



**GeoStrategies Inc.**

**QUARTERLY MONITORING REPORT**

UNOCAL Service Station No. 5325  
3220 Lakeshore Avenue  
Oakland, California

781401-10

April 28, 1992



**GeoStrategies Inc.**

2140 WEST WINTON AVENUE  
HAYWARD, CALIFORNIA 94545

(510) 352-4800

April 28, 1992

Unocal Corporation  
P.O. Box 5155  
San Ramon, California 94583

Attn: Mr. Tim Ripp

Re: QUARTERLY MONITORING REPORT  
Unocal Service Station #5325  
3220 Lakeshore Avenue  
Oakland, California

Mr. Ripp:

This Quarterly Monitoring Report has been prepared by GeoStrategies Inc. (GSI) and presents the results of the 1992 first quarter sampling for the above-referenced site (Plate 1).

There are currently three monitoring wells at the site; Wells U-1, U-2, and U-3 (Plate 2). These wells were installed in 1990 by GSI.

**CURRENT QUARTER SAMPLING RESULTS**

Depth to water-level measurements were obtained in each monitoring well on February 12, 1992. Static ground-water levels were measured from the surveyed top of the well box and recorded to the nearest  $\pm 0.01$  foot. Water-level elevations were referenced to Mean Sea Level (MSL) datum and are presented in Table 1. Water-level data were used to construct a quarterly potentiometric map (Plate 3). Shallow ground-water flow direction is to the south with an approximate hydraulic gradient of 0.005.

# GeoStrategies Inc.

Unocal Corporation  
April 28, 1992  
Page 2

Each well was checked for the presence of floating product. Floating product was not observed in the wells this quarter.

Ground-water samples were collected on February 12, 1992. Samples were analyzed for Total Petroleum Hydrocarbons calculated as Gasoline (TPH-Gasoline), according to EPA Method 8015 (Modified) and for Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) according to EPA Method 8020. The ground-water samples were analyzed by Sequoia Analytical, a California State-certified laboratory located in Redwood City, California. The laboratory analytical report and Chain-of-Custody form are included in Appendix A. These data are summarized and included with the historical chemical analytical data presented in Table 2. A chemical concentration map for benzene is presented on Plate 4. Groundwater sampling field methods and procedures are included in Appendix B.

If you have any questions, please call.

GeoStrategies Inc. by,

*Ellen C. Fostersmith*

Ellen C. Fostersmith  
Geologist

*Diane M. Lundquist*  
Diane M. Lundquist, P.E.  
Senior Engineer  
C 46725



ECF/DML/kjj

Plate 1. Vicinity Map  
Plate 2. Site Plan  
Plate 3. Potentiometric Map  
Plate 4. Benzene Concentration Map

Appendix A: Laboratory Analytical Report and Chain-of-Custody Form  
Appendix B: Field Methods and Procedures

QC Review: *JZF*

781401-10

TABLE 1

## FIELD MONITORING DATA

WELL NO.	MONITORING DATE	CASING DIA. (IN)	TOTAL WELL DEPTH (FT)	WELL ELEV. (FT)	DEPTH TO WATER (FT)	PRODUCT THICKNESS (FT)	STATIC WATER ELEV. (FT)	PURGED WELL VOLUMES	pH	TEMPERATURE (F)	CONDUCTIVITY (u MHOS/CM)
U-1	12-Feb-92	3	20.2	5.75	8.87	----	-3.12	5	7.35	65.9	2150
U-2	12-Feb-92	3	19.9	4.94	8.22	----	-3.28	2	7.13	66.7	5220
U-3	12-Feb-92	3	20.0	8.14	11.70	----	-3.56	2	7.42	64.0	895

- Notes: 1. Static water elevations referenced to Mean Sea Level (MSL).  
 2. Physical parameter measurements represent stabilized values.

TABLE 2

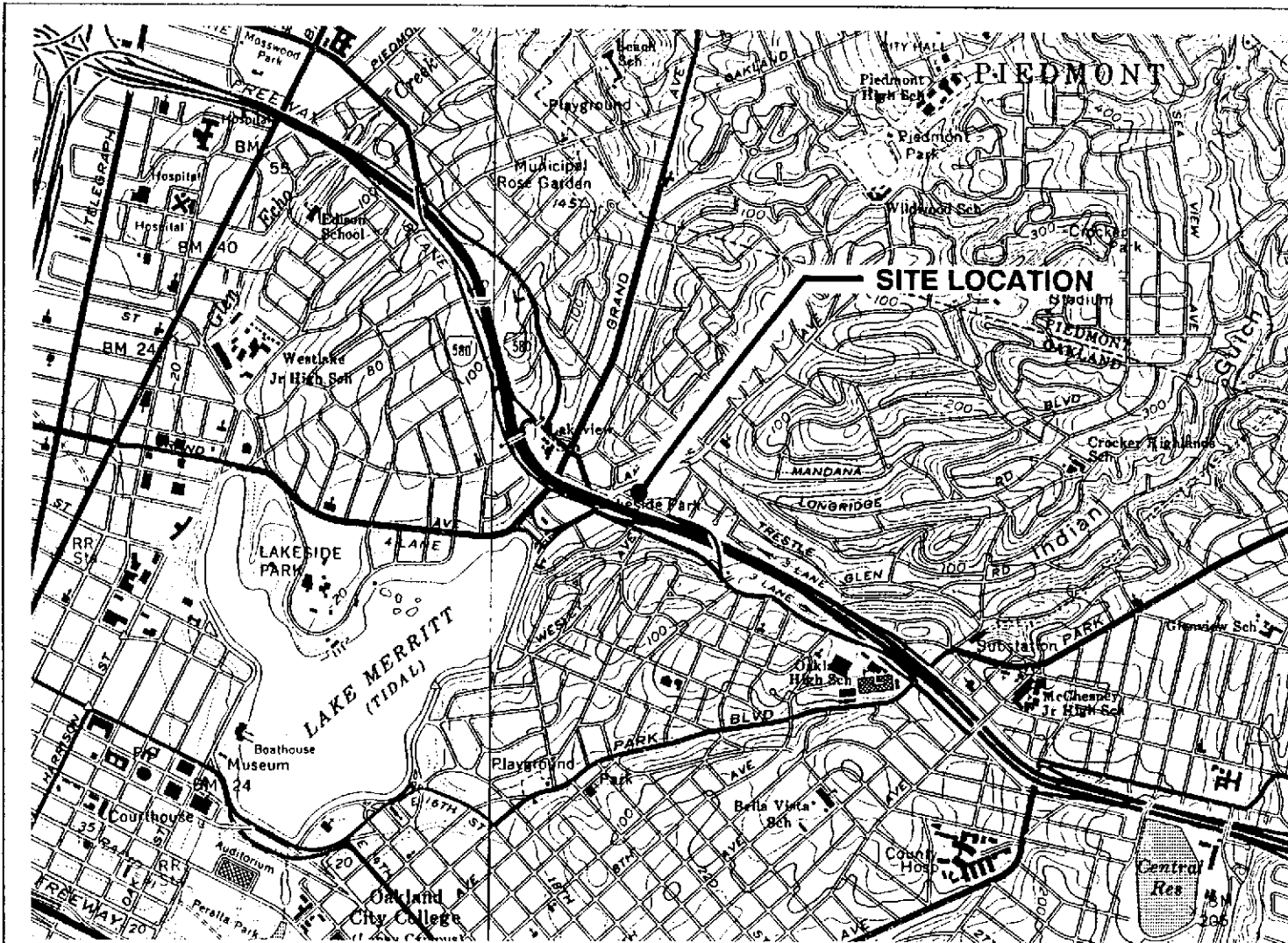
## HISTORICAL GROUND-WATER QUALITY DATABASE

SAMPLE DATE	SAMPLE POINT	TPH-G (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)
08-Oct-90	U-1	690.	38.	75.	8.6	130.
07-Jan-91	U-1	250.	22.	16.	4.2	17.
01-Apr-91	U-1	160.	13.	8.6	1.0	15.
03-Jul-91	U-1	140	21	4.3	0.36	17
09-Oct-91	U-1	<30	<0.30	<0.30	<0.30	<0.30
12-Feb-92	U-1	250	<0.30	<0.30	<0.30	<0.30
08-Oct-90	U-2	780.	27.	46.	15.	130.
07-Jan-91	U-2	1900.	67.	5.8	58.	69.
01-Apr-91	U-2	1700.	250.	89.	34.	190.
03-Jul-91	U-2	2100	150	25	3.1	290
09-Oct-91	U-2	230	7.1	<0.30	<0.30	11
12-Feb-92	U-2	410	1.9	<0.30	0.36	0.40
08-Oct-90	U-3	<50.	<0.5	<0.5	<0.5	<0.5
07-Jan-91	U-3	<50.	<0.5	<0.5	<0.5	1.8
01-Apr-91	U-3	<50.	1.0	2.9	0.53	5.4
03-Jul-91	U-3	<30	<0.30	<0.30	<0.30	<0.30
09-Oct-91	U-3	<30	<0.30	<0.30	<0.30	<0.30
12-Feb-92	U-3	<30	<0.30	<0.30	<0.30	<0.30

TPH-G = Total Petroleum Hydrocarbons calculated as Gasoline

PPB = Parts Per Billion

NOTE 1. All data shown as <X are reported as ND (none detected).



Base Map: USGS Topographic Map

Approximate Scale: 1" = 2000'



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Vicinity Map  
 UNOCAL Service Station #5325  
 3220 Lakeshore Avenue  
 Oakland, California

PLATE

1

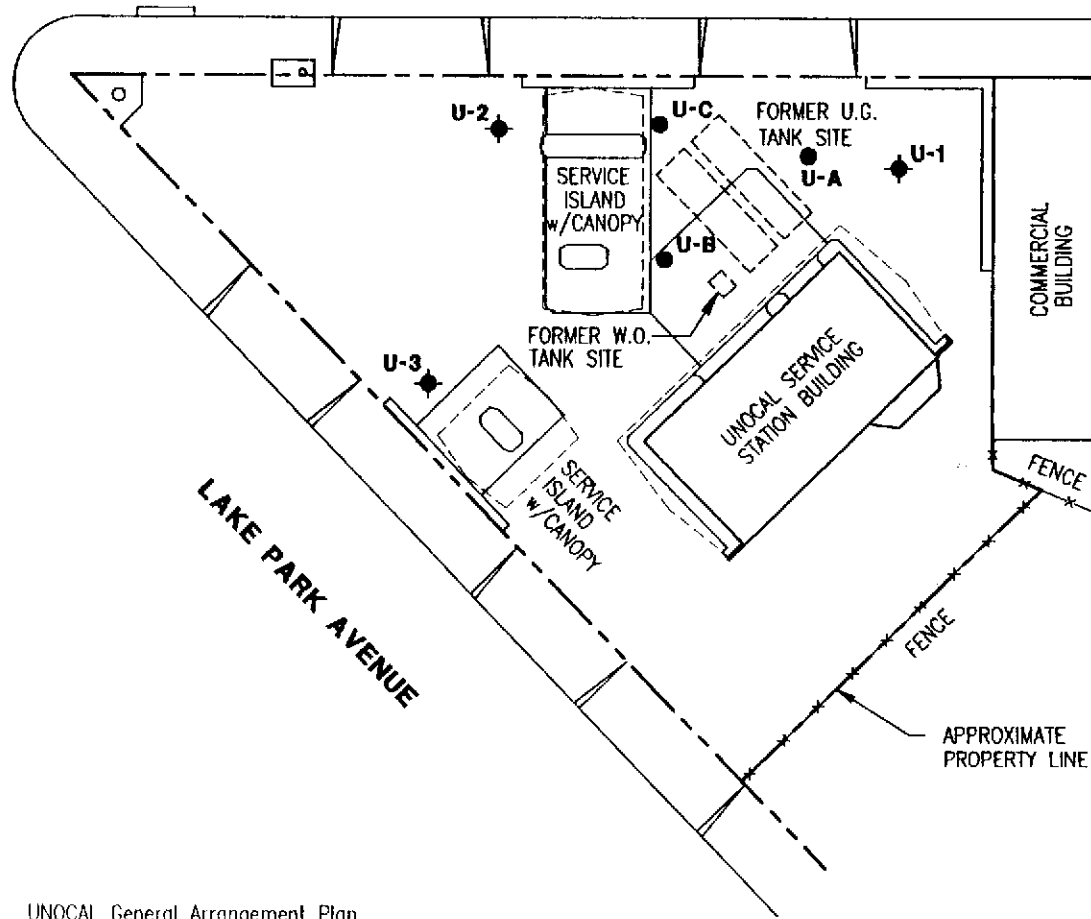
JOB NUMBER  
7814

REVIEWED BY RG/CEG  
*RG*

DATE  
6/90

REVISED DATE

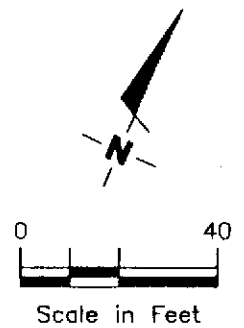
LAKESHORE AVENUE



EXPLANATION

- ◆ Ground-water monitoring well
- Soil boring

Base Map: UNOCAL General Arrangement Plan dated 7-8-66 (Rev, 12-4-84) and field observations



GeoStrategies Inc.

**SITE PLAN**  
UNOCAL Service Station #5325  
3220 Lakeshore Avenue  
Oakland, California

PLATE

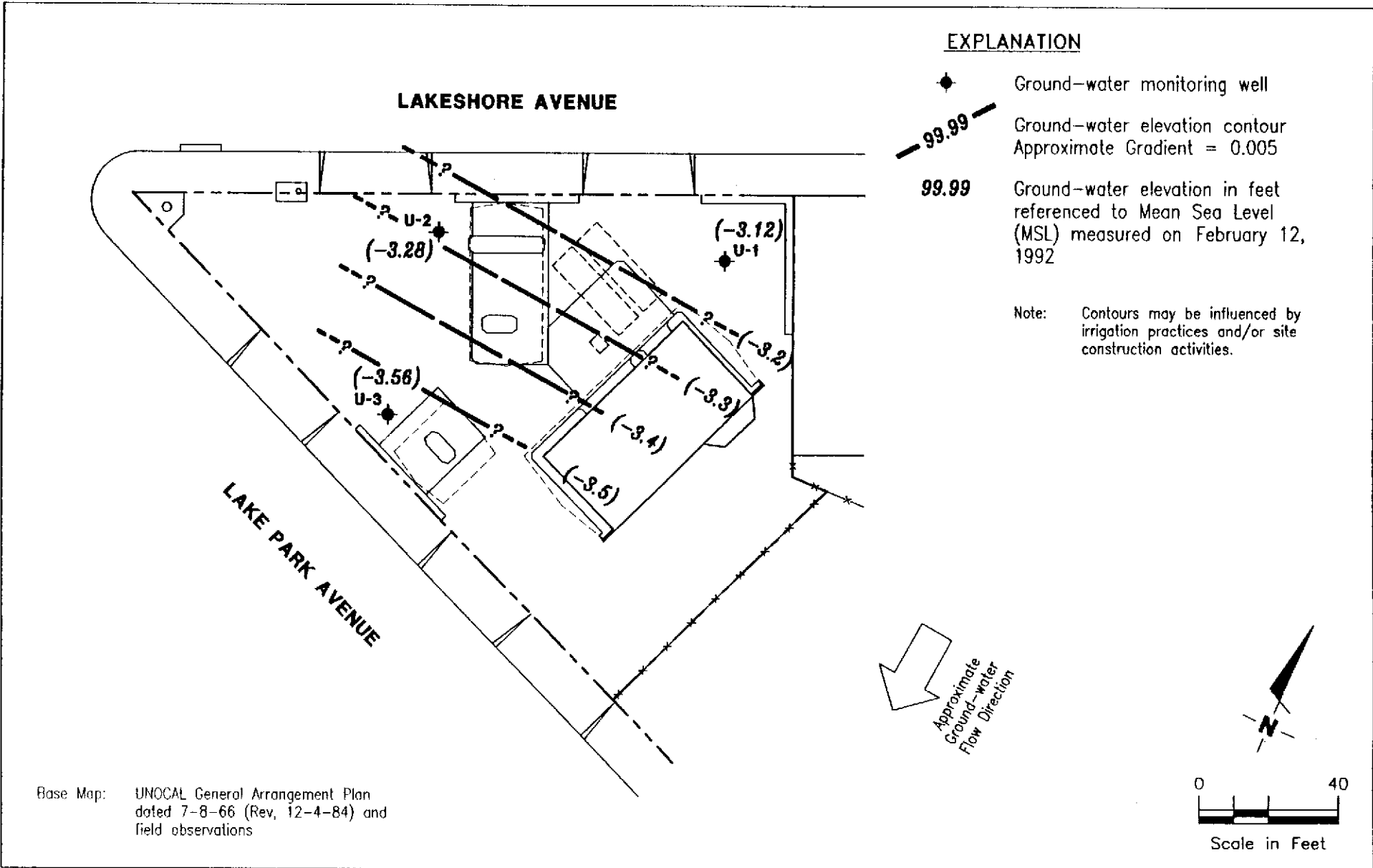
**2**

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7814

REVIEWED BY  
*sw*

DATE  
5/92

REVISED DATE



GeoStrategies Inc.

**POTENTIOMETRIC MAP**  
UNOCAL Service Station #5325  
3220 Lakeshore Avenue  
Oakland, California

PLATE

**3**

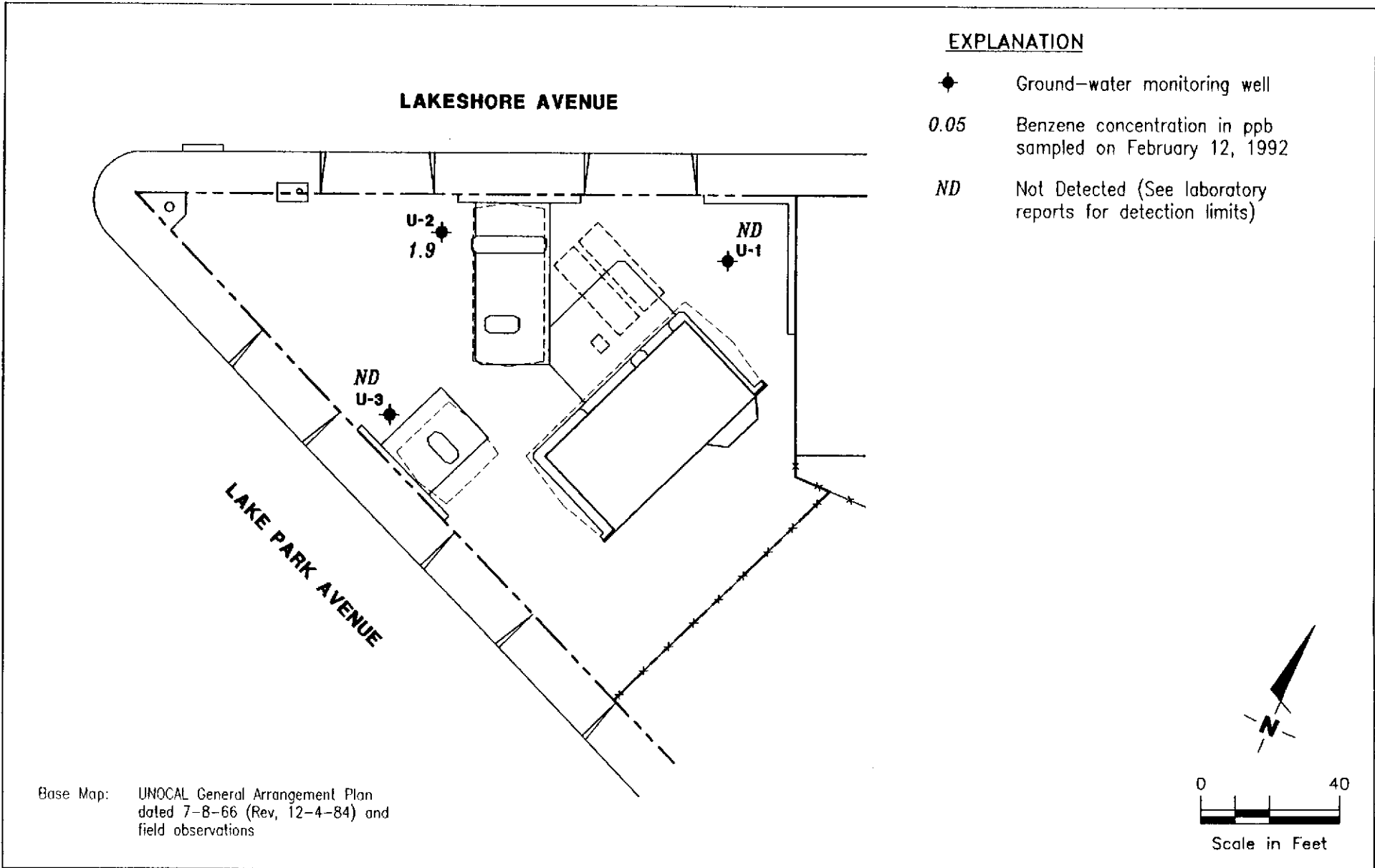
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781401-10

REVIEWED BY  
[Signature]

DATE  
5/92

REVISED DATE





GeoStrategies Inc.

**BENZENE CONCENTRATION MAP**  
 UNOCAL Service Station #5325  
 3220 Lakeshore Avenue  
 Oakland, California

PLATE

**4**

JOB NUMBER  
781401-10

REVIEWED BY  
gcs

DATE  
5/92

REVISED DATE



# SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063  
(415) 364-9600 • FAX (415) 364-9233

RECEIVED  
RECEIVED

FEB 25 1992

GETTLER-RYAN INC.

Gettler Ryan  
2150 W. Winton Avenue  
Hayward, CA 94545  
Attention: John Zwierzycki

Client Project ID: 3814.01, Unocal 5325, Oakland  
Matrix Descript: Water  
Analysis Method: EPA 5030/8015/8020  
First Sample #: 202-2381

GENERAL: Sampled: AC Feb 12, 1992  
Received: Feb 13, 1992  
Analyzed: Feb 20, 1992  
Reported: Feb 25, 1992

## TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons	Benzene	Toluene	Ethyl Benzene	Xylenes
		$\mu\text{g/L}$ (ppb)	$\mu\text{g/L}$ (ppb)	$\mu\text{g/L}$ (ppb)	$\mu\text{g/L}$ (ppb)	$\mu\text{g/L}$ (ppb)
202-2381	U-1	250	N.D.	N.D.	N.D.	N.D.
202-2382	U-2	410	1.9	N.D.	0.36	0.40
202-2383	U-3	N.D.	N.D.	N.D.	N.D.	N.D.
202-2384	Trip Blank	N.D.	N.D.	N.D.	N.D.	N.D.

Detection Limits:	30	0.30	0.30	0.30	0.30
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Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.  
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Vickie Tague  
Project Manager



# SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063  
(415) 364-9600 • FAX (415) 364-9233

Gettier Ryan  
2150 W. Winton Avenue  
Hayward, CA 94545  
Attention: John Zwierzycki

Client Project ID: 3814.01, Unocal 5325, Oakland

QC Sample Group: 2022381-84

Reported: Feb 25, 1992

## QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	M. Nipp	M. Nipp	M. Nipp	M. Nipp
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Feb 20, 1992	Feb 20, 1992	Feb 20, 1992	Feb 20, 1992
QC Sample #:	GBLK022092	GBLK022092	GBLK022092	GBLK022092
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	30
Conc. Matrix Spike:	10	10	10	30
Matrix Spike % Recovery:	100	100	100	100
Conc. Matrix Spike Dup.:	10	10	9.9	30
Matrix Spike Duplicate % Recovery:	100	100	99	100
Relative % Difference:	0.0	0.0	1.0	0.0

SEQUOIA ANALYTICAL

  
Vickie Tague  
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$



## FIELD METHODS AND PROCEDURES

### EXPLORATION DRILLING

#### Mobilization

Prior to any drilling activities, GeoStrategies Inc. (GSI) will verify that necessary drilling permits have been secured.

Utility locations will be located and drilling will be conducted so as not to disrupt activities at a project site. GSI will obtain and review available public data on subsurface geology and if warranted, the location of wells within a half-mile of the project site will be identified. Drillers will be notified in advance so that drilling equipment can be inspected prior to performing work.

#### Drilling

The subsurface investigations are typically performed to assess the lateral and vertical extent of petroleum hydrocarbons present in soils and groundwater. Drilling methods will be selected to optimize field data requirements as well as be compatible with known or suspected subsurface geologic conditions.

Monitoring wells are installed using a truck-mounted hollow-stem auger drill rig or mud-rotary drill rig. Typically, the hollow-stem rig is used for wells up to 100 feet, if subsurface conditions are favorable. Wells greater than 100-feet deep are typically drilled using mud-rotary techniques. When mud rotary drilling is used, an electric log will be performed for additional lithological information. Also during mud rotary drilling, precautions will be taken to prevent mud from circulating contaminants by using a conductor casing to seal off contaminated zones. Samples will be collected for lithologic logging by continuous chip, and where needed by drive sample or core as specified by the supervising geologist.

Soil Sampling

Shallow soil borings will be drilled using a truck-mounted hollow-stem auger drilling rig, unless site conditions favor a different drilling method. Drilling and sampling methods will be consistent with ASTM Method D-1452-80. The auger size will be a minimum 6-inch nominal outside-diameter (O.D). No drilling fluids will be used during this drilling method. The augers and other tools used in the bore hole will be steam cleaned before use and between borings to minimize the possibilities of cross-contamination between borings.

Soil samples are typically collected at 5-foot intervals as a minimum from ground surface to total depth of boring. Additional soil samples will be collected based on significant lithologic changes and/or potential chemical content. Soil samples from each sampling interval will be lithologically described by a GSI geologist (Figure 1). Soil colors will be described using the Munsell Color Chart. Rock units will be logged using appropriate lithologic terms, and colors described by the G.S.A. Rock Color Chart.

Head-space analyses will be performed to check for the evidence of volatile organic compounds. Head-space analyses will be performed using an organic vapor analyzer; either an OVA, HNU, or OVM. Organic vapor concentrations will be recorded on the GSI field log of boring (Figure 1). The selection of soil samples for chemical analysis are typically based on the following criteria:

- 1) Soil discoloration
- 2) Soil odors
- 3) Visual confirmation of chemical in soil
- 4) Depth with respect to underground tanks (or existing grade)
- 5) Depth with respect to ground water
- 6) OVA reading

Soil samples (full brass liners) selected for chemical analysis are immediately covered with aluminum foil and the liner ends are capped to prevent volatilization. The samples are labeled and entered onto a Chain-of-Custody form, and placed in a cooler on blue ice for transport to a State-certified analytical laboratory.

Soil cuttings are stockpiled on-site. Soils are sampled and analyzed for site-specific chemical parameters. Disposition of soils is dependent of chemical analytical results of the samples.

Soil Sampling - cont.

Soil borings not converted to monitoring wells will be backfilled (sealed) to ground surface using either a neat cement or cement-bentonite grout mixture. Backfilling will be tremied by continuously pumping grout from the bottom to the top of the boring where depth exceeds 20' or as required by local permit requirements.

All field and office work, including exploratory boring logs, are prepared under the direction of a registered geologist.

Monitoring Well Installation

Monitoring well casing and screen will be constructed of Schedule 40, flush-joint threaded polyvinylchloride (PVC). The well screen will be factory mill-slotted unless additional open area is required (eg. conversion to an extraction well in a low-yield aquifer). The screen length will be placed adjacent to the aquifer material to a minimum of 2-feet above encountered water. No screen shall be placed in a borehole that potentially creates hydraulic interconnection of two or more aquifer units. Screen slot size and well sand pack will be compatible with encountered aquifer materials, as confirmed by sieve analysis.

Monitoring wells will be completed below grade (Figure 2) unless special conditions exist that require above-grade completion design. In the event a monitoring well is required in an aquifer unit beneath an existing aquifer, the upper aquifer will be sealed off by installing a steel conductor casing with an annular neat cement or cement-bentonite grout seal. This seal will be continuously tremie pumped from the bottom of the annulus to ground surface.

The monitoring well sand pack will be placed adjacent to the entire screened interval and will extend a recommended minimum distance of 2-feet above the top of the screen. No sand pack will be placed that interconnects two or more aquifer units. A minimum 2-foot bentonite pellet or bentonite slurry seal will be placed above the sand pack. Sand pack, bentonite, and cement seal levels will be confirmed by sounding the annulus with a calibrated weighted tape. The remaining annular space above the bentonite seal will be grouted with a bentonite-cement mixture and will be tremie-pumped from the bottom of the annular space to the ground surface. The bentonite content of the grout will not exceed 5 percent by weight. A field log of boring and a field well completion form will be prepared by GSI for each well installed.

Decontamination of drilling equipment before drilling and between wells will consist of steam cleaning, and/or Alconox wash.

Well Development

All newly installed wells will be properly developed within 48 hours of completion. No well will be developed until the well seal has set a minimum of 12 hours. Development procedures will include one or more of the methods described below:

Bailing

Bailing will be used to remove suspended sediments and drilling fluids from the well, where applicable. The bailer will be raised and lowered through the column of water in the well so as to create a gentle surging action in the screened interval. This technique may be used in conjunction with other techniques, such as pumping, and may be used alone if the well is of low yield.

Pumping

Pumping will be used in conjunction with bailing or surging. The pump will be operated in such a manner as to gently surge the entire screened interval of the well. This may involve operating the pump with a packer type mechanism attached and slowly raising and lowering the pump, or by cycling the pump off and on to allow water to move in and out of the screened interval. Care will be used not to overpump a well.

Surging

Surging will be performed on wells that are screened in known or suspected high yield formations and/or on larger diameter (recovery) wells. A surge block will be raised and lowered through the entire screened interval, forcing water in and out of the well screen and sand pack. Pumping or air lifting will be used in conjunction with this method of development to remove any sediment brought into the well during surging.

Air Lifting

Air lifting will be used to remove sediment from wells as an alternative to pumping under certain conditions. When appropriate, a surge block designed for use with air lifting will be used to agitate the entire screened interval and water will be lifted out of the well using forced air. When air lifting is performed, the air source will be either nitrogen or filtered air and the procedure will be performed gently to prevent any damage to the well screen or casing and to insure that discharged water is contained.



Well Development - cont.

All well developing equipment will be thoroughly decontaminated prior to development using a steam cleaner and/or Alconox detergent wash and clean water rinse. During development procedures, field parameters (temperature, specific conductance and pH) will be monitored and recorded on well development forms (Figure 3). Equilibration requirements consist of a minimum of three readings with the following accuracy standards:

pH	± 0.1 pH units
Specific Conductance	± 10% of full scale reading
Temperature	± 0.5 degrees Celsius

The wells will be developed until water is visibly clear and free of sediment, and well purging parameters stabilized. A minimum of 8 to 10 well volumes will be purged from each well, if feasible. If well purging parameters have not stabilized before 10 casing volumes have been removed, well development will continue until purging parameters have stabilized and formation water is being drawn into the well. The adequacy of well development will be judged by the field technician performing the well development and based on known formation conditions.

Well Surveying

Monitoring wells will be surveyed to obtain top of box elevations to the nearest ±0.01 foot. Water level measurements will be recorded to the nearest ±0.01 foot and referenced to Mean Sea Level (MSL). If additional wells are required, then existing and newly installed wells are surveyed relative to MSL.

GROUND-WATER SAMPLING AND ANALYSISQuality Assurance/Quality Control Objectives

The sampling and analysis procedures employed by Gettler-Ryan Inc. (G-R) for ground-water sampling and monitoring follow specific Quality Assurance/Quality Control (QA/QC) guidelines. Quality Assurance objectives have been established by G-R to develop and implement procedures for obtaining and evaluating water quality and field data in an accurate, precise, and complete manner so that sampling procedures and field measurements provide information that is comparable and representative of actual field conditions. Quality Control (QC) is maintained by G-R by using specific field protocols and requiring the analytical laboratory to perform internal and external QC checks. It is the goal of G-R to provide data that are accurate, precise, complete, comparable, and representative. The definitions for accuracy, precision, completeness, comparability, and representativeness are as follows:

- Accuracy - the degree of agreement of a measurement with an accepted referenced or true value.
- Precision - a measure of agreement among individual measurements under similar conditions. Usually expressed in terms of the standard deviation.
- Completeness - the amount of valid data obtained from a measurement system compared to the amount that was expected to meet the project data goals.
- Comparability - expresses the confidence with which one data set can be compared to another.
- Representativeness - a sample or group of samples that reflects the characteristics of the media at the sampling point. It also includes how well the sampling point represents the actual parameter variations which are under study.

As part of the G-R QA/QC program, applicable federal, state, and local reference guidance documents are followed. The procedures outlined in these regulations, manuals, handbooks, guidance documents, and journals are incorporated into the G-R sampling procedures to assure that; (1) ground-water samples are properly collected, (2) ground-water samples are identified, preserved, and transported in a manner such that they are representative of field conditions, and (3) chemical analysis of samples are accurate and reproducible.

Guidance and Reference Documents Used to Collect Groundwater Samples

These documents are used to verify G-R sampling procedures and are consistent with current regulatory guidance. If site specific work and sampling plans are required, those plans will be developed from these documents, and newly received applicable documents.

U.S.E.P.A. - 330/9-51-002	NEIC Manual for Groundwater/Subsurface Investigation at Hazardous Waste Sites
U.S.E.P.A. - 530/SW611	Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities (August, 1977)
U.S.E.P.A. - 600/4-79-020	Methods for Chemical Analysis of Water and Wastes (1983)
U.S.E.P.A. - 600/4-82-029	Handbook for Sampling and Sample Preservation of Water and Wastewater (1982)
U.S.E.P.A. - 600/4-82-057	Test Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (July, 1982)
U.S.E.P.A. - SW-846#, 3rd Edition	Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (November, 1986)
40 CFR 136.3e, Table II (Code of Federal Regulations)	Required Containers, Preservation Techniques, and Holding Times
Resources Conservation and Recover Act (OSWER 9950.1)	Groundwater Monitoring Technical Enforcement Guidance Document (September, 1986)
California Regional Water Quality Control Board (Central Valley Region)	A Compilation of Water Quality Goals (September, 1988); Updates (October, 1988)
California Regional Water Quality Control Board (North Coast, San Francisco Bay, and Central Valley)	Regional Board Staff Recommendations for Initial Evaluations and Investigation of Underground Tanks: Tri-Regional Recommendations (June, 1988)

Guidance and Reference Documents Used to Collect Groundwater Samples (cont.)

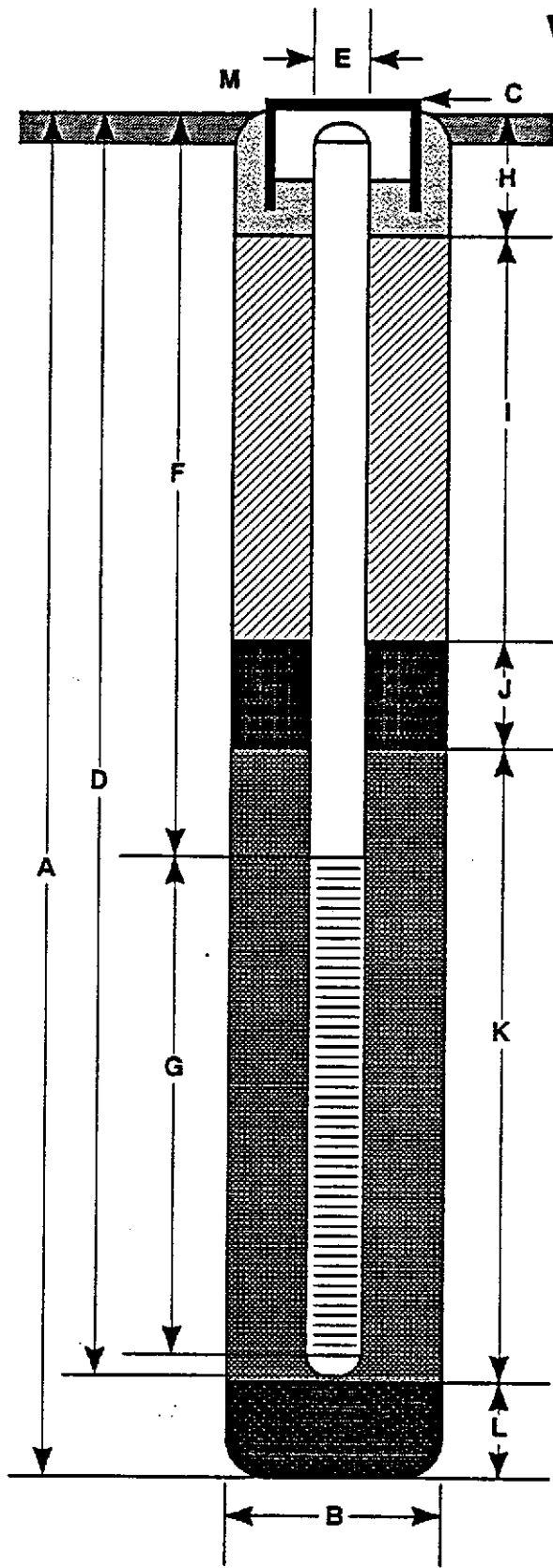
Regional Water Quality Control Board (Central Valley Region)	Memorandum: Disposal, Treatment, and Refuse of Soils Contaminated with Petroleum Fractions (August, 1986)
State of California Department of Health Services	Hazardous Waste Testing Laboratory Certification List (March, 1987)
State of California Water Resources Control Board	Leaking Underground Fuel Tank (LUFT) Field Manual (May, 1988), and LUFT Field Manual Revision (April, 1989)
State of California Water Resources Control Board	Title 23, (Register #85.#33-8-17-85), Subchapter 16: Underground Tank Regulations; Article 3, Sections 2632 and 2634; Article 4, Sections 2645, 2646, 2647, and 2648; Article 7, Sections 2670, 2671, and 2672 (October, 1986: including 1988 Amendments)
Alameda County Water District	Groundwater Protection Program: Guidelines for Groundwater and Soil Investigations at Leaking Underground Fuel Tank Sites (November, 1988)
American Public Health Association	Standard Methods for the Examination of Water and Wastewaters, 16th Edition
Analytical Chemistry (journal)	Principles of Environmental Analysis, Volume 55, Pages 2212-2218 (December, 1983)
Napa County	Napa County Underground Storage Tank Program: Guidelines for Site Investigations; February 1989.
Santa Clara Valley Water District	Guidelines for Preparing or Reviewing Sampling Plans for Soil and Groundwater Investigation of Fuel Contamination Sites (January, 1989)

Guidance and Reference Documents Used to Collect Groundwater Samples (cont.)

Santa Clara Valley Water District	Investigation and Remediation at Fuel Leak sites: Guidelines for Investigation and Technical Report Preparation (March 1989)
Santa Clara Valley Water District American Petroleum Institute	Revised Well Standards for Santa Clara County (July 18, 1989) Groundwater Monitoring & Sample Bias; API Publication 4367, Environmental Affairs Department, June 1983
American Petroleum Institute	A Guide to the Assessment and Remediation of Underground Petroleum Releases; API Publication 1628, February 1989
American Petroleum Institute	Literature Summary: Hydrocarbon Solubilities and Attenuations Mechanisms, API Publication 4414, August 1985
Site Specific (as needed)	General and specific regulatory documents as required.

# WELL CONSTRUCTION DETAIL

FIGURE 2



- A Total Depth of Boring \_\_\_\_\_ ft.
- B Diameter of Boring \_\_\_\_\_ in.  
Drilling Method \_\_\_\_\_
- C Top of Box Elevation \_\_\_\_\_ ft.  
 Referenced to Mean Sea Level  
 Referenced to Project Datum
- D Casing Length \_\_\_\_\_ ft.  
Material \_\_\_\_\_
- E Casing Diameter \_\_\_\_\_ in.
- F Depth to Top Perforations \_\_\_\_\_ ft.
- G Perforated Length \_\_\_\_\_ ft.  
Perforated Interval from \_\_\_\_\_ to \_\_\_\_\_ ft.  
Perforation Type \_\_\_\_\_  
Perforation Size \_\_\_\_\_ in.
- H Surface Seal from \_\_\_\_\_ to \_\_\_\_\_ ft.  
Seal Material \_\_\_\_\_
- I Backfill from \_\_\_\_\_ to \_\_\_\_\_ ft.  
Backfill Material \_\_\_\_\_
- J Seal from \_\_\_\_\_ to \_\_\_\_\_ ft.  
Seal Material \_\_\_\_\_
- K Gravel Pack from \_\_\_\_\_ to \_\_\_\_\_ ft.  
Pack Material \_\_\_\_\_
- L Bottom Seal \_\_\_\_\_ ft.  
Seal Material \_\_\_\_\_
- M \_\_\_\_\_  
\_\_\_\_\_

Note: Depths measured from initial ground surface



Well Construction Detail

WELL NO. \_\_\_\_\_

WELL DEVELOPMENT FORM

FIGURE 3

Page \_\_\_\_\_ of \_\_\_\_\_

(to be filled out in office)

Client \_\_\_\_\_ SS# \_\_\_\_\_ Job# \_\_\_\_\_

Name \_\_\_\_\_ Location \_\_\_\_\_

Well# \_\_\_\_\_ Screened Interval \_\_\_\_\_ Depth \_\_\_\_\_

Aquifer Material \_\_\_\_\_ Installation Date \_\_\_\_\_

Drilling Method \_\_\_\_\_ Borehole Diameter \_\_\_\_\_

Comments regarding well installation: \_\_\_\_\_

(to be filled out in the field)

Name \_\_\_\_\_

Date \_\_\_\_\_ Development Method \_\_\_\_\_

Total Depth \_\_\_\_\_ - Depth to liquid \_\_\_\_\_ = Water Column \_\_\_\_\_

Product thickness \_\_\_\_\_

Water Column x Diameter (in.) x #Vol x 0.0408 = \_\_\_\_\_ gals

Purge Start \_\_\_\_\_ Stop \_\_\_\_\_ Rate \_\_\_\_\_ gpm

Gallons	Time	Clarity	Temp.	pH	Conductivity
0	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Total gallons removed \_\_\_\_\_ Development stop time \_\_\_\_\_

Depth to liquid \_\_\_\_\_ at \_\_\_\_\_ (time)

Odor of water \_\_\_\_\_ Water discharged to \_\_\_\_\_

Comments \_\_\_\_\_

Monitoring Well Sampling Protocol Schematic

