,000-gallon above-ground storage tanks. The tanks were removed in the 1980s. The Site is currently used for public vehicle and boat trailer parking.

In 1987, petroleum hydrocarbon contamination was found on the Site and partially removed. In 2005, gasoline, diesel, and heavy oil contamination was found in soil and groundwater samples that were collected around the Site. The amount of contamination in the soil samples was above Washington State cleanup levels.

In 2007, cadmium was found in Site soil when a City of Anacortes storm drain line was moved. The amount of this metal was above state cleanup levels. The amount of remaining contamination is unknown and will be further investigated.

The Cleanup Process

Washington State's cleanup process and key opportunities for you to provide input are outlined in Figure 2. The general cleanup process includes the following steps:

- Remedial investigation (RI) - investigates the site for types, locations, and amounts of contaminants.
- Feasibility study (FS) - identifies cleanup options for those contaminants.
- Cleanup action plan (CAP) – selects the preferred cleanup option and explains how cleanup will be conducted.

Each of these steps will be documented in reports and plans that will be available for public review. Public comment periods of at least 30 calendar days are usually conducted for the following documents:

- Draft RI report.
- Draft FS report.
- Draft CAP.

These cleanup steps and documents are described in greater detail in the following subsections.

Interim Actions

Interim actions may be conducted during the cleanup if required by Ecology. An interim action partially addresses the cleanup of a site, and may be required if:

- It is technically necessary to reduce a significant threat to human health or the environment.
- It corrects a problem that may become substantially worse or cost substantially more to fix if delayed.

- It is needed to complete another cleanup activity, such as design of a cleanup plan.

Interim actions are not currently anticipated on the Shell Oil Tank Farm Site.

Remedial Investigation/Feasibility Study Report

The Port has agreed to conduct an RI on the Site. The RI determines which contaminants are on the Site, where they are located, and whether there is a significant threat to human health or the environment. The draft RI report provides baseline data about environmental conditions that will be used to develop cleanup options. The FS and report then identify and evaluate cleanup options, in preparation for the next step in the process.

The RI and FS processes typically include several phases:

- Scoping
- Site characterization
- Development and screening of cleanup alternatives
- Treatability investigations (if necessary to support decisions)
- Detailed analysis

The RI and FS reports are expected to be combined into a draft Shell Oil Tank Farm Site RI/FS report. The draft report is anticipated to be completed by the end of 2008 and will be made available for public review and comment.

Cleanup Action Plan

The Port and Ecology have agreed to develop a draft CAP for the Site. After public comment on the draft RI/FS report, a preferred cleanup alternative will be selected. The draft CAP explains the cleanup standards that will be applied at the Site, selects the preferred cleanup alternative(s), and outlines the work to be performed during the actual site remediation. The draft CAP may also evaluate the completeness and effectiveness of any interim actions that were performed on the Site. The draft CAP will be available for public review and comment. Once public comments are reviewed and any changes are made, Ecology provides final approval and site cleanup can begin. The draft CAP is anticipated to be completed in Fall 2009, and the cleanup is anticipated to be completed in Spring 2010.

3.0: Community Profile

Community Profile

Anacortes is Skagit County's second largest city and its only seaport. It is the only city on Fidalgo Island. The current population is approximately 16,300 (about 7,200 households) situated within about 12 square miles. Located on Fidalgo Bay, Anacortes has 12.5 miles of saltwater shoreline, giving rise to three Port of Anacortes piers/wharves, a shipyard, several yacht and mid-size boat building and sales operations, and several marinas. Four freshwater lakes and 3,300 acres of city-owned forestland and parks create a rural feeling, but the City also has modern educational and health care facilities. The City's 2006 labor workforce was more than 7,000, employed predominantly in manufacturing, accommodations/food service, retail, and health care.[2]

Key Community Concerns

An important part of the Public Participation Plan is to identify key community concerns for each cleanup site. The Shell Oil Tank Farm Site is located within a quarter mile of a residential area. The proximity of the community to the Site is likely to raise questions about how daily life and the future of the community may be affected during and after cleanup of the Site.

Many factors are likely to contribute to community questions, such as the amount of contamination, how the contamination will be cleaned up, or future use of the Site. Community concerns often change over time, as new information is learned and questions are answered. Identifying site-specific community concerns at each stage of the cleanup process is helpful to ensure that they are adequately addressed. On-going key community concerns will be identified for the Shell Oil Tank Farm Site through public comments and other opportunities as detailed in Section 4.

[2] Anacortes Chamber of Commerce web Site, *available at* http://www.anacortes.org/pdf/AnacortesCommunityProfileMarch2007.pdf ; Accessed 11/12/07.

4.0: Public Participation Opportunities

Ecology and the Port invite you to share your comments and participate in the cleanup in your community. As we work to meet our goals, we will evaluate whether this public participation process is successful. This section describes the public participation opportunities for this Site.

Measuring Success

We want this public participation process to succeed. Success can be measured, at least in part, in the following ways:

- Number of written comments submitted that reflect understanding of the cleanup process and the site.
- Direct "in-person" feedback about the site cleanup or public participation processes, if public meetings are held.
- Periodic updates to this plan to reflect community concerns and responses.

If we are successful, this process will increase:

- Community awareness about plans for cleanup and opportunities for public involvement.
- Public participation throughout the cleanup.
- Community understanding regarding how their input will be considered in the decision-making process.

Activities and Information Sources

Ecology Contacts

Ecology is the lead contact for questions about the cleanup in your community. The Ecology staff identified in this section are familiar with the cleanup process and activities at this Site. For more information about public involvement or the technical aspects of the cleanup, please contact:

<u>For technical questions:</u>
Panjini Balaraju
Ecology Project Manager
WA State Dept. of Ecology
Toxics Cleanup Program
P.O. Box 47600

<u>For public involvement questions:</u>
Sandra Caldwell
Public Involvement Specialist
WA State Dept. of Ecology
Toxics Cleanup Program
P.O. Box 47600

Olympia, WA 98504-7600
Phone: (360) 407-6161
E-mail: pbal461@ecy.wa.gov

Olympia, WA 98504-7600
Phone: (360) 407-7209
E-mail: saca461@ecy.wa.gov

Ecology's Webpage

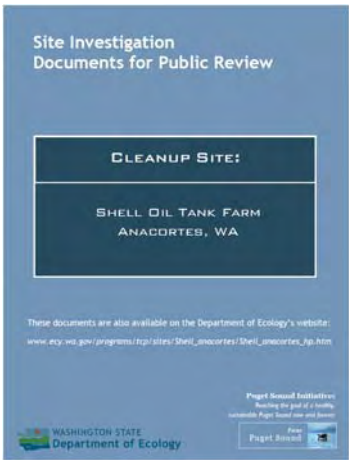
Ecology has created a webpage to provide convenient access to information. Documents such as the Agreed Order, draft reports, and cleanup plans, are posted as they are issued during the investigation and cleanup process. Visitors to the webpage can find out about public comment periods and meetings; download, print, and read information; and submit comments via e- mail. The webpage also provides links to detailed information about the MTCA cleanup process. The Shell Oil Tank Farm Site webpage is available at the following address:
http://www.ecy.wa.gov/programs/tcp/sites/shell_anacortes/shell_anacortes_hp.htm

Information Centers/Document Repositories

The most comprehensive source of information about the Shell Oil Tank Farm Site is the information center, or document repository. Two repositories provide access to the complete list of site-related documents. All Shell Oil Tank Farm Site investigation and cleanup activity reports will be kept in print at those two locations and will be available for your review. They can be requested on compact disk (CD) as well. Document repositories are updated before public comment periods to include the relevant documents for review. Documents remain at the repositories throughout the investigation and cleanup. For this Site, the document repositories and their hours are:

- **Anacortes Public Library**
  1220 10th Street
  Phone: (360) 293-1910
  Hours: Mon.-Thurs. 11 a.m.-8 p.m.,
  Fri. 11 a.m.-5 p.m., Sat.-Sun. 12-5 p.m.

- **WA Department of Ecology Headquarters**
  300 Desmond Drive SE
  Lacey, WA 98503
  By appointment. Please contact Carol Dorn at (360) 407-7224 or cesg461@ecy.wa.gov.



Look for the document cover such as the illustration at the right.

Public Comment Periods

Public comment periods provide opportunities for you to review and comment on major documents, such as the Agreed Order, draft Public Participation Plan, and the draft RI/FS report. The typical public comment period is 30 calendar days.

Notice of Public Comment Periods

Notices for each public comment period will be provided by local newspaper and by mail. These notices indicate the timeframe and subject of the comment period, and explain how you can submit your comments. For the Shell Oil Tank Farm Site, newspaper notices will be posted in the Anacortes American.

Notices are also sent by regular mail to the local community and interested parties. The community typically includes all residential and business addresses within one-quarter mile of the Site, as well as potentially interested parties such as public health entities, environmental groups, and business associations.

Fact Sheets

One common format for public comment notification is the fact sheet. Like the newspaper notice, fact sheets explain the timeframe and purpose of the comment period, but also provide background and a summary of the document under review. A fact sheet has been prepared for the Shell Oil Tank Farm Site explaining the Agreed Order and this Public Participation Plan (See Appendix A). Future fact sheets will be prepared at key milestones in the cleanup process.

MTCA Site Register

Ecology produces an electronic newsletter called the MTCA Site Register. This semi-monthly publication provides updates of the cleanup activities occurring throughout the state, including public meeting dates, public comment periods, and cleanup-related reports. Individuals who would like to receive the MTCA Site Register can sign up three ways:

- Call (360) 407-6069
- Send an email request to ltho461@ecy.wa.gov or
- Register on-line at http://www.ecy.wa.gov/programs/tcp/pub_inv/pub_inv2.html

Mailing Lists

Ecology maintains both an e-mail and regular mail distribution list throughout the cleanup process. The list is created from carrier route delineations for addresses within one-quarter mile of the Site, potentially interested parties, public meeting sign-in sheets, and requests made in person, or by regular mail or e-email. You may request to be on the mailing list by contacting Ecology's public involvement staff person listed earlier in this section.

Optional Public Meetings

A public meeting will be held during a comment period if requested by ten or more people, or if Ecology decides it would be useful. Public meetings provide additional opportunity to learn about the investigation or cleanup, and to enhance informed comment. If you are interested in a public meeting about the Shell Oil Tank Farm Site, please contact the Ecology staff listed earlier in this section.

Submitting Comments

You may submit comments by regular mail or e-mail during public comment periods to the Ecology Site Manager listed earlier in this section.

Response to Comments

Ecology will review all comments submitted during public comment periods, and will modify documents as necessary. You will receive notice by regular mail or e-mail that Ecology has received your comments, along with an explanation about how the comments were addressed.

Other

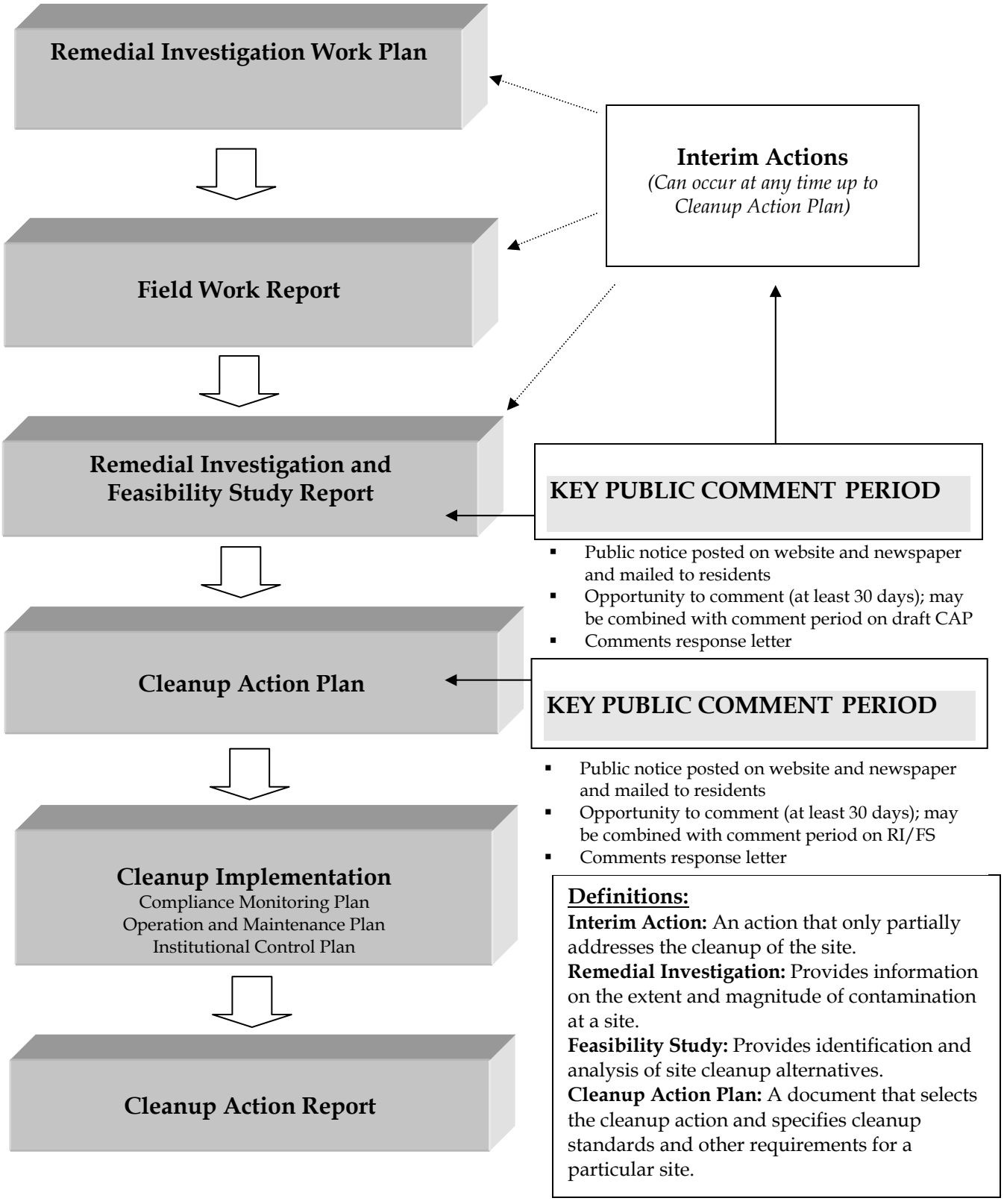
Ecology and the Port are committed to the public participation process and will consider additional means for delivering information and receiving comments, including combining public comment periods for other actions (such as those associated with the State Environmental Policy Act).

Public Participation Grants

You may be eligible to apply for a Public Participation Grant from Ecology to provide additional public participation activities. Those additional activities will not reduce the

scope of the activities defined by this plan. Activities conducted under this plan would coordinate with the additional activities defined under the grant.

Figure 2: Washington State Cleanup Process



Glossary

Cleanup: The implementation of a cleanup action or interim action.

Cleanup Action: Any remedial action except interim actions, taken at a site to eliminate, render less toxic, stabilize, contain, immobilize, isolate, treat, destroy, or remove a hazardous substance that complies with MTCA cleanup requirements, including but not limited to: complying with cleanup standards, utilizing permanent solutions to the maximum extent practicable, and including adequate monitoring to ensure the effectiveness of the cleanup action.

Cleanup Action Plan: A document that selects the cleanup action and specifies cleanup standards and other requirements for a particular site. The cleanup action plan, which follows the remedial investigation/feasibility study report, is subject to a public comment period. After completion of a comment period on the cleanup action plan, Ecology finalizes the cleanup action plan.

Cleanup Level: The concentration (or amount) of a hazardous substance in soil, water, air, or sediment that protects human health and the environment under specified exposure conditions. Cleanup levels are part of a uniform standard established in state regulations, such as MTCA.

Cleanup Process: The process for identifying, investigating, and cleaning up hazardous waste sites.

Contaminant: Any hazardous substance that does not occur naturally or occurs at greater than natural background levels.

Feasibility Study: Provides identification and analysis of site cleanup alternatives and is usually completed within a year. Evaluates sufficient site information to enable the selection of a cleanup action. The entire Remedial Investigation/Feasibility Study (RI/FS) process takes about two years and is followed by the cleanup action plan.

Hazardous Site List: A list of ranked sites that require further remedial action. These sites are published in the Site Register.

Interim Action: Any remedial action that partially addresses the cleanup of a site. It is an action that is technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance at a facility; an action that corrects a problem that may become substantially worse or cost substantially more to address if the action is delayed; an action needed to provide for completion of a site hazard assessment, state remedial investigation/feasibility study, or design of a cleanup action.

Model Toxics Control Act: Refers to Chapter 70.105D RCW. Voters approved it in November 1988. The implementing regulation is found in Chapter 173-340 WAC.

Public Notice: At a minimum, adequate notice mailed to all persons who have made a timely request of Ecology and to persons residing in the potentially affected vicinity of the proposed action; mailed to appropriate news media; published in the local (city or county) newspaper of largest circulation; and the opportunity for interested persons to comment.

Public Participation Plan: A plan prepared under the authority of WAC 173-340-600 to encourage coordinated and effective public involvement tailored to the public's needs at a particular site.

Release: Any intentional or unintentional entry of any hazardous substance into the environment, including, but not limited to, the abandonment or disposal of containers of hazardous substances.

Remedial Action: Any action or expenditure consistent with MTCA to identify, eliminate, or minimize any threat posed by hazardous substances to human health or the environment, including any investigative and monitoring activities of any release or threatened release of a hazardous substance, and any health assessments or health effects studies conducted in order to determine the risk or potential risk to human health.

Remedial Investigation: Any remedial action that provides information on the extent and magnitude of contamination at a site. This usually takes 12 to 18 months and is followed by the feasibility study. The purpose of the Remedial Investigation/Feasibility Study is to collect and develop sufficient site information to enable the selection of a cleanup action.

Shell Oil Tank Farm Site
Anacortes, Skagit County, WA

Site Investigation Documents Ready for Public Review

A PUGET SOUND INITIATIVE site – Reaching the goal of a healthy, sustainable Puget Sound now and forever

WASHINGTON STATE DEPARTMENT OF ECOLOGY

The Department of Ecology welcomes your comments on a proposed agreement and draft Public Participation Plan for a new cleanup site.

Ecology is asking for your comments on a new proposed agreement to study a site on Puget Sound for cleanup. This Site, called the Shell Oil Tank Farm, is one of several located on the waterfront that will be studied for cleanup under the state's Puget Sound Initiative. It is located between 13th and 14th Streets on Q Avenue, on Fidalgo Bay, in Anacortes, Skagit County, WA.

Site background

The Port of Anacortes purchased the Shell Oil Tank Farm Site in 1929. The Port leased the Site to Shell Oil and various other companies to distribute gasoline, diesel, oil and other chemical products. Site features included three 25,000-gallon, two 12,500- gallon, and one 4,000-gallon above- ground storage tanks. The tanks were removed in the 1980s. The Site is currently used for public vehicle and boat trailer parking.

In 1987, petroleum hydrocarbon contamination was found on the Site and partially removed. In 2005, gasoline, diesel, and heavy oil contamination was found in soil and groundwater samples that were collected around the Site. The amount of contamination in the soil samples was above Washington State cleanup levels.

In 2007, cadmium was found in Site soil when a part of the City of Anacortes storm drain pipe was replaced. The amount of this metal was above state cleanup levels. The amount of remaining contamination is unknown and will be further investigated.

Overview of the Agreed Order

The proposed agreement, called an Agreed Order, is a legal document between Ecology and the Site owner, the Port of Anacortes. The Agreed Order describes the studies that the Port agrees to perform on the Site.

The Agreed Order covers the following studies and documents:

- Remedial Investigation and Feasibility Study (RI/FS) work plan. It will explain the work needed to look for and analyze contamination in soil and water.
- RI/FS report. It will present the results of the study and propose alternatives for cleanup actions.
- Draft Cleanup Action Plan (DCAP). It will use RI/FS information to identify a preferred cleanup action and a schedule to remediate the contamination.

The purpose of the Agreed Order is to protect human health and the

Ecology requests your comments from April 30 through May 30, 2008

Send comments to:
Panjini Balaraju, Site Mgr.
WA Department of Ecology
Toxics Cleanup Program
P.O. Box 47600
Olympia, WA 98504-7600
(360) 407-6161
E-mail: pbal461@ecy.wa.gov

***To review documents*:**
Anacortes Public Library
1220 10th Street
Anacortes, WA 98221
Hours: Mon.-Thurs. 11am-8pm, Fri. 11am-5pm, Sat.-Sun. 12-5pm

WA Department of Ecology Headquarters
300 Desmond Drive SE
Lacey, WA 98503
By appointment only:
Contact Carol Dorn,
cesg461@ecy.wa.gov or
(360) 407-7224

Ecology web site:
http://www.ecy.wa.gov/programs/tcp/sites/shell_anacortes/shell_anacortes_hp.htm

Facility Site # 4781157

Publication Number 08-09-101

environment. It ensures that cleanup happens in a timely manner and according to Washington State's cleanup law, the Model Toxics Control Act.

Overview of the draft Public Participation Plan

Ecology and the Port are committed to providing the public with timely information and meaningful opportunities to participate in the cleanup process. As part of this commitment, Ecology and the Port agree to provide a public participation plan. This plan outlines how citizens and interested parties can learn about and provide input on the cleanup.

Your comments and ideas are needed to improve the cleanup. The public participation plan explains how Ecology will do the following:

- Notify the public when and where documents are available for review and comment;
- Notify the public about how they can become involved;
- Provide public participation opportunities; and
- Consider public comments in cleanup decisions.

Protecting and restoring Puget Sound at the Shell Oil Tank Farm Site

Governor Chris Gregoire and the Washington State Legislature approved the Puget Sound Initiative. One of the objectives of the Initiative is to protect and restore Puget Sound, cleaning up 50-60 sites within one-half mile of the Sound. One of these is the Shell Oil Tank Farm. These cleanup actions will help to reduce pollution and restore habitat and shorelines in Puget Sound.

Other sites and activities on Fidalgo Bay in Anacortes:

- Cap Sante Marine Site: A boat yard and marina support area, located just north of the Shell Oil Tank Farm.
- Dakota Creek Site: Used for vessel moorage, bulk fuel and oil storage, and shipbuilding activities, located at 155 Q Avenue (northernmost end).
- Custom Plywood Mill Site: A former mill and wood-box factory, located near 35th Street and V Avenue in Anacortes.

How to submit your comments

Ecology welcomes your comments on the proposed Agreed Order and draft Public Participation Plan from April 30 through May 30, 2008. For your review, these documents can be found on the Ecology web site and at the locations listed on the first page of this fact sheet.

Please direct all technical questions to Ecology Site Manager, Panjini Balaraju. Contact information can be found on the first page of this fact sheet. All other questions may be directed to Ecology Public Involvement Specialist, Sandra Caldwell at saca461@ecy.wa.gov or (360) 407-7209.

Please send your comments by May 30, 2008, to Ecology's Site Manager, Panjini Balaraju. Comments may be sent by mail or e-mail. Please include "Shell Oil Tank Farm" in the subject line.

What's next?

Once the public comment period ends, Ecology will review and consider all comments that have been received. The Agreed Order and draft public participation plan may be modified based upon your comments.

Additional public comment periods will be noticed and conducted as future documents on the Site are developed.

For information about other Ecology public comment periods, meetings, hearings, workshops, and open houses, please visit Ecology's public events calendar at: http://apps.ecy.wa.gov/pubcalendar/calendar.asp. Read *Frequently Asked Questions about Effective Public Commenting* at this link to learn more about the public comment process.

Shell Oil Tank Farm Site, Skagit County, WA

The Shell Oil Tank Farm is generally located between 13th and 14th Streets on Q Avenue, on Fidalgo Bay in Anacortes, WA.

Shell Oil Tank Farm Site, Anacortes, Skagit County, WA

Ecology Seeks Public Comment on Draft Documents

Public Comment Period
April 30 – May 30, 2008

Department of Ecology
Toxics Cleanup Program
PO Box 47600
Olympia, WA 98504-7600

GeoEngineers

APPENDIX F
ECOLOGY COMMENTS RESPONSE SUMMARY

GeoEngineers

PLAZA 600 BUILDING, 600 STEWART STREET, SUITE 1700, SEATTLE, WA 98101, TELEPHONE: (206) 728-2674, FAX: (206) 728-2732 www.geoengineers.com

MEMORANDUM

TO: Washington State Department of Ecology

FROM: John Herzog, Ph.D. and Jim Roth, LG, LHG

DATE: July 13, 2009

FILE: 5147-012-01

SUBJECT: Ecology Comment Response Summary, Draft RI/FS Work Plan for Former Shell Oil Tank Farm

On behalf of the Port of Anacortes, this memorandum presents a response summary for review comments from Ecology on the Draft Remedial Investigation/Feasibility Study Work Plan for the Former Shell Oil Tank Farm, dated January 23, 2009. Ecology comments were transmitted in a letter to John Herzog dated June 11, 2009.

1. **General Comment**

   The work plan does not include any discussion about the Terrestrial Ecological Evaluation (TEE). A section should be included in the work plan that discusses one of the applicable TEE section (sections 7490-7493) requirements under MTCA.

   Response: Discussion of TEE is presented in the last paragraph of Section 3.1.1. It appears that the site may qualify for an exclusion from TEE based on the criteria described in WAC 173-340-7491. A simplified TEE evaluation as described in 173-340-7492 will be completed if the site does not qualify for the TEE exclusion.

2. **General Comment**

   We understand that even though the previous soils investigation data (2005 borings SHL01 through SHL-07) is old, the extent of soils contamination will be defined using both the old and new data. In addition, at some of the previous boring locations (SHL-02 and CSM-13), there is insufficient information to define the complete **vertical extent** of contamination. Either new borings should be drilled to define the complete vertical extent of contamination or existing borings should be excavated to a deeper depth during the removal of TPH-contaminated soils.

   Response: Several new borings will be completed in the vicinity of previous borings SHL-02 and CSM-13 (see Figure 6). The new borings will be completed deep enough to evaluate the vertical extent of contamination.

3. **General Comment**

   The work plan proposes to install eight groundwater monitoring wells under Phase II based on the results of soil investigation. It is okay to follow this phased approach, except for the number of proposed monitoring wells. However, based on previous soils and groundwater results, it seems appropriate to install 3 to 4 groundwater monitoring wells during the soils investigation Phase to determine the current contaminant concentrations.
   Reference to the exact number (eight) of monitoring wells should be deleted. A sufficient number of monitoring wells should be installed to fully characterize the groundwater contamination at the site including upgradient and downgradient of the site. Instead of an exact number, reference to a range

.

of monitoring wells seems to be appropriate, providing flexibility in the number of monitoring wells installation.

Response: The draft work plan proposed installation of six groundwater monitoring wells during Phase II of the RI field activities (see Section 3.0, top of p.12). The text will be revised to say that approximately six to nine monitoring wells will be installed to characterize groundwater conditions at the site.

4. General Comment

A minimum of three slug tests should be conducted at three new groundwater monitoring well locations to determine the permeability range of the formation. This is needed to calculate the groundwater velocity at the site.

Response: Text will be revised accordingly to include completion of slug tests in three of the new monitoring wells.

5. Page 3, paragraph 2

Total lead was also detected during the previous groundwater investigation. Please include lead in the text.

Response: Text will be revised accordingly to include lead.

6. Page 5, paragraph 2

We understand that there is no documentation for the removal of a 4,000-gallon underground storage tank (UST). It is uncertain whether or not this UST is still present on the site. A geophysical survey would be appropriate to determine the presence or absence of this UST. Also see comment 8, below, for missing monitoring wells.

Response: Agreed. A geophysical survey to evaluate the potential presence of the 4,000-gallon UST will be included in the work plan.

7. Page 5, paragraph 3

Reference to Figure 2 should be Figure 4.

Response: Text will be revised accordingly.

8. Page 9, paragraph 5

A geophysical survey should be conducted to identify monitoring wells MW-1, MW-2 and should be abandoned as per the requirements of WAC 173-160 (if the integrity of these monitoring wells is good, these could be redeveloped and used for the future monitoring). If these well are not identified and handled properly, presence of these wells on the site could serve as a conduit to the migration of contamination. In addition, as indicated in comment 6, above, the geophysical survey will also help to determine the presence or absence of a 4,000-gallon UST.

Response: A geophysical survey will be conducted to evaluate the potential presence of the UST and MW-1, MW-2. If these wells can be located, they will be evaluated to determine whether well abandonment or redevelopment/future use in the RI is appropriate.

9. Page 10, Section 2.5, Data Gap Assessment

- Soil conditions along the historic fuel supply lines: Full extent of soil contamination at CSM-13 also needs to be evaluated, since elevated levels of diesel are present (16,000 mg/kg) at this location.

  Response: Two additional borings have been added (see Figure 6) to fully evaluate the extent of soil contamination at CSM-13. A total of three borings are now planned in the vicinity of CSM-13 (GEI-20, 21, 22).

- Please include the identification of the 4,000-gallon UST and monitoring wells MW-1 and MW-2 as a data gap.

  Response: Text will be revised accordingly.

10. Page 14, Data Objectives

Groundwater data objectives should be included here.

Response: Groundwater data objectives are presented in the Groundwater Investigation Section 3.3, p. 16. The Data Objectives on p.14 and15 of the work plan are specific to the Soil Investigation, Section 3.2.

11. Page 15, Proposed Sampling and Data Collection

- Include an additional boring at the 1987 oil observation location (between GE17 and GE9).

  Response: An additional boring was added at the location of the 1987 oil observation (Figure 6, boring GEI-8).

- cPAHs/naphthalene, VOCs, Cadmium and PCBs analysis: Please state the boring numbers from which these parameters are analyzed or refer Table-5 here.

  Response: Reference to Table 5 will be added to the text.

- If soil borings show any unusual visual characteristics indicating contamination (both in the vadose and/or saturated zone), a soil sample should be collected for analysis. In addition, as indicated in the text, additional borings may be needed at some of the locations to define the full extent of contamination.

  Response: Text will be revised accordingly to address sampling of soil with unusual visual characteristics (e.g. staining).

- If the field screening does not indicate any contamination within the unsaturated zone, a soil sample should be collect at the top of the water table for analysis.

  Response: Text will be added to clarify unsaturated zone soil sampling near top of the water table when there is no field screening evidence of contamination.

- A previous soil investigation showed elevated levels of diesel (16,000 mg/kg) at the CSM-13 location. However, no borings are proposed in this vicinity to define the extent of contamination. Enough number of borings must be drilled in the vicinity of this location to define the full extent of soil contamination.

  Response: See response to comment 9, 1st bullet. Two borings have been added at this location.

- Two more borings (east and west of TP-1) should be drilled to investigate for any Cadmium contamination.

  Response: Two borings were added east and west of TP-1 (Figure 6, GEI-14 and GEI-15A).

12. Page 16, COPCs analysis

The number of locations for the analysis of cPAHs/naphthalene, VOCs and PCBs is inconsistent with the number of proposed locations in page-15.

Response: The number of soil samples to be analyzed for PCBs is the same for the tank farm and along the historic fuel supply lines (one sample to be analyzed from each area). Soil samples from three additional borings along the fuel supply lines (GEI-20, 21, 22) will be tested for cPAHs/naphthalene to increase testing for these COPCs in the vicinity of hydrocarbon contamination that was detected previously in CSM-12 and CSM-13. A greater emphasis was placed on testing for VOCs in the tank farm vs. along the fuel supply lines because it appears that VOCs (dry cleaning solvents) were stored in a UST at the tank farm. VOCs were not transported through the fuel lines east of the tank farm and there is no suspected source of VOCs east of Q Avenue.

13. Page 16, Section 3.3, Groundwater Investigation, Data Objectives

- Include a bullet to define the full extent of groundwater contamination.

Response: Text will be revised accordingly.

- Please revise the first bullet to also include the **groundwater velocity**.

Response: Text will be revised accordingly.

- Include a bullet for conducting three slug tests to determine the permeability of the formation.

Response: Text will be revised accordingly.

14. Page 16, Groundwater Investigation, Proposed Sampling and Data Collection

- The proposed number of monitoring wells may be insufficient for characterizing the groundwater conditions and also for establishing conditional points of compliance (in the future) at the site. The exact number (six) of monitoring wells stated here should be deleted and a

general language should be included with the flexibility for installing a sufficient number of monitoring wells to characterize the upgradient, on-site and downgradient groundwater conditions at the site.

Response: Same response as General Comment 3. The draft work plan proposed installation of six groundwater monitoring wells during Phase II of the RI field activities. The text will be revised to say that approximately six to nine monitoring wells will be installed to characterize groundwater conditions at the site.

- COPCs analysis: It is proposed to decide the analysis of COPCs parameters based on the results of soils investigation. It seems inappropriate to follow this approach because COPCs may be present in groundwater and not in soils. All the COPCs must be analyzed during the first round of sampling, and the COPCs could be tailored to a smaller suite of compounds based on these results.

Response: Based on Ecology's comment, all of the groundwater samples collected from the new monitoring wells will be analyzed for gasoline-, diesel- and oil-range hydrocarbons, BETX, cPAHs/naphthalene, and lead (the primary COPCs). Cadmium and potential HVOC-related contamination appear to be limited to areas of the tank farm. The Port proposes to analyze groundwater samples from two wells on the tank farm in and downgradient of the potential source areas for cadmium and HVOCs. The specific locations of monitoring well to be sampled for cadmium and HVOCs will be provided in the groundwater work plan supplement.

15. Page 17, Feasibility Study

Include a section presenting the preliminary ARARs for the site investigation.

Response: A section presenting preliminary ARARs will be added to the FS portion of the work plan.

APPENDIX B
SAMPLING AND ANALYSIS PLAN

16. General Comment

Include a table showing the approximate number of soil environmental and QA/QC samples in the sampling and analysis plan. The number of groundwater samples could be included in the work plan supplement.

Response: The approximate number of soil samples to be analyzed during the RI will be added to the text of the SAP. The frequency of field and laboratory QA/QC samples is summarized in Table C-5 of the QAPP (Appendix C).

17. Page B-1, Section 1.0, Introduction

Reference to the exact number (six) of monitoring wells should be deleted. Please see comment number 3 regarding the groundwater investigation and monitoring wells.

Response: See response to comment number 3.

18. Page B-1, Paragraph 4

It is stated that groundwater samples may be tested for additional COPCs depending on the results of soil portion (Phase 1).
It seems inappropriate to decide the groundwater sample COPCs analysis solely based on the results of soil samples. Since the operation was ceased a long time ago, there is potential for the migration of the majority of some of the COPCs contamination to the groundwater. As a result, though the results of soils investigation show nondetects, still the groundwater could be contaminated. Therefore, the first round of groundwater samples needs to be analyzed for all COPCs, and based on these results COPCs could be narrowed down to a shorter list for the subsequent analysis.

Response: See response to second bullet of comment 14 (COPCs analysis).

19. Page B-2, Section 2.1, Underground utility locate

Will soil samples not be collected (in the upper six or nine feet) at the boring locations where the air knife is used to clear the soil from the upper six to nine feet? If the soil samples are not collected, there is potential for missing a hot spot. Consider using a hand auger for collecting soil samples at the upper six feet and then using an air knife from six to nine feet to clear the soil where utilities are not clearly identified.

Response: A hand auger will be used to attempt to collect soil samples from the upper six feet of borings where an air knife is used to clear drilling locations.

20. Page B-4, Section 2.8, Monitoring Well Development

Please state the criteria for the complete well development; i.e., to what turbidity level will the well be developed?

Response: Well development will involve removal of at least five well volumes of water from the well casing after well installation is completed. The goal of well development will be to reduce the turbidity content of the water to approximately 25 NTU. Up to 10 well volumes of water will be removed from the wells in an effort to attain the 25 NTU goal.

21. Page B-4, Section 2.9, Groundwater Monitoring and Sampling

Groundwater sampling using peristaltic pump for VOCs analysis may not be appropriate because of potential losses of contamination during the sampling. Please use a submersible pump for the collection of groundwater samples for VOCs analysis.

Response: Samples to be analyzed for VOCs will be obtained using EPA guidance for using peristaltic pumps to collect VOC samples. EPA recommends using the “soda straw” method which involves allowing the flexible tubing to fill by either lowering it into the water column (A) or by filling it with suction applied to the pump head (B). For Method A, the tubing is removed from the well after filling and the sample is allowed to drain into the sample vial. For Method B, after running the pump and filling the tubing with sample, the pump speed is reduced and the flow direction is reversed to push the sample out of the tubing into the sample vials.

APPENDIX C
QUALITY ASSURANCE PROJECT PLAN

22. General Comment

Please include telephone numbers for the Project Manager, Field Coordinator and Quality Assurance Leader.

Response: Text will be revised accordingly.

23. Page C-2, Laboratory Management

- After the selection of an accredited laboratory, Ecology should be informed of the name of the selected laboratory. Also send a copy of the laboratory-specific QA/QC plan for our review and files.

  Response: The name of the accredited laboratory will be provided to Ecology along with laboratory-specific QA/QC information.

- The laboratory should be informed of the site-specific cleanup levels, so that they can achieve the lowest possible method detection limits (MDL). The MDLs must be equal to or below the required cleanup levels.

  Response: Site-specific cleanup levels will be provided to the laboratory so they are aware of the required MDLs.

24. Page C-7, Section 3.4, Sample Shipment

Each sample shipment cooler must have a custody seal for the samples' integrity.

Response: Coolers used for shipping samples will have a custody seal.

25. Page C-9, Section 5.0, Data Reporting and Laboratory Deliverables

The data submittal must be consistent with Ecology Policy 840, EIM Data Submittal Requirements.

Response: The data submittal will be consistent with Ecology Policy 840.

26. Page C-11, Matrix Spike/Matrix Spike Duplicates

Please state the frequency of MS and MSD analysis.

Response: Frequency of MS and MSD analysis is provided in Table C-5 of the QAPP.

27. Table C-4, Page 1 of 1

The table presents the analysis of dissolved metals. Total metals must also be analyzed to compare the total metal concentrations with cleanup levels. MTCA requires the comparison of total metal

concentrations with their cleanup levels unless proven otherwise based on the turbidity of the sample and the geological formation.

Response: Groundwater samples will be analyzed for total metals for comparison to MTCA cleanup levels.

28. Table-5

- Please include the analysis of VOCs of soil samples from borings GEI-7 and GEI-8.

  Response: Soil samples from borings GEI-7 through GEI-12 will be analyzed for VOCs.

- Include the analysis of cPAHs and naphthalene of soil samples from boring GEI-18 (this boring is near to the previous boring CSM-13 where TPH-D concentration is 16,000 mg/kg).

  Response: Table 5 has been modified to include analysis of cPAHs and naphthalene for soil samples from three borings (GEI 20, 21, 22) in the vicinity of previous boring CSM-13. Note that boring GEI-18 in the draft Figure 6 has been re-named GEI-20 in the updated Figure 6.

Attachments: Table 5. Proposed Soil Sample Analyses and Location Rationale
Figure 6. Proposed Soil Sample Locations

TABLE 5
PROPOSED SOIL SAMPLE ANALYSES AND LOCATION RATIONALE
FORMER SHELL OIL TANK FARM
ANACORTES, WASHINGTON

Area	Location	Boring	Approx. Total Depth of Boring (ft bgs)[1]	Sampling Depth Interval[2]		Analyses								Sampling Rationale
				Zone	Approx. Depth (feet bgs)	TPH-G, TPH-Dx	BETX	VOCs (HVOCs and fuel additives)[4]	cPAHs[5]	Naph-thalenes[5]	PCBs[3]	Lead	Cadmium	
						NWTPH-G, NWTPH-Dx	EPA 8021	EPA 8260	EPA 8270SIM	EPA 8270SIM	EPA 8082 Modified	EPA Methods 6000/70000		
tank farm	North edge of tank farm property along 13th Street	GEI-1	12	Unsaturated	0 to 6	x	x					x		Evaluate whether hydrocarbon contamination observed in 13th Street (GeoEngineers, 2008) is associated with releases at Tank Farm.
				Saturated	6 to 10	x	x					x		
tank farm		GEI-2	12	Unsaturated	0 to 6	x	x					x		
				Saturated	6 to 10	x	x					x		
tank farm	Approximately 50 feet south of 13th Street, on the west side of Q Avenue	GEI-3	12	Unsaturated	0 to 6	x	x		x	x		x		Delineate the extent of soil contamination observed in soil boring SHL02; investigate soil conditions along the historical fuel supply line where it exits the Tank Farm.
				Saturated	6 to 10	x	x		x	x		x		
tank farm	West side of Q Avenue, along southeastern tank farm boundary	GEI-4	12	Unsaturated	0 to 6	x	x		x	x		x		Evaluate whether hydrocarbon-contaminated soil remains in the area where excavation reportedly occurred in 1987; characterize soil on east edge of site; delineate the extent of contamination observed in boring MW-2
				Saturated	6 to 10	x	x		x	x		x		
tank farm		GEI-5	12	Unsaturated	0 to 6	x	x		x	x		x		
				Saturated	6 to 10	x	x		x	x		x		
tank farm		GEI-6	12	Unsaturated	0 to 6	x	x		x	x		x		
				Saturated	6 to 10	x	x		x	x		x		
tank farm	Between MW-1 and SHL-07, to north of former surface observations of oil and white material	GEI-7	12	Unsaturated	0 to 6	x	x	x	x	x		x		Delineate the extent of soil contamination observed in soil boring SHL02; evaluate the potential presence of hydrocarbons at location of surface staining observed in 1987.
				Saturated	6 to 10	x	x	x	x	x		x		
tank farm	West/southwest MW-1, within area of former surface oil observations and south of white material	GEI-8	12	Unsaturated	0 to 6	x	x	x	x	x		x		Evaluate the potential presence of hydrocarbons at location of surface staining observed in 1987.
				Saturated	6 to 10	x	x	x	x	x		x		
tank farm	Historical fill stand	GEI-9	12	Unsaturated	0 to 6	x	x	x	x	x		x		Evaluate potential soil contamination at historical fill stand; delineate contamination found in SHL-05; analyze for HVOCs based on historical storage of dry-cleaning solvents.
				Saturated	6 to 10	x	x	x	x	x		x		
tank farm	Adjacent to historical UST and SHL-05	GEI-10	12	Unsaturated	0 to 6	x	x	x	x	x		x		Analyze samples near former location of UST(s) and boring SHL-05 for HVOCs due to historical storage of dry-cleaning solvent.
				Saturated	6 to 10	x	x	x	x	x		x		
tank farm	Adjacent to historical pump house and MW-2	GEI-11	12	Unsaturated	0 to 6	x	x	x	x	x	x	x		Characterize the condition of soils near historical pump house; delineate the extent of soil contamination encountered in MW-2 and SHL05.
				Saturated	6 to 10	x	x	x	x	x	x	x		
tank farm	To east of ASTs, approximately 25 feet east of SHL-04	GEI-12	12	Unsaturated	0 to 6	x	x	x	x	x		x		Characterize the condition of soils near former ASTs, and delineate the extent of soil contamination encountered in MW-2 and SHL05. Analyze for HVOCs due to historical storage of dry-cleaning solvents at nearby UST.
				Saturated	6 to 10	x	x	x	x	x		x		
tank farm	On north, east, south, and west sides of TP-1	GEI-13	12	Unsaturated	0 to 6								x	Delineate previous cadmium exceedance at TP-1 (GeoEngineers, 2008).
				Saturated	6 to 10								x	
tank farm		GEI-14	12	Unsaturated	0 to 6								x	
				Saturated	6 to 10								x	
tank farm		GEI-15	12	Unsaturated	0 to 6								x	
				Saturated	6 to 10								x	
tank farm		GEI-15A	12	Unsaturated	0 to 6								x	
				Saturated	6 to 10								x	
historic fuel supply lines	Along historical bulkhead, downgradient (east) of Tank Farm and east of Q Avenue	GEI-16	12	Unsaturated	0 to 6	x	x					x		Evaluate whether contamination is present downgradient of Tank Farm east of Q Avenue and along supply lines (GEI-15, GEI-16, and GEI-17). The area east of Q Avenue is a dense utility corridor; boring locations will be moved as needed to avoid utilities.
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-17	12	Unsaturated	0 to 6	x	x					x		
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-18	12	Unsaturated	0 to 6	x	x					x		
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-19	12	Unsaturated	0 to 6	x	x					x		
				Saturated	6 to 10	x	x					x		
historic fuel supply lines	Approximately 30 feet north of supply lines, halfway between CSM-12 and CSM-13	GEI-20	12	Unsaturated	0 to 6	x	x		x	x		x		Evaluate soil conditions north of the supply lines where contamination was previously detected in borings CSM-12 and CSM-13.
				Saturated	6 to 10	x	x		x	x		x		
historic fuel supply lines	Northeast of CSM-13	GEI-21	12	Unsaturated	0 to 6	x	x		x	x		x		Evaluate soil conditions north of the supply lines where contamination was previously detected in boring CSM-13.
				Saturated	6 to 10	x	x		x	x		x		
historic fuel supply lines	Northwest of CSM-13	GEI-22	12	Unsaturated	0 to 6	x	x		x	x		x		
				Saturated	6 to 10	x	x		x	x		x		
historic fuel supply lines	Along west-east stretch of supply lines between Q Avenue and the shoreline	GEI-23	12	Unsaturated	0 to 6	x	x					x		Evaluate soil conditions along fuel supply lines.
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-25	12	Unsaturated	0 to 6	x	x					x		
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-26	12	Unsaturated	0 to 6	x	x		x	x		x		
				Saturated	6 to 10	x	x		x	x		x		
historic fuel supply lines	Directly west and approximately 70 feet west of 2007 City excavation at east end of supply lines - utility corridor	GEI-24	12	Unsaturated	0 to 6	x	x					x		Evaluate City utility corridor where 2007 field observations indicated hydrocarbon-contaminated soil.
				Saturated	6 to 10	x	x					x		
historic fuel supply lines		GEI-27	12	Unsaturated	0 to 6	x	x	x	x	x	x	x		
				Saturated	6 to 10	x	x	x	x	x	x	x		
historic fuel supply lines	In vicinity of SB-13, SB-14, and area of 2007 City excavation	GEI-28	12	Unsaturated	0 to 6	x	x		x	x		x		Evaluate the extent of soil contamination detected in previous soil borings SB-13 and SB-14.
				Saturated	6 to 10	x	x		x	x		x		
historic fuel supply lines		GEI-29	12	Unsaturated	0 to 6	x	x		x	x		x		
				Saturated	6 to 10	x	x		x	x		x		

Notes:

ft bgs = Feet below ground surface
MTCA = Model Toxics Control Act
TPH-G = Gasoline-range total petroleum hydrocarbons
TPH-Dx = Diesel-range and heavy oil-range total petroleum hydrocarbons
BTEX = benzene, toluene, ethylbenzene, and xylenes
VOCs = volatile organic compounds - analyte list to consist of HVOCs (halogenated VOCs: PCE, TCE, VC, cis-1,2-DCE, and 1,1,1-TCA) and/or fuel additives (MTBE, EDB, EDC)
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
EDB = ethylene dibromide
EDC = ethylene dichloride (1,2-dichloroethane)
MTBE = methyl tertiary-butyl ether
PCE = tetrachloroethene
TCE = trichloroethene
VC = vinyl chloride
cis-1,2-DCE = cis-1,2-dichloroethene
1,1,1-TCA = 1,1,1-trichloroethane

1. If there is field evidence of hydrocarbon or VOC contamination at 12 feet, boring will proceed deeper than 12 feet until field screening observations indicate no significant evidence of contamination.
2. Depths are approximate. The groundwater table has been encountered at the tank farm between 4 and 9 feet bgs, with an average of 6 feet bgs. The unsaturated zone samples will be collected over a 1-foot interval within 0 to 6 feet bgs based on field observations of contamination. The saturated zone sample will be collected in the upper 3 to 4 feet of the saturated zone.
3. Although there is no evidence of waste oil being stored at the Site, selected soil samples will be analyzed to evaluate the potential presence of PCBs in accordance with MTCA Table 830-1 (presence of heavy oil-range petroleum hydrocarbons). PCBs will be analyzed in soil from one location on the Tank Farm and one location east of Q Avenue that appear to have elevated hydrocarbon concentrations. Locations are subject to change based on observed soil field screening.
4. VOCs list to include MTBE, EDB, and EDC. Selected soil samples in the vicinity of a reported dry cleaning solvent UST at the former tank farm will also be analyzed for PCE, TCE, cis-1,2-DCE, 1,1,1-TCA, VC, trichlorofluoromethane, and carbon tetrachloride.
5. cPAHs and naphthalenes will be analyzed at 9 locations on the Tank Farm that appear to have elevated levels of hydrocarbon contamination. Locations are subject to change based on soil field screening observations. Sufficient volume of soil will be collected from borings not specifically listed for cPAH/naphthalene analysis so that any soil sample with a TPH-Dx exceedance can be analyzed for cPAHs and naphthalenes.

General comments:

• Boring locations are shown on Figure 6.
• A third sample below 10 feet will be collected at each boring location and archived. Sufficient volume will be collected for TPH-Dx/PAHs/metals. If field observations indicate significant concentrations of petroleum hydrocarbons or VOCs (elevated vapors and/or moderate to heavy sheens) in the saturated zone interval, additional sample volume from this third interval will be collected for TPH-G/BTEX/VOCs using 5035 methods.
• If white powder, hydrocarbon, or VOCs contamination is observed at any interval or boring location not prescribed in this table, a sample will be collected and analyzed for suspected contaminants.
• Contingent "step out" borings may be added as needed to delineate areas of contamination that would not otherwise be delineated based on the borings listed in this table.
• Extra volume for MS and MSD analyses will be collected for BTEX, VOCs, cPAHs/naphthalenes, PCBs, and metals analysis, at a rate of 1 per 20 samples, from sampling locations that are believed to exhibit low-level contamination, per the QAPP (Appendix C).

Area Where Petroleum Sheen is Observed
SB-10
SB-14
GEI-28
GEI-29
GEI-26
SB-13
Oily Soil Observed in City Excavation (2007)
GEI-27
Historical Bulkhead (approximate)
Approximate Location of Historical Fuel Supply Lines
CSM03
GEI-25
GEI-24
GEI-22
GEI-23
CSM02
CSM01
CSM13
GEI-20
CSM12
GEI-21
Historical Bulkhead (approximate)
GEI-19
GEI-18
GEI-17
GEI-16
Q AVE
Surface Oil (1987 Observation)
GEI-3
GEI-4
GEI-5
GEI-6
Surface Oil (1987 Observation)
SHL01
SHL02
Historical Pump House
SHL03
GEI-2
GEI-11
Oily Sheen Frequently Observed in City Utility Line
MW-1
MW-2
GEI-7
Surface White Powder (1987 Observation)
GEI-8
GEI-12
SHL05
GEI-10
SHL07
GEI-9
SHL04
GEI-1
SHL06
Historical Diesel and Gasoline ASTs (12,500 to 25,000 gal each)
Surface Oil (1987 Observation)
GEI-14
GEI-13
GEI-15
Manhole #2
TP-4
TP-3
TP-2
TP-1
GEI-15A
Historical Fill Stand
Historical UST (2,000 and/or 4,000 gal)
Storm Drain Trench Excavation (2007)
14TH ST
13TH ST
Manhole #3

GEI-1 = Proposed Direct Push Boring
Existing Soil Sample Location (No Exceedances)
Existing Soil Sample Location Exceeding MTCA Method A
Manholes
Historical Fuel Supply Line
Historical Product Line

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communications
Reference: Roads from Skagit County. Point, line and polygon features digitized from figures 5.1 and 6.1 of November 2006 and Figure 2 of September 2005 by Floyd Snider. Imagery date - September 2007. CSBH 1979 Aerial Photo from Floyd Snider.

0 50 100 Feet

Proposed Soil Sample Locations

Former Shell Oil Tank Farm
Anacortes, Washington

GeoEngineers

Figure 6

Office: Seattle Path: W:\Seattle\Projects\5\5147012\GIS\5147012_F6.mxd Map Revised: 07/10/2009, EL, KS