KAPREALIAN ENGINEERING, INC.
Consulting Engineers
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RICK D. SISK
OCT 30 19[illegible]

KEI-P89-0703.R5
October 23, 1989

Unocal Corporation
2175 N. California Blvd., Suite 650
Walnut Creek, CA 94596

Attention: Mr. Rick Sisk

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

Dear Mr. Sisk:

This report presents the results of soil and ground water investigation for the referenced site in accordance with proposal KEI-P89-0703.P1 dated July 31, 1989. The purpose of the investigation was to determine the ground water flow direction, and to begin to determine the degree and extent of the subsurface soil and ground water contamination at the site. The work performed consisted of the following:

Coordination with regulatory agencies.

Drilling and installation of four 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 is presently used as a gasoline station. The site vicinity and site details are shown on the attached sketches.

KEI's work at the site began in July, 1989 when KEI was asked to collect soil samples following the removal of two underground fuel storage tanks and one waste oil tank at the site. Water was encountered in the pit at a depth of 10.5 feet, thus prohibiting sampling directly from beneath the fuel tanks. Sidewall samples

were collected at a depth of 10 feet. The sample from beneath the waste oil tank was collected at a depth of 8.5 feet. KEI also collected samples from the piping trenches at depths of 5 to 10 feet. After sampling, the water was pumped from the 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 hydrocarbon (TPH) as gasoline, and benzene, toluene, xylenes and ethylbenzene (BTX&E). In addition, the waste oil sample was analyzed for TPH as diesel, TOG, EPA 8010 and EPA 8270.

The analytical results of the soil samples, collected from the sidewalls of the fuel tank pit, showed levels of TPH ranging from non-detectable to 11 ppm, except for sample SW1, which had 3,100 ppm of TPH. However, after excavation of approximately 4 feet of sidewall where sample SW1 was collected, an additional sample, labeled SW1(4), was collected and the analyses indicated non-detectable levels of TPH and BTX&E. The sample from the waste oil pit showed TOG at 36 ppm. To comply with the requirements of the regulatory agencies and based on the results of the laboratory analyses, KEI proposed installation of four monitoring wells. Results of the soil samples from the tank excavation are summarized in KEI's report (KEI-J89-0702.R1) dated July 31, 1989.

FIELD ACTIVITIES

On September 6 and 7, 1989, four 2" diameter monitoring wells (designated as MW1, MW2, MW3 and MW4 on the attached Site Plan) were installed at the site. The wells were drilled, constructed and completed in accordance with the guidelines of the Regional Water Quality Control Board (RWQCB) and the County well standards.

The subsurface materials penetrated and details of the construction of the wells are described in the attached Boring Logs.

The four wells were drilled and completed to total depths ranging from 29 to 30 feet. Ground water was encountered at depths ranging from 19 to 19.5 feet beneath the surface during drilling. Soil samples were taken at approximate five foot intervals beginning at 5 feet below grade until ground water was encountered. The undisturbed soil samples were taken by driving a California-modified split-spoon sampler ahead of the drilling augers. The 2" diameter brass liners holding the samples were sealed with aluminum foil, plastic caps and tape, and stored in a cooled ice chest for delivery to a 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 wells were developed on September 12, 1989. Prior to development, the wells were checked for depth to the water table using an electronic sounder, presence of free product (using paste tape) and sheen. No free product or sheen was noted in any of the wells. After recording the monitoring data, the wells were developed with a surface pump until the evacuated water was clear and free of suspended sediment. Monitoring and well development data are summarized in Table 1.

The wells were sampled on September 15, 1989. Prior to sampling, monitoring data were collected and water samples were then collected using a clean Teflon bailer. The samples were decanted into clean glass VOA vials, and/or one liter amber bottles as appropriate, sealed with Teflon lined screw caps, and labeled and stored on ice until delivery to a certified laboratory.

ANALYTICAL RESULTS

Water and selected soil samples were analyzed at Sequoia Analytical Laboratory in Redwood City, California. All samples were accompanied by properly executed Chain of Custody documentation. Samples were analyzed for TPH as gasoline by EPA method 5030 in conjunction with modified 8015 and BTX&E by EPA method 8020. In addition, the sample from MW1 was analyzed for TPH as diesel using EPA method 3510 in conjunction with modified 8015, total oil and grease (TOG) using EPA method 418.1, and purgeable halocarbons using EPA method 8010.

Soil sample analyses showed levels of TPH as gasoline ranging from non-detectable to 20 ppm in all samples. TPH as diesel and EPA 8010 were non-detectable in all samples from MW1. All TOG levels in MW1 were <50 ppm. Benzene levels were non-detectable in all samples except MW2 at 19 feet and MW3 at 10 feet, which were 1.5 and 0.29 ppm, respectively. The water sample analyses indicated non-detectable levels of benzene in all wells. MW1 also revealed non-detectable levels of TPH as diesel and <50 ppm of TOG; however, 2.7 ppb of tetrachloroethene was detected. TPH as gasoline was 290 ppb in MW2, 32 ppb in MW3, and non-detectable in wells MW1 and MW4. Results of the soil analyses are summarized in Table 2, and the water analyses in Table 3. Copies of the laboratory analyses and Chain of Custody documentation are attached to this report.

HYDROLOGY AND GEOLOGY

The water table stabilized in the monitoring wells at depths ranging from 18.32 to 18.53 feet below existing grade. Ground water was initially encountered at depths of about 19 to 19.5 feet. The ground water flow direction appeared to be easterly, (based on water level data collected from the four monitoring wells on September 15, 1989).

Based on review of regional geologic maps (U.S.G.S. Professional Paper 943), the subject property is underlain by surficial earth materials consisting of late Pleistocene alluvium (Qpa). The thickness of the alluvium at the site is unknown, but exceeds the maximum depth of our subsurface investigation (30.5 feet).

The alluvium materials underlying the site typically consist of clay with variable amounts of sand and/or gravel to depths below grade of 16.5 to 21 feet with occasional lenses of sand and gravel (see log of MW2). The upper clay zone is in turn underlain by a coarse-grained zone consisting of gravel and/or sand lenses, which range in thickness from a minimum of 8 feet up to a maximum of about 11.5 feet. This coarse-grained zone appears to be underlain by a second clay zone, which was generally encountered at depths below grade of about 27.5 to 29 feet (except in the vicinity of well MW3, which encountered clayey gravel to the maximum depth explored of 29 feet).

Immediately underlying the surface of the site is a relatively thin layer of artificial fill materials varying in thickness from 1 to 2 feet.

DISCUSSION AND RECOMMENDATIONS

Based on the analytical results, KEI recommends implementation of a monitoring and sampling program. The wells should be monitored on a monthly basis. In addition, the wells should be purged and sampled on a quarterly basis. The proposed program should be conducted for a period of 12 months. 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 needed. Our proposal for this work is attached for your consideration.

10/30/89

DISTRIBUTION

Copies of this report should be sent to the Alameda County Flood Control District, 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 ground water levels and flow paths, thereby changing 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 investigations. 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, 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 (707) 746-6915.

Sincerely,

Kaprealian Engineering, Inc.

Don R. Braun
Certified Engineering Geologist

License No. 1310
Exp. Date 6/30/90

Jae Yang, P.E.

License No. 25337
Exp. Date 12/31/89

Mardo Kaprealian
President

Attachments: Tables 1, 2 & 3
Location Map
Site Plan
Boring Logs
Laboratory Results
Chain of Custody documentation
Proposal

KEI-P89-0703.R5
October 23, 1989

TABLE 1

SUMMARY OF GROUND WATER MONITORING AND DEVELOPMENT DATA

(Monitored and Developed on September 12, 1989)

Well #	Depth (feet)	Product Thickness	Sheen	Gallons Pumped
MW1	12.79	0	None	90
MW2	18.41	0	None	105
MW3	18.62	0	None	90
MW4	18.31	0	None	95

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October 23, 1989

TABLE 2

SUMMARY OF LABORATORY ANALYSES
SOIL

(Results in ppm)
(Collected on September 6 and 7, 1989)

Sample Number	Depth (feet)	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
MW1*	5	ND	3.4	ND	ND	ND	ND
MW1*	10	ND	5.0	ND	ND	ND	ND
MW1*	15	ND	2.2	ND	ND	ND	ND
MW1*	19	ND	ND	ND	ND	ND	ND
MW2	5	---	1.4	ND	ND	ND	ND
MW2	10	---	ND	ND	ND	ND	ND
MW2	15	---	1.8	ND	ND	ND	ND
MW2	19	---	13	1.5	2.1	1.8	0.34
MW3	5	---	1.3	ND	ND	ND	ND
MW3	10	---	1.8	0.29	ND	ND	ND
MW3	15	---	3.3	ND	ND	ND	ND
MW3	18.5	---	ND	ND	ND	ND	ND
MW4	5	---	3.1	ND	ND	ND	ND
MW4	10	---	17	ND	ND	0.10	ND
MW4	15	---	20	ND	ND	0.27	ND
MW4	18.5	---	2.1	ND	ND	ND	ND
Detection Limits		1.0	1.0	0.05	0.1	0.1	0.11

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

ND = Non-detectable.

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TABLE 3

SUMMARY OF LABORATORY ANALYSES
WATER

(Results in ppb)
(Collected on September 15, 1989)

Sample Number	Depth (feet)	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Xylenes	Ethyl-benzene
MW1*	18.48	ND	ND	ND	0.61	ND	ND
MW2	18.38	---	290	ND	12	ND	ND
MW3	18.53	---	32	ND	ND	ND	ND
MW4	18.32	---	ND	ND	ND	ND	ND
Detection Limits		50	30	0.3	0.3	0.3	0.3

* TOG was <50 ppm. EPA 8010 showed 2.7 ppb of tetrachloroethene for this sample.

ND = Non-detectable.

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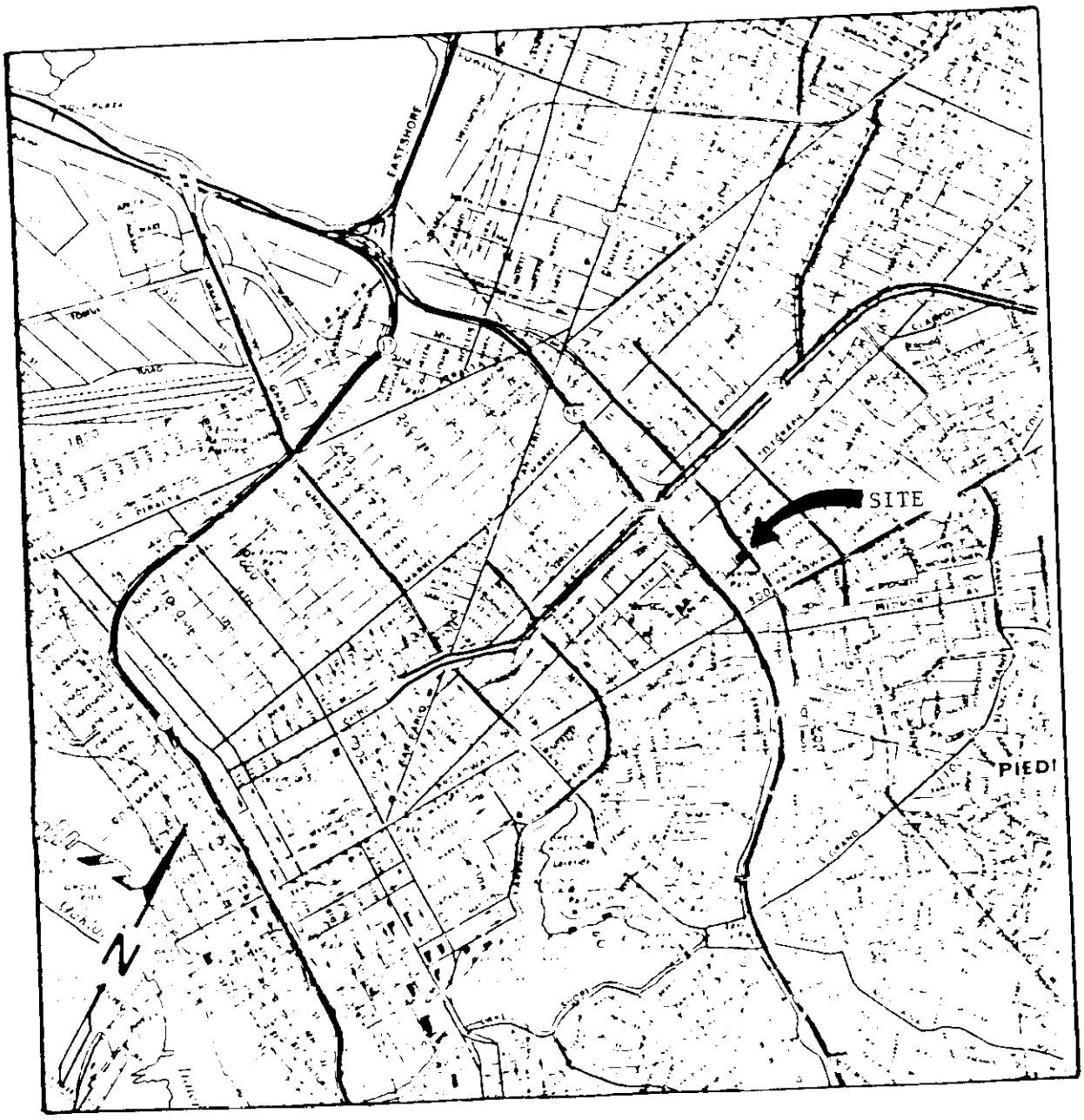

LOCATION MAP

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

KAPREALIAN ENGINEERING, INC.
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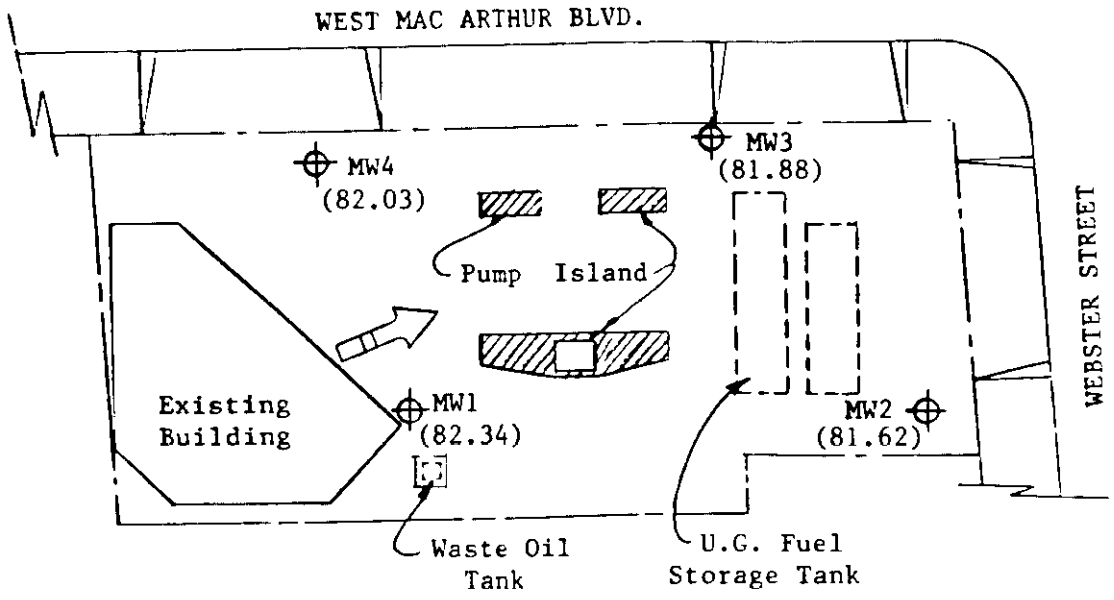


SITE PLAN

30 0 30
scale feet

⊕ Monitoring Well

( ) Ground water elevation in feet on 9/15/89. Surface elevation at top of MW2 assumed 100' as datum.

⇨ Ground water flow direction

Unocal S/S #3538
411 W. MacArthur Blvd.
Oakland, California

BORING LOG

Project No.	Boring & Casing Diameter	Logged By
KEI-P89-0703	9" 2"	D.L.
Project Name Unocal, Oakland/MacArthur	**Well Head Elevation** N/A	**Date Drilled** 9/6/89
Boring No. MW2	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
			GP-GM	Poorly graded gravel with silt and sand, very dense, wet, dark yellowish brown.
25/37/45		25	GP	Poorly graded gravel with sand, very dense, wet, dark, yellowish brown.
			CH	Clay, high plasticity, trace sand, very stiff, moist, yellowish brown.
25/29/35		30		
		35		
		40		TOTAL DEPTH 30.5'

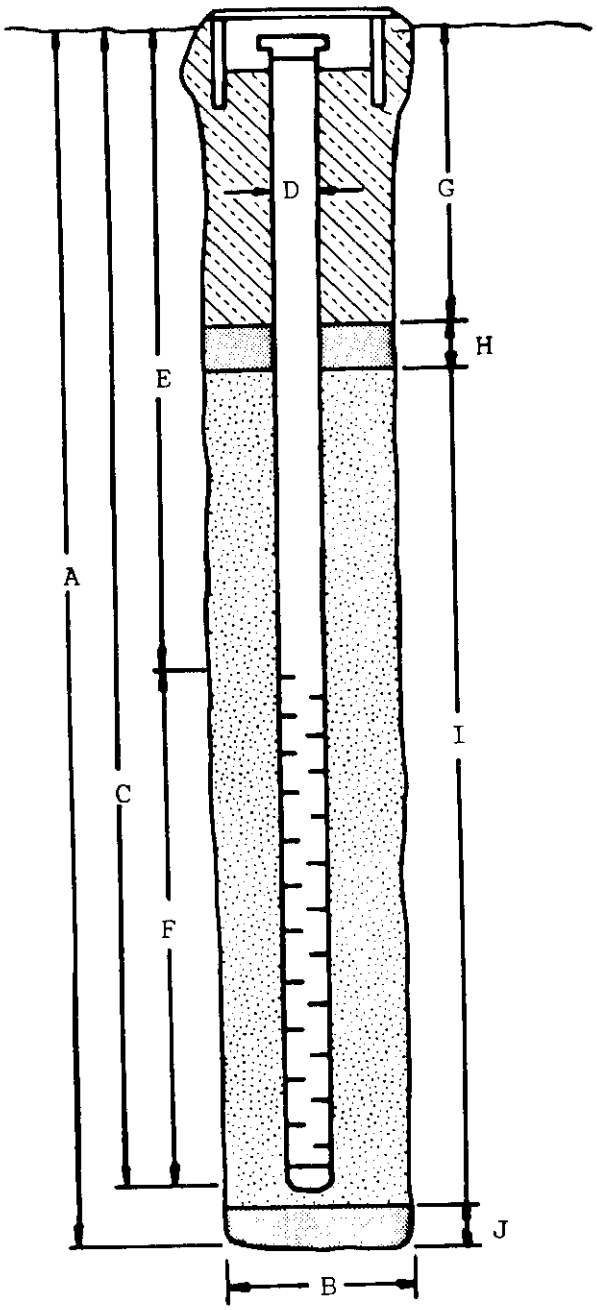
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland, MacArthur BORING/WELL NO. MW2

PROJECT NUMBER: KEI-P89-0703

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 30'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 28.5'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 3.5'

F. Perforated Length: 25'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 2'

Seal Material: Concrete

H. Seal: 1'

Seal Material: Bentonite

I. Gravel Pack: 27'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

B O R I N G L O G

Project No. KEI-P89-0703	**Boring & Casing Diameter** 9" 2"	**Logged By** D.L.
Project Name Unocal, Oakland/MacArthur	**Well Head Elevation** N/A	**Date Drilled** 9/7/89
Boring No. MW3	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
		0		Concrete Pavement
9/15/21		5	CH	Clay, high plasticity, with silt, stiff, moist, dark olive gray, very dark grayish brown above 4'.
14/17/23		10		Clay, high plasticity, very stiff, moist, pale olive, with dark greenish gray stained root holes.
15/23/33		15	CL	Sandy clay, low to moderate plasticity, 25-40% sand, stiff, moist, olive and greenish gray, mottled, lensed with clayey sand.
10/17/24	▼		CH	Sandy clay, moderate to high plasticity, stiff, moist, olive.
		20		

BORING LOG

Project No. KEI-P89-0703	Boring & Casing Diameter 9" 2"	Logged By D.L.
Project Name Unocal, Oakland/MacArthur	Well Head Elevation N/A	Date Drilled 9/7/89
Boring No. MW3	Drilling Method Hollow-stem Auger	Drilling Company EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
				Sandy clay, as above.
37/50-5-1/2"			GP-GC	Poorly graded gravel with clay and sand, very dense, wet, dark yellowish brown.
		25	GC	Clayey gravel, very dense, moist, yellowish brown.
		30		
		35		
		40		TOTAL DEPTH 29'

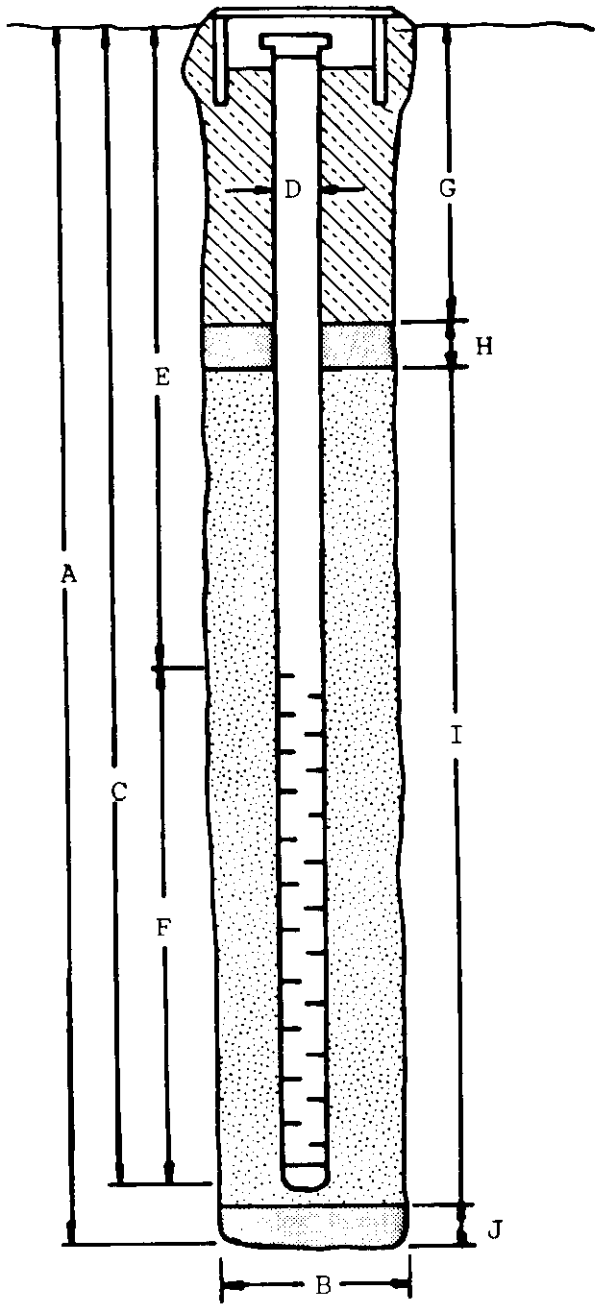
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland, MacArthur BORING/WELL NO. MW3

PROJECT NUMBER: KEI-P89-0703

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 29'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 29'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 5'

F. Perforated Length: 24'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 3'

Seal Material: Concrete

H. Seal: 1'

Seal Material: Bentonite

I. Gravel Pack: 25'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

BORING LOG

Project No. KEI-P89-0703	**Boring & Casing Diameter** 9" 2"	**Logged By** D.L.
Project Name Unocal, Oakland/MacArthur	**Well Head Elevation** N/A	**Date Drilled** 9/6/89
Boring No. MW4	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
		0		A.C. Pavement Sand and Gravel: Fill
12/16/25		5		Clay, high plasticity, very stiff, moist, very dark grayish brown, brown below 5'.
				Gravelly clay with sand, very stiff, moist, dark yellowish brown.
19/25/30		10	CH	Clay, high plasticity, very stiff, slightly moist, light yellowish brown.
14/17/29		15		Silty clay, high plasticity, 10-15%, fine sand, very stiff, moist, pale olive.
15/15/23	▼		SM	Silty sand, dense to very dense, very moist to wet, light yellowish brown.
		20	SW	Well graded sand, trace to 10%

BORING LOG

Project No. KEI-P89-0703	**Boring & Casing Diameter** 9" 2"	**Logged By** D.L.
Project Name Unocal, Oakland/MacArthur	**Well Head Elevation** N/A	**Date Drilled** 9/6/89
Boring No. MW4	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
			SW	fines, dense, wet, dark yellowish brown.
		25	GP-GC	Poorly graded gravel with clay and sand, dense, wet, dark yellowish brown, clay content, increasing with depth.
			CH	Gravelly clay, high plasticity, 5-10% sand, very stiff, moist, dark yellowish brown.
		30		
		35		
		40		TOTAL DEPTH 29'

BORING LOG

Project No.	Boring & Casing Diameter	Logged By
KEI-P89-0703	9" 2"	D.L.
Project Name Unocal, Oakland/MacArthur	**Well Head Elevation** N/A	**Date Drilled** 9/7/89
Boring No. MW1	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
		0		A.C. Pavement Sand and Gravel: fill.
11/17/22		5		Clay, high plasticity, stiff, moist, very dark grayish brown.
				Gravelly clay with sand, stiff, moist, dark yellowish brown.
32/17/20		10		Sand clay, high plasticity, stiff, moist, olive, trace gravel.
			CH	Clay, high plasticity, very stiff, moist, pale olive, with greenish gray stained root holes.
13/17/19		15		Sandy clay, moderate to high plasticity, stiff, moist, olive to light yellowish brown.
10/17/20	▼		SC	Clayey sand, dense, very moist to wet, yellowish brown.
		20		

BORING LOG

Project No. KEI-P89-0703	**Boring & Casing Diameter** 9" 2"	**Logged By** D.L.
Project Name Unocal, Oakland/MacArthur	**Well Head Elevation** N/A	**Date Drilled** 9/7/89
Boring No. MW1	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
			SC	Clayey sand, as above.
		25	SP	Poorly graded sand, yellowish brown.
			CH	Clay, high plasticity, very stiff, moist, yellowish brown.
		30		
		35		
		40		TOTAL DEPTH 29'

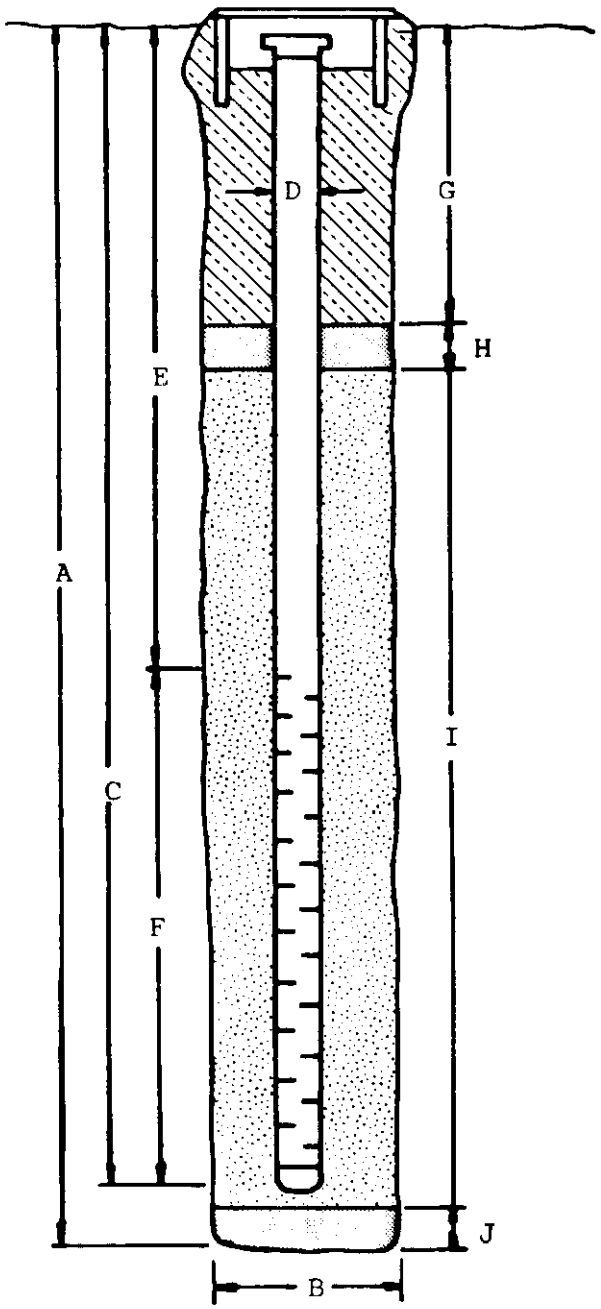
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland, MacArthur BORING/WELL NO. MW1

PROJECT NUMBER: KEI-P89-0703

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 29'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 29'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 5'

F. Perforated Length: 24'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 3'

Seal Material: Concrete

H. Seal: 1'

Seal Material: Bentonite

I. Gravel Pack: 25'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

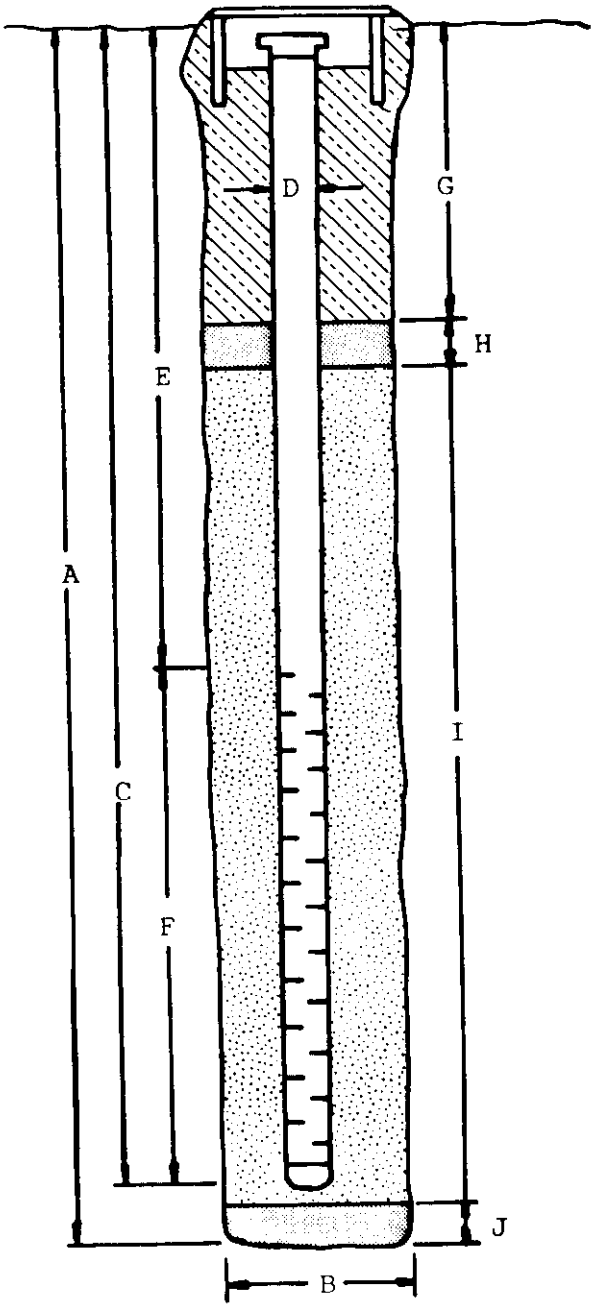
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland, MacArthur BORING/WELL NO. MW4

PROJECT NUMBER: KEI-P89-0703

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 29'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 29'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 5'

F. Perforated Length: 24'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 3'

Seal Material: Concrete

H. Seal: 1'

Seal Material: Bentonite

I. Gravel Pack: 25'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

SEQUOIA ANALYTICAL

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

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, W. MacArthur, KEI-P89-0703	Sampled:	9/6-9/7/89
P.O. Box 913	Matrix Descript:	Soil, MW1, MW2	Received:	Sep 8, 1989
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Sep 20, 1989
Attention: Mardo Kaprealian, P.E.	First Sample #:	909-0685	Reported:	Sep 22, 1989

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

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
909-0685	MW-1-(5)	3.4	N.D.	N.D.	N.D.	N.D.
909-0686	MW-1-(10)	5.0	N.D.	N.D.	N.D.	N.D.
909-0687	MW-1-(15)	2.2	N.D.	N.D.	N.D.	N.D.
909-0688	MW-1-(19)	N.D.	N.D.	N.D.	N.D.	N.D.
909-0689	MW-2-(5)	1.4	N.D.	N.D.	N.D.	N.D.
909-0690	MW-2-(10)	N.D.	N.D.	N.D.	N.D.	N.D.
909-0691	MW-2-(15)	1.8	N.D.	N.D.	N.D.	N.D.
909-0692	MW-2-(19)	13	1.5	2.1	0.34	1.8
Detection Limits:		**1.0**	**0.05**	**0.1**	**0.1**	**0.1**

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

Belinda C. Vega
Project Manager

SEQUOIA ANALYTICAL

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

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, W. McArthur, KEI-P89-0703	Sampled:	9/6-9/7/89
P.O. Box 913	Matrix Descript:	Soil	Received:	Sep 8, 1989
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Sep 20, 1989
Attention: Mardo Kaprealian, P.E.	First Sample #:	909-0677	Reported:	Sep 21, 1989

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

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
909-0677	MW-3-(5)	1.3	N.D.	N.D.	N.D.	N.D.
909-0678	MW-3-(10)	1.8	0.29	N.D.	N.D.	N.D.
909-0679	MW-3-(15)	3.3	N.D.	N.D.	N.D.	N.D.
909-0680	MW-3-(18.5)	N.D.	N.D.	N.D.	N.D.	N.D.
909-0681	MW-4-(5)	3.1	N.D.	N.D.	N.D.	N.D.
909-0682	MW-4-(10)	17	N.D.	N.D.	N.D.	0.10
909-0683	MW-4-(15)	20	N.D.	N.D.	N.D.	0.27
909-0684	MW-4-(18.5)	2.1	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**1.0**	**0.05**	**0.1**	**0.1**	**0.1**

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

Belinda C. Vega
Project Manager

SEQUOIA ANALYTICAL

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

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, W. MacArthur, KEI-P89-0703	Sampled:	9/6-9/7/89
P.O. Box 913	Matrix Descript:	Soil	Received:	Sep 8, 1989
Benicia, CA 94510	Analysis Method:	EPA 418.1 (I.R. with clean-up)	Extracted:	Sep 20, 1989
Attention: Mardo Kaprealian, P.E.	First Sample #:	909-0685	Analyzed:	Sep 21, 1989
			Reported:	Sep 22, 1989

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

Sample Number	Sample Description	Petroleum Oil mg/kg (ppm)
909-0685	MW-1-(5)	< 50
909-0686	MW-1-(10)	< 50
909-0687	MW-1-(15)	< 50
909-0688	MW-1-(19)	< 50

Detection Limits:	**1.0**

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

SEQUOIA ANALYTICAL

Belinda C. Vega
Project Manager

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, W. MacArthur, KEI-P89-0703	Sampled:	9/6-9/7/89
P.O. Box 913	Matrix Descript:	Soil	Received:	Sep 8, 1989
Benicia, CA 94510	Analysis Method:	EPA 3550/8015	Extracted:	Sep 20, 1989
Attention: Mardo Kaprealian, P.E.	First Sample #:	909-0685	Analyzed:	Sep 20, 1989
			Reported:	Sep 22, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons mg/kg (ppm)
909-0685	MW-1-(5)	N.D.
909-0686	MW-1-(10)	N.D.
909-0687	MW-1-(15)	N.D.
909-0688	MW-1-(19)	N.D.

Detection Limits:	**1.0**

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

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Project Manager

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, W. MacArthur, KEI-P89-0703	Sampled:	9/6-9/7/89
P.O. Box 913	Sample Descript:	Soil, MW-1-(5)	Received:	Sep 8, 1989
Benicia, CA 94510	Analysis Method:	EPA 5030/8010	Analyzed:	Sep 19, 1989
Attention: Mardo Kaprealian, P.E.	Lab Number:	909-0685	Reported:	Sep 22, 1989

HALOGENATED VOLATILE ORGANICS (EPA 8010)

Analyte	Detection Limit µg/kg	Sample Results µg/kg
Bromodichloromethane	5.0	N.D.
Bromoform	5.0	N.D.
Bromomethane	5.0	N.D.
Carbon tetrachloride	5.0	N.D.
Chlorobenzene	5.0	N.D.
Chloroethane	25.0	N.D.
2-Chloroethylvinyl ether	5.0	N.D.
Chloroform	5.0	N.D.
Chloromethane	5.0	N.D.
Dibromochloromethane	5.0	N.D.
1,2-Dichlorobenzene	10.0	N.D.
1,3-Dichlorobenzene	10.0	N.D.
1,4-Dichlorobenzene	10.0	N.D.
1,1-Dichloroethane	5.0	N.D.
1,2-Dichloroethane	5.0	N.D.
1,1-Dichloroethene	5.0	N.D.
Total 1,2-Dichloroethene	5.0	N.D.
1,2-Dichloropropane	5.0	N.D.
cis-1,3-Dichloropropene	5.0	N.D.
trans-1,3-Dichloropropene	5.0	N.D.
Methylene chloride	10.0	N.D.
1,1,2,2-Tetrachloroethane	5.0	N.D.
Tetrachloroethene	5.0	N.D.
1,1,1-Trichloroethane	5.0	N.D.
1,1,2-Trichloroethane	5.0	N.D.
Trichloroethene	5.0	N.D.
Trichlorofluoromethane	5.0	N.D.
Vinyl chloride	10.0	N.D.

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

SEQUOIA ANALYTICAL

Belinda C. Vega
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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, W. MacArthur, KEI-P89-0703	Sampled:	9/6-9/7/89
P.O. Box 913	Sample Descript:	Soil, MW-1-(10)	Received:	Sep 8, 1989
Benicia, CA 94510	Analysis Method:	EPA 5030/8010	Analyzed:	Sep 19, 1989
Attention: Mardo Kaprealian, P.E.	Lab Number:	909-0686	Reported:	Sep 22, 1989

HALOGENATED VOLATILE ORGANICS (EPA 8010)

Analyte	Detection Limit µg/kg	Sample Results µg/kg
Bromodichloromethane	5.0	N.D.
Bromoform	5.0	N.D.
Bromomethane	5.0	N.D.
Carbon tetrachloride	5.0	N.D.
Chlorobenzene	5.0	N.D.
Chloroethane	25.0	N.D.
2-Chloroethylvinyl ether	5.0	N.D.
Chloroform	5.0	N.D.
Chloromethane	5.0	N.D.
Dibromochloromethane	5.0	N.D.
1,2-Dichlorobenzene	10.0	N.D.
1,3-Dichlorobenzene	10.0	N.D.
1,4-Dichlorobenzene	10.0	N.D.
1,1-Dichloroethane	5.0	N.D.
1,2-Dichloroethane	5.0	N.D.
1,1-Dichloroethene	5.0	N.D.
Total 1,2-Dichloroethene	5.0	N.D.
1,2-Dichloropropane	5.0	N.D.
cis-1,3-Dichloropropene	5.0	N.D.
trans-1,3-Dichloropropene	5.0	N.D.
Methylene chloride	10.0	N.D.
1,1,2,2-Tetrachloroethane	5.0	N.D.
Tetrachloroethene	5.0	N.D.
1,1,1-Trichloroethane	5.0	N.D.
1,1,2-Trichloroethane	5.0	N.D.
Trichloroethene	5.0	N.D.
Trichlorofluoromethane	5.0	N.D.
Vinyl chloride	10.0	N.D.

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

SEQUOIA ANALYTICAL

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, W. MacArthur, KEI-P89-0703	Sampled:	9/6-9/7/89
P.O. Box 913	Sample Descript:	Soil, MW-1-(15)	Received:	Sep 8, 1989
Benicia, CA 94510	Analysis Method:	EPA 5030/8010	Analyzed:	Sep 19, 1989
Attention: Mardo Kaprealian, P.E.	Lab Number:	909-0687	Reported:	Sep 22, 1989

HALOGENATED VOLATILE ORGANICS (EPA 8010)

Analyte	Detection Limit µg/kg	Sample Results µg/kg
Bromodichloromethane	5.0	N.D.
Bromoform	5.0	N.D.
Bromomethane	5.0	N.D.
Carbon tetrachloride	5.0	N.D.
Chlorobenzene	5.0	N.D.
Chloroethane	25.0	N.D.
2-Chloroethylvinyl ether	5.0	N.D.
Chloroform	5.0	N.D.
Chloromethane	5.0	N.D.
Dibromochloromethane	5.0	N.D.
1,2-Dichlorobenzene	10.0	N.D.
1,3-Dichlorobenzene	10.0	N.D.
1,4-Dichlorobenzene	10.0	N.D.
1,1-Dichloroethane	5.0	N.D.
1,2-Dichloroethane	5.0	N.D.
1,1-Dichloroethene	5.0	N.D.
Total 1,2-Dichloroethene	5.0	N.D.
1,2-Dichloropropane	5.0	N.D.
cis-1,3-Dichloropropene	5.0	N.D.
trans-1,3-Dichloropropene	5.0	N.D.
Methylene chloride	10.0	N.D.
1,1,2,2-Tetrachloroethane	5.0	N.D.
Tetrachloroethene	5.0	N.D.
1,1,1-Trichloroethane	5.0	N.D.
1,1,2-Trichloroethane	5.0	N.D.
Trichloroethene	5.0	N.D.
Trichlorofluoromethane	5.0	N.D.
Vinyl chloride	10.0	N.D.

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

SEQUOIA ANALYTICAL

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Project Manager

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, W. MacArthur, KEI-P89-0703	Sampled:	9/6-9/7/89
P.O. Box 913	Sample Descript:	Soil, MW-1-(19)	Received:	Sep 8, 1989
Benicia, CA 94510	Analysis Method:	EPA 5030/8010	Analyzed:	Sep 19, 1989
Attention: Mardo Kaprealian, P.E.	Lab Number:	909-0688	Reported:	Sep 22, 1989

HALOGENATED VOLATILE ORGANICS (EPA 8010)

Analyte	Detection Limit µg/kg	Sample Results µg/kg
Bromodichloromethane	5.0	N.D.
Bromoform	5.0	N.D.
Bromomethane	5.0	N.D.
Carbon tetrachloride	5.0	N.D.
Chlorobenzene	5.0	N.D.
Chloroethane	25.0	N.D.
2-Chloroethylvinyl ether	5.0	N.D.
Chloroform	5.0	N.D.
Chloromethane	5.0	N.D.
Dibromochloromethane	5.0	N.D.
1,2-Dichlorobenzene	10.0	N.D.
1,3-Dichlorobenzene	10.0	N.D.
1,4-Dichlorobenzene	10.0	N.D.
1,1-Dichloroethane	5.0	N.D.
1,2-Dichloroethane	5.0	N.D.
1,1-Dichloroethene	5.0	N.D.
Total 1,2-Dichloroethene	5.0	N.D.
1,2-Dichloropropane	5.0	N.D.
cis-1,3-Dichloropropene	5.0	N.D.
trans-1,3-Dichloropropene	5.0	N.D.
Methylene chloride	10.0	N.D.
1,1,2,2-Tetrachloroethane	5.0	N.D.
Tetrachloroethene	5.0	N.D.
1,1,1-Trichloroethane	5.0	N.D.
1,1,2-Trichloroethane	5.0	N.D.
Trichloroethene	5.0	N.D.
Trichlorofluoromethane	5.0	N.D.
Vinyl chloride	10.0	N.D.

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

SEQUOIA ANALYTICAL

Belinda C. Vega
Project Manager

KAPREALIAN ENGINEERING, INC.
Consulting Engineers
P. O. BOX 913
BENICIA CA 94510
(415) 676 · 9100 (707) 746 · 6915

CHAIN OF CUSTODY

SAMPLER: _____ (Signature)

DATE/TIME OF COLLECTION: 9-6-89/9-7-89

TURN AROUND TIME: REGULAR

SAMPLE DESCRIPTION AND PROJECT NUMBER: UNOCAL/OAKLAND/WEST MACARTHUR
KEI-P89-0703

SAMPLE #	ANALYSES	GRAB OR COMP.	NUMBER OF CONTAINERS	SOIL/ WATER
MW-1-(5)	TPH-G/BTXE/TPH-D/TOG(418.1)/8010	G	1	S
MW-1-(10)	TPH-G/BTXE/TPH-D/TOG(418.1)/8010	G	1	S
MW-1-(15)	TPH-G/BTXE/TPH-D/TOG(418.1)/8010	G	1	S
MW-1-(19)	TPH-G/BTXE/TPH-D/TOG(418.1)/8010	G	1	S
MW-2-(5)	TPH-G/BTXE	G	1	S
MW-2-(10)	TPH-G/BTXE	G	1	S
MW-2-(15)	TPH-G/BTXE	G	1	S
MW-2-(19)	TPH-G/BTXE	G	1	S

RELINQUISHED BY*	TIME/DATE	RECEIVED BY*	TIME/DATE
1. _____ (KEI)	9:02 9/8/89	Tom Bolan	9:02 '89
2. Tom Bolan (Kiesa)	9-8-89	B.L. Olivia	9/9/89 11:00am
3.			

* STATE AFFILIATION NEXT TO SIGNATURE

REMARKS: _____

NOTE: IF REGULAR TURNAROUND, SOIL ANALYSES MUST BE COMPLETED WITHIN 14 CALENDAR DAYS OF SAMPLE COLLECTION. WATER ANALYSES MUST BE COMPLETED WITHIN 7 CALENDAR DAYS FOR BTX&E (UNLESS SAMPLE HAS BEEN PRESERVED), AND 14 CALENDAR DAYS FOR TPH AS GASOLINE; EXTRACT TPH AS DIESEL WITHIN 14 CALENDAR DAYS.

KAPREALIAN ENGINEERING, INC.
Consulting Engineers
P. O. BOX 913
BENICIA, CA 94510
(415) 676 - 9100 (707) 746 - 6915

CHAIN OF CUSTODY

SAMPLER: _____ (Signature)

DATE/TIME OF COLLECTION: 9-6-89/9-7-89

TURN AROUND TIME: REGULAR

SAMPLE DESCRIPTION AND PROJECT NUMBER: UNOCAL/OAKLAND/WEST MACARTHUR
KEI-P89-0703

SAMPLE #	ANALYSES	GRAB OR COMP.	NUMBER OF CONTAINERS	SOIL/ WATER
MW-3-(5)	TPH-G/BTXE	G	1	S
MW-3-(10)	TPH-G/BTXE	G	1	S
MW-3-(15)	TPH-G/BTXE	G	1	S
MW-3-(18.5)	TPH-G/BTXE	G	1	S
MW-4-(5)	TPH-G/BTXE	G	1	S
MW-4-(10)	TPH-G/BTXE	G	1	S
MW-4-(15)	TPH-G/BTXE	G	1	S
MW-4-(18.5)	TPH-G/BTXE	G	1	S

RELINQUISHED BY*	TIME/DATE	RECEIVED BY*	TIME/DATE
1. _____ (KEI)	9:02 9/8/89	Tom Beloan	9:02 9-8
2. Tom Beloan	9-8 11 Am	B.L. Olwen	9/8/89 11:00 a.m.
3.			

* STATE AFFILIATION NEXT TO SIGNATURE

REMARKS: _____

NOTE: IF REGULAR TURNAROUND, SOIL ANALYSES MUST BE COMPLETED WITHIN 14 CALENDAR DAYS OF SAMPLE COLLECTION. WATER ANALYSES MUST BE COMPLETED WITHIN 7 CALENDAR DAYS FOR BTX&E (UNLESS SAMPLE HAS BEEN PRESERVED), AND 14 CALENDAR DAYS FOR TPH AS GASOLINE; EXTRACT TPH AS DIESEL WITHIN 14 CALENDAR DAYS.

SEQUOIA ANALYTICAL

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, 411 W. MacArthur	Sampled:	Sep 15, 1989
P.O. Box 913	Matrix Descript:	Water MW1, MW2, MW3, MW4	Received:	Sep 18, 1989
Benicia, CA 94510	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Sep 23, 1989
Attention: Mardo Kaprealian, P.E.	First Sample #:	909-2077 A-B	Reported:	Sep 25, 1989

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

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons µg/L (ppb)	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)
9092077 A-B	MW1	N.D.	N.D.	0.61	N.D.	N.D.
9092078 A-B	MW2	290	N.D.	12	N.D.	N.D.
9092079 A-B	MW3	32	N.D.	N.D.	N.D.	N.D.
9092080 A-B	MW4	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**30.0**	**0.3**	**0.3**	**0.3**	**0.3**

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

Belinda C. Vega
Project Manager

SEQUOIA ANALYTICAL

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, 411 W. MacArthur	Sampled:	Sep 15, 1989
P.O. Box 913	Matrix Descript:	Water, MW1, MW2, MW3, MW4	Received:	Sep 18, 1989
Benicia, CA 94510	Analysis Method:	EPA 3510/8015	Extracted:	Sep 22, 1989
Attention: Mardo Kaprealian, P.E.	First Sample #:	909-2077 F	Analyzed:	Sep 22, 1989
			Reported:	Sep 25, 1989

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons µg/L (ppb)
909-2077	MW1	N.D.

Detection Limits:	50.0

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Belinda C. Vega
Project Manager

SEQUOIA ANALYTICAL

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Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, 411 W. MacArthur	Sampled:	Sep 15, 1989
P.O. Box 913	Matrix Descript:	Water	Received:	Sep 18, 1989
Benicia, CA 94510	Analysis Method:	EPA 418.1 (I.R. with clean-up)	Extracted:	Sep 22, 1989
Attention: Mardo Kaprealian, P.E.	First Sample #:	909-2077 E	Analyzed:	Sep 22, 1989
			Reported:	Sep 25, 1989

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

Sample Number	Sample Description	Petroleum Oil mg/L (ppm)
909-2077	MW1	< 50

Detection Limits:	1.0

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

SEQUOIA ANALYTICAL

Belinda C. Vega
Project Manager

SEQUOIA ANALYTICAL

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(415) 364-9600 • FAX (415) 364-9233

Kaprealian Engineering, Inc.	Client Project ID:	Unocal, Oakland, 411 W. MacArthur	Sampled:	Sep 15, 1989
P.O. Box 913	Sample Descript:	Water	Received:	Sep 18, 1989
Benicia, CA 94510	Analysis Method:	EPA 5030/8010	Analyzed:	Sep 21, 1989
Attention: Mardo Kaprealian, P.E.	Lab Number:	909-2077 C-D	Reported:	Sep 25, 1989

HALOGENATED VOLATILE ORGANICS (EPA 8010)

Analyte	Detection Limit µg/L	Sample Results µg/L
Bromodichloromethane	1.0	N.D.
Bromoform	1.0	N.D.
Bromomethane	1.0	N.D.
Carbon tetrachloride	1.0	N.D.
Chlorobenzene	1.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethylvinyl ether	1.0	N.D.
Chloroform	0.5	N.D.
Chloromethane	0.5	N.D.
Dibromochloromethane	0.5	N.D.
1,2-Dichlorobenzene	2.0	N.D.
1,3-Dichlorobenzene	2.0	N.D.
1,4-Dichlorobenzene	2.0	N.D.
1,1-Dichloroethane	0.5	N.D.
1,2-Dichloroethane	0.5	N.D.
1,1-Dichloroethene	1.0	N.D.
Total 1,2-Dichloroethene	1.0	N.D.
1,2-Dichloropropane	0.5	N.D.
cis-1,3-Dichloropropene	5.0	N.D.
trans-1,3-Dichloropropene	5.0	N.D.
Methylene chloride	2.0	N.D.
1,1,2,2-Tetrachloroethane	0.5	N.D.
Tetrachloroethene	**0.5**	**2.7**
1,1,1-Trichloroethane	0.5	N.D.
1,1,2-Trichloroethane	0.5	N.D.
Trichloroethene	0.5	N.D.
Trichlorofluoromethane	1.0	N.D.
Vinyl chloride	2.0	N.D.

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

SEQUOIA ANALYTICAL

Belinda C. Vega
Project Manager

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Consulting Engineers
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BENICIA, CA 94510
(415) 676 · 9100 (707) 746 · 6915

CHAIN OF CUSTODY

SAMPLER: HAGOP (Signature) DATE/TIME OF COLLECTION: 9-15-89 TURN AROUND TIME: Five Days

SAMPLE DESCRIPTION AND PROJECT NUMBER: UNOCAL-OAKLAND-411 W. MacArthur

SAMPLE #	ANALYSES	GRAB OR COMP.	NUMBER OF CONTAINERS	SOIL/ WATER
MW1	TPH-G/TPH-D/BTXE	G	2 liters	W
	TOG / 601		4 VOA's	
MW2	TPH-G/BTXE	G	2 VOA's	W
MW3	TPH-G/BTXE	G	2 VOA's	W
MW4	TPH-G/BTXE	G	2 VOA's	W

RELINQUISHED BY*	TIME/DATE	RECEIVED BY*	TIME/DATE
1. Hagop Kevork	12:30 pm 9-18-89	Priority Ben Lorenat	12:30 9-18-89
2. Priority Ben Lorenat	1:55 9-18-89	KNU	1:55 9-18-89
3.			

* STATE AFFILIATION NEXT TO SIGNATURE

REMARKS:

NOTE: IF REGULAR TURNAROUND, SOIL ANALYSES MUST BE COMPLETED WITHIN 14 CALENDAR DAYS OF SAMPLE COLLECTION. WATER ANALYSES MUST BE COMPLETED WITHIN 7 CALENDAR DAYS FOR BTX&E (UNLESS SAMPLE HAS BEEN PRESERVED), AND 14 CALENDAR DAYS FOR TPH AS GASOLINE; EXTRACT TPH AS DIESEL WITHIN 14 CALENDAR DAYS.

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KEI-P89-0703.P2
October 23, 1989

PROPOSAL TO
UNOCAL CORPORATION
for the
Unocal Service Station #3538
411 W. MacArthur Blvd.
Oakland, California

GROUND WATER MONITORING, SAMPLING AND ANALYSIS

INTRODUCTION

Preliminary investigation of the ground water conducted in September, 1989 at the referenced site showed the presence of detectable levels of hydrocarbons in the monitoring wells. Per our recommendations described in KEI's report KEI-P89-0703.R5 dated October 23, 1989, Kaprealian Engineering, Inc. (KEI) proposes the following work plan.

PROPOSED TASK

1. Monitor all existing wells (MW1 through MW4) on a monthly basis. Record the elevation of the water table and any abnormal conditions noted during inspection, including presence of product and sheen.

2. Purge and sample ground water from all monitoring wells on a quarterly basis, and analyze for total petroleum hydrocarbons (TPH) as gasoline and benzene, toluene, xylenes and ethylbenzene (BTX&E) on a quarterly basis. In addition, ground water from MW1 (adjacent to the waste oil tank), will be analyzed for TPH as diesel, total oil and grease, and 601 constituents. Prior to sampling, water table elevation will be recorded as well as the presence of any free product.

3. Prepare quarterly technical reports summarizing the field activity water sampling and analyses with discussion and recommendations.

The purging of ground water and sampling should continue for 12 months. This proposed monitoring and sampling program should be re-evaluated after each quarter if necessary.

BORING LOG

Project No. KEI-P89-0703	**Boring & Casing Diameter** 9" 2"	**Logged By** D.L.
Project Name Unocal, Oakland/MacArthur	**Well Head Elevation** N/A	**Date Drilled** 9/7/89
Boring No. MW1	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
		0		A.C. Pavement Sand and Gravel: fill.
11/17/22		5		Clay, high plasticity, stiff, moist, very dark grayish brown.
				Gravelly clay with sand, stiff, moist, dark yellowish brown.
32/17/20		10		Sand clay, high plasticity, stiff, moist, olive, trace gravel.
			CH	Clay, high plasticity, very stiff, moist, pale olive, with greenish gray stained root holes.
13/17/19		15		Sandy clay, moderate to high plasticity, stiff, moist, olive to light yellowish brown.
10/17/20	▼		SC	Clayey sand, dense, very moist to wet, yellowish brown.
		20		

BORING LOG

Project No. KEI-P89-0703	Boring & Casing Diameter 9" 2"	Logged By D.L.
Project Name Unocal, Oakland/MacArthur	Well Head Elevation N/A	Date Drilled 9/7/89
Boring No. MW1	Drilling Method Hollow-stem Auger	Drilling Company EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
			SC	Clayey sand, as above.
		25	SP	Poorly graded sand, yellowish brown.
			CH	Clay, high plasticity, very stiff, moist, yellowish brown.
		30		
		35		
		40		TOTAL DEPTH 29'

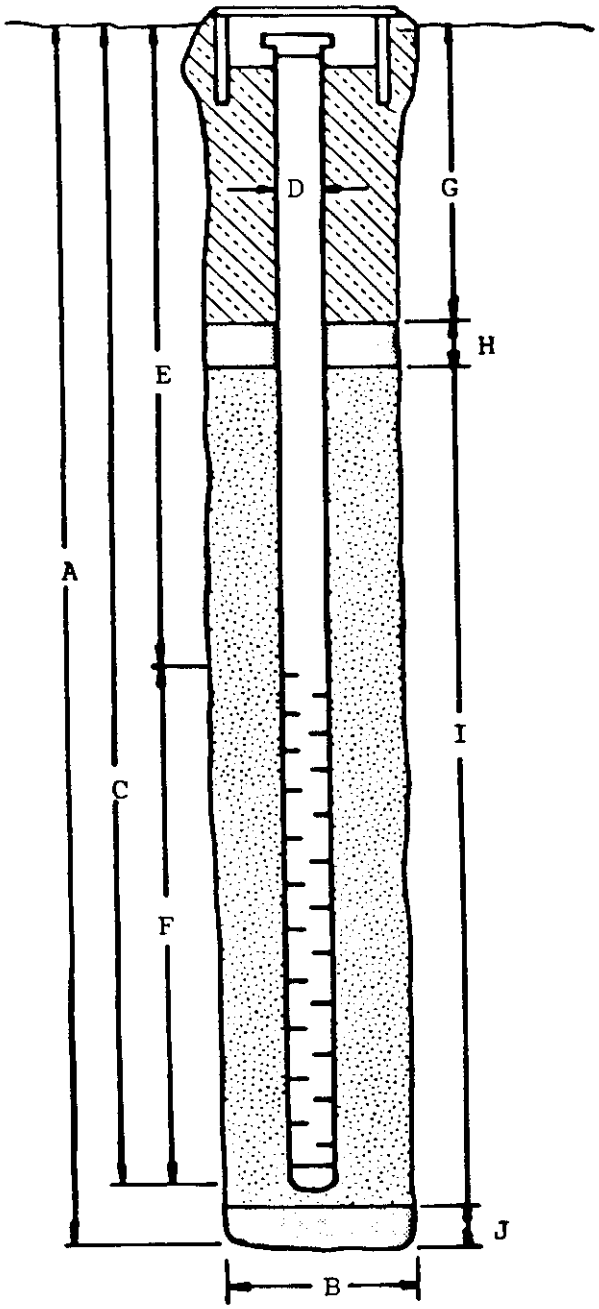
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland, MacArthur BORING/WELL NO. MW1

PROJECT NUMBER: KEI-P89-0703

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 29'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 29'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 5'

F. Perforated Length: 24'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 3'

Seal Material: Concrete

H. Seal: 1'

Seal Material: Bentonite

I. Gravel Pack: 25'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

BORING LOG

Project No. KEI-P89-0703	Boring & Casing Diameter 9" 2"	Logged By D.L.
Project Name Unocal, Oakland/MacArthur	Well Head Elevation N/A	Date Drilled 9/6/89
Boring No. MW2	Drilling Method Hollow-stem Auger	Drilling Company EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
		0		Concrete Pavement Sand and Gravel: Fill
9/14/21		5	CH	Clay, high plasticity, with silt, firm to stiff, moist, dark olive gray, black from 1.5 to 4 feet.
13/15/28		10	GC	Clayey gravel with sand, dense, moist, yellowish brown, gravel to 3/4".
9/15/19			CH	Sandy clay, high plasticity, 15-45% sand, stiff, moist, light yellowish brown and greenish gray, mottled, lensed with clayey sand.
10/15/23			SC	Clayey sand, dense to very dense, moist, olive and greenish gray.
8/10/15		15		
9/12/16			CH	Silty clay, moderate to high plasticity, firm, moist, olive.
13/37/46	▼	20	SW	Well graded sand with gravel, dense, wet, brown, silty from 19.5 feet.

BORING LOG

Project No. KEI-P89-0703	**Boring & Casing Diameter** 9" 2"	**Logged By** D.L.
Project Name Unocal, Oakland/MacArthur	**Well Head Elevation** N/A	**Date Drilled** 9/6/89
Boring No. MW2	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
			GP-GM	Poorly graded gravel with silt and sand, very dense, wet, dark yellowish brown.
25/37/45		25	GP	Poorly graded gravel with sand, very dense, wet, dark, yellowish brown.
			CH	Clay, high plasticity, trace sand, very stiff, moist, yellowish brown.
25/29/35		30		
		35		
		40		TOTAL DEPTH 30.5'

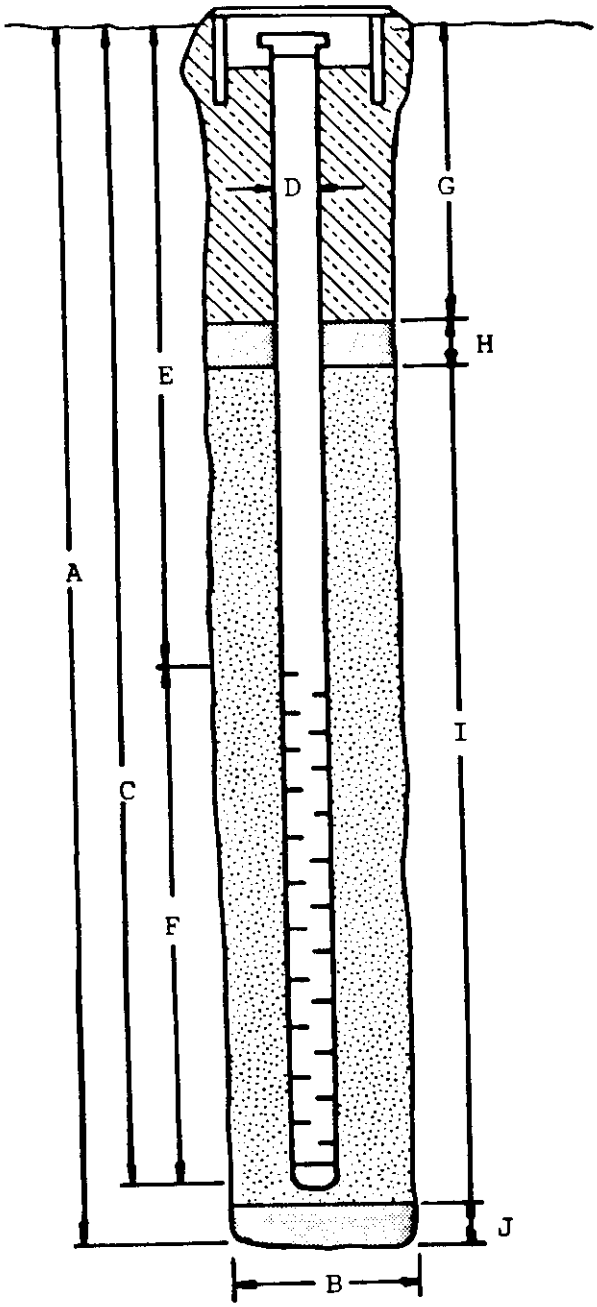
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Oakland, MacArthur BORING/WELL NO. MW2

PROJECT NUMBER: KEI-P89-0703

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 30'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 28.5'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375"

ID = 2.067"

E. Depth to Perforations: 3.5'

F. Perforated Length: 25'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 2'

Seal Material: Concrete

H. Seal: 1'

Seal Material: Bentonite

I. Gravel Pack: 27'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: None

Seal Material: N/A

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.