KAPREALIAN ENGINEERING
INCORPORATED

February 9, 1993

Alameda County Health Care Services
80 Swan Way, Room 200
Oakland, CA 94621

RE: Unocal Service Station #3538
411 W. MacArthur Blvd.
Oakland, California

Gentlemen:

Per the request of Mr. Tim Howard of Unocal Corporation, enclosed please find our report dated January 18, 1993, for the above referenced site.

If you should have any questions, please feel free to call our office at (510) 602-5100.

Sincerely,

Kaprealian Engineering, Inc.

Judy A. Dewey

jad\82

Enclosure

cc: Tim Howard, Unocal Corporation

2401 Stanwell Drive, Suite 400
Concord, California 94520
Tel: 510.602.5100 Fax: 510.687.0602

KAPREALIAN ENGINEERING
INCORPORATED

KEI-P89-0703.R6
January 18, 1993

Unocal Corporation
2000 Crow Canyon Place, Suite 400
P.O. Box 5155
San Ramon, California 94583

Attention: Mr. Tim Howard

RE: Continuing Ground Water Investigation at
Unocal Service Station #3538
411 W. MacArthur Boulevard
Oakland, California

Dear Mr. Howard:

This report presents the results of Kaprealian Engineering, Inc's. (KEI) soil and ground water investigation for the referenced site, in accordance with KEI's proposal (KEI-P89-0703.P3) dated February 28, 1991. The purpose of the investigation was to further determine the degree and extent of soil and ground water contamination at and in the vicinity of the site. The scope of the work performed by KEI consisted of the following:

Coordination with regulatory agencies

Geologic logging of two borings for the installation of two monitoring wells

Soil sampling

Ground water monitoring, purging, and sampling

Laboratory analyses

Data analysis, interpretation, and report preparation

SITE DESCRIPTION AND BACKGROUND

The subject site contains a Unocal service station facility. The site is located on gently sloping, south-southwest trending topography, and is situated approximately 1,900 feet northwest of Glen Echo Creek. The site is also located adjacent to and west of Mosswood Park and southwest of a BP service station.

KEI's initial work at the site began in July of 1989, when KEI was retained by Unocal to collect soil samples following the removal of two underground gasoline storage tanks and one waste oil tank at the site. The tanks consisted of one 10,000 gallon super unleaded

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gasoline tank, one 12,000 gallon regular unleaded gasoline tank, and one 550 gallon waste oil tank. No apparent holes or cracks were observed in the fuel tanks; however, the waste oil tank had four small holes. Water was encountered in the fuel tank pit at a depth of 10.5 feet below grade, thus prohibiting sampling directly from beneath the fuel tanks. Six sidewall samples, labeled SW1, SW1(4), SW2, SW3, SW4, and SW4(2), were collected from the fuel tank pit at depths of 10 feet below grade. The soil sample collected from beneath the waste oil tank, labeled WO1, was collected at a depth of 8.5 feet below grade. KEI also collected four samples, labeled P1 through P4, from the piping trenches at depths of 5 to 10 feet below grade (the sample point locations are as shown on the attached Figure 3). After sampling, ground water was pumped from the fuel tank pit. Since there was no recharge, a water sample was not collected. All samples were analyzed by Sequoia Analytical Laboratory in Redwood City, California, for total petroleum hydrocarbons (TPH) as gasoline, and benzene, toluene, xylenes, and ethylbenzene (BTX&E). In addition, the waste oil tank sample was also analyzed for TPH as diesel, total oil and grease (TOG), and EPA methods 8010 and 8270 compounds.

The analytical results of the fuel tank pit soil samples showed levels of TPH as gasoline ranging from non-detectable to 11 ppm, except for sample SW1, which showed 3,100 ppm of TPH as gasoline. However, following excavation of approximately 4 feet of the sidewall where sample SW1 was collected, an additional sample, labeled SW1(4), was collected, analyzed, and indicated non-detectable levels of TPH as gasoline and BTX&E. The soil sample collected from the waste oil pit showed non-detectable levels of TPH as gasoline, TPH as diesel, and BTX&E, with TOG levels at 36 ppm. The results of the soil analyses are summarized in Table 3. Documentation of the tank and piping removal procedures, sample collection techniques, and analytical results from the tank excavation are summarized in KEI's report (KEI-J89-0703.R1) dated July 31, 1989. To comply with the requirements of the regulatory agencies and based on the results of the laboratory analyses, KEI recommended the installation of four monitoring wells.

On September 6 and 7, 1989, four two-inch diameter monitoring wells, designated as MW1, MW2, MW3, and MW4 on the attached Figure 1, were installed at the site. The four wells were each drilled and completed to total depths ranging from 29 to 30 feet below grade. Ground water was encountered at depths ranging from 19 to 19.5 feet beneath the surface during drilling. The wells were developed on September 12, 1989, and were initially sampled on September 15, 1989.

Water and selected soil samples were analyzed at Sequoia Analytical Laboratory in Redwood City, California. Samples were analyzed for TPH as gasoline and BTX&E. In addition, the sample collected from monitoring well MW1 was analyzed for TPH as diesel, TOG, and EPA method 8010 constituents. Analytical results of the soil samples collected from the borings for the monitoring wells showed levels of TPH as gasoline ranging from non-detectable to 20 ppm. TPH as diesel and EPA method 8010 compounds were non-detectable in all samples collected from MW1. All TOG levels in MW1 were less than 50 ppm. Benzene levels were non-detectable in all samples, except MW2 at 19 feet and MW3 at 10 feet, which were 1.5 ppm and 0.29 ppm, respectively. The analytical results of water samples collected from the monitoring wells MW1 through MW4 indicated non-detectable levels of benzene. Analytical results of the water sample collected from MW1 also revealed non-detectable levels of TPH as diesel, less than 50 ppm of TOG, and non-detectable levels of all EPA method 8010 constituents, except for 2.7 ppb of tetrachloroethene (PCE). TPH as gasoline levels were 290 ppb in MW2, 32 ppb in MW3, and non-detectable in wells MW1 and MW4. The results of the soil samples are summarized in Table 3, and the results of the water samples are summarized in Table 2. Documentation of the monitoring well installation procedures, sample collection techniques, and analytical results are presented in KEI's report (KEI-P89-0703.R5) dated October 23, 1989. Based on these analytical results, KEI recommended the implementation of a monthly monitoring and quarterly sampling program. The monthly monitoring and quarterly sampling was initiated in November of 1989.

Based on the contaminant levels detected in monitoring wells MW2 and MW3 in subsequent quarters, KEI recommended the installation of two additional monitoring wells in KEI's quarterly report (KEI-P89-0703.QR5) dated February 28, 1991. KEI considered proposing the installation of monitoring wells in the median strip in the center of MacArthur Boulevard; however, access is precluded due to the presence of underground utilities and trees.

RECENT FIELD ACTIVITIES

On November 18, 1992, two additional two-inch diameter monitoring wells (designated as MW5 and MW6 on the attached Figure 1) were installed in the vicinity of the site. The wells were each drilled, constructed, and completed in accordance with the guidelines of the Regional Water Quality Control Board (RWQCB) and the California Well Standards (per Bulletin 74-90). The subsurface materials penetrated and details of the construction of the wells are described in the attached Boring Logs.

The two new wells were each drilled and completed to total depths of 30 feet below grade. Ground water was encountered at depths ranging from 20 to 22 feet below grade during drilling. Soil samples were collected for laboratory analysis and for lithologic logging purposes at a maximum spacing of 5 foot intervals, at significant changes in lithology, at obvious areas of contamination, and at or within the soil/ground water interface, beginning at a depth of approximately 5 feet below grade and continuing until ground water was encountered. Soil sampling conducted below the ground water table was for lithologic logging purposes only. The undisturbed soil samples were collected by driving a California-modified split-spoon sampler (lined with brass liners) ahead of the drilling augers. The two-inch diameter brass liners holding the samples were sealed with aluminum foil, plastic caps and tape, labeled, and stored in a cooler, on ice, until delivery to a state-certified laboratory. Each well casing was installed with a watertight cap and padlock. A round, watertight, flush-mounted well cover was cemented in place over each well casing.

The surface of each well cover was surveyed by Kier & Wright of Pleasanton, California, to Mean Sea Level (MSL) and to a vertical accuracy of 0.01 feet.

The new wells were developed on November 23, 1992. Prior to development, the wells were checked for the depth to the water table (by the use of an electronic sounder) and the presence of free product (by the use of an interface probe or paste tape). No free product was noted in either of the wells. After recording the monitoring data, the two new wells were each purged (by the use of a surface pump) of 8 and 12 gallons of water, respectively, until the evacuated water was clear and free of suspended sediment. Monitoring and well development data are summarized in Table 1.

The two new wells (MW5 and MW6) were sampled on November 30, 1992. In addition, monitoring wells MW1 through MW4 were also monitored on November 30, 1992. Prior to sampling, monitoring data were collected, and wells MW5 and MS6 were purged of 9 and 11 gallons of water, respectively, by the use of a surface pump. Water samples were collected by the use of a clean Teflon bailer. Samples were decanted into clean VOA vials that were then sealed with Teflon-lined screw caps, labeled, and stored in a cooler, on ice, until delivery to a state-certified laboratory.

ANALYTICAL RESULTS

Water and selected soil samples from the borings of MW5 and MW6 were analyzed at Sequoia Analytical Laboratory. All samples analyzed were accompanied by properly executed Chain of Custody

documentation. The samples were analyzed for TPH as gasoline by EPA method 5030/modified 8015, and BTX&E by EPA method 8020.

The concentrations of TPH as gasoline and benzene detected in the ground water samples collected from monitoring wells MW5 and MW6 on November 30, 1992, are shown on the attached Figure 2. The results of the soil analyses are summarized in Table 3, and the results of the water analyses are summarized in Table 2. Copies of the laboratory analyses and the Chain of Custody documentation are attached to this report.

HYDROLOGY AND GEOLOGY

The measured depth to ground water at the site on November 30, 1992, ranged between 14.36 and 18.80 feet below grade. The ground water flow direction appeared to be to the south on November 30, 1992. Prior to the drilling of the two off-site monitoring wells, the ground water flow direction at the site was reported to be to the east for the past ten quarters. However, water level data obtained during the November 30, 1992, monitoring event (including data from the two new wells) indicated that the predominant ground water flow direction was to the south, with an easterly ground water flow direction present in the southern half of the site. Based on the water level data collected from the monitoring wells on November 30, 1992, the hydraulic gradient at and in the vicinity of the site varied between 0.009 and 0.033.

Based on review of regional geologic maps (U.S. Geological Survey Professional Paper 943 "Flatland Deposits of the San Francisco Bay Region, California - Their Geology and Engineering Properties, and their Importance to Comprehensive Planning" by E.J. Helley and K.R. Lajoie, 1979), the subject site is underlain by Late Pleistocene Alluvium (Qpa). These materials, considered to be alluvial fan deposits, are described as consisting of weakly consolidated, slightly weathered, irregularly interbedded clay, silt, sand, and gravel. The maximum thickness of these deposits is unknown, but is considered to be at least 150 feet thick.

Based on the results of our subsurface studies, the site is underlain by fill materials to a depth of about 1.5 feet below grade. The fill is in turn underlain by alluvial sediments to the maximum depth explored (30.5 feet below grade). The alluvium underlying the site typically consist of sandy/gravelly clay, clayey sand, clayey silt, and gravel with sand and silt.

The unsaturated zone beneath the site is approximately 18 feet thick and consists predominantly of sandy/gravelly clay, which also characterizes the base of the unsaturated zone. The first water

bearing unit beneath the site (first aquifer) consists largely of poorly graded gravel with silt and sand, and subordinate amounts of clayey silt and clayey sand. Sandy/gravelly clay, clayey sand, and clayey silt characterize the units immediately below the water table.

DISCUSSION AND RECOMMENDATIONS

Based on the analytical results of the soil and ground water samples collected from wells MW5 and MW6, the extent of soil and ground water contamination to the north and east of the site appears to have been well defined. TPH as gasoline and BTX&E were not detected in any of the soil and ground water samples collected from the two new off-site monitoring wells.

Based on the analytical results collected and evaluated to date, KEI recommends the continuation of the current ground water monitoring and sampling program, per KEI's proposal (KEI-P89-0703.P3) dated February 28, 1991, and as modified in KEI's quarterly reports (KEI-P89-0703.QR7) dated August 20, 1991, and (KEI-P89-0703.QR11) dated August 12, 1992. All of the wells are currently monitored quarterly, and wells MW2, MW3, MW5, and MW6 are sampled on a quarterly basis. Wells MW1 and MW4 are sampled on an annual basis. The results of the monitoring program will be documented and evaluated after each monitoring and sampling event. Recommendations for altering or terminating the program will be made as warranted.

DISTRIBUTION

A copy of this report should be sent to the Alameda County Health Care Services Agency, and to the RWQCB, San Francisco Bay Region.

LIMITATIONS

Soil deposits and rock formations may vary in thickness, lithology, saturation, strength and other properties across any site. In addition, environmental changes, either naturally-occurring or artificially-induced, may cause changes in the extent and concentration of any contaminants. Our studies assume that the field and laboratory data are reasonably representative of the site as a whole, and assume that subsurface conditions are reasonably conducive to interpolation and extrapolation.

The results of this study are based on the data obtained from the field and laboratory analyses obtained from a state-certified laboratory. We have analyzed this data using what we believe to be currently applicable engineering techniques and principles in the

Northern California region. We make no warranty, either expressed or implied, regarding the above, including laboratory analyses, except that our services have been performed in accordance with generally accepted professional principles and practices existing for such work.

Should you have any questions regarding this report, please do not hesitate to call me at (510) 602-5100.

Sincerely,

Kaprealian Engineering, Inc.

Thomas J. Berkins

Thomas J. Berkins
Senior Environmental Engineer

Joel G. Greger

Joel G. Greger, C.E.G.
Senior Engineering Geologist

License No. 1633
Exp. Date 6/30/94

Timothy R. Ross

Timothy R. Ross
Project Manager

\jad

Attachments: Tables 1, 2 & 3
Location Map
Potentiometric Surface Map - Figure 1
Petroleum Hydrocarbon Concentration Map - Figure 2
Sample Point Location Map - Figure 3
Boring Logs
Laboratory Analyses
Chain of Custody documentation

KEI-P89-0703.R6
January 18, 1993

TABLE 1

SUMMARY OF GROUND WATER MONITORING AND PURGING DATA

Well #	Ground Water Elevation (feet)	Depth to Water (feet)	Product Thickness (feet)	Sheen	Water Purged (gallons)
(Monitored and Sampled on November 30, 1992)					
MW1*	53.63	18.80	0	--	0
MW2*	53.09	18.54	0	--	0
MW3*	53.33	18.73	0	--	0
MW4*	53.45	18.53	0	--	0
MW5	53.33	18.18	0	No	9
MW6	57.43	14.36	0	No	11
(Monitored and Developed on November 23, 1992)					
MW5	53.41	18.10	0	--	8
MW6	57.62	14.17	0	--	12

Well No.	Well Cover Elevation** (feet)
MW1	72.43
MW2	71.63
MW3	72.06
MW4	71.98
MW5	71.51
MW6	71.79

* Monitored only.

** The elevations of the tops of the well covers have been surveyed relative to MSL, per the City of Oakland Benchmark #9NW10 (elevation = 75.50).

-- Sheen determination was not performed.

KEI-P89-0703.R6
January 18, 1993

TABLE 2

SUMMARY OF LABORATORY ANALYSES
WATER

Date	Sample Well #	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene	PCE
11/30/92	MW5	--	ND	ND	ND	ND	ND	--
	MW6	--	ND	ND	ND	ND	ND	--
10/12/92	MW2	--	370	3.4	0.56	11	ND	--
	MW3	--	3,200	160	10	540	230	--
7/14/92	MW1+	--	ND	ND	ND	ND	ND	1.4
	MW2	--	130	3.7	ND	ND	ND	--
	MW3	--	21,000	890	200	4,300	1,200	--
	MW4	--	ND	1.3	2.5	1.0	ND	--
4/14/92	MW2	--	150	6.2	ND	1.4	ND	--
	MW3	--	14,000	660	48	2,000	560	--
1/15/92	MW2	--	220	37	0.52	7.0	1.1	--
	MW3	--	3,000	590	14	750	310	--
10/15/91	MW2	--	140	44	0.56	12	1.5	--
	MW3	--	3,100	390	34	390	150	--
7/15/91	MW1*	ND	ND	ND	ND	ND	ND	1.8
	MW2	--	2,200	770	12	370	72	--
	MW3	--	9,200	1,300	230	1,900	490	--
	MW4	--	ND	ND	ND	ND	ND	--
4/12/91	MW1*	ND	ND	ND	ND	ND	ND	2.0
	MW2	--	2,200	160	4.3	62	23	--
	MW3	--	880	170	1.1	110	34	--
	MW4	--	ND	ND	ND	ND	ND	--
1/15/91	MW1*	ND	ND	ND	ND	ND	ND	2.1
	MW2	--	680	170	0.7	81	19	--
	MW3	--	3,200	460	1.5	270	120	--
	MW4	--	ND	ND	ND	ND	ND	--
10/16/90	MW1*	ND	ND	ND	ND	ND	ND	2.0
	MW2	--	1,400	430	2.0	240	48	--
	MW3	--	740	210	1.4	82	2.5	--
	MW4	--	ND	ND	ND	ND	ND	--

KEI-P89-0703.R6
January 18, 1993

TABLE 2 (Continued)

SUMMARY OF LABORATORY ANALYSES
WATER

Date	Sample Well #	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene	PCE
7/17/90	MW1*	ND	ND	ND	ND	ND	ND	1.7
	MW2	--	490	76	0.59	46	11	--
	MW3	--	4,000	270	48	250	130	--
	MW4	--	ND	ND	ND	ND	ND	--
4/19/90	MW1*	ND	ND	ND	ND	ND	ND	2.2
	MW2	--	3,900	550	5.1	390	91	--
	MW3	--	3,100	600	27	220	54	--
	MW4	--	ND	ND	0.48	ND	ND	--
1/23/90	MW1**	ND	ND	1.5	2.3	4.3	ND	2.1
	MW2	--	400	73	36	40	10	--
	MW3	--	450	110	1.2	11	4.4	--
	MW4	--	ND	ND	0.40	ND	ND	--
9/15/89	MW1***	ND	ND	ND	0.61	ND	ND	2.7
	MW2	--	290	ND	12	ND	ND	--
	MW3	--	32	ND	ND	ND	ND	--
	MW4	--	ND	ND	ND	ND	ND	--

-- Indicates analysis was not performed.

+ All EPA method 8010 compounds were non-detectable, except for PCE.

* TOG was non-detectable. All EPA method 8010 compounds were non-detectable, except for PCE.

** TOG was 1.5 ppm. All EPA method 8010 compounds were non-detectable, except for PCE.

*** TOG was <50 ppm. All EPA method 8010 compounds were non-detectable, except for PCE.

ND = Non-detectable.

Results in parts per billion (ppb), unless otherwise indicated.

KEI-P89-0703.R6
January 18, 1993

TABLE 3

SUMMARY OF LABORATORY ANALYSES
SOIL

Sample	Depth (feet)	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
(Collected on July 12 & 17, 1989)							
SW1	10.0	--	3,100	12	300	730	110
SW1(4)	10.0	--	ND	ND	ND	ND	ND
SW2	10.0	--	1.1	0.10	ND	0.18	ND
SW3	10.0	--	5.7	0.26	ND	0.45	0.23
SW4	10.0	--	2.5	ND	ND	0.24	ND
SW4(2)	10.0	--	11	0.61	0.51	1.3	0.44
P1	6.5	--	ND	ND	ND	ND	ND
P2	6.5	--	ND	ND	ND	ND	ND
P3	5.5	--	ND	ND	ND	ND	ND
P4	10.0	--	170	0.71	12	47	6.8
WO1*	8.5	ND	ND	ND	ND	ND	ND
(Collected on September 6 & 7, 1989)							
MW1(5)**	5.0	ND	3.4	ND	ND	ND	ND
MW1(10)**	10.0	ND	5.0	ND	ND	ND	ND
MW1(15)**	15.0	ND	2.2	ND	ND	ND	ND
MW1(19)**	19.0	ND	ND	ND	ND	ND	ND
MW2(5)	5.0	--	1.4	ND	ND	ND	ND
MW2(10)	10.0	--	ND	ND	ND	ND	ND
MW2(15)	15.0	--	1.8	ND	ND	ND	ND
MW2(19)	19.0	--	13	1.5	2.1	1.8	0.34
MW3(5)	5.0	--	1.3	ND	ND	ND	ND
MW3(10)	10.0	--	1.8	0.29	ND	ND	ND
MW3(15)	15.0	--	3.3	ND	ND	ND	ND
MW3(18.5)	18.5	--	ND	ND	ND	ND	ND
MW4(5)	5.0	--	3.1	ND	ND	ND	ND
MW4(10)	10.0	--	17	ND	ND	0.10	ND
MW4(15)	15.0	--	20	ND	ND	0.27	ND
MW4(18.5)	18.5	--	2.1	ND	ND	ND	ND

TABLE 3 (Continued)

SUMMARY OF LABORATORY ANALYSES
SOIL

Sample	Depth (feet)	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
(Collected on November 18, 1992)							
MW5(5)	5.0	--	ND	ND	ND	ND	ND
MW5(10)	10.0	--	ND	ND	ND	ND	ND
MW5(15)	15.0	--	ND	ND	ND	ND	ND
MW5(21)	21.0	--	ND	ND	ND	ND	ND
MW6(5)	5.0	--	ND	ND	ND	ND	ND
MW6(10)	10.0	--	ND	ND	ND	ND	ND
MW6(15)	15.0	--	ND	ND	ND	ND	ND
MW6(19.5)	19.5	--	ND	ND	ND	ND	ND

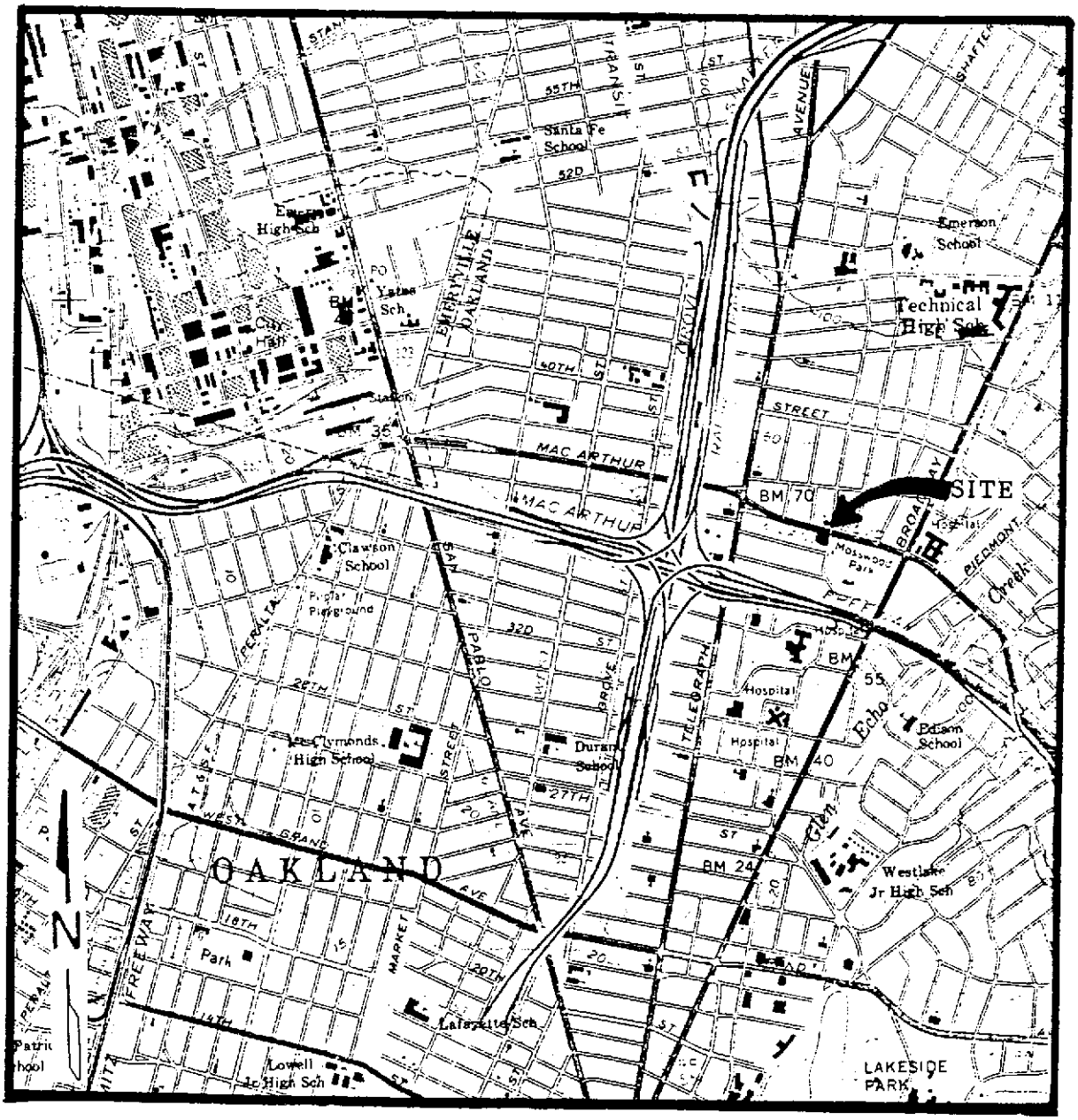
* TOG was 36 ppm, and EPA method 8010 and 8270 constituents were non-detectable.

** TOG was <50 ppm for these samples. EPA method 8010 compounds were non-detectable for these samples.

ND = Non-detectable.

-- Indicates analysis was not performed.

Results in parts per million (ppm), unless otherwise indicated.

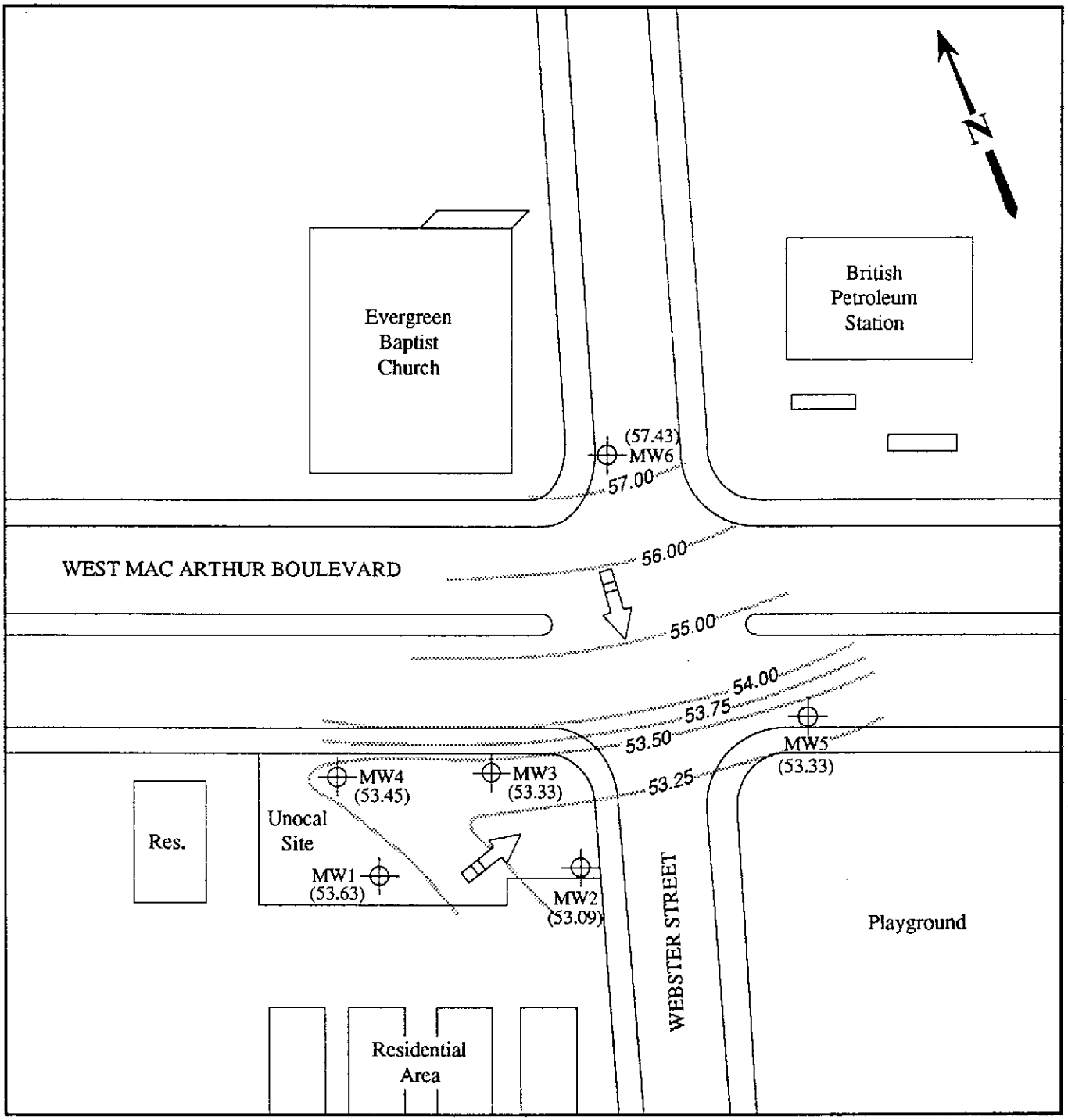


Base modified from 7.5 minute U.S.G.S. Oakland West Quadrangle
(photorevised 1980)

0 2000 4000

Approx. scale feet

KAPREALIAN ENGINEERING INCORPORATED	UNOCAL SERVICE STATION # 3538 411 W. MACARTHUR BOULEVARD OAKLAND, CA	LOCATION MAP



LEGEND

- Monitoring well
- ( ) Ground water elevation in feet above Mean Sea Level
- Direction of ground water flow
- Contours of ground water elevation

0 60 120

Approx. scale feet

POTENTIOMETRIC SURFACE MAP FOR THE NOVEMBER 30, 1992 MONITORING EVENT

KAPREALIAN ENGINEERING
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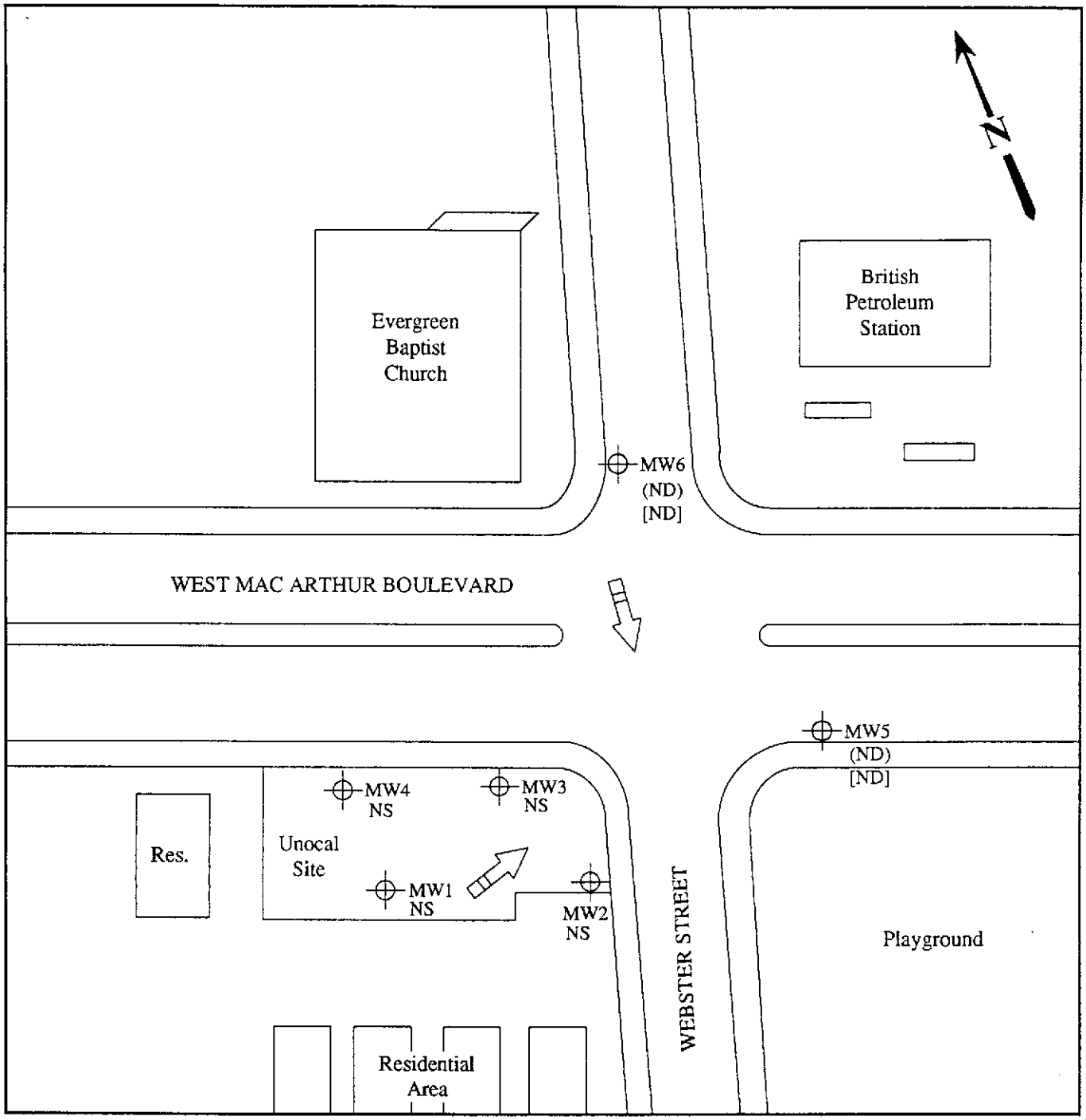
UNOCAL SERVICE STATION # 3538
411 W. MACARTHUR BOULEVARD
OAKLAND, CA

FIGURE
1



LEGEND

- Monitoring well
- ( ) Concentration of TPH as gasoline in ppb
- [ ] Concentration of benzene in ppb
- NS = Not sampled
- ND = Non-detectable
- Direction of ground water flow

0 60 120

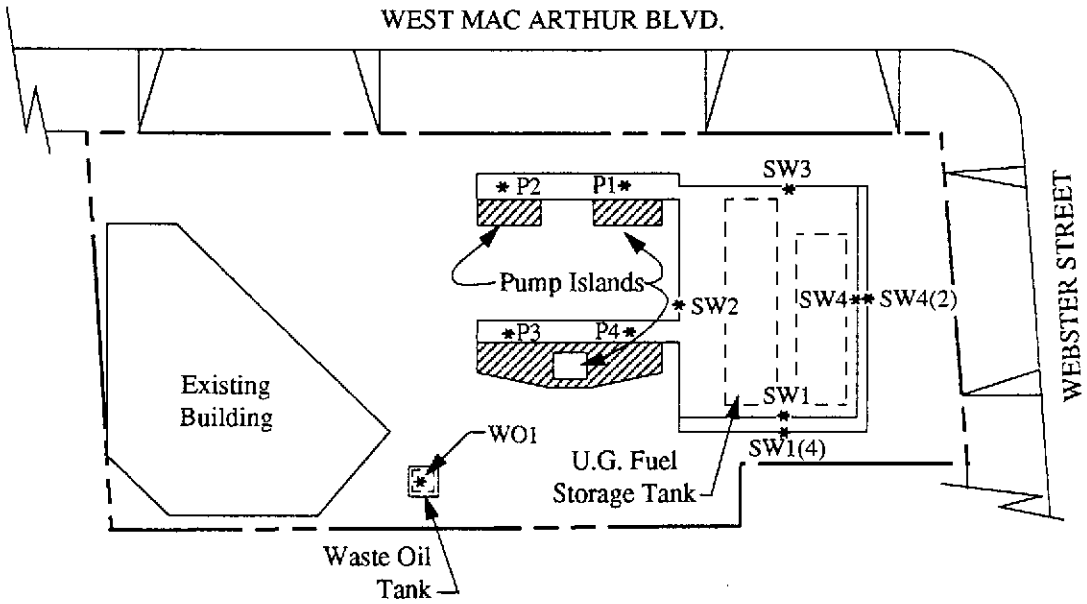
Approx. scale feet

PETROLEUM HYDROCARBON CONCENTRATIONS IN GROUND WATER ON NOVEMBER 30, 1992

KAPREALIAN ENGINEERING
INCORPORATED

UNOCAL SERVICE STATION # 3538
411 W. MACARTHUR BOULEVARD
OAKLAND, CA

FIGURE
2



N

LEGEND

* Sample point location

Samples collected on 7/12 & 7/17/89

0 30 60

Approx. scale feet

SAMPLE POINT LOCATION MAP

KAPREALIAN ENGINEERING INCORPORATED

UNOCAL SERVICE STATION # 3538
411 W. MACARTHUR BOULEVARD
OAKLAND, CA

FIGURE
3

KAPREALIAN ENGINEERING
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MAJOR DIVISIONS	SYMBOLS		TYPICAL SOIL DESCRIPTIONS
GRAVELS (More than 1/2 of coarse fraction > No. 4 sieve size)	GW		Well graded gravels or gravel - sand mixtures, little or no fines
	GP		Poorly graded gravels or gravel - sand mixtures, little or no fines
	GM		Silty gravels, gravel - sand - silt mixtures
	GC		Clayey gravels, gravel - sand - clay mixtures
SANDS (More than 1/2 of coarse fraction < No. 4 sieve size)	SW		Well graded sands or gravelly sands, little or no fines
	SP		Poorly graded sands or gravelly sands, little or no fines
	SM		Silty sands, sand - silt mixtures
	SC		Clayey sands, sand - clay mixtures
SILTS & CLAYS LL < 50	ML		Inorganic silts and very fine 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 silty clays of low plasticity
SILTS & CLAYS LL > 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH		Inorganic clays of high plasticity, fat clays
	OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS	Pt		Peat and other highly organic soils
DUAL (TRANSITION) SOILS	Soil characterisitics are transitional between the soil classifications listed above		

CLASSIFICATION CHART (Unified Soil Classification System)

BORING LOG

Project No. KEI-P89-0703	**Boring Diameter** 9" **Casing Diameter** 2"	**Logged By** JGG W.W. CEG 1633
Project Name Unocal S/S #3538 411 West MacArthur Blvd., Oakland	**Well Cover Elevation**	**Date Drilled** 11/18/92
Boring No. MW5	**Drilling Method** Hollow-stem Auger	**Drilling Company** Woodward Drilling Co.

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0		Six inches of concrete pavement over sand and gravel base.
				Silty clay, estimated at 35% silt, moist, black, strong brown staining in pores.
8/13/17		5	CL	Silty clay, estimated at 15% silt, 5% sand, and trace gravel to 3/8 inch in diameter, hard, moist, yellowish brown (10YR 5/4) and light brownish gray (10YR 6/2) mottled, trace pores.
8/11/16		10	ML	Clayey silt, estimated at 15-20% clay and 5% fine-grained sand, very stiff, moist, pale yellow (2.5Y 7/3), trace pores.
6/10/17		15		Silt, estimated at 5-10% clay, very stiff, moist to very moist, pale yellow (2.5Y 7/3) with slight yellowish brown (10YR 5/6) mottling, trace sand and pores.
				Silt, trace clay, hard, very moist, very pale brown (10YR 7/3) and strong brown (7.5YR 5/6) mottled, slightly micaceous.
10/20/24		20	CL	Silty clay, estimated at 35-40% silt, hard, moist, very pale brown (10YR 5/4) mottled.
8/13/25	▼		ML	Clayey silt, estimated at 15% clay and 5-10% sand, hard, very moist, pale yellow (2.5Y 7/3).

BORING LOG

Project No. KEI-P89-0703	**Boring Diameter** 9" **Casing Diameter** 2"	**Logged By** JGG W.W. CEG 1633
Project Name Unocal S/S #3538 411 West MacArthur Blvd., Oakland	**Well Cover Elevation**	**Date Drilled** 11/18/92
Boring No. MW5	**Drilling Method** Hollow-stem Auger	**Drilling Company** Woodward Drilling Co.

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
9/20/36		25	ML	Clayey silt, estimated at 15% clay and 5-10% sand, hard, very moist, pale yellow (2.5Y 7/3). Clayey silt, estimated at 20-25% clay and 5% sand, hard, moist, very pale brown (10YR 7/3).
13/19/28		30	CL	Silty clay, estimated at 15-20% fine-grained silt and 5% sand, hard, moist, very pale brown (10YR 7/3), trace organic matter. Silty clay, estimated at 15% silt, 5-10% sand, and trace gravel, hard, moist, very pale brown (10YR 7/3).
				TOTAL DEPTH: 30'
		35		
		40		

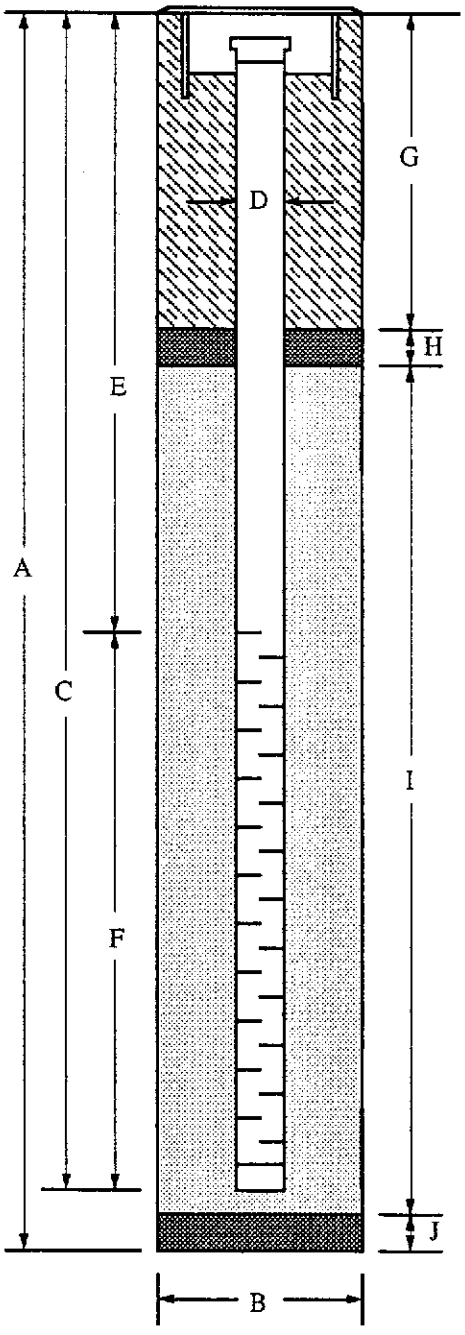
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal S/S #3538, 411 West MacArthur Blvd., Oakland WELL NO. MW5

PROJECT NUMBER: KEI-P89-0703

WELL PERMIT NO.: 91185

Flush-mounted Well Cover



A. Total Depth : 30'

B. Boring Diameter: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 30'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375"

ID = 2.067"

E. Depth to Perforations: 13'

F. Perforated Length: 17'

Perforation Type: Machined Slot

Perforation Size: 0.010"

G. Surface Seal: 9'

Seal Material: Neat Cement

H. Seal: 2'

Seal Material: Bentonite

I. Filter Pack: 19'

Pack Material: RMC Lonestar Sand

Size: 2/12

J. Bottom Seal: None

Seal Material: N/A

BORING LOG

Project No. KEI-P89-0703	**Boring Diameter** 9" **Casing Diameter** 2"	**Logged By** JGG W.W. CEG 1633
Project Name Unocal S/S #3538 411 West MacArthur Blvd., Oakland	**Well Cover Elevation**	**Date Drilled** 11/18/92
Boring No. MW6	**Drilling Method** Hollow-stem Auger	**Drilling Company** Woodward Drilling Co.

Penetration blows/6"	G. W. level	Depth (feet) Samples	Strati-graphy USCS	Description
		0		Fifteen inches of asphalt pavement.
				Silty clay, estimated at 20% silt and trace sand, moist, very dark gray.
				Silty clay, estimated at 20-25% silt and 5% sand, hard, moist, greenish gray (5GY 5/1).
18/30/34		5		
				Silty clay with sand and gravel, estimated at 15-20% silt, 15% gravel to 2 inches in diameter, and 10-15% sand, hard, moist, greenish gray (5GY 5/1) with strong brown (7.5YR 4/6) staining.
			CL	
19/23/35		10		Silty clay, estimated at 15% silt and trace sand, hard, moist, greenish gray (5GY 6/1) with slight light yellowish brown (10YR 6/4) mottling.
				Silty clay, estimated at 20% silt, hard, moist, light yellowish brown (10YR 6/4) with slight light gray (5Y 7/1) staining in pores, trace organic matter.
13/22/27		15		
				Clayey silt, estimated at 15% clay and 5-10% very fine-grained sand, hard, very moist, light yellowish brown (10YR 6/4).
12/18/20	▽	20	ML	

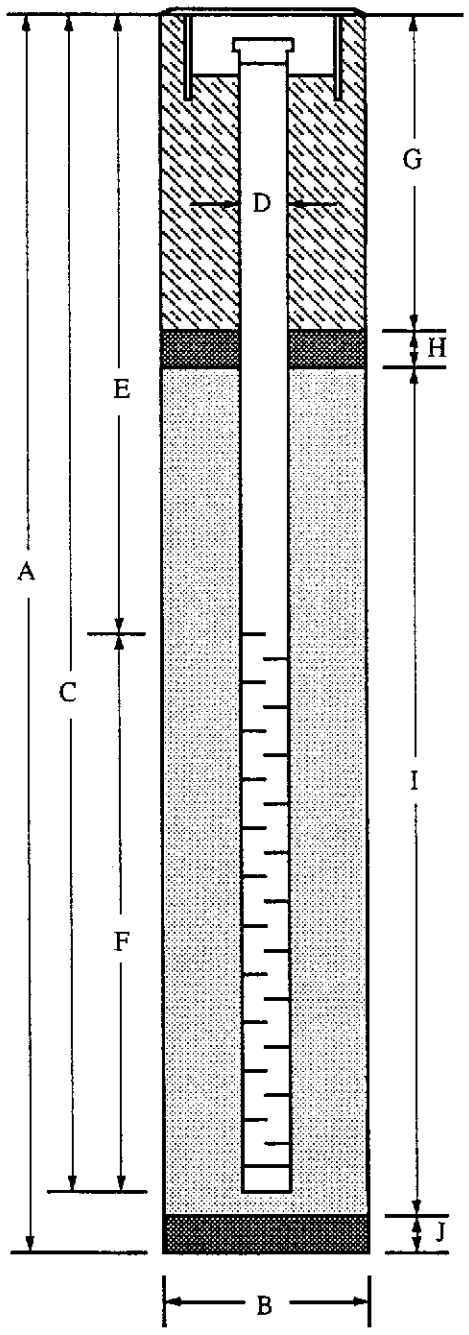
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal S/S #3538, 411 West MacArthur Blvd., Oakland WELL NO. MW6

PROJECT NUMBER: KEI-P89-0703

WELL PERMIT NO.: 91185

Flush-mounted Well Cover



A. Total Depth : 30'

B. Boring Diameter: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 30'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375"

ID = 2.067"

E. Depth to Perforations: 13'

F. Perforated Length: 17'

Perforation Type: Machined Slot

Perforation Size: 0.010"

G. Surface Seal: 9'

Seal Material: Neat Cement

H. Seal: 2'

Seal Material: Bentonite

I. Filter Pack: 19'

Pack Material: RMC Lonestar Sand

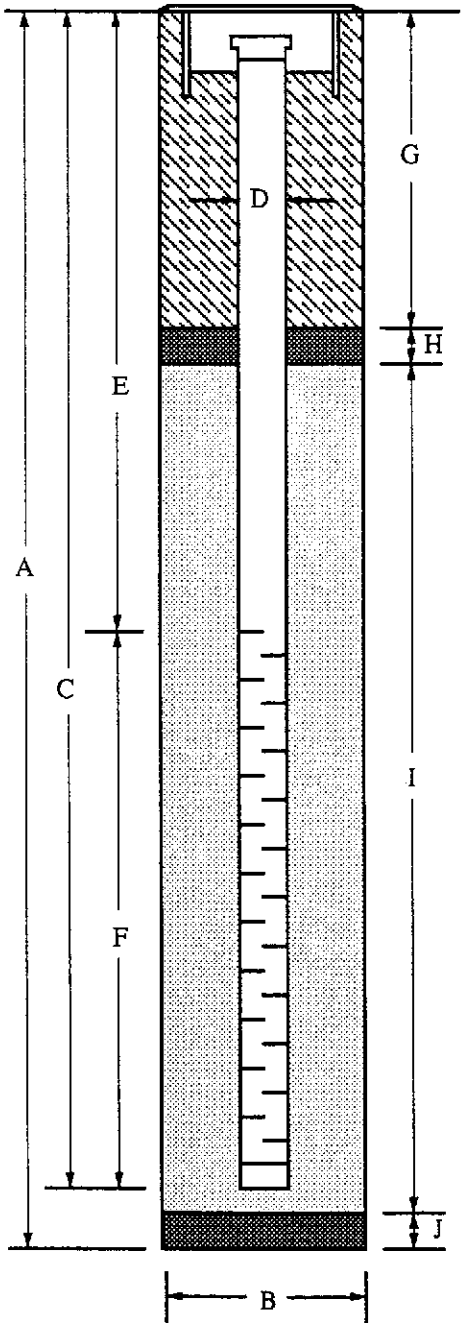
Size: 2/12

J. Bottom Seal: None

Seal Material: N/A

WELL COMPLETION DIAGRAM
(SCHEMATIC)

Flush-mounted Well Cover



WELL DETAILS*

1. Well will be terminated 10 to 15 feet into the first encountered ground water, unless an aquitard five feet or greater in thickness is encountered below the water table, in which case the bottom of the boring will be backfilled with bentonite pellets and the well terminated at the top of this aquitard [A].

2. Boring diameter [B] is 8 inches for 2 inch wells, 10 inches for 4 inch wells, and 12 inches for 6 inch wells.

3. Perforated interval [F] will extend from bottom of casing to five feet above the first encountered ground water table (unless water <5 feet deep).

4. Schedule 40 PVC casing, 2 inch in diameter [D], will be used. Screen is 0.020 or 0.010 inch factory machined slots, depending on filter pack grain size.

5. Filter pack will be placed from bottom of casing to two feet above perforated interval [I]. (Bottom seal [J] is not installed unless required.) One to two feet of bentonite [H] will be placed above the filter pack. Concrete grout [G] will be placed from top of bentonite seal to the surface (unless modified due to shallow water). Blank casing [E] will extend from the top of the perforated casing to the top of the hole.

6. The well will be installed with a waterproof cap, padlock and a flush-mounted well cover.

* See text for additional information.

SEQUOIA ANALYTICAL

1900 Bates Avenue • Suite LM • Concord, California 94520
(510) 686-9600 • FAX (510) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, 411 W. MacArthur Blvd., Oakland	Sampled:	Nov 30, 1992
2401 Stanwell Drive, Suite 400	Sample Matrix:	Water	Received:	Nov 30, 1992
Concord, CA 94520	Analysis Method:	EPA 5030/8015/8020	Reported:	Dec 9, 1992
Attention: Mardo Kaprealian, P.E.	First Sample #:	212-0030		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit µg/L	Sample I.D. 212-0030 MW-5	Sample I.D. 212-0031 MW-6	Sample I.D. Matrix Blank
Purgeable Hydrocarbons	50	N.D.	N.D.	
Benzene	0.5	N.D.	N.D.	
Toluene	0.5	N.D.	N.D.	
Ethyl Benzene	0.5	N.D.	N.D.	
Total Xylenes	0.5	N.D.	N.D.	
Chromatogram Pattern:		--	--	

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0	1.0
Date Analyzed:	12/3/92	12/3/92	12/3/92
Instrument Identification:	HP-2	HP-2	HP-2
Surrogate Recovery, %: (QC Limits = 70-130%)	101	101	100

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

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Scott A. Chieffo
Project Manager

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Kaprealian Engineering, Inc.
2401 Stanwell Drive, Suite 400
Concord, CA 94520
Attention: Mardo Kaprealian, P.E.

Client Project ID: Unocal, 411 W. MacArthur Blvd., Oakland
QC Sample Group: 2120030-31
Reported: Dec 9, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8015/8020	EPA 8015/8020	EPA 8015/8020	EPA 8015/8020
Analyst:	J.F.	J.F.	J.F.	J.F.
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Dec 3, 1992	Dec 3, 1992	Dec 3, 1992	Dec 3, 1992
QC Sample #:	211-1303	211-1303	211-1303	211-1303
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	20	20	20	60
Conc. Matrix Spike:	22	21	21	66
Matrix Spike % Recovery:	110	105	105	110
Conc. Matrix Spike Dup.:	21	20	20	63
Matrix Spike Duplicate % Recovery:	105	100	100	105
Relative % Difference:	4.7	4.9	4.9	4.7

Laboratory blank contained the following analytes: None Detected

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Scott A. Chieffo
Project Manager

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

KAPREALIAN ENGINEERING, INC.

CHAIN OF CUSTODY

SAMPLER: Vartkes

WITNESSING AGENCY:

SITE NAME & ADDRESS: Unocal / Oakland
411 W. MacArthur Blvd.

ANALYSES REQUESTED: TPHG + BTXE

TURN AROUND TIME: Regular

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	TPHG + BTXE	REMARKS
MW 5	11/30/92	10:45 a.m.		X	X		2	Monitoring well	X	212003OAB ↓ 031AB
MW 6	11/30/92	11:35 am.		X	X		2	" "	X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
W. Blackburn	11/30/92 6:15	11/30/92 1815
Jim Little	12-1-92 1400	
	12-1-92.	
	Date/Time	Received by: (Signature)

The following MUST BE completed by the laboratory accepting samples for analysis:

1. Have all samples received for analysis been stored in ice? Yes
2. Will samples remain refrigerated until analyzed? Yes
3. Did any samples received for analysis have head space? No
4. Were samples in appropriate containers and properly packaged? Yes

Signature: [signature] Title: Analyst Date: 11/30/92

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(510) 686-9600 • FAX (510) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal #3538, Oakland	Sampled:	Nov 18, 1992
2401 Stanwell Drive, Suite 400	Sample Matrix:	Soil	Received:	Nov 19, 1992
Concord, CA 94520	Analysis Method:	EPA 5030/8015/8020	Reported:	Dec 3, 1992
Attention: Mardo Kaprealian, P.E.	First Sample #:	211-1015		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 211-1015 MW5-(5)	Sample I.D. 211-1016 MW5-(10)	Sample I.D. 211-1017 MW5-(15)	Sample I.D. 211-1018 MW5-(21)	Sample I.D. 211-1019 MW6-(5)	Sample I.D. 211-1020 MW6-(10)
Purgeable Hydrocarbons	1.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	0.005	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Toluene	0.005	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ethyl Benzene	0.005	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Total Xylenes	0.005	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chromatogram Pattern:		--	--	--	--	--	--

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0	1.0	1.0	1.0	1.0
Date Analyzed:	11/30/92	11/30/92	11/30/92	11/30/92	11/30/92	11/30/92
Instrument Identification:	HP-2	HP-2	HP-2	HP-2	HP-2	HP-2
Surrogate Recovery, %: (QC Limits = 70-130%)	98	83	96	105	94	92

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

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Scott A. Chieffo
Project Manager

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(510) 686-9600 • FAX (510) 686-9689

Kaprealian Engineering, Inc.	Client Project ID:	Unocal #3538, Oakland	Sampled: Nov 18, 1992
2401 Stanwell Drive, Suite 400	Sample Matrix:	Soil	Received: Nov 19, 1992
Concord, CA 94520	Analysis Method:	EPA 5030/8015/8020	Reported: Dec 3, 1992
Attention: Mardo Kaprealian, P.E.	First Sample #:	211-1021	

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 211-1021 MW6-(15)	Sample I.D. 211-1022 MW6-(19.5)	Sample I.D. Matrix Blank
Purgeable Hydrocarbons	1.0	N.D.	N.D.	
Benzene	0.005	N.D.	N.D.	
Toluene	0.005	N.D.	N.D.	
Ethyl Benzene	0.005	N.D.	N.D.	
Total Xylenes	0.005	N.D.	N.D.	
Chromatogram Pattern:		--	--	

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0	1.0
Date Analyzed:	11/30/92	11/30/92	11/30/92
Instrument Identification:	HP-2	HP-2	HP-5
Surrogate Recovery, %: (QC Limits = 70-130%)	95	93	96

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

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Scott A. Chieffo
Project Manager

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1900 Bates Avenue • Suite LM • Concord, California 94520
(510) 686-9600 • FAX (510) 686-9689

Kaprealian Engineering, Inc. Client Project ID: Unocal #3538, Oakland
2401 Stanwell Drive, Suite 400
Concord, CA 94520
Attention: Mardo Kaprealian, P.E. QC Sample Group: 2111015-22 Reported: Dec 3, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8015/8020	EPA 8015/8020	EPA 8015/8020	EPA 8015/8020
Analyst:	J.F.	J.F.	J.F.	J.F.
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Nov 30, 1992	Nov 30, 1992	Nov 30, 1992	Nov 30, 1992
QC Sample #:	211-1022	211-1022	211-1022	211-1022
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.40	0.40	0.40	1.2
Conc. Matrix Spike:	0.44	0.42	0.42	1.3
Matrix Spike % Recovery:	110	105	105	108
Conc. Matrix Spike Dup.:	0.44	0.42	0.42	1.3
Matrix Spike Duplicate % Recovery:	110	105	105	108
Relative % Difference:	0.0	0.0	0.0	0.0

Laboratory blank contained the following analytes: None Detected

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Scott A. Chieffo
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

KAPREALIAN ENGINEERING
INCORPORATED

CHAIN OF CUSTODY

SAMPLER: Wade Weston
WITNESSING AGENCY:
SITE NAME & ADDRESS: Unocal #3538 Oakland
ANALYSES REQUESTED: TPH-G/BTXE
TURN AROUND TIME: Regular

SAMPLE ID NO.	DATE	TIME	SOIL	WATER	GRAB	COMP	NO. OF CONT.	SAMPLING LOCATION	TPH-G/BTXE	REMARKS
MW5-(5)	11/18/92		✓		✓		1	See Sample ID *	✓	211015
MW5-(10)	"		✓		✓		1		✓	1016
MW5-(15)	"		✓		✓		1		✓	1017
MW5-(21)	"		✓		✓		1		✓	1018
MW6-(5)	"		✓		✓		1		✓	1019
MW6-(10)	"		✓		✓		1		✓	1020
MW6-(15)	"		✓		✓		1		✓	1021
MW6-(19.5)	"		✓		✓		1		✓	1022

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Wade Weston	11/19/92 1555	[redacted]
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)

The following MUST BE completed by the laboratory accepting samples for analysis:

1. Have all samples received for analysis been stored in Ice? Y
2. Will samples remain refrigerated until analyzed? Y
3. Did any samples received for analysis have head space? N/A
4. Were samples in appropriate containers and properly packaged? Y

Signature	Title	Date
SP	F.S.	11/19/92

2401 Stanwell Drive, Suite 400
Concord, California 94520
Tel: 510.602.5100 Fax: 510.687.0602