Site Characterization Report
1920 Port of Tacoma Road
Tacoma, Washington

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Ferndale, Washington
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1920 Port of Tacoma Road
Tacoma, Washington

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SITE CHARACTERIZATION REPORT
1920 PORT OF TACOMA ROAD
TACOMA, WASHINGTON

INTRODUCTION

This report presents the results of push-probe sampling completed beneath a portion of the Port of Tacoma Road located south of its intersection with Maxwell Ave. near 1920 Port of Tacoma Road, Tacoma, Washington (Figures 1 and 2). The sampling work was completed in accordance with an Ecology approved Remedial Action Work Plan (Work Plan - DOF 2011b) prepared to fulfill the requirements of Agreed Order No. DE 8914 between the Washington State Department of Ecology (Ecology) and U.S. Oil & Refining Co. (USOR).

In December 2010, asphalt grinding in the vicinity of a former refinery-to-dock petroleum pipeline crossing caused several flashes. The suspected cause of the flashes was petroleum vapors emanating from soil beneath the roadway. The referenced Work Plan was prepared to assess the nature and extent of the volatile petroleum hydrocarbons that appeared to have caused the flashes. Fourteen push-probes were advanced and sampled at the locations shown on Figure 3.

BACKGROUND

As part of developing the Work Plan, existing information was compiled and reviewed. The first indications that a release had occurred were discovered by the City of Tacoma (City) utilities department in 1995 during a road excavation. The City reported *"very contaminated soil"* was encountered approximately 30 feet south of the USOR pipeline easement in the northbound driving lane. USOR worked with the City to assess the possible extent of the release by sampling near-by monitoring wells, completing soil sampling and reviewing pipeline hydro-test records. A review of chromatograms indicted that the predominant hydrocarbon present beneath the roadway was likely gasoline or weathered gasoline. By late 1996, Ecology informed USOR that the department could not identify any other potential sources of the observed release.

In January 1997, eleven geoprobes and six test pits (P-1 to P-11 and TP1 to TP6 - Figure 4) were sampled by Dalton, Olmsted & Fuglevand, Inc. (DOF) for USOR along the sides of the roadway where petroleum constituents were detected in the vicinity of the former pipeline crossing. The 1997 soil analytical data are summarized in Table 1 (adapted from Table 3 in DOF 1997a). The work was done as part of a City waterline repair project (DOF 1997a, 1997b, 1998). In June 1997 CeCon (for the City) dug a series of bell holes to repair the water line. Contaminated soil was reported to be present in two excavations in the vicinity of the pipeline easement (Figure 4). Contaminated soil was not observed in two additional excavations located to the southeast of the pipeline alignment in the

roadway. The estimated extent of contaminated soil observed in 1997 is shown on Figures 4 and 5. A small cleanup of soil containing diesel range hydrocarbons also occurred in 1997.

In June 1998, USOR completed re-location of the refinery-to-dock pipelines that were re-routed to accommodate a Port of Tacoma terminal development project. The lines beneath the roadway to the USOR marine terminal entrance were flushed, filled with grout and abandoned in-place. Any contaminated soil encountered during the relocation was removed from the excavations. The location of the former and existing pipeline alignments are shown on Figures 2 to 4.

In 2007, a new 24-inch pipeline was installed from the refinery to the USOR marine terminal. In addition, two existing 8-inch (gasoline) and one existing 10-inch (jet/diesel) pipelines from the refinery to the Port of Tacoma road right-of-way were abandoned in-place and replaced with two new 8-inch (gasoline) and one new 10-inch (jet/diesel) pipelines. This project also included the removal of the 8-inch fuel oil line from the refinery to the marine terminal. During this work, staff from DOF observed the pipeline excavations. No evidence of petroleum hydrocarbons were detected in the excavation along Port of Tacoma road. The field observations were confirmed by analysis of soil samples (RDS-20, -22 to -25) collected from the excavation (shown on Figure 4). The 2007 soil analytical data proximal to the project area are summarized in Table 2.

On December 17, 2010, Dave Cooper with DOF visited the site after the flashes had been detected during asphalt grinding. The top 6 inches of asphalt had been ground off. The subgrade consisted of crushed rock and soft asphalt that had a very strong gasoline odor. Mr. Cooper collected a sample (sample location is shown on Figure 4) of the subgrade materials and submitted the sample to Analytical Resources Inc. (ARI) for analysis of petroleum hydrocarbons using methods NWTPH-HCID and TPHG/BTEX. The results of the analysis are listed below and the laboratory data sheets are included in Appendix B.

Results 2010 Subgrade Solids Sample

Analyte	Concentration (mg/kg)
Benzene	5.3
Toluene	96
Ethylbenzene	40
m,p-Xylene	310
o-Xlyene	120
Gasoline Range Hydrocarbons	5,200
Type	Mixture of gasoline/weathered gasoline and other gasoline range organics that do not match a gasoline pattern

The results of field observations and soil analytical data collected between 1997 and 2010 are graphically shown on Figure 5. Gasoline range hydrocarbons concentrations were detected above screening levels (SLs[i]) in soil samples from the 1997 probes P-3W, P-4W and P-9E and the 2010 subgrade sample. These locations appeared to generally define the approximate area where the asphalt grinding flashes were observed and where soils containing gasoline range hydrocarbons are present beneath the roadway. After the flashes were observed, the City placed a concrete patch in the area where the asphalt grinding occurred.

To further assess the possible source of petroleum hydrocarbons beneath the roadway, shallow aquifer monitoring well MW-USO-5S was sampled on December 20, 2010 and April 23, 2011 (DOF 2011a). This monitoring well is located on the southwest side of the roadway near the pipeline alignment (Figures 1, 4 and 5). The collected groundwater samples were analyzed for petroleum hydrocarbons including gasoline range hydrocarbons and aromatic hydrocarbons. The recent results were compared to the results available for samples from this well since 1993. The data indicated no significant recent changes to dissolved groundwater concentrations had occurred. The most recent results are presented later in this report.

SITE LAYOUT

The project area, for purposes of this report, lies beneath 200 to 300 feet (100 to 150 feet on either side of the former pipeline easement) of the heavily used Port of Tacoma Road (Figure 2). The paved roadway is approximately 60 feet wide composed of four traffic lanes and a central turn lane. The entrance to the Washington United Terminal is present on the northeast side of the roadway and a separate north-bound truck lane provides access to the terminal entrance.

The roadway surface generally consists of asphalt. However, in the area of the December 2010 asphalt grinding, a concrete patch was placed. The approximate location of the concrete patch is shown on Figures 2 to 10.

Three utility lines lie beneath the roadway at the approximate locations shown on Figure 5. The lines include a water line and two sewer lines (separate sanitary and storm lines).

[i] For purposes of this report, a gasoline range organics SL of 100 mg/kg is used. The SL is based on Total Petroleum Hydrocarbon soil cleanup level (CUL) contained in the Washington State Model Toxics Control Act (MTCA - Chapter 173-340 WAC – Table 745-1). Note the CULs are based on protection of groundwater for drinking water uses and are considered conservative because the upper groundwater zone in the vicinity of the release is not used, and is unlikely to be used in the future, for drinking water purposes.

2012 PUSH-PROBE SAMPLING

To further refine the extent of soil concentrations of gasoline range hydrocarbons, fourteen push-probes were drilled and sampled at the locations shown on Figures 3 and 4. The original work plan contemplated drilling thirteen probes; an additional probe was added to more reliably define the extent of petroleum containing soil beneath the roadway. The probes were advanced to a depth of approximately ten feet below the existing road surface. Consistent with the requirements of the Work Plan, prior to the start of the sampling:

- Health and safety plan was prepared and submitted to Ecology,
- Traffic control plan was prepared and approved by the City of Tacoma (City),
- Right-of-Way Special Permit (No. 40000180664) was obtained from the City,
- An access agreement was obtained from the Port of Tacoma for sampling on Port property (probes P7 and P8), and
- Buried utility checks were conducted (to clear proposed drilling locations).

Push-probe soil sampling was conducted on the weekend of May 19 and 20, 2012, when truck traffic volumes were lighter as compared to weekdays. Traffic control was provided by National Barricade Co. LLC. The push-probe rig and crew were provided by Cascade Drilling Inc. Dave Cooper, Sr. Engineering Geologist with DOF observed the sampling operation, described the soils encountered including evidence of soil contamination (odors, sheens) and collected samples for laboratory analysis. Soil samples were described using ASTM-D2488 as a general guide. The logs of the push-probes are presented in Appendix A.

Probe coordinate locations were determined using a Trimble GeoXH GPS. Probe locations are considered accurate to +/- 2.0 feet. The horizontal coordinates are included on the probe logs.

As the samples were obtained, a portion of each sample was placed in a 2-ounce glass jar and two 40ml vials containing a MeOH preservative (in accordance with EPA Method 5035A) for laboratory analysis and in a 1 quart plastic bag for field screening. The filled glass jars were labeled and placed in chilled coolers for transport to the analytical laboratory. After the bagged samples reached ambient temperature, an organic vapor head space measurement was made using a photoionization detector - PID (MiniRae PGM7300). The PID was calibrated with 100 ppm isobutylene gas at the beginning of each day. The PID measurements are summarized on the probe logs and in Table 3.

The jarred samples were transported to Analytical Resources Inc. (ARI), a Washington State certified laboratory, located in Tukwila, Washington. Sample handling was documented using standard chain-of-custody procedures. Chain-of-custody records are included with the laboratory reports in Appendix B.

ARI analyzed the soil samples for gasoline range hydrocarbons (TPH-G) and aromatic hydrocarbons (benzene, toluene, ethylbenzene and xylene or BTEX) using the following Washington State approved methods:

- TPH-G – NWTPHG
- BTEX – SW8021BMod

The analytical results are summarized in Table 3 while the laboratory reports are included in Appendix B.

GEOLOGY

The logs of push-probes completed in the project area indicate the following geologic sequence:

- **Road Surface Materials.** Six to eight inches of asphalt concrete overlying six to twenty-eight inches of crushed rock. At most locations the crushed rock was approximately six to twelve inches thick and the combined thickness ranged from 12 to 18 inches. Approximately 2 feet of crushed rock was encountered at probe P8.

- **Fine to Medium Sand.** Lies immediately below the road surface materials to approximate depths of 8 to 8.5 feet below existing grade. The unit is approximately seven feet thick and is generally described as moist to wet, gray, fine to medium sand with a trace of gravel. The unit appears to be a dredge fill material placed over the original tidal flat deposits.

- **Brown Silt.** A fine grained silt layer underlies the fine to medium sand layer and is interpreted to be the surface of the original tidal flat deposits. The unit was encountered in all the probes at depths of approximately 8 to 8.5 feet and was described as a wet, gray to brown, clayey silt to organic silt with fibrous organics and marsh grass in places. The bottom of the silt unit was not encountered in any of the probes (drilled to a depth of ten feet).

SOIL CHARACTERIZATION – GASOLINE RANGE HYDROCARBONS

As indicated on the logs, field observations and PID measurements indicated the presence of gasoline range petroleum hydrocarbons. Strong odors and sheens were associated with many of the soil samples and PID measurements were greater than 5,000 ppm at a number of locations (P2, P3, and P10) as summarized in Table 3.

Figures 6 to 10 show TPH-G concentrations by depth[ii]. The range of concentrations is summarized in the following table using the 2012 data:

TPH-G Concentration Ranges – 2012 Probe Soil Samples

Depth Range (feet)	Predominant Material Type	Highest TPH-G Conc. (mg/kg)	No. Samples >1000 mg/kg
1 to 2	Sand	6000 (P3)	8 of 14
3 to 4	Sand	12000 (P6)	9 of 14
5 to 6	Sand	12000 (P6)	9 of 14
7 to 8	Sand	260 (P4)	None
9 to 10	Silt	44 (P6)	None

The fine to medium sand unit generally appeared saturated with groundwater below a depth of seven feet during probing. Sheens and odor abruptly stopped at this depth. The soil analytical results are consistent with the field observations. Higher gasoline range hydrocarbon concentrations (greater than 260 mg/kg) are present in sand deposits less than approximately seven feet in depth. Concentrations dramatically decline in the lower portion of the sand unit and upper portion of the silt unit. The highest TPH-G concentrations are located near the former pipeline alignment (locations P6 and P11) at depths of two to six feet below existing grade.

The available data indicate that the large majority of contaminated soil lies beneath the paved roadway. This is based on data from 2012 probes P7 and P8 located near the entrance of Washington Marine Terminals, observations made in the 2007 pipe line excavation that paralleled the roadway and groundwater analytical data from monitoring well location MW-USO-5S, supported by probe and test pit data collected in 1997. The most recent analysis of a groundwater sample from MW-USO-5S was in April 2011 (DOF 2011a). The results of this analysis are summarized below. If significant soil contamination was present on the MW-USO-5S side of the roadway, it would be expected groundwater concentrations would be higher than those detected below.

Results of MW-USO-5S Groundwater Analysis (4-23-11)

Constituent	Result (mg/l)
Gasoline Range Hydrocarbons	0.51
Diesel Range Hydrocarbons	0.29
Benzene	0.0048
Toluene	<0.001
Ethylbenzene	<0.001
Total Xylenes	<0.001

The northward and southward extent of contaminated soil in the southbound traffic lanes (west side of roadway) is defined by samples from probes P9 and P14. As summarized in Table 3, gasoline range hydrocarbons and benzene were not detected at reporting limits

[ii] TPH-G concentrations are used to describe the general site conditions. BTEX concentrations are also elevated in soil sample with elevated TPH-G concentrations.

less than approximately 8 mg/kg and 28 ug/kg, respectively. Trace concentrations of toluene (up to 35 ug/kg), ethylbenzene (up to 61 ug/kg) and total xylenes (up to 83 ug/kg) were detected in one or more samples, however these concentrations are well below the Method A CULs (WAC 173-340-900 – Table 740-1) of 7,000 ug/kg (toluene), 6,000 ug/kg (ethylbenzene) and 9,000 ug/kg (xylenes).

The northward and southward extent of contaminated soil was not delineated in the northbound lanes. This was recognized in the field based on PID vapor measurements and soil observations; however time constraints (weekend sampling), buried utilities, traffic control and permit conditions did not allow for the sampling of additional push-probes. TPH-G concentrations at probe P1 ranged between 1,100 and 2,200 mg/kg between the surface and a depth of six feet and appeared to be declining in a southward direction based comparison with data from probes P2 and P3. In 1997 excavation of two water line bell holes by CeCon located approximately 150 feet from P2 did not detect petroleum hydrocarbons. The bell holes likely bound the southern north-bound lane area where contaminated soil exists, as the pipeline crossing was abandoned in 1998.

At location P4, the northern most probe in the north-bound lanes, TPH-G concentrations ranged between 5,100 and 5,900 mg/kg in three soil samples collected above a depth of six feet. It is expected the northern edge of soil contamination in the north-bound lane lies between location P4 and the current USOR roadway pipeline crossing.

FINDINGS AND RECOMMENDATIONS

The primary purpose of the soil probe testing program was to define the extent of high concentrations of volatile petroleum hydrocarbons beneath the roadway so that notice could be posted/recorded for repair crews that may need to disturb the roadway above where the petroleum containing soils exist. This objective was generally achieved, although some additional testing in the north bound traffic lane may be warranted in the future to refine this area. Such testing would consist of drilling four to five additional probes. Three of the probes should be located north of P4 and an additional two probes should be located south of P1. Soil samples should be analyzed for gasoline range hydrocarbons and BTEX in a similar manner as was done for the initial characterization effort.

The benefit of completing the additional testing would be to limit the area requiring posting. Using the current information, we recommend the area to be posted extend from the current pipeline crossing southward to three hundred feet south of the former pipeline crossing. The posted area would be 600 feet long generally centered on the former pipeline crossing.

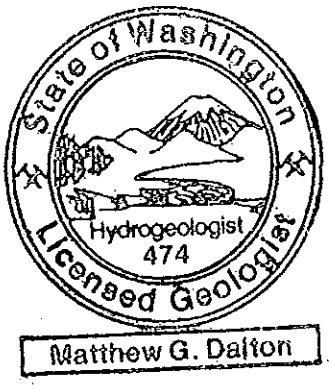
CLOSING AND SIGNATURE

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, expressed or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

Dalton, Olmsted & Fuglevand, Inc.

Matthew G. Dalton
Sr. Consulting Hydrogeologist.



REFERENCES

- DOF (Dalton, Olmsted & Fuglevand, Inc.), 1997a, Preliminary Characterization of Soil Quality Conditions Adjacent to U.S. Oil & Refining Pipelines, Port of Tacoma Road, March 18, 1997.

- DOF, 1997b, Observations of Roadway Excavations by City of Tacoma to Repair Waterline Leaks in Vicinity of U.S. Oil & Refining Pipelines, Port of Tacoma Road, June 20, 1997.

- DOF, 1998, Independent Remedial Action Report, Cleanup of Impacted Soils Associated with Refinery to Dock Pipeline Corridor Improvements, U.S. Oil & Refining Co., Tacoma, Washington, April 17, 2008.

- DOF, 2011a, Groundwater Quality Trends, Monitoring Well USO-05S, Technical Memorandum to Ty Gaub (U.S. Oil & Refining Co.), May 3, 2011.

- DOF, 2011b, Site Investigation Work Plan, 1920 Port of Tacoma Road, Tacoma, Washington, Prepared for U.S. Oil & Refining Co., Agency Draft: November 16, 2011 (Exhibit C to Agreed Order DE 8914.

TABLE 1 - Soil Analytical Data - January 1997

TABLE 3. SUMMARY OF PROBE AND TEST PIT SOIL SAMPLES AND ANALYTICAL RESULTS

U. S. Oil
Port of Tacoma Road, Tacoma, Washington

PROBE/ TEST PIT NO.	Spl.No.	Spl Depth (Ft.) From - To	Date Time	SOIL TYPE	Observed Odor - Sheen	Gasoline-Range Hydrocarbons and BTEX (WTPH-G & EPA 8020A) (mg/kg)					Diesel and Heavy Oil RangeHydrocarbons (WTPH-DX) (mg/kg)	
						Gasoline(C-7-C12)	Benzene	Toluene	Ethylbenzene	Xylenes	Diesel (C-12-24)	Heavy Oil (C24-C40)
P1W	-	0-2	1/23/97 093	SAND	None - None	-	-	-	-	-	-	-
	P-1W(2-4)	2-4	1020	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	<10	<25
	P-1W(4-6)	4-6	1025	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	<10	<25
P2W	-	0-2	0910	SAND	None - None	-	-	-	-	-	-	-
	-	2-4	0920	SAND	None - None	-	-	-	-	-	-	-
	P-2W(4-6)	4-6	0925	SAND	Slight - None	8.3	<0.05	<0.05	<0.05	<0.10	21	<25
	P-2W(6-8)	6-8	0930	SAND	Slight - None	<5.0	<0.05	<0.05	0.78	0.19	<10	<25
P3W	-	0-2	0845	SAND	None - None	-	-	-	-	-	-	-
	P-3W(2-4)	2-4	0846	SAND	Yes - Yes	1,640	4.1	2.6	12	40	119	101
	P-3W(4-6)	4-6	0850	SAND	Yes - Yes	1,870	5.9	3.2	16	21	260	157
	P-3W(6-8)	6-8	0852	SAND	Slight - None	8.1	0.09	<0.05	0.06	<0.1	<10	<25
P4W	-	0-2	1000	SAND	None - None	-	-	-	-	-	-	-
	P-4W(2-4)	2-4	1002	SAND	Yes - None	39	0.36	<0.05	0.46	0.64	45	29
	P-4W(4-6)	4-6	1005	SAND	Yes - Yes	497	0.26	0.26	0.73	2.0	53	<25
	P-4W(6-8)	6-8	1010	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	<10	<25
P5W	-	0-2	1015	SAND	None - None	-	-	-	-	-	-	-
	-	2-4	1020	SAND	None - None	-	-	-	-	-	-	-
	P-5W(4-6)	4-6	1025	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	25	<25
	-	6-8	1027	SAND\	None - None	-	-	-	-	-	-	-
P6W	-	0-2	1050	SAND	None - None	-	-	-	-	-	-	-
	P-6W(4-6)	2-4	1052	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	<10	<25
	-	4-6	1055	SAND	None - None	-	-	-	-	-	-	-
P7E	-	0-2	1110	SAND	None - None	-	-	-	-	-	-	-
	-	2-4	1115	SAND	None - None	-	-	-	-	-	-	-
	P-7E(4-6)	4-6	1120	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	<10	<25
P8E	-	0-2	1110	SAND	None - None	-	-	-	-	-	-	-
	-	2-4	1115	SAND	None - None	-	-	-	-	-	-	-
	P-8E(4-6)	4-6	1120	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	<10	<25
P9E	-	0-2	1250	SAND	None - None	-	-	-	-	-	-	-
	P-9E(2-4)	2-4	1252	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	57	<25
	P-9E(4-6)	4-6	1320	SAND	Yes - Yes	1,910	<0.05	<0.05	11	109	1,060	194
	P-9E(6-8)	6-8	1325	SAND	Slight - Slight	15	<0.05	<0.05	0.07	0.74	11	<25
P10E	-	0-2	1310	SAND	None - None	-	-	-	-	-	-	-
		2-4	1315	SAND	None - None	-	-	-	-	-	-	-
	P-10E(4-6)	4-6	1320	SAND	Yes - Yes	7.9	<0.05	<0.05	<0.05	<0.10	80	40
	P-10E(6-8)	6-8	1325	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	27	<25
P11E	-	0-2	1350	SAND	None - None	-	-	-	-	-	-	-
	P-11E(2-4)	2-4	1355	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	<10	<25
	P-11E(4-6)	4-6	1400	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	<10	<25
		6-8	1405	SAND	None - None	-	-	-	-	-	-	-

Table 1 - Soil Analytical Data - January 1997 (p. 2 of 2)

TABLE 3. SUMMARY OF PROBE AND TEST PIT SOIL SAMPLES AND ANALYTICAL RESULTS

U. S. Oil
Port of Tacoma Road, Tacoma, Washington

PROBE/ TEST PIT NO.	Spl.No.	Spl Depth (Ft.) From - To	Date Time	SOIL TYPE	Observed Odor - Sheen	Gasoline-Range Hydrocarbons and BTEX (WTPH-G & EPA 8020A) (mg/kg)					Diesel and Heavy Oil RangeHydrocarbons (WTPH-DX) (mg/kg)	
						Gasoline(C-7-C12)	Benzene	Toluene	Ethylbenzene	Xylenes	Diesel (C-12-24)	Heavy Oil (C24-C40)
TP-1	TP-1(0-4')	0-4	7/10/97 082	SAND	Mod - None	<5.0	<0.05	<0.05	<0.05	<0.10	**1050**	**578**
	TP-1(4-5')	4-5	0825	SAND	Mod-Light	<5.0	<0.05	<0.05	<0.05	<0.10	**47**	**45**
TP-2	TP-2(0-4')	0-4	0840	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	**37**	**39**
TP-3	TP-3(0-4')	0-4	0900	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	**112**	**93**
TP-4	TP-4(0-4')	0-4	0915	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	<10	<25
TP-5	TP-5(0-4')	0-4	0930	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	<10	<25
TP-6	TP-6(0-3.5')	0-3.5	0945	SAND	None - None	<5.0	<0.05	<0.05	<0.05	<0.10	<10	<25

TABLE 2 - Summary of New Pipeline Trench Data - November 2007

Port of Tacoma Road
Tacoma, Washington

Sample No.	Sample Date	Sample Depth (ft)	Observations		Material Type	TPH-G (mg/kg)	Benzene (ug/kg)	Toluene (ug/kg)	Ethylbenzene (ug/kg)	m,p-Xylene (ug/kg)	o-Xylene (ug/kg)	Total Xylenes (ug/kg)
			Odor	Sheen								
Confirmation Samples Obtained in Pipeline Excavation												
RDS-20	11/4/07	(1)	None	None	Sand	<5.1	<13	<13	<13	<26	<13	<26
RDS-22	11/13/07	(1)	None	None	Sand	<5.0	<13	<13	<13	<26	<13	<26
RDS-23	11/28/07	(1)	None	None	Sand	<4.5	<11	<11	<11	<22	<11	<22
RDS-24	11/28/07	(1)	None	None	Sand	**6.4**	<11	<11	<11	<22	<11	<22
RDS-25	11/28/07	(1)	None	None	Sand	<4.8	<12	<12	<12	<24	<12	<24

Note: (1) - Sample obtained near bottom or edge of excavation
Source: DOF 2008

TABLE 3 - Summary of Soil Probe Soil Analytical Data - May 2012

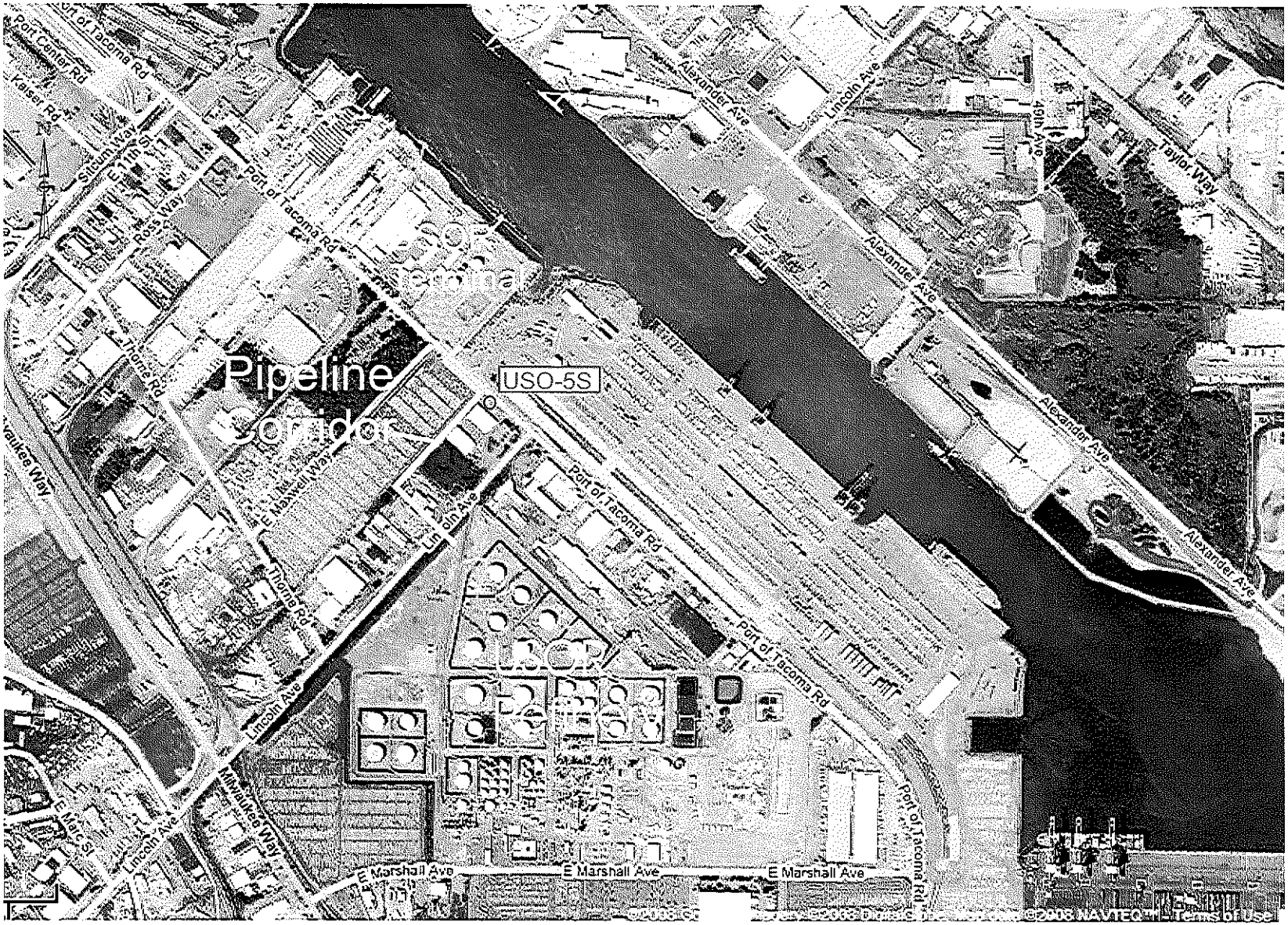
Port of Tacoma Road
Tacoma, Washington

Sample No.	Sample Date	Sample Depth (ft)	Material Type	PID (ppm)	ARI Group	TPH Type	TPH-G (mg/kg)	Benzene (ug/kg)	Toluene (ug/kg)	Ethylbenzene (ug/kg)	m,p-Xylene (ug/kg)	o-Xylene (ug/kg)	Total Xylenes (ug/kg)
P1-A	5/19/12	1-2	Sand	272	UV10	Gas/GRO	2200	71	1100	9000	21000	1400	22400
P1-B	5/19/12	3-4	Sand	381	UV10	Gas/GRO	1500	26	730	7200	4600	1100	5700
P1-C	5/19/12	5-6	Sand	177	UV10	Gas/GRO	1100	<15	62	3700	1600	740	2340
P1-D	5/19/12	7-8	Sand	107	UV10	-----	<5.6	27	14	<14	<28	<14	<28
P1-E	5/19/12	9-10	Silt	2.1	UV10	Gas/GRO	39	150	38	140	130	<38	130
P2-A	5/19/12	1-2	Sand	3800	UV10	Gas/GRO	1800	1300	200	13000	59000	1200	60200
P2-B	5/19/12	3-4	Sand	>5000	UV10	Gas/GRO	2000	810	<270	14000	77000	4200	81200
P2-C	5/19/12	5-6	Sand	>5000	UV10	Gas/GRO	3600	440	220	31000	160000	4800	164800
P2-D	5/19/12	7-8	Sand	2760	UV10	Gas/GRO	150	380	29	970	3400	270	3670
P2-E	5/19/12	9-10	Silt	35	UV10	-----	<24	<61	<61	<61	220	<61	220
P3-A	5/19/12	1-2	Sand	>5000	UV10	Gas/GRO	6000	2400	860	37000	21000	2500	23500
P3-B	5/19/12	3-4	Sand	3380	UV10	Gas/GRO	4700	3100	800	33000	13000	<70	13000
P3-C	5/19/12	5-6	Sand	4320	UV10	Gas/GRO	2100	2800	290	15000	<110	<53	<110
P3-D	5/19/12	7-8	Sand	15	UV10	Gas/GRO	16	800	62	130	140	28	168
P3-E	5/19/12	9-10	Silt	2	UV10	-----	<20	<50	<50	<50	<99	<50	<99
P4-A	5/19/12	1-2	Sand	305	UV10	Gas/GRO	5900	7900	83000	40000	290000	97000	387000
P4-B	5/19/12	3-4	Sand	2430	UV10	Gas/GRO	5800	3800	45000	35000	270000	88000	358000
P4-C	5/19/12	5-6	Sand	336	UV10	Gas/GRO	5100	11000	1000	40000	280000	52000	332000
P4-D	5/19/12	7-8	Sand	222	UV10	GRO	260	<15	<15	630	<29	<15	<29
P4-E	5/19/12	9-10	Silt	51	UV10	GRO	42	<60	<60	<60	180	<60	180
P5-A	5/19/12	1-2	Sand	315	UV11	Gas	1200	<140	990	3400	22000	5600	27600
P5-B	5/19/12	3-4	Sand	2987	UV11	Gas	2100	350	5800	10000	63000	18000	81000
P5-C	5/19/12	5-6	Sand	183	UV11	Gas	4200	4500	45000	32000	190000	64000	254000
P5-D	5/19/12	7-8	Sand	27	UV11	Gas/GRO	33	1500	48	150	180	27	207
P5-E	5/19/12	9-10	Silt	9	UV11	-----	<11	<28	31	<28	<55	<28	<55
P6-A	5/19/12	1-2	Sand	1589	UV11	Gas	4200	4100	63000	28000	180000	68000	248000
P6-B	5/19/12	3-4	Sand	1073	UV11	Gas	12000	21000	230000	98000	530000	200000	730000
P6-C	5/19/12	5-6	Sand	1171	UV11	Gas	12000	14000	200000	93000	540000	200000	740000
P6-D	5/19/12	7-8	Silt/Sand	785	UV11	Gas	23	1100	1500	290	1600	610	2210
P6-E	5/19/12	9-10	Silt	47	UV11	Gas/GRO	44	4900	100	450	310	27	337
P7-A	5/19/12	1-2	Sand	8	UV11	Gas	20	17	38	37	150	23	173
P7-B	5/19/12	3-4	Sand	20	UV11	Gas	25	31	91	55	210	29	239
P7-C	5/19/12	5-6	Sand	8	UV11	Gas/GRO	38	79	28	100	210	<16	210
P7-D	5/19/12	7-8	Silt/Sand	12	UV11	Gas/GRO	14	680	38	84	190	<17	190
P7-E	5/19/12	9-10	Silt	0	UV11	-----	<13	<32	36	<32	<64	<32	<64

TABLE 3 - Summary of Soil Probe Soil Analytical Data - May 2012

Port of Tacoma Road
Tacoma, Washington

Sample No.	Sample Date	Sample Depth (ft)	Material Type	PID (ppm)	ARI Group	TPH Type	TPH-G (mg/kg)	Benzene (ug/kg)	Toluene (ug/kg)	Ethylbenzene (ug/kg)	m,p-Xylene (ug/kg)	o-Xylene (ug/kg)	Total Xylenes (ug/kg)
P8-A	5/19/12	1-2	Sand	26	UV11	Gas/GRO	50	69	160	120	470	220	690
P8-B	5/19/12	3-4	Sand	9	UV11	GRO	38	40	78	22	120	70	190
P8-C	5/19/12	5-6	Sand	5	UV11	-----	<5.9	180	24	<15	<30	<15	<30
P8-D	5/19/12	7-8	Sand	140	UV11	GRO	20	73	19	19	<32	<16	<32
P9-A	5/20/12	1-2	Sand	0	UV12	-----	<5.3	<13	15	<13	<27	<13	<27
P9-B	5/20/12	3-4	Sand	0	UV12	-----	<6.1	<15	17	<15	<31	<15	<31
P9-C	5/20/12	5-6	Sand	0	UV12	-----	<7.4	<19	<19	<19	<37	<19	<37
P9-D	5/20/12	7-8	Sand	0	UV12	-----	<6.9	<17	<17	<17	<34	<17	<34
P9-E	5/20/12	9-10	Silt	0	UV12	-----	<11	<27	35	<27	<54	<27	<54
P10-A	5/20/12	1-2	Sand	4090	UV12	Gas/GRO	800	130	350	4100	4400	940	5340
P10-B	5/20/12	3-4	Sand	>5000	UV12	Gas/GRO	3600	750	1600	19000	18000	2500	20500
P10-C	5/20/12	5-6	Sand	1826	UV12	Gas/GRO	2500	920	2900	21000	600 J	1900	2500 J
P10-D	5/20/12	7-8	Sand	17	UV12	-----	<7.2	<18	19	47	44	<18	44
P10-E	5/20/12	9-10	Silt	5	UV12	-----	<22	<55	<55	<55	<110	<55	<110
P11-A	5/20/12	1.3-2	Sand	4111	UV12	Gas/GRO	4400	4900	3000	31000	62000	5700	67700
P11-B	5/20/12	3-4	Sand	2220	UV12	Gas/GRO	4000	3600	2400	26000	31000	2500	33500
P11-C	5/20/12	5-6	Sand	351	UV12	Gas/GRO	10000	14000	7000	82000	40000	6800	46800
P11-D	5/20/12	7-8	Sand	29	UV12	-----	<7.8	<19	23	<19	<39	<19	<39
P11-E	5/20/12	9-10	Silt	5	UV12	-----	<13	<32	39	<32	<65	<32	<65
P12-A	5/20/12	1-2	Sand	387	UV12	Gas/GRO	2200	560	1400	20000	13000	1900	14900
P12-B	5/20/12	3-4	Sand	390	UV12	Gas/GRO	1600	1100	1000	12000	5300	960	6260
P12-C	5/20/12	5-6	Sand	384	UV12	Gas/GRO	4900	4600	2500	43000	3000	2600	5600
P12-D	5/20/12	7-8	Sand	8	UV12	-----	<6.7	<17	19	<17	43	<17	43
P12-E	5/20/12	9-10	Silt	31	UV12	-----	<13	<34	<34	<34	<67	<34	<67
P13-A	5/20/12	1-2	Sand	145	UV13	Gas/GRO	270	62	64	800	130	360	490
P13-B	5/20/12	3-4	Sand	181	UV13	Gas/GRO	150	270	62	1200	220	130	350
P13-C	5/20/12	5-6	Sand	184	UV13	Gas/GRO	670	<17	240	420	240	1100	1340
P13-D	5/20/12	7-8	Sand	2	UV13	-----	<5.1	<13	<13	<13	<26	<13	<26
P13-E	5/20/12	9-10	Silt	3	UV13	-----	<23	<58	69	<58	<120	<58	<120
P14-A	5/20/12	1-2	Sand	1	UV13	-----	<5.3	<13	14	<13	<26	<13	<26
P14-B	5/20/12	3-4	Sand	0	UV13	-----	<7.3	<18	22	<18	<36	<18	<36
P14-C	5/20/12	5-6	Sand	1	UV13	-----	<7.0	<17	21	61	83	<17	83
P14-D	5/20/12	7-8	Sand	1	UV13	-----	<6.6	<17	<17	<17	<33	<17	<33
P14-E	5/20/12	9-10	Silt	0	UV13	-----	<11	<28	30	<28	<57	<28	<57



1000 0 1000 2000

Approx. Scale in Feet

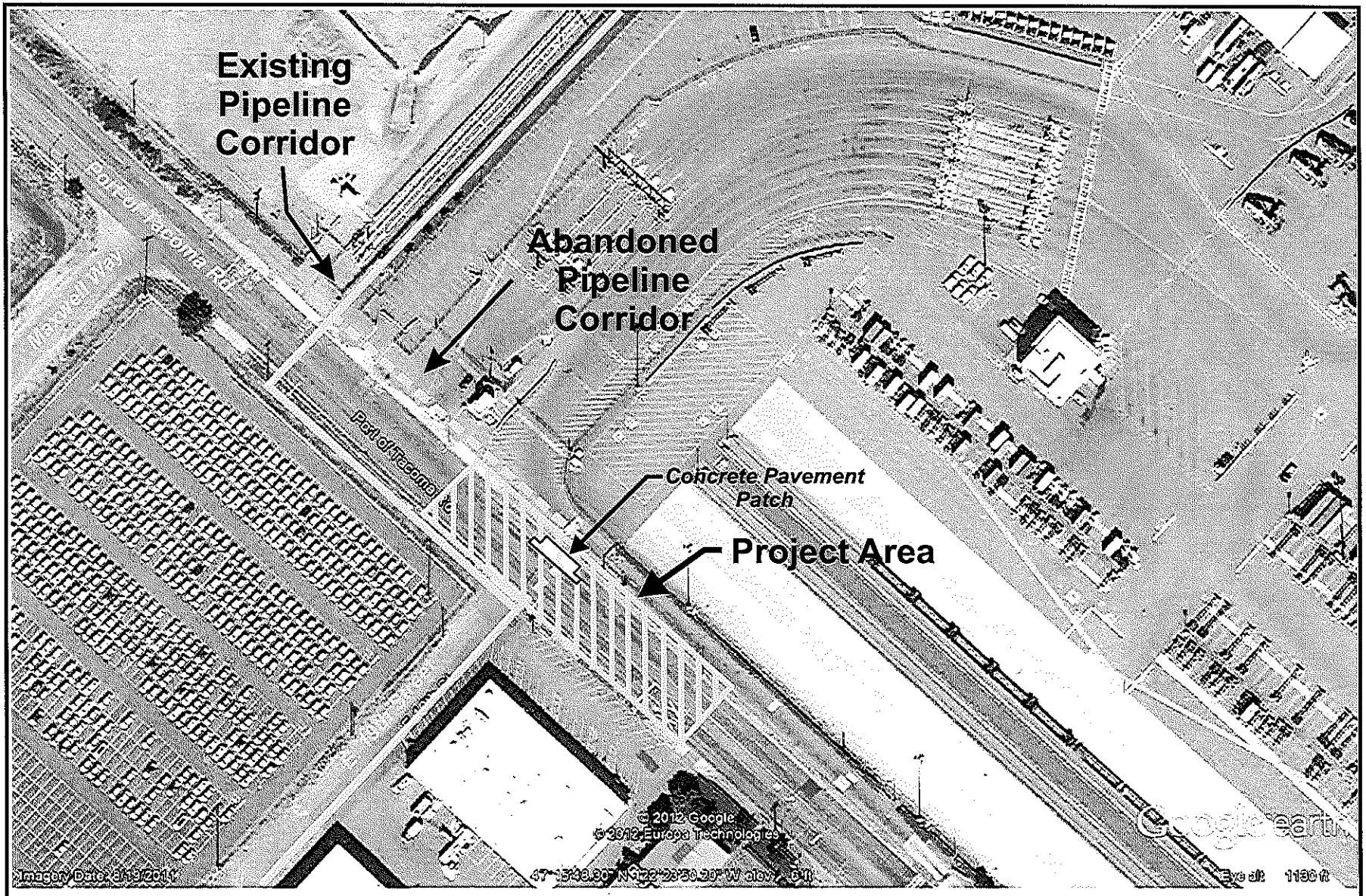
U. S. Oil & Refining Co.
Refinery to Dock Pipeline Replacement

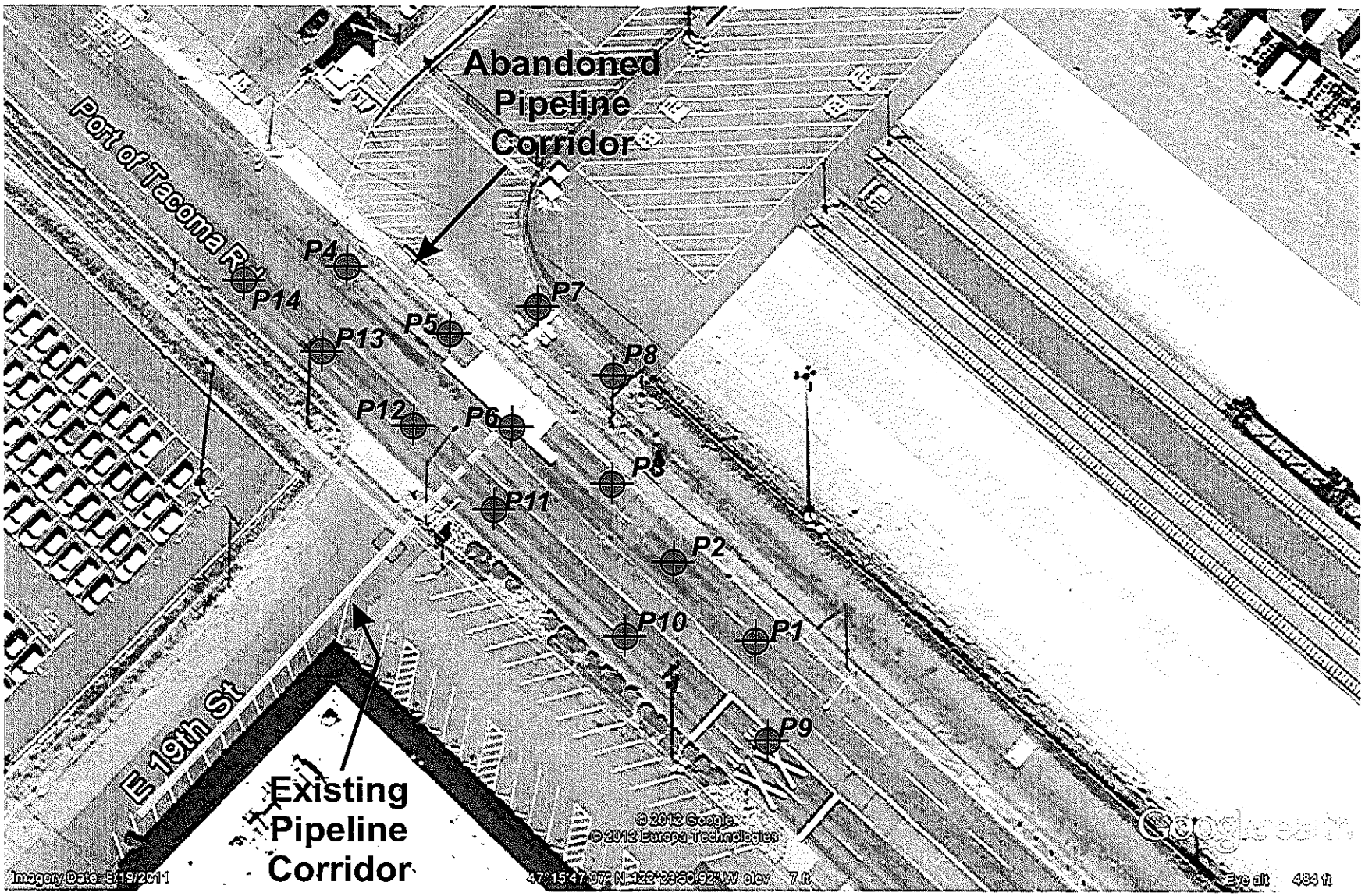
VICINITY MAP

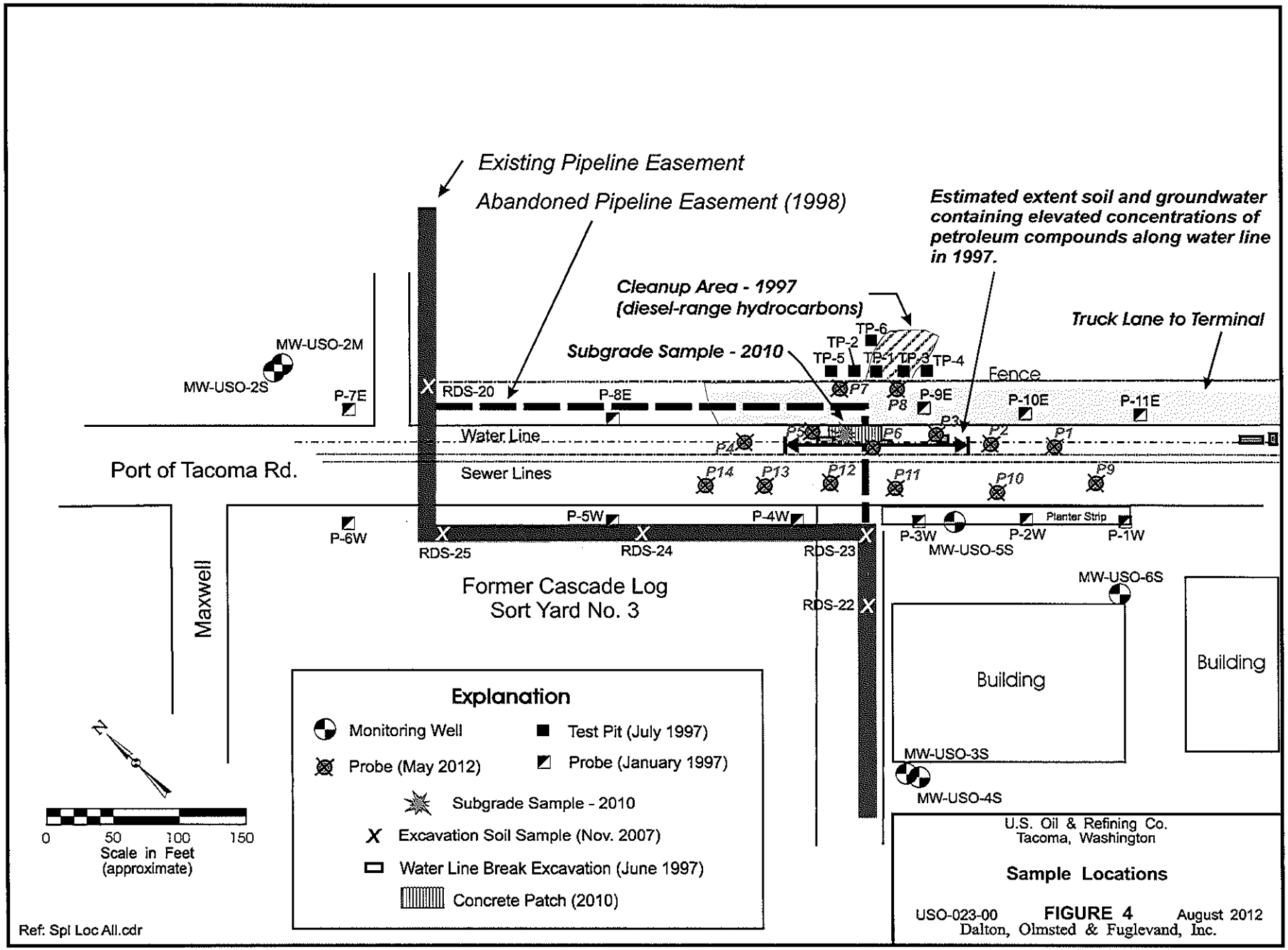
FIGURE 1

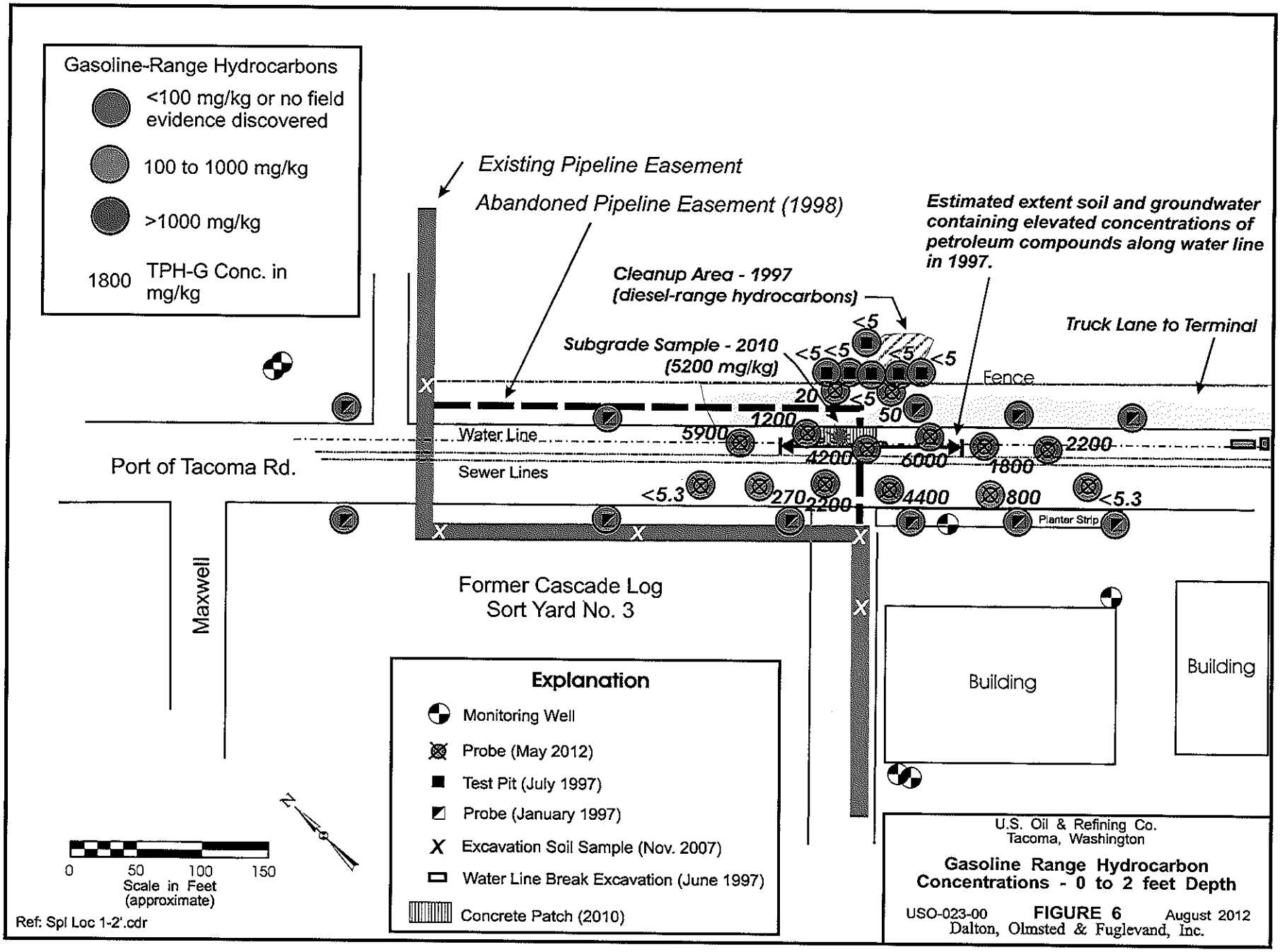
USO-021 March 2008

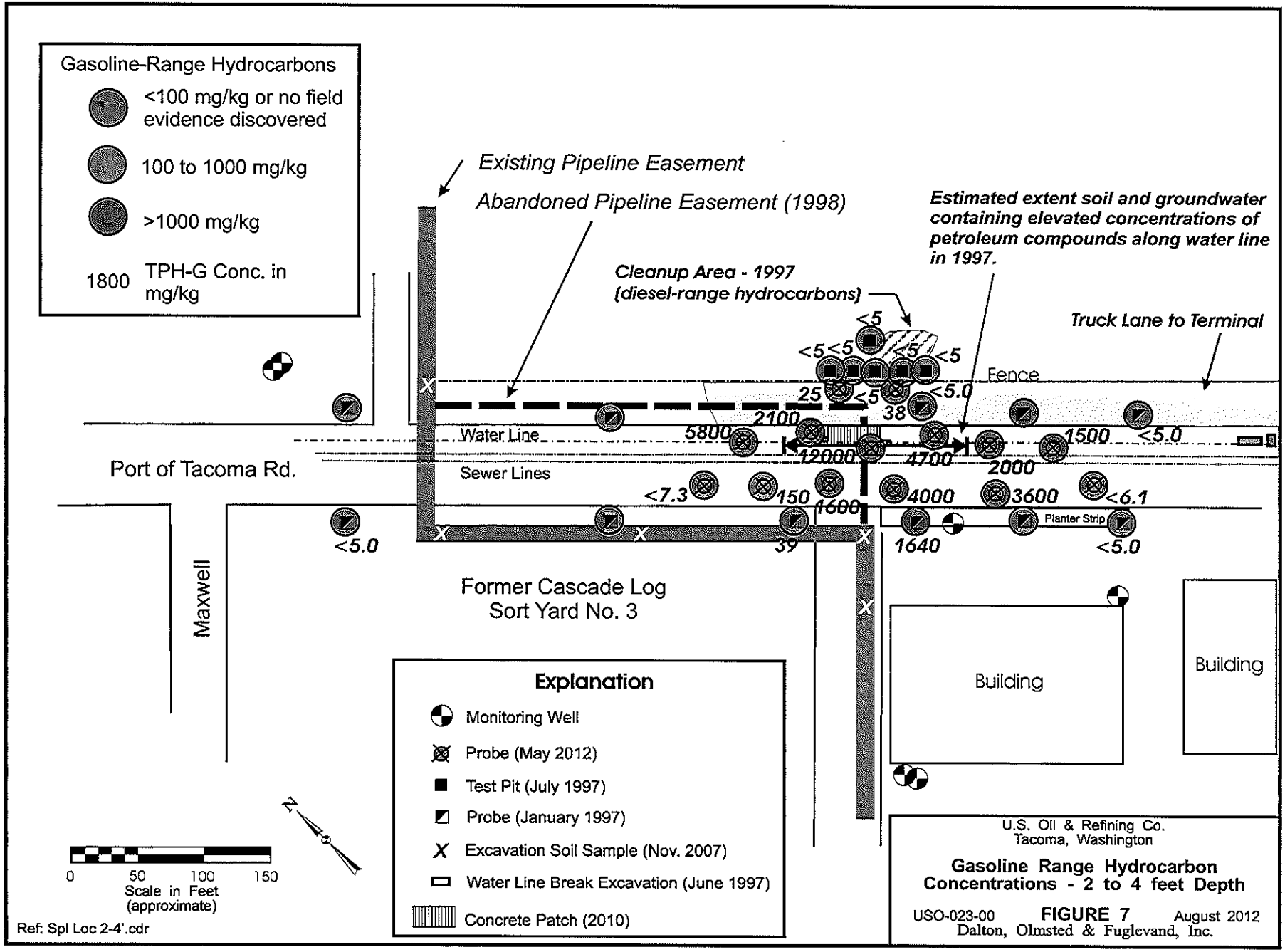
Dalton, Olmsted & Fuglevand, Inc.

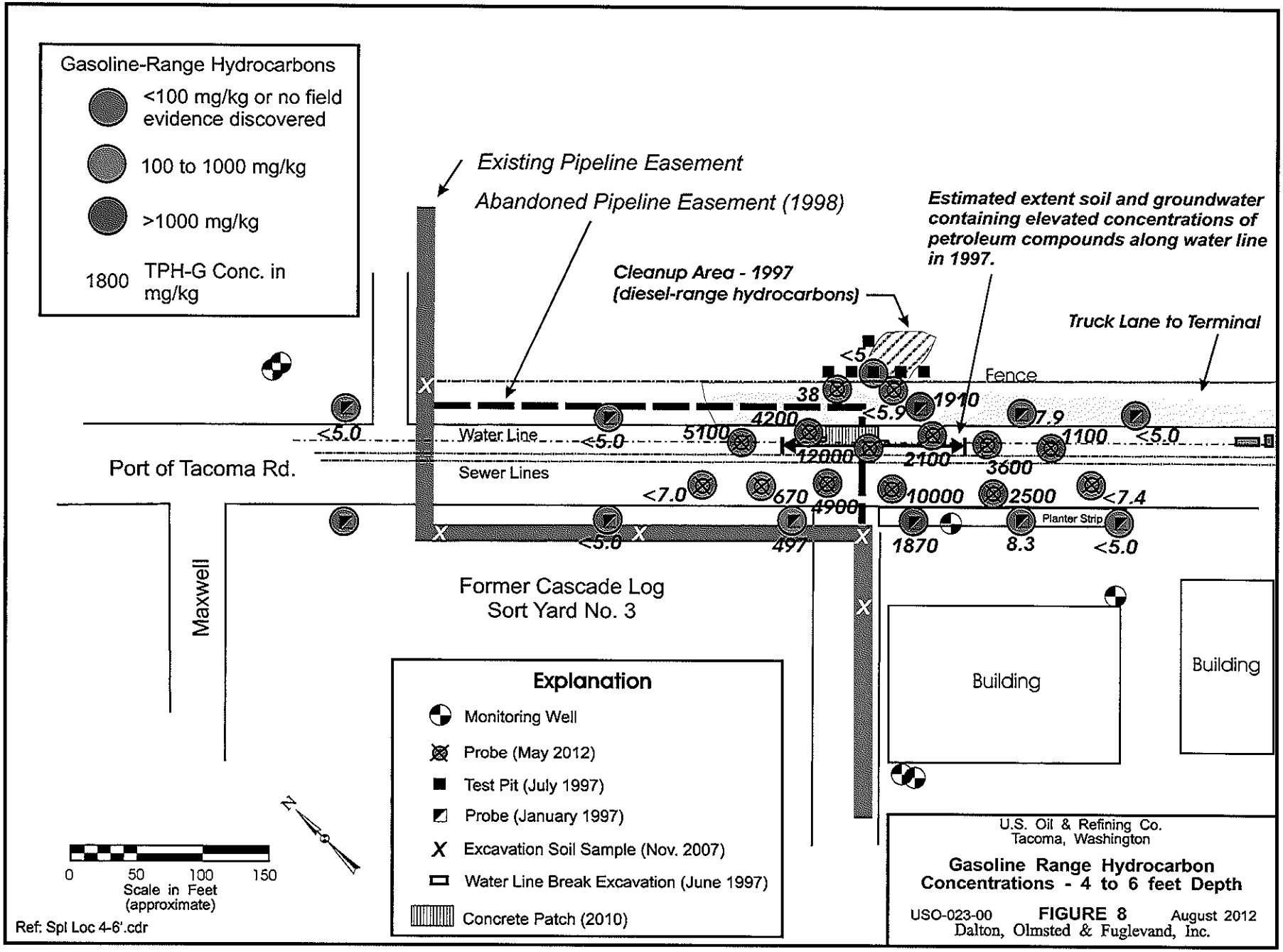

Existing Pipeline Corridor
Abandoned Pipeline Corridor
Concrete Pavement Patch
Project Area
Port of Tacoma Rd
Port of Tacoma Rd
© 2012 Google
© 2012 Europa Technologies
Imagery Date: 8/1/2011
Eye alt 1130 ft
0
xxx
Scale in Feet
(approximate)
N
Ref: Layout.cdr
1920 Port of Tacoma Road
Tacoma, Washington
Project Area Layout
USO-023-00
FIGURE 2
July 2012
Dalton, Olmsted & Fuglevand, Inc.

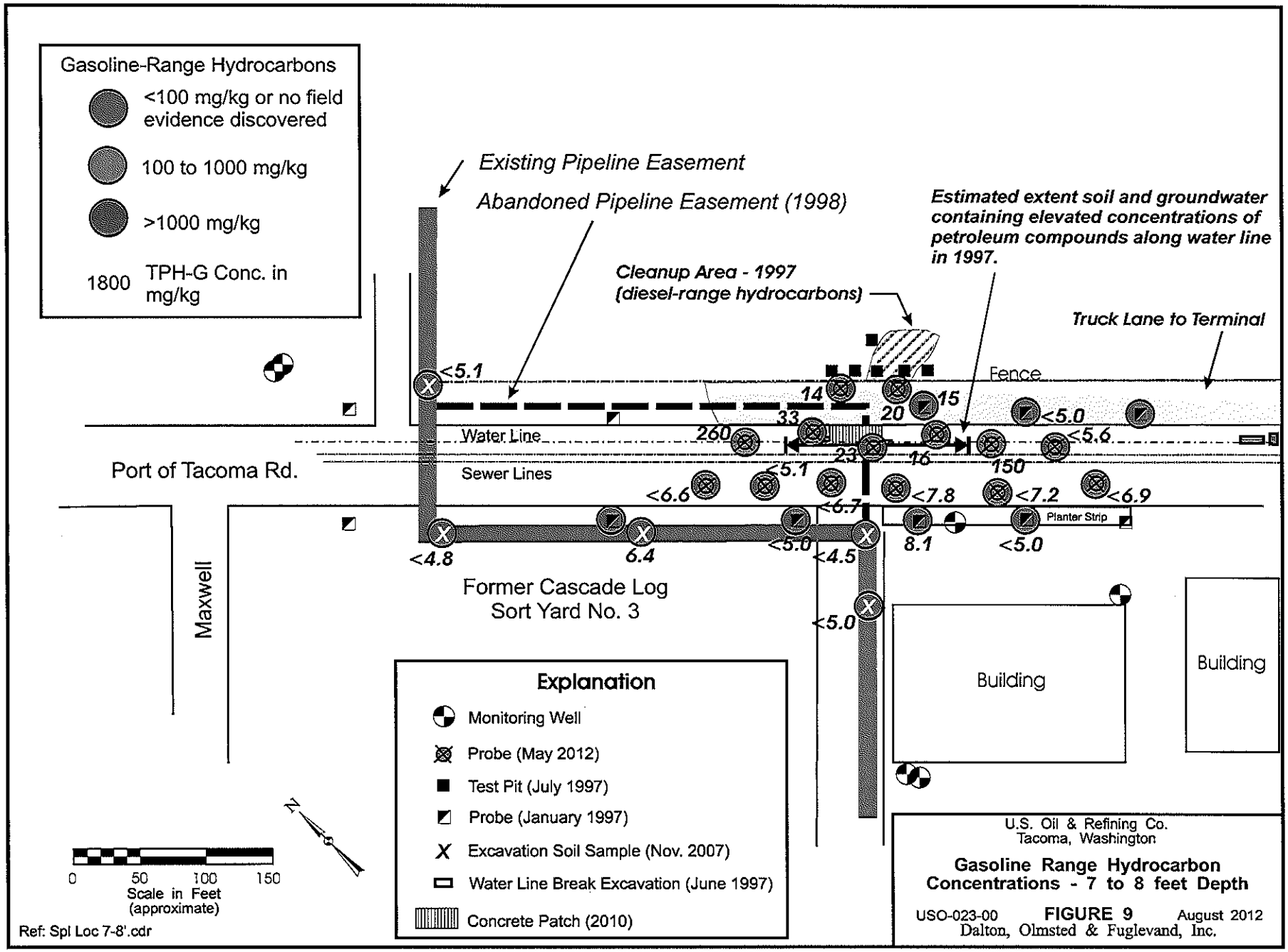

Abandoned Pipeline Corridor
Port of Tacoma Rd
P4
P14
P7
P13
P5
P8
P12
P6
P3
P11
P2
P10
P1
P9
E 19th St
Existing Pipeline Corridor
Imagery Date: 8/19/2011
© 2012 Google
© 2013 Europa Technologies
Google earth
Eye alt 434 ft
0
62
Scale in Feet
(approximate)
N
2012 Soil Probe
1920 Port of Tacoma Road
Tacoma, Washington
Probe Locations - May 2012
USO-023-00
FIGURE 3
July 2012
Dalton, Olmsted & Fuglevand, Inc.
Ref: Spl Loc 2012 probes.cdr

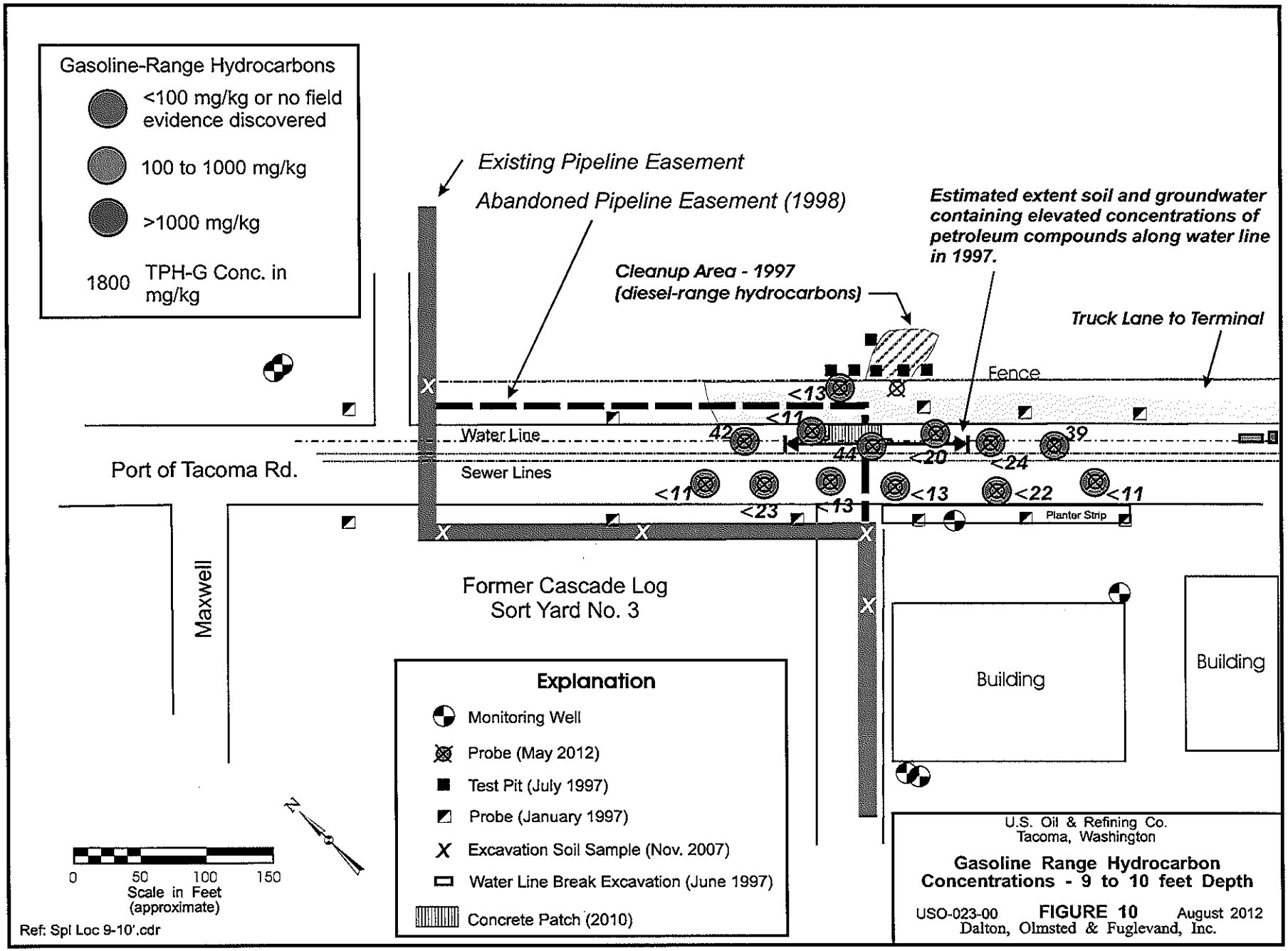

Existing Pipeline Easement
Abandoned Pipeline Easement (1998)
Estimated extent soil and groundwater containing elevated concentrations of petroleum compounds along water line in 1997.
Cleanup Area - 1997
(diesel-range hydrocarbons)
Truck Lane to Terminal
Subgrade Sample - 2010
MW-USO-2M
MW-USO-2S
P-7E
RDS-20
P-8E
TP-6
TP-2
TP-5
TP-1
TP-3
TP-4
P7
P8
P-9E
Fence
P-10E
P-11E
Water Line
P5
P6
P3
P2
P1
P4
Port of Tacoma Rd.
Sewer Lines
P14
P13
P12
P11
P10
P9
P-6W
P-5W
P-4W
RDS-25
RDS-24
RDS-23
RDS-22
P-3W
P-2W
P-1W
Planter Strip
MW-USO-5S
MW-USO-6S
Maxwell
Former Cascade Log
Sort Yard No. 3
Building
Building
MW-USO-3S
MW-USO-4S
N
0
50
100
150
Scale in Feet
(approximate)
Explanation
Monitoring Well
Test Pit (July 1997)
Probe (May 2012)
Probe (January 1997)
Subgrade Sample - 2010
Excavation Soil Sample (Nov. 2007)
Water Line Break Excavation (June 1997)
Concrete Patch (2010)
U.S. Oil & Refining Co.
Tacoma, Washington
Sample Locations
USO-023-00
FIGURE 4
August 2012
Dalton, Olmsted & Fuglevand, Inc.
Ref: Spl Loc All.cdr


Gasoline-Range Hydrocarbons
<100 mg/kg or no field evidence discovered
100 to 1000 mg/kg
>1000 mg/kg
1800 TPH-G Conc. in mg/kg
Existing Pipeline Easement
Abandoned Pipeline Easement (1998)
Cleanup Area - 1997
(diesel-range hydrocarbons)
Subgrade Sample - 2010
(5200 mg/kg)
Estimated extent soil and groundwater containing elevated concentrations of petroleum compounds along water line in 1997.
Truck Lane to Terminal
Fence
Water Line
Sewer Lines
Port of Tacoma Rd.
Maxwell
Former Cascade Log
Sort Yard No. 3
Planter Strip
Building
Building
<5
<5 <5
<5
<5
<5
20
<5
50
1200
5900
4200
6000
1800
2200
<5.3
270
2200
4400
800
<5.3
Explanation
Monitoring Well
Probe (May 2012)
Test Pit (July 1997)
Probe (January 1997)
Excavation Soil Sample (Nov. 2007)
Water Line Break Excavation (June 1997)
Concrete Patch (2010)
0 50 100 150
Scale in Feet
(approximate)
Ref: Spl Loc 1-2'.cdr
U.S. Oil & Refining Co.
Tacoma, Washington
Gasoline Range Hydrocarbon Concentrations - 0 to 2 feet Depth
USO-023-00 FIGURE 6 August 2012
Dalton, Olmsted & Fuglevand, Inc.


Gasoline-Range Hydrocarbons
<100 mg/kg or no field evidence discovered
100 to 1000 mg/kg
>1000 mg/kg
1800 TPH-G Conc. in mg/kg
Existing Pipeline Easement
Abandoned Pipeline Easement (1998)
Cleanup Area - 1997
(diesel-range hydrocarbons)
Estimated extent soil and groundwater containing elevated concentrations of petroleum compounds along water line in 1997.
Truck Lane to Terminal
Fence
Water Line
Sewer Lines
Port of Tacoma Rd.
Maxwell
Former Cascade Log
Sort Yard No. 3
Planter Strip
Building
Building
<5
<5 <5 <5 <5
25
<5
38
<5.0
2100
5800
12000
4700
2000
1500
<5.0
<7.3
150
1600
4000
3600
<6.1
<5.0
39
1640
<5.0
Explanation
Monitoring Well
Probe (May 2012)
Test Pit (July 1997)
Probe (January 1997)
Excavation Soil Sample (Nov. 2007)
Water Line Break Excavation (June 1997)
Concrete Patch (2010)
N
0 50 100 150
Scale in Feet
(approximate)
Ref: Spl Loc 2-4'.cdr
U.S. Oil & Refining Co.
Tacoma, Washington
Gasoline Range Hydrocarbon Concentrations - 2 to 4 feet Depth
USO-023-00 FIGURE 7 August 2012
Dalton, Olmsted & Fuglevand, Inc.


Gasoline-Range Hydrocarbons
<100 mg/kg or no field evidence discovered
100 to 1000 mg/kg
>1000 mg/kg
1800 TPH-G Conc. in mg/kg
Existing Pipeline Easement
Abandoned Pipeline Easement (1998)
Cleanup Area - 1997
(diesel-range hydrocarbons)
Estimated extent soil and groundwater containing elevated concentrations of petroleum compounds along water line in 1997.
Truck Lane to Terminal
Fence
Water Line
Sewer Lines
Port of Tacoma Rd.
Maxwell
Former Cascade Log
Sort Yard No. 3
Planter Strip
Building
Building
<5
38
1910
<5.9
7.9
1100
<5.0
<5.0
4200
5100
12000
2100
3600
<5.0
<7.0
670
4900
10000
2500
<7.4
<5.0
497
1870
8.3
<5.0
Explanation
Monitoring Well
Probe (May 2012)
Test Pit (July 1997)
Probe (January 1997)
Excavation Soil Sample (Nov. 2007)
Water Line Break Excavation (June 1997)
Concrete Patch (2010)
0 50 100 150
Scale in Feet
(approximate)
N
Ref: Spl Loc 4-6'.cdr
U.S. Oil & Refining Co.
Tacoma, Washington
Gasoline Range Hydrocarbon Concentrations - 4 to 6 feet Depth
USO-023-00 FIGURE 8 August 2012
Dalton, Olmsted & Fuglevand, Inc.


Gasoline-Range Hydrocarbons
<100 mg/kg or no field evidence discovered
100 to 1000 mg/kg
>1000 mg/kg
1800 TPH-G Conc. in mg/kg
Existing Pipeline Easement
Abandoned Pipeline Easement (1998)
Cleanup Area - 1997
(diesel-range hydrocarbons)
Estimated extent soil and groundwater containing elevated concentrations of petroleum compounds along water line in 1997.
Truck Lane to Terminal
Fence
Water Line
Sewer Lines
Port of Tacoma Rd.
Maxwell
Former Cascade Log
Sort Yard No. 3
Planter Strip
Building
Building
<5.1
14
15
20
<5.0
33
260
<5.6
23
16
150
<5.1
<6.6
<7.8
<7.2
<6.9
<6.7
<4.8
6.4
<5.0
<4.5
8.1
<5.0
<5.0
Explanation
Monitoring Well
Probe (May 2012)
Test Pit (July 1997)
Probe (January 1997)
Excavation Soil Sample (Nov. 2007)
Water Line Break Excavation (June 1997)
Concrete Patch (2010)
N
0 50 100 150
Scale in Feet
(approximate)
Ref: Spl Loc 7-8'.cdr
U.S. Oil & Refining Co.
Tacoma, Washington
Gasoline Range Hydrocarbon Concentrations - 7 to 8 feet Depth
USO-023-00 FIGURE 9 August 2012
Dalton, Olmsted & Fuglevand, Inc.


Gasoline-Range Hydrocarbons
<100 mg/kg or no field evidence discovered
100 to 1000 mg/kg
>1000 mg/kg
1800 TPH-G Conc. in mg/kg
Existing Pipeline Easement
Abandoned Pipeline Easement (1998)
Cleanup Area - 1997
(diesel-range hydrocarbons)
Estimated extent soil and groundwater containing elevated concentrations of petroleum compounds along water line in 1997.
Truck Lane to Terminal
Fence
Water Line
Sewer Lines
Port of Tacoma Rd.
Maxwell
Former Cascade Log
Sort Yard No. 3
Planter Strip
Building
Building
<13
<11
42
44
<20
<24
39
<11
<23
<13
<13
<22
<11
Explanation
Monitoring Well
Probe (May 2012)
Test Pit (July 1997)
Probe (January 1997)
Excavation Soil Sample (Nov. 2007)
Water Line Break Excavation (June 1997)
Concrete Patch (2010)
N
0 50 100 150
Scale in Feet
(approximate)
Ref: Spl Loc 9-10'.cdr
U.S. Oil & Refining Co.
Tacoma, Washington
Gasoline Range Hydrocarbon Concentrations - 9 to 10 feet Depth
USO-023-00 FIGURE 10 August 2012
Dalton, Olmsted & Fuglevand, Inc.

APPENDIX A
SOIL BORING LOGS 2012
Port of Tacoma Road Project

BORING - DESCRIPTION OF SAMPLES & DATA

P1

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709319 E1169351
Elevation (Ft.):
Date Completed: 05/19/12
Weather: Clear 60F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement

Sampler Type: 2" Macro w/ acrylic liner

Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	48		0-0.5 Asphalt concrete
A	Grab 1-2'	272			0905	0.5-1.5 3/4" minus crushed rock
B	Grab 3-4'	381			0910	1.5-5 Moist, gry, F-M SAND, w/trace gravel, odor, ns
			5-10	50		5-8.5 Wet to sat, gry, F-M SAND, w/trace gravel, odor, no sheen
C	Grab 5-6'	177			0915	Saturated below 7.5'
D	Grab 7-8'	107			0920	8.5-10 Wet, bwn, silt, w/fiberous organics, no, ns
E	Grab 9-10'	2.1			0925	

LABORATORY SAMPLES:

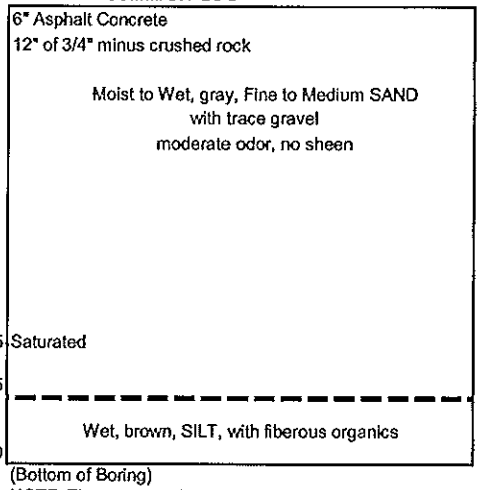
Soil:
USO-P1-A
USO-P1-B
USO-P1-C
USO-P1-D
USO-P1-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated

Depth(ft.)

SUMMARY LOG



(Bottom of Boring)

NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P2

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709353 E1169317
Elevation (Ft.):
Date Completed: 05/19/12
Weather: Clear 60F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement

Sampler Type: 2" Macro w/ acrylic liner

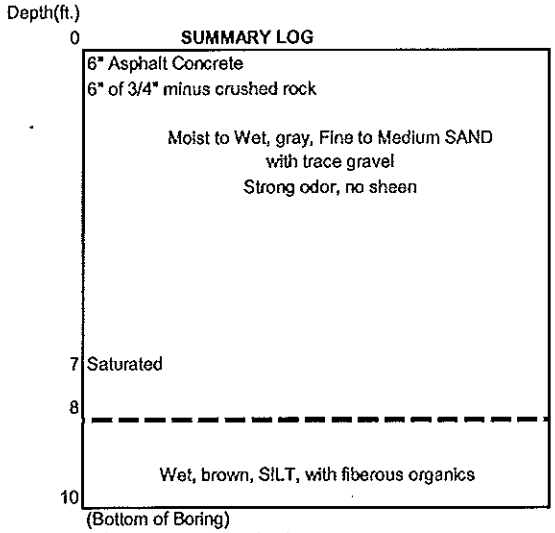
Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	55		0-0.5 Asphalt concrete
A	Grab 1-2'	3,800			1005	0.5-1.0 3/4" minus crushed rock
B	Grab 3-4'	>5,000			1010	1.0-5 Moist, gry, F-M SAND, w/trace gravel, odor, ns
			5-10	60		5-8.0 Wet to sat, gry, F-M SAND, w/trace gravel, odor, no sheen
C	Grab 5-6'	>5000			1015	Saturated below 7.5'
D	Grab 7-8'	2,760			1020	8.0-10 Wet, bwn, silt, w/fiberous organics, no, ns
E	Grab 9-10'	35			1025	

LABORATORY SAMPLES:

Soil:
USO-P2-A
USO-P2-B
USO-P2-C
USO-P2-D
USO-P2-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated



(Bottom of Boring)
NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P3

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709388 E1169291
Elevation (Ft.):
Date Completed: 05/19/12
Weather: Clear 60F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement

Sampler Type: 2" Macro w/ acrylic liner

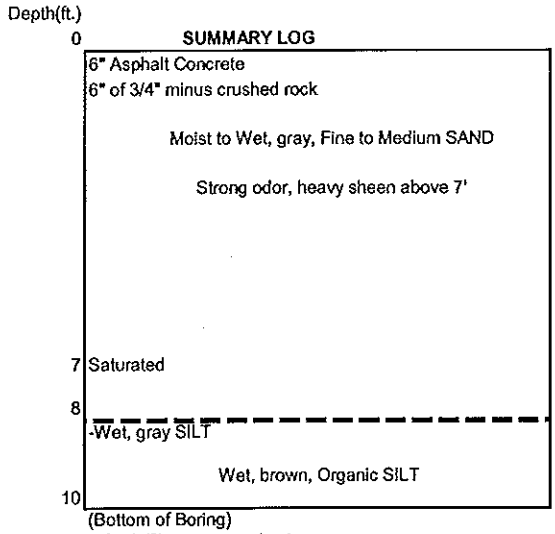
Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	50		0-0.5 Asphalt concrete
A	Grab 1-2'	>5,000			1045	0.5-1.0 3/4" minus crushed rock
B	Grab 3-4'	3,380			1050	1.0-5 Moist, gry, F-M SAND, odor, sheen
			5-10	50		5-8.0 Wet to sat, gry, F-M SAND, odor, sheen
C	Grab 5-6'	4,320			1055	Saturated below 7'
D	Grab 7-8'	15			1100	8.0-8.2 Wet, gry, SILT
E	Grab 9-10'	2			1105	8.2-10 Wet, bwn, organic, SILT, no, ns

LABORATORY SAMPLES:

Soil:
USO-P3-A
USO-P3-B
USO-P3-C
USO-P3-D
USO-P3-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated



NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P4

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709485 E1169181
Elevation (Ft.):
Date Completed: 05/19/12
Weather: Clear 65F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement

Sampler Type: 2" Macro w/ acrylic liner

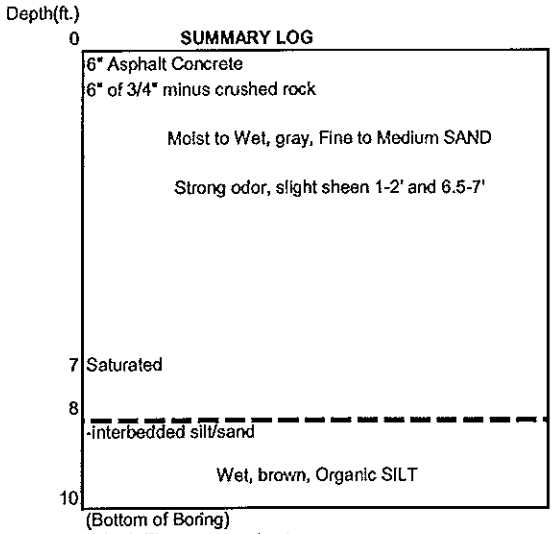
Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	55		0-0.5 Asphalt concrete
A	Grab 1-2'	305			1125	0.5-1.0 3/4" minus crushed rock
B	Grab 3-4'	2,430			1130	1.0-5 Moist, gry, F-M SAND, odor, sheen
						Brown staining 1-2'
			5-10	55		5-8.0 Wet to sat, gry, F-M SAND, odor, sheen 6.5-7'
C	Grab 5-6'	336			1135	Saturated below 7'
D	Grab 7-8'	222			1140	8.0-8.5 interbedded SILT/SAND, no, ns
E	Grab 9-10'	51			1145	8.5-10 Wet, bwn, organic, SILT, no, ns

LABORATORY SAMPLES:

Soil:
USO-P4-A
USO-P4-B
USO-P4-C
USO-P4-D
USO-P4-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated



NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P5

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709456 E1169224
Elevation (Ft.):
Date Completed: 05/19/12
Weather: Clear 65F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement

Sampler Type: 2" Macro w/ acrylic liner

Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	50		0-0.5 Asphalt concrete
A	Grab 1-2'	315			1205	0.5-1.0 3/4" minus crushed rock
B	Grab 3-4'	2,987			1210	1.0-5 Moist, gry, F-M SAND, odor, sheen @ 4'
			5-10	50		5-8.0 Wet to sat, gry, F-M SAND, odor, sheen 5-6.5'
C	Grab 5-6'	183			1215	Saturated below 6.5'
D	Grab 7-8'	27			1220	8.0-8.3 Wet, bwn, silty, Fiberous Organics
E	Grab 9-10'	9			1225	8.3-10 Wet, bwn, organic, SILT, no, ns

LABORATORY SAMPLES:

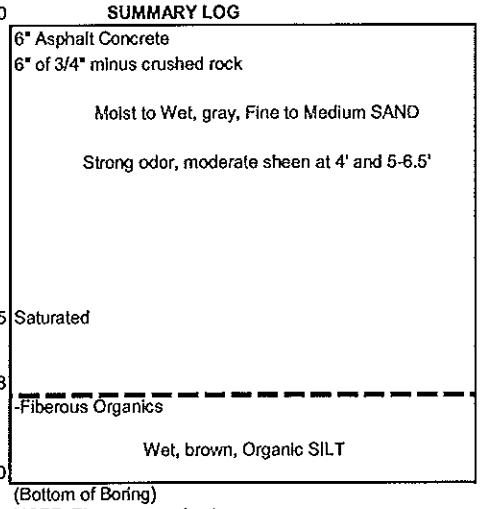
Soil:
USO-P5-A
USO-P5-B
USO-P5-C
USO-P5-D
USO-P5-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated

Depth(ft.)

0 **SUMMARY LOG**



(Bottom of Boring)

NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P6

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709414 E1169251
Elevation (Ft.):
Date Completed: 05/19/12
Weather: Clear 65F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement

Sampler Type: 2" Macro w/ acrylic liner

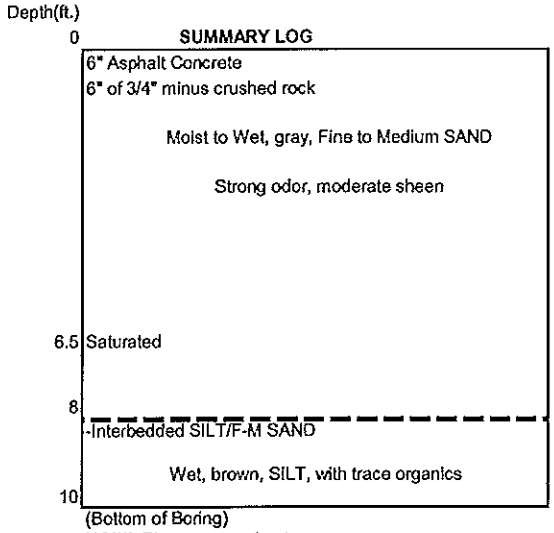
Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	55		0-0.5 Asphalt concrete
A	Grab 1-2'	1,589			1335	0.5-1.0 3/4" minus crushed rock
B	Grab 3-4'	1,073			1340	1.0-5 Moist, gry, F-M SAND, odor, sheen
			5-10	55		5-8.0 Wet to sat, gry, F-M SAND, odor, sheen
C	Grab 5-6'	1,171			1345	Saturated below 7'
D	Grab 7-8'	785			1350	8.0-9.0 Interbedded Silt & F-M Sand, no, ns
E	Grab 9-10'	47			1400	9-10 Wet, bwn, SILT, w/trace organics, no, ns

LABORATORY SAMPLES:

Soil:
USO-P6-A
USO-P6-B
USO-P6-C
USO-P6-D
USO-P6-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated



NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P7

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709468 E1169262
Elevation (Ft.):
Date Completed: 05/19/12
Weather: Clear 65F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement

Sampler Type: 2" Macro w/ acrylic liner

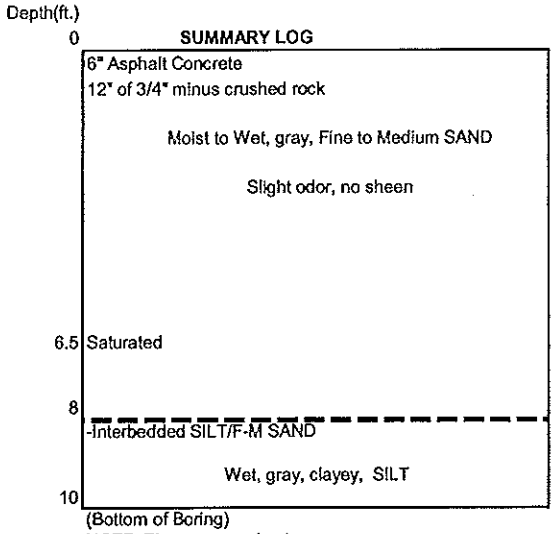
Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	55		0-0.5 Asphalt concrete
A	Grab 1.5-2'	8			1420	0.5-1.5 3/4" minus crushed rock
B	Grab 3-4'	20			1425	1.5-5 Moist, gry, F-M SAND, silt clast @ 4.5', odor, ns
			5-10	55		5-8.5 Wet to sat, gry, F-M SAND, no, ns
C	Grab 5-6'	8			1430	Saturated below 7'
D	Grab 7-8'	12			1435	8.5-9.0 Interbedded Silt & F-M Sand, no, ns
E	Grab 9-10'	0			1440	9-10 Wet, gry, clayey, SILT, plastic, no, ns

LABORATORY SAMPLES:

Soil:
USO-P7-A
USO-P7-B
USO-P7-C
USO-P7-D
USO-P7-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated



NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P8

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709434 E1169296
Elevation (Ft.):
Date Completed: 05/19/12
Weather: Clear 65F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement

Sampler Type: 2" Macro w/ acrylic liner

Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	48		0-0.7 Asphalt concrete
A	Grab 2-3'	26			1505	0.7-2.0 3/4" minus crushed rock
B	Grab 4-5'	9			1510	2.0-5 Moist, gry, F-M SAND, w/some gravel, no, ns
			5-10	40		5-6 Wet to sat, gry, F-M SAND, w/some gravel, no, ns
C	Grab 6-7'	5		poor recovery	1515	6-7 Sat, gry, M-C SAND, no, ns
D	Grab 7-8'	140			1520	7-8 Sat, gry, F-M SAND, no, ns

LABORATORY SAMPLES:

Soil:
USO-P8-A
USO-P8-B
USO-P8-C
USO-P8-D

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated

Depth(ft.)

0 **SUMMARY LOG**

8" Asphalt Concrete
28" of 3/4" minus crushed rock

Moist to Saturated, gray, Fine to Medium SAND

No odor, no sheen

6

-Medium to Coarse SAND

7

8

(Bottom of Boring)

NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P9

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709275 E1169355
Elevation (Ft.):
Date Completed: 05/20/12
Weather: showers 65F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement

Sampler Type: 2" Macro w/ acrylic liner

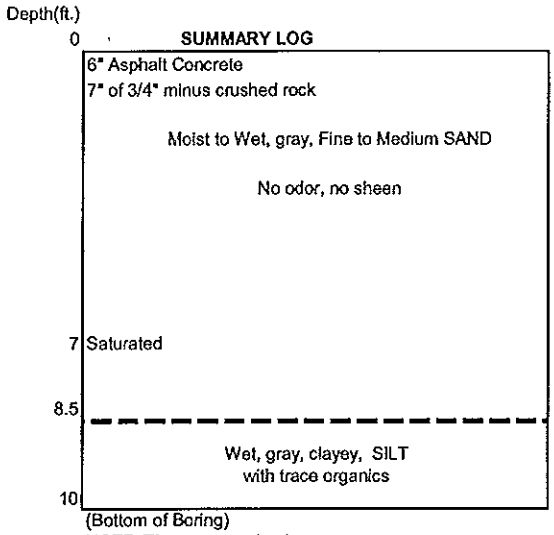
Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	60		0-0.5 Asphalt concrete
A	Grab 1-2'	0			0905	0.5-1.1 3/4" minus crushed rock
B	Grab 3-4'	0			0910	1.1-5 Moist, gry, F-M SAND, no, ns
			5-10	55		5-8.5 Wet to sat, gry, F-M SAND, no, ns
C	Grab 5-6'	0			0915	Saturated below 7'
D	Grab 7-8'	0			0920	8.5-10.0 Wet, gry, clayey, SILT, w/trace organics, no, ns
E	Grab 9-10'	0			0925	

LABORATORY SAMPLES:

Soil:
USO-P9-A
USO-P9-B
USO-P9-C
USO-P9-D
USO-P9-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated



NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P10

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709323 E1169298
Elevation (Ft.):
Date Completed: 05/20/12
Weather: showers 65F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement

Sampler Type: 2" Macro w/ acrylic liner

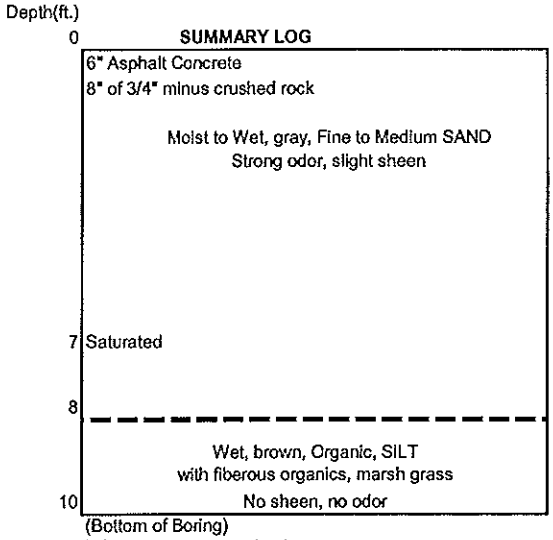
Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	55		0-0.5 Asphalt concrete
A	Grab 1.2-2'	4,090			0935	0.5-1.2 3/4" minus crushed rock
B	Grab 3-4'	>5,000			0940	1.2-5 Moist, gry, F-M SAND, odor, sheen
			5-10	55		5-8 Wet to sat, gry, F-M SAND, odor, sheen
C	Grab 5-6'	1,826			0945	Saturated below 7'
D	Grab 7-8'	17			0950	8-10 Wet, bwn, organic, SILT, w/fiberous organics, no, ns
E	Grab 9-10'	5			0955	

LABORATORY SAMPLES:

Soil:
USO-P10-A
USO-P10-B
USO-P10-C
USO-P10-D
USO-P10-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated



NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

P11

BORING - DESCRIPTION OF SAMPLES & DATA

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709379 E1169242
Elevation (Ft.):
Date Completed: 05/20/12
Weather: showers 65F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement

Sampler Type: 2" Macro w/ acrylic liner

Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	55		0-0.5 Asphalt concrete
A	Grab 1.3-2'	4,111			1005	0.5-1.3 3/4" minus crushed rock
B	Grab 3-4'	2,220			1010	1.3-5 Moist, gry, F-M SAND, odor, sheen
			5-10	55		5-8.2 Wet to sat, gry, F-M SAND, odor, sheen
C	Grab 5-6'	351			1015	Saturated below 7'
D	Grab 7-8'	29			1020	8.2-8.5 Sat, gry, F sandy, SILT, odor, ns
E	Grab 9-10'	5			1030	8.5-10 Wet, bwn, organic, SILT, no, ns

LABORATORY SAMPLES:

Soil:
USO-P11-A
USO-P11-B
USO-P11-C
USO-P11-D
USO-P11-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated

Depth(ft.)

SUMMARY LOG

0 — 6" Asphalt Concrete
8" of 3/4" minus crushed rock

Moist to Wet, gray, Fine to Medium SAND
Very Strong odor, moderate sheen

7 Saturated

8 — -Fine sandy, SILT
Wet, brown, Organic, SILT
No odor, no sheen

10 (Bottom of Boring)

NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P12

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709416 E1169208
Elevation (Ft.):
Date Completed: 05/20/12
Weather: showers 65F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement
Sampler Type: 2" Macro w/ acrylic liner

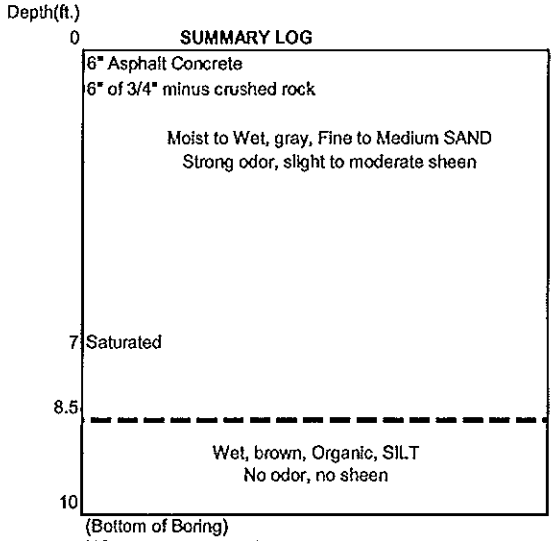
Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	55		0-0.5 Asphalt concrete
A	Grab 1-2'	387			1050	0.5-1 3/4" minus crushed rock
B	Grab 3-4'	390			1055	1-5 Moist, gry, F-M SAND, odor, sheen
			5-10	50		5-8.5 Wet to sat, gry, F-M SAND, odor, sheen
C	Grab 5-6'	384			1100	Saturated below 7'
D	Grab 7-8'	8			1105	8.5-10 Wet, bwn, Organic, SLT, no, ns
E	Grab 9-10'	31			1110	

LABORATORY SAMPLES:

Soil:
USO-P12-A
USO-P12-B
USO-P12-C
USO-P12-D
USO-P12-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated



NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P13

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709448 E1169169
Elevation (Ft.):
Date Completed: 05/20/12
Weather: showers 65F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement
Sampler Type: 2" Macro w/ acrylic liner

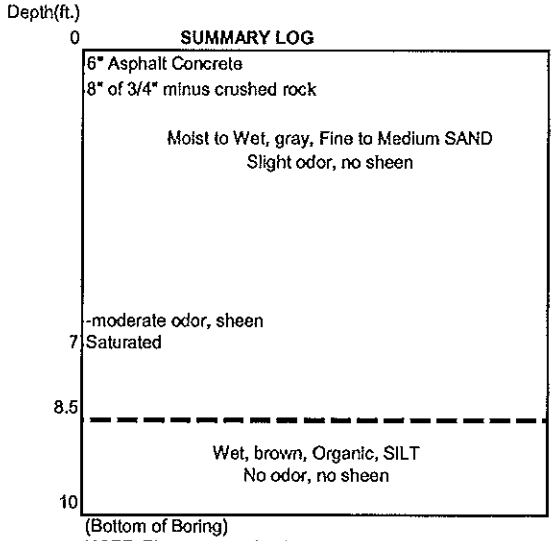
Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	55		0-0.5 Asphalt concrete
A	Grab 1-2'	145			1125	0.5-1.3 3/4" minus crushed rock
B	Grab 3-4'	181			1130	1.3-5 Moist, gry, F-M SAND, odor, ns
			5-10	50		5-8.5 Wet to sat, gry, F-M SAND, odor, sheen 6.5-7'
C	Grab 5-6'	184			1135	Saturated below 7'
D	Grab 7-8'	2			1140	8.5-10 Wet, bwn, Organic, SLT, w/marsh grass, no, ns
E	Grab 9-10'	3			1145	

LABORATORY SAMPLES:

Soil:
USO-P12-A
USO-P12-B
USO-P12-C
USO-P12-D
USO-P12-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated



NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.

BORING - DESCRIPTION OF SAMPLES & DATA

P14

Field Rep: DG Cooper
Drilling Co.: Cascade
Driller: Josh Marks
Drill Type: Geoprobe 6600
Size/Type Casing: 2" Rod

Location: N709480 E1169137
Elevation (Ft.):
Date Completed: 05/20/12
Weather: showers 65F
Hammer Type: Direct push

Ground Surface: Asphalt Pavement
Sampler Type: 2" Macro w/ acrylic liner

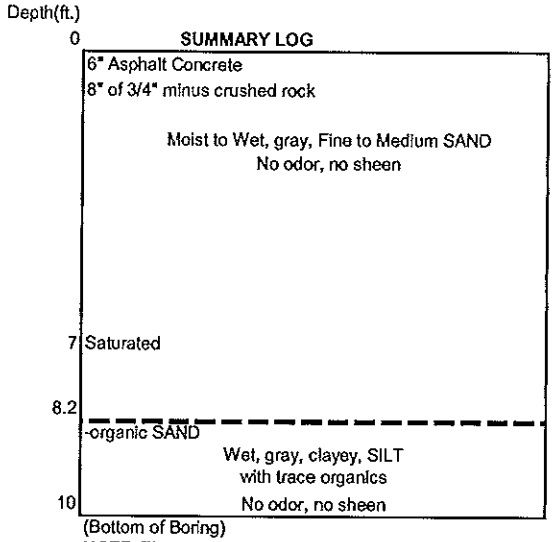
Spl.No.	Type sample saved	PID (ppm)	Spl Depth (Ft.) From - To	Spl length inches	Time	Sample Description
			0-5	60		0-0.5 Asphalt concrete
A	Grab 1-2'	1			1220	0.5-1.3 3/4" minus crushed rock
B	Grab 3-4'	0			1225	1.3-5 Moist, gry, F-M SAND, no, ns
			5-10	55		5-8.2 Wet to sat, gry, F-M SAND, no, ns
C	Grab 5-6'	1			1230	Saturated below 7'
D	Grab 7-8'	1			1235	8.2-8.5 Wet, gry, organic, SAND, fiberous organics, no, ns
E	Grab 9-10'	0			1240	8.5-10 Wet, gry, clayey, SILT, w/trace organics, no, ns

LABORATORY SAMPLES:

Soil:
USO-P12-A
USO-P12-B
USO-P12-C
USO-P12-D
USO-P12-E

Notes: Completed boring backfilled with bentonite grout

ns - no sheen
no - no odor
F - fine
M - medium
Sat. - saturated



NOTE: The summary log is an interpretation based on samples, drill action, and interpolation. Variations between what is shown and actual conditions should be anticipated.