GeoResearch

3777 Depot Road, Suite 418
Hayward, California 94545
Phone: (510) 785-1111
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January 3, 1994

Ms. Tina Berry
Unocal Corporation Environmental Remediation & Technology
2000 Crow Canyon Place
San Ramon, CA 94583

RE: MONITORING WELL INSTALLATION AT UNOCAL SERVICE STATION #5367, 500 BANCROFT AVENUE, SAN LEANDRO, CALIFORNIA.

Dear Ms. Berry:

This letter report details the results and methodology for the installation of monitoring well MW9 adjacent to Unocal service station #5367 at 500 Bancroft Avenue in San Leandro, California (Figure 1). The work was conducted for Unocal Corporation Environmental Remediation & Technology (Unocal CERT) in accordance with the GeoResearch Feasibility Study Report for Ground Water submitted to the Alameda County Health Care Services Agency, Department of Environmental Health (ACHA) dated July 22, 1994. The purpose of the installation of the well was to assess the distribution of petroleum hydrocarbons in the ground-water north of the subject site.

SCOPE OF WORK

The scope of work for the investigation included the following:

- Permitting of the monitoring well;
- Drilling of one soil boring and collection of a soil sample;
- Completion of the soil boring as a monitoring well;
- Development and surveying of the new monitoring well;
- Ground-water sampling of the new monitoring well;
- Analysis of soil and ground-water samples; and
- Preparation of a letter report outlining the work conducted.

BACKGROUND

Unocal service station 5367 is at the east corner of the intersection of Bancroft Avenue and Dowling Boulevard in San Leandro, California (Figure 2). Two underground storage

tanks (USTs) were removed from the site in 1987 and replaced with new USTs at the same location. Total petroleum hydrocarbons as gasoline (TPH-G) impacted soil was excavated and remediated on site by aeration and, upon verification of successful treatment, was transported off site for disposal (Applied GeoSystems, 1987).

Eight soil borings were completed in the site vicinity and converted to ground-water monitoring wells between 1987 and 1990. Five borings/wells were completed within the subject property boundaries and three borings/wells were completed off-site to the west and southwest of the site (Applied GeoSystems, 1987, 1988, 1990).

Soil samples collected during drilling indicate TPH-G and benzene, toluene, ethylbenzene, and total xylenes (BTEX) concentrations in soil between 25 and 30 feet below ground surface (bgs). Ground-water samples collected from the eight monitoring wells indicate TPH-G has impacted ground water beneath the site in the vicinity of the former USTs and pump islands. The impacted ground water appears to have migrated off-site to the west. The ground-water flow direction in the site vicinity is generally to the west towards MW-8 (Applied GeoSystems, 1987, 1988, 1990 and MPDS, 1993, 1994).

In a letter to Unocal dated July 1, 1994, the ACHA requested that additional assessment be completed to the north of the UST area and to the southwest of monitoring well MW-8. The scope of work detailed in this report addresses this request.

PRE-FIELD ACTIVITIES

Prior to field activities, a permit for drilling was obtained from the Zone 7 Water Agency and an encroachment permit was obtained from the City of San Leandro. Additionally, GeoResearch contacted Underground Service Alert (USA) to clear the borings of underground utility lines. Due to subsurface lines in the original location (sidewalk of Bancroft Avenue), the boring was moved into the northbound parking lane of Bancroft Avenue (Figure 2).

SUBSURFACE INVESTIGATION

On December 16, 1994, one soil boring, designated as MW9, was drilled to the north of the site using a CME-75 mobile drilling rig equipped with 8-inch outer-diameter (OD) hollow-stem augers. The drilling was conducted by Bayland Drilling (BD) of Menlo Park, California, under the direction of GeoResearch. Soil boring MW9 was drilled to a depth of approximately 45 feet bgs with a soil sample collected at the interpreted soil/ground-water interface. The field work was conducted in accordance with the field procedures outlined in Appendix A. The boring log is presented in Appendix B.

The lithologies observed during drilling at the site generally consisted of a silty clay (CL) to approximately 29 feet bgs. The clay was generally stiff and yellowish brown with low plasticity and minor fine to coarse sand. At 29 feet bgs, a silt (ML) was detected. The silt was stiff, yellowish brown, and wet. Ground-water was detected at approximately 30 feet bgs. Volatile organic compound (VOC) vapors were not detected in the soil sample collected from MW9 using a Century 128 organic vapor analyzer (OVA). VOC vapors were not detected in any of the soil cuttings.

Immediately following drilling, soil boring MW9 was completed as a monitoring well. The well was constructed with approximately 20 feet of 2-inch-diameter polyvinyl chloride (PVC) schedule 40 blank casing and 25 feet of 2-inch-diameter 0.020 slotted casing. The filter pack was emplaced using No. 3 Monterey Sand, and the well was sealed with a portland cement/bentonite slurry. The well was screened between 20 to 45 feet bgs with the bottom of the well set at approximately 45 feet bgs. The installation of the well was conducted by BD under the direction of GeoResearch. The well was installed in accordance with the field procedures outlined in Appendix A. Well details are shown on boring log MW9 presented in Appendix B.

probably needed finer well screen pack ?

Prior to setting the annular well seal, monitoring well MW9 was developed by the surge and bail method. The well was alternately surged with a surge block for approximately 10 to 15 minutes, and then bailed for approximately the same length of time. During development, approximately 25 gallons of ground water were purged from the well. Development of the monitoring well was conducted in accordance with the field procedures presented in Appendix A.

The water purged from the well was cloudy with suspended silt and clay. Turbidity of the water generally remained unchanged throughout well development. No petroleum hydrocarbon odors were noted in the purged development water.

As part of the routine quarterly monitoring and sampling of the site, monitoring well MW9 was sampled by MPDS of Concord, California on December 19, 1994. The results of the quarterly monitoring and sampling activities will be included in the fourth quarter ground-water monitoring report for the site.

LABORATORY ANALYSIS

The soil sample collected from monitoring well MW9 was submitted to Sequoia Analytical (Sequoia), of Redwood City, California, a state-certified hazardous waste laboratory. The soil sample was analyzed for TPH-G in accordance with the California Department of Health Services (DOHS) Methods for TPH-G characterization. In addition, the soil samples were analyzed for BTEX in accordance with Environmental Protection Agency (EPA) Method 8020. The results of the soil analyses indicated that the soil sample was below detection limits for both TPH-G and BTEX. Laboratory reports and chain-of-custody documentation are included in Appendix C.

The ground-water sample collected from MW-9 was also submitted to Sequoia. The ground-water sample was analyzed for TPH-G and BTEX with the results indicating that the sample was below detection limits for both TPH-G and benzene.

ADDITIONAL INVESTIGATION

In the July 1, 1994 ACHA letter, the ACHA requested that additional assessment be completed to the north of the UST area and to the southwest of monitoring well MW-8. Well MW9 was drilled to assess soil and ground water to the north of the UST area; however, due to difficulties in obtaining site access southwest of MW8, a well has not been drilled in this location. GeoResearch and Unocal have made repeated attempts to obtain site access to the property at 525 Bancroft Avenue (Hoopes Property). In a letter dated December 7, 1994 to ACHA, GeoResearch requested your assistance if an additional down-gradient well is to be installed.

GeoResearch has also conducted a 72-hour vapor extraction test (VET) at the property and completed a site reconnaissance of the site vicinity for monitoring and extraction wells. The results of the VET and the site reconnaissance will be included in the Amended Site Feasibility Report to be submitted to the ACHA by January 15, 1995

CONCLUSIONS

Based on the information presented in this report and the professional judgement of GeoResearch, the following conclusion has been reached:

- Ground-water impacted by gasoline and benzene has not migrated to well MW9 north of the site.

STATEMENT OF LIMITATIONS AND PROFESSIONAL CERTIFICATION

Information provided in this report for GeoResearch Project Number 9480600100 is intended exclusively for Unocal CERT for evaluation of the monitoring well installation at Unocal service station #5367 in San Leandro, California. The professional services provided have been performed in accordance with practices generally accepted by other geologists, hydrologists, hydrogeologists, engineers, and environmental scientists practicing in this field. No other warranty, either expressed or implied, is made. As with all subsurface investigations, there is no guarantee that the work conducted will identify any or all sources or locations of contamination.

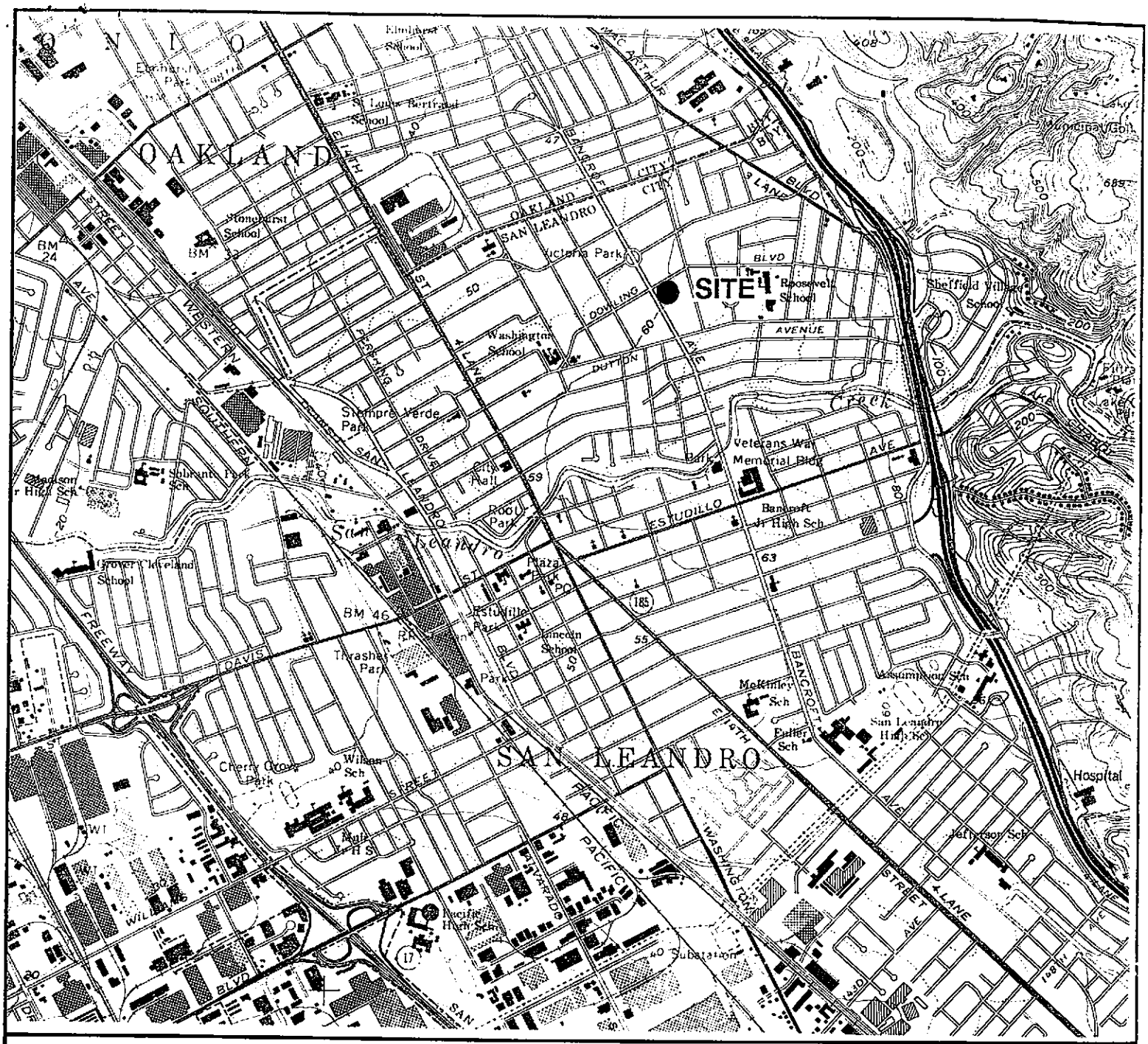
This report is issued with the understanding that the Client is responsible for ensuring that the information contained in this report is brought to the attention of the appropriate building owners and/or regulatory agencies. The enclosed report has been reviewed by a Registered Geologist in the State of California whose signature and certification number appears below.

If you have any questions regarding this report or any aspect of the project, please contact Mr. Frank R. Poss at (510) 785-1111.

Sincerely,

Frank R. Poss
Associate Hydrogeologist

Warren W. Gross, CEG #1528
Associate Hydrogeologist



REFERENCE:
U.S.G.S. SAN LEANDRO QUADRANGLE, 1959,
PHOTOREVISED 1980

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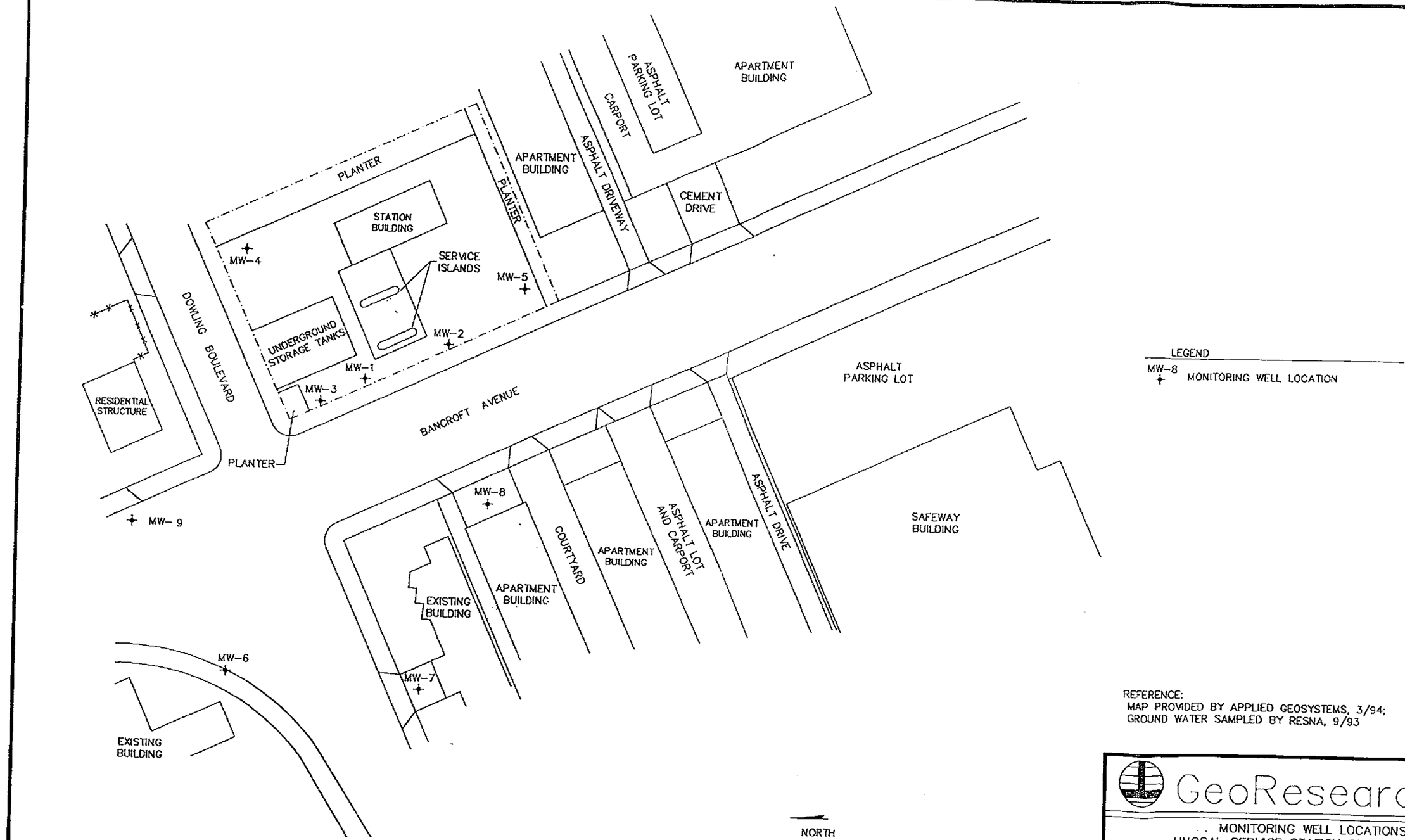
SITE LOCATION
UNOCAL SERVICE STATION 5367
500 BANCROFT AVENUE
SAN LEANDRO, CALIFORNIA
PROJECT NUMBER 9480600100

DATE: 3/15/94	CKD BY:	FIGURE NO: 1
FILE NO: A1		DRAWN BY: S.NASH



REFERENCE:
MAP PROVIDED BY APPLIED GEOSYSTEMS, 3/94;
GROUND WATER SAMPLED BY RESNA, 9/93

GeoResearch

MONITORING WELL LOCATIONS
UNOCAL SERVICE STATION 5367
500 BANCROFT AVENUE
SAN LEANDRO, CALIFORNIA
PROJECT NUMBER: 9480600100

DATE: 7/22/94	CKD BY:	FIGURE NO.: 2
FILE NO: C1		DRAWN BY: S.NASH

APPENDIX A

FIELD PROCEDURES

APPENDIX A
FIELD PROCEDURES

I. DRILLING OF SOIL BORINGS AND COLLECTION OF SOIL SAMPLES

The following procedures were used for the drilling and sampling of the soil borings drilled at the site:

1. Drilling was conducted by Bayland Drilling (BD) of Menlo Park, California under the supervision of GeoResearch. Drilling was performed using a CME-75 mobile drilling rig equipped with 8-inch outer-diameter (OD) hollow-stem continuous flight augers. Augers were reported to have been steam washed at BD's yard prior to use at the site and were steam washed on site between soil borings.

2. Prior to the commencement of drilling activities at the site, Underground Surface Alert (USA) was contacted to identify underground utilities in the areas that the well was located. In addition, the well location was hand-augured to an approximate depth of 5 feet below ground surface (bgs) prior to advancing the auger into the ground.

3. Boring logs for the soil borings drilled at the site were prepared under the supervision of a State-registered geologist. The soil cuttings observed during drilling were described in accordance with the Unified Soil Classification System.

4. A 2.5-inch inter diameter (ID) California Modified Split-Spoon Sampler (sampler) was used for the collection of soil samples. Prior to sampling, the sampler was lined with four precleaned 2-inch diameter stainless steel or brass tubes. Soil samples were collected by driving the sampler approximately 18-inches into the bottom of the soil boring through the center of the drilling bit using a 140 pound rig driven slide-hammer. The slide hammer was repeatedly dropped from approximately a 30-inch height and the blow counts were recorded in six inch increments.

5. The first tube in the sampler (deepest) was collected for analysis. The ends of the sample were covered with teflon sheets and capped with polyvinyl chloride (PVC) end caps. The sample was labeled and placed in a zip-lock bag in a chilled cooler pending delivery to the laboratory for analysis.

6. Soil samples were assigned identification numbers such as B1-5, where B1 indicates boring 1, and -5 indicates that the sample was collected at 5 feet bgs. The samples were labeled with the sampling designation, depth, date, client name, and project number.

7. A soil sample was collected at the interpreted soil/ground-water interface.

8. Soil samplers were washed between sampling intervals with Alconox soap followed by two deionized-water rinses.

9. Chain-of-custody procedures using chain-of-custody forms were used to document sample handling and transportation.

10. A Century 128 organic vapor analyzer (OVA) was used to monitor volatile organic compounds (VOCs) in the ambient air during drilling at the site in accordance with the site health and safety plan. VOC concentrations in the soil were measured and recorded on the borings logs for depths that soil samples were collected. VOCs in the soil were measured at the sampling depths by partially filling a brass tube with soil and capping the ends. The components of the soil were allowed to volatilize and fill the head space in the tube for approximately 30 minutes prior to inserting the OVA probe through one of the end caps and recording the measurements.

11. Soil cuttings and steam wash water generated during drilling activities at the site were contained in Department of Transportation (DOT) approved 55-gallon drums. The drums were labeled with the contents, date, well or boring number, client name, and project number.

II. WELL INSTALLATION

The following procedures were used for the installation of the monitoring well at the site:

1. The soil boring was completed as a monitoring well by installing 2-inch diameter PVC schedule 40 casing and 2-inch diameter PVC schedule 40 screen with 0.02 machined slotted and 1/4 spacing between slots. The bottom of the screen was fitted with a 2-inch PVC threaded end cap. All of the PVC sections are flush-threaded and were mechanically screwed together. The filter pack was constructed with #3 Monterey Sand and the seal was constructed with hydrated bentonite chips and portland cement.

2. The filter pack was installed by pouring the # 3 Monterey Sand slowly through the auger segments into the annulus surrounding the screen to a height approximately 1 foot above the top of the screen. The auger was incremental raised as the filter pack was being installed.

3. After the top of the filter pack was installed to approximately 1 foot above the screen, the well was surged using a surge block for approximately 15 to 20 minutes and until the level of the top of the filter pack stabilized. After surging the well, the level of the filter pack was reestablished at least 1 foot above the slots and the well seal was installed.

4. The well seal was installed by pouring approximately 2 feet of medium bentonite chips slowly through the auger segments on top of the filter pack. The bentonite was hydrated with approximately 5 gallons of potable water and allowed to set prior to installing the cement seal.

5. The remaining annular space above the bentonite seal was backfilled to approximately 2 feet bgs with portland cement. A 10-inch Emco-Wheaton well box was installed at the surface of the monitoring well to grade. The well box was set in concrete and the surface of the concrete was dyed black. The top of the well casing was capped with a locking well cap and locked with a lock.

6. Specific well construction details for the monitoring well is presented on boring log MW9 found in Appendix B.

IV. WELL DEVELOPMENT

The following procedures were used to develop the monitoring well at the site:

1. Subsequent to well installation, the water in the well was gently surged using a rubber surge block slightly smaller than the casing diameter for approximately 15 to 20 minutes.

2. Subsequent to surging the well, water was removed from the well using a 2-inch diameter PVC bailer. The well was purged of 3 to 5 well volumes (approximately 25-gallons).

3. One well volume was calculated by the following equation:

$V = 3.14 \times 7.481 \times h \left[r_1^2 + 0.3 \times (r^2 - r^2)^2 \right]$

where:

V = one well volume
h = (d1-d2)
d1 = depth of the well in feet

d2 = depth to ground water in feet
r1 = the radius of the well in feet
r2 = the radius of the filter pack in feet

4. All equipment was either washed by hand in Alconox solution followed by two deionized-water rinses or was steam washed prior to entering the well.

5. Purged development water was contained in a DOT approved 55-gallon drum. The drum was labeled with the contents, date, well number, client name, and project number.

APPENDIX B

BORING LOGS

KEY TO BORING LOG SYMBOLS

SOIL DESCRIPTIONS USED IN THIS REPORT ARE IN GENERAL ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM.

MAJOR DIVISONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE)	GRAVELS (MORE THAN 50% OF COARSE FRACTION IS LARGER THAN THE NO. 4 SIEVE SIZE)	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	Well-graded gravels or gravel sand mixtures, little or no fines.
			GP	Poorly-graded gravels or gravel sand mixture, little or no fines.
		GRAVELS WITH FINES (APPRECIABLE AMT. OF FINES)	GM	Silty gravels, gravel-sand-clay mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (MORE THAN 50% OF COARSE FRACTION IS SMALLER THAN THE NO.4 SIEVE SIZE)	CLEAN SANDS (LITTLE OR NO FINES)	SW	Well-graded sands or gravelly sands, little or no fines.
			SP	Poorly-graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (APPRECIABLE AMT. OF FINES)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE)	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)		ML	Inorganic silts & very fine-grained sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silt-clays of low plasticity.
	SILTS AND CLAYS (LIQUID LIMIT GREATER THAN 50)		MH	Inorganic silts, micaceous or diatomaceous fine-grained sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils.
			AF	Artificial fill material.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		
	NO.200	NO.40	NO.10	NO. 4	3/4 IN.	3 IN.	12 IN.

BOUNDRY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

DASHED LINES used to separate soil types represent approximate or gradational contacts.

SOLID LINES represesent sharp contacts.

B1-5 SAMPLE NUMBER

BLOWS/6" Numbers of BLOWS to drive sampler 6" into undisturbed soil. Driving weight of hammer and height of drop specified on page 1.

OVA Organic Vapor Analyzer reading in parts per million (ppm).

SAMPLE TYPES

	SPLIT-SPOON/RING
	CORE
B	BULK/JAR
	NO RECOVERY
	NOT SAMPLED

WELL CONSTRUCTION/ BORING COMPLETION

	SAND PACK/FILTER PACK
	BENTONITE ANNULAR SEAL
	BENTONITE/CEMENT ANNULAR SEAL
	CEMENT ANNULAR SEAL
	DRILL CUTTINGS
	BLANK CASING
	MACHINE-SLOTTED CASING

GeoResearch form #GR10K 8/95

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FIELD LOG OF BORING

BORING/WELL I.D. MW9
SHEET 1 OF 2

PROJECT NAME	PROJECT NUMBER	ELEVATION AND DATUM	REFERENCE
UNOCAL SAN LEANDRO	9480600100	NA	NA

DRILLING COMPANY	DRILLER	DATE & TIME STARTED	DATE & TIME COMPLETED
BAYLAND DRILLING	KURT VOSS'	12/16/94 11:20 AM	12/16/94

DRILLING EQUIPMENT METHOD	DIRECTION OF BORING	TOTAL DEPTH OF BORING
CME-75	[x] VERTICAL [ ] SLANT _____ DEG. FROM VERT	45 FT.

SIZE AND TYPE OF BIT	TOTAL NO. OF SAMPLES	BULK	SS	OTHER
8" HOLLOW STEM AUGER	1		1	

DRILLING FLUID	WATER LEVEL	FIRST	AFTER HOURS
NONE			

SAMPLER	HYDROGEOLOGIST/DATE	CHECKED BY/DATE
TYPE CAL MOD DRIVING WT. 130 DROP 30"	MICHAEL GUY 12/16/94	

DEPTH (FEET)	WELL CONST CSG	WELL CONST FILL	OVA (PPM)	SAMPLES NO.	SAMPLES TYPE	SAMPLES BLOWS /6"	GRAPH. LOG	SOIL CLASS (USCS)	DESCRIPTION OF MATERIALS	REMARKS
0								AF	ASPHALT	
								CL	[redacted]CLAY, moderate yellowish-brown, stiff, moist, low to medium plasticity, minor fine to coarse sand. Becomes low plasticity at 4.5 ft.	
5										
10										
15										
20									Becomes clay between 23-25 ft. and [redacted]	
25										

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FIELD LOG OF BORING

BORING/WELL I.D. MW9
SHEET 2 OF 2

PROJECT NAME	PROJECT NUMBER	HYDROGEOLOGIST	CHECKED BY/DATE
UNOCAL SAN LEANDRO	9480600100	MICHAEL GUY 12/16/94	

DEPTH (FEET)	WELL CONST CSG	WELL CONST FILL	OVA (PPM)	SAMPLES NO.	SAMPLES TYPE	SAMPLES BLOWS /6"	GRAPH. LOG	SOIL CLASS (USCS)	DESCRIPTION OF MATERIALS	REMARKS
								CL	**SILTY CLAY**, yellowish-brown, stiff, moist, low plasticity, minor to coarse sand.	
			0			2 3 5		ML	**SILT**, moderate yellowish-brown, stiff, [redacted]	
30										
35										
40										
45									Boring terminated at 4 ft.	

APPENDIX C

LABORATORY REPORTS AND CHAIN-OF-CUSTODY RECORDS

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
1900 Bates Avenue, Suite L, Concord, CA 94520, (510) 686-9600, FAX (510) 686-9689
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Kapreallan Engineering Inc.
2401 Stanwell Drive Suite 400
Concord, CA 94520

Attention: Avo Avedesslan

Client Proj. ID: Unocal SS# 5367, San Leandro
Sample Descript: MW-9
Matrix: LIQUID
Analysis Method: 8015Mod/8020
Lab Number: 9412B55-05

Sampled: 12/19/94
Received: 12/19/94

Analyzed: 12/20/94
Reported: 12/22/94

QC Batch Number: GC121994BTEX03A
Instrument ID: GCHP03

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit ug/L	Sample Results ug/L
TPPH as Gas	50	N.D.
Benzene	0.50	N.D.
Toluene	0.50	1.6
Ethyl Benzene	0.50	1.5
Xylenes (Total)	0.50	8.4
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	104

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Suzanne Chin
Project Manager

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
1900 Bates Avenue, Suite L, Concord, CA 94520, (510) 686-9600, FAX (510) 686-9689
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Geo Research
3777 Depot Road Suite 418
Hayward, CA 94545

Attention: Frank Poss

Client Proj. ID: Unocal 5367 San Leandro
Sample Descript: MW9-30
Matrix: SOLID
Analysis Method: 8015Mod/8020
Lab Number: 9412B41-01

Sampled: 12/16/94
Received: 12/16/94
Extracted: 12/27/94
Analyzed: 12/27/94
Reported: 01/04/95

QC Batch Number: GC122894BTEXEXA
Instrument ID: GCHP 18

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	82

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Andrea Fulcher
Project Manager