TRANSMITTAL FORM

Applied GeoSystems
43255 Mission Boulevard Fremont, California 94539
(415) 651-1906
FAX (415) 651-8647

Date 11/7/89 Project No. 1806-3

Subject: Report, Supplemental Subsurface Environmental Investigation at Unocal Station No. 5484, Castro Valley, CA.

TO Mr. Scott Seery
Alameda County Health Care Services Agency
Hazardous Materials Division
80 Swan Way, Room 200
Oakland, California 94621

FROM Jon R. Luella

TITLE Project Geologist

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REMARKS At the request of Mr. Tim Ross of Unocal Corporation, the attached report is submitted for your review and consideration.

COPIES: 1 to AGS project file no. 1806-3
Tim Ross, Unocal Corp.

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

togwater.rpt

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon Luellen

Date Received: 11-21-89
Laboratory Number: 91131W02
Project #: 18061-5
Sample #: W-16-MW5
Matrix: Water

Parameter	Result (mg/L)	Detection Limit (mg/L)	Date Analyzed
TPH as Oil and Grease	ND	5	12-05-89

mg/L = milligrams per liter = ppm
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.

PROCEDURES

TPH as Oil and Grease: Total Petroleum Hydrocarbons as Oil and Grease are measured by extraction and gravimetric analysis according to Standard Method 503A/E.

Laura Kuck
Laura Kuck, Laboratory Manager

12-07-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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REPORT
SUPPLEMENTAL SUBSURFACE ENVIRONMENTAL INVESTIGATION
at
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

Sept 11, 1989

AGS Job No. 18061-3

Report prepared for

Unocal Corporation
2175 North California Boulevard
Suite 605
Walnut Creek, California

by
Applied GeoSystems

Jon R. Luellen
Project Geologist

Walter H. Howe
R.G. 730

September 11, 1989

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

• FREMONT • IRVINE • HOUSTON • BOSTON • SACRAMENTO • CULVER CITY • SAN JOSE

September 11, 1989
AGS 18061-3

Mr. Tim Ross
Unocal Corporation
Suite 605
2175 North California Boulevard
Walnut Creek, California 94596

Subject: Executive Summary of Report on Supplemental Subsurface Environmental Investigation at Unocal Service Station No. 5484, 18950 Lake Chabot Road, Castro Valley, California.

Mr. Ross:

At your request, this report presents the results of our supplemental subsurface environmental investigation at Unocal Service Station No. 5484, in Castro Valley, California. We conducted additional investigative work to assess the extent and concentrations of hydrocarbons in the soil and ground-water at and adjacent to the above-referenced site. The work was performed to comply with requirements of the Alameda County Health Care Services Agency.

Applied GeoSystems' investigation included drilling three 10-inch-diameter boreholes, constructing 4-inch-diameter ground-water monitoring wells in the borings, collecting soil samples from the borings, and collecting water samples from the three newly installed monitoring wells and one onsite monitoring well for laboratory analysis. In addition, we evaluated the ground-water gradient. We installed two of the ground-water monitoring wells (MW-4 and MW-5) offsite (southwest and south, respectively) of the Unocal Station No. 5484 property; we installed the third monitoring well (MW-6) in the northern portion of the Unocal property, northwest of the underground gasoline storage tank pit. Work completed under the current investigation was conducted in accordance with Applied GeoSystems' Letter Work Plan No. 18061-3W, dated March 22, 1989.

The soil and ground-water samples were analyzed in the laboratory for total petroleum hydrocarbons as gasoline (TPHg) by Environmental Protection Agency (EPA) Method 8015 and for the purgeable gasoline constituents benzene, ethylbenzene, toluene, and total xylene isomers (BTEX) by EPA Method 8020 for soil and EPA Method 602 for water. The analyses indicated nondetectable to very low (less than 2.4 parts per million [ppm]) concentrations of TPHg in the soil samples taken from the borings. Analyses of ground-water samples collected from the three newly installed monitoring wells indicated nondetectable to very low (less than 0.026 ppm TPHg; less than 0.00083 ppm benzene) concentrations of dissolved hydrocarbon constituents. The analyses indicated detectable concentrations of hydrocarbons (0.55 ppm TPHg) in ground-water samples collected from existing well MW-2.

The wellheads of the new and existing onsite wells were surveyed to a local benchmark by a licensed land surveyor. Data from the site survey were combined with ground-water depth measurements to evaluate the ground-water flow direction in the site area. Static ground water was encountered at 7.34 to 9.60 feet below the ground surface in the wells. A flow direction of approximately southwest was interpreted from the ground-water depth and well elevation data. The magnitude of the ground-water gradient near the site ranges from approximately 0.067 to 0.111 (approximately 6.7 to 11.1 feet vertical distance per 100 feet horizontal distance).

The results of this investigation suggest that low levels of dissolved hydrocarbon constituents have migrated through ground water a relatively short distance toward the southwest from the area of the underground gasoline-storage tank pit, and possibly also from the former area of the waste-oil-storage tank. In our opinion, the extent of gasoline-related hydrocarbon contamination in the northern, southern and southwestern areas of the site, and southwest (downgradient) of the site has been delineated adequately.

At the time this investigation was being conducted, the two underground gasoline-storage tanks and one waste-oil-storage tank were being removed and replaced by Paradiso Construction under separate contract to Unocal. At Unocal's request, excavation, sampling, and aeration of hydrocarbon-contaminated soil in conjunction with the tank removal and replacement is being performed under the guidance of Applied GeoSystems. We anticipate that this excavation will allow us to evaluate further the lateral and vertical extent of soil contamination at the site. The results of the soil excavation, and recommendations regarding additional delineation of soil contamination, if necessary, will be discussed in forthcoming Applied GeoSystems Report No. 18061-4.

We recommend that the water in the ground-water monitoring wells be purged, sampled, and analyzed quarterly beginning in September 1989. Ground-water samples collected from the wells should be analyzed for TPHg and BTEX by EPA Methods 8015 and 602, respectively. Additionally, water samples collected from wells MW-5 and MW-2 also should

be analyzed at least one time for total oil and grease by Standard Method 503E, and for halogenated volatile organic compounds by EPA method 624. The purpose of the monitoring program is to evaluate trends in the concentrations of hydrocarbon constituents in ground water over time, and to assess the extent, if any, of possible migration of contaminants in ground water from the area of the waste-oil-storage tank.

We recommend that copies of this report be submitted to Mr. Scott Seery of the Alameda County Health Care Services Agency, Department of Environmental Health, Hazardous Materials Division, 80 Swan Way, Room 200, Oakland, California 94621, and Mr. Lester Feldman of the California Regional Water Quality Control Board, San Francisco Bay Region, 1111 Jackson Street, Room 6040, Oakland, California 94607. Please call if you have any questions regarding this report.

Sincerely,
Applied GeoSystems

Jon R. Luellen
Project Geologist

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Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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REPORT
SUPPLEMENTAL SUBSURFACE ENVIRONMENTAL INVESTIGATION
at
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

for Unocal Corporation

INTRODUCTION

At the request of Unocal Corporation (Unocal), Applied GeoSystems conducted a supplemental subsurface investigation at Unocal Service Station No. 5484, at 18950 Lake Chabot Road in Castro Valley, California. The site is shown on the Site Vicinity Map (Plate P-1). The purpose of the investigation was to delineate the extent and concentrations of petroleum hydrocarbon constituents in soil and ground water on and adjacent to the Station No. 5484 site. This report describes the work conducted during our investigation, discusses our interpretations of the data collected, and presents our conclusions and recommendations. Field work included drilling three 10-inch-diameter soil borings, two offsite and downgradient of the site and one located in the northern portion of the site, upgradient of the underground gasoline-storage tank pit; collecting soil samples from the borings for laboratory analysis; installing 4-inch-diameter ground-water monitoring wells in the borings; developing the newly constructed ground-water monitoring wells; purging and

collecting water samples from the wells for subjective and laboratory analysis; and evaluating the ground-water flow direction and ground-water gradient.

Work performed during this phase of work was completed in accordance with Applied GeoSystems' Letter Work Plan (Applied GeoSystems, March 22, 1989). The Letter Work Plan and additional site investigative work were requested by the Hazardous Materials Division, Department of Environmental Health, of the Alameda County Department of Health Services Agency (letter to Unocal dated February 15, 1989).

BACKGROUND AND PREVIOUS WORK

Unocal Service Station No. 5484 is at the southeastern corner of the intersection of Lake Chabot Road and Quail Avenue (Walnut Road) in Castro Valley, California. The site is located at an elevation of approximately 230 feet above mean sea level. The site is bounded on the north across Quail Avenue by residential properties. A community center and park properties administered by the Hayward Area Recreation and Park District lie south and east of the site. There are several commercial business and two vacant lots west of the site across Lake Chabot Road.

Two 10,000-gallon underground gasoline storage tanks were located in a tank pit in the south-central portion of the site, and one 280-gallon waste-oil-storage tank was located just

south of the station building. At the time this investigation was undertaken, the two gasoline-storage tanks and associated product lines, and the waste-oil-storage tank, were being excavated and removed by Paradiso Construction, under contract to Unocal (see below). It is our understanding that one of the 10,000-gallon tanks was used to store regular-unleaded gasoline, and the other tank was used to store premium-unleaded gasoline. On the basis of information obtained from Unocal, it is suspected that leaks previously occurred in the fiberglass adapter and the sub-pump swing joint of the underground unleaded product-storage tank. The locations of the gasoline- and waste-oil-storage tanks, and other pertinent features at the site, are shown on the Generalized Site Plan, Plate P-2.

On July 12 and 13, 1988, at Unocal's request, Applied GeoSystems drilled three soil borings at the site, and installed ground-water monitoring wells (MW-1, MW-2, and MW-3) within the borings to evaluate ground-water conditions in the vicinity of the underground gasoline-storage tanks (Applied GeoSystems, August 30, 1988). The locations of wells MW-1 through MW-3 are shown on the Generalized Site Plan, Plate P-2.

At the request of Unocal, Applied GeoSystems has monitored and sampled ground water in the three existing onsite ground-water monitoring wells (MW-1, MW-2, and MW-3) since October 1988. The purpose of this program is to evaluate trends in the concentrations

of hydrocarbons in ground water with time in the vicinity of the underground gasoline-storage tank pit.

During a site monitoring visit on October 14, 1988, personnel from Applied GeoSystems observed a 9-inch-thick layer of brown floating product on the water surface in monitoring well MW-3. We subsequently recommended a program of biweekly monitoring of ground water in the three wells and removal of floating product from well MW-3 (Applied GeoSystems, January 6, 1989).

Geologists from Applied GeoSystems revisited the site on January 3 and January 16, 1989 (Applied GeoSystems, February 9, 1989). Work performed by Applied GeoSystems included measuring depth to ground water in three ground-water monitoring wells at the site; examining ground-water samples collected from the three wells for subjective evidence of hydrocarbons; measuring the thickness of floating product, if any, in well MW-3; bailing floating product, when present, from this well; and periodically purging and collecting ground-water samples from two of the wells for laboratory analysis. Cumulative results of previous subjective analyses of ground-water samples, including the results of the January 3 and 16, 1989, monitoring, are presented in Table 1. Free product, when encountered in well MW-3, was bailed from the well and temporarily stored onsite in three Department of Transportation 17E 55-gallon, waste-liquid drums for later removal and consignment at Unocal's request. Recharge rates into well MW-3 subsequent to bailing were low.

TABLE 1
CUMULATIVE RESULTS OF PREVIOUS SUBJECTIVE
ANALYSES OF WATER IN WELLS
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley California
(page 1 of 1)

Well	Date	Depth to Water*	Inches of Floating Product	Sheen	Emulsion
MW-1	7/88	5.16	NONE	NONE	NONE
	10/88	7.10	NONE	NONE	NONE
	11/2/88	6.08	NONE	NONE	NONE
	11/9/88	6.14	NONE	NONE	NONE
	12/15/88	6.51	NONE	SLIGHT	NONE
	1/3/89	5.10	NONE	NONE	NONE
	1/16/89	4.75	NONE	NONE	NONE
MW-2	7/88	6.85	NONE	NONE	NONE
	10/88	7.81	NONE	SLIGHT	NONE
	11/2/88	7.83	NONE	NONE	NONE
	11/9/88	7.98	NONE	NONE	NONE
	12/15/88	7.89	NONE	NONE	NONE
	1/3/89	6.50	NONE	NONE	NONE
	1/16/89	6.02	NONE	NONE	NONE
MW-3	7/88	7.49	NONE	NONE	NONE
	10/88	9.06	9.0	NA	NA
	11/2/88	9.12	11.5	NA	NA
	11/9/88	7.60	0.75	NA	NA
	12/15/88	7.97	6.72	NA	NA
	1/3/89	7.20	1.08	NA	NA
	1/16/89	6.36	2.64	NA	NA

* = Depth to water measured in feet below top of casing.
NA = Not applicable

Ground-water samples previously collected from the onsite monitoring wells were analyzed for total petroleum hydrocarbons as gasoline (TPHg) using modified Environmental

Protection Agency (EPA) Method 8015 and the gasoline constituents benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) using EPA Method 602. Cumulative results of previous laboratory analyses of ground-water samples are presented in Table 2.

TABLE 2
CUMULATIVE RESULTS OF PREVIOUS LABORATORY ANALYSES OF GROUND-WATER SAMPLES
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

SAMPLE	DATE	B	T	E	X	TPH
W-7-MW1	7/88	0.0061	0.0827	0.0356	0.1803	0.540
W-8-MW1	10/88	0.0132	0.0041	0.1638	0.0581	1.420
W-5-MW1	1/89	0.0065	0.0104	0.0118	0.0442	0.41
W-9-MW2	7/88	0.072	0.139	0.033	0.1570	1.080
W-9-MW2	10/88	0.080	0.010	0.025	0.0260	1.140
W-6-MW2	1/89	0.103	0.673	0.078	0.527	4.04
W-9-MW3	7/88	0.385	0.640	0.369	2.258	7.800
	10/88	Well not sampled				
	1/89	Well not sampled				

Results in parts per million (ppm)
BTEX = Benzene, Ethylbenzene, Toluene, and Total Xylenes
TPH = Total Petroleum Hydrocarbons as gasoline
Sample designation: W-15-MW1

- W — Water sample
- 15 — Approximate depth of sample (feet)
- MW1 — Monitoring well (MW) number

PERIODIC GROUND-WATER MONITORING

With the authorization of Unocal, Applied GeoSystems personnel again visited the site on February 15, March 17, April 14, and May 19, 1989 to measure depths to ground water in three ground-water monitoring wells at the site, examine ground-water samples collected from the three wells for subjective evidence of hydrocarbons, measure the thickness of floating product, if any, in well MW-3, and bail floating product, when present, from this well.

At each site visit, we measured the static water level in each well to the nearest 0.01 foot using a Solinst electric water-level indicator. After static ground-water level was recorded, an initial sample of ground water was collected from each well and checked for floating product, sheen, and emulsion. The samples were collected by gently lowering approximately half the length of a clean Teflon bailer past the air-water interface and collecting a sample from near the surface of the water in each well. Cumulative results of previous subjective analyses, including the results of the February 15 through May 19, 1989 site monitoring visits, are presented in Table 3.

TABLE 3
CUMULATIVE RESULTS OF SUBJECTIVE
ANALYSES OF WATER IN WELLS
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley California
(page 1 of 1)

Well	Date	Depth to Water*	Inches of Floating Product	Sheen	Emulsion
MW-1	7/88	5.16	NONE	NONE	NONE
	10/88	7.10	NONE	NONE	NONE
	11/2/88	6.08	NONE	NONE	NONE
	11/9/88	6.14	NONE	NONE	NONE
	12/15/88	6.51	NONE	SLIGHT	NONE
	1/3/89	5.10	NONE	NONE	NONE
	1/16/89	4.75	NONE	NONE	NONE
	2/15/89	5.13	NONE	NONE	NONE
	3/17/89	3.68	NONE	NONE	NONE
	4/14/89	3.12	NONE	NONE	NONE
	5/19/89	3.46	NONE	NONE	NONE
MW-2	7/88	6.85	NONE	NONE	NONE
	10/88	7.81	NONE	SLIGHT	NONE
	11/2/88	7.83	NONE	NONE	NONE
	11/9/88	7.98	NONE	NONE	NONE
	12/15/88	7.89	NONE	NONE	NONE
	1/3/89	6.50	NONE	NONE	NONE
	1/16/89	6.02	NONE	NONE	NONE
	2/15/89	5.22	NONE	NONE	NONE
	3/17/89	3.98	NONE	NONE	NONE
	4/14/89	3.83	NONE	NONE	NONE
	5/19/89	4.85	NONE	NONE	NONE
MW-3	7/88	7.49	NONE	NONE	NONE
	10/88	9.06	9.0	NA	NA
	11/2/88	9.12	11.5	NA	NA
	11/9/88	7.60	0.75	NA	NA
	12/15/88	7.97	6.72	NA	NA

See notes on page 2 of 2.

TABLE 3
CUMULATIVE RESULTS OF SUBJECTIVE
ANALYSES OF WATER IN WELLS
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley California
(page 2 of 2)

Well	Date	Depth to Water*	Inches of Floating Product	Sheen	Emulsion
MW-3	1/3/89	7.20	1.08	NA	NA
	1/16/89	6.36	2.64	NA	NA
	2/15/89	5.16	0.12	NA	NA
	3/17/89	5.01	0.48	NA	NA
	4/14/89	4.71	<0.01	HEAVY	NONE
	5/19/89	5.49	NONE	MODERATE	NONE

* = Depth to water measured in feet below top of casing.
NA = Not applicable

OTHER ONGOING WORK

As mentioned anbove, the two underground gasoline-storage tanks and the waste-oil-storage tank were being excavated and removed at the time this investigation was being conducted. Removal of the three tanks began on June 12, 1989. The two gasoline-storage tanks were replaced on June 19, 1989, with two new 12,000-gallon tanks. At Unocal's request, the tank excavation and replacement, and related field testing and soil sampling, are being performed under the guidance of Applied GeoSystems. The results of this phase of work will be described in forthcoming Applied GeoSystems Report No. 18061-4.

REGIONAL GEOLOGY AND HYDROGEOLOGY

The subject site is adjacent to the eastern margin of the San Francisco Bay Plain (Bay Plain), which forms the eastern portion of the San Francisco Bay Depression. The Bay Plain is bounded on the east by the Diablo Range and on the west by San Francisco Bay. The Bay Plain consists of alluvial deposits between the highlands and the marshlands adjacent to San Francisco Bay. The alluvial areas consist of large, coalescing cones (fans) formed by debris transported by streams and creeks that drained from the highlands (Maslonkowski, 1984). The active Hayward Fault, which is located along the base of the Diablo Range escarpment, passes approximately 10,000 feet southwest of the site.

The subject site is in the northwestern corner of the Castro Valley Basin ground water subarea of the eastern portion of the Bay Plain (East Bay Plain). The basin is underlain by a surface layer of early Pleistocene alluvium consisting of well sorted fine sand and silt. The maximum thickness of this alluvium in the CastroValley Basin is approximately 80 feet (Hickenbottom and Muir, 1988, p. 35).

The site is underlain by Older Quaternary alluvium and Pliocene- and older-age undivided Tertiary, Cretaceous, and Jurassic bedrock units. These units were deposited in the region mainly as marine sedimentary and volcanic rocks in a geosyncline that occupied this area during Jurassic, Cretaceous, and Tertiary times, and presently form the boundary of the

East Bay Plain aquifer system. Deposits in the region were complexly folded and faulted toward the end of the Tertiary period, and consist of a series of consolidated or highly compacted sandstone, shale, mudstone, and chert; some volcanic rocks and consolidated conglomerates also are present locally (Ibid, p. 28).

Ground water in the Castro Valley area is unconfined (Ibid, p. 39). Ground water has been found in some of the sandstone and conglomerate units and fractures in other rock types. Wells completed in sandstone and conglomerate units in the region typically have low yields.

Recharge to the ground water in the area occurs mainly as a result of direct precipitation that falls on the adjacent hills. Water reaches the ground-water reservoir through seepage from streams, infiltration through the soil, and subsurface inflow from adjacent soil and bedrock units.

SITE SAFETY PLAN

Field work performed by Applied GeoSystems on behalf of Unocal Corporation was conducted in accordance with Applied GeoSystems' Site Safety Plan No. 18061-3S (Applied GeoSystems, May 22, 1989). This Plan describes the safety requirements for the subsurface environmental investigation and for drilling of soil borings at the site. The Site Safety Plan

is applicable to personnel and subcontractors of Applied GeoSystems. Personnel and subcontractors of Applied GeoSystems scheduled to perform work at the site were briefed on the contents of the Site Safety Plan before work began. A copy of the Site Safety Plan was kept at the site, and was available for reference by appropriate parties during work at the site. The Staff Geologist of Applied GeoSystems was the Site Safety Officer.

BOREHOLE DRILLING

Before drilling began, a Groundwater Protection Ordinance Permit for well construction was acquired from the Alameda County Flood Control and Water Conservation District (ACFCWCD). Authorization was obtained from the property owner to drill a soil boring (and install a monitoring well in the boring) on the vacant lot addressed at 18959 Lake Chabot Road. Applied GeoSystems acquired an encroachment permit from the Alameda County Public Works Agency to drill a soil boring and install a monitoring well in the adeg of the sidewalk south of the Unocal Station No. 5484 site. Copies of the ACFCWCD and encroachment permits are included in Appendix A to this report. At least 48 hours before drilling began, Underground Service Alert was contacted to help locate public utility lines in the site area.

Geologists from Applied GeoSystems visited the site on May 23 and 24, and June 5, 1989, to observe the drilling of three 10-inch-diameter soil borings and to log and collect soil

samples from the borings. Boring B-4 was drilled in a vacant lot (18959 Lake Chabot Road) across Lake Chabot Road, approximately 120 feet southwest (the inferred downgradient direction) of the Station No. 5484 underground storage-tank pit. The boring was advanced to a depth of approximately 29 feet. Boring B-5 was drilled to a depth of approximately 24 feet, through the sidewalk adjacent to 18988 Lake Chabot Road, approximately 100 feet south of the Station No. 5484 tank pit. Boring B-6 was drilled in the northern portion of the Unocal property, approximately 90 feet northwest of the tank pit, to a depth of approximately 29 feet.

The borings were drilled using 10-inch-diameter, continuous-flight, hollow-stem augers, with a Mobile B-53 truck-mounted drill rig operated by Kvilhaug Well Drilling and Pump Company, Inc., of Concord, California. The augers were steam-cleaned before each use to minimize the possibilty of cross-contamination.

Soil cuttings from the boreholes were temporarily placed on and covered with plastic, or placed in 17H, 55-gallon, solid-waste drums approved for this use by the Department of Transportation. The cuttings were planned to be disposed at an appropriate disposal facility pending the results of laboratory analysis of soil samples.

SOIL SAMPLING

Soil samples were collected from the borings and described to evaluate soil conditions. The samples were collected at 5-foot intervals beginning at a depth of approximately 3-1/2 feet below the ground surface in the borings. The Unified Soil Classification System, which is summarized on Plate P-3, was used to identify the soils encountered in the samples and cuttings. Descriptions of the earth materials encountered in the borings are presented on the Logs of Borings (Plates P-4 through P-9).

The samples were collected by advancing each boring to a point immediately above the sampling depth and then driving a California-modified, split-spoon sampler (2.5-inch-inside-diameter) into the soil through the hollow center of the auger. The sampler was driven 18 inches with a standard 140-pound hammer repeatedly dropped 30 inches. The number of blows required to drive the sampler each 6-inch increment was counted and recorded to evaluate the relative consistency of soil materials.

An Organic Vapor Meter (OVM) was used to evaluate the organic vapor concentrations in soil samples collected from the borings. Readings were obtained by placing the rubber cup skirting the intake probe flush against the soil sample immediately after it was removed from the sampler. Field instruments such as the OVM can indicate relative organic vapor concentrations in soil, but cannot be used to measure concentrations of hydrocarbons in soil

with the precision of laboratory analyses. Concentrations of hydrocarbon vapors measured in the samples were very low to nondetectable (less than 0.7 ppm) with the exception of one reading of 17 ppm in the sample collected from a depth of 13-1/2 feet in boring B-5. The OVM readings are shown on the boring logs, Plates P-4 through P-9, under the column entitled "P.I.D." (photoionization detector).

Selected soil samples were removed from the sampler and promptly sealed in their brass sleeves with aluminum foil, plastic caps, and aluminized duct tape. The samples were then labeled and placed in iced storage for transport to the laboratory. Soil samples from the deepest unsaturated sample interval (samples S-13.5-B4, S-13.5-B5, and S-8.5-B6, respectively) in borings B-4, B-5, and B-6 were selected for laboratory analysis to evaluate potential hydrocarbon concentrations near the top of the saturated zone. Selected soil samples from depths ranging from 8-1/2 to 13-1/2 feet below the ground surface also were retained for laboratory analysis. A total of six soil samples were delivered to the Applied GeoSystems laboratory in Fremont, California, for analysis. This laboratory is certified by the State of California to perform the required tests (Hazardous Waste Testing Laboratory Certificate No. 153). Chain of Custody Records were initiated by the field geologist for the samples collected, and updated throughout handling of the samples. Completed copies of the Chain of Custody Records for the samples are included in Appendix B to this report.

At the request of Unocal, samples of the soil cuttings were collected from each borehole (one per drum and one from the small soil stockpile covered and underlain by plastic) on June 26, 1989, and submitted to Applied GeoSystems' laboratory for compositing and analysis. A copy of the completed Chain of Custody Record for these samples also is included in Appendix B to this report.

MONITORING WELL CONSTRUCTION

Ground-water monitoring wells MW-4, MW-5, and MW-6 were constructed in borings B-4, B-5, and B-6 respectively to monitor ground-water conditions at and adjacent to the site. The wells were constructed of thread-jointed, 4-inch-diameter, Schedule 40, PVC casing. No chemical cements, glues, or solvents were used in the well construction. The ground-water monitoring well casing consists of machine-slotted PVC with 0.020-inch-wide slots. Well screen was set from the total depth of each boring to approximately 7-1/2 feet below the ground surface in borings B-4 and B-6, and approximately 9 feet below the ground surface in boring B-5. Unperforated PVC casing was set from the top of the screened casing to a few inches below the ground surface. The annular space of each well was backfilled with No. 3 sorted sand from the total depth to approximately 1-1/2 to 2 feet above the top of the screened casing. A bentonite plug, approximately 1 to 3 feet thick, was placed above the sand as a seal against cement entering the sand pack. The remaining annulus was backfilled with neat cement to a few inches below the ground surface.

The top of each casing was covered with a locking watertight cap, and a threaded end cap was added to the bottom. An aluminum utility box with PVC apron was placed over each wellhead and grouted in place approximately flush with the ground surface as described above. Graphic representations of the newly constructed wells are shown on the right margin of the boring logs (Plates P-4 through P-9).

WELL DEVELOPMENT AND GROUND-WATER SAMPLING

Geologists from Applied GeoSystems visited the site on June 13 and June 26, 1989, to develop newly constructed monitoring wells MW-4 and MW-5. Monitoring well MW-6 was covered for approximately 1 month with the large stockpile of soil excavated from the gasoline-storage tank pit; on July 28, 1989, Applied GeoSystems personnel gained access to and developed this well. A surge-pumping technique was used to evacuate approximately 1-1/4 to 2 well volumes of water from the wells. The development equipment was steam-cleaned prior to use and between wells to minimize cross-contamination. The three wells recharged very slowly (e.g., less than approximately 1 foot per 30 minutes), making well development difficult and time-consuming.

A geologist from Applied GeoSystems visited the site on June 28 and June 29, 1989, to purge and collect water samples from ground-water monitoring wells MW-4, MW-5, and existing onsite monitoring well MW-2. Monitoring wells MW-1 and MW-3 had been

destroyed during excavation of hydrocarbon-contaminated soil in conjunction with removal and replacement of the two gasoline-storage tanks. On August 1, 1989, an Applied GeoSystems geologist returned to the site to purge and collect water samples from ground-water monitoring well MW-6. The depth to water in each well was measured to the nearest 0.01 foot using a Solinst water-level indicator. An initial ground-water sample was collected from each well and checked for floating product, sheen, and emulsion. The samples were collected by gently lowering approximately half the length of a clean Teflon bailer past the air-water interface and collecting a sample from near the surface of the water in each well. No subjective evidence of floating product, sheen, or emulsion was detected in the water samples. The total depths of the wells, depths to ground water, and results of the subjective analyses are shown in Table 4.

TABLE 4
RESULTS OF SUBJECTIVE ANALYSES
UNOCAL Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

Well Number	Well Depth	Depth to Water	Floating Product	Sheen	Emulsion
June 29, 1989					
MW-1	Well destroyed during tank excavation				
MW-2	18.85	7.24	NONE	NONE	NONE
MW-3	Well destroyed during tank excavation				
MW-4	27.40	9.95	NONE	NONE	NONE
MW-5	23.44	9.03	NONE	NONE	NONE
August 1, 1989					
MW-6	27.01	7.34	NONE	NONE	NONE

Well depth and depth to water in feet below top of casing.

After subjective analysis, the wells were purged of a minimum of approximately one well volume of water prior to sampling for chemical analysis, which dewatered the wells. Ground water was then allowed to recover to at least 80 percent of its static water level in the wells. A Teflon bailer that had been thoroughly cleaned with Alconox and water was lowered gently approximately half its length past the air-water interface to collect a representative sample of the formation water. The ground-water samples were recovered and gently decanted into laboratory-cleaned, 40-milliliter, volatile organic glass sample vials; hydrochloric acid was added to the samples as a preservative. The vials were sealed with Teflon-lined caps, labeled, and placed in iced storage for transport to the analytical laboratory.

Ground-water samples collected from wells MW-2, MW-4, MW-5, and MW-6 were submitted to Applied GeoSystems' laboratory in Fremont for analysis. Chain of Custody Records were initiated by the geologist and updated throughout handling of the samples; copies of the completed Chain of Custody Records for the water samples are included in Appendix B to this report.

SUBSURFACE MATERIALS

Geologic materials encountered during drilling at the site consisted primarily of weathered mudstone and siltstone, with underlying sandstone and unweathered mudstone. Plates P-10

and P-11 present geologic cross sections interpreted from information shown on the boring logs. The reference locations of the cross sections are shown on Plate P-2. Approximately 5 feet of sandy clay, 5 feet of clayey gravel, and 3 feet of clay are present below the ground surface in borings B-4, B-5, and B-6, respectively. The weathered mudstone, siltstone, and sandstone units are heavily to lightly fractured, with fracture intensity decreasing with depth (Plates P-4 through P-9). The weathered mudstone is typically green-brown, damp, and hard, with variable amounts of clay in the fractures. The majority of the moisture observed in the borings appears to be associated with the fractures.

RESULTS OF ANALYSES OF SOIL AND WATER SAMPLES

Six soil samples collected from borings B-4, B-5, and B-6, and four ground-water samples from monitoring wells MW-4 through MW-6, and well MW-2 were analyzed for total petroleum hydrocarbons as gasoline (TPHg) by modified Environmental Protection Agency (EPA) Method 8015; and for the purgeable hydrocarbon constituents benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) by EPA Method 8020 for soil and EPA Method 602 for water. The results of the soil and water analyses are presented in Table 5 and on the laboratory Analysis Reports included in Appendix B to this report.

Soil samples collected from drummed and stockpiled cuttings were composited and analyzed in the laboratory for TPHg by EPA Method 8015. The analysis indicated no detectable concentrations of TPHg in the composite sample. Results of the analysis are included in Table 5. A copy of the laboratory Analysis Report is included in Appendix B. At the request of Unocal, Applied GeoSystems is arranging to have the soil cuttings removed from the site for disposal at an appropriate Class III landfill.

EVALUATION OF GROUND-WATER FLOW DIRECTION

The elevation of the top of each well casing was surveyed to a local benchmark by Ron Archer Civil Engineer, Inc., in June 1989. The results were presented in a memorandum and survey map from Ron Archer dated July 3, 1989; copies of the memorandum and survey map are included in Appendix C to this report. The differences in wellhead elevations were combined with ground-water depths in wells measured on June 13, 1989, to calculate the differences in the water-level elevations (Table 6).

A graphic interpretation of the ground-water surface for June 13, 1989, is shown on the Ground-Water Surface Gradient Map (Plate P-12). The graphic interpretation suggests that ground water is flowing toward the southwest. The magnitude of the ground-water gradient near the site (interpreted from the figure) varies between approximately 0.067 and 0.111 (approximately 6.7 to 11.1 feet vertical distance per 100 feet horizontal distance).

TABLE 5
ANALYTICAL RESULTS OF SOIL AND GROUND-WATER SAMPLES
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

Sample Number	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes
Soil Samples (May 25 & June 6, 1989)					
S-8.5-B4	<2.0	<0.050	<0.050	<0.050	<0.050
S-13.5-B4	<2.0	<0.050	<0.050	<0.050	<0.050
S-8.5-B5	<2.0	<0.050	<0.050	<0.050	<0.050
S-13.5-B5	2.4	<0.050	<0.050	<0.050	0.083
S-8.5-B6	<2.0	<0.050	<0.050	<0.050	<0.050
S-13.5-B6	<2.0	<0.050	<0.050	<0.050	<0.050
Water Samples (June 28 & 29; August 1, 1989)					
-----MW1	Well destroyed during tank excavation				
W-10-MW2	0.55	0.0027	0.0019	0.010	0.034
-----MW3	Well destroyed during tank excavation				
W-14-MW4	<0.020	<0.00050	<0.00050	<0.00050	<0.00050
W-11-MW5	<0.020	0.00083	<0.00050	0.00057	0.00094
W-12-MW6	0.026	<0.00050	<0.00050	<0.00050	<0.00050
Composite Soil Sample (June 26, 1989)					
S-0626-1A-1D	<2.0	--	--	--	--

TPHg = total petroleum hydrocarbons as gasoline
Results are in milligrams per liter (mg/l), or parts per million (ppm)
< = below the detection limits of the analysis
Sample designation = S-13.5-B6
- S = Soil (S) or water (W) sample
- 13.5 = Sample depth in feet
- B6 = Well (MW) or boring (B) number

TABLE 6
GROUND-WATER ELEVATION DIFFERENCES
UNOCAL Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California
(measured on June 13, 1989)

Monitoring Well Number	Top of Casing (C)	Static Water Depth (W)	Water level Elevation (C - W)
MW-1	Well destroyed during tank excavation		
MW-2	228.88	5.65	223.23
MW-3	231.83	6.65	225.18
MW-4	227.75	9.40	218.35
MW-5	225.10	8.74	216.36
MW-6	Well inaccessible - covered with soil		

Measurements are in feet.
Static water depth measured in feet below top of casing.

DISCUSSION

Laboratory analysis of soil and ground-water samples collected from borings B-4, B-5, and B-6, and monitoring wells MW-4, MW-5, and MW-6 indicate nondetectable to low levels of gasoline-related hydrocarbon contamination in soil and ground-water in the northern portion of the site, and south and southwest (downgradient) of the underground gasoline-storage tank pit and the area of the former waste-oil-storage tank pit at the site. No detectable levels of hydrocarbons were found in soil or ground water in boring/monitoring well B-4/MW-4 installed on the property across Lake Chabot Road, southwest of the site.

The soil sample collected from a depth of 13-1/2 feet in downgradient boring B-5, which contained 2.4 ppm TPHg, was the only soil sample that contained detectable concentrations of hydrocarbons. The OVM measurements and laboratory analyses of the soil samples indicate that hydrocarbon concentrations in the soil near boring B-5 appear to be limited to the proximity of the ground-water table.

Very low levels of dissolved hydrocarbon constituents were detected in water samples collected from wells MW-5 and MW-6 (0.00083 ppm benzene in well MW-5; 0.026 ppm TPHg in well MW-6). No detectable levels of BTEX were found in the water sample from well MW-6. Concentrations of benzene, ethylbenzene, and total xylene isomers in well MW-5 were less than the Maximum Contaminant Levels (MCL) established for these constituents in drinking water (0.001 ppm; 0.680 ppm; and 1.750 ppm, respectively) under Title 22 of the California Administrative Code (CAC). The concentration of toluene in water in well MW-5 was below the maximum concentration for this constituent in drinking water (0.100 ppm) recommended by the California Department of Health Services. Analysis of a ground-water sample collected from existing onsite well MW-2 indicated detectable levels (e.g, 0.55 ppm of TPHg) of dissolved hydrocarbons; the concentration of benzene in the water sample (0.0027 ppm) exceeded the MCL for benzene.

CONCLUSIONS AND RECOMMENDATIONS

The results of this investigation indicate that low levels of gasoline-related hydrocarbon constituents have migrated through ground water a relatively short distance southwest (less than approximately 110 feet in the direction of well MW-4, and approximately 120 feet in the direction of well MW-5) from the area of the underground gasoline-storage tank pit. Hydrocarbon concentrations detected in soil and ground water in boring B-5 and monitoring well MW-5, and in ground water in onsite monitoring well MW-2 and in monitoring wells MW-1 through MW-3 during previous monitoring episodes apparently originated from the underground gasoline-storage tank pit; however, the waste-oil tank also may be a contributor to the detected contamination. In our opinion, the present monitoring wells appear to adequately delineate the extent of hydrocarbon contamination related to gasoline in the northern, southern and southwestern areas of the site, and southwest (downgradient) of the site.

We anticipate that excavation (ongoing) of hydrocarbon-contaminated soil in the areas of the underground gasoline- and waste-oil-storage tanks will allow us to evaluate further the lateral and vertical extent of soil contamination at the site. Analysis of soil samples collected from the floors and sidewalls of the excavated pits after further soil removal should indicate whether additional investigation of the extent of soil contamination is needed. The results of the soil excavation, and recommendations regarding further

delineation and remediation of soil contamination, if necessary, will be discussed in forthcoming Applied GeoSystems Report No. 18061-4.

We recommend that the water in monitoring wells MW-2, MW-4, MW-5, and MW-6 continue to be purged, sampled, and analyzed to evaluate further the trends in dissolved hydrocarbon concentrations with time. We recommend that such sampling be performed quarterly. Water samples collected from the wells should be analyzed for TPHg by EPA Method 8015, and for BETX by EPA Method 602. Additionally, the water samples from wells MW-2 and MW-5 should be analyzed at least one time for total oil and grease by EPA method 503E, and for volatile hydrocarbons by EPA method 601 to evaluate the extent, if any, of possible migration of contaminants from the area of the waste-oil tank. We also recommend that the ground-water gradient be evaluated quarterly. Future gradient evaluations should incorporate ground-water data from each of the remaining wells, including MW-6. The next quarterly sampling should be performed in September 1989. After the results of this sampling and gradient evaluation are available, the need for additional borings or wells for delineation of hydrocarbons, if necessary, should be evaluated.

We recommend that Unocal forward copies of this report to Mr. Scott Seery at the Alameda County Health Care Services Agency, Department of Environmental Health, Hazardous Materials Division, 80 Swan Way, Room 200, Oakland, California 94621, and

Mr. Lester Feldman of the California Regional Water Quality Control Board, San Francisco Bay Region, 1111 Jackson Street, Room 6040, Oakland, California 94607.

LIMITATIONS

This report was prepared in accordance with generally accepted standards of environmental geological practice in California at the time this investigation was performed. This investigation was conducted solely for the purpose of evaluating environmental conditions of the soil and first ground water with respect to hydrocarbon-product contamination in the vicinity of the subject property. No soil engineering or geotechnical recommendations are implied or should be inferred. Evaluation of the geologic conditions at the site for the purpose of this investigation is made from a limited number of observation points. Subsurface conditions may vary away from the data points available. Additional work, including further subsurface investigation, can reduce the inherent uncertainties associated with this type of investigation.

REFERENCES CITED

Applied GeoSystems. August 30, 1988. Report, Subsurface Environmental Investigation at Unocal Service Station No. 5484, 18950 Lake Chabot Road, Castro Valley, California. Job No. 18061-1.

Applied GeoSystems. January 6, 1989. Letter Report, Quarterly Ground-Water Monitoring at Unocal Service Station No. 5484, 18950 Lake Chabot Road, Castro Valley, California. Job No. 18061-2.

Applied GeoSystems. February 9, 1989. Letter Report, Quarterly Ground-Water Monitoring at Unocal Service Station No. 5484, 18950 Lake Chabot Road, Castro Valley, California. Job No. 18061-2.

Applied GeoSystems. March 22, 1989. Letter Work Plan, Delineation of Ground-Water Contamination at Unocal Service Station No. 5484, 18950 Lake Chabot Road, Castro Valley, California. Job No. 18061-3W.

Applied GeoSystems. May 22, 1989. Site Safety Plan. Job No. 18061-3S.

Hickenbottom, Kelvin, and Muir, Kenneth. June 1988. Geohydrology and Groundwater Quality Overview, East Bay Plain Area, Alameda County, California, 205(J) Report. Alameda County Flood Control and Water Conservation District.

Maslonkowski, D. P. 1984. Groundwater in the San Leandro and San Lorenzo alluvial cones of the East Bay Plan of Alameda County. Alameda County Flood Control and Water Conservation District.

Source: U.S. Geological Survey
7.5-Minute Quadrangle
Hayward, California
Photorevised 1980

N

Approximate Scale

2000 1000 0 2000 4000

feet

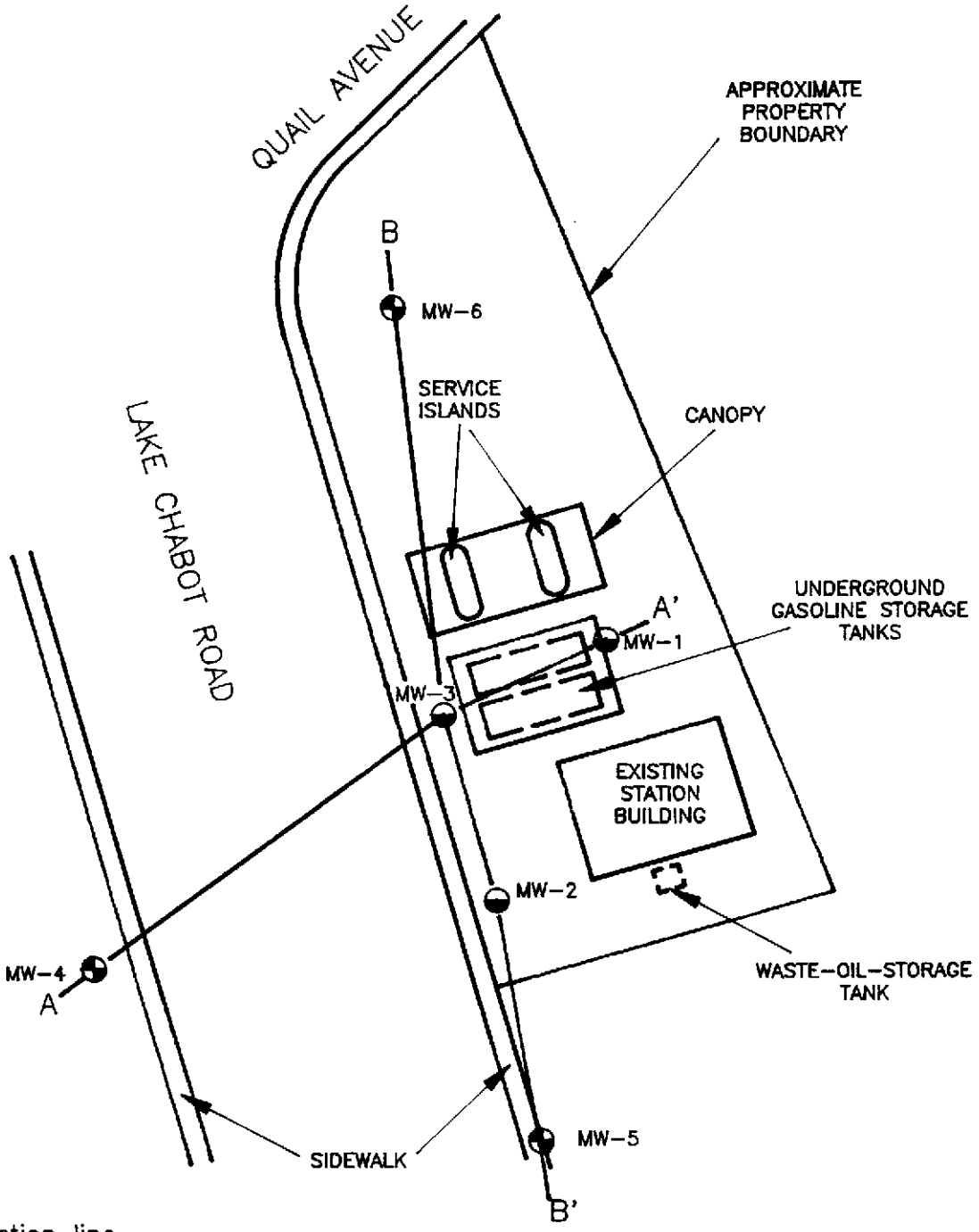
Applied GeoSystems

PROJECT NO. 18061-3W

SITE VICINITY MAP
UNOCAL Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 1



B — B' = Cross section line

MW-6 = New monitoring well

MW-3 = Monitoring well installed by Applied GeoSystems (1988)

Source: Surveyed by Ron Archer, Civil Engineer, Inc.

N

Approximate Scale

40 20 0 40 80

feet

Applied GeoSystems

PROJECT NO. 18061-3

GENERALIZED SITE PLAN
Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 2

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		LTR	DESCRIPTION	MAJOR DIVISIONS		LTR	DESCRIPTION
Coarse-grained soils	Gravel and gravelly soils	GW	Well-graded gravels of gravel-sand mixtures, little or no fines	Fine-grained soils	Silts and clays LL<50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		GM	Silty gravels, gravel-sand-silt mixtures			OL	Organic silts and organic silt-clays of low plasticity
		GC	Clayey gravels, gravel-sand-clay mixtures		Silts and clays LL>50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils. Elastic silts
	Sand and sandy soils	SW	Well-graded sand of gravelly sands, little or no fines			CH	Inorganic clays of high plasticity, fat clays
		SP	Poorly-graded sands or gravelly sands, little or no fines			OH	Organic clays of medium to high plasticity, organic silts
		SM	Silty sands, sand-silt mixtures	Highly organic soils		PT	Peat and other highly organic soils
		SC	Clayey sands, sand-clay mixtures				

Depth through which sampler is driven

Relatively undisturbed sample

No sample recovered

Static water level observed in boring

Initial water level observed in boring

S-10 Sample number

Sand pack

Bentonite annular seal

Neat cement annular seal

Caved native soil

Blank PVC

Machine-slotted PVC

BLOWS REPRESENT THE NUMBER OF BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES TO DRIVE THE SAMPLER THROUGH EACH 6 INCHES OF AN 18-INCH PENETRATION.

DASHED LINES SEPARATING UNITS ON THE LOG REPRESENT APPROXIMATE BOUNDARIES ONLY. ACTUAL BOUNDARIES MAY BE GRADUAL. LOGS REPRESENT SUBSURFACE CONDITIONS AT THE BORING LOCATION AT THE TIME OF DRILLING ONLY.

Applied GeoSystems

PROJECT NO. 18061-3

UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY
UNOCAL Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE
P - 3

Total depth of boring: 29 feet **Diameter of boring:** 10 inches **Date drilled:** 5-24-89

Casing diameter: 4 inches **Length:** 27-1/2 feet **Slot size:** 0.020-inch

Screen diameter: 4 inches **Length:** 20 feet **Material type:** Sch 40 PVC

Drilling Company: Kvilhaug Well Drilling **Driller:** Rod and Tony

Method Used: Hollow-Stem Auger **Field Geologist:** Leigh Beem

Signature of Registered Professional: _____

Registration No.: _____ **State:** CA

DEPTH	SAMPLE NO.	BLOWS	P.I.D.	USCS CODE	DESCRIPTION	WELL CONST.
0				CL	Sandy clay, with minor gravel and fine- to coarse-grained sand, tan-brown, dry, medium plasticity, hard.	
2						
4	S-3.5	30	0.5			
6					Weathered, mottled mudstone, green-brown, damp, very fractured with clay in fractures.	
8		25				
8	S-8.5	50	0.5			
10					Weathered mottled siltstone, green-brown, damp, very fractured.	
12		20				
12		35				
14	S-13.5	40	0.1			
16						
18		20				
18		40				
18	S-18.5	80	0.5		Siltstone with gray clay and some roots.	
20					Weathered mudstone, black, damp, fractured.	
					(Section continues downward)	

Applied GeoSystems

PROJECT NO. 18061-3

LOG OF BORING B-4/MW-4

UNOCAL Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 4

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22					Weathered mudstone, black, damp, fractured.	
24	S–23.5	80	0.7			
26						
28	S–28.5	80	0.5		Unweathered mudstone, dry.	
30					Total Depth = 29 feet.	
32						
34						
36						
38						
40						
42						
44						
46						
48						
50						

Applied GeoSystems

PROJECT NO. 18061-3

LOG OF BORING B-4/MW-4

UNOCAL Station No. 5484
18950 Lake Valley Road
Castro Valley, California

PLATE

P - 5

Total depth of boring: 24 feet **Diameter of boring:** 10 inches **Date drilled:** 6-5-89

Casing diameter: 4 inches **Length:** 24 feet **Slot size:** 0.020-inch

Screen diameter: 4 inches **Length:** 15 feet **Material type:** Sch 40 PVC

Drilling Company: Kvilhaug Well Drilling **Driller:** Rod and Dan

Method Used: Hollow-Stem Auger **Field Geologist:** Leigh Beem

Signature of Registered Professional:

Registration No.: G.E. 2023 **State:** CA

DEPTH	SAMPLE NO.	BLOWS	P.I.D.	USCS CODE	DESCRIPTION	WELL CONST.
0					Concrete (3 inches) over baserock (6 inches).	
2				GC	Clayey gravel, with very fine-grained sandstone, brown-black, highly fractured, some rootlets.	
4	S-3.5	24/50	0			
6					Weathered mudstone, gray-black, damp, very fractured, with clay in fractures.	
8	S-8.5	50	0	▼		
10						
12						
14	S-13.5	50	17		Weathered siltstone, brown-black, fractured, slightly wet in fractures.	
16					Moderately weathered siltstone, black-gray, damp.	
18						
20	S-18.5	50	0			

(Section continues downward)

Applied GeoSystems

PROJECT NO. 18061-3

LOG OF BORING B-5/MW-5

UNOCAL Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 6

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22					Moderately weathered siltstone, black–gray, dry to damp, calcite in fractures.	
24	S–23.5	50	0		Total Depth = 24 feet.	
26						
28						
30						
32						
34						
36						
38						
40						
42						
44						
46						
48						
50						

Applied GeoSystems

PROJECT NO. 18061-3

LOG OF BORING B-5/MW-5

UNOCAL Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 7

Total depth of boring: 29 feet **Diameter of boring:** 10 inches **Date drilled:** 5-24-89

Casing diameter: 4 inches **Length:** 27-1/2 feet **Slot size:** 0.020-inch

Screen diameter: 4 inches **Length:** 20 feet **Material type:** Sch 40 PVC

Drilling Company: Kvilhaug Well Drilling **Driller:** Rod and Tony

Method Used: Hollow-Stem Auger **Field Geologist:** Leigh Beem

Signature of Registered Professional: _____

Registration No.: _____ **State:** CA

DEPTH	SAMPLE NO.	BLOWS	P.I.D.	USCS CODE	DESCRIPTION	WELL CONST.
0					Asphalt (2 inches) over baserock (6 inches).	
2				CH	Clay, brown, damp, high plasticity, medium stiff.	
4	S-3.5	20 35	0.5		Very weathered mudstone/siltstone, with green-brown mottling, damp, very fractured with clay in fractures.	
6					Very weathered siltstone, green-brown, damp, fractured.	
8	S-8.5	10 18	0.3			
10						
12		6				
14	S-13.5	12 25	0.1			
16						
18	S-18.5	10 30 50	0.1			
20					Sandstone, fine-grained, gray, fractured. (Section continues downward)	

Applied GeoSystems

PROJECT NO. 18061-3

LOG OF BORING B-6/MW-6

UNOCAL Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 8

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22					Sandstone, fine-grained, gray, fractured.	
24	S-23.5	50	0.1			
26					Unweathered mudstone, black, damp.	
28	S-28.5	50	0			
					Total Depth = 29 feet.	
30						
32						
34						
36						
38						
40						
42						
44						
46						
48						
50						

Applied GeoSystems

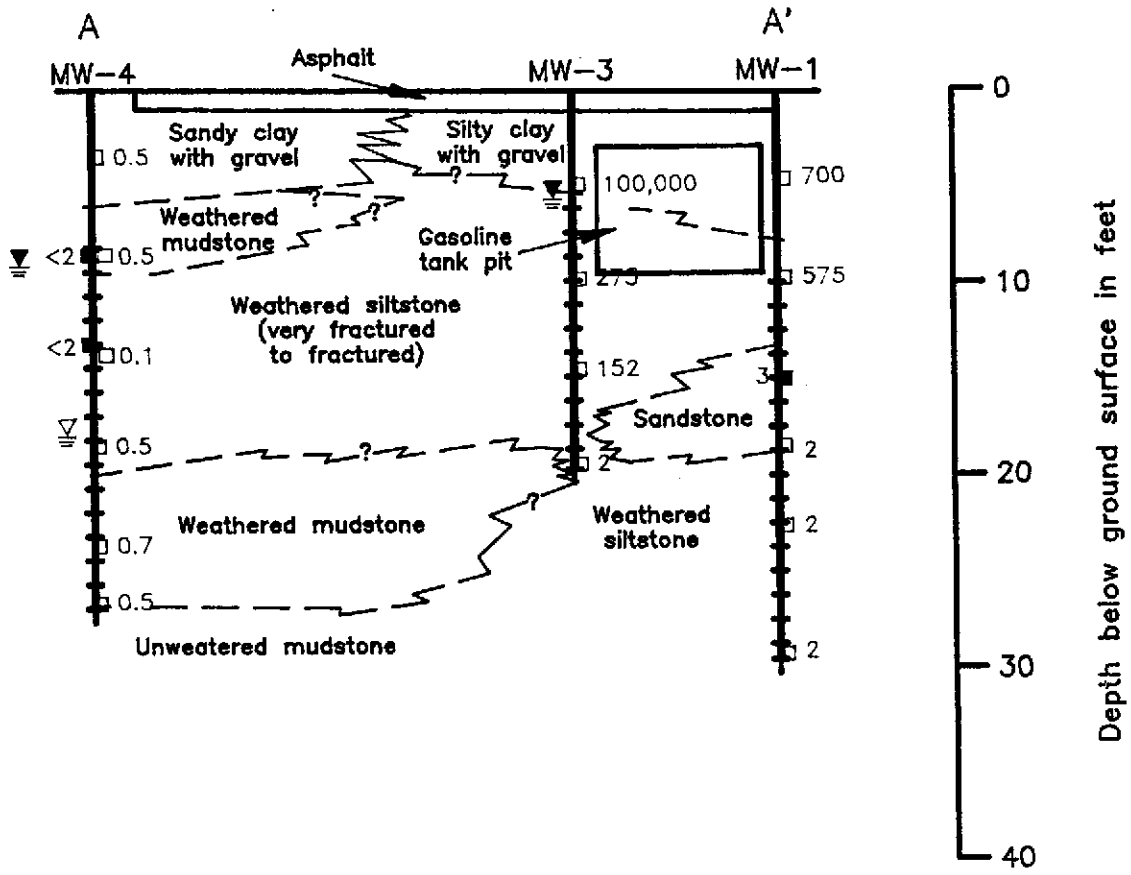
PROJECT NO. 18061-3

LOG OF BORING B-6/MW-6

UNOCAL Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 9



= OVM reading in ppm

= Analytical result in ppm (TPH)

= Well casing

= Well screen

= Boring

= Initial water level

= Static water level (June 13, 1989)

N

Approximate Horizontal Scale

40 20 0 40 80

feet

Approximate Vertical Scale

10 5 0 10 20

feet

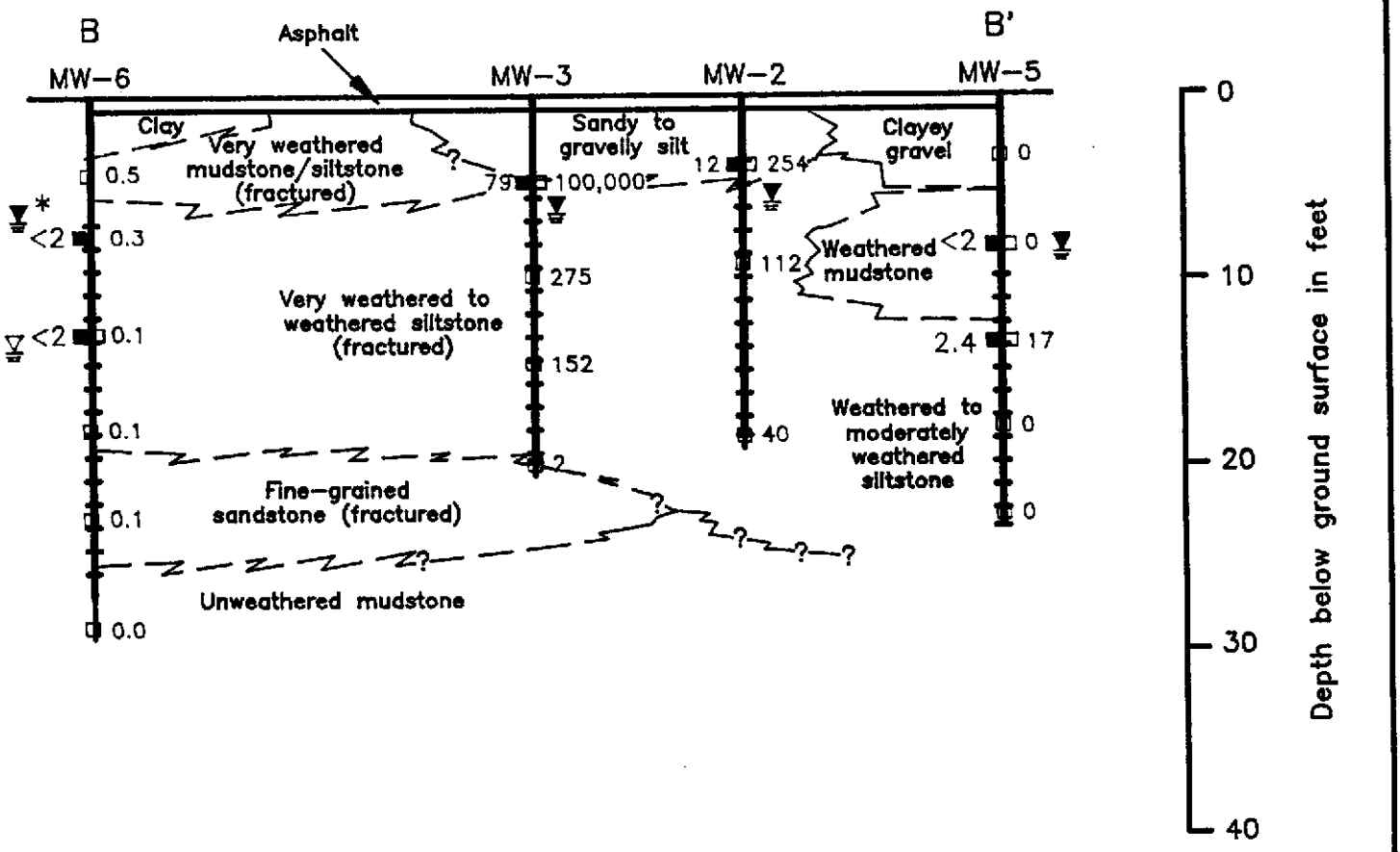
Applied GeoSystems

PROJECT NO. 18061-3

CROSS SECTION A - A'
Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 10



= OVM reading in ppm

= Analytical result in ppm (TPH)

= Well casing

= Well screen

= Boring

= Initial water level

= Static water level (June 13, 1989)

* = Static water level (July 28, 1989)

N

Approximate Horizontal Scale

40 20 0 40 80

feet

Approximate Vertical Scale

10 5 0 10 20

feet

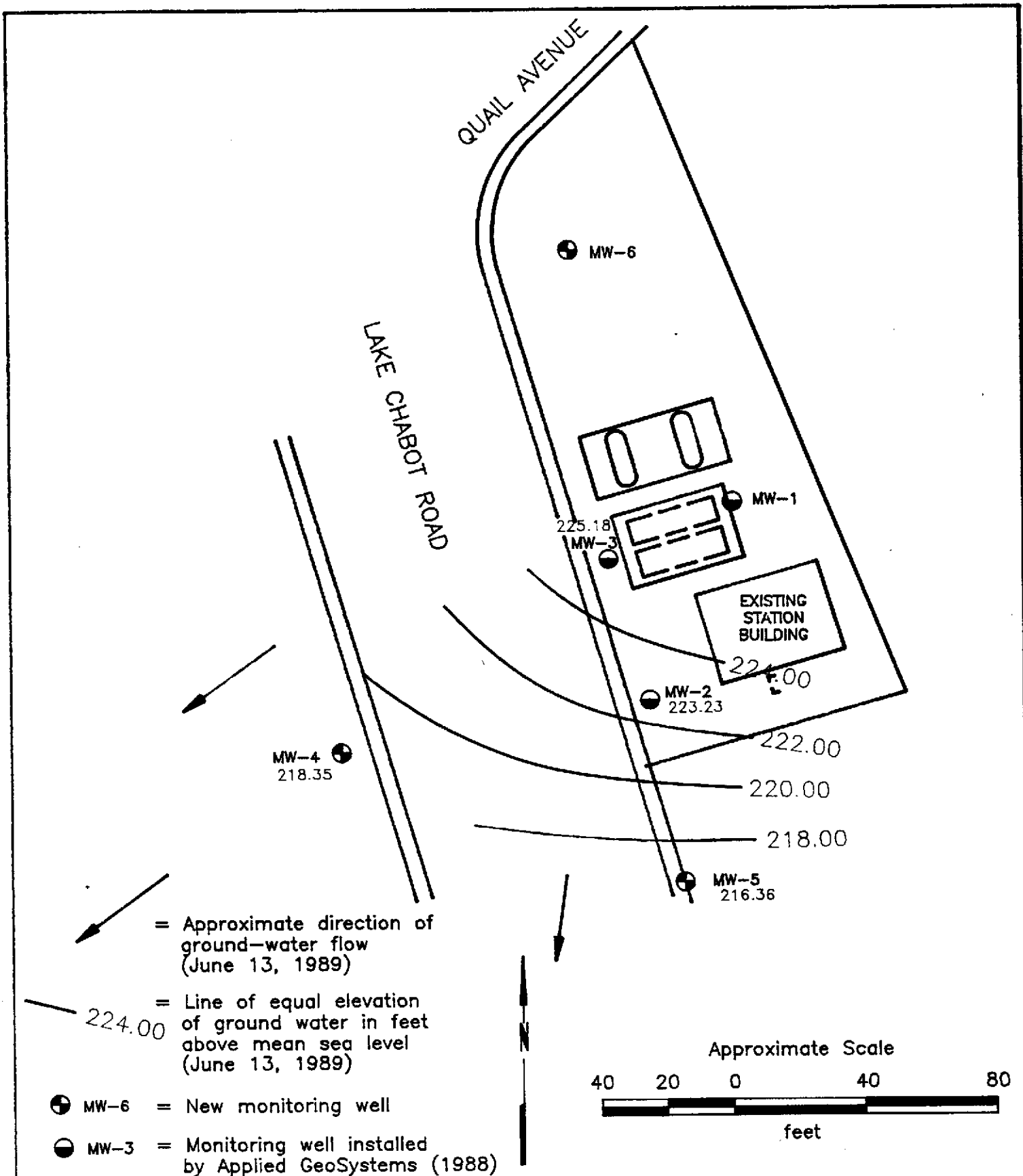
Applied GeoSystems

PROJECT NO. 18061-3

CROSS SECTION B - B'
Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 11



Applied GeoSystems

PROJECT NO. 18061-3

GROUND-WATER GRADIENT MAP
Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 12

APPENDIX A

1806-3

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
5997 PARKSIDE DRIVE • PLEASANTON, CALIFORNIA 94566 • (415) 484-2600

10 May 1989

Applied Geosystems
43255 Mission Boulevard, Suite B
Fremont, CA 94539

Gentlemen:

Enclosed is Groundwater Protection Ordinance permit 89274 for a monitoring well construction project at 18950 Lake Chabot Road in Castro Valley for Unocal.

Please note that permit condition A-3 requires that a well construction report be submitted after completion of the work. The report should include drilling and completion logs, location sketch, and permit number.

If you have any questions, please contact Wyman Hong or Craig Mayfield at 484-2600.

Very truly yours,

Mun J. Mar
General Manager

By J. Killingstad
J. Killingstad, Chief
Water Resources Engineering

TW:bkm
Enc.

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE ♦ PLEASANTON, CALIFORNIA 94566 ♦ (415) 484-2600

GROUNDWATER PROTECTION ORDINANCE PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

(1) LOCATION OF PROJECT 18950* Lake Chabot Road
Castro Valley, California
(*and 18988; 18959 Lake Chabot Road)

(2) CLIENT
Name UNOCAL Corporation
Address 2175 N. Calif. Blvd. Phone (415) 945-7676
City Walnut Creek Zip 94596

(3) APPLICANT
Name Applied GeoSystems for UNOCAL Corporation
Address 43255 Mission Blvd. Phone (415) 651-1906
City Fremont, Calif. Zip 94539

(4) DESCRIPTION OF PROJECT
(3) Water Well Construction ✓ Geotechnical ___
Cathodic Protection ___ Well Destruction ___

(5) PROPOSED WATER WELL USE
Domestic ___ Industrial ___ Irrigation ___
Municipal ___ (3) Monitoring ✓ Other ___

(6) PROPOSED CONSTRUCTION
Drilling Method:
Mud Rotary ___ Air Rotary ___ Auger ✓
Cable ___ Other ___

WELL PROJECTS
Drill Hole Diameter 10 in. Depth(s) 30 to 40 ft.
Casing Diameter 4 in. Number of Wells 3
Surface Seal Depth 5-15 ft. (SURFACE TO)
Driller's License No. 482390

GEOTECHNICAL PROJECTS
Number ___
Diameter ___ in. Maximum Depth ___ ft.

(7) ESTIMATED STARTING DATE 5/23/89
ESTIMATED COMPLETION DATE 5/24/89

(8) I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE Jon R. Kvella Date 5/5/89

FOR OFFICE USE

PERMIT NUMBER 89274
LOCATION NUMBER ___

Approved Todd N. Wendler Date 9 May 89
Todd N. Wendler

PERMIT CONDITIONS

Circled Permit Requirements Apply

(A.) GENERAL
1. A permit application should be submitted so as to arrive at the Zone 7 office five days prior to proposed starting date.
2. Notify this office (484-2600) at least one day prior to starting work on permitted work and before placing well seals.
3. Submit to Zone 7 within 60 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well projects, or bore hole logs and location sketch for geotechnical projects. Permitted work is completed when the last surface seal is placed or the last boring is completed.
4. Permit is void if project not begun within 90 days of approval date.

(B.) WATER WELLS, INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie, or equivalent.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic, irrigation, and monitoring wells unless a lesser depth is specially approved.

C. GEOTECHNICAL. Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material.

D. CATHODIC. Fill hole above anode zone with concrete placed by tremie, or equivalent.

E. WELL DESTRUCTION. See attached.

91987

ALAMEDA COUNTY PUBLIC WORKS
399 ELMHURST STREET, HAYWARD, CALIFORNIA 94544
ROAD ENCROACHMENT PERMIT

In accordance with Chapter 1 of Title 5, Streets and Highways, Ordinance Code, County of Alameda, an ordinance providing for the protection of public highways [illegible] regulating the [illegible] thereof and the manner in which [illegible] may be [illegible] obstructed or encroached upon, and providing penalties for the violation of the provisions thereof:

Permit to: APPLIED GEOSYSTEMS	Permit Number: [illegible]
43255 MISSION BLVD	Issue Date: [illegible] 1989
FREMONT, CA 94539	Expiration Date: [illegible] 89
Phone: [illegible]	Permit Issue Fee: [illegible]
	Inspection Number: [illegible]
	Work Order Number: [illegible]

Job Site: 18950 LAKE CHABOT RD
Township: CV

In compliance with and subject to all the terms, conditions and restrictions contained in Chapter 1 of Title 5 of said Ordinance Code and as stated below or printed as general or special provisions on any part of or attached to and made a part of this encroachment permit.

THE ABOVE APPLICANT HEREBY REQUESTS PERMISSION TO:
INSTALL A MONITORING WELL (MW-3) AS SHOWN ON PLANS BY APPLIED GEOSYSTEMS FOR UNOCAL GAS STATION AT 18950 LAKE CHABOT ROAD, CASTRO VALLEY. THE WELL IS TO BE LOCATED IN SIDEWALK AREA AND BE INSTALLED FLUSHED WITH SIDEWALK. THE WELL SHALL BE DESTROYED TO THE SATISFACTION OF THE COUNTY. BOND SHALL BE HELD UNTIL THE WELL IS SATISFACTORILY DESTROYED.

Attention is directed to the general provisions printed on the attached sheets of this permit and to the special provisions attached hereto and made a part hereof.

PORTLAND CEMENT CONCRETE SPECIAL PROVISION NUMBERS: A

This permit does not authorize, and it shall not be construed to authorize any infringement upon the property rights of owners of the fee title of the highway referred to herein. Notice of start of work and other required notices shall be given to the field office, 951 Turner Court, Hayward, Phone (415) 670-5591 or (415) 670-5500.

Other Required Permits: ALAMEDA COUNTY HEALTH CARE SERVICES
Bond Information: CASH $250.00
Inspection Deposit: $125.00

By: ____________ Applicant Received By: [illegible]
Work Completed: ____________
By: ____________ ALAMEDA COUNTY Inspector: ____________

Where no maps or plats are furnished, a sketch of the proposed work, showing location, name of road and other information must be made on a separate sheet, in triplicate.

ALAMEDA COUNTY PUBLIC WORKS AGENCY

PORTLAND CEMENT CONCRETE CURB, GUTTER, SIDEWALK AND DRIVEWAY

GENERAL AND SPECIAL PROVISIONS

These general and special provisions are attached to and made a part of Encroachment Permit No. Enc-990599, issued in accordance with Chapter 1 of Title 5 of the Alameda County Ordinance Code of the County of Alameda; failure to comply with the provisions noted shall void said permit.

GENERAL PROVISIONS

1. It is understood and agreed upon by the Permittee that the performance of any work authorized by this permit shall constitute acceptance of the terms, provisions and conditions of the permit.

2. This permit shall be readily available for inspection at the highway site and must be shown to any representative of the Public Works Agency or any Law Enforcement Officer upon demand.

3. All work authorized by the permit shall be performed in a workmanlike, diligent and expeditious manner and must be completed to the satisfaction of the Director of Public Works.

4. This permit is limited to work to be performed within, upon or adjacent to county roads and highways under the jurisdiction of the Board of Supervisors of the County of Alameda.

5. The Permittee shall be responsible for all liability imposed by law for personal injury or property damage which may arise out of the work permitted and done by Permittee under this permit, or which may arise out of the failure on the part of the Permittee to perform his obligations under said permit in respect to maintenance of the encroachment. The Permittee shall protect and indemnify the County of Alameda, its officers and employees, and save them harmless in every way from all action at law for damage or injury to persons or property that may arise out of or be occasioned in any way because of his operations as provided in this permit.

6. Except as specifically provided herein, the requirements of the vehicle code and any other applicable laws must be complied with in all particulars.

7. The Permittee shall be fully responsible for taking proper precautions for the prevention of accidents to persons and/or damage to public or private property at the site of the work. The Permittee shall provide watchmen and flagmen and shall provide and maintain such fences, barriers, signs, guardrails, red lights and other safety devices adjacent to and on the site at or near all barriers as may be necessary to control traffic and prevent accidents to the public. He shall furnish, place and maintain such lights as may be necessary for illuminating the said signs and fences. Signs, flags, lights and other warning and safety devices shall conform to the requirements set forth in the latest edition of "Manual of Traffic Controls for Construction and Maintenance Work Zones", issued by the California State Department of Transportation.

8. The Permittee shall schedule and pursue his operations in such a manner that undesirable construction conditions will be minimized.

9. Alameda County Survey Monuments destroyed or displaced during the progress of the work shall be replaced by the Permittee at no expense to the County of Alameda. The monument pin will be set by the County of Alameda.

10. Material excavated or removed from within the county road right of way under this permit shall be removed and disposed of in any legal manner. The right of way shall be left clean and orderly to the satisfaction of the Director of Public Works.

11. The Permittee agrees to exercise reasonable care in properly maintaining any authorized encroachment placed in the county right of way and to exercise reasonable care in inspecting for and immediately repairing and making good any injury to any portion of the county right of way which occurs as a result of the maintenance of the encroachment in the highway or as a result of the work done under this permit, including any and all injury to the roadway which would not have occurred had such work not been done or such encroachment not placed therein. A separate encroachment permit will be required for maintenance of these facilities.

12. The permittee shall begin work as authorized under this permit within 90 days from the date of issuance, unless a different date is stated in the permit. If the work is not begun within 90 days or the time stated in the permit, the permit shall become void. The permit shall be valid for a term of one year from the date of issuance, unless discontinued by the use or removal of the encroachment for which the permit was issued (Section 5-3.10 Ordinance Code of the County of Alameda).

13. Permittee is hereby cautioned that unless otherwise noted, traffic signal detectors, wiring, etc., are not to be disturbed.

14. Permittee shall furnish all safeguards for pedestrians and post warning signs in advance of work area for vehicular traffic and shall clear the roadway at the end of each work day of any obstructions or debris. Failure to comply with this provision will result in the County's taking whatever measures are necessary to conform and billing the permittee for all expenses incurred.

APPENDIX B

CHAIN OF CUSTODY RECORD

Applied GeoSystems
43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-1906

SAMPLER (signature): L A Bem

Phone: (415) 651-1906

LABORATORY: Applied GeoSystems

TURNAROUND TIME: 2 week

Project Leader: Jon Luellen

Phone No. (415) 651-1906

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Service Used

Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
L A Bem	Jon K. Luellen	5/26/89	3:30
Jon K. Luellen	Received for laboratory by:	5-26-89	1530

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-8.5-B4	18061-3	5-25-89	TPH & BTEX	ICED
S-13.5-B4	18061-3	5-25-89		
S-13.5-B6	18061-3	5-25-89		
S-8.5-B6	18061-3	5-25-89		

CHAIN OF CUSTODY RECORD

SAMPLER (signature): L. Beem

Phone: 651-1906

LABORATORY: Applied GeoSystems, Fremont CA.

TURNAROUND TIME: 2-weeks

Project Leader: John Luellen

Phone No. 651-1906

Applied GeoSystems
43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-1906

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Service Used

Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
L. Beem		6-6-89	0920
	Received for laboratory by: [signature]	6-6-89	0920

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-8.5-B5	18061-3	6-6-89	TPH (gas) + BTEX	ICE
S-13.5-B5	" LB	" LB	" LB	" LB

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 05-26-89
Laboratory Number: 90546S01
Project #: 18061-3
Sample #: S-8.5-B4
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	ND		2.0		06-01-89	
TEH as Diesel						NR
Benzene	ND		0.050		06-01-89	
Toluene	ND		0.050		06-01-89	
Ethylbenzene	ND		0.050		06-01-89	
Total Xylenes	ND		0.050		06-01-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

06-06-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 05-26-89
Laboratory Number: 90546S02
Project #: 18061-3
Sample #: S-13.5-B4
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	ND		2.0		06-01-89	
TEH as Diesel						NR
Benzene	ND		0.050		06-01-89	
Toluene	ND		0.050		06-01-89	
Ethylbenzene	ND		0.050		06-01-89	
Total Xylenes	ND		0.050		06-01-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

06-06-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 05-26-89
Laboratory Number: 90546S03
Project #: 18061-3
Sample #: S-8.5-B6
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	ND		2.0		06-01-89	
TEH as Diesel						NR
Benzene	ND		0.050		06-01-89	
Toluene	ND		0.050		06-01-89	
Ethylbenzene	ND		0.050		06-01-89	
Total Xylenes	ND		0.050		06-01-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

06-06-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 05-26-89
Laboratory Number: 90546S04
Project #: 18061-3
Sample #: S-13.5-B6
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	ND		2.0		06-01-89	
TEH as Diesel						NR
Benzene	ND		0.050		06-01-89	
Toluene	ND		0.050		06-01-89	
Ethylbenzene	ND		0.050		06-01-89	
Total Xylenes	ND		0.050		06-01-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

06-06-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

02121ab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 06-06-89
Laboratory Number: 90611S01
Project #: 18061-3
Sample #: S-8.5-B5
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline TPH as Gasoline	ND		2.0		06-16-89	
TEH as Diesel						
Benzene	ND		0.050		06-16-89	
Toluene	ND		0.050		06-16-89	
Ethylbenzene	ND		0.050		06-16-89	
Total Xylenes	ND		0.050		06-16-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

06-19-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 06-06-89
Laboratory Number: 90611S02
Project #: 18061-3
Sample #: S-13.5-B5
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline TPH as Gasoline TEH as Diesel	2.4		2.0		06-16-89	
Benzene	ND		0.050		06-16-89	
Toluene	ND		0.050		06-16-89	
Ethylbenzene	ND		0.050		06-16-89	
Total Xylenes	0.083		0.050		06-16-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

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TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

06-19-89
Date Reported

CHAIN OF CUSTODY RECORD

Applied GeoSystems

43255 Mission Blvd Suite B Fremont CA 94539 (415) 651-1906

SAMPLER (signature): Keith McVicker

Phone: (415) 651-1906

LABORATORY: AGS FREMONT

TURNAROUND TIME: 2 WEEKS

Project Leader:

Phone No.

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Service Used

Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
Keith McVicker	Jon R. Zwellen	6/26/89	16:11
Jon R. Zwellen	Received for laboratory by: Dawn Luck	6/26/89	14:1[illegible]

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-06.26-1A (COMPOSITE)	1806/-3	6-26-89	TPHg	ICED
S-06.26-1B (COMPOSITE)				
S-06.26-1C (COMPOSITE)				
S-06.26-1D (COMPOSITE)	KM	KM	KM	KM

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 06-26-89
Laboratory Number: 90638S01
Project #: 18061-3
Sample #: S-0626-1(ABCD)
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	ND		2.0		06-28-89	
TEH as Diesel						NR
Benzene						NR
Toluene						NR
Ethylbenzene						NR
Total Xylenes						NR

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

06-30-89
Date Reported

CHAIN OF CUSTODY RECORD

Applied GeoSystems
43255 Mission Blvd Suite B Fremont CA 94539 (415) 651-1906

SAMPLER (signature): Keith McVicker
Phone: (415) 651-1906

LABORATORY: AGS

TURNAROUND TIME: 2 WEEKS

Project Leader: JON LUELLEN
Phone No. (415) 651-1906

SHIPPING INFORMATION:
Shipper
Address
Date Shipped
Service Used
Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
Keith McVicker			
	Received for laboratory by:	6/29/89	20[illegible]

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
W-14-MW4	19061-3	6-28-89	TPH / BTEX	ICED / HCl

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

• FREMONT • COSTA MESA • SACRAMENTO • HOUSTON

ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 06-29-89
Laboratory Number: 90651W01
Project #: 18061-3
Sample #: W-14-MW4
Matrix: Water

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline		ND		0.020	07-05-89	
TEH as Diesel						NR
Benzene		ND		0.00050	07-05-89	
Toluene		ND		0.00050	07-05-89	
Ethylbenzene		ND		0.00050	07-05-89	
Total Xylenes		ND		0.00050	07-05-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

07-10-89
Date Reported

CHAIN OF CUSTODY RECORD

Applied GeoSystems

43255 Mission Blvd Suite B Fremont, CA 94539 415/651-1906

SAMPLER (signature): Keith McVay

Phone: (415) 651-1906

LABORATORY: ATS

TURNAROUND TIME: 2 weeks

Project Leader: JON LHELLEN

Phone No. (415) 651-1906

SHIPPING INFORMATION:

Shipper _____

Address _____

Date Shipped _____

Service Used _____

Airbill No. _____ Cooler No. _____

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
Keith McVay			
	Received for laboratory by: [illegible]	6/29/89	20

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
W-11-MW5	18061-3	6-29-89	TPH / BTEX	ICED / HCl
W-10-MW2				

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 06-29-89
Laboratory Number: 90650W01
Project #: 18061-3
Sample #: W-10-MW2
Matrix: Water

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline		0.55		0.020	07-05-89	
TEH as Diesel						NR
Benzene		0.0027		0.00050	07-05-89	
Toluene		0.0019		0.00050	07-05-89	
Ethylbenzene		0.010		0.00050	07-05-89	
Total Xylenes		0.034		0.00050	07-05-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

07-10-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 06-29-89
Laboratory Number: 90650W02
Project #: 18061-3
Sample #: W-11-MW5
Matrix: Water

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline		ND		0.020	07-05-89	
TEH as Diesel						NR
Benzene		0.00083		0.00050	07-05-89	
Toluene		ND		0.00050	07-05-89	
Ethylbenzene		0.00057		0.00050	07-05-89	
Total Xylenes		0.00094		0.00050	07-05-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

07-10-89
Date Reported

CHAIN OF CUSTODY RECORD

Applied GeoSystems

43255 Mission Blvd. Suite B Fremont, CA 94539 (415) 651-1906

SAMPLER (signature): [signature]

Phone: (415) 651-1906

LABORATORY: Applied GeoSystems

TURNAROUND TIME: 2 weeks

Project Leader: Jon Lueller

Phone No. (415) 651-1906

SHIPPING INFORMATION:

Shipper ______

Address ______

Date Shipped ______

Service Used ______

Airbill No. ______ Cooler No. ______

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
[signature]			
	Received for laboratory by: [signature]	8/1/89	1800

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
W-12-MW6	18061-4	8-1-89	TPH(gasoline) and BTEX	iced; 4 x 40ml

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

• FREMONT • COSTA MESA • SACRAMENTO • HOUSTON

ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 08-01-89
Laboratory Number: 90806W01
Project #: 18061-4
Sample #: W-12-MW6
Matrix: Water

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline		0.026		0.020	08-07-89	
TEH as Diesel						NR
Benzene		ND		0.00050	08-07-89	
Toluene		ND		0.00050	08-07-89	
Ethylbenzene		ND		0.00050	08-07-89	
Total Xylenes		ND		0.00050	08-07-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

08-10-89
Date Reported

APPENDIX C

RON ARCHER
CIVIL ENGINEER, INC.

CONSULTING • PLANNING • DESIGN • SURVEYING

4133 Mohr Ave., Suite E • Pleasanton, CA 94566
(415) 462-9372

JULY 3, 1989 JOB NO. 1567

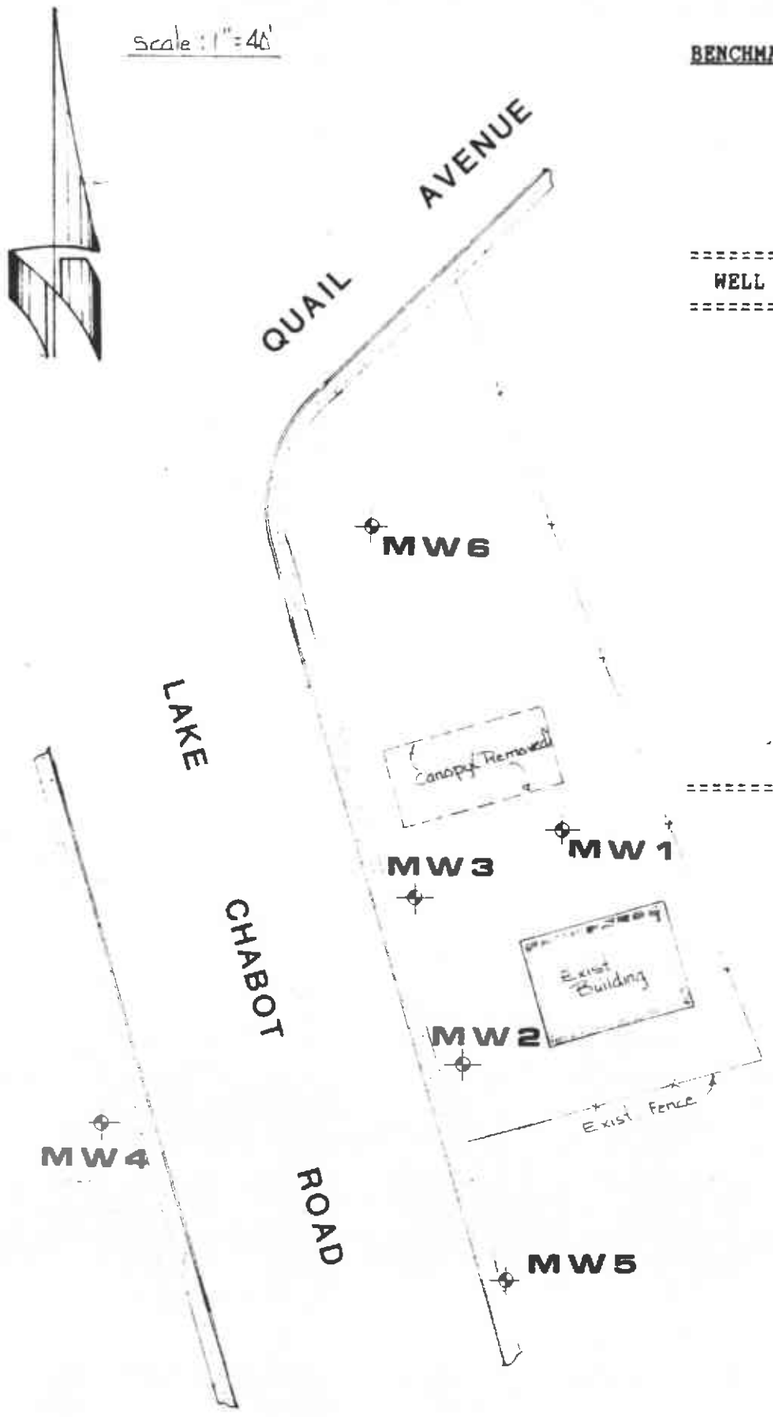
ELEVATIONS OF EXISTING MONITOR WELLS LOCATED AT AND NEAR THE UNOCAL STATION NO. 5484 LOCATED AT 18950 LAKE CHABOT ROAD AT QUAIL AVENUE CASTRO VALLEY, ALAMEDA COUNTY, CALIFORNIA.

FOR: APPLIED GEOSYSTEMS
PROJECT NO. 18061-3W

BENCHMARK: #SEV-LAKE
TOP OF A BRASS DISC SET IN TOP OF CURB AT THE EAST END OF RETURN AT THE SOUTHEAST CORNER OF INTERSECTION OF LAKE CHABOT ROAD AND SYDNEY WAY. ELEVATION TAKEN AS 242.834 M.S.L.

MONITOR WELL DATA TABLE

WELL DESIGNATION	ELEVATION	DESCRIPTION
MW-1	233.66	TOP OF CASING
	234.02	TOP OF BOX
MW-2	228.88	TOP OF CASING
	229.41	TOP OF BOX
MW-3	231.83	TOP OF CASING
	232.28	TOP OF BOX
MW-4	227.75	TOP OF CASING
	228.07	TOP OF BOX
MW-5	225.10	TOP OF CASING
	225.35	TOP OF BOX
MW-6	239.00	TOP OF CASING



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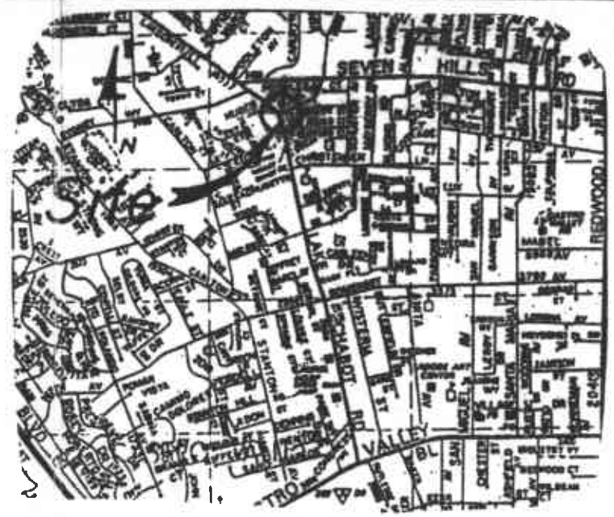
	229.41	TOP OF BOX
MW-3	231.83	TOP OF CASING
	232.28	TOP OF BOX
MW-4	227.75	TOP OF CASING
	228.07	TOP OF BOX
MW-5	225.10	TOP OF CASING
	225.35	TOP OF BOX
MW-6	239.00	TOP OF CASING



Vicinity Map
No Scale

REGISTERED PROFESSIONAL ENGINEER
RONALD R. ARCHER
No. 23721
EXPIRES 12/31/89
CIVIL
STATE OF CALIFORNIA

JULY 3, 1989 JOB NO. 1567

PLAT OF EXISTING MONITOR WELLS LOCATED AT AND NEAR THE UNOCAL STATION NO. 5484 LOCATED AT 18950 LAKE CHABOT ROAD AT QUAIL AVENUE CASTRO VALLEY, ALAMEDA COUNTY, CALIFORNIA.

FOR: APPLIED GEOSYSTEMS
PROJECT NO. 18061-3W

1" = 40'
0 20 40 80 120
Graphic Scale

RON ARCHER
CIVIL ENGINEER, INC
CONSULTING • PLANNING • DESIGN • SURVEYING
4133 Mohr Ave., Suite E • Pleasanton, CA 94566
(415) 462-9372