First Quarter 2006 Groundwater Monitoring Report

Former Fir Haven Shell
Miranda, California
Case No. 12748

Prepared for:

Mr. Eugene Sky

Consulting Engineers & Geologists, Inc.

812 W. Wabash Avenue
Eureka, CA 95501-2138
707/441-8855

May 2006

001032

CONSULTING ENGINEERS & GEOLOGISTS, INC.
812 W. Wabash • Eureka, CA 95501-2138 • 707-441-8855 • Fax 707-441-8877 • info@shn-eureka.com

Reference: 001032

May 10, 2006

Mr. Mark Verhey
Humboldt County Division of Environmental Health
100 H Street, Suite 100
Eureka, CA 95501

Subject: Groundwater Monitoring Report, First Quarter 2006, Former Fir Haven Shell, Miranda, California; Case No. 12748

Dear Mr. Verhey:

This report presents the results of the first quarter 2006 groundwater monitoring for the former Fir Haven Shell site, located at 5251 Highway 254 in Miranda, California. Site monitoring activities were conducted on February 2, 2006. SHN Consulting Engineers & Geologists, Inc. (SHN) performed this work on behalf of Mr. Eugene Sky.

If you have any questions, please call me at 707/441-8855.

Sincerely,

SHN Consulting Engineers & Geologists, Inc.

Erik J. Nielsen, P.G.
Project Manager

EJN/JLL:kas
Enclosure: Report

c. w/encl: Mr. Eugene Sky

Reference: 001032

First Quarter 2006
Groundwater Monitoring Report

Former Fir Haven Shell
Miranda, California
Case No. 12748

Prepared for:

Mr. Eugene Sky

Prepared by:

Consulting Engineers & Geologists, Inc.
812 W. Wabash Avenue
Eureka, CA 95501-2138
707/441-8855

May 2006

QA/QC:EJN

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Acronyms and Abbreviations

<	denotes a value that is "less than" the method detection limit
mV	millivolts
ppm	parts per million
ug/L	micrograms per Liter
BTEX	Benzene, Toluene, Ethylbenzene, and total Xylenes
DCO_2	Dissolved Carbon Dioxide
DO	Dissolved Oxygen
EC	Electrical Conductivity
EPA	U.S. Environmental Protection Agency
HCDEH	Humboldt County Division of Environmental Health
MTBE	Methyl Tertiary-Butyl Ether
MW-#	Monitoring Well-#
NAVD	North American Vertical Datum
NM	Not Measured
ORP	Oxidation-Reduction Potential
QA/QC	Quality Assurance/Quality Control
SHN	SHN Consulting Engineers & Geologists, Inc.
TPHG	Total Petroleum Hydrocarbons as Gasoline
UST	Underground Storage Tank

1.0 Introduction

This report presents the results of groundwater-monitoring activities for the first quarter 2006, conducted at the former Fir Haven Shell (site; Case No. 12748). The site is located at 5251 Highway 254 in Miranda, California (Figure 1). SHN Consulting Engineers & Geologists, Inc. (SHN) conducted groundwater monitoring on February 2, 2006, as requested by the Humboldt County Division of Environmental Health (HCDEH).

1.1 Organization of the Report

This report is presented in five sections. This section introduces the reader to the site. Section 2.0 discusses the scope of work completed at the site during the first quarter 2006 monitoring event. Section 3.0 presents the results of the current groundwater-monitoring event. Section 4.0 presents a discussion regarding the nature of the site and future site activities. Section 5.0 presents a list of references cited.

1.2 Background

The subject site is the location of a former Shell service station (Figure 2). On March 29, 2001, two Underground Storage Tanks (USTs) previously used to store gasoline were abandoned in place under permit from HCDEH. During the UST abandonments, soil samples were collected from beneath the location of each tank to access the soil conditions. Petroleum constituents consisting of Total Petroleum Hydrocarbons as Gasoline (TPHG) and Benzene, Toluene, Ethylbenzene, and total Xylenes (BTEX) were detected in soil samples collected from the site (SHN 2001).

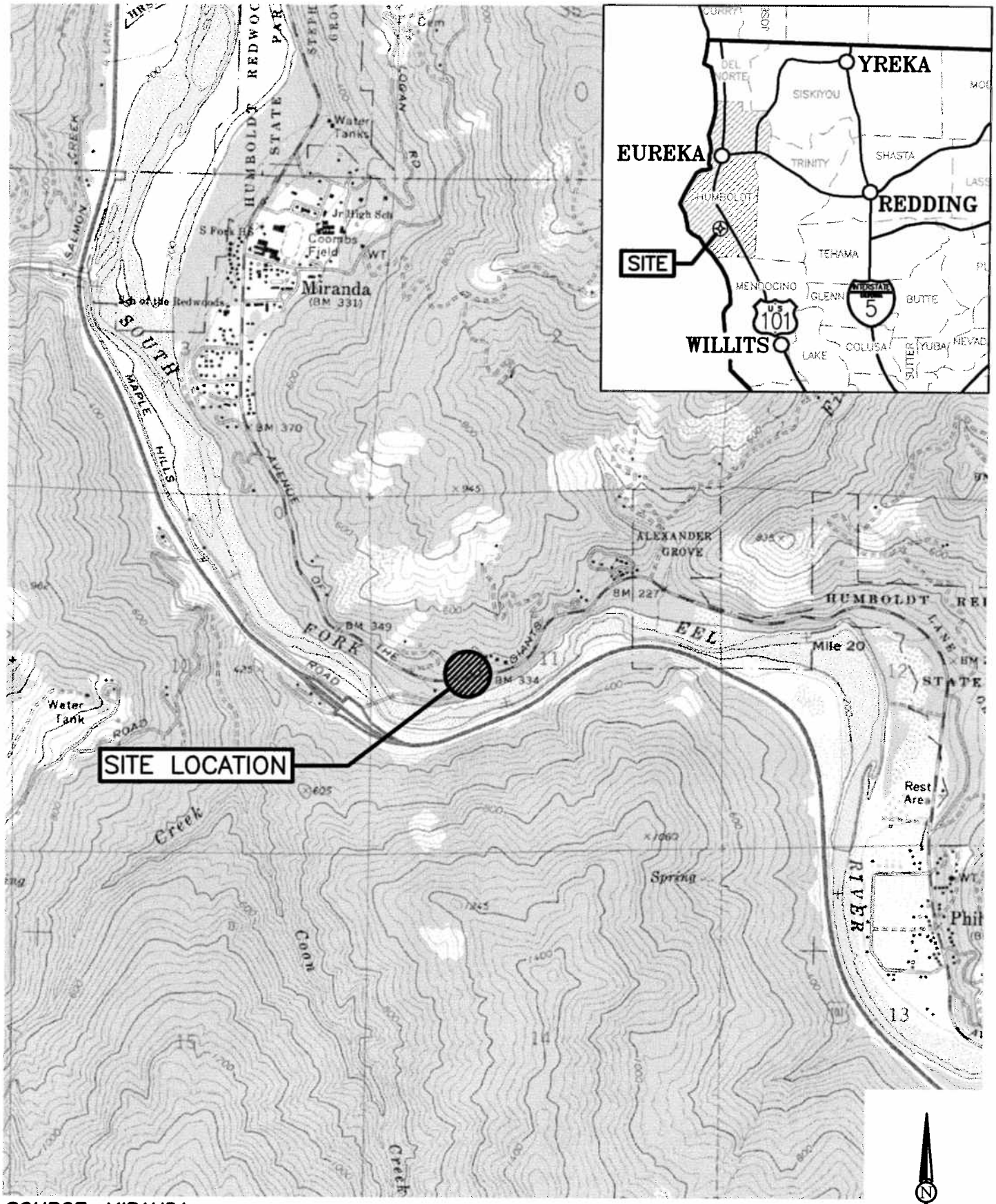
On November 24, 2003, a site investigation was completed to further define the vertical and lateral extent of petroleum hydrocarbon contamination at the site. Based on the results of this site investigation, it appeared that soil and groundwater in the area of the abandoned USTs had been impacted with petroleum hydrocarbons (SHN 2004).

On November 12 and 13, 2004, four groundwater-monitoring wells were installed at the site for the implementation of a site-monitoring program (MW-1, MW-2, MW-3, and MW-4, in Figure 2; SHN, 2005). Groundwater monitoring at Former Fir Haven Shell site occurs on a quarterly basis, as required by the HCDEH.

2.0 Field Activities

2.1 Monitoring Well Sampling

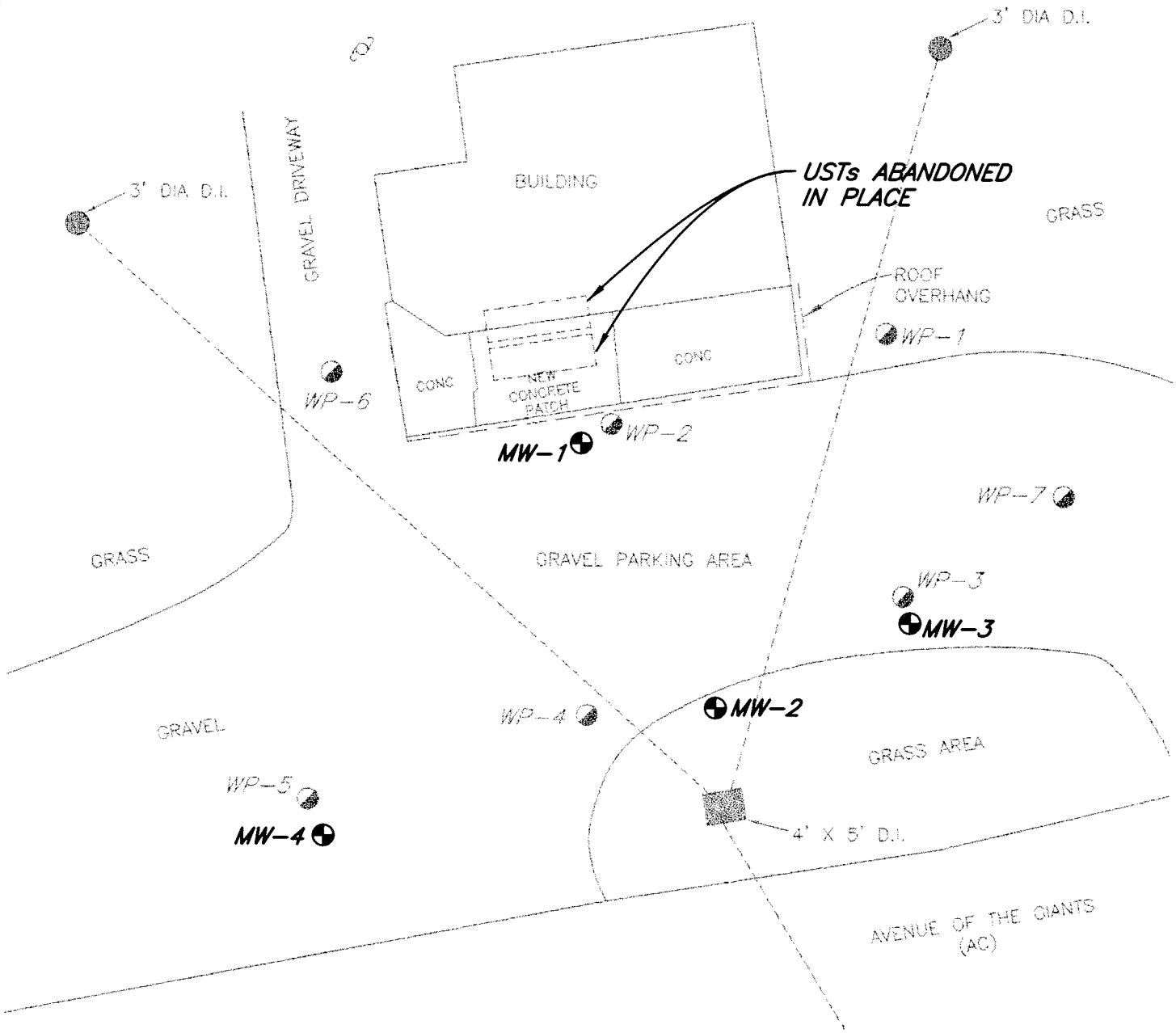
SHN conducted quarterly groundwater monitoring on February 2, 2006. As part of the monitoring program, wells MW-1, MW-2, MW-3, and MW-4 were purged and sampled. Prior to commencing purging activities, all four monitoring wells were measured for depth-to-water and checked for the presence of floating product (none was observed). Electrical Conductivity (EC), pH, and temperature were monitored periodically in site wells during purging activities using portable instrumentation. Each well was also monitored for Oxidation-Reduction Potential (ORP) and



SOURCE: MIRANDA USGS 7.5 MINUTE QUADRANGLE

1"=2000'±

SHN Consulting Engineers & Geologists, Inc.	Former Fir Haven Shell Miranda, California		Site Location Map SHN 001032
	MAY 2005	001032-LOCATION	Figure 1



EXPLANATION

WP-1 BORING LOCATION AND DESIGNATION (SHN, NOVEMBER 2003)

MW-1 MONITORING WELL LOCATION AND DESIGNATION (SHN, NOVEMBER 2004)

NOTE: BORING LOCATIONS ARE APPROXIMATE

N

1"=20'

SHN Consulting Engineers & Geologists, Inc.	Former Fir Haven Shell Miranda, California		Site Plan SHN 001032
	DECEMBER 2004	001032-SI1-DEC-04	Figure 2

Dissolved Carbon Dioxide (DCO_2). Dissolved Oxygen (DO) was not measured due to a malfunctioning DO probe. ORP was measured using portable instrumentation, and DCO_2 was measured using a field test kit.

Each of the four wells was purged of at least three casing volumes prior to sampling. A groundwater sample was then collected from monitoring wells MW-1, MW-2, MW-3, and MW-4 using a disposable polyethylene bailer. The water samples were immediately placed in an ice-filled cooler and submitted to the laboratory for analyses under appropriate chain-of-custody. Field notes and water sampling data sheets from the first quarter 2006, groundwater-monitoring event are included in Appendix A.

2.2 Laboratory Analysis

Each groundwater sample was analyzed for the following:

- TPHG, in general accordance with U.S. Environmental Protection Agency (EPA) Method Nos. 5030/GCFID/8015B.
- BTEX and Methyl Tertiary-Butyl Ether (MTBE), in general accordance with EPA Method Nos. 5030/8021B.

North Coast Laboratories, Ltd., a State-certified analytical laboratory located in Arcata, California, conducted all analyses.

2.3 Equipment Decontamination Procedures

All monitoring and sampling equipment was cleaned prior to being transported to the site. All smaller equipment was initially washed in a water solution containing Liquinox® cleaner, followed by two distilled water rinses. The groundwater samples were collected using pre-cleaned, disposable bailers, and transferred into laboratory-supplied containers.

2.4 Investigation-Derived Waste Management

All rinse water used for decontaminating field-sampling equipment and the well purge water was temporarily stored in 5-gallon buckets. The water was then transported to SHN's 1,000-gallon purge water storage tank located at 812 West Wabash Avenue in Eureka, California. Approximately 29 gallons of decontamination and purge water from the February 2, 2006, groundwater-monitoring event was discharged, under permit, to the City of Eureka municipal wastewater collection system. A discharge receipt is included in Appendix A.

3.0 Groundwater Monitoring Results

3.1 Hydrology

SHN measured depth-to-groundwater in site monitoring wells on February 2, 2006. The results are summarized in Table 1.

Table 1
Groundwater Elevations, February 2, 2006
Former Fir Haven Shell, Miranda, California

Sample Location	Top of Casing Elevation[1] (feet)	Depth to Water[2] (feet)	Groundwater Elevation (feet)
MW-1	339.23	16.56	322.67
MW-2	338.77	24.48	314.29
MW-3	339.02	24.41	314.61
MW-4	340.11	14.53	325.58

1. Referenced to North American Vertical Datum (NAVD) 88
2. Below top of casing

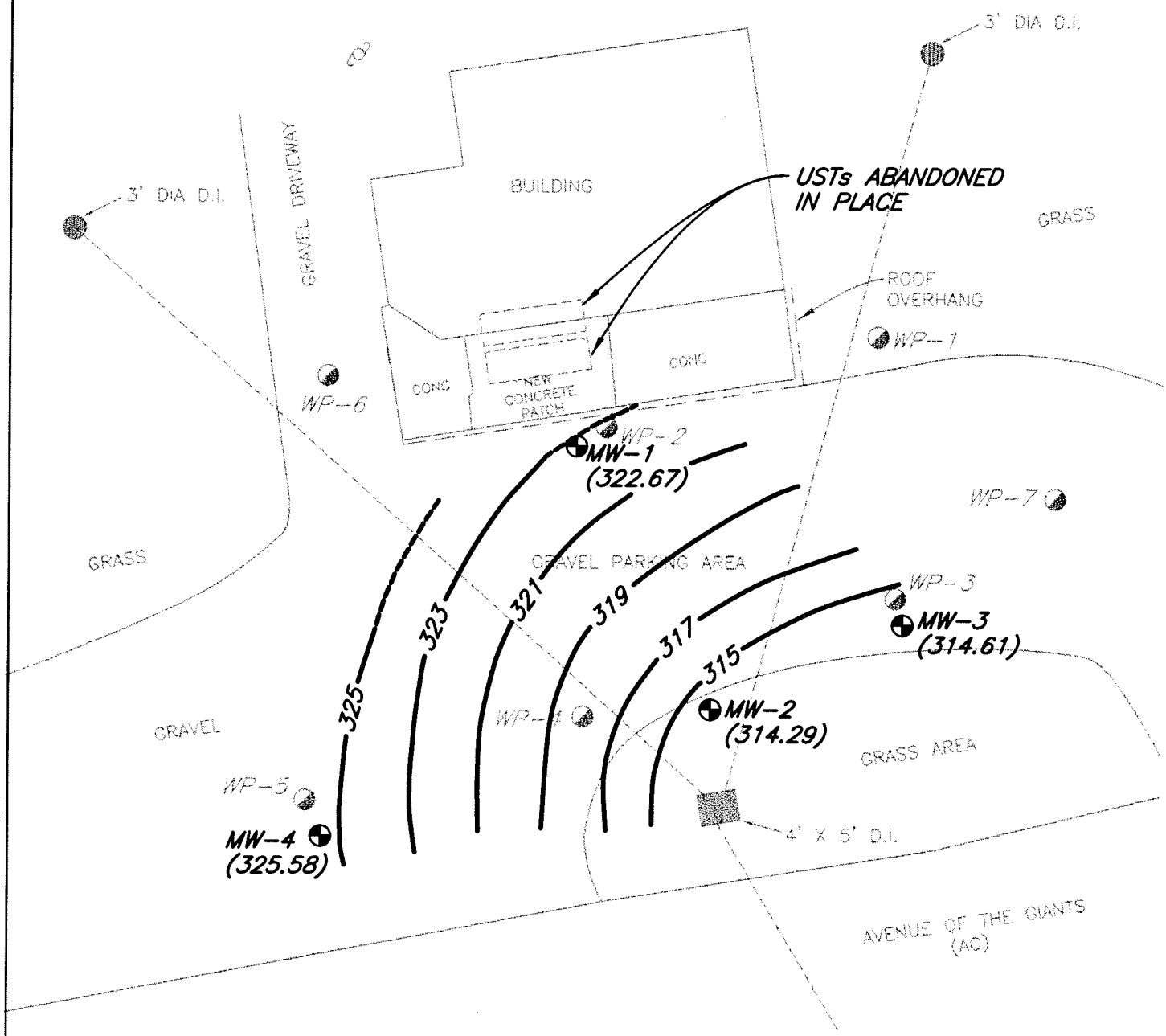
During this monitoring event, the direction of groundwater flow beneath the site was to the southeast, with an estimated gradient of 0.22. A groundwater contour map for the February 2, 2006, monitoring event is presented as Figure 3. Historic groundwater elevation data are presented in Appendix B, Table B-1.

3.2 Groundwater Analytical Results

The laboratory analytical results for the groundwater samples collected during the first quarter 2006, monitoring event are summarized in Table 2.

TPHG was detected in the groundwater sample collected from well MW-1 at a concentration of 24,000 micrograms per Liter (ug/L). BTEX components were also detected in the groundwater sample from well MW-1 at concentrations of 2,100 ug/L, 1,500 ug/L, 610 ug/L, and 2,590 ug/L, respectively. The groundwater samples collected from wells MW-2, MW-3, and MW-4 did not contain any detectable concentrations of either TPHG or BTEX. MTBE was not detected in any of the groundwater samples collected from site wells during the first quarter 2006, monitoring event.

The concentrations of TPHG, benzene, and MTBE detected in groundwater samples collected from site wells on February 2, 2006, are shown on Figure 4. The complete laboratory test results, Quality Assurance/Quality Control (QA/QC) data, and chain-of-custody documentation are included in Appendix C. Historic groundwater monitoring data are presented in Appendix B, Table B-2.



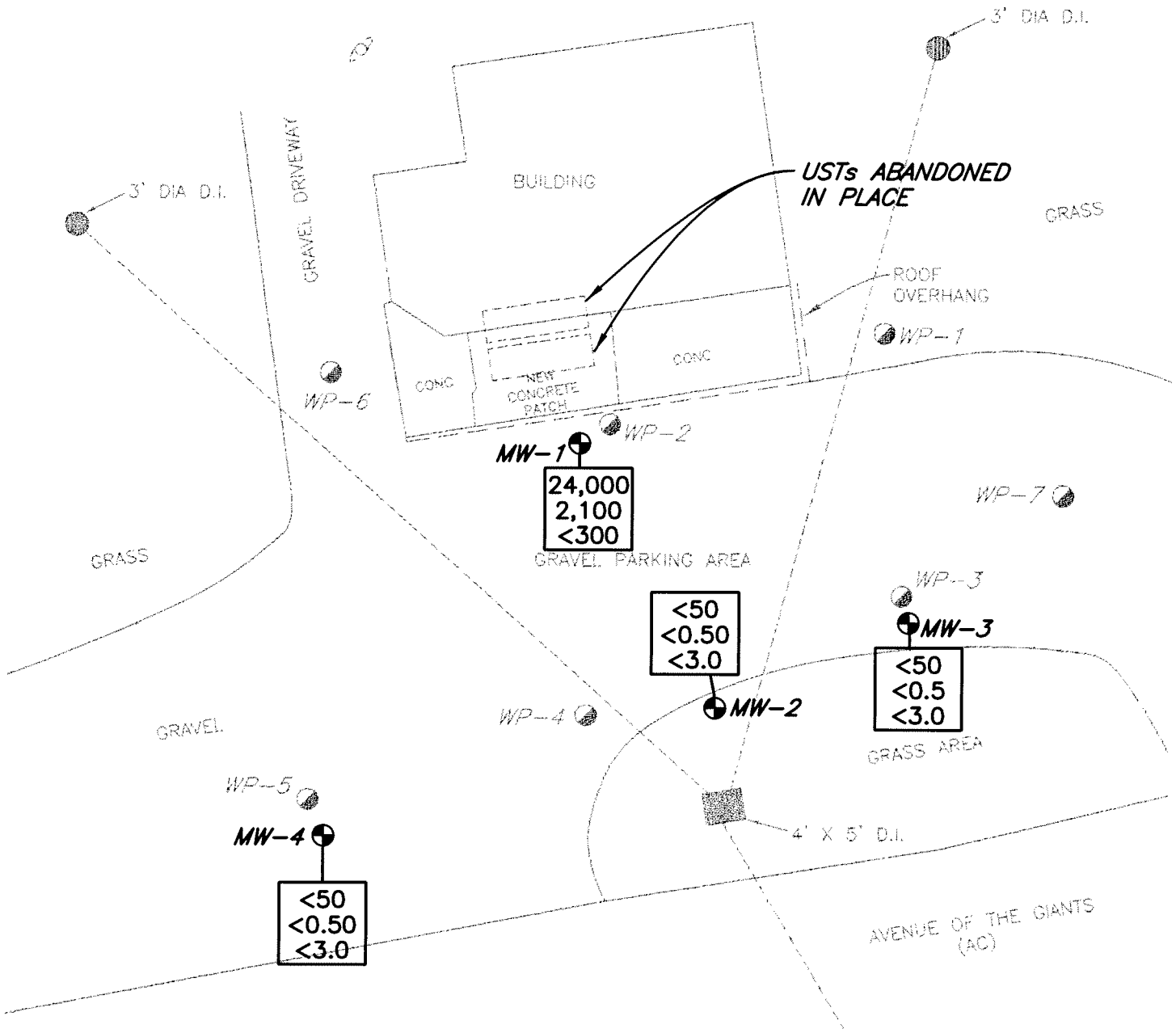
EXPLANATION

WP-1	SOIL BORING LOCATION AND DESIGNATION (SHN, NOVEMBER 2003)
MW-1	MONITORING WELL LOCATION AND DESIGNATION (SHN, NOVEMBER 2004)
(320.21)	GROUNDWATER ELEVATION IN FEET (NAVD88)
—315—	GROUNDWATER CONTOUR IN FEET (NAVD88)

N

1"=20'

SHN Consulting Engineers & Geologists, Inc.	Former Fir Haven Shell Miranda, California	Groundwater Contours February 2, 2006 SHN 001032
	March 2006	001032-GWC-FEB-2006	Figure 3



EXPLANATION

WP-1 — SOIL BORING LOCATION AND DESIGNATION (SHN, NOVEMBER 2003)

MW-1 — MONITORING WELL LOCATION AND DESIGNATION (SHN, NOVEMBER 2004)

<50	TPHG	RESULTS IN ug/L
<0.50	BENZENE	
<3.0	MTBE	

(NS) NOT SAMPLED

N

1"=20'

SHN Consulting Engineers & Geologists, Inc.	Former Fir Haven Shell Miranda, California	Petroleum Hydrocarbon Concentrations in Groundwater, February 2, 2006 SHN 001032
	March 2006	001032-PHC-FEB-2006	Figure 4

Table 2 Groundwater Analytical Results, February 2, 2006 Former Fir Haven Shell, Miranda, California (in ug/L)[1]						
Sample Location	TPHG[2]	Benzene[3]	Toluene[3]	Ethylbenzene[3]	Total Xylenes[3]	MTBE[3]
MW-1	**24,000[4]**	**2,100**	**1,500**	**610**	**2,590**	<300[5,6]
MW-2	<50	<0.50	<0.50	<0.50	<0.50	<3.0
MW-3	<50	<0.50	<0.50	<0.50	<0.50	<3.0
MW-4	<50	<0.50	<0.50	<0.50	<0.50	<3.0

1. ug/L: micrograms per Liter
2. Total Petroleum Hydrocarbons as Gasoline (TPHG), analyzed in general accordance with U.S. Environmental Protection Agency (EPA) Method No. 5030/GCFID/8015B
3. Benzene, Toluene, Ethylbenzene, total Xylenes, and Methyl Tertiary-Butyl Ether (MTBE), analyzed in general accordance with EPA Method No. 5030/8021B
4. Sample appears to be similar to gasoline, but certain peak ratios are not that of a fresh gasoline standard. The reported result represents the amount of material in the gasoline range.
5. <: Denotes a value that is "less than" the laboratory method detection limit.
6. Reporting limit was raised due to matrix interference

3.3 Natural Attenuation Monitoring

Natural attenuation parameters DCO_2, and ORP were measured in all four groundwater-monitoring wells on February 2, 2006, prior to sampling, and are summarized in Table 3. DO was not measured in site wells due to an equipment malfunction.

Table 3 DO, DCO_2, and ORP Measurement Results, February 2, 2006 Former Fir Haven Shell, Miranda, California			
Sample Location	DO[1] (ppm)[2]	DCO_2[3] (ppm)	ORP[4] (mV)[5]
MW-1	NM[6]	100	23
MW-2	NM	30	108
MW-3	NM	55	152
MW-4	NM	50	38

1. DO: Dissolved Oxygen
2. ppm: parts per million
3. DCO_2: Dissolved Carbon Dioxide, field measured using a field test kit
4. ORP: Oxidation-Reduction Potential; field measurement using portable instrumentation
5. mV: millivolts
6. NM: Not Measured

During this monitoring event, DCO_2 concentrations ranged from 30 ppm in well MW-2, to 100 ppm in well MW-1, and indicate that biodegradation may be occurring in the vicinity of well MW-1. ORP measurements ranged from 23 millivolts (mV) in well MW-1, to 152 mV in well MW-3, and indicate that mild oxidizing conditions exist in site groundwater. Historic DO, DCO_2, and ORP measurements are presented in Appendix A, Table A-3.

4.0 Discussion and Recommendations

During the first quarter 2006, monitoring event, the groundwater sample collected from monitoring well MW-1 contained elevated concentrations of TPHG and BTEX constituents. The groundwater samples collected from wells MW-2, MW-3, and MW-4 did not contain detectable concentrations of either TPHG or BTEX. Petroleum hydrocarbon concentrations in well MW-1 have decreased for all constituents, compared to the previous site-monitoring event (November 2005)

Based on the results of this and the previous groundwater-monitoring events, it does not appear that the petroleum hydrocarbon plume present in the source area is migrating. However, the continued elevated petroleum hydrocarbon constituents found in groundwater samples collected from well MW-1 indicate that petroleum hydrocarbon contamination persists in the source area.

As required by the HCDEH, SHN will continue quarterly groundwater monitoring at the site. The next groundwater-monitoring event is scheduled for May 2006. SHN recommends the preparation of an additional site investigation work plan to further define the extent of petroleum hydrocarbon contamination near the source area. The intent of this additional site investigation would be to identify the limit of the contaminant plume.

5.0 References Cited

SHN Consulting Engineers & Geologists, Inc. (June 19, 2001). "Site Investigation Work Plan, Former Fir Haven Shell, 5251 Highway 254, Miranda, California, HCDEH LOP No. 12748." Eureka: SHN.

---. (January 2004). *Well point Investigation Report of Findings, Former Fir Haven Shell, Miranda, California; Case No. 12748.* Eureka: SHN.

---. (January 2005). *Groundwater Monitoring Well Installation Report of Findings, Former Fir Haven Shell, Miranda, California; Case No. 12748.* Eureka: SHN.

Appendix A

Field Notes

Daily Field Report

Job No. 001032		
Page 1 of 1		
Project Name: Former Fir Haven Shell	Client/Owner: Eugene Sky	Daily Field Report Sequence No
General Location Of Work: Miranda, CA	Owner/Client Representative	Date: 2-2-06 / Day Of Week: THURS
General Contractor: SHN	Grading Contractor	Project Engineer: Frans Lowman
Type Of Work: Quarterly MW Sampling	Grading Contractor, Superintendent, Or Foreman	Supervisor: EJN
Source & Description Of Fill Material	Weather	Technician: A. Melody / J. Largent
	Key Persons Contacted (Civil Engr, Architect, Developer, Etc)	

Describe Equipment Used For Hauling, Spreading, Watering, Conditioning, & Compacting

0930 - Arrive at site, opened all wells, began taking depth to water measurements + DO readings, DO meter malfunctioned → No DO readings taken.
1110 - Began purging, MW-3 with disposable bailer. All water caught in 5 gal bucket.
1155 - Sampled MW-3 with its bailer. Secured well. MW-3
1200 - Began purging MW-4 with a disposable bailer. All water caught in 5-gal. bucket.
1235 - Sampled MW-4 with its bailer, Secured well MW-4
1320 - Began purging MW-2 with disposable bailer, all water caught in 5-gal bucket.
1420 - Sampled MW-2. Secured wells. MW-2
1430 - Begin purging MW-1 with disposable bailer. All water caught in 5-gal bucket.
1505 - Sampled MW-1 with its disposable bailer. Secured well MW-1
1530 - off site

Note: All purge water & decon water was caught in 5 gallon buckets w/lids then transported to SHN's 1,000 gallon PWST located at 812 W. Wabash Avenue, Eureka, California. 29.25 gallons total.

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Groundwater Elevations

Job No.: 001032
Name: A. Melody / J. Largent
Client: EUGENE SKY
Date: 2·2·06
Location: MIRANDA, CA
Weather: p+ly cloudy

Sample Location	Time of Reading	Top of Casing Elevation (feet)	Depth To Water (feet)	Water Surface Elevation (feet)
MW-1	1010	339.23	16.56	322.67
MW-2	1005	338.77	24.48	314.29
MW-3	0955	339.02	24.41	314.61
MW-4	1000	340.11	14.53	325.58

3-4-2-1

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Water Sampling Data Sheet

Project Name:	Former Fir Haven Shell	Date/Time:	2·2·06
Project No.:	001032	Sampler Name:	J. Largent
Location:	Miranda, CA	Sample Type:	GW
Well #:	MW-1	Weather	overcast
Hydrocarbon Thickness/Depth (feet):	—	Key Needed:	dolphin

Total Well Depth (feet)	-	Initial Depth to Water (feet)	=	Height of Water Column (feet)	x	0.163 gal/ft (2-inch well) / 0.653 gal/ft (4-inch well)	=	1 Casing Volume (gal)
30.05	-	16.56	=	13.49	x	.163	=	2.20

Time	DO (ppm)	CO_2 (ppm)	ORP (mV)	EC (uS/cm)	Temp (°F)	pH	Water Removed (gal)	Comments
1430	—	100	23	—	—	—	0.25	HC odor/clear
1435	↓			511	58.9	6.49	2.25	HC odor-grey
1440	NO Flow			503	58.8	6.53	4.50	
1445	thru cell			527	59.3	6.58	6.75	
(1505)	Sample	Time						

Purge Method: hand bail

Total Volume Removed: 6.75 (gal)

Laboratory Information

Sample ID	# & Type of Containers	Preservative / Type	Laboratory	Analyses
MW-1	3-40ml VOAs	HCl	NCL	TPH6/BTEX/M+BE

Well Condition:

Remarks:

Recharged to 18.85 'BTOC at sample time (1505)

299.15
30.08
- 16.56
13.49

13.49
x 0.163
4047
80940
134900
219887

2.1
6.75
+12.75
7.25
2.50

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Water Sampling Data Sheet

Project Name: Former Fir Haven Shell
Project No.: 001032
Location: Miranda, CA
Well #: MW-2
Hydrocarbon Thickness/Depth (feet): —
Date/Time: 2.2.06
Sampler Name: J. Largent
Sample Type: GW
Weather: overcast
Key Needed: dolphin

Total Well Depth (feet)	-	Initial Depth to Water (feet)	=	Height of Water Column (feet)	x	0.163 gal/ft (2-inch well) / 0.653 gal/ft (4-inch well)	=	1 Casing Volume (gal)
50.17	-	24.48	=	25.69	x	.163	=	4.19/8.38/12.5

Time	DO (ppm)	CO_2 (ppm)	ORP (mV)	EC (uS/cm)	Temp (°F)	pH	Water Removed (gal)	Comments
	NM							
1320	—	30	108	—	—	—	0.25	clear
1340	—	—	—	125	61.1	6.36	4.25	clear
1350	NO Flow			146	61.3	6.34	8.50	
1405	thru cell			161	61.7	6.42	12.75	
(1420)	Sample	Time						

Purge Method: hand bail

Total Volume Removed: 12.75 (gal)

Laboratory Information

Sample ID	# & Type of Containers	Preservative / Type	Laboratory	Analyses
MW-2	3-40ml VOAs	HCl	NCL	TPH G/BTEX/M+BE

Well Condition:

Remarks:

Recharged to 30.0 'BTOC at sample time (1420)

49.17
50.17
-24.48
25.69

25.69
x 0.163
117707
154140
256900
4.18747

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Water Sampling Data Sheet

Project Name:	Former Fir Haven Shell	Date/Time:	2·2·06
Project No.:	001032	Sampler Name:	A. Melody / J. Largent
Location:	Miranda, CA	Sample Type:	GW
Well #:	MW-3	Weather	Overcast
Hydrocarbon Thickness/Depth (feet):	NA	Key Needed:	dolphin

Total Well Depth (feet)	-	Initial Depth to Water (feet)	=	Height of Water Column (feet)	x	0.163 gal/ft (2-inch well) / 0.653 gal/ft (4-inch well)	=	1 Casing Volume (gal)
29.35	-	24.41	=	4.94	x	.163	=	0.81 x 3 = 2.43

Time	DO (ppm) 27.75	CO_2 (ppm)	ORP (mV)	EC (uS/cm)	Temp (°F)	pH	Water Removed (gal)	Comments
	NM	—	—	—	—	—	0.0	
1110	↓	55	152	—	—	—	0.25	
1115	↓			510	56.5	6.46	1.0	
1120	NO Flow			499	56.5	6.56	1.75	
1125	thru cell			454	56.2	6.54	2.50	
(1155)	Sample	Time						

Purge Method: hand bail

Total Volume Removed: 2.50 (gal)

Laboratory Information

Sample ID	# & Type of Containers	Preservative / Type	Laboratory	Analyses
MW-3	3-40ml VOAs	HCl	NCL	TPH G/BTEX/MtBE

Well Condition:

Remarks:

Recharged to 'BTOC at sample time (1155)

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29.35
-24.41
4.94

25.2
4.94
-0.163
2 4 8 2
2 2 6 4 0
4 9 4 0 2

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Water Sampling Data Sheet

Project Name: Former Fir Haven Shell
Project No.: 001032
Location: Miranda, CA
Well #: MW-4
Hydrocarbon Thickness/Depth (feet): —

Date/Time: 2-2-06
Sampler Name: J. Largent
Sample Type: GW
Weather: overcast
Key Needed: dolphin

Total Well Depth (feet)	-	Initial Depth to Water (feet)	=	Height of Water Column (feet)	x	0.163 gal/ft (2-inch well) / 0.653 gal/ft (4-inch well)	=	1 Casing Volume (gal)
29.32	-	14.53	=	14.79	x	.163	=	2.41x3 = 7.23

Time	DO (ppm)	CO_2 (ppm)	ORP (mV)	EC (uS/cm)	Temp (°F)	pH	Water Removed (gal)	Comments
	NM	—	—	—	—	—		
1200	↓	50	38	—	—	—	0.25	
1205	↓	—	—	561	64.6	6.78	2.50	
1215	NO Flow			547	64.5	6.78	5.00	
1225	thru cell			556	65.0	6.78	7.25	
(1235)	Sample Time							

Purge Method: hand bail

Total Volume Removed: 7.25 (gal)

Laboratory Information

Sample ID	# & Type of Containers	Preservative / Type	Laboratory	Analyses
MW-4	3-40ml VOAs	HCl	NCL	TPH6/BTEX/M+BE

Well Condition:

Remarks:

Recharged to 21.39 'BTOC at sample time (1235)

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29.32
-14.53
14.79

295
14.79
x 0.163
24437
88740
47900
241077

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EQUIPMENT CALIBRATION SHEET

Name: A. Melody / J. Largent

Project Name: Former Fir Haven Shell

Reference No.: 001032

Date: 2-2-06

Equipment: ☒ pH & EC ☐ PID ☐ $GTCO_2$ ☐ GTLEL
☐ Turbidity ☒ Other Diss. Oxygen Meter YSI 550A

Description of Calibration Procedure and Results:

pH + EC meter was calibrated using a 2 buffer solution method with 7.00 + 4.01, the EC (conductivity) is set using 1413 µS.

DO meter is self calibrating with the altimeter set at 3. (550A, YSI)

NORTH COAST LABORATORIES LTD.
5680 West End Road • Arcata • CA 95521-9202
707-822-4649 Fax 707-822-6831

Chain of Custody

#0602082 P. 1 of 1

LABORATORY NUMBER: [redacted]

Attention: Frans Lowman
Results & Invoice to: SHN
Address: 812 West Wabash Avenue
Eureka, CA 95501
Phone: 441-8855
Copies of Report to:
Sampler (Sign & Print): Ann D. Tulay Aaron Melody

TAT: ☐ 24 Hr ☐ 48 Hr ☐ 5 Day ☐ 5–7 Day
☒ STD (2–3 Wk) ☐ Other:
PRIOR AUTHORIZATION IS REQUIRED FOR RUSHES

REPORTING REQUIREMENTS: State Forms ☐
Preliminary: FAX ☐ Verbal ☐ By: __/__/__
Final Report: FAX ☐ Verbal ☐ By: __/__/__

CONTAINER CODES: 1—½ gal. pl; 2—250 ml pl; 3—500 ml pl; 4—1 L Nalgene; 5—250 ml BG; 6—500 ml BG; 7—1 L BG; 8—1 L cg; 9—40 ml VOA; 10—125 ml VOA; 11—4 oz glass jar; 12—8 oz glass jar; 13—brass tube; 14—other

PRESERVATIVE CODES: a—HNO_3; b—HCl; c—H_2SO_4; d—$Na_2S_2O_3$; e—NaOH; f—$C_2H_3O_2Cl$; g—other

PROJECT INFORMATION

Project Number: 001032
Project Name: Former Fir Haven Shell
Purchase Order Number:

LAB ID	SAMPLE ID	DATE	TIME	MATRIX*	CONTAINERS 6	CONTAINERS 9	ANALYSIS TPHG/BTEX/MtBE	SAMPLE CONDITION/SPECIAL INSTRUCTIONS
	MW-3	2·2·06	1155	GW			X	
	MW-4	↓	1235	↓			X	EDF
	MW-2	↓	1420	↓			X	
	MW-1	↓	1505	↓			X	
								Cooler temp = 5.6°C

RELINQUISHED BY (Sign & Print)	DATE/TIME	RECEIVED BY (Sign & Print)	DATE/TIME
Ann D. Tulay Aaron Melody	2·3·06	Jennifer Martin	2-3-06 1900

SAMPLE DISPOSAL
☒ NCL Disposal of Non-Contaminated
☐ Return ☐ Pickup

CHAIN OF CUSTODY SEALS Y/N/NA [redacted]
SHIPPED VIA: UPS Air-Ex Fed-Ex Bus Hand

PU

*MATRIX: DW=Drinking Water; Eff=Effluent; Inf=Influent; SW=Surface Water; GW=Ground Water; S=Soil; O=Other.

ALL CONTAMINATED NON-AQUEOUS SAMPLES WILL BE RETURNED TO CLIENT

Appendix B

Historic Data

Table B-1
Historic Groundwater Elevations
Former Fir Haven Shell, Miranda, California

Sample Location	Sample Date	Top of Casing Elevation (feet)[1]	Depth to Water[2] (feet)	Groundwater Elevation (feet)
MW-1	11/20/04	339.23	19.95	319.28
	1/21/05		18.13	321.10
	5/11/05		17.73	321.50
	8/2/05		19.02	320.21
	11/2/05		19.07	320.16
	2/2/06		16.56	322.67
MW-2	11/20/04	338.77	32.78	305.99
	1/21/05		29.55	309.22
	5/11/05		27.73	311.04
	8/2/05		32.70	306.07
	11/2/05		31.80	306.97
	2/2/06		24.48	314.29
MW-3	11/20/04	339.02	DRY[3]	--
	1/21/05		27.44	311.58
	5/11/05		26.70	312.32
	8/2/05		28.80	310.22
	11/2/05		28.89	310.16
	2/2/06		24.41	314.61
MW-4	11/20/04	340.11	22.68	317.43
	1/21/05		18.09	322.02
	5/11/05		16.82	323.29
	8/2/05		19.15	320.96
	11/2/05		21.28	318.83
	2/2/06		14.53	325.58

1. Referenced to North American Vertical Datum (NAVD) 88
2. Below top of casing
3. Well was dry on November 20, 2004. As such, a depth to water measurement could not be collected.

Table B-2
Historic Groundwater Monitoring Well Analytical Results
Former Fir Haven Shell, Miranda, California
(in ug/L)[1]

Sample Location	Sample Date	TPHG[2]	B[3]	T[3]	E[3]	X[3]	MTBE[3]
MW-1	11/20/04	**53,000[4]**	**4,300**	**5,900**	**1,600**	**8,600**	<600[5,6]
	1/21/05	**26,000**	**3,200**	**2,500**	**870**	**3,900**	<300[6]
	5/11/05	**35,000[4]**	**2,800**	**4,000**	**980**	**5,200**	<300[6]
	8/2/05	**53,000[4]**	**3,100**	**6,500**	**1,500**	**8,500**	<300[6]
	11/2/05	**46,000**	**2,700**	**4,800**	**1,400**	**7,800**	<300[6]
	2/2/06	**24,000**	**2,100**	**1,500**	**610**	**2,590**	<300[6]
MW-2	11/20/04	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	1/21/05	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	5/11/05	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	8/2/05	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	11/2/05	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	2/2/06	<50	<0.50	<0.50	<0.50	<0.50	<3.0
MW-3	11/20/04	NS[7]	NS	NS	NS	NS	NS
	1/21/05	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	5/11/05	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	8/2/05	NS	NS	NS	NS	NS	NS
	11/2/05	NS	NS	NS	NS	NS	NS
	2/2/06	<50	<0.50	<0.50	<0.50	<0.50	<3.0
MW-4	11/20/04	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	1/21/05	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	5/11/05	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	8/2/05	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	11/2/05	<50	<0.50	<0.50	<0.50	<0.50	<3.0
	2/2/06	<50	<0.50	<0.50	<0.50	<0.50	<3.0

1. ug/L: micrograms per Liter
2. TPHG: Total Petroleum Hydrocarbons as Gasoline, analyzed in general accordance with U.S. Environmental Protection Agency (EPA) Method Nos. 3510/GCFID/8015B or 5030/GCFID/8015B
3. Benzene (B), Toluene (T), Ethylbenzene (E), m,p-Xylene, o-Xylene, and Methyl Tertiary-Butyl Ether (MTBE), analyzed in general accordance with EPA Method Nos. 5030/8021B
4. Sample appears to be similar to gasoline, but certain peak ratios are not that of a fresh gasoline standard. The reported result represents the amount of material in the gasoline range.
5. <: Denotes a value that is "less than" the method detection limit
6. Reporting limit raised due to matrix interference
7. NS: Not Sampled

Table B-3
Historic DO, DCO_2, and ORP Measurement Results
Former Fir Haven Shell, Miranda, California

Sample Location	Sample Date	DO[1] (ppm)[2]	DCO_2[3] (ppm)	ORP[4] (mV)[5]
MW-1	1/21/05	2.09	180	-67
	5/11/05	0.05	150	-90
	8/2/05	1.15	120	-84
	11/2/05	0.09	120	-132
	2/2/06	NM[6]	100	23
MW-2	1/21/05	4.96	30	93
	5/11/05	4.00	30	208
	8/2/05	1.77	20	128
	11/2/05	1.60	20	118
	11/2/05	NM[6]	30	108
MW-3	1/21/05	5.26	60	116
	5/11/05	1.83	60	145
	8/2/05	2.95	60	135
	11/2/05	0.50	40	148
	11/2/05	NM[6]	55	152
MW-4	1/21/05	2.04	40	104
	5/11/05	0.05	40	175
	8/2/05	1.26	40	131
	11/2/05	0.06	40	111
	11/2/05	NM[6]	50	38

1. DO: Dissolved Oxygen, field measured using portable instrumentation
2. ppm: parts per million
3. DCO_2: Dissolved Carbon Dioxide, field measured using a field test kit
4. ORP: Oxidation-Reduction Potential; field measurement using portable instrumentation
5. mV: millivolts
6. NM: not measured for parameter

Appendix C

Laboratory Analytical Report

NORTH COAST LABORATORIES LTD.

R[illegible] 3 1 7 2006

February 15, 2006

SHN Consulting Engineers and Geologists
812 West Wabash Avenue
Eureka, CA 95501

Attn: Frans Lowman

RE: 001032, Former Fir Haven Shell

Order No.: 0602082
Invoice No.: 56275
PO No.:
ELAP No. 1247-Expires July 2006

SAMPLE IDENTIFICATION

Fraction	Client Sample Description
01A	MW-3
02A	MW-4
03A	MW-2
04A	MW-1

ND = Not Detected at the Reporting Limit

Limit = Reporting Limit

All solid results are expressed on a wet-weight basis unless otherwise noted.

REPORT CERTIFIED BY

Colleen Blackstone — Laboratory Supervisor(s)

T. Sh[illegible] — QA Unit

Jesse G. Chaney, Jr.
Laboratory Director

5680 West End Road • Arcata California 95521-9202 • 707-822-4649 • FAX 707-822-6831

Printed on Recycled Paper

CLIENT: SHN Consulting Engineers and Geologists
Project: 001032, Former Fir Haven Shell
Lab Order: 0602082

CASE NARRATIVE

TPH as Gasoline:
Sample MW-1 appears to be similar to gasoline but certain peak ratios are not that of a fresh gasoline standard. The reported result represents the amount of material in the gasoline range.

BTEX:
Sample MW-1 was reported as ND with a dilution due to matrix interference.

The surrogate recoveries for the method blank and samples MW-3 and MW-2 were below the lower acceptance limit. The response of the reporting limit standard was such that the analytes would have been detected even with the low recovery; therefore, the data were accepted.

The relative percent difference (RPD) for the laboratory control samples was above the acceptance limit for MTBE. This indicates that the results could be variable. Since there were no detectable levels of analyte in the samples, the data were accepted.

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Date: 15-Feb-06
WorkOrder: 0602082

ANALYTICAL REPORT

Client Sample ID: MW-3 **Received:** 2/3/06 **Collected:** 2/2/06 11:55
Lab ID: 0602082-01A

Test Name: BTEX **Reference:** EPA 5030/EPA 8021B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
MTBE	ND	3.0	µg/L	1.0		2/14/06
Benzene	ND	0.50	µg/L	1.0		2/14/06
Toluene	ND	0.50	µg/L	1.0		2/14/06
Ethylbenzene	ND	0.50	µg/L	1.0		2/14/06
m,p-Xylene	ND	0.50	µg/L	1.0		2/14/06
o-Xylene	ND	0.50	µg/L	1.0		2/14/06
Surrogate: Cis-1,2-Dichloroethylene	83.7	85-115	% Rec	1.0		2/14/06

Test Name: TPH as Gasoline **Reference:** EPA 5030/GCFID(LUFT)/EPA 8015B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
TPHC Gas (C6-C14)	ND	50	µg/L	1.0		2/14/06

Client Sample ID: MW-4 **Received:** 2/3/06 **Collected:** 2/2/06 12:35
Lab ID: 0602082-02A

Test Name: BTEX **Reference:** EPA 5030/EPA 8021B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
MTBE	ND	3.0	µg/L	1.0		2/14/06
Benzene	ND	0.50	µg/L	1.0		2/14/06
Toluene	ND	0.50	µg/L	1.0		2/14/06
Ethylbenzene	ND	0.50	µg/L	1.0		2/14/06
m,p-Xylene	ND	0.50	µg/L	1.0		2/14/06
o-Xylene	ND	0.50	µg/L	1.0		2/14/06
Surrogate: Cis-1,2-Dichloroethylene	88.9	85-115	% Rec	1.0		2/14/06

Test Name: TPH as Gasoline **Reference:** EPA 5030/GCFID(LUFT)/EPA 8015B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
TPHC Gas (C6-C14)	ND	50	µg/L	1.0		2/14/06

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Date: 15-Feb-06
WorkOrder: 0602082

ANALYTICAL REPORT

Client Sample ID: MW-2 **Received:** 2/3/06 **Collected:** 2/2/06 14:20
Lab ID: 0602082-03A

Test Name: BTEX **Reference:** EPA 5030/EPA 8021B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
MTBE	ND	3.0	µg/L	1.0		2/14/06
Benzene	ND	0.50	µg/L	1.0		2/14/06
Toluene	ND	0.50	µg/L	1.0		2/14/06
Ethylbenzene	ND	0.50	µg/L	1.0		2/14/06
m,p-Xylene	ND	0.50	µg/L	1.0		2/14/06
o-Xylene	ND	0.50	µg/L	1.0		2/14/06
Surrogate: Cis-1,2-Dichloroethylene	79.2	85-115	% Rec	1.0		2/14/06

Test Name: TPH as Gasoline **Reference:** EPA 5030/GCFID(LUFT)/EPA 8015B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
TPHC Gas (C6-C14)	ND	50	µg/L	1.0		2/14/06

Client Sample ID: MW-1 **Received:** 2/3/06 **Collected:** 2/2/06 15:05
Lab ID: 0602082-04A

Test Name: BTEX **Reference:** EPA 5030/EPA 8021B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
MTBE	ND	300	µg/L	100		2/14/06
Benzene	2,100	500	µg/L	1,000		2/14/06
Toluene	1,500	500	µg/L	1,000		2/14/06
Ethylbenzene	610	50	µg/L	100		2/14/06
m,p-Xylene	1,900	500	µg/L	1,000		2/14/06
o-Xylene	690	50	µg/L	100		2/14/06
Surrogate: Cis-1,2-Dichloroethylene	95.0	85-115	% Rec	100		2/14/06

Test Name: TPH as Gasoline **Reference:** EPA 5030/GCFID(LUFT)/EPA 8015B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
TPHC Gas (C6-C14)	24,000	5,000	µg/L	100		2/14/06

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North Coast Laboratories, Ltd.

Date: 15-Feb-06

CLIENT: SHN Consulting Engineers and Geologists
Work Order: 0602082
Project: 001032, Former Fir Haven Shell

QC SUMMARY REPORT

Method Blank

Sample ID: **MB-2/13/06** Batch ID: **R39734** Test Code: **BTXEW** Units: **µg/L** Analysis Date: **2/13/06 11:20:06 PM** Prep Date:

Client ID: Run ID: **ORGC8_060213B** SeqNo: **570922**

Analyte	Result	Limit	SPK value	SPK Ref Val	% Rec	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
MTBE	ND	3.0									
Benzene	ND	0.50									
Toluene	ND	0.50									
Ethylbenzene	ND	0.50									
m,p-Xylene	ND	0.50									
o-Xylene	ND	0.50									
Cis-1,2-Dichloroethylene	0.801	0.10	1.00	0	80.1%	85	115	0			S

Sample ID: **MB-2/13/06** Batch ID: **R39733** Test Code: **TPHCGW** Units: **µg/L** Analysis Date: **2/13/06 11:20:06 PM** Prep Date:

Client ID: Run ID: **ORGC8_060213A** SeqNo: **570903**

Analyte	Result	Limit	SPK value	SPK Ref Val	% Rec	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
TPHC Gas (C6-C14)	ND	50									

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank

North Coast Laboratories, Ltd.

Date: 15-Feb-06

CLIENT: SHN Consulting Engineers and Geologists
Work Order: 0602082
Project: 001032, Former Fir Haven Shell

QC SUMMARY REPORT

Laboratory Control Spike

Sample ID: **LCS-06097** Batch ID: **R39734** Test Code: **BTXEW** Units: **µg/L** Analysis Date: **2/13/06 8:27:41 PM** Prep Date:
Client ID: Run ID: **ORGC8_060213B** SeqNo: **570920**

Analyte	Result	Limit	SPK value	SPK Ref Val	% Rec	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
MTBE	41.62	3.0	40.0	0	104%	85	115	0			
Benzene	4.857	0.50	5.00	0	97.1%	85	115	0			
Toluene	4.907	0.50	5.00	0	98.1%	85	115	0			
Ethylbenzene	4.867	0.50	5.00	0	97.3%	85	115	0			
m,p-Xylene	9.836	0.50	10.0	0	98.4%	85	115	0			
o-Xylene	4.922	0.50	5.00	0	98.4%	85	115	0			
Cis-1,2-Dichloroethylene	1.05	0.10	1.00	0	105%	85	115	0			

Sample ID: **LCSD-06097** Batch ID: **R39734** Test Code: **BTXEW** Units: **µg/L** Analysis Date: **2/14/06 5:36:06 AM** Prep Date:
Client ID: Run ID: **ORGC8_060213B** SeqNo: **570932**

Analyte	Result	Limit	SPK value	SPK Ref Val	% Rec	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
MTBE	35.53	3.0	40.0	0	88.8%	85	115	41.6	15.8%	15	R
Benzene	4.714	0.50	5.00	0	94.3%	85	115	4.86	2.97%	15	
Toluene	4.778	0.50	5.00	0	95.6%	85	115	4.91	2.66%	15	
Ethylbenzene	4.748	0.50	5.00	0	95.0%	85	115	4.87	2.47%	15	
m,p-Xylene	9.550	0.50	10.0	0	95.5%	85	115	9.84	2.95%	15	
o-Xylene	4.754	0.50	5.00	0	95.1%	85	115	4.92	3.46%	15	
Cis-1,2-Dichloroethylene	0.936	0.10	1.00	0	93.6%	85	115	1.05	11.2%	15	

Sample ID: **LCS-06098** Batch ID: **R39733** Test Code: **TPHCGW** Units: **µg/L** Analysis Date: **2/13/06 9:36:49 PM** Prep Date:
Client ID: Run ID: **ORGC8_060213A** SeqNo: **570901**

Analyte	Result	Limit	SPK value	SPK Ref Val	% Rec	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
TPHC Gas (C6-C14)	486.5	50	500	0	97.3%	85	115	0			

Qualifiers: ND - Not Detected at the Reporting Limit; S - Spike Recovery outside accepted recovery limits; B - Analyte detected in the associated Method Blank; J - Analyte detected below quantitation limits; R - RPD outside accepted recovery limits

CLIENT: SHN Consulting Engineers and Geologists
Work Order: 0602082
Project: 001032, Former Fir Haven Shell

QC SUMMARY REPORT

Laboratory Control Spike Duplicate

Sample ID: **LCSD-06098** Batch ID: **R39733** Test Code: **TPHCGW** Units: **µg/L** Analysis Date: **2/14/06 6:10:00 AM** Prep Date:

Client ID: Run ID: **ORGC8_060213A** SeqNo: **570913**

Analyte	Result	Limit	SPK value	SPK Ref Val	% Rec	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
TPHC Gas (C6-C14)	463.2	50	500	0	92.6%	85	115	486	4.90%	15	

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank

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Chain of Custody

#0607082 P. 1 of 1

LABORATORY NUMBER:

Attention: Frans Lowman
Results & Invoice to: SHN
Address: 812 West Wabash Avenue
Eureka, CA 95501
Phone: 441-8855
Copies of Report to:
Sampler (Sign & Print): Ann D. Tulley Aaron Melody

TAT: ☐ 24 Hr ☐ 48 Hr ☐ 5 Day ☐ 5–7 Day
☒ STD (2–3 Wk) ☐ Other:
PRIOR AUTHORIZATION IS REQUIRED FOR RUSHES

REPORTING REQUIREMENTS: State Forms ☐
Preliminary: FAX ☐ Verbal ☐ By:__/__/__
Final Report: FAX ☐ Verbal ☐ By:__/__/__

CONTAINER CODES: 1—½ gal. pl; 2—250 ml pl; 3—500 ml pl; 4—1 L Nalgene; 5—250 ml BG; 6—500 ml BG; 7—1 L BG; 8—1 L cg; 9—40 ml VOA; 10—125 ml VOA; 11—4 oz glass jar; 12—8 oz glass jar; 13—brass tube; 14—other

PRESERVATIVE CODES: a—HNO_3; b—HCl; c—H_2SO_4; d—$Na_2S_2O_3$; e—NaOH; f—$C_2H_3O_2Cl$; g—other

PROJECT INFORMATION
Project Number: 001032
Project Name: Former Fir Haven Shell
Purchase Order Number:

LAB ID	SAMPLE ID	DATE	TIME	MATRIX*	ANALYSIS: TPHG/BTEX/MTBE	CONTAINER	PRESERVATIVE
	MW-3	2·2·06	1155	GW	X	9	b
	MW-4	↓	1235	↓	X		
	MW-2	↓	1420	↓	X		
	MW-1	↓	1505	↓	X		

SAMPLE CONDITION/SPECIAL INSTRUCTIONS
EDF
cooler temp = 5.6°C

RELINQUISHED BY (Sign & Print)	DATE/TIME	RECEIVED BY (Sign)	DATE/TIME
Ann D. Tulley Aaron Melody	2·3·06	Jennifer Martin	2-3-06 1400

SAMPLE DISPOSAL
☒ NCL Disposal of Non-Contaminated
☐ Return ☐ Pickup

CHAIN OF CUSTODY SEALS Y/N/NA
SHIPPED VIA: UPS Air-Ex Fed-Ex Bus Hand

PU

***MATRIX:** DW=Drinking Water; Eff=Effluent; Inf=Influent; SW=Surface Water; GW=Ground Water; S=Soil; O=Other.

ALL CONTAMINATED NON-AQUEOUS SAMPLES WILL BE RETURNED TO CLIENT