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Consulting Engineers and Geoscientists
Offices in Washington, Oregon, and Alaska

Tosco Distribution Company
5528 Northwest Doane Avenue
Portland, Oregon 97207

Attention: Mr. Martin A. Cramer

Site Characterization Activities
Inman Oil Company Facility
Vancouver, Washington
File No. 4823-022-00

INTRODUCTION

GeoEngineers is pleased to provide this report describing the results of site characterization activities conducted at Tosco Distribution Company's (Tosco) Inman Oil Company (Inman) facility located at 1300 West 12th Street, Vancouver, Washington. The location of the site relative to surrounding features is described in Figure 1. Our services were performed in general accordance with our Proposal dated February 27, 1998 and under the terms and conditions referenced in the Services Agreement between Tosco and GeoEngineers dated May 6, 1998.

SCOPE OF SERVICES

The purpose of the site characterization activities conducted at the Inman facility was to further delineate the vertical extent of petroleum hydrocarbon-affected soil in areas where concentrations in excess of the Washington State Department of Ecology's (Ecology) Model Toxics Control Act (MTCA) Method A cleanup level were detected by Pacific Environmental Group, Inc. (PEG) in 1997, and to investigate ground water quality beneath the facility. The results of PEG's study are described in their report titled "Soil Investigation, Inman Oil Company Facility, 1300 West 12th Street, Vancouver, Washington" dated November 7, 1998. Specifically, our scope of services involved the following tasks.

1. Conduct a site visit prior to mobilizing drilling equipment to mark the locations of proposed borings and wells, and clear the locations for the presence of underground utilities. The scope of work was discussed with the site operator to reduce disruption to normal facility operations.

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2. Conduct a brief review of historical records to evaluate if operations were conducted in areas of the facility not previously investigated.
3. Drill seven deep borings (borings MW-1 through MW-3 and GEI-1 through GEI-4) to depths ranging between 21.5 and 50.0 feet below ground surface (BGS) to evaluate soil conditions.
4. Hand auger four shallow borings (borings HA-1 through HA-4) to depths ranging between 3 and 8 feet BGS to evaluate soil conditions at locations where surface obstructions did not permit drilling rig access.
5. Collect soil samples at a minimum of 2.5-foot intervals during drilling for lithologic evaluation and potential laboratory evaluation.
6. Install three ground water monitoring wells (MW-1, MW-2 and MW-3) in three of the deeper borings. Construct the wells of 25 feet of 2-inch-diameter polyvinyl chloride (PVC) screen and 25 feet of 2-inch-diameter PVC casing.
7. Measure the depth to water in each of the monitoring wells and survey the relative casing elevations.
8. Collect representative ground water samples from each of the monitoring wells and from one of the remaining deep borings (GEI-4) for laboratory analysis.
9. Provide for laboratory analysis of soil and ground water samples using Northwest Method TPH-D extended for diesel- and heavy oil-range hydrocarbons, Northwest Method TPH-G for gasoline-range hydrocarbons, and/or benzene, ethylbenzene, toluene, and xylenes (BETX) compounds by U.S. Environmental Protection Agency (EPA) Method 8020A.
10. Evaluate the data with respect to Ecology's MTCA Method A cleanup levels.

HISTORICAL RESEARCH AND SUBSURFACE EXPLORATION RESULTS

GENERAL

GeoEngineers conducted field work at the facility on June 24, 25, 26 and 29, 1998. Field methods and sampling details are contained in Attachment A. The approximate locations of the soil borings are depicted in the site plan provided in Figure 2. Copies of soil boring and well construction logs are presented in Attachment A.

The field work was conducted in general accordance with the Proposal. Where surface structures prevented drilling rig access, the proposed locations of several soil borings were either moved to nearby locations or advanced as deep as possible using a hand auger.

In addition to those borings specified in our proposal, four additional soil borings (GEI-1 through GEI-4) were drilled in the vicinity of a building and related storage area that were formerly located near the south boundary of the facility. The former building and storage yard were identified in 1935, 1940 and 1948 aerial photographs obtained from the US Army Corps of Engineers. The building was not present in a 1956 aerial photograph.

SOIL CONDITIONS

Soil beneath the facility generally consists of brown fine- to course-grained silty sand with gravel and cobbles from ground surface to a depth ranging between 2 and 5 feet BGS, and brown fine-to coarse-grained sand with occasional gravel from 5 to 50 feet BGS. Results of field screening generally did not indicate the presence of petroleum hydrocarbons in soil samples. There was generally little petroleum odor, and headspace vapor concentrations were generally less that the lower detection limit of the field instrument. When soil samples were placed in water, the resulting sheen was slight or not present. A strong petroleum odor was only noticed in soil collected from beneath concrete debris at approximately 2.5 to 3.5 feet BGS in boring GEI-4. The concrete debris may potentially be related to the former building and storage area.

A total of 20 soil samples were submitted for laboratory analysis based on results of field screening and depth relative to previous sampling results. All of the soil samples selected for laboratory analysis were analyzed for the presence of diesel- and heavy oil-range hydrocarbons by Northwest Method TPH-D extended. At the request of Ecology, two soil samples collected from borings located near where low concentrations of gasoline-range hydrocarbons were detected in the previous investigation were analyzed for the presence of gasoline-range hydrocarbons by Northwest Method TPH-G. Soil analytical results are summarized in Table 1. Copies of the laboratory reports are presented in Attachment B.

GROUND WATER CONDITIONS

Ground water was encountered while drilling borings MW-1, MW-2, MW-3, which were completed as ground water monitoring wells, and boring GEI-4 at depths ranging between 38.5 and 41.5 feet BGS. Several days after completing the wells, the top of casing elevation for each monitoring well was surveyed relative to a benchmark at the facility, and the depth to water was measured. The elevation of water in each well was calculated by subtracting the depth to water measurement from the surveyed elevation. The elevations of ground water at the facility ranged from to 57.22 feet in monitoring well MW-1, to 56.78 feet in monitoring well MW-2, to 56.76 feet in monitoring well MW-3, as described in Table 2. Based on the elevations, shallow ground water beneath the facility appears to flow to the west-southwest, as depicted in Figure 2.

Ground water samples obtained from each monitoring well and from boring GEI-4 were submitted for laboratory analysis. The ground water samples were analyzed for the presence of gasoline-range hydrocarbons, diesel- and heavy oil-range hydrocarbons and BETX by Northwest Method TPH-G, Northwest Method TPH-D extended, EPA Method 8020A, respectively. Ground water analytical results are summarized in Table 3. Copies of the laboratory reports are presented in Attachment B.

CONCLUSIONS

Based on the information obtained during our investigation and the information presented in the PEG report, soil containing diesel- and heavy oil-range hydrocarbons at concentrations greater than the MTCA Method A cleanup level (200 milligrams per kilogram [mg/kg]) are present at the facility, but at relatively shallow depths. With the exception of soil collected from boring B-1 at 12 feet BGS and from boring GEI-1 at 11 feet BGS, the depth of contaminated soil in most areas of the facility appears to be limited to approximately 5 feet BGS or less. Gasoline-range hydrocarbons do not appear to be present in soil at the facility.

Heavy oil-range hydrocarbons were detected at concentrations greater than the MTCA Method A cleanup level in boring B-1 at 12 feet BGS; however the petroleum contamination in this area does not appear to be laterally extensive or extend appreciably beyond 12 feet BGS. Neither diesel- or heavy oil-range hydrocarbons were detected in soil collected from 10.0 and 16.5 feet BGS in boring MW-2, which was completed near boring B-1.

Heavy oil-range hydrocarbons were detected at a relatively high concentration in soil collected from 11 feet BGS in boring GEI-1; however, neither diesel- or heavy oil-range hydrocarbons were detected in other soil samples collected from 6.0 and 13.5 feet BGS. The petroleum-contaminated soil detected in boring GEI-1 may be related to the former building and storage area located along the southern boundary of the facility.

Ground water beneath the facility does not appear to be affected by petroleum hydrocarbons. Neither diesel- or heavy oil-range hydrocarbons or BETX compounds were detected in the ground water samples collected during this investigation.

LIMITATIONS

This report has been prepared for the use of Tosco and their agents. This report is not intended for the use by others and the information contained herein is not applicable to other sites. The conclusions presented in this report are based on the agreed-upon scope of work outlined in the report. Use or misuse of this report, or reliance upon the findings hereof by any other parties is at their own risk. Neither Client nor GeoEngineers makes any representation or warranty to such other parties as to the accuracy or completeness of this report or the suitability of its use by any other parties for any purpose whatever, known or unknown. Neither Client nor GeoEngineers shall have any liability to, or indemnifies or holds harmless third parties of any losses incurred by the actual or purported use or misuse of this report.

The data reported herein are based on soil and ground water sampling conducted on the subject property. The services provided by GeoEngineers satisfy the standard of care and skill ordinarily performed by professionals performing similar services in this area at the time the services were completed. A potential always exists for areas of contamination that were not identified in this study. Further evaluation of such potential would require appropriate subsurface exploration and testing.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with the generally accepted practices in this area at the time the report was prepared. No other warranty, express or implied, should be understood.

GeoEngineers appreciates the opportunity to provide Tosco with professional environmental services. We trust this report meets your needs. If you have any questions concerning the information presented in this report, or require any additional information, please contact one of the undersigned.

Yours very truly,

GeoEngineers, Inc.

William H. Collins, R.P.G.
Project Manager/Hydrogeologist

Terry T. Fisk, R.P.G.
Associate

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Document ID: 4823022Rpt.doc

Attachments

Two copies submitted

TABLE 1
SUMMARY OF SOIL FIELD SCREENING RESULTS AND CHEMICAL ANALYTICAL DATA[1]

INMAN OIL FACILITY
VANCOUVER, WASHINGTON

Soil Sample Number	Date Sampled	Depth of Sample (feet)	Field Screening Results[2]		Gasoline-range Hydrocarbons (Northwest Method TPH-Gx) (mg/kg)	Diesel- and Oil-range Hydrocarbons (Northwest Method TPH-Dx) (mg/kg)	
			Headspace Vapor (ppm)	Sheen		Diesel	Oil
HA1-5.0	06/26/98	5.0	--	SS	--	274	60.4
HA1-7.5	06/26/98	7.5	--	SS	--	37.3	<50.0
HA2-2.5	06/29/98	2.5	--	NS	--	<25.0	<50.0
HA3-2.5	06/29/98	2.5	--	NS	--	<25.0	<50.0
HA4-2.5	06/29/98	2.5	--	NS	--	<25.0	97.1
HA4-5.0	06/29/98	5.0	--	NS	--	<25.0	191
GEI1-6.0	06/26/98	6.0	<100	SS	--	<25.0	<50.0
GEI1-11.0	06/26/98	11.0	<100	NS	--	<125	2,350
GEI1-13.5	06/26/98	13.5	<100	NS	--	<25.0	<50.0
GEI2-5.5	06/26/98	5.5	--	MS	--	44.1	157
GEI2-10.0	06/26/98	10.0	--	SS	--	<25.0	<50.0
GEI3-3.5	06/26/98	3.5	<100	SS	--	87.9	55.3
GEI3-11.5	06/26/98	11.5	<100	SS	--	<25.0	<50.0
GEI4-6.0	06/26/98	6.0	<100	MS	--	74.1	<50.0
GEI4-10.5	06/26/98	10.5	<100	SS	--	<25.0	<50.0
MW1-2.5	06/25/98	2.5	<100	SS	--	57.1	127
MW1-10.0	06/25/98	10.0	<100	SS	--	<25.0	<50.0
MW2-10.0	06/25/98	10.0	--	--	5.18	<25.0	<50.0
MW2-16.5	06/25/98	16.5	--	NS	--	<25.0	<50.0
MW3-4.0	06/25/98	4.0	<100	SS	<4.00	<25.0	658
MW3-11.5	06/25/98	11.5	<100	SS	--	<25.0	<50.0
MTCA Method A Cleanup Levels					100	200	

Notes:
[1]Chemical analyses were conducted by North Creek Analytical of Portland, Oregon.
[2]See Attachment A for a description of field screening methods. NS = no sheen, SS = slight sheen, MS = moderate sheen
ppm = parts per million
mg/kg = milligrams per kilogram
"--" = not analyzed
"<50.0" indicates that the analyte was not detected at a concentration greater than the concentration indicated.
Shading indicates concentrations greater than Ecology cleanup standards.

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TABLE 2
SUMMARY OF GROUND WATER FIELD MEASUREMENTS
INMAN OIL FACILITY
VANCOUVER, WASHINGTON

Monitoring Well Number	Date Monitored	Elevation of Casing[1] (feet)	Depth to Ground Water From Measure Point[2] (feet)	Water Table Elevation[1] (feet)
MW-1	06/29/98	96.52	39.70	57.22
MW-2	06/29/98	96.95	40.17	56.78
MW-3	06/29/98	96.32	39.56	56.76

Notes:
[1]Referenced to a site datum with an assumed elevation of 100.00 feet.
[2]Referenced to the elevation of the top of the casing.

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TABLE 3
SUMMARY OF GROUND WATER CHEMICAL ANALYTICAL DATA[1]
INMAN OIL FACILITY
VANCOUVER, WASHINGTON

Monitoring Well Number	Date Sampled	BETX[2] (EPA Method 8020A) (µg/l)				Gasoline-range Hydrocarbons (Northwest Method TPH-G) (µg/l)	Diesel- and Oil-range Hydrocarbons (Northwest Method TPH-Dx) (µg/l)	
		B	E	T	X		Diesel	Oil
MW-1	06/29/98	<0.500	<0.500	<0.500	<1.00	<80.0	<250	<500
MW-2	06/29/98	<0.500	<0.500	<0.500	<1.00	<80.0	<250	<500
MW-3	06/29/98	<0.500	<0.500	<0.500	<1.00	<80.0	<250	<500
GEI-4	06/26/98	<0.500	<0.500	<0.500	<1.00	<80.0	<250	<500
MTCA Method A Cleanup Levels		5	30	40	20	NE	1.0[3]	

Notes:
[1]Chemical analyses were conducted by North Creek Analytical of Portland, Oregon.
[2]B = benzene, E = ethylbenzene, T = toluene, X = xylenes.
[3]The MTCA Method A cleanup level for the sum of gasoline-, diesel- and heavy oil-range hydrocarbons is 1 mg/l if carbon ranges are distinctly quantified using gas chromatography methods.
µg/l = micrograms per liter
NE = not established
"<0.500" indicates that the analyte was not detected at concentrations greater than the concentration indicated.
Shading indicates concentrations exceeding regulatory cleanup criteria.

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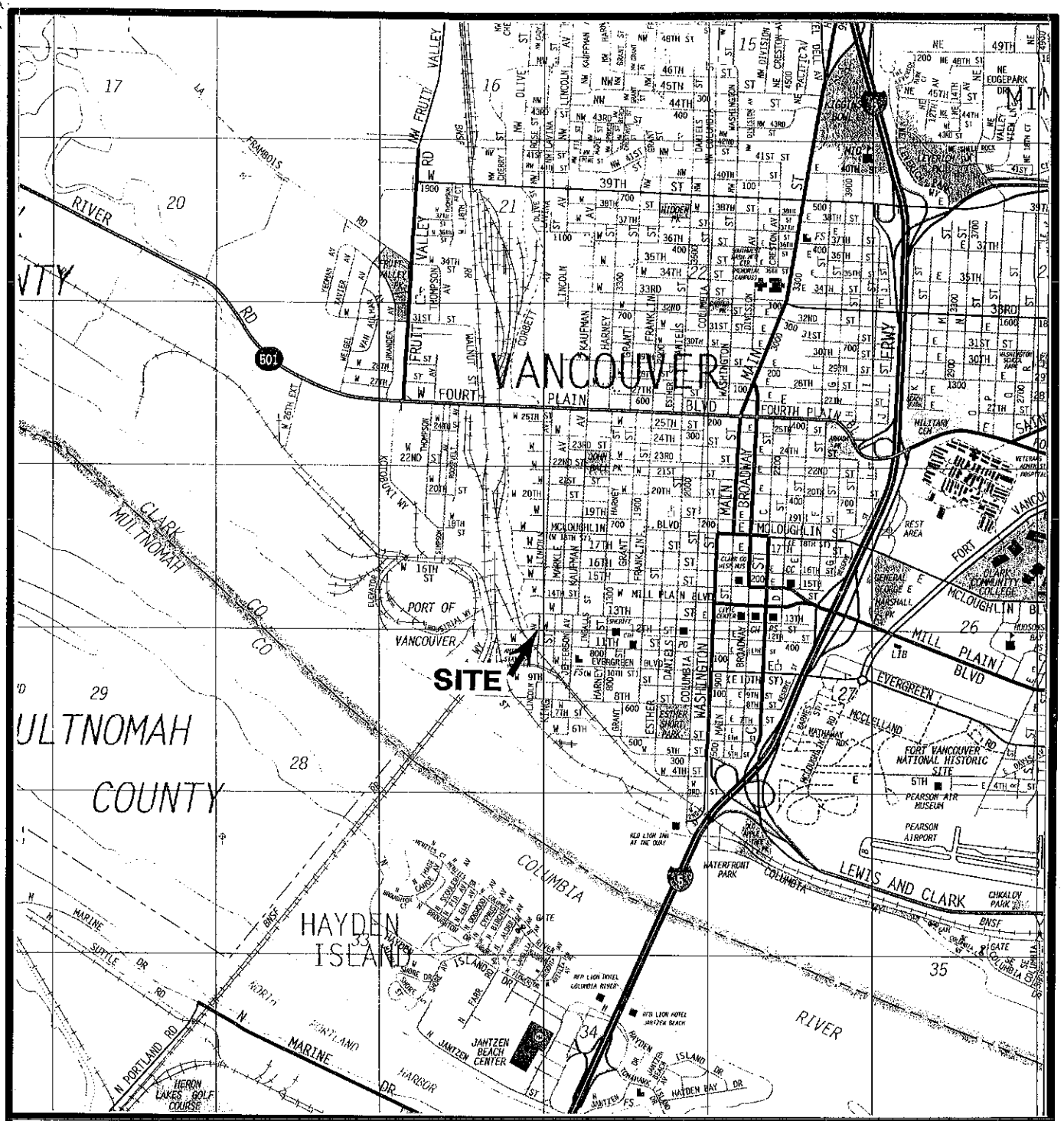

0 2400 4800

SCALE IN FEET

N

Reference:
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VICINITY MAP

FIGURE 1

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ATTACHMENT A

ATTACHMENT A

FIELD EXPLORATION PROGRAM

GENERAL

Subsurface conditions for this study were explored during June 1998 by completing eleven exploratory borings to depths ranging between 3 and 50 feet BGS. Four of the borings encountered ground water at depths ranging between 38.5 and 41.5 feet BGS. Three of the borings were completed as monitoring wells. The approximate locations of the borings and monitoring wells are shown in Figure 2.

A GeoEngineers staff member determined the boring locations, evaluated and classified the soils encountered, and prepared a detailed log of each boring. Soils encountered were classified visually in general accordance with American Society of Testing and Measurement (ASTM) D-2488-90, which is described in Figure A-1. An explanation of the boring log symbols is presented in Figure A-2. The boring logs are presented in Figures A-3 through A-13.

DRILLING AND SOIL SAMPLING PROGRAM

The soil borings were drilled using truck-mounted hollow-stem auger drilling equipment owned and operated by GeoTech Explorations of Portland, Oregon. Soil samples were collected at 2.5-foot intervals using a Dames and Moore split-barrel sampler. If results of field screening did not indicate the potential presence of petroleum hydrocarbons the sampling interval was increased with depth. The sample was driven 18 inches by a 140-pound hammer falling a vertical distance of 30 inches. The number of blows needed to advance the sampler in the final 12 inches, or other specified interval, is indicated to the left of the corresponding sample notations on the boring logs. Soil sampling equipment was cleaned with a Liquinox wash, tap water rinse, and a distilled water rinse between each sampling event. The soil samples were obtained using brass sleeves inside the Dames and Moore sampler. Soil samples were placed in an ice chest containing frozen blue-ice for storage prior to delivery to the laboratory. Standard chain-of-custody procedures were observed during transport of the samples to the testing. Samples that were submitted for chemical analysis are denoted on the boring logs with "CA".

FIELD SCREENING METHODS

A GeoEngineers representative performed field screening tests on the soil samples obtained from the borings. Field screening results were used as a general guideline to delineate areas of possible petroleum-related contamination. In addition, screening results were used to aid in the selection of soil samples for chemical analysis. The screening methods used included: (1) visual examination; (2) water sheen screening; and (3) headspace vapor screening using a Bacharach TLV Sniffer.

Visual screening consists of inspecting the soil for stains indicative of petroleum-related contamination, Visual screening is generally more effective when contamination is related to

heavy petroleum hydrocarbons, such as motor oil, or when hydrocarbon concentrations are relatively high. Water sheen screening and headspace screening are more sensitive methods that have been effective in detecting contamination at concentrations less than regulatory cleanup guidelines.

Water sheen screening involves placing soil in water and observing the water surface for signs of sheen. Sheen classifications are as follows:

No Sheen (NS)	No visible sheen on the water surface;
Slight Sheen (SS)	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly. Natural organic matter in the soil may produce a slight sheen;
Moderate Sheen (MS)	Light to heavy sheen; may have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on water surface; and
Heavy Sheen (HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen.

Headspace vapor screening involves placing a soil sample in a plastic bag. Air is captured in the bag, and the bag is shaken to expose the soil to the air trapped in the bag. The probe of a Bacharach TLV Sniffer is inserted into the bag, and the TLV Sniffer measures the concentrations of combustible vapor concentrations in parts per million (ppm) and is calibrated to hexane. The TLV Sniffer is designed to quantify combustible gas concentrations in the range between 100 ppm and 10,000 ppm in this application.

Field screening results are site- and boring-specific. The results may vary with temperature, soil moisture content, soil type, and type of contaminant.

GROUND WATER ELEVATIONS

The depths to ground water relative to the casing rims were measured in the on-site monitoring wells. The measurements were made with an electric water level indicator. The equipment used to measure the depth to ground water was cleaned with a Liquinox solution wash and a distilled water rinse prior to use in each well. Ground water elevations were calculated by subtracting the depth to water from the surveyed casing rim elevation.

GROUND WATER MONITORING WELL CONSTRUCTION

Borings MW-1, MW-2 and MW-3 were completed as a ground water monitoring wells. Well construction details are shown in Figures A-11 through A-13. The monitoring wells were constructed from their total depth of approximately 50 feet BGS to 25 feet BGS with 2-inch-diameter Schedule 40 PVC 0.010-inch slotted screen casing and from 25 feet BGS to surface with 2-inch-diameter Schedule 40 PVC blank casing. A threaded plastic end cap was placed on the bottom of the monitoring well casing. The annulus of the monitoring well was filled with medium sand backfill from the bottom of the well to approximately 22 feet BGS. Hydrated bentonite chips were placed on top of the sand backfill to seal the well. A traffic-rated steel vault was set in bentonite concrete slurry to protect the monitoring well head. A watertight

locking cap was installed on the top of the well casing. The monitoring wells were developed by surging over various screened intervals and/or pumping at least five well volumes of water from the well using an electric submersible pump.

GROUND WATER MONITORING AND SAMPLING

Ground water samples were collected from monitoring wells MW-1, MW-2 and MW-3 using clean disposable polyethylene bailers after at least three well volumes of ground water were removed. A new bailer and cord were used to sample each monitoring well. A ground water sample was collected from boring GEI-4 using a clean disposable polyethylene bailer that was lowered into the open hole after removing approximately three well volumes of water. The water samples were transferred in the field to laboratory-supplied sample containers. A hydrochloric acid preservative was present in the laboratory-supplied sample containers used for samples evaluated for the presence of BETX compounds. The sample containers were labeled and placed in a cooler with ice for transport, under chain-of-custody procedures, to North Creek Analytical in Portland, Oregon, for chemical analysis.

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS More Than 50% Retained on No. 200 Sieve	GRAVEL More Than 50% of Coarse Fraction Retained on No. 4 Sieve	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND More Than 50% of Coarse Fraction Passes No. 4 Sieve	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS More Than 50% Passes No. 200 Sieve	SILT AND CLAY Liquid Limit Less Than 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY Liquid Limit 50 or More	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-90.
2. Soil classification using laboratory tests is based on ASTM D2487-90.
3. Descriptions of soil density or consistency are based on interpretation of blow count data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water

Wet - Visible free water or saturated, usually soil is obtained from below water table

GEI 85-85 Rev. 05/93

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SOIL CLASSIFICATION SYSTEM

FIGURE A-1

LABORATORY TESTS:

CA Chemical Analysis

FIELD SCREENING TESTS:

Headspace vapor concentration data given in parts per million

Sheen classification system:

NS No Visible Sheen
SS Slight Sheen
MS Moderate Sheen
HS Heavy Sheen
-- Not Tested

SOIL GRAPH:

SM Soil Group Symbol (See Note 2)

Distinct Contact Between Soil Strata

Gradual or Approximate Location of Change Between Soil Strata

Water Level

Bottom of Boring

BLOW-COUNT/SAMPLE DATA:

Blows required to drive a 2.4-inch I.D. split-barrel sampler 12 inches or other indicated distances using a 140-pound hammer falling 30 inches.

22 Location of relatively undisturbed sample

12 Location of disturbed sample

17 Location of sampling attempt with no recovery

Blows required to drive a 1.5-inch I.D. (SPT) split-barrel sampler 12 inches or other indicated distances using a 140-pound hammer falling 30 inches.

10 Location of sample obtained in general accordance with Standard Penetration Test (ASTM D 1586) procedures

26 Location of SPT sampling attempt with no recovery

Location of grab sample

"P" indicates sampler pushed with weight of hammer or against weight of drill rig.

NOTES:

1. The reader must refer to the discussion in the report text, the Key to Boring Log Symbols and the exploration logs for a proper understanding of subsurface conditions.
2. Soil classification system is summarized in Figure A-1.

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KEY TO BORING LOG SYMBOLS

FIGURE A-2

G:\ACAD\DETAILS\K2BOR140
GEI 121-90

TEST DATA

HAND-AUGERED BORING HA-1

Sheen	Vapor Conc. (ppm)	Other Test	Blow Count	Samples	Group Symbol	DESCRIPTION
					SM	Brown silty fine to coarse sand with gravel and cobbles with trace silt (moist)
					SW	Brown fine to coarse sand with occasional gravel and trace silt (moist)
SS	--			☒		
						Brown fine to coarse sand with trace silt (moist)
MS	--	CA		☒		
SS		CA		☒		
						Boring completed at 8.0 feet on 06/26/98 No ground water encountered

DEPTH IN FEET

0, 5, 10, 15, 20, 25, 30, 35, 40

Note: See Figure A-2 for explanation of symbols

TTF:CRH:mln 7/29/98

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LOG OF HAND-AUGERED BORING

FIGURE A-3

TEST DATA

HAND-AUGERED BORING HA-2

Sheen	Vapor Conc. (ppm)	Other Test	Blow Count	Samples	Group Symbol	DESCRIPTION
NS	--	CA		☒	SW/GW	Medium to coarse sand with gravel (moist)

Boring completed at 3.5 feet on 06/29/98
No ground water encountered

DEPTH IN FEET: 0, 5, 10, 15, 20, 25, 30, 35, 40

Note: See Figure A-2 for explanation of symbols

TTF:CRH:mln 7/29/98

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LOG OF HAND-AUGERED BORING

FIGURE A-4

TEST DATA

HAND-AUGERED BORING HA-3

Sheen	Vapor Conc. (ppm)	Other Test	Blow Count	Samples	Group Symbol	DESCRIPTION
					SP	Coarse sand with gravel and cobbles (moist)
NS	--	CA		☒		
						Boring completed at 3.0 feet on 06/29/98 No ground water encountered

DEPTH IN FEET

0, 5, 10, 15, 20, 25, 30, 35, 40

Note: See Figure A-2 for explanation of symbols

TTF:CRH:mln 7/29/98

4823-022-00-2150

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LOG OF HAND-AUGERED BORING

FIGURE A-5

TEST DATA

HAND-AUGERED BORING HA-4

Sheen	Vapor Conc. (ppm)	Other Test	Blow Count	Samples	Group Symbol	DESCRIPTION
					SP-SM	Coarse sand with silt and gravel (moist)
					SW	Fine to coarse sand with trace silt and occasional gravel (moist)
NS	--	CA		☒		
NS	--	CA		☒		

Boring completed at 6.0 feet on 06/29/98
No ground water encountered

DEPTH IN FEET: 0, 5, 10, 15, 20, 25, 30, 35, 40

Note: See Figure A-2 for explanation of symbols

TTF:CRH:mln 7/29/98

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LOG OF HAND-AUGERED BORING

FIGURE A-6

TEST DATA

BORING GEI-1

Depth (feet)	Sheen	Vapor Conc. (ppm)	Other Test	Blow Count	Samples	Group Symbol	DESCRIPTION
0						GP	2 inches angular gravel (fill)
						SM	Brown silty fine to coarse sand with gravel and occasional cobbles (very dense, moist)
				58			
5	SS	<100	CA	18		SW	Brown fine to coarse sand with trace silt (medium dense, moist)
	NS	<100		14			Brown fine to coarse sand with trace silt and occasional cobbles/gravel (medium dense, moist)
10	NS	<100	CA	34			
	NS	<100		40			
15	NS	<100		31			
20	NS	<100		30			
							Boring completed at 21.5 feet on 06/25/98 No ground water encountered
25							
30							
35							
40							

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

TTF:CRH:mln 7/29/98

4823-022-00-2150

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LOG OF BORING

FIGURE A-7

BORING GEI-2

TEST DATA

Depth (feet)	Sheen	Vapor Conc. (ppm)	Other Test	Blow Count	Samples	Group Symbol	DESCRIPTION
0						GP	2 inches angular gravel
						SM	Gray fine to coarse sand with gravel, cobbles and silt (dense, moist)
	MS	--		49-51/12"			
5	MS	--	CA	51		SW	Brown fine to coarse sand with gravel and trace silt (very dense, moist)
	--	--		15			
	SS	--	CA	19			
10	SS	--		35			
	SS	--		36			Brown fine to coarse sand with trace silt (dense, moist)
15							
20	SS	<100		20			
							Encountered gravel at 23.5 feet
25	NS	<100		22		SM	Brown silty fine sand (medium dense, moist)
							Boring completed at 26.5 feet on 06/25/98
							No ground water encountered
30							
35							
40							

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

TTF:CRH:min 7/29/98

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LOG OF BORING

FIGURE A-8

BORING GEI-3

Depth (feet)	Sheen	Vapor Conc. (ppm)	Other Test	Blow Count	Samples	Group Symbol	DESCRIPTION
0						GP	2 inches angular gravel (fill)
						SM	Brown silty fine to coarse sand with gravel (moist) (fill)
						CONCRETE	Concrete debris
						SW	
	SS	<100	CA	40			Brown fine to coarse sand with gravel, cobbles and trace silt (dense, moist)
5	SS	<100		36			
	SS	<100		15			Brown fine to coarse sand with occasional gravel and trace silt (medium dense, moist)
10	SS	<100	CA	20			
	SS	<100		50/5"			
15	SS	<100		28			
20	SS	--		44			
25	NS	--		26			Brown fine to coarse sand with trace silt (medium dense, moist)
							Boring completed at 26.5 feet on 06/26/98 No ground water encountered
30							
35							
40							

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

TTF:CRH:mln 7/30/98

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LOG OF BORING

FIGURE A-9

BORING GEI-4

TEST DATA

Depth (ft)	Sheen	Vapor Conc. (ppm)	Other Test	Blow Count	Samples	Group Symbol	DESCRIPTION
0						GP	2 inches angular gravel (fill)
						SM	Brown fine to coarse sand with gravel and silt and occasional cobbles (moist) (fill)
	SS	<100		50/5"		CONCRETE	Concrete debris
						SW	Gray fine to coarse sand with trace silt and occasional gravel (very dense, moist) (heavy oil odor at 5.5 feet)
5	MS	<100	CA	25			
	SS	<100		37			
10	SS	<100	CA	41			Brown fine to coarse sand with trace silt (dense, moist)
	SS	<100		44			
15	--	<100		19			Brown fine to coarse sand with trace silt and occasional gravel (medium dense, moist)
20	SS	<100		44			
25	NS	<100		30			
						SM	Brown silty fine sand with trace clay (medium dense, moist)
30	NS	<100		30			Brown silty fine sand (medium dense, moist)
35	NS	<100		30			
40							

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

TTF:CRH:mln 7/29/98

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LOG OF BORING

FIGURE A-10

TEST DATA

BORING GEI-4
(Continued)

Depth (feet)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION
40	NS	<100		28			Brown silty fine sand (medium dense, wet)
						SW	Brown/gray fine to coarse sand (medium dense, wet)
45	NS	<100		27			
							Boring completed at 46.5 feet on 06/26/98 Ground water encountered at approximately 38.5 feet during drilling
50							
55							
60							
65							
70							
75							
80							

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

TTF:CRH:mln 7/29/98

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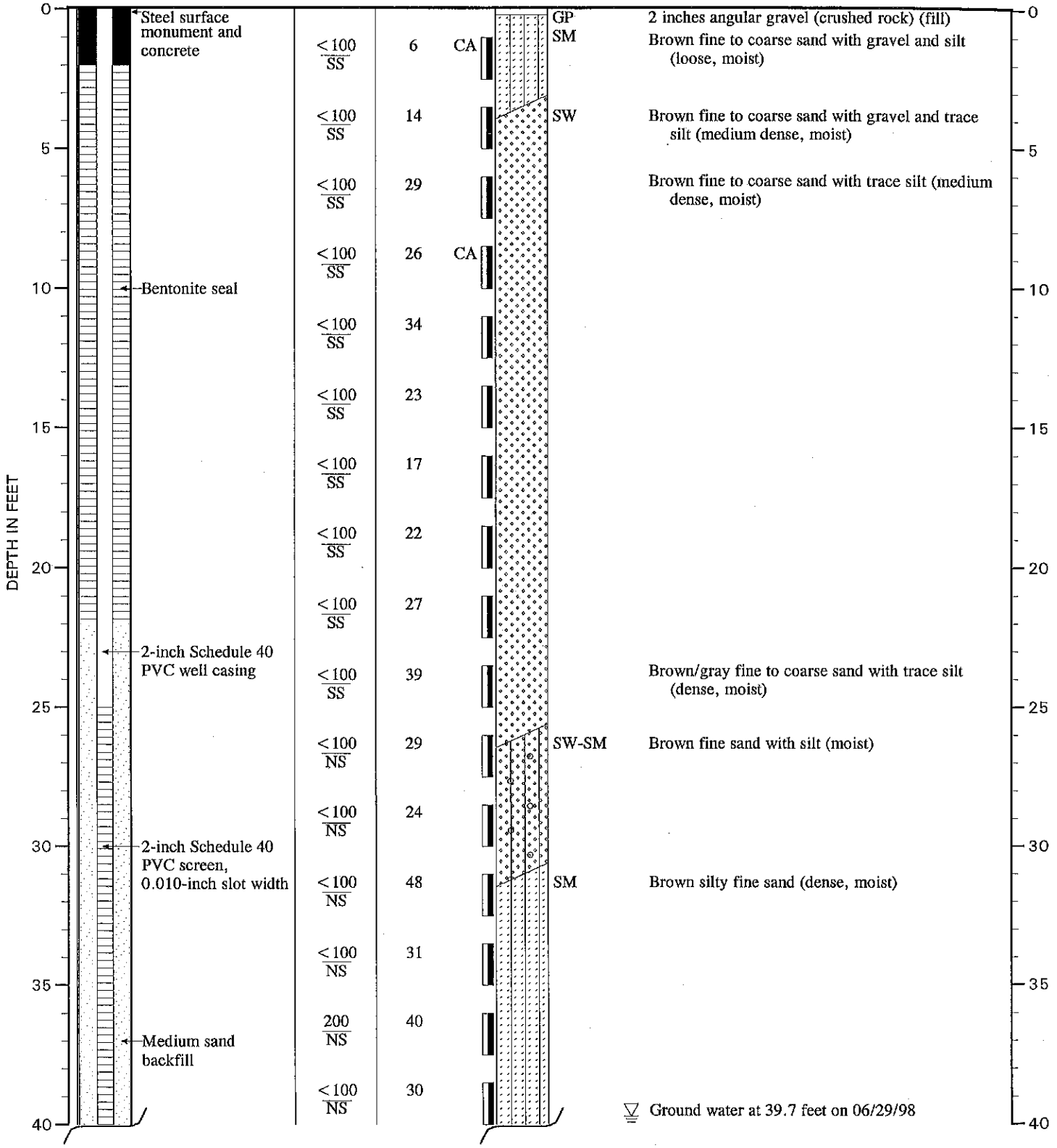
LOG OF BORING

FIGURE A-10

MONITORING WELL MW-1

WELL SCHEMATIC

Casing Elevation (ft.):
Casing Stickup (ft.):



Note: See Figure A- 2 for explanation of symbols

TTF:CRH:mln 7/30/98

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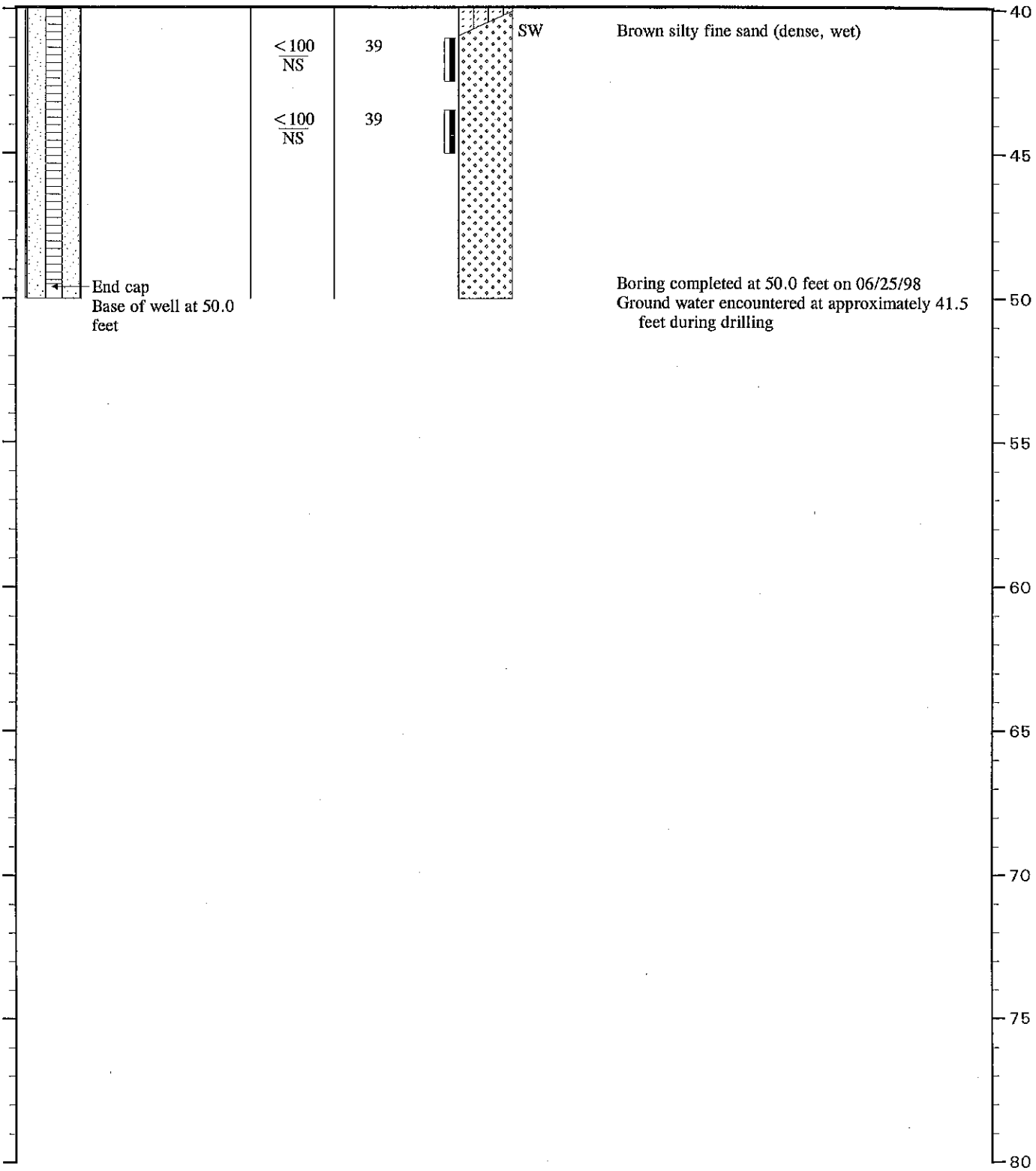
LOG OF MONITORING WELL

FIGURE A-11

MONITORING WELL MW-1
(Continued)

WELL SCHEMATIC

Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION
<100 / NS	39		SW	Brown silty fine sand (dense, wet)
<100 / NS	39			



Boring completed at 50.0 feet on 06/25/98
Ground water encountered at approximately 41.5 feet during drilling

Note: See Figure A- 2 for explanation of symbols

TTF:CRH:mln 7/30/98

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LOG OF MONITORING WELL

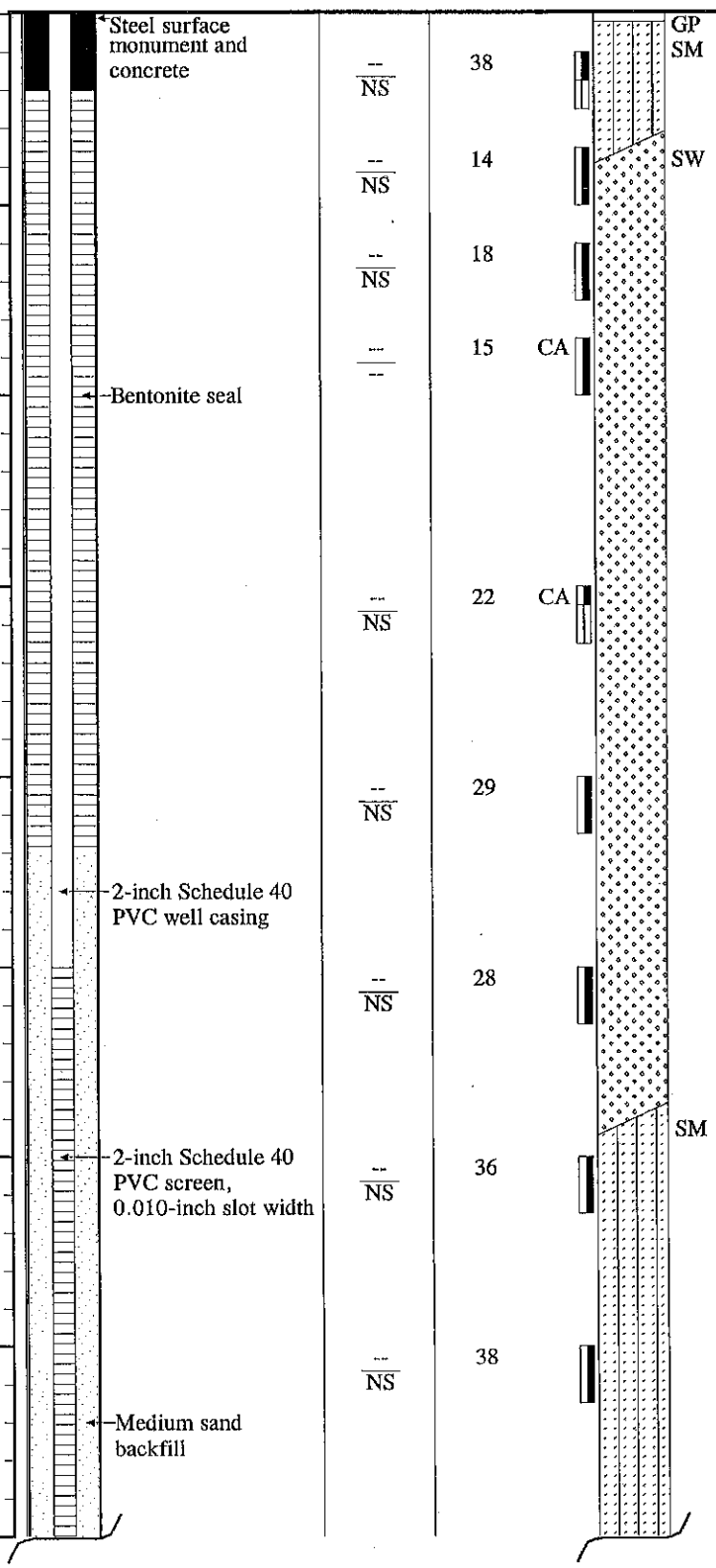
FIGURE A-11

MONITORING WELL MW-2

WELL SCHEMATIC

Casing Elevation (ft.):
Casing Stickup (ft.):

Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION
-- / NS	38		GP / SM	2 inches angular gravel (crushed rock) Brown fine to coarse sand with gravel and silt (dense, moist)
-- / NS	14		SW	Brown fine to coarse sand with trace silt (medium dense, moist)
-- / NS	18			Brown fine to coarse sand (medium dense, moist)
-- / --	15	CA		Brown fine to coarse sand with occasional cobbles (medium dense, moist)
-- / NS	22	CA		Brown fine to coarse sand (medium dense, moist)
-- / NS	29			Brown fine to coarse sand with trace silt (medium dense, moist)
-- / NS	28			
-- / NS	36		SM	Brown silty fine sand (dense, moist)
-- / NS	38			



Note: See Figure A- 2 for explanation of symbols

TTF:CRH:mln 7/29/98

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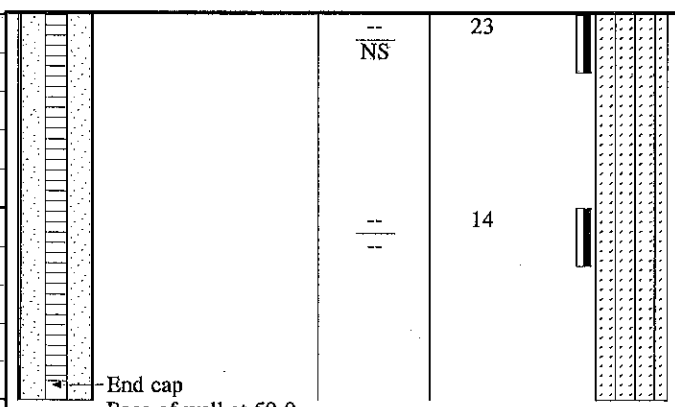
LOG OF MONITORING WELL

FIGURE A-12

MONITORING WELL MW-2
(Continued)

WELL SCHEMATIC

Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION
-- / NS	23			Ground water at 40.17 feet on 06/29/98 Grades to wet
-- / --	14			
				Boring completed at 50.0 feet on 06/25/98 Ground water encountered at approximately 40.0 feet during drilling



DEPTH IN FEET

40 45 50 55 60 65 70 75 80

Note: See Figure A- 2 for explanation of symbols

TTF:CRH:mln 7/29/98

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LOG OF MONITORING WELL

FIGURE A-12

MONITORING WELL MW-3

WELL SCHEMATIC

Casing Elevation (ft.):
Casing Stickup (ft.):

Depth (ft.)	Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION
0				GP	2 inches angular gravel (crushed rock)
				SM	Brown fine to coarse sand with gravel and silt (loose, moist)
	<100 / SS	10	CA		
5	-- / SS	5		SW	Brown fine to coarse sand with trace silt (loose, moist)
	<100 / SS	7			
10	<100 / SS	17	CA		
	<100 / SS	23			
15	<100 / SS	15			
	<100 / NS	24			
20	-- / NS	31			
				SM	Brown silty fine sand (medium dense, moist)
25	-- / NS	29			
30	-- / NS	30			
35	-- / NS	21			
40					

Steel surface monument and concrete

Bentonite seal

2-inch Schedule 40 PVC well casing

2-inch Schedule 40 PVC screen, 0.010-inch slot width

Medium sand backfill

DEPTH IN FEET

Ground water at 39.56 feet on 06/29/98

Note: See Figure A- 2 for explanation of symbols

TTF:CRH:mln 7/30/98

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LOG OF MONITORING WELL

FIGURE A-13

MONITORING WELL MW-3
(Continued)

WELL SCHEMATIC	Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION
	<100 / NS	42			Grades to wet
	-- / NS	27			
End cap Base of well at 50.0 feet					Boring completed at 50.0 feet on 06/25/98 Ground water encountered at approximately 40.0 feet during drilling

DEPTH IN FEET: 40, 45, 50, 55, 60, 65, 70, 75, 80

Note: See Figure A- 2 for explanation of symbols

TTF:CRH:mln 7/30/98

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LOG OF MONITORING WELL

FIGURE A-13