#### TECHNICAL MEMORANDUM

## PHASE 1 MONITORING WELL INSTALLATION

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**April 30, 2004** 



#### Prepared by:

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Prepared for:

Astoria Area-Wide PRP Group

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Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

Principal/Hydrogeologist

Project Manager

Astoria, Oregon
April 30, 2004
This report has been prepared by <i>EnviroLogic Resources</i> , <i>Inc.</i> , of Portland, Oregon.
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## TECHNICAL MEMORANDUM PHASE 1 MONITORING WELL INSTALLATION

# Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

#### 1.0 INTRODUCTION

This Technical Memorandum presents the results of monitoring well installation fieldwork completed in August and September 2003 for the Remedial Investigation/Feasibility Study (RI/FS) at the Astoria Area-Wide Petroleum Site. The fieldwork was performed at the site from August 25 through September 17, 2003, in accordance with the Work Plan Addendum, Phase 2 Ground Water Assessment (*EnviroLogic Resources*, 2003b). This technical memorandum presents details of the monitoring well installation phase of the Phase 1 Ground-Water Assessment. Analytical results from soil samples collected during well installation will be presented in a Phase 2 soil/source characterization report. Ground-water sampling and analytical results will be presented in a report of the first quarterly monitoring event, which occurred in October 2003. Modifications to the Phase 1 RI Work Plan and Work Plan Addenda, methods and procedures, well construction details, and local hydrogeology are outlined in this technical memorandum.

The Oregon Department of Environmental Quality (DEQ) issued a unilateral order requiring the investigation and potential cleanup of properties in an area near the Port of Astoria in Astoria, Oregon. The Order (DEQ Unilateral Order No. ECSR-NWR-01-11) was issued to several of the current and former facility operators, property owners, and leaseholders that have engaged in industrial and commercial activities. ChevronTexaco Products Company (ChevronTexaco), Delphia Oil Company (Delphia), McCall Oil and Chemical Company (McCall), Ed Niemi Oil Company (Niemi Oil), Flying Dutchman and Harris Enterprises (Harris/Van West), Port of Astoria (the Port), Owest Communications International (Owest),

and Shell Oil Company (Shell), collectively potentially responsible parties (PRPs), are identified in the Order and have agreed to comply with its requirements. The following is a list of the consultants representing each PRP:

PRP	CONSULTANT
1 1/1	CONSULTAIN

ChevronTexaco	SAIC
Delphia Oil	Maul, Foster & Alongi, Inc.
Harris/Van West	Kleinfelder, Inc.
McCall Oil	Anchor Environmental, LLC
Niemi Oil	AMEC, Inc.
Port of Astoria	EnviroLogic Resources, Inc.
Qwest	Tetra Tech EM, Inc.
Shell Oil	Hart Crowser, Inc.

Exxon Mobil Corporation has also agreed to participate in investigations conducted by the PRP group. The areas within which investigations are focused are termed the Astoria Area-Wide Petroleum Site (Astoria Area-Wide) and the Regional Study Area (RSA). The boundaries of these areas are shown on Figure 1.

The RI/FS and IRAM Development Work Plan Phase 1(RI/FS Work Plan) was submitted by the PRPs to the DEQ on July 15, 2002 (*EnviroLogic Resources*, 2002b). The Work Plan provides details regarding investigations to be conducted during the Phase 1 RI at the Astoria Area-Wide site. The Work Plan Addendum, Phase 1 Ground Water Assessment was submitted to the DEQ on July 2, 2003 (*EnviroLogic Resources*, 2003b). The Work Plan Addendum, Phase 2 Soil Characterization (*EnviroLogic Resources*, 2003c) was submitted to the DEQ on July 28, 2003.

#### 1.1 BACKGROUND

The Astoria Area-Wide site comprises properties located at and near the Port of Astoria in Astoria, Oregon (Figure 1). The RSA includes the Astoria Area-Wide site and the surrounding areas. The RSA is located in Section 7, Township 8 North, Range 9 West, and Section 12, Township 8 North, Range 10 West, Willamette Base and Meridian. The Astoria Area-Wide site includes that property bounded by the Burlington Northern Railroad tracks to the southeast, Portway to the northeast, the Columbia River to the northwest, and Hamburg Street (including the former McCall bulk plant); and the property bounded by the Burlington Northern Railroad tracks to the northwest, Hamburg Street to the southwest, Marine Drive to the southeast, and Portway to the northeast.

A topographic high to the east forms a prominent hill overlooking the RSA. West Marine Drive (US Highways 26, 30, and 101) is located on a topographic bench, at the base of the prominent hill, approximately 15 feet above the level of the Port facilities. The Columbia River flows to the west on the north side of the RSA. Young's Bay lies to the south.

The area around the Port has been used for petroleum storage and distribution since the 1920s. Aboveground storage tanks (AST), underground storage tanks (UST), and pipelines are present on several of the facilities subject to this investigation. Historically, the area was home to at least four bulk petroleum storage facilities and five vehicle fueling or service stations between West Marine Drive and the Columbia River in the RSA. Pipelines from at least two of the bulk fuel storage facilities extend onto piers at the Port. The area is currently zoned for industrial and commercial uses and the zoning is expected to remain unchanged. Figure 2 shows the RSA and the locations of each of the properties subject to the Order. Remedial actions have been conducted at several facilities in association with the occurrence of petroleum hydrocarbons.

#### 1.2 SUMMARY OF WORK COMPLETED

The Work Plan Addendum, Phase 1 Ground Water Assessment (*EnviroLogic Resources*, 2003b) included the rational for the proposed monitoring well locations. The methods and procedures followed during well installation are presented in the RI/FS Work Plan (Appendix A and Appendix E). Eleven monitoring wells and two recovery wells already exist at the site. The location of these previously existing monitoring wells and recovery wells are shown on Figure 3.

Thirty-six monitoring wells were installed at the Astoria Area-Wide site between August 25, 2003, and September 17, 2003. The completed well locations are shown on Figure 3. Six wells are located northwest of Industry Street near the Port offices [MW-32(A), MW-33(A), MW-34(A), MW-41(A), MW-42(A), and MW-43(A)]. Three wells are located at the former McCall Bulk plant [MW-46(A), MW-47(A), and MW-48(A)]. Five wells are located near the former Mobil/Niemi Bulk Oil facility [MW-37(A), MW-39(A), MW-40(A), MW-44(A), and MW-44(A)]. Four wells are located in the area of the former furniture and steel works buildings between Portway and Industry Street [MW-22(A), MW-30(A), MW-31(A), and MW-35(A)]. Three wells are located at the former Shell bulk plant [MW-19(A), MW-20(A), MW-21(A)]. MW-18(A) is located between the former Shell bulk plant and the Delphia Oil property. Six wells are located on or near the Delphia Oil property and Val's Texaco property [MW-12(A), MW-13(A), MW-14(A), MW-15(A), MW-16(A), and MW-17(A)]. Four wells are at or near the Niemi Oil Cardlock property [MW-23(A), MW-26(A), MW-28(A), and MW-29(A)]. Monitoring well MW-24(A) is located at the base of the Harris/VanWest property. Monitoring wells MW-27(A) and MW-36(A) are located on the Qwest property; and MW-38(A) is located northwest of Industry Street, southeast of the former Mobil/Niemi bulk oil facility. One of the proposed upgradient wells, MW-25(A) was not completed because ground water was not encountered in the boring above a depth of 25 feet.

#### 1.3 MODIFICATIONS TO THE WORK PLAN

Appendix A (Field Sampling Plan, FSP) and Appendix E (Technical Specifications for Drilling Operations) of the Work Plan outlined the methods and procedures which were to be followed by the PRP field representative and the drillers while drilling and sampling soil borings and constructing monitoring wells at the Astoria Area-Wide site. Modifications to these appendices are documented below:

One implemented modification was related to decontamination procedures. As documented in the Phase 1 Soil Technical Memorandum (*EnviroLogic Resources*, 2003a), the original decontamination procedures were not effective. A more effective procedure for a Geoprobe <sup>®</sup> type drill rig was presented for future field exploration activities. This procedure was modified for use with a hollow-stem auger type rig. The decontamination procedure consisted of:

- Initial tap water rinse to remove large particles, if applicable (all down hole equipment);
- ➤ Alconox tap water rinse (sampling equipment only);
- > Steam tap water pressure rinse (all downhole equipment); and
- Final deionized water rinse for sampling gear.

A second modification occurred during this phase of field activities. In a few cases, soil samples were collected into sample jars instead of remaining in the brass sleeves. This was necessary when soil recovery was small or brass sleeves were not inserted into the sampler. Otherwise, samples were contained by placing end caps over Teflon sheeting on the brass sleeves; then sealed in a resealable bag.

Modifications to the Work Plan Addendum, Phase 1 Ground Water Assessment (*EnviroLogic Resources*, 2003b) included

- A modification requested by DEQ was to adjust the location of MW-38(A). The modified location of MW-38(A) is shown on Figure 2.
- Monitoring well MW-25(A) was not installed because ground water was not encountered above a depth of 25 feet during drilling. Drilling deeper to install a deeper monitoring well was considered not representative of the shallow groundwater aquifer that the remainder of the monitoring wells at the site penetrate.

#### 2.0 METHODS AND PROCEDURES

Standardized methods and procedures were developed prior to commencement of field activities. This protocol helped to control the quality of samples collected, provided a consistent framework for description of geologic materials, and helped to protect the health and safety of all site personnel. Quality-assurance protocols utilized are discussed in detail in the Quality Assurance Project Plan (QAPP) in Appendix B of the RI/FS Work Plan. Technical Specifications for Drilling Operations are in Appendix E of the RI/FS Work Plan.

#### 2.1 DRILLING PROGRAM

Geo-Tech Explorations, Inc., of Tualatin, Oregon, installed 36 monitoring wells at the Astoria Area-Wide site using hollow-stem auger drilling rigs. Prior to drilling at the Astoria Area-Wide site, the Utility Notification Service Center arranged for the location of underground utilities in the work area to be marked. Locates Down Under of Milwaukie, Oregon also performed specific boring clearances at each proposed well location. Proposed well locations were relocated where necessary, usually within five feet of the original location.

Prior to drilling, the Astoria Area-Wide Health and Safety Plan was reviewed by the drillers and field representatives. After the initial safety meeting, the drilling program began. Decontamination procedures were established to control the movement of potential contaminants to clean, uncontaminated areas, and to prevent cross-contamination between wells and samples. Before and after each use, the drilling equipment was decontaminated by using a high-pressure hot-water washer. The water was contained on a trailer, and then transferred to a 4,000-gallon Baker tank located near the base of Slip 2. Water was transferred by using a submersible pump with a hose directed directly into the tank. Soil cuttings were deposited in a Baker bin located adjacent to the Baker tank.

Soil samples collected for laboratory analysis from many of the well borings will help to further characterize soil/source conditions at the Astoria Area-Wide site. Standardized protocols were employed during the soil-sampling operation. Soil samples were collected during hollow stem auger drilling by driving a 1.5-foot long, 2-inch I.D., split-spoon sampler with a 140-pound hammer. Brass sleeves were inserted into the sampler when samples were collected for laboratory analysis. End caps were fitted over Teflon sheeting at the ends of the brass sleeve and stored in resealable bags in a cooler with ice. Where samples were not necessary, the soil was collected in the split spoon sampler without sleeves. Soil samples were generally obtained and logged at 5-foot intervals (5, 10, 15, etc. feet) as specified in the project Work Plan. A portion of each soil sample was also collected into resealable bags for PID readings to be taken.

The borings were advanced to the specified depth. Once the drilling was complete, a monitoring well was constructed. Ten feet of Schedule 40 PVC slotted well screen with 0.01 diameter slots was connected to solid casing and a well point, and then inserted into the borehole with the augers still in place. The bottom 10 feet of each well is screened. The depth of the wells depends on the depth to water at each location. A filter pack was installed by pouring 10x20 silica sand between the well casing and the auger. The sand was placed to approximately one foot above the screen. A weighted tape was used to measure the depth of sand. The well was then surged with a surge block until the filter pack settled. More sand was added if necessary to keep the filter pack one foot above the screen. Then bentonite was installed between the well casing and the auger to approximately one foot below ground surface. As the sand and bentonite were poured into the well bore, the augers were slowly lifted out of the ground. Surface completions were made with flush-mounted traffic-rated monuments and concrete. The construction details for each monitoring well are presented in Table 1.

After installation, each monitoring well was developed. Data related to well development are presented in Table 2. Well development occurred at least approximately 24 hours after installation. Development included surging and pumping water from the well. Surging was

performed with a metal surge block on PVC piping. To pump the water from the well, a purger pump, which was connected to nylon reinforced PVC tubing, was lowered into the well. The pump was connected to a portable battery for power. The wells were surged with the surge block at least two times during development. Moving the pump up and down during pumping allowed for extra surging. Development was not considered complete until at least 3 borehole volumes were pumped from the well and the pH, temperature, and specific conductance had stabilized. By the end of development the water in the wells was mostly or completely free of sediment and appeared clear. In a few wells, ground-water recharge was minimal and therefore not as much water was pumped out or there was not enough water for field parameter measurements to stabilize. The purged water was collected into drums, and then transferred into the Baker tank for storage.

#### 2.2 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW), including soil cuttings and decontamination water were stored on-site in one staging area. Soil cuttings and water were stored close together at the base of Slip 2. Decontamination water is stored in a 4,000-gallon Baker tank and soil cuttings are stored in a 20 cubic yard Baker bin. The bin was lined with visqueen before adding soil.

The concentrations of constituents in the decontamination and purge water were below discharge limits and the water was discharged from the Baker tank to a nearby storm water catch basin that has an outfall in Slip 2. Samples of the water in the Baker Tank were collected and analyzed to compare concentrations to the discharge limits set by DEQ in a letter dated August 27, 2003.

#### 2.3 QUALITY ASSURANCE/QUALITY CONTROL

Samples were collected from known or suspected areas of contamination and from areas located to provide representative distribution of the data. Sampling procedures and protocols

for each sampling activity were developed to meet the project data quality objectives and were based on proven and acceptable sampling methods as established by EPA guidance documents, Oregon state regulations, and professional judgment.

Field equipment blanks were collected and analyzed along with laboratory method blanks to evaluate whether the analytical results are representative of the sampled material and not influenced by non-site related contamination. Laboratory QC samples included laboratory matrix or method spikes, laboratory matrix spike duplicates, laboratory duplicates, and laboratory method blanks. These are described in Appendix B of the Work Plan (*EnviroLogic Resources*, 2002b).

#### 3.0 LOCAL HYDROGEOLOGY

Based on a review of the recent boring logs and boring logs from the previous investigations most of the Astoria Area-Wide site is underlain by gray and light brown sand fill. Lenses of silt and clay are present in the fill as well as gravel, wood, and other organics. In addition three native materials were encountered beneath the site; two native river deposits and the Astoria Formation. The native materials were not encountered near the site surface but at depth. This is consistent with the conceptual hydrogeologic model presented in the RI/FS Work Plan (*EnviroLogic Resources*, 2002b).

Native river deposits consisting of dark greenish-gray silty sandy clay with cobbles were encountered beneath the Qwest site, such as in SB-802(Q) and SB-835(Q). The deposit was encountered at approximately 9-10 feet bgs. Very hard, mostly dry gray clay was encountered beneath the greenish-gray river material at approximately 13 feet. This very hard clay was encountered in soil borings on the west side of the Niemi Oil Cardlock, the east side of Qwest, and beneath Harris/VanWest. The borings encountering the clay layer include SB-017(A), SB-834(A), SB-632(N), and SB-004(A). The wells constructed from these borings do not produce significant amounts of water and go dry quickly. A well was not constructed at the boring location SB-004(A) because no water was encountered in this boring. This boring included mudstone and yellowish-red and yellowish-brown silts that were also encountered in soil borings located at the Harris/Van West [SB-404 (F)] and the Young's Bay Texaco [SB-101(C) and SB-103(C)] sites, respectively. These borings also did not produce significant amounts of water. The mudstone and silts were encountered near the base of the borings from depths of 14 to 18 feet bgs. The mudstone and silt are interpreted to be part of the Astoria Formation.

Depth to ground water was generally encountered between 7 and 11 feet bgs at the site, except along West Marine Drive. The three sites along West Marine Drive have a surface elevation approximately 15 feet above the remainder of the site and the depth to ground

water was generally 22 feet bgs. Boring logs are presented in Appendix B. These logs also show the well construction details in a graphical format

#### 4.0 CLOSING COMMENTS

Evaluations of the quality of analytical data received as part of the well installation program will be presented in subsequent reports. Soil data validation and occurrence of COIs in soil will be presented in a technical memorandum documenting Phase 2 soil/source characterization work. Ground-water data validation and occurrence of COIs in ground water will be presented in the first quarterly ground-water monitoring report.

#### 5.0 REFERENCES

- EnviroLogic Resources, Inc., 2002a, RI/FS and IRAM Development Proposal, Remedial Investigation/Feasibility Study, Astoria Area-Wide Petroleum Site, Astoria, Oregon: consultant report dated January 21, 2002.
- EnviroLogic Resources, Inc., 2002b, RI/FS and IRAM Development Work Plan, Phase 1, Remedial Investigation/Feasibility Study, Astoria Area-Wide Petroleum Site, Astoria, Oregon: consultant report dated July 15, 2002.
- EnviroLogic Resources, Inc., 2003a, Phase 1 Soil Technical Memorandum, Remedial Investigation/Feasibility Study, Astoria Area-Wide Petroleum Site, Astoria, Oregon: consultant report dated January 30, 2003.
- EnviroLogic Resources, Inc., 2003b, Work Plan Addendum, Phase 2 Ground Water Assessment, Remedial Investigation/Feasibility Study, Astoria Area-Wide Petroleum Site, Astoria, Oregon: consultant report dated July 2, 2003.
- EnviroLogic Resources, Inc., 2003c, Work Plan Addendum, Phase 2 Soil Characterization, Remedial Investigation/Feasibility Study, Astoria Area-Wide Petroleum Site, Astoria, Oregon: consultant report dated July 28, 2003.





#### WELL CONSTRUCTION DETAILS

			Reference	Borehole Cross	State Well		Borehole	Casing	Casing	Screen	
Locator ID	Northing	Easting	Pt Elevation (feet msl at	Reference	ID	Surface Casing	Diameter	Diameter	Material	Diameter	Screen Material
			TOC)				(inches)	(inches)		(inches)	
MW-1(M)	936599.486	7351297.572	14.54			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-2(M)	936530.791	7351348.236	15.06			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-3(M)	936568.313	7351406.763	15.45			Sched 40 PVC		2	Sched 40 PVC	2	0.020 slotted PVC
MW-4(M)	936477.915	7351421.833	15.50			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-5(M)	936446.436	7351500.403	16.44			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-6(M)	936550.238	7351279.371	13.79			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-7(M)	936485.617	7351302.960	14.86			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-8(M)	936633.137	7351313.880	15.25			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-9(M)	936626.508	7351451.934	15.42			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-10(M)	936731.336	7351321.429	16.34			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-11(M)	936729.240	7351467.813	16.36			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-12(A)	936314.138	7352293.111	30.58	SB-329(D)	58682	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-13(A)	936334.085	7352241.488	31.36	SB-331(D)	58685	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-14(A)	936438.991	7352296.778	23.39	SB-323(D)		Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-15(A)	936386.330	7352192.877	16.95	SB-321(D)	58651	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-16(A)	936525.728	7352217.851	16.48	SB-330(D)	58680	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-17(A)	936436.580	7352066.972	15.69	SB-016(A)	58670	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-18(A)	936480.671	7352092.844	16.23	SB-003(A)	58669	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-19(A)	936575.474	7352122.213	17.98	SB-912(S)	58666	Scehd 40 PVC	8	2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-20(A)		7352021.007	17.04	SB-913(S)		Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-21(A)	936680.008	7351918.040		SB-914(S)	58668	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-22(A)		7351908.218	16.13	SB-014(A)	58662	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-23(A)		7351993.982	16.22	SB-631(N)			8	2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-24(A)		7351866.186	16.56	SB-017(A)	58677		8	2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-26(A)		7351881.738	16.27	SB-632(N)	58679	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-27(A)		7351808.165	16.36	SB-834(Q)	58676	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-28(A)	936322.039	7351904.695	16.13	SB-630(N)	58678		8	2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-29(A)		7351825.232	15.84	SB-015(A)	58686	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-30(A)		7351760.934	16.67	SB-013(A)	58665	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-31(A)		7351708.131	16.23	SB-012(A)	58663		8	2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-32(A)		7351629.597	16.51	SB-002(A)	58655	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-33(A)		7351489.292	16.14	SB-001(A)	58656	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-34(A)		7351547.440	15.83	SB-010(A)	58654		8	2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-35(A)	936383.840	7351623.420	16.50	SB-011(A)	58664		8	2		2	0.010 Slotted Sched 40 PVC
MW-36(A)		7351680.069	16.14	SB-835(Q)	58675	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-37(A)		7351532.055	18.22	SB-018(A)	58661	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-38(A)	936089.963	7351406.382	17.20	SB-005(A)	58674		8	2	Sched 40 PVC		0.010 Slotted Sched 40 PVC
MW-39(A)		7351431.091	17.29	SB-629(N)	5501 =	Sched 40 PVC		2	Sched 40 PVC		0.010 Slotted Sched 40 PVC

#### WELL CONSTRUCTION DETAILS

Locator ID	Northing	Easting	Reference Pt Elevation (feet msl at TOC)	Borehole Cross Reference	State Well ID	Surface Casing	Borehole Diameter (inches)	Casing Diameter (inches)	Casing Material	Screen Diameter (inches)	Screen Material
MW-40(A)	936375.283	7351463.578	16.17	SB-019(A)	58657	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-41(A)	936448.934	7351458.350	15.67	SB-009(A)	58653	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-42(A)	936439.391	7351371.438	15.91	SB-007(A)	58652	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-43(A)	936374.994	7351371.438	15.94	SB-008(A)	58651	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-44(A)	936332.492	7351384.014	15.31	SB-627(N)	58658	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-45(A)	936215.481	7351344.047	17.32	SB-628(N)	58660	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-46(A)	935841.070	7350941.175	16.00	SB-253(C)	58671	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-47(A)	935986.536	7350785.091	16.39	SB-254(C)	58673	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-48(A)	935832.958	7350516.937	16.21	SB-255(C)		Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
R-1(M)	936619.280	7351336.572	13.75			PVC	12	6	PVC	6	0.020 slotted PVC
R-2(M)	936650.673	7351447.581	15.16			PVC	15	6	PVC	6	0.020 slotted PVC

#### WELL CONSTRUCTION DETAILS

Locator ID	Filter Pack	Filter Pack Interval	Surface Seal	Total Well Depth	Borehole Depth	Screened Interval	Installation Date	Installed By	Drilling Method	Development Date	Development Method	Developed By
		(feet)		(feet)	(feet)	(feet)						
MW-1(M)	20x40 sand	4 - 19	Concrete	19.5	21.5	5.0 - 19.5	11/10/1994	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-2(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	11/10/1994	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-3(M)	20x40 sand	4 - 20	Concrete	19.5'	21.5	5.0 - 19.5	11/10/1994	GeoTech	Hollow-Stem Auger	9/13/2002	Swab/Pump	GeoTech
MW-4(M)	20x40 sand	4 - 25	Concrete	25.0	26.5	5.0 - 25.0	11/11/1994	GeoTech	Hollow-Stem Auger	9/13/2002	Swab/Pump	GeoTech
MW-5(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	11/11/1994	GeoTech	Hollow-Stem Auger			
MW-6(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	11/30/1994	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-7(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	12/1/1994	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-8(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	12/1/1994	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-9(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	12/1/1994	GeoTech	Hollow-Stem Auger	9/13/2002	Swab/Pump	GeoTech
MW-10(M)	10x20 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	3/3/1995	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-11(M)	10x20 sand	4 - 20	Concrete	20.0	20.5	5.0-20.0	3/3/1995	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-12(A)	10x20 sand	14 - 25	Concrete	25	26.5	15 - 25	09/09/2003	GeoTech	Hollow-Stem Auger	09/11/2003	Swab/Pump	EnviroLogic
MW-13(A)	10x20 sand	15 - 16	Concrete	26	27	16 - 26	09/11/2003	GeoTech	Hollow-Stem Auger	09/12/2003	Swab/Pump	EnviroLogic
MW-14(A)	10x20 sand	7 - 18	Concrete	18	20	8 - 18	09/10/2003	GeoTech	GeoProbe/Hollow-Stem Auger	09/11/2003	Swab/Pump	EnviroLogic
MW-15(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/09/2003	GeoTech	Hollow-Stem Auger	09/10/2003	Swab/Pump	EnviroLogic
MW-16(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/09/2003	GeoTech	Hollow-Stem Auger	09/10/2003	Swab/Pump	EnviroLogic
MW-17(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/04/2003	GeoTech	Hollow-Stem Auger	09/12/2003	Swab/Pump	EnviroLogic
MW-18(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/04/2003	GeoTech	Hollow-Stem Auger	09/12/2003	Swab/Pump	EnviroLogic
MW-19(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/03/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-20(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/03/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-21(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/03/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-22(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/02/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-23(A)	10x20 sand	4 - 15	Concrete	15	15	5 - 15	09/10/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-24(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/08/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-26(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/08/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-27(A)	10x20 sand	4 - 15	Concrete	15	15	5 - 15	09/05/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-28(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/08/2003	GeoTech	Hollow-Stem Auger	09/12/2003	Swab/Pump	EnviroLogic
MW-29(A)	10x20 sand	4 - 15	Concrete	15	15	5 - 15	09/10/2003	GeoTech	GeoProbe/Hollow-Stem Auger	09/12/2003	Swab/Pump	EnviroLogic
MW-30(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/03/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-31(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/02/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-32(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/27/2003	GeoTech	Hollow-Stem Auger	08/29/2003	Swab/Pump	EnviroLogic
MW-33(A)	10x20 sand	6 - 17	Concrete	17	17	7 - 17	08/27/2003	GeoTech	Hollow-Stem Auger	08/29/2003	Swab/Pump	EnviroLogic
MW-34(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/27/2003	GeoTech	Hollow-Stem Auger	09/17/2003	Swab/Pump	EnviroLogic
MW-35(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/03/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-36(A)	10x20 sand	4 - 15	Concrete	15	15	5 - 15	09/05/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-37(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/28/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-38(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/05/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-39(A)	10x20 sand	4 - 15			16.5	5 - 15	08/28/2003	GeoTech	Hollow-Stem Auger	08/29/2003	Swab/Pump	EnviroLogic

#### WELL CONSTRUCTION DETAILS

Locator ID	Filter Pack	Filter Pack Interval	Surface Seal	Total Well Depth	Borehole Depth	Screened Interval	Installation Date	Installed By	Drilling Method	Development Date	Development Method	Developed By
		(feet)		(feet)	(feet)	(feet)						
MW-40(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/27/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-41(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/27/2003	GeoTech	Hollow-Stem Auger	09/17/2003	Swab/Pump	EnviroLogic
MW-42(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/26/2003	GeoTech	Hollow-Stem Auger	08/29/2003	Swab/Pump	EnviroLogic
MW-43(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/26/2003	GeoTech	Hollow-Stem Auger	08/28/2003	Swab/Pump	EnviroLogic
MW-44(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/28/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-45(A)	10x20 sand	6 - 17	Concrete	17	17	7 - 17	08/28/2003	GeoTech	Hollow-Stem Auger	08/29/2003	Swab/Pump	EnviroLogic
MW-46(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/04/2003	GeoTech	Hollow-Stem Auger	09/17/2003	Swab/Pump	EnviroLogic
MW-47(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/04/2003	GeoTech	Hollow-Stem Auger	09/17/2003	Swab/Pump	EnviroLogic
MW-48(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/04/2003	GeoTech	Hollow-Stem Auger	09/17/2003	Swab/Pump	EnviroLogic
R-1(M)	20-40 sand	4 - 28	Concrete	28.0	30	5.0 - 27.5	12/1/1994	GeoTech	Hollow-Stem Auger			_
R-2(M)	20-40 sand	4 - 28	Concrete	28.0	30	5.0 - 28.0	3/3/1995	GeoTech	Hollow-Stem Auger			

TABLE 2
WELL DEVELOPMENT RECORD

							Water						
		Time	Time	DTB	DTW		Removed	Well				DTB	
Well #	Date	Start	Finish	Before	Before	Method	(gal)	Volumes	pН	Temp (C)	Cond (uS)	After	Comments
MW-12(A)	9/11/2003	15:19	17:33	25.31	18.94	Swab/Subpi	50		6.53	14.2	755	25.38	
` ,						•			6.48	14.1	746		
									6.51	14.1	746		Mostly clear
MW-13(A)	9/12/2003	7:16	14:10	26.41	22.3	Swab/Subpi	54		6.92	15.3	696	26.42	
, ,						•			7.04	15	686		Complete Discharge
									7.08	14.9	684		
									7.09	14.9	681		
MW-14(A)	9/11/2003	10:22	11:55	18.81	14.71	Swab/Subpi	50		6.75	14.7	652		
									6.72	14.7	654		Complete Discharge
									6.74	14.8	656		Slightly turbid
MW-15(A)	9/10/2003	8:38	9:30	14.81	8.8	Swab/Subpi	53		7.43	14.6	784		
	9/11/2003								7.39	14.7	780		
									7.38	14.7	775		Mostly clear
MW-16(A)	9/10/2003	8:25	9:46	15.16	8.36	Swab/Subpi	55		6.44	16.6	629	15.21	
									6.47	16.5	641		Complete Discharge
									6.49	16.5	633		Clear
MW-17(A)	9/12/2003	9:32	10:05	15.22	8.12	Swab/Subpi	53		6.93	14.5	587	15.35	
									6.84	14.5	577		
									6.79	14.4	577		
									6.79	14.4	576		Clear
MW-18(A)	9/12/2003	8:11	9:15	15.31	8.62	Swab/Subpi	64		6.49	16.4	625	15.36	
									6.56	16.4	611		
									6.66	16.4	595		
									6.66	16.3	596		Clear

TABLE 2
WELL DEVELOPMENT RECORD

							Water	1					
		Time	Time	DTB	DTW		Water Removed	Well				DTB	
Well #	Date	Start	Finish	Before	Before	Method	(gal)	Volumes	рН	Temn (C)	Cond (uS)	After	Comments
MW-19(A)	9/16/2003	10:55	Tillish	15.3		Swab/Subpi	35	Volumes	6.22	14.6	426	TRICE	Comments
1V1VV-13(A)	9/10/2003	10.55		13.3	10.42	Swab/Subpi	33		6.34	14.6	436		
									6.37	14.5	440		
									6.38	14.6	434		
									6.38	14.6	437		Clear
MW-20(A)	9/16/2003	10:05	13:00	15.35	9.87	Swab/Subpi	50		6.3	15.5	314	15.39	
	0.10.2000				0.0.	опавловор.			6.38	15.3	315		
									6.44	15.3	316		
									6.47	15.2	313		Clear
MW-21(A)	9/16/2003	8:15	8:45	15.31	9.11	Swab/Subpi	47		6.31	15.4	277	15.35	
	0.10.2000	00	0		• • • • • • • • • • • • • • • • • • • •	опавловор.	• •		6.39	15.4	273		
									6.4	15.4	275		
									6.41	15.4	273		Clear
MW-22(A)	9/16/2003	9:00	9:45	15.03	9.03	Swab/Subpi	45		6.32	14.1	342	15.08	
									6.38	14.1	341		
									6.41	14.1	340		
									6.43	14.1	339		Clear
MW-23(A)	9/16/2003	13:00	14:05	14.9	8.61	Swab/Subpi	85		6.03	15	344	14.93	
									6.21	14.5	339		
									6.28	14.5	340		
									6.29	14.5	337		Clear
MW-24(A)	9/15/2003	14:15		14.87	8.94	Swab/Subpi	50		6.12	15.9	311		
	9/16/2003		16:00						6.31	14.8	309		Discharged completely
									6.58	14.4			Murky/Dry
MW-26(A)	9/15/2003	13:30	17:40	15.3	5.88	Swab/Subpi	50		6.32	14.5	517	15.35	
									6.67	14	536		Discharge completely
									6.69	14.1	523		
									6.6	14.1	516		
									6.6	13.8	511		

TABLE 2
WELL DEVELOPMENT RECORD

							Water						
		Time	Time	DTB	DTW		Removed	Well				DTB	
Well#	Date	Start	Finish	Before	Before	Method	(gal)	Volumes	pН	Temp (C)	Cond (uS)	After	Comments
MW-27(A)	9/15/2003	11:25	13:10	15.21	9	Swab/Subp	50		6.38	16.8	235	15.24	
									6.34	16.2	261		Discharge completely
									6.2	17.5	232		
									6.16	16.2	238		
									6.01	17.2	225		
									6.13	16.6	230		
									6.2	16	238		Slightly cloudy
MW-28(A)	9/12/2003	10:17	11:00	15.3	8.78	Swab/Subp	55		6.37	16.8	396	15.36	
									6.36	16.6	390		
									6.35	16.5	388		
									6.35	16.7	388		Clear
MW-29(A)	9/12/2003	11:11	12:00	15.34	8.61	Swab/Subp	55		6.34	16.9	314	15.37	
- ( )									6.38	16.7	309		
									6.39	16.6	308		
									6.4	16.5	310		
									6.4	16.5	308		Clear
MW-30(A)	9/15/2003	15:50	16:50	15.1	9.7	Swab/Subp	50		6.24	14.5	356	15.11	
( )						•			6.38	14.1	351		
									6.49	14	344		
									6.49	13.9	342		
									6.51	13.9	341		Clear
MW-31(A)	9/15/2003	15:00	15:30	15.31	9.71	Swab/Subp	47		6.38	15.7	423		
						-			6.54	15.3	413		
									6.61	15.4	396		
									6.62	15.2	397		
									6.62	15.2	396		Clear
MW-32(A)	8/29/2003	9:14	9:49	15.33	10.3	Swab/Subp	42		6.71	15.4	413	15.36	
- *						·			6.74	15.3	403		
									6.75	15.2	404		Clear

TABLE 2
WELL DEVELOPMENT RECORD

			<b></b>	ъжъ			Water	***				D. 27.D	
XX7 D //	<b>D</b> (	Time	Time	DTB	DTW	3.5.0.3	Removed	Well	**	TT (C)	G 1(0)	DTB	
Well #	Date	Start	Finish	Before	Before	Method	(gal)	Volumes	pН		Cond (uS)	After	Comments
MW-33(A)	8/29/2003	8:14	8:56	17.24	10.86	Swab/Subpi	53		6.64	15.5	412	17.31	
									6.61	15.4	403		M
									6.62	15.4	407		Mostly Clear
MW-34(A)	9/17/2003	11:25	12:12	15.31	9.6	Swab/Subpi	55		6.27	16.1	369	15.35	
` ,						·			6.36	15.6	369		
									6.39	15.6	371		
									6.4	15.4	369		
									6.39	15.5	366		Clear
MW-35(A)	9/16/2003	17:50	18:45	15.25	9.76	Swab/Subpi	45		6.34	14.4	145.5	15.32	
( )									6.4	14.1	145.6		
									6.45	14.1	145.2		Clear
MANAL OCIAN	0/45/2002			15.00	0.71	Curch/Cuha	17						
MW-36(A)	9/15/2003			15.36	0.71	Swab/Subp	17						Not much water
MW-37(A)	9/16/2003	16:00	17:00	15.39	11.19	Swab/Subp	55		6.31	14.2	343	15.41	
									6.4	13.9	340		
									6.44	13.8	339		
									6.44	13.8	339		Clear
MW-38(A)	9/15/2003	10:00	11:00	15.31	8.77	Swab/Subpi	52		6.1	17.2	357	15.38	
									6.42	16.8	343		
									6.42	16.8	341		
									6.42	16.8	342		
MW-39(A)	8/29/2003	14:08	15:50	15.34	8.81	Swab/Subpi	28		6.27	14.9	158.9	15.41	
									6.36	14.6	136.8		Complete Discharge
									6.41	14.8	138.5		, , , , , , , , , , , , , , , , , , ,
									6.41	14.8	138.9		Slightly Cloudy
MW-40(A)	9/16/2003	15:00	15:50	15.36	9.52	Swab/Subpi	56		6.35	15.9	377	15.42	
()									6.37	15.1	346		
									6.37	15	349		
									6.39	14.7	351		
									6.38	14.7	349		Clear

TABLE 2
WELL DEVELOPMENT RECORD

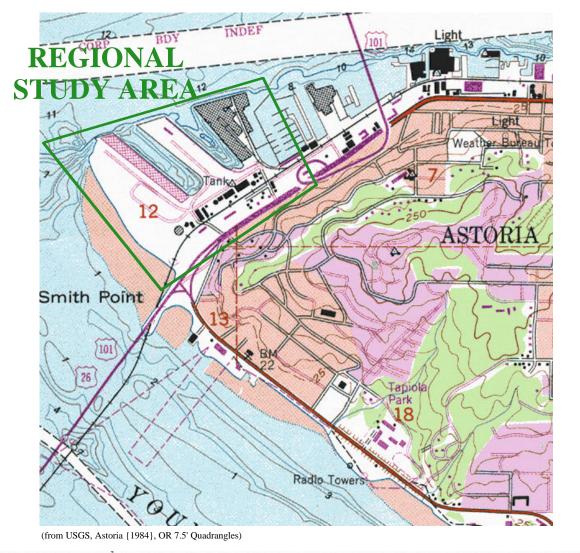
		Time	Time	DTB	DTW		Water Removed	Well				DTB	
Well #	Date	Start	Finish	Before	Before	Method	(gal)	Volumes	pН	Temp (C)	Cond (uS)	After	Comments
MW-41(A)	9/17/2003	12:20	13:16	15.33	9.25	Swab/Subpi	55		6.7	15.9	339	15.35	
• •									6.57	15.7	333		
									6.5	15.6	330		
									6.46	15.5	330		
									6.44	15.5	329		Clear
MW-42(A)	8/29/2003	7:11	7:52	15.36	9.24	Swab/Subpi	55		6.54	15.4	517	15.37	
						Bail			6.55		458		
									6.55	15.1	451		Mostly Clear
MW-43(A)	8/28/2003	16:27	17:25		8.8	Swab/Subpi	60		6.68	14.7	300	15.35	
									6.8	14.5	194.9		Complete Discharge
									6.8	14.9	194.8		Mostly Clear
MW-44(A)	9/16/2003	15:50	17:15	15.35	8.45	Swab/Subpi	70		6.16	17.1	344	15.41	
									6.22		345		
									6.23	16.8	342		Clear
MW-45(A)	8/29/2003	10:24	13:25	17.07	9.34	Swab/Subpi	73		6.23	15.8	176.8	17.16	
						Bail			6.5		173.2		Bailer stuck/recovery
									6.51	15.4	174.1		
									6.53	15.5	173.8		Mostly Clear
<b>NW-46(A)</b>	9/17/2003	10:13	11:15	15.28	7.37	Swab/Subpi	68		6.19	14.1	186	15.34	
									6.28	14	184		
									6.31	13.9	184		
									6.32	13.9	184		
									6.37	14	182		
									6.34	14.5	182		
									6.35	14	180		
									6.34	14	180		
									6.35	14	180		
									6.35	13.9	180		Transparent Yellow

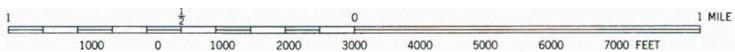
TABLE 2
WELL DEVELOPMENT RECORD

		Time	Time	DTB	DTW		Water Removed	Well				DTB	
Well #	Date	Start	Finish	Before	Before	Method	(gal)	Volumes	pН	Temp (C)	Cond (uS)	After	Comments
MW-47(A)	9/17/2003	9:22	9:58	15.31	8.22	Swab/Subpi	55		6.32	14.8	177	15.37	
									6.38	14.7	163		
									6.41	14.6	161		
									6.43	14.6	160		
									6.43	14.6	160		Mostly Clear/Slightly cloudy
MW-48(A)	9/17/2003	8:30	9:15	15.11	8.38	Swab/Subpi	56		6.11	14.4	258	15.88	
									6.24	14.2	255		
									6.31	14.2	253		
									6.34	14.2	252		Mostly Clear/Slightly Cloudy
R-1(M)	9/17/2003	13:34	14:45	19.33	5.56	Subpump	55		6.48	18.6	169	19.34	
									6.38	18.3	165		
									6.37	18	164		
									6.35	17.9	165		
									6.34	18.3	167		Clogged pumps



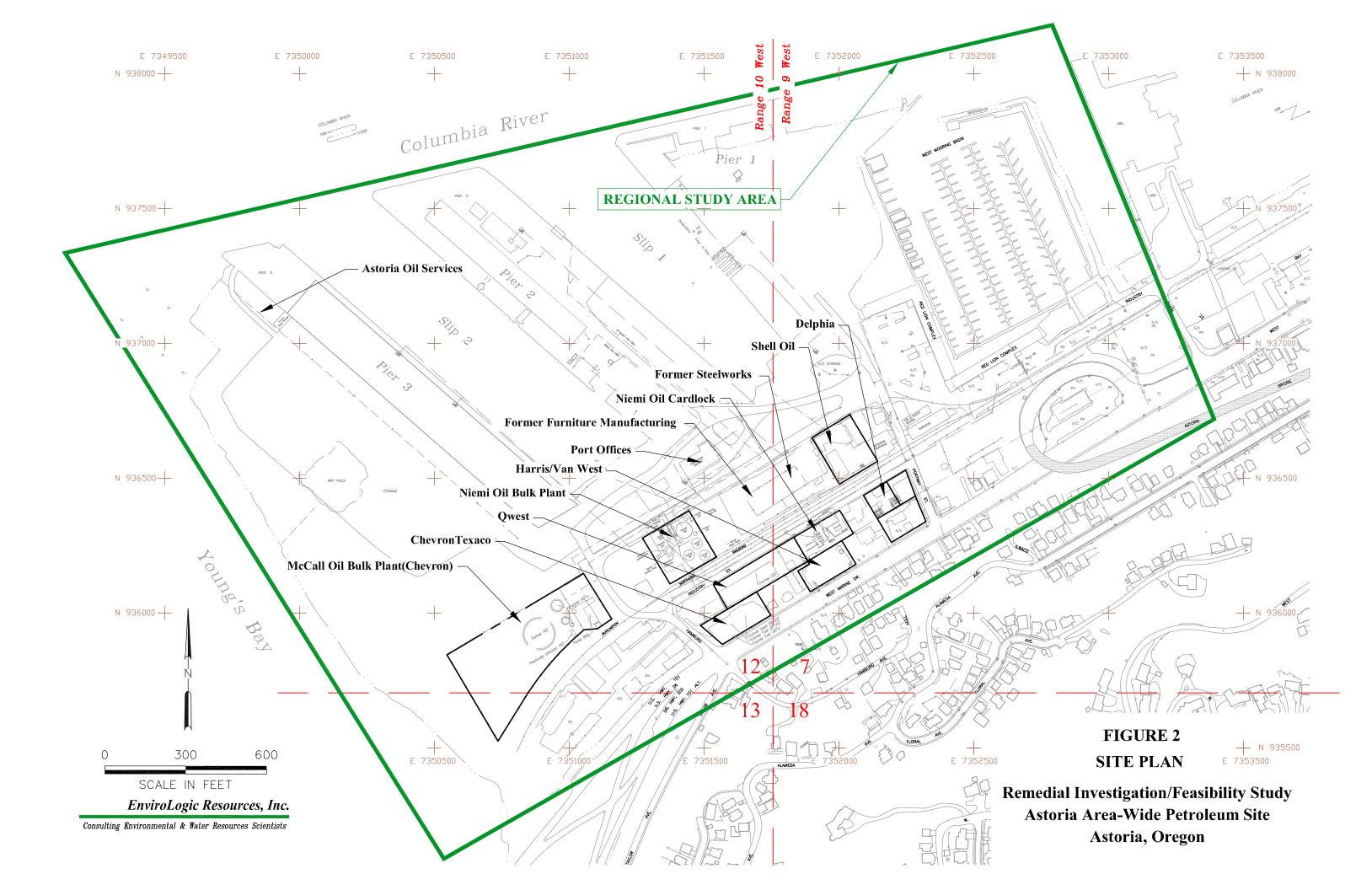


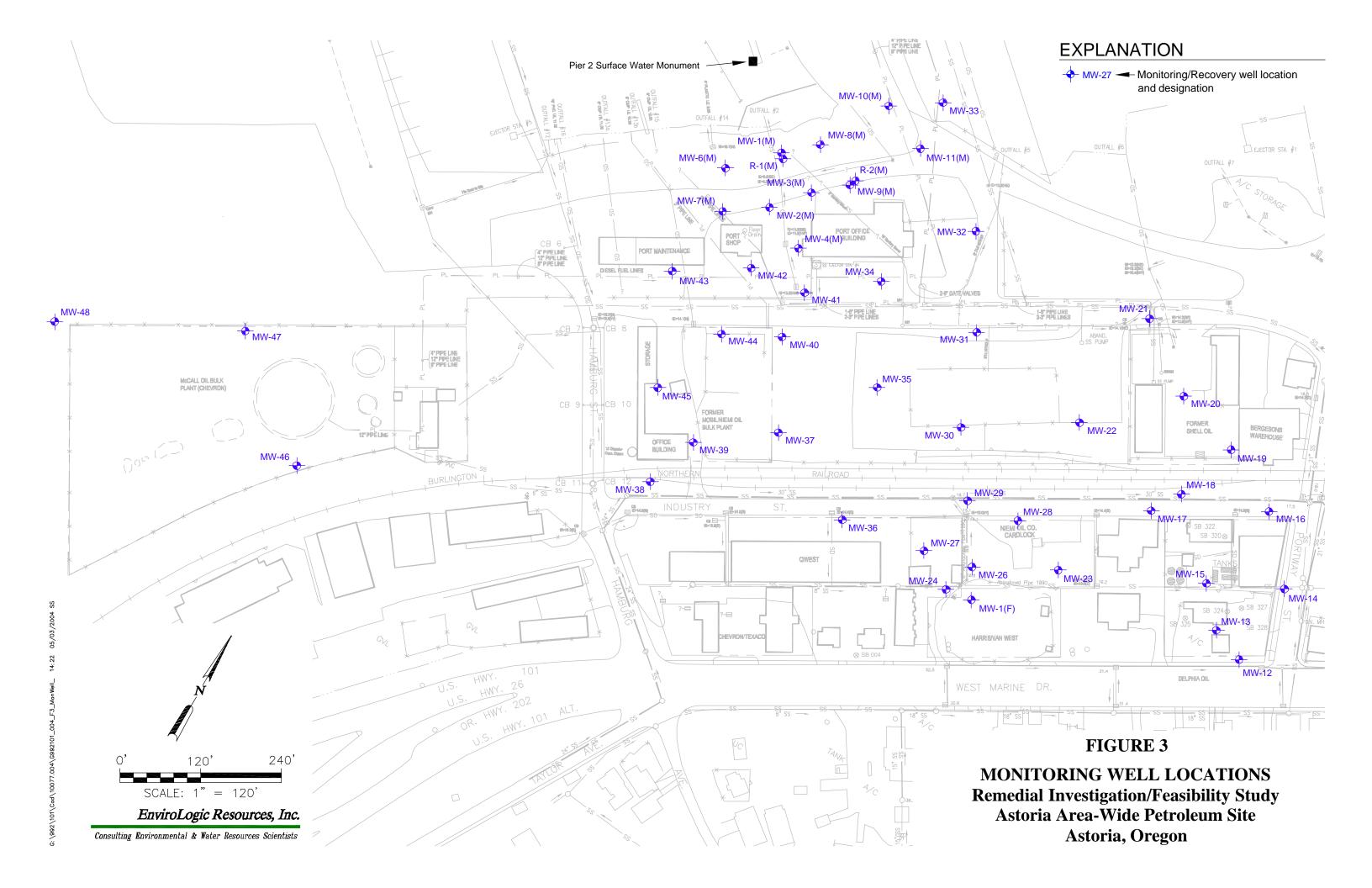


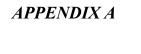




## FIGURE 1 SITE LOCATION







**WELL CONSTRUCTION LOGS** 

LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY REFERENCE POINT DESCRIPTION Melanie Bocianowski DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 08/27/2003 DEPTH (FT) **BLOWS/6IN** SAMPLES (mdd) WELL CONSTRUCTION DETAIL 吕 MATERIALS DESCRIPTION MW-33(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 2.5 feet: brown (10YR 3/3) SILT (ML) with angular gravels (medium size). 22 22 @ 2.0 feet: no recovery. 2.5 to 4.0 feet: medium brown (2.5Y 3/3) SILT (ML) with small gravels, light tan and gray. (FILL) Bentonite Chips 4.0 to 7.0 feet: brown (2.5Y 3/2) silty SAND (SP), medium size angular gravels. (FILL) 15 10 5 @ 6.0 feet: no recovery on first try, on second try grayish brown SAND (SP) with silt and gravels, no odor, only in shoe. 1.7 14 7.0 to 11.0 feet: light grayish brown fine (5Y 3/1) SAND (SP), piece of 12 wood, silty lense with gravels, slightly moist, no odor. 7 10 4 2.0 5 7 11.0 to 16.0 feet: brownish gray (2.5Y 4/1) fine SAND (SP), slightly moist, 10 x 20 Silica Sand no odor. Gray (GLEY 1 5/N) fine SAND (SP), no odor, slightly moist.  $\nabla$ 0 3 3 3 16.0 to 17.0 feet: medium gray (GLEY 1 3/N) fine SAND (SP), wet, no Bottom of boring = 17.0 feet. 20

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**PROJECT** 

Astoria Area-Wide Petroleum Site

#### FIGURE A-1

TOTAL DEPTH

17 feet

#### LOG OF SOIL BORING SB-001(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

EnviroLogic Resources, Inc.

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 08/27/2003 DEPTH (FT) **BLOWS/6IN** SAMPLES (mdd) WELL CONSTRUCTION DETAIL 吕 MATERIALS DESCRIPTION MW-32(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 2.0 feet: brown (10YR 3/3) SILT (ML) and SAND (SP). (FILL) 5.0 10 15 2.0 to 5.0 feet: light greenish gray (5Y 4/1) fine SAND (SP). Bentonite Chips 16 1.3 10 5.0 to 8.0 feet: light brown (5Y 4/2) fine SAND (SP), slightly silty, slightly 5 7 3 4.0 @ 6.5 feet: bands of SILTY SAND, orangish brown (10YR 4/4). 5 7 8.0 to 10.0 feet: light brownish gray (5Y 4/1) fine SAND (SP), no odor, slightly moist. 10 10.0 to 11.0 feet: light brown (5Y 4/2) fine **SAND** (SP). 10 x 20 Silica Sand 3 6 7 11.0 to 11.5 feet: light brownish gray (2.5Y 4/1) fine SAND (SP), no odor, 11.5 to 15.0 feet: gray (GLEY 1 3/N) fine SILTY SAND (SM), no odor, 0 15.0 to 16.0 feet: light brown (5Y 4/2) fine SAND (SP) with gray banding, 3 6 6 no odor, wet. 16.0 to 16.5 feet: gray (GLEY 1 3/N) fine SAND (SP), no odor, wet. Bottom of boring = 16.5 feet. 20 25

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FIGURE A-2

LOG OF SOIL BORING SB-002(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

EnviroLogic Resources, Inc.

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/04/2003 BLOWS/6IN DEPTH (FT) PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-18(A) 0 to 0.5 foot: small GRAVEL. Concrete 0.5 to 10.0 feet: brownish gray (5Y 4/1) fine **SAND** (SP), with orangish brown (10YR 4/4) banding, some gravel (from surface?), 50 percent Bentonite Chips  $\boxtimes$ 0 12 9 10.0 to 15.0 feet: medium gray (GLEY 1 3/N) fine SAND (SP), no 10 x 20 Silica Sand 5.9 5 6 5 sheen, slight odor, wet. 15.0 to 16.5 feet: medium gray (GLEY 1 3/N) fine **SAND** (SP), two small 0.9 3 2 3 bands of dark gray (GLEY 1 2.5/N) SILT (MH), 65 percent recovery, no odor, wet. Bottom of boring = 16.5 feet. 20

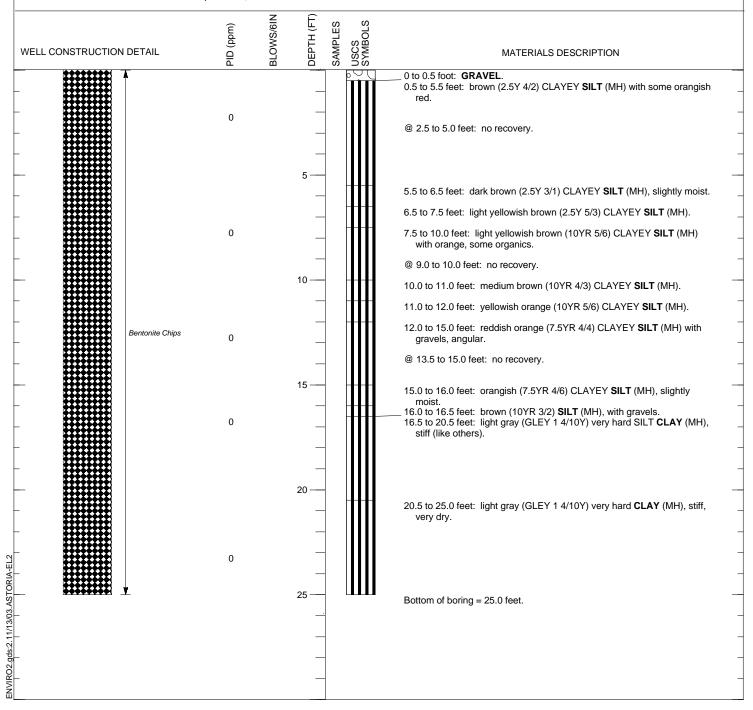
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**FIGURE A-3** 

LOG OF SOIL BORING SB-003(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Geoprobe DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED



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FIGURE A-4

25 feet

09/11/2003

LOG OF SOIL BORING SB-004(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon REFERENCE POINT ELEVATION JOB NUMBER 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/05/2003 DEPTH (FT) **BLOWS/6IN** USCS SYMBOLS SAMPLES (mdd) WELL CONSTRUCTION DETAIL 吕 MATERIALS DESCRIPTION MW-38(A) 0 to 0.5 foot: SILT and GRAVEL. Concrete 0.5 to 5.0 feet: tannish gray (5Y 4/1) fine SAND (SP), micaceous. 0.3 Bentonite Chips 3.3 2 5.0 to 7.0 feet: brownish gray (5Y 4/2) fine SAND (SP), slightly moist. 4 6 @ 6.5 feet: woody debris.  $\times$ 0 6 7.0 to 10.0 feet: light brown (2.5Y 4/2) fine SAND (SP), slightly moist. 6  $\nabla$ 6 10 10.0 to 10.5 feet: gray (GLEY 1 4/N) fine **SAND** (SP), no odor, wet. 10.5 to 15.0 feet: dark gray (GLEY 1 2.5/N) sandy **SILT** (MH), small 10 x 20 Silica Sand 0.4 3 4 3 layers of organics, sticky, no odor, wet. 0 15.0 to 16.5 feet: dark gray (GLEY 1 2.5/N) sandy SILT (MH), bands of 4 7 SILTY SAND and some organics, sticky, no odor, wet. 8 Bottom of boring = 16.5 feet. 20

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FIGURE A-5

LOG OF SOIL BORING SB-005(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 08/26/2003 BLOWS/6IN DEPTH (FT) PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-42 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 6.0 feet: light to medium gray (GLEY 1 4/N) fine SAND (SP). Bentonite Chips 5 7 68 8 6.0 to 11.0 feet: medium gray (GLEY 1 4/N) fine SAND (SP), sheen observed, odor, moisture. 7 8 917  $\nabla$ 8 10 10 x 20 Silica Sand 3 7 8 11.0 to 15.5 feet: medium gray (GLEY 1 4/N) fine SAND (SP), sheen observed, odor, wet. 2 2 15.5 to 16.5 feet: medium gray (GLEY 1 4/N) fine SAND (SP), sheen observed, slight odor, wet. Bottom of boring = 16.5 feet. 20

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FIGURE A-6

LOG OF SOIL BORING SB-007(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 08/26/2003 DEPTH (FT) **BLOWS/6IN** PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-43(A) 0 to 0.5 foot: GRAVEL and SOIL. Concrete 0.5 to 5.0 feet: grayish (5Y 7/1) light brown fine SAND (SP), graded.  $\times$ 20 Bentonite Chips 30 7 5.0 to 7.5 feet: grayish medium brown (2.5Y 3/1) fine SAND (SP), slightly 10 11 0 11 7.5 to 11.0 feet: gray (GLEY 1 4/N) fine graded SAND (SP), no odor, 14 10 10 7 6 7 10 x 20 Silica Sand 11.0 to 15.0 feet: gray (GLEY 1 2.5/N) fine graded SAND (SP), no odor, 15.0 to 16.5 feet: gray (GLEY 1 2.5/N) fine graded SAND (SP), no odor, 2 4 4 very wet. Bottom of boring = 16.5 feet. 20

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FIGURE A-7

LOG OF SOIL BORING SB-008(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 08/27/2003 DEPTH (FT) **BLOWS/6IN** PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-41(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 1.5 feet: medium brown (10YR 4/3) SILT (ML) with angular gravel. 2.4 1.5 to 2.5 feet: medium brownish gray (2.5Y 4/2) fine SAND (SP). 10 Bentonite Chips 13 2.5 to 5.5 feet: gray (GLEY 1 4/N) fine SAND (SP). 12.1 7 9 5.5 to 7.5 feet: gray (GLEY 1 4/N) fine SAND (SP), slight odor. 9 340 6 7 7.5 to 10.5 feet: medium gray (GLEY 1 4/N) fine SAND (SP), slight 10 sheen, odor, moist. 10 4 10 x 20 Silica Sand 248 6 6 10.5 to 15.5 feet: medium gray (GLEY 1 4/N) fine SAND (SP), sheen, 18.9 2 6 8 15.5 to 16.5 feet: medium gray (GLEY 1 3/N) fine **SAND** (SP), sheen, odor, wet. Bottom of boring = 16.5 feet. 20

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**FIGURE A-8** 

LOG OF SOIL BORING SB-009(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 08/27/2003 DEPTH (FT) **BLOWS/6IN** SAMPLES (mdd) WELL CONSTRUCTION DETAIL 吕 MATERIALS DESCRIPTION MW-34(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 2.0 feet: brown (2.5Y 3/1) SILT (ML) with angular gravel. (FILL) 6.0 16 2.0 to 5.5 feet: light to medium gray (GLEY 1 5/N) fine SAND (SP). Bentonite Chips 16 0.5 3 5 5.5 to 8.0 feet: medium gray (GLEY 1 4/N) fine SAND (SP), no odor, 9 4 very slightly moist. 2.1 8 8 ∑ 8.0 to 10.0 feet: medium gray (GLEY 1 4/N) fine SAND (SP), no sheen, no odor, moisture. 10 10.0 to 11.0 feet: brownish gray (5Y 4/1) fine SAND (SP), moist. 10 x 20 Silica Sand 0.7 3 4 8 11.0 to 11.5 feet: light brown 2.5Y 4/2) fine SAND (SP), moist. 11.5 to 15.0 feet: brownish gray (5Y 4/1) fine SAND (SP), with light brown (2.5Y 4/2) slightly silty banding, no odor, moist. 15.0 to 16.5 feet: light brown to medium gray (GLEY 1 3/N) fine **SAND** 10.9 (SP), no odor, wet. 3 Bottom of boring = 16.5 feet. 20

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FIGURE A-9

LOG OF SOIL BORING SB-010(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/03/2003 DEPTH (FT) **BLOWS/6IN** PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-35(A) 0 to 0.5 foot: ASPHALT, concrete, gravel. Concrete 0.5 to 7.0 feet: light brownish gray (5Y 4/1) fine SAND (SP), micaceous. Bentonite Chips 0 7 10 13 0.6 6 7 7.0 to 10.0 feet: medium grayish brown (5Y 3/1) fine SAND (SP), no odor, slightly moist. 9  $\nabla$ 10 10.0 to 11.5 feet: grayish brown to brownish gray (5Y 4/1) fine SAND 10 x 20 Silica Sand 0.8 2 4 7 (SP), with bands of light brown (2.5Y 4/2) fine SAND, moist to wet. 11.5 to 15.0 feet: medium gray (GLEY 1 4/N) fine SAND (SP), no odor, 0 15.0 to 15.5 feet: gray (GLEY 1 4/N) fine SAND (SP), no odor, wet. 2 3 15.5 to 16.0 feet: small band of dark brown (2.5Y 2.5/1) fine **SAND** (SP). 16.0 to 16.5 feet: light brown (2.5Y 4/2) fine **SAND** (SP), wet. Bottom of boring = 16.5 feet. 20

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**FIGURE A-10** 

LOG OF SOIL BORING SB-011(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon REFERENCE POINT ELEVATION JOB NUMBER 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/02/2003 DEPTH (FT) **BLOWS/6IN** USCS SYMBOLS PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-31(A) 0 to 0.5 foot: GRAVEL and SILT. Concrete 0.5 to 10.0 feet: grayish tan (5Y 4/1) and light brown (2.5Y 4/3) layered fine **SAND** (SP), 50 percent recovery. Bentonite Chips 12.0 12 8 @ 6.0 feet: 1/2-inch layer of tan (2.5Y 4/1) SILT, moist.  $\bar{\Delta}$ 6.1 10.0 10.0 to 10.5 feet: grayish tan (5Y 4/1) and light brown (2.5Y 4/3) layered 10 x 20 Silica Sand 3 4 3 SILTY SAND (SP). 10.5 to 11.0 feet: gray (GLEY 1 3/N) fine SAND (SP), no odor, moist. 11.0 to 15.0 feet: gray (GLEY 1 3/N) fine SAND (SP), no sheen, slight @ 15.0 feet: slight odor. 9.1 3 3 4 15.0 to 16.5 feet: medium gray (GLEY 1 4/N) fine SAND (SP), no odor, Bottom of boring = 16.5 feet. 20

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**FIGURE A-11** 

LOG OF SOIL BORING SB-012(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/03/2003 DEPTH (FT) **BLOWS/6IN** PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-30(A) 0 to 0.5 foot: ASPHALT, GRAVEL, SILT, CONCRETE. Concrete 0.5 to 5.5 feet: light brown (2.5Y 4/2) fine SAND (SP). Bentonite Chips 8.9 4 6 5.5 to 6.0 feet: gray silty SAND (SP), with band of SILT (MH). 8 6.0 to 7.5 feet: gray (GLEY 1 4/N) fine SAND (SP). 5.1 5 8 7.5 to 10.0 feet: gray (GLEY 1 4/N) fine SAND (SP), small band of gray 8 SILT, no odor, slightly moist. 10 10.0 to 10.5 feet: gray (GLEY 1 4/N) fine SAND (SP), no odor, moist. 10.5 to 15.5 feet: gray (GLEY 1 4/N) fine SAND (SP), no odor, wet. 10 x 20 Silica Sand 4.5 3 3 5 20.1 3 3 3 15.5 to 16.5 feet: gray (GLEY 1 3/N) fine **SAND** (SP), no sheen, slight odor (not petroleum-like), wet. Bottom of boring = 16.5 feet. 20 ENVIRO2.gds:3.12/03/03.ASTORIA-EL2

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**FIGURE A-12** 

LOG OF SOIL BORING SB-013(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/02/2003 BLOWS/6IN DEPTH (FT) PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-22(A) 0 to 0.5 foot: ASPHALT, CONCRETE. Concrete 0.5 to 10.5 feet: grayish tan (5Y 4/1) fine SAND (SP), micaceous. Bentonite Chips 13.8 3 6 8  $\nabla$ 4 3 10 x 20 Silica Sand 0.4 10.5 to 15.5 feet: slightly grayish brown (5Y 2.5/2) fine SAND (SP), layers of light brown (5Y 4/3) SAND (SP), moist. Gray (GLEY 1 3/N) fine SAND (SP), very moist, no odor. 2.0 15.5 to 16.5 feet: dark gray (GLEY 1 2.5N) fine SAND (SP), no sheen, no odor, wet. Bottom of boring = 16.5 feet. 20

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FIGURE A-13

LOG OF SOIL BORING SB-014(S)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

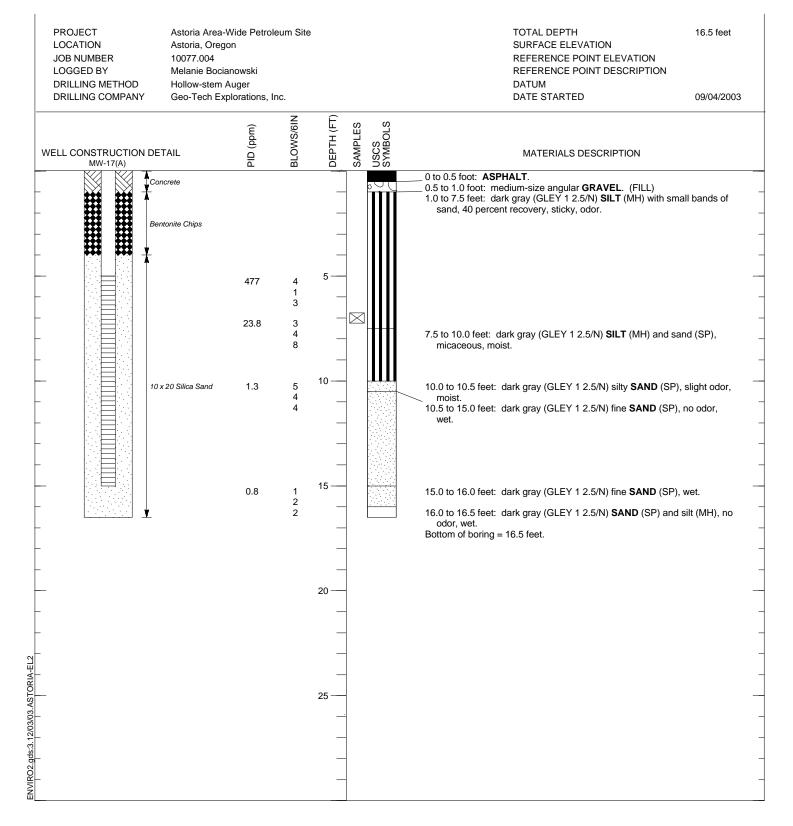
**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 15 feet LOCATION SURFACE ELEVATION Astoria, Oregon REFERENCE POINT ELEVATION JOB NUMBER 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Geoprobe and Hollow-stem Auger DATUM DRILLING COMPANY DATE STARTED 09/10/2003 Geo-Tech Explorations, Inc. DEPTH (FT) **BLOWS/6IN** PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-29(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 3.0 feet: light brown (5Y 4/1) fine SAND (SP), some silty mottling, micaceous. Bentonite Chips 3.0 to 6.0 feet: gray (GLEY 1 5/N) fine SAND (SP), some silty mottling, micaceous, slightly moist. 3.9 6.0 to 7.0 feet: gray silty SAND (SP), some small gravels, slight odor. 7.0 to 10.5 feet: dark blackish gray (GLEY 1 2.5/N) small angular GRAVELS (GP), some sand, sheen, strong odor. 367 10 x 20 Silica Sand 10.5 to 12.0 feet: dark blackish gray (GLEY 1 2.5/N) small angular GRAVELS (GP), sheen, strong odor. 12.0 to 15.0 feet: gray (GLEY 1 4/N) fine SAND (SP), no odor, wet. 18.2 Bottom of boring = 15.0 feet. 20

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**FIGURE A-14** 

LOG OF SOIL BORING SB-015(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

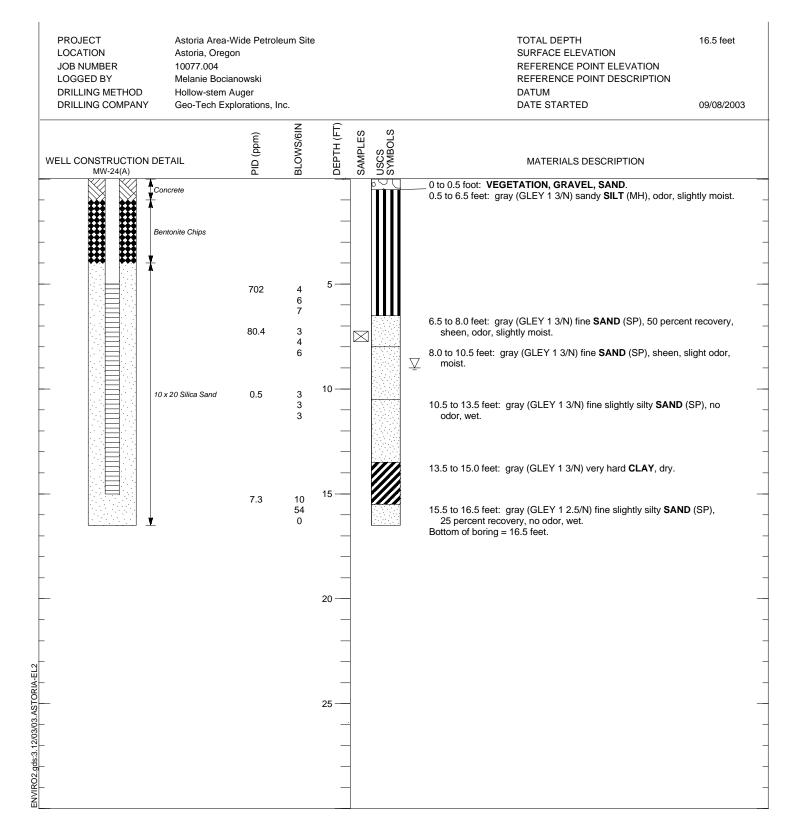


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**FIGURE A-15** 

LOG OF SOIL BORING SB-016(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon



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**FIGURE A-16** 

LOG OF SOIL BORING SB-017(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 08/28/2003 BLOWS/6IN DEPTH (FT) USCS SYMBOLS PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-37(A) 0 to 0.5 foot: medium to large size GRAVEL. Concrete 0.5 to 6.5 feet: grayish brown (5Y 3/1) fine SAND (SP). Bentonite Chips 0.5 8 9 10 6.5 to 10.0 feet: gray (GLEY 1 4/N) fine SAND (SP), slight odor. 720 10.0 to 15.0 feet: gray (GLEY 1 3/N) fine **SAND** (SP),  $\frac{1}{2}$ -inch band of 10 x 20 Silica Sand 4 5 5 darker gray (GLEY 1 2.5/N), no sheen, moist.  $\sqrt{}$ 15.0 to 16.5 feet: gray (GLEY 1 2.5/N) fine SAND (SP) with 3/4-inch layer 2.6 3 3 3 of silty sand, no odor, wet. Bottom of boring = 16.5 feet. 20

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FIGURE A-17

LOG OF SOIL BORING SB-018(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 08/27/2003 DEPTH (FT) **BLOWS/6IN** USCS SYMBOLS PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-40(A) 0 to 0.5 foot: GRAVEL and SILT. Concrete 0.5 to 6.0 feet: brownish gray (5Y 3/1) fine SAND (SP). 2.5  $\boxtimes$ Bentonite Chips 22 62.3 3 8 6.0 to 8.0 feet: gray (GLEY 1 3/N) fine SAND (SP), odor, slightly moist. 1030 6 7 8.0 to 10.5 feet: gray (GLEY 1 3/N) fine SAND (SP), sheen, odor, slightly 9 10 10 x 20 Silica Sand 1025 6 8 7 10.5 to 15.5 feet: gray (GLEY 1 3/N) fine SAND (SP), odor, wet. 1040 3 7 15.5 to 16.5 feet: gray (GLEY 1 3/N) fine SAND (SP), odor, wet. 10 Bottom of boring = 16.5 feet. 20

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**FIGURE A-18** 

LOG OF SOIL BORING SB-019(A)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/04/2003 BLOWS/6IN DEPTH (FT) USCS SYMBOLS PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-46(A) 0 to 5.5 feet: grayish brown (5Y 4/1) fine SAND (SP), micaceous. Concrete 10  $\times$ 10 Bentonite Chips 11 3.9 3 8 5.5 to 7.5 feet: grayish brown (5Y 4/1) fine SAND (SP), micaceous. 10 3 5 0 7.5 to 8.0 feet: grayish brown (5Y 4/2) fine SAND (SP), moist. 8 8.0 to 10.0 feet: brownish gray (GLEY 1 4/10Y) fine SAND (SP), no odor, moist to wet. 10 3 3 10.0 to 15.0 feet: gray (GLEY 1 3/N) fine SAND (SP), no odor, wet. 10 x 20 Silica Sand 0 @ 11.0 feet: lense of black woody debris. 8.0 15.0 to 16.5 feet: gray (GLEY 1 3/N) fine SAND (SP), no odor, wet. 3 3 3 Bottom of boring = 16.5 feet. 20

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**FIGURE A-19** 

LOG OF SOIL BORING SB-253(C)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/04/2003 BLOWS/6IN DEPTH (FT) USCS SYMBOLS PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-47(A) 0 to 5.0 feet: medium dark brown (5Y 2.5/2) fine SAND (SP) with small Concrete 0.3  $\times$ Bentonite Chips 8.0 3 5.0 to 7.5 feet: brownish gray (5Y 4/1) fine SAND (SP), micaceous. 6 3  $\times$ 3 6.5 6 7.5 to 10.5 feet: grayish brown (5Y 3/1) fine SAND (SP), moist, some 9 6 9 10 x 20 Silica Sand 2.9 10.5 to 11.5 feet: grayish brown (5Y 3/1) fine SAND (SP), wet. 13 11.5 to 15.0 feet: gray (GLEY 1 4/N) fine SAND (SP), wet. 15.0 to 16.5 feet: gray (GLEY 1 4/N) fine SAND (SP), no odor, wet. 0.4 2 3 3 Bottom of boring = 16.5 feet. 20

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FIGURE A-20

LOG OF SOIL BORING SB-254(C)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/04/2003 DEPTH (FT) **BLOWS/6IN** PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-48(A) 0 to 0.5 foot: GRAVEL, FILL, SILT. Concrete 0.5 to 2.5 feet: brown (2.5Y 4/2) fine **SAND** (SP). 0.2 40 Bentonite Chips 50 2.5 to 5.5 feet: gray (GLEY 1 3/N) silty SAND (SP), some organics, very 5.6 19 40 5.5 to 7.5 feet: black silty SAND (SP) with organics (very woody), 50 percent recovery.  $\times$ 7.5 to 10.0 feet: black silty SAND (SP), medium to large gravels, wood, no 10.0 to 10.2 feet: CONCRETE. 10 x 20 Silica Sand 3.2 7 7 7 10.2 to 15.0 feet: dark gray (GLEY 1 2.5/N) fine **SAND** (SP), some woody debris, no odor, wet. 0 3 6 15.0 to 16.5 feet: dark brownish gray (GLEY 1 2.5/10Y) silty SAND (SP), no odor, wet. 10 Bottom of boring = 16.5 feet. 20 ENVIRO2.gds:3.12/03/03.ASTORIA-EL2

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FIGURE A-21

LOG OF SOIL BORING SB-255(C)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/09/2003 DEPTH (FT) **BLOWS/6IN** SAMPLES (mdd) WELL CONSTRUCTION DETAIL 吕 MATERIALS DESCRIPTION MW-15(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 2.0 feet: sandy SILT (MH) with organics (GLEY 1 3/N). 115 14 2.0 to 4.5 feet: gray (GLEY 1 4/N) fine SAND (SP), 60 percent recovery, Bentonite Chips 17 4.5 to 5.0 feet: gray (GLEY 1 4/N) fine SAND (SP), odor, moist. Ш 855 5.0 to 5.5 feet: gray (GLEY 1 3/N) SILT (MH), organics, sheen, odor, 3 5 5.5 to 10.0 feet: gray (GLEY 1 4/N) fine SAND (SP), sheen, odor, moist 10.0 to 15.0 feet: gray (GLEY 1 3/N) silty SAND (SP) with 1- to 2-inch 10 x 20 Silica Sand 341 1 2 2 layers of clayey silt (MH), sheen, odor, wet at 11.0 feet, moist before 702 13 15.0 to 15.5 feet: gray (GLEY 1 3/N) silty SAND (SP), odor (possibly 20 from above), moist. 40 15.5 to 16.5 feet: brownish to yellowish gray (GLEY 1 4/10Y) very hard CLAY (CL), very dry. Bottom of boring = 16.5 feet. 20 ENVIRO2.gds:3.12/03/03.ASTORIA-EL2

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FIGURE A-22

LOG OF SOIL BORING SB-321(D)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 20 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Geoprobe and Hollow-stem Auger DATUM DRILLING COMPANY DATE STARTED 09/10/2003 Geo-Tech Explorations, Inc. DEPTH (FT) **BLOWS/6IN** USCS SYMBOLS PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-14(A) 0 to 0.5 foot: silt and vegetation. 0.5 to 6.0 feet: light to medium brown (2.5Y 4/2) fine SAND (SP), micaceous. @ 2.0 to 5.0 feet: no recovery. Bentonite Chips 4.1 6.0 to 10.0 feet: grayish brown (10YR 4/1) fine SAND (SP), micaceous.  $\times$ @ 7.0 to 10.0 feet: no recovery. 10.0 to 11.0 feet: grayish brown (10YR 4/1) fine SAND (SP), micaceous, 11.0 to 11.5 feet: grayish dark brown (2.5YR 3/2) fine SAND (SP), wet. 11.5 to 12.0 feet: orangish, reddish brown (7.5YR 3/4) fine SAND (SP), 0.4 12.0 to 15.0 feet: gray (GLEY 1 3/N) fine SAND (SP), no recovery, no odor, wet. 10 x 20 Silica Sand 15 15.0 to 20.0 feet: dark gray (GLEY 1 2.5/N) silty SAND (SP), bands of silt, micaceous, wet. 0 @ 18.0 to 20.0 feet: no recovery. 20 Bottom of boring = 20.0 feet. ENVIRO2.gds:2.11/13/03.ASTORIA-EL2

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FIGURE A-23

LOG OF SOIL BORING SB-323(D)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

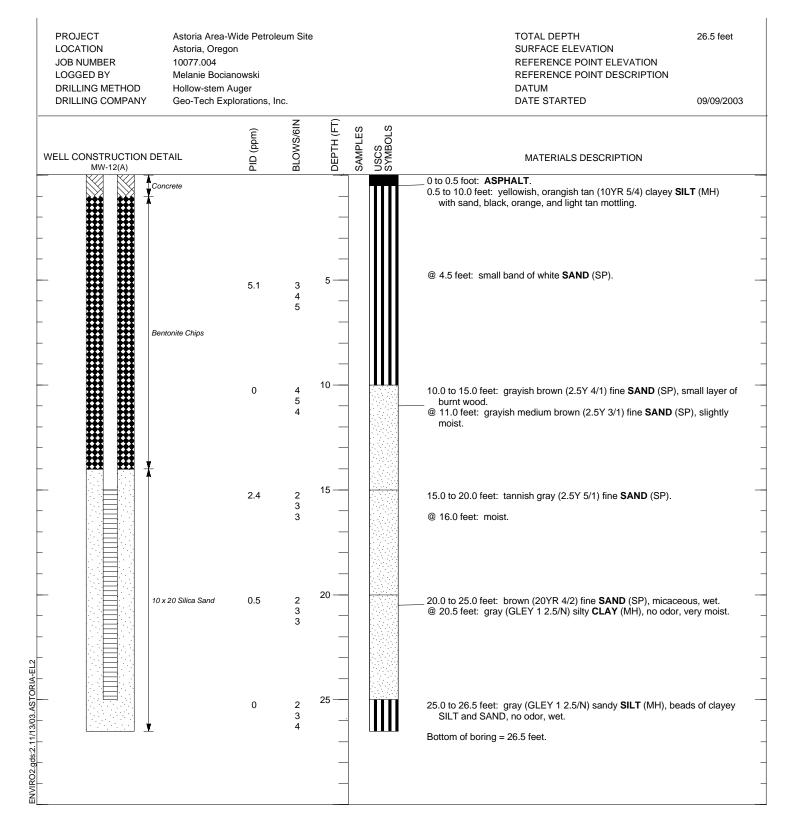
**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 15 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/09/2003 DEPTH (FT) **BLOWS/6IN** PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION 0 to 0.5 foot: ASPHALT. 0.5 to 5.0 feet: light gray (GLEY 1 7/N) and orangish brown (10YR 5/6) sandy SILT (MH), dry, stiff, some burnt wood, odor at 2.0 feet, 2.5 50 percent recovery. 185 3 5.0 to 10.0 feet: same as above, medium brown (2.5Y 3/2) SILT (MH) with above, dark brown silt layer, whitish gray (GLEY 1 8/N), sand (SP), 10 odd odor, 50 percent recovery, dry. Bentonite Chips 10.0 to 15.0 feet: whitish gray (GLEY 1 8/N), fine SAND (SP), moist, with 732 3 4 5 greens and grays, strong odd odor, mottled with some hard silt. Wood refusal = relocated well. 20

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**FIGURE A-24** 

LOG OF SOIL BORING SB-326(D)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon



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FIGURE A-25

LOG OF SOIL BORING SB-329(D)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/09/2003 BLOWS/6IN DEPTH (FT) PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-16(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 10.0 feet: grayish tan (10YR 5/1) fine SAND (SP), 40 percent recovery, micaceous. Bentonite Chips 0 11 4 3 3 4 10.0 to 15.0 feet: gray (GLEY 1 3/N) fine SAND (SP), small band of dark 10 x 20 Silica Sand gray SILT, no sheen, odor, wet. 0 15.0 to 16.0 feet: gray (GLEY 1 4/N) fine SAND (SP), no odor, wet. 3 3 3 16.0 to 16.5 feet: gray (GLEY 1 3/N) fine slightly silty SAND (SP), no odor, wet. Bottom of boring = 16.5 feet. 20

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FIGURE A-26

LOG OF SOIL BORING SB-330(D)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 27 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/09/2003 BLOWS/6IN DEPTH (FT) USCS SYMBOLS PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-13(A) Drilled straight to 15.0 feet. Refer to 326 (D) for 0 to 15.0 feet boring log. Bentonite Chips 15.0 to 15.5 feet: light green and gray silty **SAND** (SP), strong odor. 834 15 15 15.5 to 15.7 feet: 2-inches of brown and black **WOOD**. 15 15.7 to 20.0 feet: gray fine SAND (SP), strong odor. 20 20.0 to 25.0 feet: dark gray (GLEY 1 2.5/N) slightly silty SAND (SP) with 54.0 2 4 4 2-inch band of SILT, odor, moist to wet. 10 x 20 Silica Sand ENVIRO2.gds:3.12/03/03.ASTORIA-EL2 112 3 25.0 to 27.0 feet: gray (GLEY 1 3/N) fine SAND (SP) and SILT (MH), 5 4 layered, no odor, wet. Bottom of boring = 27.0 feet.

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FIGURE A-27

LOG OF SOIL BORING SB-331(D)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 08/28/2003 DEPTH (FT) **BLOWS/6IN** USCS SYMBOLS PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-44(A) 0 to 0.5 foot: SAND and GRAVEL. Concrete 0.5 to 5.0 feet: grayish brown (5Y 3/1) fine SAND (SP) with gravels (concrete), 30 percent recovery.  $\times$ 15 Bentonite Chips 3 817 8 5.0 to 8.0 feet: grayish brown (5Y 3/1) fine SAND (SP) with gravel. 9 9 1128 6 10 8.0 to 11.0 feet: medium gray (GLEY 1 3/N) fine SAND (SP), sheen, 8 odor, moist. 10 3 3 10 x 20 Silica Sand 63.5 @ 10.5 feet: small silty SAND band. 11.0 to 16.0 feet: medium gray (GLEY 1 3/N) fine SAND (SP), no odor, 17.4 2 3 5 16.0 to 16.5 feet: medium gray (GLEY 1 3/N) fine SAND (SP), very small amount of woody debris, slight sheen, no odor, wet. Bottom of boring = 16.5 feet. 20 ENVIRO2.gds:3.12/03/03.ASTORIA-EL2

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FIGURE A-28

LOG OF SOIL BORING SB-627(N)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 17 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 08/28/2003 BLOWS/6IN DEPTH (FT) PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-45(A) 0 to 0.5 foot: ASPHALT, CONCRETE. 0.5 to 10.0 feet: grayish light brown (5Y 4/2) fine SAND (SP). Bentonite Chips 0.5 2 5 8 1.5 10.0 to 15.0 feet: grayish brown (5Y 4/2) fine SAND (SP), slight brown 7 5 7 10 x 20 Silica Sand 5 4 4 15.0 to 16.0 feet: grayish brown (5Y 4/3) fine SAND (SP), some gray silt. 1.1 16.0 to 16.5 feet: gray (GLEY 1 4/N) fine SILTY SAND (SP), somewhat sticky, no odor, wet. Bottom of boring = 16.5 feet. 20

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FIGURE A-29

LOG OF SOIL BORING SB-628(N)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 08/28/2003 DEPTH (FT) **BLOWS/6IN** PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-39(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 8.0 feet: medium gray (GLEY 1 4/N) fine SAND (SP), 50 percent recovery, odor, slightly moist. Bentonite Chips 322 4 6 6 354 4 5 √ 8.0 to 10.0 feet: medium gray (GLEY 1 4/N) fine SAND (SP), slight 5 sheen, odor, slightly moist. 10 2 3 10.0 to 11.0 feet: medium gray (GLEY 1 4/N) fine SAND (SP), no odor, 10 x 20 Silica Sand 17.2 11.0 to 15.0 feet: medium grayish brown (5Y 3/2) fine SAND (SP), slightly larger granules, no odor, wet. 15.0 to 16.0 feet: medium grayish brown (5Y 3/2) fine SAND (SP), no 9.2 3 3 4 16.0 to 16.5 feet: medium gray (GLEY 1 3/N) fine SAND (SP), sheen, no Bottom of boring = 16.5 feet. 20

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FIGURE A-30

LOG OF SOIL BORING SB-629(N)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/08/2003 BLOWS/6IN DEPTH (FT) PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-28(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 10.0 feet: gray (GLEY 1 3/N) fine slightly silty **SAND** (SP) with mostly SILT layers, no sheen, odor, slightly moist. Bentonite Chips 342 3 10.0 to 15.0 feet: gray (GLEY 1 3/N) fine SAND (SP), micaceous, no 10 x 20 Silica Sand 5.2 3 2 4 10.9 15.0 to 16.5 feet: gray (GLEY 1 3/N) fine SAND (SP), micaceous, no 3 3 3 odor, wet. Bottom of boring = 16.5 feet. 20

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FIGURE A-31

LOG OF SOIL BORING SB-630(N)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 15 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER 10077.004 REFERENCE POINT ELEVATION LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Geoprobe DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/10/2003 BLOWS/6IN DEPTH (FT) PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-23(A) 0 to 0.5 foot: GRAVEL, SILT, VEGETATION. Concrete 0.5 to 5.0 feet: grayish tan (5Y 5/1) fine SAND (SP), orange brown mottling, micaceous. Bentonite Chips @ 3.0 to 5.0 feet: no recovery. 5.0 to 11.0 feet: orangish, reddish, brown (7.5YR 4/4) silty SAND (SP), with gray (GLEY 1 3/N) SANDY SILT layers, moist. 0 @ 8.5 to 10.0 feet: no recovery. 10 x 20 Silica Sand 11.0 to 13.0 feet: gray (GLEY 1 3/N) fine SAND (SP), no odor, wet. 0 13.0 to 15.0 feet: brownish gray (GLEY 1 3/10Y) silty CLAY (CL), hard, moist to dry. @ 14.0 to 15.0 feet: no recovery. 15 Bottom of boring = 15.0 feet. 20

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FIGURE A-32

LOG OF SOIL BORING SB-631(N)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon REFERENCE POINT ELEVATION JOB NUMBER 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/08/2003 BLOWS/6IN DEPTH (FT) USCS SYMBOLS PID (ppm) SAMPLES WELL CONSTRUCTION DETAIL MATERIALS DESCRIPTION MW-26(A) 0 to 0.5 foot: VEGETATION. Concrete 0.5 to 7.5 feet: light gray (GLEY 1 4/N) fine SAND (SP), micaceous, sheen, strong odor. Bentonite Chips 939 3 8 855 3 6 7.5 to 10.5 feet: gray (GLEY 1 3/N) fine SAND (SP), some SILT, sheen, 6 strong odor, moist. 10 3 3 10 x 20 Silica Sand 162 10.5 to 15.0 feet: dark gray (GLEY 1 3/N) fine slightly silty SAND (SP), no sheen, no odor, wet. 298 6 15.0 to 16.0 feet: brownish gray (GLEY 1 3/10Y) very hard CLAY (CL), 50 6 mostly dry (like chocolate), wet on outside of core.

16.0 to 16.5 feet: dark gray (GLEY 1 2.5/N) slightly silty **SAND** (SP), no Bottom of boring = 16.5 feet. 20

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FIGURE A-33

LOG OF SOIL BORING SB-632(N)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 15 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/05/2003 DEPTH (FT) **BLOWS/6IN** SAMPLES (mdd) WELL CONSTRUCTION DETAIL 吕 MATERIALS DESCRIPTION MW-27(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 5.5 feet: grayish tan (5Y 4/2) fine SAND (SP), micaceous. 10.1  $\times$ Bentonite Chips 4 6.3 4 6 5.5 to 7.0 feet: gray (GLEY 1 3/N) fine SAND (SP), none to slight odor. 4 4.3 4 7.0 to 8.0 feet: gray (GLEY 1 4/N) fine slightly silty SAND (SP), no odor, 4 6 8.0 to 10.0 feet: grayish brown (5Y 4/2) fine SAND (SP), some brown banding, no odor, moist. 10 x 20 Silica Sand 10 1 2 10.0 to 14.0 feet: brown (10YR 4/2 and 10YR 4/4) fine SAND (SP), wet. 0.5 3 @ 11.0 feet: 2-inch layer of gray (GLEY 1 3/N) sandy SILT (MH), no odor, wet. @ 12.5 feet: large GRAVEL. 14.0 to 14.5 feet: very hard gray CLAY(CL). 14.5 to 15.0 feet: gray (GLEY 1 3/N) clayey SILT, no odor, wet, refusal at 15 15.0 feet. Bottom of boring = 15.0 feet. 20

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FIGURE A-34

LOG OF SOIL BORING SB-834(Q)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon REFERENCE POINT ELEVATION JOB NUMBER 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/05/2003 DEPTH (FT) **BLOWS/6IN** SAMPLES (mdd) WELL CONSTRUCTION DETAIL 吕 MATERIALS DESCRIPTION MW-36(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 5.0 feet: orangish brown (10YR 3/2 with 10YR 4/4) fine SAND (SP), 20 to 30 percent recovery. Bentonite Chips 4 0 3 5.0 to 7.0 feet: grayish tan (5Y 4/2) fine SAND (SP), micaceous. 4 4  $\times$ 0 4 7.0 to 8.5 feet: light brown (10YR 4/1 and 10YR 4/2) fine SAND (SP), 4 slightly moist. 2 8.5 to 10.0 feet: gray (GLEY 1 4/N) fine SAND (SP), no odor, wet. 6 10.0 to 16.5 feet: dark gray, green, and greenish (GLEY 1 4/10Y, 10 x 20 Silica Sand 0 13 GLEY 1 3/N) silty CLAY (CL) with medium size gravels, no odor, 9 7 @ 16.0 feet: no recovery, CLAYS, moist. @ 16.5 feet: no recovery, CLAYS, moist. Bottom of boring = 16.5 feet. 20

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FIGURE A-35

LOG OF SOIL BORING SB-835(Q)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger **DATUM** DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/03/2003 DEPTH (FT) **BLOWS/6IN** SAMPLES (mdd) WELL CONSTRUCTION DETAIL 吕 MATERIALS DESCRIPTION MW-19(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 2.0 feet: brown SILT and angular GRAVELS. (FILL) 23.0 17 2.0 to 5.0 feet: brownish (2.5Y 3/2) fine SAND (SP), approximately Bentonite Chips 16 60 percent recovery. 18.1 6 5.0 to 7.5 feet: brownish (2.5Y 3/2) fine SAND (SP) with gravel, slight orangish brown mottling, 50 percent recovery. 5  $\times$ 5.8 4 5 7.5 to 10.0 feet: orangish brown (10YR 4/4) fine SAND (SP), 60 to 70 percent recovery, micaceous, slightly moist. 10 10.0 to 11.5 feet: brown and orangish brown (2.5Y 3/1 and 10YR 4/4) 10 x 20 Silica Sand 1.0 3 7 fine SAND (SP). 5 11.5 to 15.0 feet; mostly gray (GLEY 1 4/N) fine SAND (SP), 50 percent recovery, moist. 405 15.0 to 16.0 feet: grayish brown (5Y 4/1) fine SAND (SP), wet. 6 2 2 @ 16.0 feet: 1-inch layer gray (GLEY 1 4/N) fine SAND (SP), sheen, odor, wet. 16.0 to 16.5 feet: grayish brown (5Y 4/1) fine SAND (SP), wet. Bottom of boring = 16.5 feet. 20 ENVIRO2.gds:3.12/03/03.ASTORIA-EL2

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**PROJECT** 

Astoria Area-Wide Petroleum Site

FIGURE A-36

TOTAL DEPTH

16.5 feet

LOG OF SOIL BORING SB-912(S)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon REFERENCE POINT ELEVATION JOB NUMBER 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/03/2003 DEPTH (FT) **BLOWS/6IN** SAMPLES (mdd) WELL CONSTRUCTION DETAIL 吕 MATERIALS DESCRIPTION MW-20(A) 0 to 0.5 foot: ASPHALT. Concrete 0.5 to 5.0 feet: dark blackish brownish gray (GLEY 1 2.5/N) silty SAND (SP), brittle, odor (old petroleum-like). 37 Bentonite Chips 50 0 3 5.0 to 7.5 feet: grayish tan (5Y 4/1) fine SAND (SP), small light brown 5 mottling, micaceous. 6  $\times$ 8.1 9 12 7.5 to 10.0 feet: orangish brown (10YR 3/6) slightly SILTY SAND (SP), 13 slight odor (very old gas?). 10 10.0 to 11.0 feet: orangish brown and grayish brown (10YR 3/6 and 10 x 20 Silica Sand 4.9 3 3 3 5Y 4/1) fine **SAND** (SP) 11.0 to 15.0 feet: gray (GLEY 1 4/N) fine SAND slight odor, moist. 15.0 to 16.5 feet: gray (GLEY 1 4/N) fine SAND (SP), odor (gas), wet. 3.1 3 3 3 Bottom of boring = 16.5 feet. 20

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FIGURE A-37

LOG OF SOIL BORING SB-913(S)

Remedial Investigation/Feasibility Study Astoria Area-Wide Petroleum Site Astoria, Oregon

**PROJECT** Astoria Area-Wide Petroleum Site TOTAL DEPTH 16.5 feet LOCATION SURFACE ELEVATION Astoria, Oregon JOB NUMBER REFERENCE POINT ELEVATION 10077.004 LOGGED BY Melanie Bocianowski REFERENCE POINT DESCRIPTION DRILLING METHOD Hollow-stem Auger DATUM DRILLING COMPANY Geo-Tech Explorations, Inc. DATE STARTED 09/03/2003 DEPTH (FT) **BLOWS/6IN** SAMPLES (mdd) WELL CONSTRUCTION DETAIL 吕 MATERIALS DESCRIPTION MW-21(A) 0 to 0.5 foot: ASPHALT, CONCRETE. Concrete 0.5 to 5.0 feet; brownish gray (5Y 3/1) fine SAND (SP), micaceous. 9.9  $\times$ Bentonite Chips 14 15.8 3 5.0 to 7.5 feet: brownish gray (5Y 3/1) fine SAND (SP). 5 9 1.0 4 5 7.5 to 10.0 feet: brownish gray (5Y 3/1) fine SAND (SP), slightly moist, no 6 10 10.0 to 11.0 feet: brownish gray (5Y 3/1) fine SAND (SP), slightly moist, 10 x 20 Silica Sand 15.8 2 2 3 11.0 to 15.0 feet: gray (GLEY 1 4/N) fine SAND (SP), slight odor, wet. 4.2 15.0 to 16.0 feet: light brown to gray (5Y 3/1) fine SAND (SP), wet. 2 4 4 16.0 to 16.5 feet: gray (GLEY 1 3/N) fine SAND (SP), no sheen, slight to no odor, wet. Bottom of boring = 16.5 feet. 20

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FIGURE A-38

LOG OF SOIL BORING SB-914(S)

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