HARTCROWSER

Earth and Environmental Technologies

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J-3603

September 2, 1992

Ms. Karen Rose
Snohomish County Public Utilities District No.1
1802 - 75th Street SW
Everett, Washington 98206

Re: Site Assessment Report
Halls Lake Substation Remedial Services
Professional Services Contract No. 2048

Dear Karen:

Hart Crowser is pleased to present to you this report of the findings of our site investigation at the Snohomish County PUD Halls Lake Substation located in Mountlake Terrace, Washington. This report includes chemical analytical results from soils and groundwater samples and our recommendations for remedial alternatives for this site. Work was completed in accordance with the Exhibit A "Scope of Work" included in Professional Services Contract No. 2048, and with the Hart Crowser work scope dated June 19, 1992.

SUMMARY

Hart Crowser completed a total of 11 borings and two monitoring wells in the upper and lower ditches and sump at the Halls Lake Substation (Figure 1). Soil samples were obtained at 2.5- and 5.0-foot-depth intervals as noted on the boring logs presented in Attachment A of this report. Soil samples were tested for total petroleum hydrocarbons (TPH), total lead, and toxicity characteristic leaching procedure (TCLP) lead as noted in the soil chemical analytical results, presented in Attachment B of this report and summarized on Figures 2 and 3.

Groundwater samples from the upper and lower ditch were tested for dissolved lead and TPH. Field conductivity and pH measurements were completed as part of Hart Crowser's routine groundwater sampling procedure and these results, along with groundwater chemical analytical results, are presented in Attachment B.

Based on our findings, lead and TPH concentrations exceed soil cleanup levels set by the Washington State Department of Ecology (Ecology) at the surface and upper 2.5 feet of soil along the entire centerlines of both the upper and lower ditches. More specifically, soil with TCLP lead exceeding the 5.0 mg/L hazardous waste limit (RCRA soil) extends from the surface to depths of approximately 1.75 feet and has a total estimated volume of 65 cubic yards. Soil exceeding MTCA cleanup standards (MTCA soil) was observed from a depth of 1.75 feet to 2.5 feet with a total estimated volume of 30 cubic yards.

Groundwater was found to be perched in the upper 15 feet beneath the surface of both ditches to within approximately 4 feet of the surface. Lead and TPH concentrations from the upper ditch groundwater sample were found to exceed MTCA Method A groundwater cleanup standards for lead and TPH.

We have proposed two alternatives for site remediation:

- Alternative 1 involves excavation and separation of soils into RCRA and MTCA stockpiles, and disposal of these soils at an appropriate hazardous or solid waste landfill. The estimated cost is about $95,000; and

- Alternative 2 involves excavation and separation of the soils into RCRA and MTCA stockpiles, treatment of the RCRA soils to achieve MTCA cleanup standards and final disposal of the soil at a solid waste landfill. The estimated cost for this alternative is about $110,000.

PROJECT BACKGROUND AND OBJECTIVES

Hart Crowser was retained by the Snohomish County PUD to perform a site investigation of the Halls Lake Substation and adjoining right-of-way (ROW) to determine the extent and volume of soils contaminated with motor oil and lead in

order that the property may be remediated for worker safety and compliance with applicable state and federal laws.

Initial testing by the Snohomish PUD and Ecology indicated high concentrations of lead and petroleum in two ditches running east-west on the property (Figures 2 and 3). The suspected source of contamination is a nearby radiator shop, Ken's Radiator, that has a drainage pipe leading into the east end of the upper ditch.

The objective of this site investigation is to assess the extent of soil contamination that must be remediated to achieve the following cleanup standards that have already been negotiated between the PUD and Ecology:

- Inside the PUD yard, the lower of either 1,000 mg/kg total lead or 5.0 mg/L TCLP lead; and
- Within the ROW, 250 mg/kg total lead.

PROJECT SCOPE OF WORK

The following tasks were requested by the PUD and included as part of this work scope:

- Collect soil samples to assess the extent of soil contamination by placing soil borings in the drainage ditches and analyzing soil samples for total lead, TCLP lead, and total petroleum hydrocarbons (TPH by method 418.1);
- Collect groundwater samples to assess potential groundwater contamination for total lead and total petroleum hydrocarbons;
- Review remediation options and alternatives that are cost-effective to the PUD, and will accommodate the PUD's proposed use of the affected property and the PUD's current construction schedule; and
- Provide a written report to the PUD containing site investigation findings and site remediation recommendations within 30 days of the notice to proceed.

RESULTS OF SOIL CHEMICAL ANALYSES

Refer to Figures 2 and 3 for boring locations and a summary of laboratory analytical results for soil samples from the upper and lower ditches, respectively. The following conclusions are based on these analytical results:

- A positive correlation was established between high lead and high TPH concentrations at all sample points; in almost all cases, where the TPH exceeded the MTCA cleanup standard of 200 mg/kg, the lead concentration also exceeded the negotiated MTCA cleanup standard.

- Concentrations of total lead in the soil exceeded the 1,000 and 250 mg/kg cleanup standards set by Ecology for inside the PUD yard (the upper ditch) and the ROW (the sump and lower ditch), respectively, in surface samples collected from centerline borings HC-1, HC-3, HC-5, HC-7 (sump), and HC-8. The only exception was HC-10, the last boring in the centerline of the lower ditch, which showed a surface lead concentration of 47 mg/kg.

- All samples collected from off-center of the ditches (borings HC-2, HC-6, and HC-9) showed lead concentrations below the cleanup standards.

- Concentrations of TCLP lead generally diminished to below the RCRA lead level of 5.0 mg/L at a depth of 1 to 2.5 feet beneath the ground surface along the centerlines of both ditches. The RCRA soil extends from the surface to an estimated average depth of about 1.75 feet.

- Concentrations of total lead in the soil diminished to below cleanup standards within a depth of about 2.5 feet below ground surface along the centerline of the ditches.

- Assuming lead RCRA soils extend from the surface to depths of 1.75 feet and to a total width of 4 feet across the ditch, total RCRA soil volume would be approximately 51 cubic yards. By including a 25 percent contingency, the estimated volume of RCRA soil is about 65 cubic yards.

- Assuming MTCA soils extend from depths of 1.75 to 2.5 feet and to a total width of 4 feet across the ditch, total MTCA soil volume would be approximately 22 cubic yards. By including a 25 percent contingency, the estimated volume of MTCA soil is about 30 cubic yards.

- Boring HC-1 soil test results showed instances of contamination deeper than expected. Boring HC-1A was installed to confirm the presence or absence of the lead at these deeper levels. Soil test results from HC-1A showed no deep lead contamination, indicating that the instances of deep lead contamination in HC-1 were most likely caused by sluffing of the high lead concentration soils at the surface into the deeper part of HC-1.

RESULTS OF GROUNDWATER CHEMICAL ANALYSES

Groundwater depth in the upper ditch monitoring well (HCG-3) was measured at 3.9 feet beneath the ground surface. Groundwater depth in the lower ditch monitoring well (HCG-8) was measured at 4.3 feet beneath the ground surface. It appears that the perched groundwater table was below the vertical extent of soil contamination when we sampled in July 1992. It is unknown whether the groundwater table rises during the wet season to an elevation that is within the contaminated soil interval.

Both dissolved lead and TPH were detected in the upper ditch groundwater well at concentrations which exceeded MTCA Method A groundwater cleanup standards. Dissolved lead was detected at a concentration of 53 μg/L and TPH detected at a concentration of 2,500 μg/L. The MTCA Method A cleanup standard for these two constituents is 5.0 μg/L for lead and 1,000 μg/L for TPH. An assessment of the groundwater gradient was beyond the scope of this initial investigation, so at this time it is not known whether the contaminated groundwater has migrated beyond the source.

Monitoring well HCG-8 in the lower ditch was apparently completed in a boring that contained unset grout, which resulted in a pH of 12 and very high conductivity measurements. Because of the high water pH, analytical results from this well were invalidated. HCG-8 was a planned temporary well and a more permanent well is recommended for this area and for the upper ditch once soil remediation has

occurred. The permanent well should be sufficient for providing initial as well as ongoing groundwater analyses.

SUMMARY OF RECOMMENDED REMEDIAL ALTERNATIVES

Soil Remediation

We have included two recommended alternatives for soil cleanup. These alternatives are deemed the most cost-effective based on the calculated volumes of soil affected and the most time-effective given the time constraints of this project.

Alternative 1 - Excavation and Direct Disposal

Alternative 1 involves careful excavation of the contaminated soil in thin layers, and separation and placement of the layers into stockpiles of approximately 10 cubic yards in volume for testing and disposal designation. Soil stockpiles that exceed the TCLP lead limit of 5 mg/L (we estimate 65 cubic yards) will be shipped to the hazardous waste landfill in Arlington, Oregon. Remaining soil stockpiles that exceed the 1,000 mg/kg total lead cleanup standard from the upper ditch, or the 250 mg/kg total lead cleanup standard from the lower ditch (estimated to be about 30 cubic yards) will be shipped to a permitted solid waste landfill.

Excavation side walls and bottoms will be sampled and analyzed for total lead, TCLP lead (where necessary), and TPH to verify that the cleanup standards have been achieved.

Table 1 provides a summary of estimated costs for Alternative 1. The total estimated cost for excavation and direct disposal is $95,000.

We assume that the site can be excavated without encountering the perched groundwater. If that is true, then no soil dewatering would be needed to pass the paint filter test for free liquid. If the excavation encounters perched water, then additional steps would be required to dewater the excavated soil.

Alternative 2 - On-Site Soil Treatment and Off-Site Disposal

Alternative 2 involves excavation and segregation of the soils into RCRA and MTCA stockpiles. RCRA soil stockpiles would first be treated on site to reduce the TCLP lead level to below the RCRA cleanup level.

All excavated soils that then exceed the total lead limit of 1,000 mg/kg from the upper ditch or 250 mg/kg from the lower ditch would be shipped to a permitted solid waste landfill for ultimate disposal. Excavation side walls and bottoms will be sampled to verify that the cleanup standard has been achieved.

A treatability study would be performed by the Hart Crowser *FAST* Laboratory to determine the optimum treatment for stabilization of the RCRA soils to reduce the TCLP lead concentration to less than 5 mg/L. This method might involve the use of fly ash, Portland cement, or other materials mixed to achieve the desired result.

Table 2 provides a summary of estimated costs for Alternative 2. The total estimated cost for treatment and disposal is $110,000.

Post-Cleanup Activities

Once soil remediation has been accomplished using either Alternative 1 or Alternative 2 described above, the site will be restored with clean, approved structural backfill.

A site closure report will be prepared that summarizes final volumes of soil excavated, treatment methods used, if applicable, and final destination(s) of affected soils. Soil cleanup will be verified based on excavation side wall and bottom soil samples analytical results.

Groundwater Monitoring

Finally, as part of this remediation effort, we recommend that groundwater monitoring wells be installed in or adjacent to the upper and lower ditches and that groundwater be sampled quarterly for a minimum of one year to assess groundwater quality improvements. By removal of the TPH and lead contaminant sources, the

perched groundwater should slowly improve in quality. We wish to emphasize, however, that given our limited knowledge about this groundwater hydraulic system and the type of co-contaminants that may be affecting it, it is impossible to predict to what degree and how soon groundwater quality improvements will occur.

RECOMMENDED ADDITIONAL SITE WORK

If, after a year's time, no improvement in groundwater quality is seen, you may wish to consider installing additional groundwater monitoring wells for the purposes of establishing flow directions and flow volumes, and to determine background quality of the groundwater.

LIMITATIONS

Work for this project was performed, and this letter report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Snohomish County Public Utilities District No. 1 for specific application to the referenced property. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

Any questions regarding our work and this letter report, the presentation of the information, and the interpretation of the data are welcome and should be referred to the undersigned.

We trust that this report meets your needs.

Sincerely,

HART CROWSER, INC.

SUSAN P. HARP
Project Engineer

JAMES M. WILDER
Associate

PHS1.LR

Attachments:
Table 1 - Estimated Costs for Excavation and Off-site Disposal
Table 2 - Estimated Costs for Soil Treatment and Off-site Disposal
Figure 1 - Vicinity Map
Figure 2 - Chemical Analytical Results for Upper Ditch Soil Samples and Upper Ditch Boring Location Plan
Figure 3 - Chemical Analytical Results for Lower Ditch Soil Samples and Lower Ditch Boring Location Plan
Attachment A - Soil Boring Logs
Attachment B - Soil and Groundwater Chemical Analytical Results Hart Crowser *FAST* Laboratory and Sound Analytical Services, Inc.

Table 1 – Estimated Costs for Excavation and Off-site Disposal
Sno PUD Halls Lake

Basis:
Excavate and segregate soil with TPH or lead exceeding cleanup standard.
Sample each 10-cy stockpile for disposal designation.
Ship TCLP-lead soil to Arlington.
Ship remaining soil to sanitary landfill.
Restore site with structural backfill.
Install groundwater monitoring well; 4 rounds of samples for Pb/TPH.
Prepare site closure reports.

DESCRIPTION	UNITS	QUANT.	UNIT COST	SUBTOTAL COST	
Permits and Approvals					
CWMI approval	Ea	1	$1,500	$1,500	
Sanitary landfill approval	Ea	1	$100	$100	
Grading permit	Ea	1	$800	$800	
Contracts and procurement	Ea	1	$1,000	$1,000	
Subtotal					$3,400
Soil Remediation					
Mobilization	Ea	1	$2,000	$2,000	
Strategic Sidewall Sampling	Ea	25	$250	$6,250	
Soil Excavation	Cy	95	$28	$2,660	
Stockpile Sampling	Samples	10	$250	$2,500	
Soil Loading	Ton	150	$5	$750	
RCRA Ship/Disposal	Ton	98	$245	$24,010	
Sanitary Ship/Disposal	Ton	45	$65	$2,925	
Site Backfilling	Cy	95	$20	$1,900	
Field Supervisor	Days	6	$1,200	$7,200	
Sampling Technician	Days	6	$600	$3,600	
Subtotal					$53,795
Groundwater Quality Monitoring					
Mobilization	Ea	1	$2,000	$2,000	
Sampling Plan	Ea	1	$2,500	$2,500	
Well Installation	Ea	2	$3,000	$6,000	
Well Sampling	Days	4	$800	$3,200	
Water Analysis	Ea	10	$200	$2,000	
Subtotal					$15,700
Remediation Documentation					
Soil Remediation Report	Ea	1	$3,000	$3,000	
Groundwater Quality Report	Ea	1	$2,500	$2,500	
Subtotal					$5,500
SUBTOTAL COST					$78,395
CONTINGENCY (20%)					$15,679
TOTAL COST					$94,074

Table 2 - Estimated Costs for Soil Treatment and Off-site Disposal
Sno PUD Halls Lake

Basis:
Perform lead treatability tests.
Excavate and segregate soil with TPH or lead exceeding cleanup standard.
Treat TCLP-lead to under TCLP limits.
Ship all soil to sanitary landfill.
Restore site with structural backfill.
Install groundwater monitoring well; 4 rounds of samples for Pb/TPH.
Prepare site closure reports.

DESCRIPTION	UNITS	QUANT.	UNIT COST	SUBTOTAL COST	
Permits and Approvals					
RCRA/TBG Approval	Ea	1	$5,000	$5,000	
Sanitary landfill approval	Ea	1	$100	$100	
Grading permit	Ea	1	$800	$800	
Contracts and procurement	Ea	1	$1,000	$1,000	
Subtotal					$6,900
Soil Remediation					
Treatability Tests	Ea	1	$15,000	$15,000	
Mobilization	Ea	1	$5,000	$5,000	
Strategic Sidewall Sampling	Ea	25	$250	$6,250	
Soil Excavation/Segregation	Cy	95	$28	$2,660	
Stockpile Sampling	Samples	10	$250	$2,500	
Soil Stabilization	Ton	90	$60	$5,400	
Landfill Shipping/Disposal	Ton	222	$56.48	$12,539	
Site Backfilling	Cy	95	$20	$1,900	
Field Supervisor	Days	7	$1,200	$8,400	
Sampling Technician	Days	7	$600	$4,200	
Subtotal					$63,849
Groundwater Quality Monitoring					
Mobilization	Ea	1	$2,000	$2,000	
Sampling Plan	Ea	1	$2,500	$2,500	
Well Installation	Ea	2	$3,000	$6,000	
Well Sampling	Days	4	$800	$3,200	
Water Analysis	Ea	8	$250	$2,000	
Subtotal					$15,700
Remediation Documentation					
Soil Remediation Report	Ea	1	$3,000	$3,000	
Groundwater Quality Report	Ea	1	$2,500	$2,500	
Subtotal					$5,500
SUBTOTAL COST					$91,949
CONTINGENCY (20%)					$18,390
TOTAL COST					$110,338

Vicinity Map

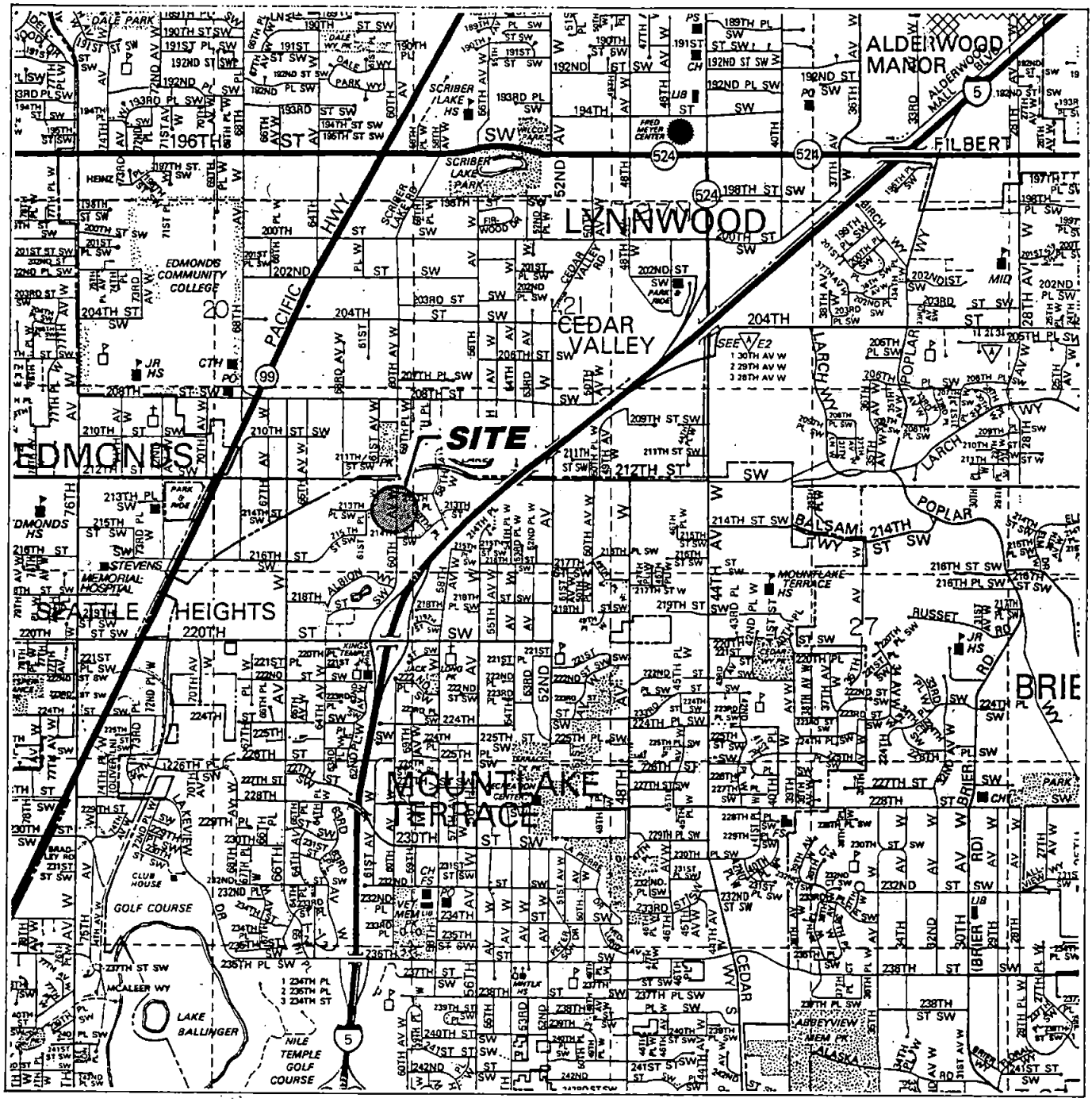

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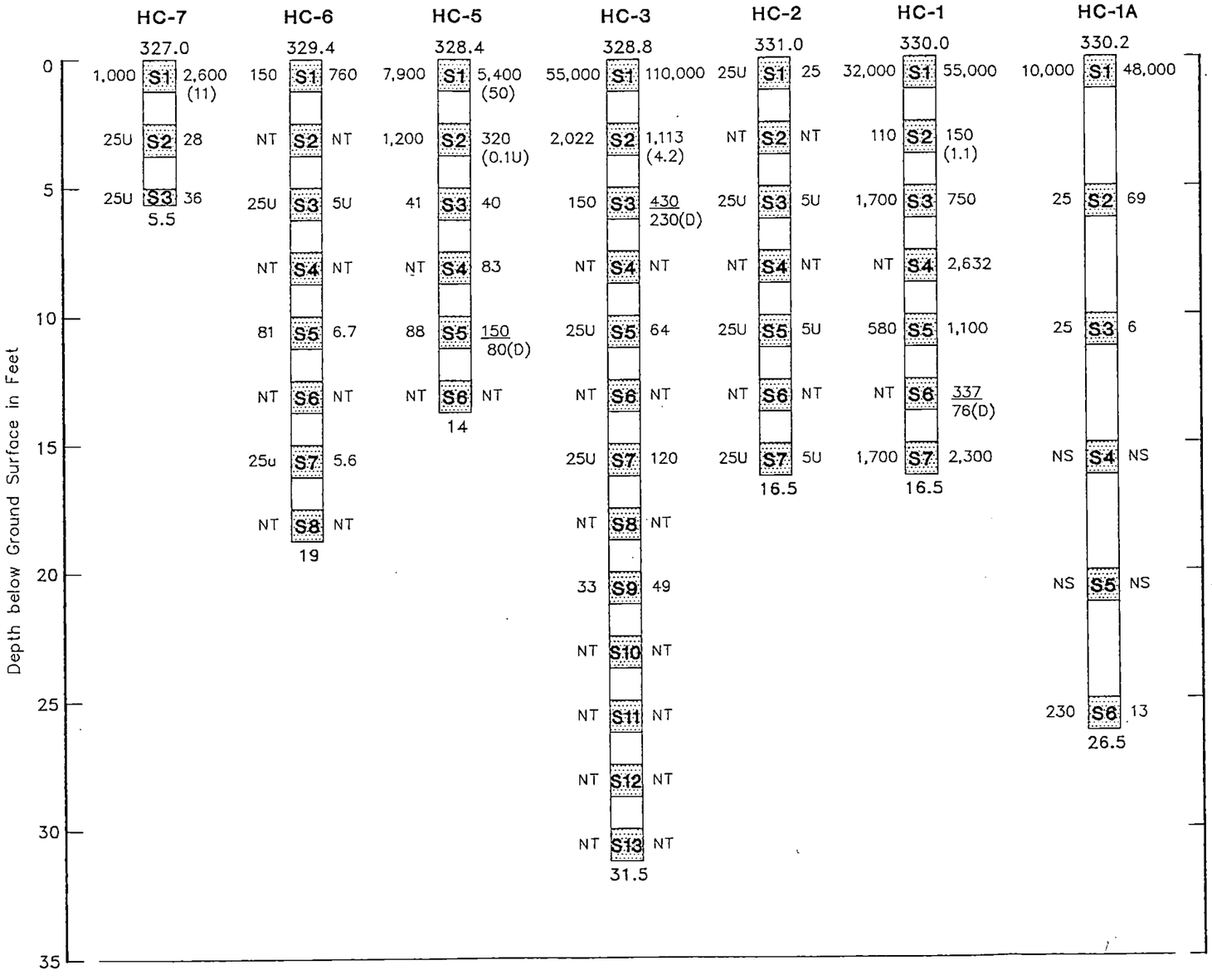
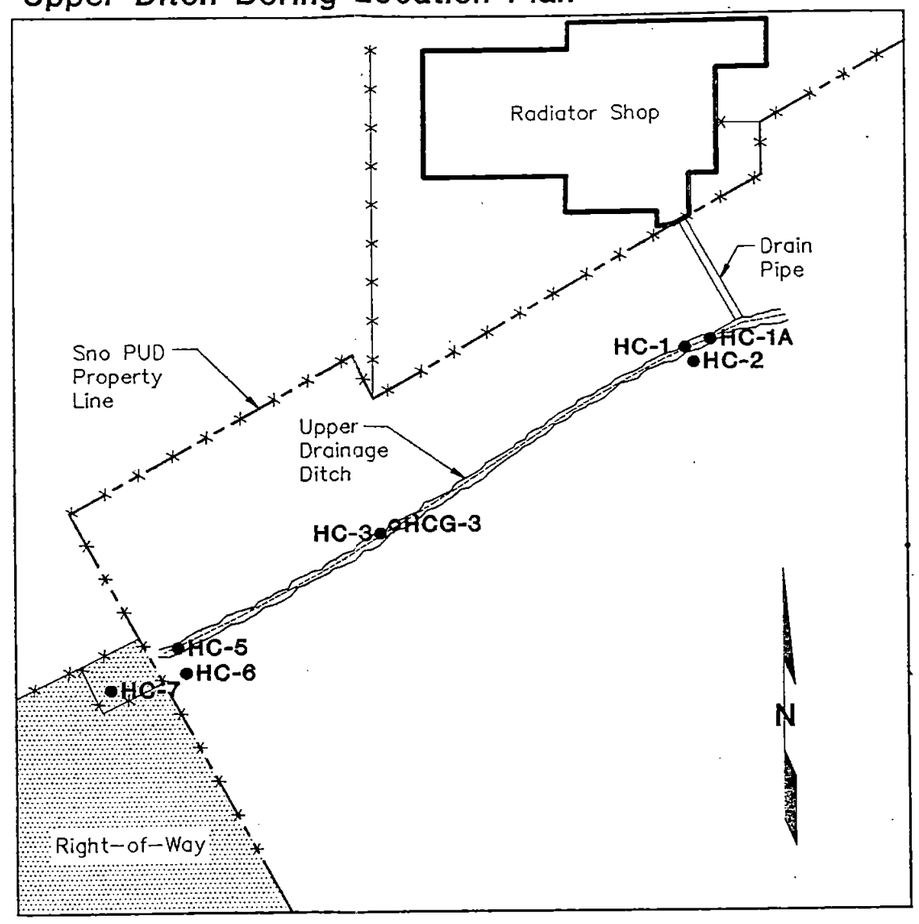
Figure 1

Chemical Analytical Results for Upper Ditch Soil Samples



Upper Ditch Boring Location Plan



●HC-9 Boring Location and Number

oHCG-3 Monitoring Well Location and Number

0 40 80
Scale in Feet

HC-1 Boring Number

330.0 Approximate Elevation in Feet

TPH in mg/kg S1 Total Pb in mg/kg (TCLP Pb in mg/L) Constituent and Concentration

S2 Sample Number and Approximate Sampling Interval

19 Total Depth of Boring in Feet

NS Not Sampled

NT Not Tested

25U Not Detected at Detection Limit Indicated

(D) Duplicate Sample

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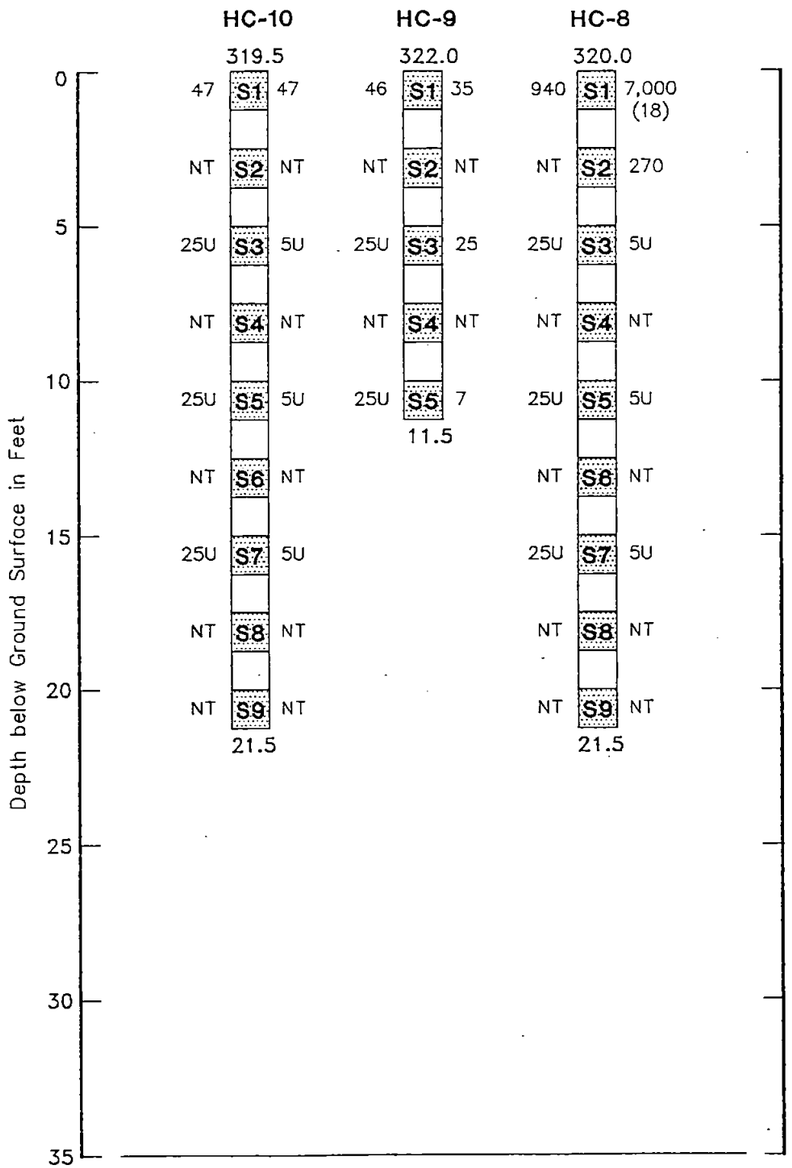
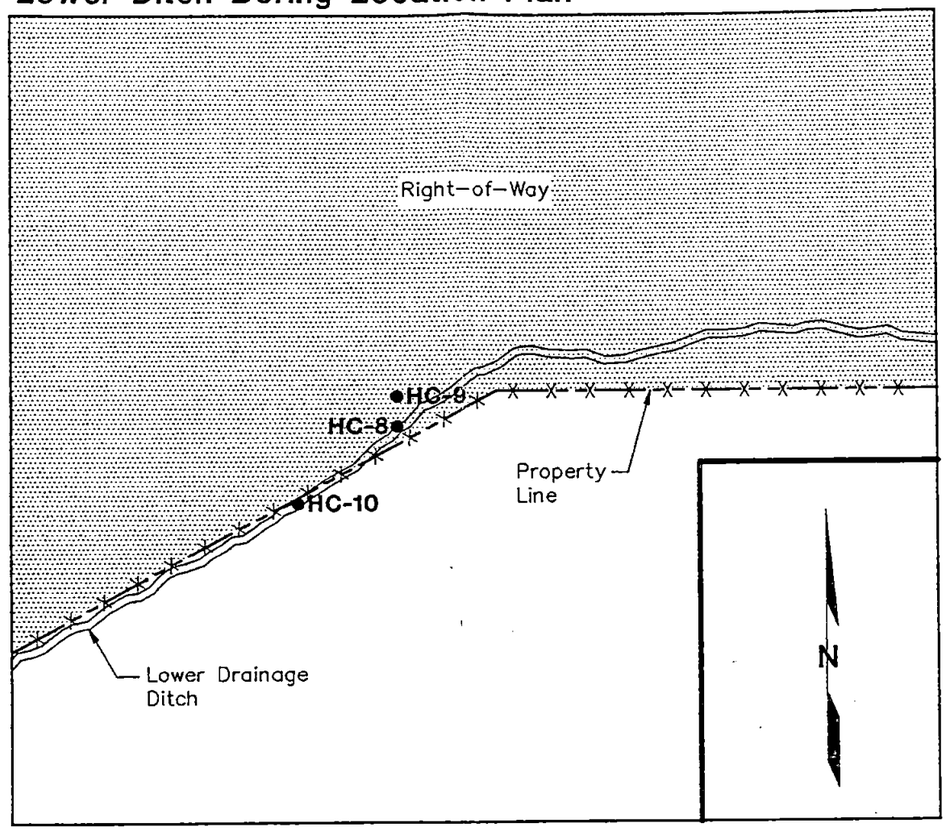
Figure 2

Chemical Analytical Results for Lower Ditch Soil Samples



Lower Ditch Boring Location Plan



●HC-9 Boring Location and Number

HC-8 Boring Number

320.0 Approximate Elevation in Feet

TPH in mg/kg | S1 | Total Pb in mg/kg (TCLP Pb in mg/L) — Constituent and Concentration

S2 — Sample Number and Approximate Sampling Interval

21.5 Total Depth of Boring in Feet

NS Not Sampled

NT Not Tested

25U Not Detected at Detection Limit Indicated

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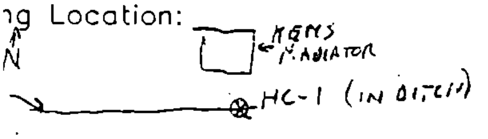
Figure 3

Hart Crowser
J-3603

ATTACHMENT A
SOIL BORING LOGS

ng Location:



ation: Datum:

Well Install. Yes ~~No~~

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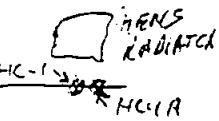
Boring HC-1 Date 7/22/92 Sheet 1 of 1
Job SNOHOMISH P.U.D. Job No. 3603
Logged By CWW Weather DRIZZLE
Drilled By CAMBELL
Drill Type/Method HSA 140 lb HAMMER
Sampling Method 2" SPT
Bottom of Boring 16.5 ATD Water Level Depth 3.8 No

(%) S Range	F Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
10 C	60		0	1		S-1			1715 (SOFT) MOIST BLACKISH BRN VY SANDY SILT - ORGANICS, ODOR - PETROL? BLACK STAINS IN SOIL	1-16 OZ JAR	VY SANDY SILT
50 C	25		2.5	4.0	X	S-2		7 / 14 / 19 (33)	DENSE WET BROWNISH GRAY SILTY GRAVELLY SAND - NO STAIN OR ODOR	1-16 OZ No STANDING H₂O	SILTY GRAVELLY SAND
45 SM	35		5	6.5	X	S-3		50/5	VY DENSE MOIST TAN GRAVELLY VY SILTY SAND TILL?	1-16 OZ DRILLING VY HARD	GRAVELLY VY SILTY SAND
45 SM	35		7.5	9.0	X	S-4		50/4	VY DENSE MOIST TAN GRAVELLY VY SILTY SAND	1-16 OZ	
55 SM	25		10	11.5	X	S-5		50/4	VY DENSE MOIST TAN GRAVELLY SILTY SAND	1-16 OZ	GRAVELLY SILTY SAND
10 SM	35				X	S-6		50/5	VY DENSE MOIST GRAY GRAVELLY VY SILTY SAND TILL?	1-16 OZ	GRAVELLY VY SILTY SAND
10 SM	35				X	S-7		50/2	VY DENSE MOIST GRAY GRAVELLY VY SILTY SAND	POOR RECOVERY 1-16 OZ	
									BOTTOM OF BORING 16.5' 1840		

g Location:



tion: Datum:

Well Install. Yes No

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Boring HC-1A Date 7/30/92 Sheet 1 of 2
Job SNO P.U.D Job No. 3603
Logged By CWL Weather SUNNY
Drilled By CAMBELL
Drill Type/Method HSA 140 lb HAMMER
Sampling Method 2" SPT
Bottom of Boring 26.5 ATD Water Level Depth No

(%) S	(%) F	Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
5	20			0	1		S-1	0		(LOOSE) MOIST DK BROWN SILTY VY GRAVELLY SAND - HIGH ORGANICS; SILT HAS BLACK STAINING - PETROL ODOR, PIECES OF GLASS FOUND	1-1/60Z	SILTY VY GRAVELLY SAND
5	20			5	6.5		S-2	5	50/6	VY DENSE WET GRAY BROWN SILTY VY SANDY GRAVEL	1/3 - 1/60Z	SILTY VY SANDY GRAVEL
0	12			10	11.5		S-3	10	50/4	VY DENSE MOIST LT REDDISH BROWN SILTY GRAVELLY SAND - SL FE STAIN	1/2 - 1/60Z	SILTY GRAVELLY SAND
											DRILLING VERY HARD	
				15	16.5		S-4	15	50/3	NO RECOVERY - HITTING ON TOP OF ROCK? TILL?	NO SAMPLE	
								20				

ng Location:

ation: Datum:

Well Install. [Yes] [No]

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Boring HC-1A Date 7/30/92 Sheet 2 of 2

Job SNO PUD Job No. 3603

Logged By CWW Weather SUNNY 90°

Drilled By CASCADE DRILLING

Drill Type/Method HSA 140 lb HAMMER

Sampling Method 2" SPT

Bottom of Boring 26.5 ATD Water Level Depth [No]

(%) S	(%) F	Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
				20	21.5	X	S-5		50/4	NO RECOVERY	NO SAMPLE	
35	15			25	26.5	X	S-6		50/3	VV DENSE WET GRAY SILTY VV SANDY GRAVEL TILL?	POOR RECOVERY 1/8 +/- 6oz	SILTY VV SANDY GRAVEL
										B.O. BORING 26.5'		

20 21 22 23 24 25 26 27 28 29 30 1 2 3 4 5 6 7 8 9 0

ng Location:

ITEMS RADIATOR

HC-2

ation: Datum:

Well Install. Yes [X] No

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Boring HC-2 Date 7/22/92 Sheet 1 of 1

Job SNOHOMISH PUD Job No. 3603

Logged By CLAIR Weather DRIZZLE

Drilled By CAMPBELL

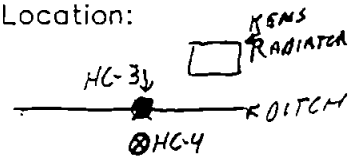
Drill Type/Method HSA 140 lb HAMMER

Sampling Method 2" SPT

Bottom of Boring 16.5' ATD Water Level Depth 10.5' No

(%) S	(%) F	Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
35	15	15		0	1		S-1			1330 (LOOSE) MOIST RED BROWN SILTY VY SANDY GRAVEL	1-16 oz SAMPLE	SILTY VY SANDY GRAVEL
5	60			2.5	3.0		S-2		14	(STIFF) MOIST RED BROWN GRAVELLY SANDY SILT	1/2-16 oz	GRAVELLY SANDY SILT
5	2			3.0	4.0		S-2A	(43)	16 27	DENSE MOIST GRAY RED BROWN VY SANDY GRAVEL Fe STAIN	1-16 oz	VY SANDY GRAVEL
45	35			5	6.5		S-3		54/4	VY DENSE MOIST BROWNISH GRAY GRAVELLY VY SILTY SAND - TILL?	1-16oz	GRAVELLY VY SILTY SAND
25	25			7.5	9.0		S-4		33 50/1	VY DENSE MOIST-WET GRAY SILTY SANDY GRAVEL - Fe STAIN TILL?	1-16 oz SAMPLE CONTAINS MORE MOISTURE THAN ABOVE - NO STANDING H_2O	SILTY SANDY GRAVEL
30	10	10		10	11.5		S-5		50/2	VY DENSE WET GRAY BROWN SC SILTY VY SANDY GRAVEL	POOR RECOVERY 1/4 16 oz * STANDING H_2O - MEAS AT 10.5' W/ SOUNDER	SC SILTY VY SANDY GRAVEL
20				12.5	14.0		S-6		50/5	VY DENSE WET BROWN SANDY GRAVEL - SAND IS INTERBEDDED WITH THE GRAVELS	1-16 oz STANDING H_2O	SANDY GRAVEL
15	35	15		15	16.5		S-7		50/5	VY DENSE MOIST GRAY SANDY VY SILTY GRAVEL	POOR RECOVERY APPEAR TO HAVE GONE THROUGH H_2O ZONE	SANDY VY SILTY GRAVEL
							S-8			BOTTOM OF BORING 16.5' 1545		

ıg Location:



ıtion: Datum:

Well Install. [X] Yes [ ] No

HARTCROWSER

Boring HC-3 Date 7/23/92 Sheet 1 of 2
Job SNOHOMISH P.U.D - HALLS LAKE Job No. 3603
Logged By CLW Weather PTLY CLOUDY
Drilled By CAMPBELL DRILLING
Drill Type/Method HSA 140# HAMMER
Sampling Method 2" SPT
Bottom of Boring 31.5 ATD Water Level Depth 3.9' No

(%) F Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
90		0	1		S-1		0	SOFT WET BLACK BROWN SL SANDY SILTY CLAY - HIGH ORGANICS; BLACK LAYERS IN CLAY; PETROL ODOR	LOCATED IN DITCH 1-1602	SL SANDY SILTY CLAY
85	—	2.5	3.5		S-2		1	SOFT WET DK BROWN SANDY SILT - SOME YELLOW BLACK STAINS; ORGANICS - NO DETECTABLE ODOR	1-1603	SANDY SILT
100		3.5	4		S-2A		2	SOFT WET DK RED BROWN SILTY CLAY - STRONG ROTTEN EGG ODOR - HIGH ORGANICS	1-1602	SILTY CLAY
25		5.0	6.5		S-3	(46)	6 21 27	DENSE MOIST BROWN GRAY SILTY GRAVELLY SAND - SL Fe STAIN.	1-1607	SILTY GRAVELLY SAND
15		7.5	9.0		S-4	(47)	15 19 29	DENSE WET GREEN BROWN SILTY SAND	POOR RECOVERY 1/5 - 1602	SILTY SAND
15		10.0	11.5		S-5	(55)	11 18 17	DENSE WET GREEN BROWN SL GRAVELLY SILTY SAND	1-1602	SL GRAVELLY SILTY SAND
2		12.5	14.0		S-6		50/6	VY DENSE WET GREEN BROWN SL GRAVELLY SAND - POSSIBLE SLUFF - SAND DOESN'T APPEAR TO BE AS DENSE AS RECORDED	1-1602	SL GRAVELLY SAND
15		15	16.5		S-7	(86)	11 36 50	VY DENSE WET GREEN BROWN SL GRAVELLY SILTY SAND - SOME OF SAND POSSIBLE SLUFF	1/4 1602	SL GRAVELLY SILTY SAND

g Location:

tion: Datum:

Well Install. [X] Yes [ ] No

HARTCROWSER

Boring HC-3 Date 2/24/92 Sheet 2 of 2

Job SNOHOMISH P.U.D Job No. 3603

Logged By CWL Weather

Drilled By CASCADE DRILLING

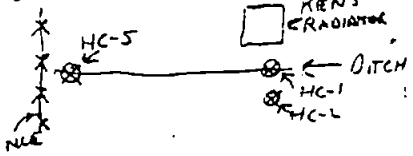
Drill Type/Method HSA 140 lb HAMMER

Sampling Method 2" SPT

Bottom of Boring 31.5' ATD Water Level Depth 3.9 No

(%) F Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc....	SUMMARY LOG (Water & Date)
25		20	21.5	X	S-8	20	50/6	VY DENSE MOIST GRAY SL GRAVELLY SILTY SAND TILL?	2' HEAVE 1-16 02	SL GRAVELLY SILTY SAND
						21				
						22				
						23				
						24				
15		25	26.5	X	S-9	25	50/5	VY DENSE MOIST TO WET GRAY SILTY GRAVELLY SAND	18" HEAVE 1-16 02 DRILLING EASIER AT 26'	SILTY GRAVELLY SAND
						26				
						27				
						28				
						29				
		30	31.5	X	S-10	30	50/4	NO RECOVERY - HITTING ON TOP OF LG ROCK		
						31		B.O.B 31.5'		
						32				
						33				
						34				
						35				
						36				
						37				
						38				
						39				
						40				

g Location:



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ıtion: Datum:

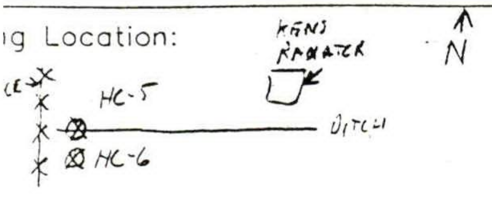
Well Install. Yes [X] No

HARTCROWSER

Boring HC-5 Date 2/23/12 Sheet 1 of 1
Job SNOHOMISH P.U.D Job No. 3603
Logged By CWW Weather DRIZZLE
Drilled By CASCADE DRILLING
Drill Type/Method HSA 140lb HAMMER
Sampling Method 2" SPT
Bottom of Boring 14.0' ATD Water Level Depth ✱ No

(%) S	(%) F	Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
		45		0	1		S-1	0		(LOOSE) WET DK BROWN VY SILTY SAND - LOTS OF ORGANICS - THIN BLACK LAYERS PETRL? ODOR - SHEEN ON WATER	✱STANDING H_2O IN DITCH 1-160z JAR	VY SILTY SAND
		100		2.5	4		S-2	1	1	(SOFT) MOIST - WET DK BRN SILTY CLAY - HIGH IN ORGANICS - ROTTEN EGG ODOR: SOME BLACK STAIN	1-160z	SILTY CLAY
		45		5	6.5		S-3	2	4	MED DENSE WET GRAY VY SILTY SAND - THIN INTERBEDDED BANDS OF SILT + SAND - NO STAIN OR ODOR	AMEAR TO BE IN WATER ZONE 1-160z	VY SILTY SAND
		20		7.5	8.5		S-4	16	7	DENSE WET GRAY SL GRAVELLY SILTY SAND	1-160z	SL GRAVELLY SILTY SAND
		20		8.5	9.0		S-4A	31	13	DENSE WET DK RED BROWN SILTY SAND - SEPARATED OUT FROM S-4 DUE TO STAINING	1-160z	SILTY SAND
		25		10	11.5		S-5	33	18	VY DENSE "WET" GRAY GRAVELLY SILTY SAND TILL? SAMPLE WET DUE TO WATER RUNNING IN FROM DITCH	POOR RECOVERY 1 1/8 160z	GRAVELLY SILTY SAND
		25		12.5	14		S-6	50/5	50/5	VY DENSE MOIST GRAY SILTY SANDY GRAVEL	POOR RECOVERY 1/4 160z	SILTY SANDY GRAVEL
										BOTTOM OF BORING 14'		

...g Location:



...ation: Datum:

Well Install. Yes [X] No

HARTCROWSER

Boring HC-6 Date 7/23/92 Sheet 1 of 1
Job SNOHOMISH P.U.D. Job No. 3603
Logged By CWW Weather CLOUDY
Drilled By CAMPBELL DRILLING
Drill Type/Method HSA 140 lb HAMMER
Sampling Method 2" SPT
Bottom of Boring 19 ATD Water Level Depth * No

(%) S Range	F Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
-5 -M	20		0	1		S-1			(LOOSE) MOIST DK BROWN SILTY GRAVELLY SAND - ORGANICS NO STAIN OR ODOR	1-16 oz	SILTY GRAVELLY SAND
10 -M	25		2.5	4.0		S-2		4, 3, 1 (4)	LOOSE MOIST-WET RED BROWN SL GRAVELLY SILTY SAND - LOTS OF WOOD FRAGS	1/2 16 oz	SL GRAVELLY SILTY SAND
3	95		5	6		S-3		7, 9 (26)	STIFF MOIST DK RED BROWN SILT - LOTS OF WOOD - ROTTEN EGG ODOR	1-16 oz	SILT
5	25		6	6.5		S-3A		17	MED DENSE MOIST GRAY SILTY SAND	1-16 oz	SILTY SAND
3 -C	15		7.5	9.0		S-4		11, 22, 26 (48)	DENSE WET GRAY SILTY SAND - SOME Fe STAIN	1-16 oz	
40 -M	2		10	11.5		S-5		54/5	VY DENSE WET GRAY W/ SANDY GRAVEL - TILL?	1/4-16 oz	VY SANDY GRAVEL
40	2		12.5	14.0		S-6		33, 50/3	VY DENSE WET GRAY VY SANDY GRAVEL - SL Fe STAIN	1-16 oz	
.0	20		15	16.5		S-7		50/3	VY DENSE WET GRAY SILTY GRAVELLY SAND - SL Fe STAIN WETNESS COULD BE COMING IN FROM ABOVE	POOR RECOVERY 1/16-16 oz	SILTY GRAVELLY SAND
5 F	10		17.5	19		S-8		50/2	VY DENSE MOIST GRAY SL SILTY VY SANDY GRAVEL - SL Fe STAIN	POOR RECOVERY 1/8-16 oz	SL SILTY VY SANDY GRAVEL
									B.O.B 19'		

* LEFT HOLE OPEN - WILL DETERMINE H_2O LEVEL 7/24/92 AM [illegible]

ıg Location: FENCE HC-7 HC-5 HC-6 MEN'S RADIATOR PATCH FENCE

ıtion: Datum:

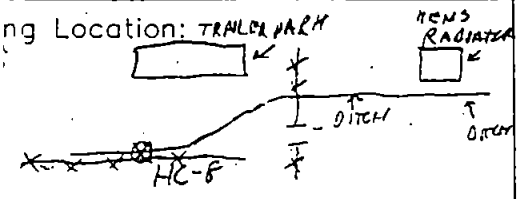
Well Install. Yes [X] No

HARTCROWSER

Boring HC-7 Date 7/27/92 Sheet 1 of 1
Job SNO. P.U.D. Job No. 3603
Logged By CWW Weather SUNNY
Drilled By CAMPBELL DRILLING
Drill Type/Method 40lb HANDHAMMER
Sampling Method 2" SPT
Bottom of Boring 5.5 ATD Water Level Depth 1.5? No

(%) S	(%) F	Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
		25		0	1		S-1			(LOOSE) MOIST DK BROWN SILTY GRAVELLY SAND HIGH ORGANICS	1-16oz	SILTY GRAVELLY SAND
		15		2.5	4.0		S-2			(MED DENSE) WET BROWN SILTY GRAVELLY SAND - Fe STAIN	1-16oz	
		15		4.0	5.5		S-3			(DENSE) WET GRAY SILTY W GRAVELLY SAND - TILL *	1/4-16oz	SILTY W GRAVELLY SAND
										B.O. HOLE 5.5'		
										* COULD PENETRATE FURTHER WITH TOOLS AT HAND		
										DUE TO 40 lb HAMMER NO BLOW COUNTS WERE TAKEN - NOT ENOUGH WEIGHT TO MOVE SPT THROUGH SOIL		

ng Location: TRAILER PARK



ation: Datum:

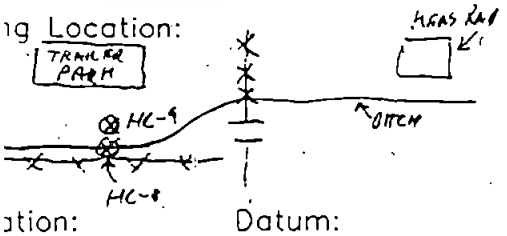
Well Install. [Yes] [No]

HARTCROWSER

Boring HC-8 Date 7/27/92 Sheet 1 of 1
Job SNOHOMISH P.U.D. Job No. 3603
Logged By CLW Weather SUNNY
Drilled By CAMBELL DRILLING
Drill Type/Method HSA 140# HAMMER
Sampling Method 2" SPT
Bottom of Boring 21.5 ATD Water Level Depth 4.3 No

E (%) S	E (%) F	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
Range	Att. Limits										
75 FM	25		0	1		S-1	0		(LOOSE) MOIST DK BROWN SILTY SAND - HIGH ORGANICS NO STAIN OR ODOR	1-16oz	SILTY SAND
50 FM	35		2.5	4.0		S-2	1 2 3 4	2 3 5 (8)	LOOSE MOIST-WET RED BRN GRAVELLY VY SILTY SAND ORGANICS, Fe STAIN, SL BLACK STAIN - NO ODOR	1-16oz	GRAVELLY VY SILTY SAND
50 FM	35		5	6.0		S-3	5 6	3 5 (12)	LOOSE WET BROWN GRAVELLY SILTY SAND - ORGANICS Fe STAIN	1-16oz	
00 FM	—		6.0	6.5		S-3A	6 7	7	MED DENSE WET GREEN GRAY SAND - SL Fe STAIN	1-16oz	SAND
—	—		7.5	9.0		S-4	8 9	50/2	NO RECOVERY - HITTING ON TOP OF ROCK?	No SAMPLE	
55 FM	20		10	11.5		S-5	10 11	32 50/6	VY DENSE WET GRAY GRAVELLY SILTY SAND - TILL?	1/2-16oz	GRAVELLY SILTY SAND
			15	16.5		S-6	15 16	50/4	NO RECOVERY - SPT-WET	No SAMPLE	
58 FM	2		20	21.5		S-7	20	50/5	VY DENSE WET GRAY VY GRAVELLY SAND	Poor RECOVERY 4/4-16oz	VY GRAVELLY SAND

ng Location: TRAILER PARK



ation: Datum:

Well Install. Yes [No]

HARTCROWSER

Boring HC-9 Date 7/27/92 Sheet 1 of

Job SNO P.U.D. Job No. 3603

Logged By CLW Weather SUNNY

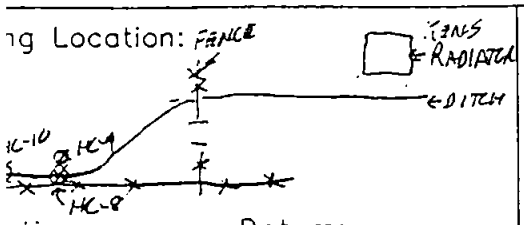
Drilled By CAMPBELL DRILLING

Drill Type/Method HSA 140 lb HAMMER

Sampling Method 2" SPT

Bottom of Boring 11.5' ATD Water Level Depth 4.9' No

(%) S	(%) F	Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
		15		0	1		S-1	0		LOOSE DAMP BROWN SILTY GRAVELLY SAND - ORGANICS - NO STAIN OR ODOR	1-16 oz	SILTY GRAVELLY SAND
		40		2.5	4.0		S-2	3	3	LOOSE DAMP-WET GRAVELLY VY SILTY SAND - ORGANICS Fe STAIN + SOME SL BLACK STAINING	1-16oz	GRAVELLY VY SILTY SAND
								9	4			
		25		5.0	5.5		S-3	4	5	(LOOSE) MOIST AND BROWN SL GRAVELLY SILTY SAND	1/4 - 16oz	
		55		5.5	6.5		S-3A	(13)	4	STIFF VY WET GRANGE SANDY GRAVELLY SILT - VY HIGH Fe STAIN - ORGANICS	1-16oz	SANDY GRAVELLY SILT
								6	4			
									7			
		1		7.5	9.0		S-4	8	28	VY DENSE WET GRAY GRAVELLY SAND	1-16oz	GRAVELLY SAND
								(60)	42			
								9	38			
								10	45	VY DENSE WET GRAY GRAVELLY SAND	3/4 - 16oz	
				10	11.5		S-5	11	50/6			
								12		B, O, B 11.5'		
								13				
								14				
								15				
								6				
								7				
								8				
								9				
								0				

ng Location: 

ation: Datum:

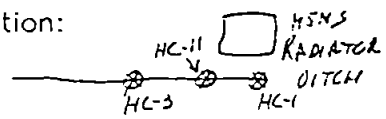
Well Install. Yes [No]

HARTCROWSER

Boring HC-10 Date 7/27/92 Sheet 1 of 1
Job SNO. P.U.D. Job No. 3603
Logged By CWW Weather SUNNY
Drilled By CAMBELL DRILLING
Drill Type/Method HSA 140lb HAMMER
Sampling Method 2" SPT
Bottom of Boring 21.5 ATD Water Level Depth [No]

(%) S	(%) F	Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
55	20			0	1		S-1	0		(LOOSE) DAMP BROWN SILTY GRAVELLY SAND - HIGH ORGANICS, NO STAIN OR ODOR	1-16 oz	SILTY GRAVELLY SAND
								1				
								2				
-5	20			2.5	3.5		S-2	3	4	MED DENSE MOIST BROWN SILTY GRAVELLY SAND - ORGANICS	1/2 16 oz	
								(4)	24			
60	25			3.5	4.0		S-2A	4	17	DENSE MOIST RED BROWN & GRAVELLY SILTY SAND - ORGANICS	1/2 - 16 oz	SL GRAVELLY SILTY SAND
								5				
55	20			5.0	6.5		S-3	(18)	4	MED DENSE RED GRAY BRN SILTY GRAVELLY SAND	1 - 16 oz	SILTY GRAVELLY SAND
								6	7	Fe STAIN		
									11			
								7				
50	15			7.5	9.0		S-4	8	8	DENSE WET GRAY SILTY SAND	3/4 - 16 oz	SILTY SAND
								(39)	19			
								9	20			
								10				
55	10			10	11.5		S-5		17	VY DENSE WET GRAY SL SILTY GRAVELLY SAND - TILL?	1-16 oz	SL SILTY GRAVELLY SAND
								11	50/4			
								12				
								13				
								14				
								15	15	VY DENSE MOIST GRAY SILTY GRAVELLY SAND	1/2 - 16 oz	SILTY GRAVELLY SAND
70	15			15.0	16.5		S-6		50/3			
F								16				
								17				
								18				
								19				
								20	48	VY DENSE WET GRAY GRAVELLY	1/2 16 oz	GRAVELLY VY SILTY SAND
55	30			20	21.5		S-8		50/5	VY SILTY SAND		
F												

ıg Location:



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Well Install. [Yes] [No]

HARTCROWSER

Boring HC-11 Date 7/30/92 Sheet 1 of 1
Job SNO TUD Job No. 2603
Logged By CWW Weather SUNNY 90°
Drilled By CAMBELL DRILLING
Drill Type/Method RAMCO 140lb HAMMER
Sampling Method 2" SPT
Bottom of Boring _____ ATD Water Level Depth No

(%) S	(%) F	ange	Att. Limits	PID or other	DEPTH From	DEPTH To	SAMPLE Type	SAMPLE Number	SAMPLE RECOVERY	Penetration Resistance	DESCRIPTION; Den., moist., color, minor, MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	REMARKS; Drill action, drill and sample procedures, water conditions, heave,...etc...	SUMMARY LOG (Water & Date)
			45		0	1		S-1			(LOOSE) MOIST BLACKISH OR BROWN VY SILTY SAND + HIGH ORGANICS - BLACK STAIN IN SILT - PETROL ODOR?	1-1602	
					2.5	4.0		S-2			SHUT DOWN DUE TO BREAKDOWN OF RAMCO DRILLING UNIT		
					5	6.5		S-3					
					7.5	9.0		S-4					
					10	11.5		S-5					
					15	16.5		S-6					
					20	21.5		S-7					

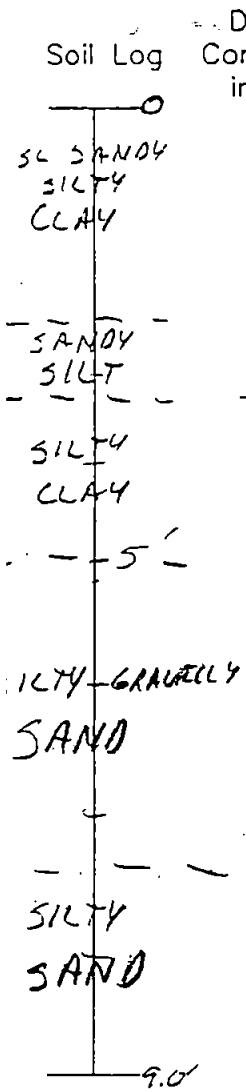
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21.5

Installation Report — Monitoring Well HC-3

Project SNOHOMISH P.U.D. Job No 3603 Date 7/24/92

Location MILK TERRACE (HALLS LANE) HC Observer CWW Driller TOM CAMPBELL

Type of Well (Observation, Sampling, Vapor Extraction) OBSERVATION



Stick up in Feet 2.1'
Relative to Approximate Ground Surface Elevation in Feet

Type of Monument ABOVE GROUND

Type of Surface Seal CONCRETE

Diameter and Type of Casing/Riser Pipe 2" PVC

Type of Grout N/A

Type of Plug MED BENTONITE CHIPS

Diameter of Borehole 8"

Screen Diameter, Slot Size, and Type 20 SLOT PVC

Type of Filter Material 10/20 SILICA SAND

Type of End Cap/Tail Pipe THREADED

Remarks: MONITORING WELL LOCATED ~ 4' EAST OF ORIGINAL HC-3 IN DITCH. NEW BORING DRILLED TO 9.0'

Materials Tally:

(100 lb) Sand 3 BAGS (300 lbs)

(60 lb) Cement 4 BAGS (240 lbs)

(50 lb) Bentonite 1 BAG (50 lb)

Monument 1

PVC 10'

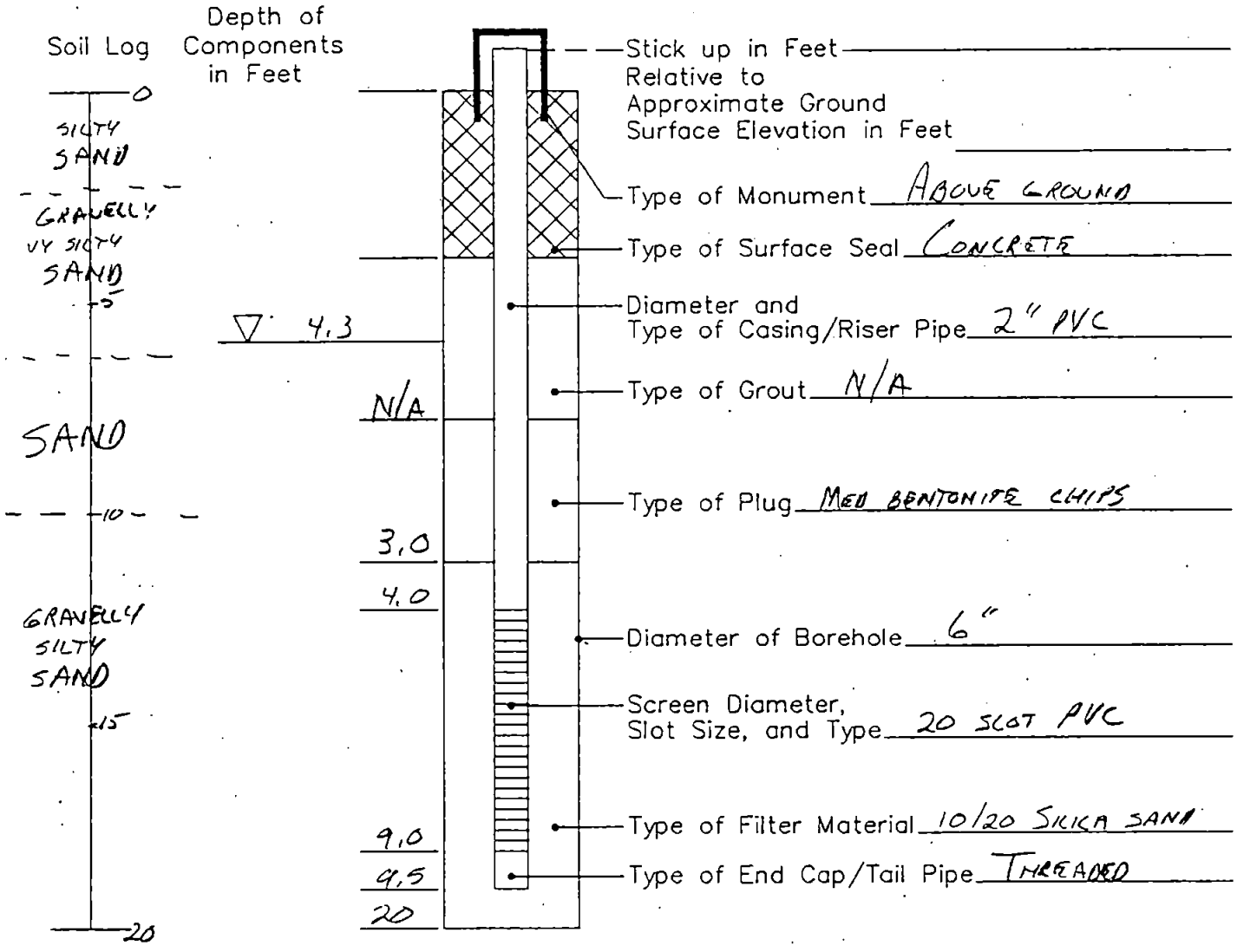
Other

Installation Report — Monitoring Well HC-8

Project SNOHOMISH P.U.D. Job No 3603 Date 7/27/92

Location MILL TERRACE, WA HC Observer CWW Driller CAMBELL

Type of Well (Observation, Sampling, Vapor Extraction) OBSERVATION



Remarks: ABANDONED HOLE FROM 10-20'

Materials Tally:

(100/4) Sand 3 BAGS (300/4) Monument 1

(60/6) Cement 6 BAGS (360/6) PVC

Bentonite Other

Groundwater Sampling Data

Project SNOHOMISH P.U.D. Job No. 3603
Field Rep. CARL WOLFE Date 7/30/92

WELL NUMBER	DATE SAMPLED	WELL DEPTH IN FEET	DEPTH TO WATER IN FEET	DEPTH TO SEDIMENT IN FEET	SEDIMENT THICKNESS IN FEET	METHOD OF SAMPLING	COMMENTS	DO mg/L	T °C	pH	EC IN µMHOS	CASING VOLUME IN GALLONS	PURGE VOLUME IN GALLONS
HC-3 STICK UP 1.70'	7/30/92	8'	3.95			2" SS BAILER	WILL BAIL DRY 2 TIMES BEFORE SAMPLING DK BROWN VY TURBID H2O - NO SHEEN OR ODOR - ~½" OF FINE SAND AT BOTTOM OF BUCKET	2.7	15.5	6.5 7.9 8.0	400 320 350	.82 GAL	(1) DRY @ 4 gal (2) " " 3.5 gal
HC-8 STICK UP 2.0'	7/30/92	9'	4.62			"	DK BROWN VY TURBID H2O. NO SHEEN OR ODOR - SL SUDSY PH & CONDUCTIVITY ARE OFF THE SCALE * WATER LEFT IN BUCKET DEVELOPED A SHEEN - NOT PETRO MORE LIKE A SOAPY FILM	4.8	15.9	12.0 11.5 11.7	7100 6500 6400	.71 gal	(1) DRY @ 1.0 gal (2) DRY AT .8 gal

Hart Crowser, Inc.

ATTACHMENT B
SOIL AND GROUNDWATER CHEMICAL ANALYTICAL RESULTS
HART CROWSER *FAST* LABORATORY AND
SOUND ANALYTICAL SERVICES, INC.

HARTCROWSER

FAST

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699
FAX 206.328.5581
206.324.9530

Field Analytical Services and Technologies

FAST Laboratory Analytical Report

FROM: James Herndon, Analytical Chemist
TO: Susan Harp, Project Engineer
DATE: August 10, 1992
CLIENT: Snohomish PUD
SITE: Halls Lake
RE: J-3603

Attached are the compiled results from analysis conducted on samples received and analyzed July 23, 1992. Analysis was performed for TPH-418.1 and Lead (7420). This report contains:

- Results for 8 soil samples presented on a dry weight basis.
- Results for method blanks.
- Recoveries for spiked samples.
- Differences for duplicate analyses.

Site: Halls Lake
J-3603

Analytical Results

Results in ppm (mg/kg or mg/L)

Compound	HC-1 S-1	Duplicate HC-1 S-1	HC-1 S-3	HC-1 S-5
Matrix	Soil	Soil	Soil	Soil
% Moisture	35%	35%	10%	11%
TPH-418.1	32,000	n/t	1,700	580
Lead	55,000	56,000	750	1,100

Compound	HC-1 S-7	HC-2 S-1	HC-2 S-3	HC-2 S-5
Matrix	Soil	Soil	Soil	Soil
% Moisture	8%	20%	11%	10%
TPH-418.1	1,700	25 U	25 U	25 U
Lead	2,300	25	5.0 U	5.0 U

U = indicates not detected at indicated detection limit.
n/t = test not performed.

Site: Halls Lake
J-3603

Analytical Results, continued

Results in ppm (mg/kg or mg/L)

Compound	Duplicate HC-2 S-5	HC-2 S-7
Matrix	Soil	Soil
% Moisture	n/a	7%
TPH-418.1	25 U	25 U
Lead	n/t	5.0 U

U = indicates not detected at indicated detection limit.
n/t = test not performed.

Method Blanks

Results in ppm (mg/kg or mg/L)

Compound	
Matrix	Soil
TPH-418.1	25 U
Lead	5.0 U

U = indicates not detected at indicated detection limit.

Site: Halls Lake
J-3603

Spikes

% Recovery

Compound	MS HC-2 S-5	MSD HC-2 S-5
Matrix	Soil	Soil
TPH-418.1	82%	89%

Duplicates

Relative % Difference

Compound	HC-1 S-1	HC-2 S-5
Matrix	Soil	Soil
TPH-418.1		-8%
Lead	0%	

Sample Custody Record

DATE 7/23/92 PAGE 1 OF 1

HARTCROWSER

1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER 3603 LAB NUMBER

PROJECT MANAGER S. HARP

PROJECT NAME HALLS LAKE

SAMPLED BY: C. Wolfe

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TPH (418.1)	Total Lead									NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/COMPOSITING INSTRUCTIONS
	H-C 1	8:00am	S-4	Soil												Likely to exceed very high lead levels in some samples.
	S-1		↓	↓	✓	✓										
	S-2															
	S-3				✓	✓										
	S-4															
	S-5				✓	✓										
	S-6															24 hour TAT
	S-7				✓	✓										(Please call x4329
	~~HC-2~~															when Ready)
	~~S-1, S-2~~				✓	✓										
	~~S-3, S-4~~				✓	✓										
	~~S-5, S-6~~	~~S-7~~	↓	↓	✓	✓										

SPH 7/23/92

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE: SH / C. Wolfe	7/22	SIGNATURE: Valerie Ivanil	7/22
PRINTED NAME: HC	TIME: P.M.	PRINTED NAME: VALERY IVANIL / HC	TIME: 8:40
COMPANY		COMPANY	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE: S. Harp	7/23/92	SIGNATURE	
PRINTED NAME: S. Harp	TIME: 8:00 Am	PRINTED NAME	TIME
COMPANY: Hart Crowser		COMPANY	

TOTAL NUMBER OF CONTAINERS: 14 samples, 2 boxes

METHOD OF SHIPMENT: Hand delivered

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS: Keep samples for future TCLP Testing

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

HARTCROWSER

FAST

Field Analytical Services and Technologies

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699
FAX 206.328.5581
206.324.9530

FAST Laboratory Analytical Report

FROM: James Herndon, Analytical Chemist
TO: Susan Harp, Project Engineer
DATE: August 10, 1992
CLIENT: Snohomish PUD
SITE: Halls Lake
RE: J-3603

Attached are the compiled results from analysis conducted on samples received and analyzed July 24, 1992. Analysis was performed for TPH-418.1 and Lead (7420). This report contains:

- Results for 8 soil samples presented on a dry weight basis.
- Results for method blanks.
- Recoveries for spiked samples.
- Differences for duplicate analyses.

Analytical Comment

Spike recoveries for lead on sample HC-5 S-3 were above control limits. The sample, spike, and spike duplicate were re-extracted and re-analyzed. The high lead recoveries were repeated in the re-analysis.

Site: Halls Lake
J-3603

Analytical Results

Results in ppm (mg/kg or mg/L)

Compound	HC-5 S-1	HC-5 S-3	HC-5 S-5	HC-5 S-6
Matrix	Soil	Soil	Soil	Soil
% Moisture	39%	19%	12%	10%
TPH-418.1	7,900	41	88	25 U
Lead	5,400	80	150	5.6

Compound	HC-6 S-1	HC-6 S-3	HC-6 S-5	HC-6 S-7
Matrix	Soil	Soil	Soil	Soil
% Moisture	26%	62%	10%	10%
TPH-418.1	150	25 U	81	25 U
Lead	760	5.0 U	6.7	5.6

U = indicates not detected at indicated detection limit.

Site: Halls Lake
J-3603

Method Blanks

Results in ppm (mg/kg or mg/L)

Compound	
Matrix	Soil
TPH-418.1	25 U
Lead	5.0 U

U = indicates not detected at indicated detection limit.

Site: Halls Lake
J-3603

Spikes

% Recovery

Compound	MS HC-5 S-3	MSD HC-5 S-3	MS HC-6 S-7	MSD HC-6 S-7
Matrix	Soil	Soil	Soil	Soil
TPH-418.1			138%	138%
Lead	174%	160%		

Duplicates

Relative % Difference

Compound	HC-5 S-3	HC-6 S-7
Matrix	Soil	Soil
TPH-418.1		0%
Lead	8%	

Sample Custody Record

DATE 7/24/92 PAGE ____ OF ____

HARTCROWSER

1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER 3603 LAB NUMBER ____

PROJECT MANAGER S. HARP

PROJECT NAME HALLS LAKE

SAMPLED BY: C. Wolfe

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TPH 418.1	Total Lead	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
HC-5	S-1		4	Soil	X	X		
	S-3		4					
	S-5		4					24 hr. TAT
	S-6		4					
HC-6	S-1		4					
	S-3		4					
	S-5		4					
	S-7		4					

RELINQUISHED BY	DATE	RECEIVED BY	DATE
Signature: S. Harp	7/24/92	Signature: Rob Roberts	7/24
Printed Name: S. HARP	Time: 9:30	Printed Name: Rob Roberts	Time: 9:35
Company: HC		Company: HC	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
Signature:		Signature:	
Printed Name:	Time:	Printed Name:	Time:
Company:		Company:	

TOTAL NUMBER OF CONTAINERS: 8 jars

METHOD OF SHIPMENT: Hand Carried

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS: Save Samples for future TCLP analysis

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

HARTCROWSER

FAST

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699
FAX 206.328.5581
206.324.9530

Field Analytical Services and Technologies

FAST Laboratory Analytical Report

FROM: James Herndon, Analytical Chemist
TO: Susan Harp, Project Engineer
DATE: August 10, 1992
CLIENT: Snohomish PUD
SITE: Halls Lake
RE: J-3603

Attached are the compiled results from analysis conducted on samples received and analyzed July 27, 1992. Analysis was performed for TPH-418.1 and Lead (7420). This report contains:

- Results for 7 soil samples presented on a dry weight basis.
- Results for method blanks.
- Recoveries for spiked samples.
- Differences for duplicate analyses.
- Recoveries for Buffalo River sediment quality control.

Analytical Comment

The duplicate value for TPH-418.1 on sample HC-6 S-2 is above control limits. The sample, spike, and spike duplicate were re-extracted and reanalyzed. The out of control difference was repeated in the reanalysis. The out of control condition is caused by matrix variation.

The concentration of Lead in sample HC-3 S-1 was greater than five times the concentration of the spike. The relative percent difference value was calculated from the sample concentration in the spike and spike duplicate.

Site: Halls Lake
J-3603

Analytical Results

Results in ppm (mg/kg or mg/L)

Compound	HC-3 S-1	HC-3 S-1 MS	HC-3 S-1 MSD	HC-3 S-3
Matrix	Soil	Soil	Soil	Soil
% Moisture	55%	55%	55%	12%
TPH-418.1	55,000	n/t	n/t	150
Lead	110,000	100,000	110,000	430

Compound	HC-3 S-5	HC-3 S-7	HC-3 S-9	HC-5 S-2
Matrix	Soil	Soil	Soil	Soil
% Moisture	14%	14%	9%	76%
TPH-418.1	25 U	25 U	33	1,200
Lead	64	120	49	320

U = indicates not detected at indicated detection limit.
n/t = test not performed. n/a = not applicable.

Site: Halls Lake
J-3603

Analytical Results, continued

Results in ppm (mg/kg or mg/L)

Compound	HC-6 S-2
Matrix	Soil
% Moisture	22%
TPH-418.1	65
Lead	120

U = indicates not detected at indicated detection limit.

Site: Halls Lake
J-3603

Method Blanks

Results in ppm (mg/kg or mg/L)

Compound	
Matrix	Soil
TPH-418.1	25 U
Lead	5.0 U

U = indicates not detected at indicated detection limit.

Site: Halls Lake
J-3603

Spikes

% Recovery

Compound	MS HC-6 S-2	MSD HC-6 S-2
Matrix	Soil	Soil
TPH-418.1	148%	103%

Duplicates

Relative % Difference

Compound	HC-3 S-1	HC-6 S-2
Matrix	Soil	Soil
TPH-418.1		36%
Lead	10%	

Site: Halls Lake
J-3603

Buffalo River Sediment Quality Control

% Recovery

Compound	
Matrix	Soil
Lead	84%

Sample Custody Record

DATE 7/27 PAGE 1 OF 1

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Seattle, Washington 98102-3699

JOB NUMBER 3603 LAB NUMBER

PROJECT MANAGER S. HARP

PROJECT NAME HALL LAKE

SAMPLED BY: C. Wolfe

LAB NO.	SAMPLE	TIME	STATION	MATRIX	Total Lead	TPH 418.1	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
HC-3	S1	10:00 AM	[illegible]	SOIL	X	X		24 hour T.A.T.
	S3							
	S5							
	S7							
	S9							
HC-5	S-2	10:30 AM	[illegible]	SOIL	X	X		"
HC-6	S-2	10:30 AM	[illegible]	SOIL	X	X		"

RELINQUISHED BY	DATE	RECEIVED BY	DATE
[signature]	7/27	[signature]	7/27
SIGNATURE		SIGNATURE	
S. Harp	TIME	Yi Shui Hau	TIME
PRINTED NAME	10:00 AM	PRINTED NAME	11:00 AM
COMPANY		HC COMPANY	
RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE	TIME	SIGNATURE	TIME
PRINTED NAME		PRINTED NAME	
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS ~~FIVE~~ SEVEN TO BE TESTED

METHOD OF SHIPMENT HAND DELIVERED

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS

SAVE SOIL SAMPLES FOR FUTURE TCLP TESTS.

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
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1910 Fairview Avenue East
Seattle, Washington 98102-3699
FAX 206.328.5581
206.324.9530

Field Analytical Services and Technologies

FAST Laboratory Analytical Report

FROM: James Herndon, Analytical Chemist
TO: Susan Harp, Project Engineer
DATE: August 10, 1992
CLIENT: Snohomish PUD
SITE: Halls Lake
RE: J-3603

Attached are the compiled results from analysis conducted on samples received July 28, 1992, and analyzed July 29, 1992. Analysis was performed for TPH-418.1 and Lead (7420). This report contains:

- Results for 21 soil samples presented on a dry weight basis.
- Results for method blanks.
- Recoveries for spiked samples.
- Differences for duplicate analyses.
- Recoveries for Buffalo River sediment quality control.

Analytical Comments

TPH-418.1 Analysis

Sample HC-1 S-7 contained insufficient sample for TPH analysis. TPH-418.1 results are not available for this sample.

The relative percent difference (RPD) for TPH-418.1 analysis on samples HC-7 S-3 and HC-10 S-3 were outside the control limits. The samples were re-extracted and re-analyzed. The RPD for sample HC-10 S-3 is outside the control limits on the re-analysis.

Lead Analysis

The concentration of lead in sample HC-8 S-5 is greater than five times the spike level. Spike and spike duplicate recoveries were not calculated. The relative percent difference is calculated using the spike and spike duplicate concentrations.

The spike recoveries and RPD for sample HC-8 S-5 were outside control limits in the origional analysis. The sample was re-extracted and re-analyzed. The RPD is outside control limits on the re-analysis. The matrix for sample HC-8 S-5 is variable.

Site: Halls Lake
J-3603

Analytical Results

Results in ppm (mg/kg or mg/L)

Compound	HC-1 S-2	HC-1 S-3	HC-1 S-4	HC-1 S-5
Matrix	Soil	Soil	Soil	Soil
% Moisture	11%	10%	9%	11%
TPH-418.1	110	1,000	1,100	2,500
Lead	150	110	2,900	920

Compound	HC-1 S-6	HC-1 S-6 MS	HC-1 S-6 MSD	HC-1 S-7
Matrix	Soil	Soil	Soil	Soil
% Moisture	7%	7%	7%	8%
TPH-418.1	440	n/t	n/t	n/t
Lead	360	340	300	3,300

U = indicates not detected at indicated detection limit.
n/t = test not performed. n/a = not applicable.

Analytical Results, continued

Results in ppm (mg/kg or mg/L)

Compound	HC-3 S-2	HC-7 S-1	HC-7 S-2	HC-7 S-3
Matrix	Soil	Soil	Soil	Soil
% Moisture	36%	24%	10%	9%
TPH-418.1	3,200	1,000	25 U	25 U
Lead	1,700	2,600	28	36

Compound	HC-8 S-1	HC-8 S-3	HC-8 S-5	HC-8 S-7
Matrix	Soil	Soil	Soil	Soil
% Moisture	34%	30%	12%	10%
TPH-418.1	940	25 U	25 U	25 U
Lead	7,000	5.0 U	92	5.0 U

U = indicates not detected at indicated detection limit.

Analytical Results, continued

Results in ppm (mg/kg or mg/L)

Compound	HC-9 S-1	HC-9 S-3	HC-9 S-5	HC-10 S-1
Matrix	Soil	Soil	Soil	Soil
% Moisture	7%	29%	11%	9%
TPH-418.1	46	25 U	25 U	47
Lead	35	25	7	47

Compound	HC-10 S-3	HC-10 S-5	HC-10 S-7
Matrix	Soil	Soil	Soil
% Moisture	12%	11%	13%
TPH-418.1	25 U	25 U	25 U
Lead	5.0 U	5.0 U	5.0 U

U = indicates not detected at indicated detection limit.

Method Blanks

Results in ppm (mg/kg or mg/L)

Compound	
Matrix	Soil
TPH-418.1	25 U
Lead	5.0 U

U = indicates not detected at indicated detection limit.

Site: Halls Lake
J-3603

Spikes

% Recovery

Compound	MS HC-7 S-3	MSD HC-7 S-3	MS HC-8 S-5	MSD HC-8 S-5
Matrix	Soil	Soil	Soil	Soil
TPH-418.1	84%	110%		
Lead			58%	90%

Compound	MS HC-10 S-7	MSD HC-10 S-7
Matrix	Soil	Soil
TPH-418.1	72%	104%

Site: Halls Lake
J-3603

Duplicates

Relative % Difference

Compound	HC-1 S-6	HC-7 S-3	HC-8 S-5	HC-10 S-7
Matrix	Soil	Soil	Soil	Soil
TPH-418.1		-27%		-36%
Lead	-13%		-43%	

Buffalo River Sediment Quality Control

% Recovery

Compound		
Matrix	Soil	Soil
Lead	87%	80%

Sample Custody Record

DATE 7/29/92 PAGE 1 OF 2

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Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER 3603 LAB NUMBER

PROJECT MANAGER S HARP

PROJECT NAME HALLS LAKE

SAMPLED BY: C. Wolfe

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TESTING: Total Lead	TESTING: TPH 418.1	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
HC-1	S-3	3:00 PM	Re-Run	SOIL	X	X		24 hr. TAT
↓	S-5		Re-Run	SOIL				
↓	S-7		Re-Run	SOIL				
HC-1	S-2		~~Re-Run~~	↓				
↓	S-4		~~Re-Run~~					
↓	S-6		~~Re-Run~~					
HC-3	S-2		~~Re-Run~~					
HC-7	S-1		↓					
↓	S-2							
↓	S-3							
~~HC-10~~	~~S-1~~							

RELINQUISHED BY	DATE	RECEIVED BY	DATE
Jason P. Harp	7/29	Sherry Laughlin	7/29/92
SIGNATURE		SIGNATURE	
J. HARP	TIME	SHERRY LAUGHLIN	TIME
PRINTED NAME	3:15	PRINTED NAME	1535
COMPANY		HC	
RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE	
PRINTED NAME	TIME	PRINTED NAME	TIME
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS ~~10~~ 16-OZ 2~~3~~ JARS.

METHOD OF SHIPMENT HAND DELIVERED

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS

SAVE SAMPLES FOR TCLP ANALYSIS.

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

Sample Custody Record

DATE _____ PAGE 2 OF 2

HARTCROWSER

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER 3603 LAB NUMBER _____

PROJECT MANAGER S. HARP

PROJECT NAME ISLAND CREST

SAMPLED BY: C. Wolfe

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TOTAL Pb	TPH 418.1	NO. OF CONTAINERS	OBSERVATIONS / COMMENTS / COMPOSITING INSTRUCTIONS
HC 8	S-1	3:00 PM	S-1	SOIL	X	X		24 hr. TAT
	S-3							
	S-5							
	S-7							
	~~S-9~~ SPLIT							
HC 9	S-1							
	S-3							
	S-5							
HC 10	S-1							
	S-3							
	S-5							
	S-7							

TESTING

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE: J. Harp	7/27	SIGNATURE: Sherry Laughlin	7/28/92
PRINTED NAME: J. HARP	TIME: 330	PRINTED NAME: SHERRY LAUGHLIN	TIME: 1535
COMPANY:		COMPANY: HC	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE:		SIGNATURE:	
	TIME		TIME
PRINTED NAME:		PRINTED NAME:	
COMPANY:		COMPANY:	

TOTAL NUMBER OF CONTAINERS: ~~23~~ Total 16 oz

METHOD OF SHIPMENT

SPECIAL SHIPMENT / HANDLING OR STORAGE REQUIREMENTS

SAVE SAMPLES

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
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Field Analytical Services and Technologies

FAST

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699
FAX 206.328.5581
206.324.9530

FAST Laboratory Analytical Report

FROM: James Herndon, Analytical Chemist
TO: Susan Harp, Project Engineer
DATE: August 28, 1992
CLIENT: Snohomish PUD
SITE: Halls Lake
RE: J-3603

Attached are the compiled results from analysis conducted on samples received and analyzed July 31, 1992. Analysis was performed for TPH-418.1 and Lead (7420). This report contains:

- Results for 4 soil samples presented on a dry weight basis.
- Results for method blanks.
- Recoveries for spiked samples.
- Differences for duplicate analyses.
- Recoveries for Buffalo River sediment quality control.

Site: Halls Lake
J-Snohomish PUD

Analytical Results

Results in ppm (mg/kg or mg/L)

Compound	HC1A-S1	HC1A-S2	HC1A-S3	HC1A-S6
Matrix	Soil	Soil	Soil	Soil
% Moisture	24%	9%	10%	11%
TPH-418.1	10,000	25 U	25 U	230
Lead	48,000	69	6	13

U = indicates not detected at indicated detection limit.

Site: Halls Lake
J-Snohomish PUD

Method Blanks

Results in ppm (mg/kg or mg/L)

Compound	
Matrix	Soil
TPH-418.1	25 U
Lead	5.0 U

U = indicates not detected at indicated detection limit.

Site: Halls Lake
J-Snohomish PUD

Spikes

% Recovery

Compound	MS HC1A-S2	MSD HC1A-S2
Matrix	Soil	Soil
TPH-418.1	126%	143%

Duplicates

Relative % Difference

Compound	HC1A-S2
Matrix	Soil
TPH-418.1	-13%

Site: Halls Lake
J-Snohomish PUD

Buffalo River Sediment Quality Control

% Recovery

Compound	
Matrix	Soil
Lead	90%

Sample Custody Record

DATE 7/31/92 PAGE ____ OF ____

HARTCROWSER

1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER 3603 LAB NUMBER ____

PROJECT MANAGER HARP

PROJECT NAME HALLS LAKE

SAMPLED BY: C. Wolfe

LAB NO.	SAMPLE	TIME	STATION	MATRIX	Total Pb	TPH 418.1	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
HC 1A	S1	9:35 am	S4	Soil	/	/	1	24 hr. TAT
	S2	↓	↓	↓	/	/	1	
	S3				/	/	1	
	S6				/	/	1	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
Susan Harp	7/31	Yu Sun Han	7/31/92
SIGNATURE		SIGNATURE	
SUSAN HARP	TIME	YU SUN HAN	TIME
PRINTED NAME		PRINTED NAME	
HC	9:40	HC	9:40
COMPANY		COMPANY	
RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE	
	TIME		TIME
PRINTED NAME		PRINTED NAME	
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS: 4 16oz JARS

METHOD OF SHIPMENT: Hand delivered

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS: V. High lead + TPH
Keep Samples for future TCLP.

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

HARTCROWSER

FAST

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699
FAX 206.328.5581
206.324.9530

ield Analytical Services and Technologies

FAST Laboratory Analytical Report

FROM: James Herndon, Analytical Chemist
TO: Susan Harp, Project Engineer
DATE: September 1, 1992
CLIENT: Snohomish PUD
SITE: Halls Lake
RE: J-3603

Attached are the compiled results from analysis conducted on samples received August 7, 1992, and analyzed August 10, 1992. Analysis was performed for TPH-418.1 and Lead (7420). This report contains:

- Results for 1 soil sample presented on a dry weight basis.
- Results for method blanks.
- Recoveries for spiked samples.
- Differences for duplicate analyses.
- Recoveries for Buffalo River sediment quality control.

Analytical Comment

Spike and spike duplicate recovery values for lead analysis were outside control limits for sample HC8-S2. The total sample was homogenized, re-extracted and re-analyzed. Spike recoveries for the re-analysis were outside of control limits. Metal flecks within the sample matrix cause variations in the sample results. Sample results are close to, but do not exceed, five times the spike concentration. Relative percent difference (RPD) values are calculated from spike percent recoveries.

Site: Halls Lake
J-Snohomish PUD

Analytical Results

Results in ppm (mg/kg or mg/L)

Compound	HC8-S2	Duplicate HC8-S2
Matrix	Soil	Soil
% Moisture	26%	n/t
TPH-418.1	58	51
Lead	270	n/t

U = indicates not detected at indicated detection limit.
n/t = test not performed.

Site: Halls Lake
J-Snohomish PUD

Method Blanks

Results in ppm (mg/kg or mg/L)

Compound	
Matrix	Soil
TPH-418.1	25 U
Lead	5.0 U

U = indicates not detected at indicated detection limit.

Site: Halls Lake
J-Snohomish PUD

Spikes

% Recovery

Compound	MS HC8-S2	MSD HC8-S2	MS HC8-S2
Matrix	Soil	Soil	Soil
TPH-418.1			126%
Lead	20%	0%	

Duplicates

Relative % Difference

Compound	HC8-S2
Matrix	Soil
TPH-418.1	13%
Lead	200%

Site: Halls Lake
J-Snohomish PUD

Buffalo River Sediment Quality Control

% Recovery

Compound	
Matrix	Soil
Lead	87%

Sample Custody Record

DATE 8/7/92 PAGE 1 OF 1

HARTCROWSER

1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER 3603 LAB NUMBER —

PROJECT MANAGER S. HARP

PROJECT NAME HALLS LAKE

SAMPLED BY: C. Wolfe

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TESTING: TPH (418.1)	TESTING: Total Lead	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
HC-8	S-2	4:25pm		SOIL	X	X	1	24 hr. TAT

RELINQUISHED BY	DATE	RECEIVED BY	DATE
Susan P. Harp	8/7	Sherry Laich	8/7/92
SIGNATURE		SIGNATURE	
SUSAN P. HARP	TIME	SHERRY LAICHLAN	TIME
PRINTED NAME		PRINTED NAME	1630
HC		HC	
COMPANY		COMPANY	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE	
	TIME		TIME
PRINTED NAME		PRINTED NAME	
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS 1

METHOD OF SHIPMENT Hand delivered

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS Save sample for future TCLP

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (205)922-5047

Report To: Hart Crowser

Date: August 5, 1992

Report On: Analysis of Soil & Water

Lab No.: 26077

IDENTIFICATION:
Samples received on 07-31-92
Project: Hall's Lake

ANALYSIS:

Lab No. 26077-1

Client ID: HC-3 (water)

TPH per EPA Method 418.1
Date Extracted: 8-3-92
Date Analyzed: 8-4-92

Total Petroleum Hydrocarbons, mg/l	2.5

Dissolved ICP Metals Per Method 6010
Date Digested: 8-3-92
Date Analyzed: 8-3-92

Lead, mg/l	0.053

Lab No. 26077-2

Client ID: HC-8 (water)

TPH per EPA Method 418.1
Date Extracted: 8-3-92
Date Analyzed: 8-4-92

Total Petroleum Hydrocarbons, mg/l	< 1.0

Dissolved ICP Metals Per Method 6010
Date Digested: 8-3-92
Date Analyzed: 8-3-92

Lead, mg/l	0.014

Continued . . .

SOUND ANALYTICAL SERVICES, INC.

Hart Crowser
Project: Hall's Lake

Lab No. 26077
August 5, 1992

Lab No. 26077-3 Client ID: HC-1 S2 (soil)

Toxicity Characteristic Leaching Procedure (TCLP) Method 1311
ICP Metals by Method 6010
Date Extracted: 8-3-92
Date Analyzed: 8-4-92

Contaminant	Concentration (mg/l)	Max Conc., (mg/l)
Lead	1.1	5.0

Lab No. 26077-4 Client ID: HC-3 S2 (soil)

Toxicity Characteristic Leaching Procedure (TCLP) Method 1311
ICP Metals by Method 6010
Date Extracted: 8-3-92
Date Analyzed: 8-4-92

Contaminant	Concentration (mg/l)	Max Conc., (mg/l)
Lead	4.2	5.0

Continued . . .

SOUND ANALYTICAL SERVICES, INC.

Hart Crowser
Project: Hall's Lake

Lab No. 26077
August 5, 1992

Lab No. 26077-5 Client ID: HC-5 S1 (soil)

Toxicity Characteristic Leaching Procedure (TCLP) Method 1311
ICP Metals by Method 6010
Date Extracted: 8-3-92
Date Analyzed: 8-4-92

Contaminant	Concentration (mg/l)	Max Conc., (mg/l)
Lead	50	5.0

Lab No. 26077-6 Client ID: HC-5 S2 (soil)

Toxicity Characteristic Leaching Procedure (TCLP) Method 1311
ICP Metals by Method 6010
Date Extracted: 8-3-92
Date Analyzed: 8-4-92

Contaminant	Concentration (mg/l)	Max Conc., (mg/l)
Lead	< 0.1	5.0

Continued . . .

SOUND ANALYTICAL SERVICES, INC.

Hart Crowser
Project: Hall's Lake

Lab No. 26077
August 5, 1992

Lab No. 26077-7 Client ID: HC-7 S1 (soil)

Toxicity Characteristic Leaching Procedure (TCLP) Method 1311
ICP Metals by Method 6010
Date Extracted: 8-3-92
Date Analyzed: 8-4-92

Contaminant	Concentration (mg/l)	Max Conc., (mg/l)
Lead	11	5.0

Lab No. 26077-8 Client ID: HC-8 S1 (soil)

Toxicity Characteristic Leaching Procedure (TCLP) Method 1311
ICP Metals by Method 6010
Date Extracted: 8-3-92
Date Analyzed: 8-4-92

Contaminant	Concentration (mg/l)	Max Conc., (mg/l)
Lead	18	5.0

Continued . . .

SOUND ANALYTICAL SERVICES, INC.

Hart Crowser
Project: Hall's Lake
Page 5 of
Lab No. 26077
August 5, 1992

Lab No. 26077-9 Client ID: HC-1 S6 (soil)

ICP Metals Per Method 6010
Date Digested: 8-3-92
Date Analyzed: 8-3-92

Lead, mg/kg	76

Lab No. 26077-10 Client ID: HC-3 S3 (soil)

ICP Metals Per Method 6010
Date Digested: 8-3-92
Date Analyzed: 8-3-92

Lead, mg/kg	230

Lab No. 26077-11 Client ID: HC-5 S4 (soil)

ICP Metals Per Method 6010
Date Digested: 8-3-92
Date Analyzed: 8-3-92

Lead, mg/kg	83

SOUND ANALYTICAL SERVICES

STAN P. PALMQUIST

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206) 922-2310 - FAX (206) 922-5047

QUALITY CONTROL REPORT

TPH by Method 418.1

Client: Hart Crowser
Lab No: 26077qc3
Matrix: Soil
Units: mg/kg
Date: August 5, 1992

METHOD BLANK

Parameter	Blank Value
Total Petroleum Hydrocarbons	< 1.0

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

QUALITY CONTROL REPORT

METHOD BLANKS

Client: Hart Crowser
Lab No: 26077qc1
Matrix: Soil
Units: mg/kg
Date: August 5, 1992

Total Lead

Parameter	Blank Value
Lead	< 1.4

TCLP Lead

Parameter	Blank Value
Lead	< 0.1

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

QUALITY CONTROL REPORT

Dissolved Lead

Client: Hart Crowser
Lab No: 26077qc2
Matrix: Soil
Units: mg/kg
Date: August 5, 1992

DUPLICATE

Dup No. 26077-1

Parameter	Sample (S)	Duplicate (D)	RPD
Lead	0.053	0.059	10.7

RPD = Relative Percent Difference
= [(S - D) / ((S + D) / 2] x 100

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY

MSD No. 26077-1

Parameter	Sample Result (SR)	Spiked Sample Result (MS)	Spike Added (SA)	%R	Spike Dup Result (MSD)	RPD
Lead	0.053	0.070	0.020	85.0	0.066	5.9

R = Percent Recovery
= [(MS - SR) / SA] x 100

RPD = Relative Percent Difference
= [(MS - MSD) / ((MS + MSD) / 2] x 100

ANALYTICAL & ENVIRONMENTAL CHEMISTS

(206) 922-2310 • FAX (206) 922-5047

UST PARAMETERS
CHAIN OF CUSTODY / REQUEST FOR LABORATORY ANALYSIS

CLIENT: HART CROWSER

PROJECT NAME: HALL'S LAKE

CONTACT: SUSAN HARP

PHONE NO: 324-9530

ANALYSIS REQUESTED: Specify State _____

LAB #	SAMPLE I.D.	DATE	TIME	MATRIX	# of Containers	HCID	TPH-G	TPH-D	TPH 418.1	BTEX	TPH-G / BTEX	TPH 8015M	Total Lead	TCLP Lead	PCB's	PAH's	Phenols	Halogenated Volatiles EPA 601/8010	Aromatic Volatiles EPA 602/8020	Volatile Organics EPA 624/8240 GC/MS	Semi-volatiles EPA 625/8270 GC/MS	Metals	Total Halogens	Dissolved Pb			CLOSURE DELIVERABLES
	HC-3	7/31	10:30	H2O					X															X			
	HC-8	"	"	"					X															X			
	HC-1 S2	7/31	1230	SOIL										X													
	HC-3 S2	"	"	"										X													
	HC-5 S1	"	"	"										X													
	HC-5 S2	"	"	"										X													
	HC-7 S1	"	"	"										X													
	HC-8 S1	"	"	"										X													
	HC-1 S6	"	"	SOIL									X														
	HC-3 S3	"	"	"									X														
	HC-5 S4	"	"	"									X														

	Signature	Printed Name	Firm	Time / Date
Relinquished By		SUSAN HARP	Hart Crowser	10:35 / 7/31/92
Received By		PALMQUIST	SAS	10:35 7-31
Relinquished By		PALMQUIST	SAS	12:0[illegible] 8-3
Received By				
Relinquished By				
Received By				

SPECIAL INSTRUCTIONS/COMMENTS:

High Lead / TPH

Save soil samples for add'l tests

~~24 hr.~~ 3 day TAT

HART CROWSER

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699
FAX 206.328.5581
206.324.9530

th and Environmental Technologies

Letter of Transmittal

To: Snohomish County P.U.D. No. 1
1802 - 75th Street SW
Everett, Washington 98206

Date: 9/2/92

Job No. 3603

ttn: Ms. Karen Rose

Re: Halls Lake Substation

We are sending the following items:

Date	Copies	Description
9/2/92	2	Final version letter report
		Re: Site Assessment Report
		Halls Lake Substation Remedial Services
		Professional Services Contract No. 2048

These are transmitted:

☐ For your information ☐ For action specified below ☐ For review and comment XXXX For your use ☐ As requested

Remarks

By: Susan P. Harp
Project Engineer

pies to:

Title: