Applied GeoSystems

3315 Almaden Expressway, Suite 34
San Jose, California 95118
(408) 264-7723 FAX (408) 264-2435

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TRANSMITTAL

TO: MR. GIL WISTAR
ALAMEDA COUNTY DEPT OF ENVIR. HEALTH
80 SWAN WAY, ROOM 200
OAKLAND, CALIFORNIA

DATE: 4/26/91
PROJECT NUMBER: AGS 69028.04
SUBJECT: ARCO STATION 6113, LIVERMORE, CALIFORNIA

FROM: GREG BARCLAY
TITLE: GENERAL MANAGER

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REMARKS: THIS REPORT HAS BEEN FORWARDED TO YOU AT THE REQUEST OF MR. CHUCK CARMEL OF ARCO PRODUCTS COMPANY.

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LIMITED SUBSURFACE ENVIRONMENTAL INVESTIGATION RELATED TO THE FORMER WASTE-OIL TANK

at

ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

AGS 69028.04

Report prepared for

ARCO Products Company
P.O. Box 5811
San Mateo, California 94403

by

Resna/Applied GeoSystems

Marc A. Briggs
Geological Technician

Greg Barclay
General Manager

Joan Tiernan, Ph.D., P.E.
Engineering Manager

REGISTERED PROFESSIONAL ENGINEER
JOAN E. TIERNAN
No. C 044600
Exp. 2-21-94
CIVIL
STATE OF CALIFORNIA

April 16, 1991

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(Continued)

Applied GeoSystems 3315 Almaden Expressway, Suite 34, San Jose, CA 95118 (408) 264-7723
• FREMONT • IRVINE • HOUSTON • BOSTON • SACRAMENTO • CULVER CITY • SAN JOSE

LIMITED SUBSURFACE ENVIRONMENTAL INVESTIGATION RELATED TO THE FORMER WASTE-OIL TANK at ARCO Station 6113 785 East Stanley Boulevard Livermore, California

For ARCO Products Company

INTRODUCTION

ARCO Products Company (ARCO) contracted with RESNA/Applied GeoSystems (AGS) to perform a limited environmental investigation at the ARCO Station 6113, 785 East Stanley Boulevard, Livermore, California. This work was limited to evaluation of the lateral and vertical extent of waste-oil related hydrocarbons in the soil, and the potential impact of these hydrocarbons on ground water downgradient of the former underground waste-oil tank. ARCO requested that AGS perform this investigation in response to letters from Alameda County Department of Environmental Health (ACDEH) to ARCO, dated September 21, 1990 and November 16, 1990.

Work performed for this investigation included drilling one soil boring, collecting and describing soil samples from the boring, installing and developing a 4-inch-diameter ground-water monitoring well (MW-4) in the boring (B-4), sampling ground water from the monitoring wells at the site, surveying wellhead elevations, measuring depths-to-water (DTW) in the wells, and laboratory analysis of selected soil and ground-water samples.

This report includes summaries of field procedures used during this investigation, the results and interpretation of the data, and conclusions. This work was performed in accordance with the previously submitted and approved Work Plan (AGS 69028-1, July 18, 1989) and Addendum to Work Plan (AGS, December 16, 1990).

SITE DESCRIPTION AND BACKGROUND

General

The site is an operating gasoline station and mini-market in a commercial and residential area. It is located on the southwestern corner of East Stanley Boulevard and Murrieta Boulevard in Livermore, California, as shown on the Site Vicinity Map (Plate 1). The site is bounded by East Stanley Boulevard to the north, Murrieta Boulevard to the east, and the Arroyo Mocho to the south and west. An operating Shell Service Station is on the southeastern corner of East Stanley Boulevard and Murrieta Boulevard. The elevation of the site is approximately 457 feet above mean sea level.

Four underground gasoline-storage tanks (USTs) are present at the site. On January 26, 1989, prior to AGS involvement with the site, the 280-gallon waste-oil storage tank was excavated and removed from the site (see previous work, below). The former waste-oil tank location is covered by a large concrete utility-pad. The USTs are presently in service at the site. The locations of a former underground waste-oil tank, USTs, and pertinent site features are shown on the Generalized Site Plan (Plate 2).

Geology and Hydrogeology

The City of Livermore is located in the Livermore Valley, which is an intermontane valley in the Coast Ranges Geomorphic Province. The valley is approximately 13 miles long in an east-west direction and is four miles wide. The valley is surrounded by hills of the Diablo Range (California Department of Water Resources, 1974). The valley floor slopes gently toward the west. The principal streams in the area are the Arroyo Valley and Arroyo Mocho, which flow toward the western end of the valley. Arroyo Mocho is approximately 50 feet south-southwest of the site.

Livermore Valley is underlain by non-water-bearing rocks, water-bearing units, and sediments. The water-bearing units and sediments comprise the Livermore Valley ground-water basin. Water-bearing units include the Tassajara Formation, the Livermore Formation, and valley-fill materials (California Department of Water Resources, 1966, 1974). The Livermore Valley ground-water basin is divided into sub-basins on the basis of fault traces or other hydrologic discontinuities (California Department of Water Resources, 1974). The ground-water system in Livermore Valley is a multilayered system with an unconfined aquifer overlying a sequence of leaky or semiconfined aquifers. Ground water in the basin flows downslope toward the east-west-trending axis of the valley and then flows generally to the west (Alameda County Flood Control and Water Conservation District - Zone 7, 1986).

Well Research

A survey of active, inactive, and destroyed water supply wells and monitoring wells listed with the Alameda County Flood Control and Water Conservation District - Zone 7

(ACFCWCD) within a 1/2-mile radius of the site was performed as part of this environmental investigation. According to ACFCWCD records, currently there are nine destroyed water producing wells and 27 ground-water monitoring wells within a 1/2-mile radius of the site. The depths of the destroyed water wells range between 115 feet to 658 feet in depth. Ground-water monitoring wells located within a 1/2-mile radius of the site range between 40 and 530 feet in depth. No other details on well locations or construction was available at the time of this investigation.

PREVIOUS WORK

Prior to the present investigation, AGS and others performed environmental investigations related to the removal of the underground waste-oil storage tank. The results of these investigations are presented in reports listed in references of this report. A brief summary of previous work performed at the site is included in Appendix A.

FIELD WORK

Drilling

A well construction permit was acquired from the ACFCWCD. A copy of the permit is included in Appendix B. A summary of the field procedures employed by AGS is included in the July 1989 Work Plan previously submitted for this site. The work for this investigation was performed in accordance with the Site Safety Plan (AGS, February 14, 1991).

Boring B-4 was drilled near the northeastern corner of the service station, downgradient from former waste oil tank location. The boring was drilled to a depth just below the first-encountered water-bearing zone, and ground-water monitoring well MW-4 was installed in the boring, to further evaluate the extent of waste-oil related hydrocarbons in the soil and first-encountered ground water downgradient of the former waste-oil storage tank. The location of the boring and ground-water monitoring well are shown on Plate 2.

Soil Sampling and Description

Soil samples were collected from the soil boring and described in accordance to the Unified Soil Classification System, Plate 3, and as indicated on the Logs of Boring, Plates 4 and 5. Boring B-4 was sampled at a depth of approximately 5 feet below the ground surface, and then every 5 feet to the total depth of approximately 32 feet. Sampling procedures are described in the Work Plan (AGS, July 1989).

The earth materials encountered at the site during this investigation consisted primarily of clayey silt, with some gravel and sand (see Logs of Boring, Plates 4 and 5). Silty sand with gravel, possibly fill material, was encountered in the boring from the ground surface to depths of approximately 2 feet below the ground surface in the boring. Gravel to clayey gravel was encountered below the silty sand to a depth of approximately 14 feet below the ground surface. Beneath this material, sandy clay was encountered to a depth of approximately 22 feet.

Ground water was first encountered in a layer approximately 5 feet thick composed of silty to clayey sand beneath the sandy clay at depths of approximately 22 to 27 feet below the ground surface. Damp to moist sandy to silty clay was encountered at depths of

approximately 27 feet to the bottom of the boring at 32-1/2 feet. Geologic Cross Section locations are shown on Plate 2. Geologic Cross Sections A-A' and B-B' are represented on Plates 6 and 7, respectively.

Monitoring Well Construction and Well Development

Ground-water monitoring well MW-4 was constructed in boring B-4. The well was completed with 4-inch-diameter, Schedule 40, polyvinyl chloride (PVC) casing. The well casing was set in the well to a depth of approximately 27 feet below ground surface. The screened casing for the monitoring well consists of 4-inch-diameter, 0.020 inch machine-slotted PVC set from the total depth of the well to approximately 21 feet below the ground surface. Blank PVC casing was set from the top of the screened casing to within a few inches below the ground surface.

The new monitoring well MW-4 was developed on February 15, 1991, by surge block, bailing, and pumping techniques until water being removed from the well was found to be clean of sediments. Approximately 75 gallons was removed from the well during development. Construction and development of the well was completed according to the protocol included in the Work Plan.

Ground-Water Sampling

DTW measurements were taken and water samples were collected from ground-water monitoring wells MW-1 through MW-4 for subjective analysis on February 21, 1991, after waiting a period of at least 48 hours subsequent to development of the new well MW-4. Water samples collected from the monitoring wells showed no evidence of measurable

floating product or product sheen. Ground-water monitoring wells MW-1 through MW-4 were then purged and sampled for laboratory analysis on February 21, 1991. Descriptions of subjective analysis and ground-water sampling protocol are included in the Work Plan.

Sampling of Stockpiled Soil

One composite soil sample was collected for laboratory analysis from the approximately 1 cubic yard of soil in the drill cuttings stockpile on February 21, 1991. A description of the composite soil sample collection protocol is included in the Work Plan.

EVALUATION OF GROUND-WATER GRADIENT

On February 5, 1991, the wellhead for the new ground-water monitoring well was surveyed to a local National Geodetic Vertical Datum benchmark by Ron Archer Civil Engineer, Inc., of Pleasanton, California, a licensed land surveyor. The results of this wellhead survey are included in Appendix D, Wellhead Survey. The ground-water elevations for each well were calculated by subtracting the February 21 and March 20, 1991 DTW measurements from the surveyed elevation of the wellhead. The DTW measurements, wellhead elevations, and ground-water elevations are presented in Table 1, Cumulative Ground-Water Monitoring Data.

The ground-water gradient evaluated from the March 20, 1991 data is 0.009 to the east/northeast. Plate 8 is a graphic interpretation of the ground-water elevations based on this ground-water monitoring data. The ground-water gradient evaluated from the February 21, 1991 data is to the southeast. This gradient appears anomalous based on previous

gradients between September 1989 and December 1990, and the latest March 1991 gradient (AGS, August and November 1990, and January 1991).

LABORATORY ANALYSIS

Soil Samples

Selected soil samples collected from boring B-4 were analyzed for the gasoline constituents benzene, toluene, ethylbenzene, and total xylenes (BTEX) and total petroleum hydrocarbons as gasoline (TPHg) using modified Environmental Protection Agency (EPA) Methods 5030/8015/8020; total petroleum hydrocarbons as diesel (TPHd) using EPA Method 5030/8015; and Total Oil and Grease (TOG) using LUFT Standard Method 5520 E/F, at Applied Analytical Laboratories (California State Certification Number 1211). These soil samples were selected for laboratory analysis based on:

- location above first-encountered ground-water;
- location in a potential confining or perching layer below first-encountered ground water; and
- areas where the presence of petroleum hydrocarbons were suspected.

The composite sample from the drill cuttings stockpile was analyzed for TPHg and BTEX using modified EPA methods 5030/8015/8020. Results of laboratory analysis of soil samples are summarized in Table 2, Results of Laboratory Analysis of Soil Samples. Copies of laboratory reports and Chain of Custody documents for soil samples obtained during this investigation are included in Appendix E of this report. All samples contained

nondetectable concentrations of TPHg, TPHd, TOG, and BTEX, except one sample collected at 29 feet from B-4,, which contained a very low concentration of benzene at 0.008 parts per million (ppm), slightly above the laboratory detection limit.

Water Samples

Water samples from monitoring wells MW-1 through MW-4 were analyzed for BTEX and TPHg using modified EPA Methods 5030/8015/602, and TOG by LUFT Methods 5520 B/F. These analyses were also performed by Applied Analytical Laboratories. Results of the analyses for the water samples are summarized in Table 3, Cumulative Results of Ground Water Laboratory Analyses. Copies of original laboratory reports and Chain of Custody documents for water samples collected during this investigation are included in Appendix E of this report.

Laboratory analysis of ground-water samples collected on February 21, 1991 from monitoring wells MW-1 through MW-4 reported concentrations of BTEX in the wells below the State of California Department of Health Services (DHS) maximum contaminant levels (MCLs) and recommended action levels for drinking water (which for BTEX are 1.0 parts per billion [ppb], 100 ppb, 680 ppb, and 1,750 ppb, respectively [DHS, October 1990]), with the exception of benzene in wells MW-1 (1.2 ppb) and MW-4 (410 ppb). The concentration of benzene has increased in MW-1 since the last monitoring episode. Concentrations of TPHg and TOG continue to remain nondetectable in wells MW-1 through MW-3, which are generally upgradient of the former waste oil tank; however, 3,500 ppb TPHg and nondetectable concentrations of TOG were reported in the water sample obtained from MW-4, downgradient of the former waste-oil tank.

CONCLUSIONS

Based on this investigation and previous work at the site, AGS concludes:

- The vertical extent of waste-oil related hydrocarbons in the soil at the site has been delineated in the soil, with the exception of the immediate area under the station building.
- Waste-oil related hydrocarbons were not detected in the ground water at the site in February 1991.
- Gasoline-related hydrocarbons appear to have impacted the ground-water in the vicinity of the underground gasoline storage tanks.
- The vertical and lateral extent of gasoline in the ground water has not been delineated.

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 ground water with respect to waste-oil-related hydrocarbons at the site. No soil engineering or geotechnical references 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

Applied GeoSystems. July 18, 1989. Work Plan - Limited Subsurface Environmental Investigation at ARCO Station 6113, 785 East Stanley Boulevard, Livermore, California. AGS Report 69028-1W.

Applied GeoSystems. December 6, 1989. Limited Subsurface Environmental Investigation at ARCO Station 6113, 785 East Stanley Boulevard, Livermore, California. AGS Report 69028-2.

Applied GeoSystems. August 29, 1990. Letter Report, Quarterly Ground-Water Monitoring Second Quarter 1990 at ARCO Station 6113, 785 East Stanley Boulevard, Livermore, California. AGS Report 69028-3.

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Applied GeoSystems. December 16, 1990. Addendum to Work Plan for Arco Station 6113, 785 East Stanley Boulevard, Livermore, California. AGS 69028-4.

Applied GeoSystems. January 27, 1991. Letter Report, Quarterly Ground-Water Monitoring Fourth Quarter 1990 at ARCO Station 6113, 785 East Stanley Boulevard, Livermore, California. AGS Report 69028-3.

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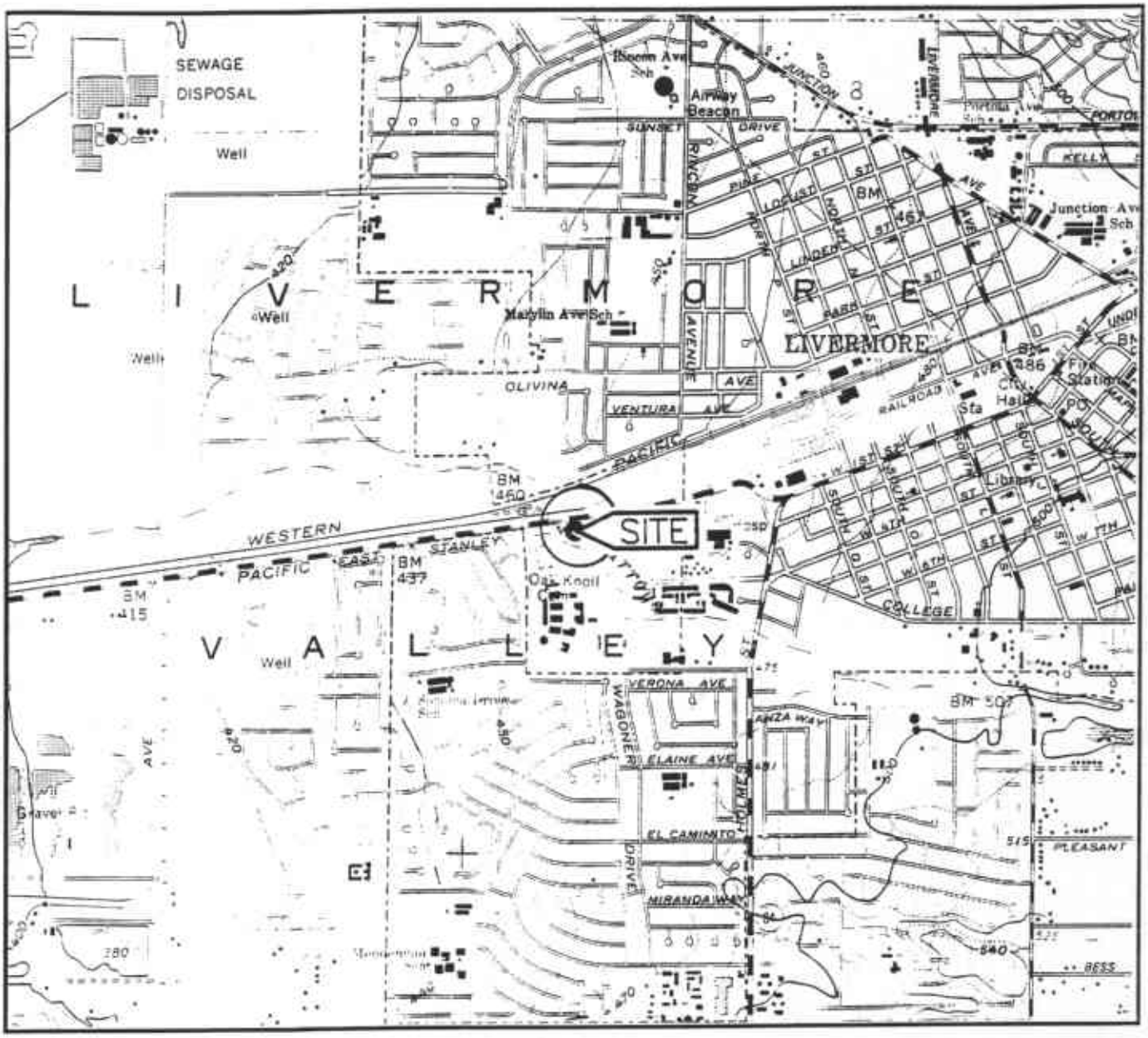
California Department of Health Services, October 24, 1990, "Summary of California Drinking Water Standards", Berkeley, California.

California Department of Water Resources. 1966. Evaluation of Ground-Water Resources, Livermore and Sonol Valleys, California Department of Water Resources Bulletin 118-2, Appendix A.

REFERENCES

California Department of Water Resources. 1974. Evaluation of Ground-Water Resources, Livermore and Sonol Valleys, California Department of Water Resources Bulletin 118-2, Appendix A.

Pacific Environmental Group. April 25, 1989. ARCO Station 6113, 785 E. Stanley Boulevard, Livermore, California. Project 330-53.01



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

N

Approximate Scale

2000 1000 0 2000 4000

feet

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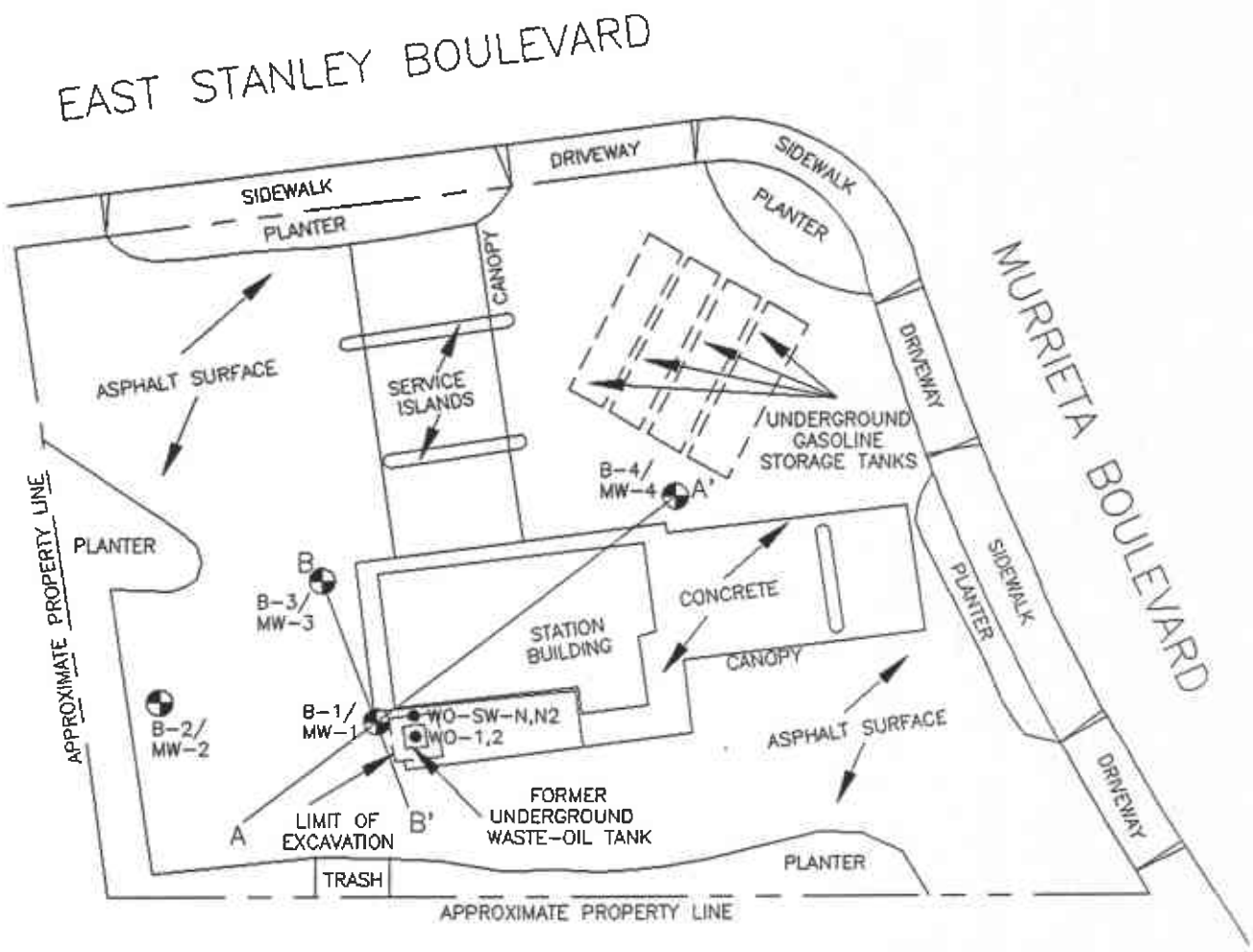
PROJECT **69028-4**

SITE VICINITY MAP
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE

1



N

Approximate Scale

40 20 0 40 80

feet

EXPLANATION

WO-SW-N,N2 ● = Soil sample collected by Pacific (1989)

B-4/MW-4 ⊕ = Boring/monitoring well (Applied GeoSystems, September 1989 and February 1991)

B —— B' = Geologic cross sections

Source: Modified from plan supplied by Ron Archer, Civil Engineer Inc., October 1988.

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GENERALIZED SITE PLAN
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE 2

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISION		LTR	DESCRIPTION	MAJOR DIVISION		LTR	DESCRIPTION
COARSE-GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded Gravels or 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 Gravel, 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 or 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.				
		SC	Clayey Sands, Sand-Clay mixtures.	HIGHLY ORGANIC SOILS		PT	Peat and other highly Organic Soils.


Depth through which sampler is driven


Relatively undisturbed sample


No sample recovered


Static water level observed in well/boring


Initial water level observed in boring

S-10 Sample number


Sand pack


Bentonite


Neat cement


Caved native soil


Blank PVC


Machine-slotted PVC

P.I.D. Photoionization detector

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.

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UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE 3

Depth of boring: 32-1/2 feet Diameter of boring: 10 inches Date drilled: 2-14-91

Well depth: 27 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 21 to 27 feet Slot size: 0.020-inch

Drilling Company: Exploration GeoServices Driller: John Collins

Method Used: Hollow-Stem Auger Field Geologist: Marc & Ken

Signature of Registered Professional:

Registration No.: CE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt (4 inches).	
				SM	Silty sand with gravel, brown, damp, loose: Fill.	
2				SW	Sandy gravel, subangular to subrounded gravel to 6 inch., brown, damp, very dense.	
4	S-4	18 50/2"	0			
6					Gravel composed of chert and sandstone.	
8	S-9	25 50/4"	0			
10						
12				SM	Silty sand, some gravel, gray, damp, dense; noticeable product odor.	
14	S-14.5	17 30 40	24	CL	Sandy clay, some gravel, gray mottled with brown, damp, low to medium plasticity; noticeable product odor.	
16						
18						
20	S-19.5	33 50/6"	5		Gray-brown, moist.	

(Section continues downward)

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LOG OF BORING B-4/MW-4

ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE 4

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				CL	Sandy clay, some gravel, gray–brown, moist, low to medium plasticity, hard.	
				SM	Silty sand, brown, very moist, dense.	
24		8				
	S–24.5	8	0	SC	Clayey sand, brown, wet, dense.	
		14				
26						
				CL	Sandy clay, gray mottled with brown, moist, low to medium plasticity, very stiff.	
28		28		CH	Silty clay, brown mottled with gray, damp, high plasticity, very stiff.	
	S–29	34	0			
		50				
30		19				
	S–30.5	3	0			
		35				
32					Total Depth = 32–1/2 feet.	
34						
36						
38						
40						
42						
44						
46						
48						
50						

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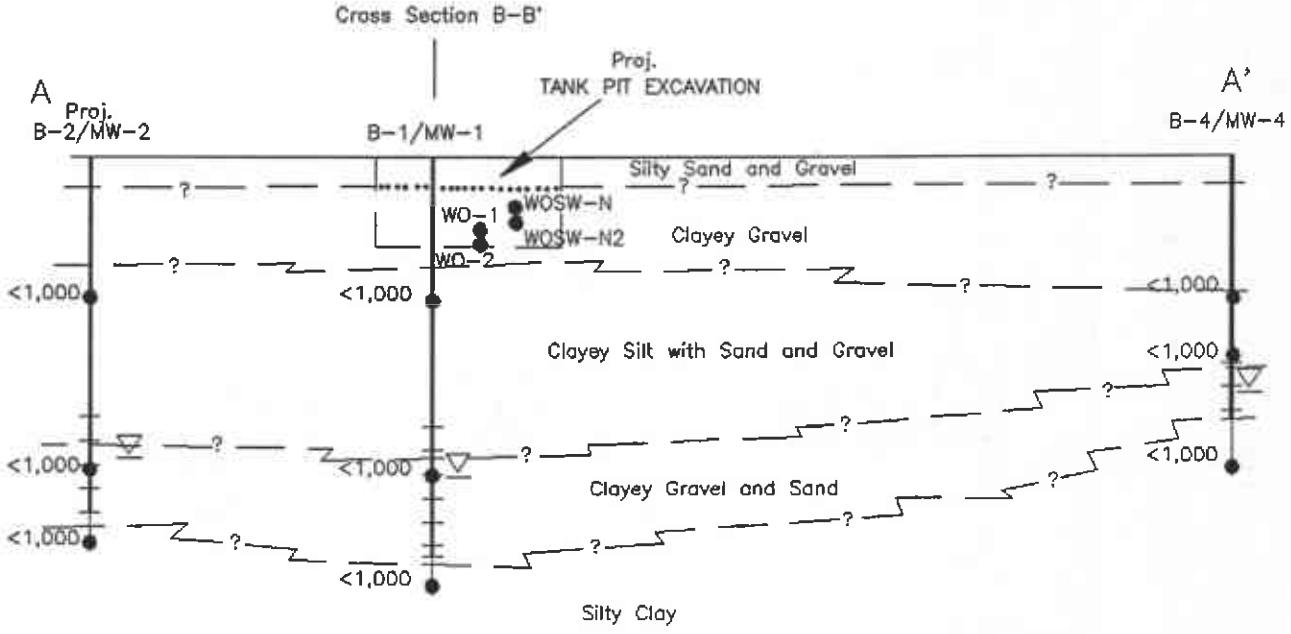
PROJECT 69028–4

LOG OF BORING B–4/MW–4

ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE 5



EXPLANATION

<1,000 = Laboratory analyzed soil samples showing concentration of TPHg in parts per million

= Well casing

= Well screen

= Boring

= Initial water level in boring

= Static water level in well (March 20, 1991)

Approximate Horizontal and Vertical Scale

20 10 0 20 40

feet

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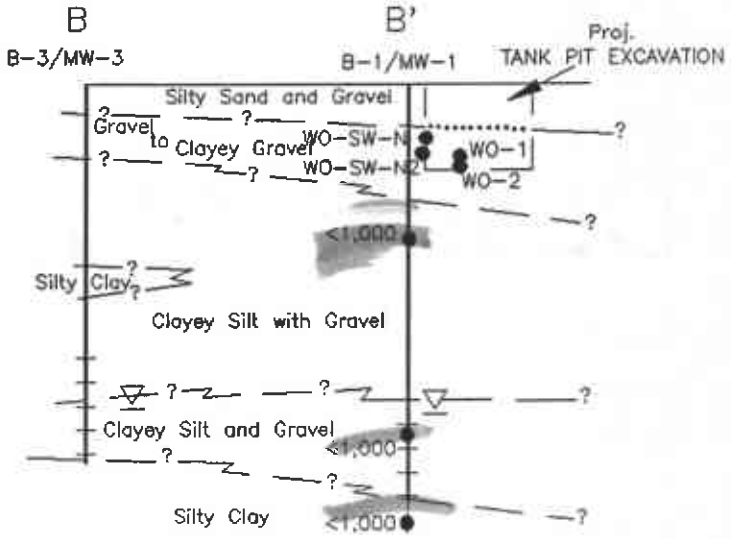
PROJECT 69028-4

GEOLOGIC CROSS SECTION A-A'
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE 6



EXPLANATION

<1,000 = Laboratory analyzed soil sample showing concentration of TPHg in parts per million

= Well casing

= Well screen

= Boring

= Initial water level in boring

= Static water level in well (March 20,1991)

Approximate Horizontal and Vertical Scale

20 10 0 20 40

feet

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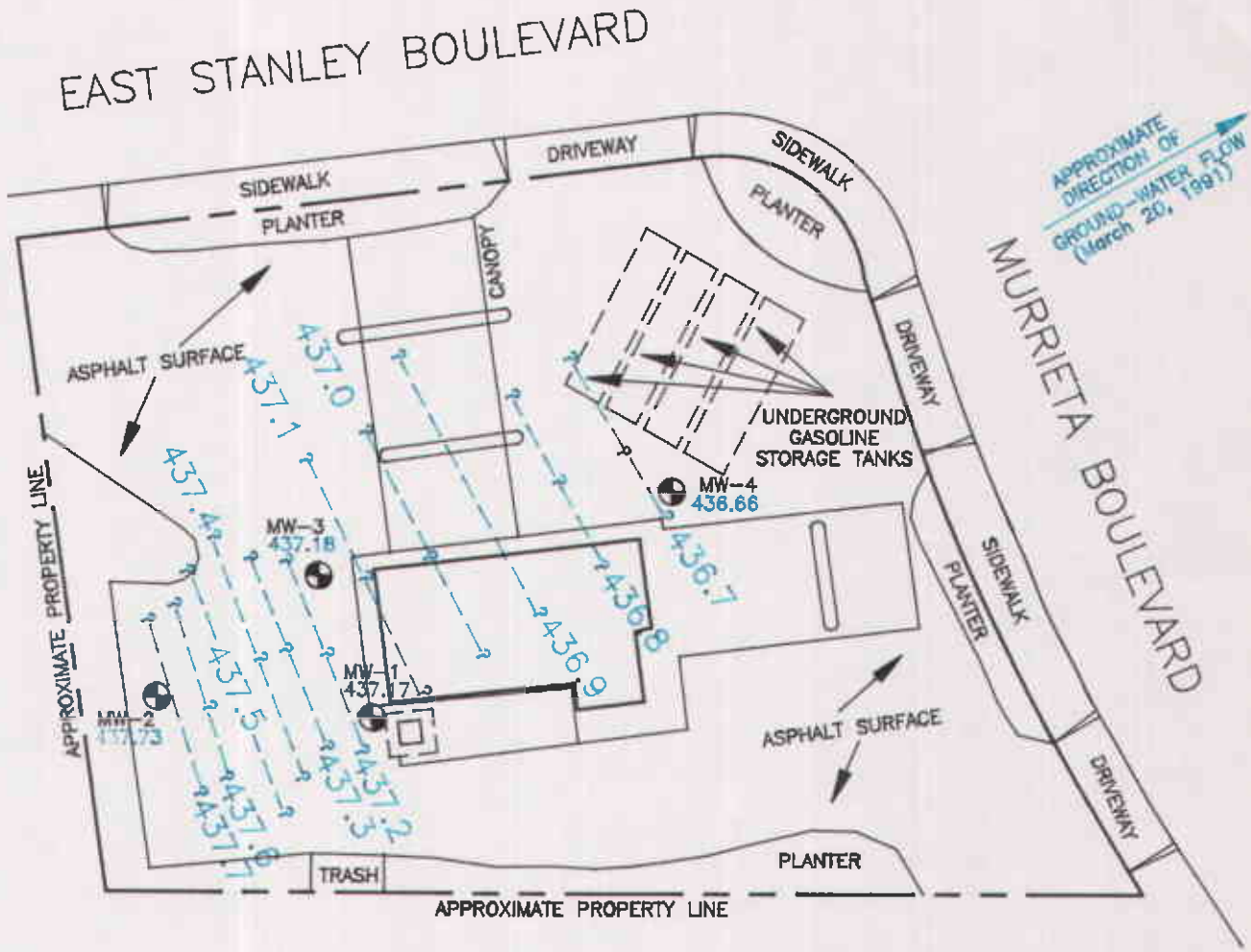
PROJECT 69028-4

GEOLOGIC CROSS SECTION B-B'
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE 7



437.7 — EXPLANATION

— = Line of equal elevation of ground water above Mean Sea Level (MSL)

437.73 = Elevation of ground water in feet (March 20, 1991)

MW-4 = Boring/monitoring well (Applied GeoSystems, September 1989 and February 1991)

N

Approximate Scale

40 20 0 40 80

feet

Source: Modified from plan supplied by Ron Archer, Civil Engineer Inc., October 1988.

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GROUND-WATER GRADIENT MAP
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
8

TABLE 1
CUMULATIVE GROUND-WATER MONITORING DATA
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

Well Date	Elevation of Wellhead	Depth to Water	Elevation of Ground-Water	Floating Product
MW-1				
09/20/89	457.04	21.03	436.01	NONE
10/12/89		19.64	437.40	NONE
06/21/90		21.72	435.32	NONE
09/20/90		19.79	437.25	NONE
12/18/90		19.28	437.76	NONE
02/21/91		22.45	434.59	NONE
03/20/91		19.87	437.17	NONE
MW-2				
09/20/89	457.74	20.67	437.07	NONE
10/12/89		18.98	438.76	NONE
06/21/90		21.88	435.86	NONE
09/20/90		19.90	437.84	NONE
12/18/90		19.32	438.42	NONE
02/21/91		23.02	434.72	NONE
03/20/91		20.01	437.73	NONE
MW-3				
09/20/89	456.97	20.98	435.99	NONE
10/12/89		19.66	437.31	NONE
06/21/90		21.72	435.25	NONE
09/20/90		19.72	437.25	NONE
12/18/90		19.21	437.76	NONE
02/21/91		22.36	434.61	NONE
03/20/91		19.79	437.18	NONE
MW-4				
02/21/91	456.97	22.01	434.96	NONE
03/20/91		20.31	436.66	NONE

Wellhead Elevation based on benchmark: Top of pin set in concrete in the most westerly monument at the intersection of East Stanley Boulevard and Fenton Avenue. Elevation taken as 455.896 mean sea level, City of Livermore datum.
Measurements in feet.

TABLE 2
RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

Sample	B	T	E	X	TPHg	TPHd	TOG
S-14½-B4	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<50
S-19½-B4	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<50
S-29-B4	0.008	<0.005	<0.005	<0.005	<1.0	<10	<50
S-0221 -SP1(A-D)	<0.005	<0.005	<0.005	<0.005	<1.0	<10	NA

Results in parts per million (ppm).
<: Results reported as less than the detection limit.
NA: Not Analyzed
TPHg: Total petroleum hydrocarbons as gasoline by EPA method 5030/8015.
TPHd: Total petroleum hydrocarbons as diesel by EPA method 3550/8015.
B: Benzene, T: Toluene, E: Ethylbenzene, T: Total Xylene isomers
BTEX: Analyzed by EPA method 5030/8020.
TOG: Total Oil and Grease by Standard Method 5520 E&F.

Composite soil sample (S-0221-SP1(A-D)) consists of four soil samples taken from stockpiled soil.

Sample designation:

S-29-B4
- Boring number
- Sample depth in feet below ground surface
- Soil sample

TABLE 3
CUMULATIVE RESULTS OF LABORATORY ANALYSIS
OF GROUND-WATER SAMPLES
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

Well Date	TPHg	TPHd	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Oil & Grease
MW-1							
09/20/89	[illegible]	<50	[illegible]	1.0	0.7	1	<5,000
06/21/90	<20	<100	<0.50	0.66	<0.50	<0.50	[illegible]
09/20/90	<50	<50	<0.5	1.0	<0.5	1.8	<5,000
12/18/90	<50	NA	<0.5	1.8	<0.5	1.7	<5,000
02/21/91	<50	NA	[illegible]	2.3	<0.5	2.2	<5,000
MW-2							
09/20/89	<50	<50	<0.5	<0.5	<0.5	<1	<5,000
06/21/90	<20	<100	<0.50	<0.50	<0.50	<0.50	<5,000
09/20/90	<50	<50	<0.5	0.7	<0.5	1.4	<5,000
12/18/90	<50	NA	[illegible]	[illegible]	<0.5	1.9	<5,000
02/21/91	<50	NA	<0.5	<0.5	<0.5	<0.5	<5,000
MW-3							
09/20/89	[illegible]	<50	[illegible]	0.6	1.1	<1	<5,000
06/21/90	<20	<100	<0.50	1.0	<0.50	<0.50	10,000
09/20/90	<50	<50	<0.5	1.0	<0.5	1.9	<5,000
12/18/90	<50	NA	<0.5	1.7	<0.5	2.0	<5,000
02/21/91	<50	NA	<0.5	<0.5	<0.5	<0.5	<5,000
MW-4							
02/21/91	[illegible]	NA	[illegible]	7.6	30	47	<5,000
Jan. 1990							
MCLs	---		1.0	---	680	1,750	
ALs	---		---	100	---	---	

Results in parts per billion (ppb).
TPHg : Total petroleum hydrocarbons as gasoline by EPA Method 5030/8015
B: Benzene, T: Toluene, E: Ethylbenzene, T: Total Xylene isomers
BTEX : Analyzed by EPA method 5030/8020.
TPHd : Total petroleum hydrocarbons as diesel by EPA Method 3510/8015
TOG : Total Oil and Grease by Standard Method 5520 B/F
< : Less than the detection limits shown.
MCLs : Adopted Maximum Contaminant Levels in Drinking Water, DHS (July 1989)
Als : Recommended Drinking Water Action Levels, DHS (January 1990)
NA : Not Analyzed

PREVIOUS WORK

Pacific Environmental Group

Previous work performed at the site in January and February 1989 by Pacific Environmental Group (Pacific), included soil excavation, removal of the 280-gallon waste-oil tank, and collection of soil samples for laboratory analysis. The waste-oil tank pit was excavated and the tank removed from the pit by Crosby and Overton, Inc. on January 26, 1989. During removal of the waste-oil tank, Pacific noted that the tank displayed no sign of leakage from either the fill pipe or the tank, and reported no detectable product odor in the soil beneath the tank. Pacific reported that soil removed from the northern wall of the tank excavation was slightly darker than soil from other areas of the excavation. The tank pit was excavated to a depth of 7-1/2 feet below grade. Pacific collected a soil sample (WO-1) at this depth (two feet below the bottom of the former waste-oil tank) in the central portion of the excavation. Pacific also collected a soil sample (WOSW-N) from the discolored area at a depth of 5 feet in the northern wall of the tank excavation, as requested by Mr. Gil Wistar of ACDEH. The soil samples were analyzed for total oil and grease, high boiling hydrocarbons (HBHC, calculated as oil and diesel), semi-volatile organic compounds (VOC), and cadmium, chromium, lead, and zinc at International Technology Corporation (Hazardous Waste Testing Laboratory No. 137) in San Jose, California. Pacific reported that concentrations of chromium, lead, and VOCs were below the levels set by the California Regional Water Quality Control Board for these compounds in soil. Because elevated concentrations of TOG (660 to 1700 ppm) and HBHC (60 to 790 ppm) were detected in both samples, the pit was excavated further two feet laterally and one foot vertically on February 3, 1989. According to Pacific's report, further excavation would have threatened the stability of the station building. Two additional samples (WO-2 at a depth of 8-½ feet from the center of the excavation, and WOSW-N2, at a depth of 7 feet from the northern end of the excavation) and analyzed for total oil and grease and HBHC. The results of Pacific's soil laboratory testing are shown in Table A1. The excavation was backfilled with clean fill.

RESNA/Applied GeoSystems

Resna/Applied GeoSystems (AGS) drilled and sampled three soil boring (B-1, B-2, and B-3), and installed and sampled three ground-water monitoring wells (MW-1, MW-2, and MW-3, respectively) in the boring (AGS, December 6, 1989). The locations of these boring are shown on Plate 2. Laboratory analysis of soil samples obtained from each of the borings reported nondetectable (less than 1 ppm) levels of TPHg, nondetectable (less than 10 ppm) levels of TPHd, and nondetectable (less than 30 ppm) levels of TOG. Laboratory analysis

of water samples obtained from wells MW-1, MW-2, and MW-3 during quarterly monitoring by AGS reported nondetectable levels of TPHd (less than 20.0 ppb) and TOG (less than 0.5 ppb) in the wells (see Table 3, Cumulative Results of Laboratory Analysis of Water Samples). The gasoline constituents BTEX in water samples obtained from wells MW-1 through MW-3 have been below the California State Department of Health Services (DHS) maximum contaminant levels for drinking water.

Static water elevations as measured in wells MW-1 through MW-3 have increased since monitoring began in September 1989. The ground water gradient evaluated from the ground-water elevation data has remained consistent since September 1989, evaluated from 0.028 to 0.009 to the northeast (AGS, August and November 1990, and January 1991).

TABLE A-1
RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES
FOR PETROLEUM HYDROCARBONS AND METALS
ARCO Service Station No. 6113
785 East Stanley Boulevard
Livermore, California

Sample Identifier	TOG	HBHC DIESEL	HBHC OIL	ZN	PB	CD	CR
01/26/89							
W0-1	660	160	60	36	18	ND	35
W0SW-N	1700	490	790	43	16	ND	61
02/03/89							
W0-2	ND	ND	ND	NM	NM	NM	NM
W0SW-N2	1100	30	800	NM	NM	NM	NM

Results in parts per million (ppm).
Results from work performed by Pacific Environmental Group, April 25, 1989
TOG: Total oil and grease
HBHC: High boiling hydrocarbons
ZN: zinc PB: lead CD: cadmium CR: chromium

ND: Not detected NM: Not measured

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 Arco Service Station 6113
785 E Stanley Boulevard
Livermore CA

(2) CLIENT
Name Arco Products Company
Address PO Box 5811 Phone
City San Mateo CA Zip 94402

(3) APPLICANT
Name Marc A Briggs
Applied GeoSystems Suite 34
Address 3315 Almaden Ex Phone 408-264-1723
City San Jose Zip 95118

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

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

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

WELL PROJECTS
Drill Hole Diameter 10 in. Depth(s) 35 ft.
Casing Diameter 4 in. Number
Surface Seal Depth 20 ft. of Wells 1
Driller's License No. 424288

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

(7) ESTIMATED STARTING DATE 2/14/91
ESTIMATED COMPLETION DATE 2/14/91

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

APPLICANT'S SIGNATURE Marc A Briggs Date 2/4/91

FOR OFFICE USE

PERMIT NUMBER 91067
LOCATION NUMBER

Approved Wyman Hong Date 5 Feb 91
Wyman Hong

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

WELL PURGE DATA SHEET

Project Name: ARCO 6113 Job No. 69028-4

Date: February 21, 1991 Page 1 of 1

Well No. MW-2 Time Started 12:20

Time (hr)	Gallons (cum.)	Temp. (F)	pH	Conduct. (micromoh)
12:20	Begin purging MW-2			
12:27	5	62.5	8.38	7.47
12:33	10	62.7	8.33	7.39
12:39	15	63.3	8.23	7.29
12:45	20	63.2	8.02	7.26
12:51	25	63.3	8.12	7.32
12:57	30	63.5	8.06	7.23
13:03	35	64.0	8.07	7.28
13:10	40	63.8	7.99	7.20
13:17	45	63.9	8.09	7.24
13:23	50	64.6	8.07	7.31
13:30	55	63.5	8.06	7.26
13:30	Stop purging MW-2			

Notes:

Depth to Bottom (feet) :	37.8
Depth to Water - initial (feet) :	23.02
Depth to Water - final (feet) :	23.31
% recovery :	98.0%
Time Sampled :	14:30
Gallons per Well Casing Volume :	2.41
Gallons Purged :	55.0
Well Casing Volumes Purged :	22.80
Approximate Pumping Rate (gpm) :	0.79

WELL PURGE DATA SHEET

Project Name: ARCO 6113 Job No. 69028-4

Date: February 21, 1991 Page 1 of 1

Well No. MW-3 Time Started 9:35

Time (hr)	Gallons (cum.)	Temp. (F)	pH	Conduct. (micromoh)
9:35	Begin purging MW-3			
9:55	5	61.5	8.28	6.68
11:11	10	61.7	8.12	7.44
11:17	15	61.0	8.08	6.77
11:24	20	61.6	8.27	7.22
11:29	25	62.1	8.30	7.19
11:36	30	62.2	8.32	7.22
11:43	35	62.1	8.20	7.16
11:50	40	62.5	8.21	7.14
11:56	45	62.8	8.20	7.20
12:02	50	62.8	8.21	7.19
12:07	55	63.1	8.230	7.23
12:07	Stop purging MW-3			

Notes:

Depth to Bottom (feet)	:	38.1
Depth to Water - initial (feet)	:	22.36
Depth to Water - final (feet)	:	22.52
% recovery	:	99.0%
Time Sampled	:	12:45
Gallons per Well Casing Volume	:	2.57
Gallons Purged	:	55.0
Well Casing Volumes Purged	:	21.41
Approximate Pumping Rate (gpm)	:	0.88

WELL PURGE DATA SHEET

Project Name: ARCO 6113 Job No. 69028-4

Date: February 21, 1991 Page 1 of 1

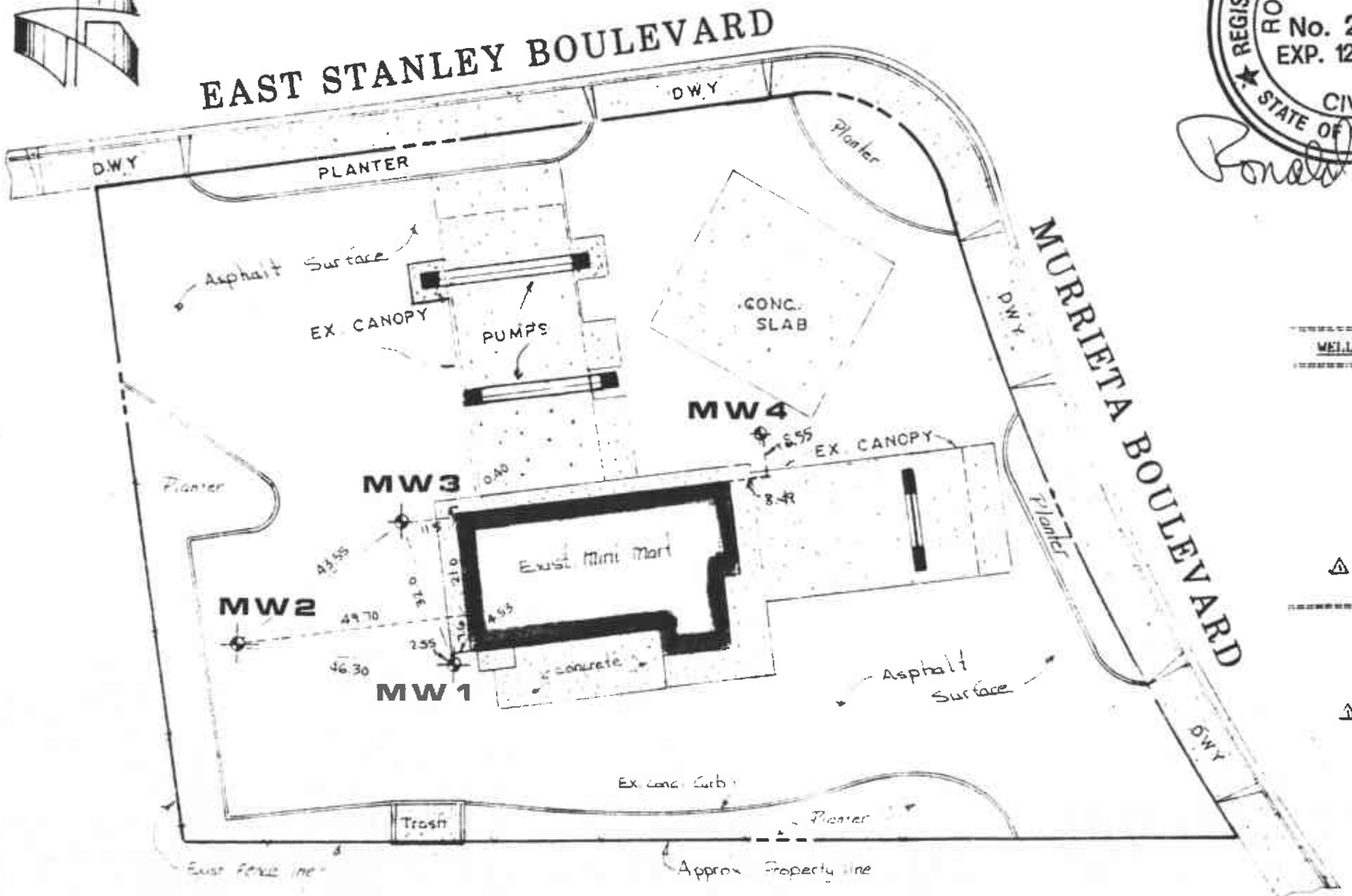
Well No. MW-4 Time Started 15:10

Time (hr)	Gallons (cum.)	Temp. (F)	pH	Conduct. (micromoh)
15:10	Begin purging MW-4			
15:18	3	64.3	8.02	8.63
13.20	5	64.4	7.78	8.52
15:25	7	64.0	7.63	8.70
15:30	10	63.3	7.49	8.84
15:36	13	64.0	7.49	8.78
15:40	15	63.4	7.51	8.63
15:53	17	63.2	7.55	8.72
15:00	20	63.3	7.50	8.89
15:00	Stop purging MW-4			

Notes:

Depth to Bottom (feet)	:	26.8
Depth to Water - initial (feet)	:	22.01
Depth to Water - final (feet)	:	23.00
% recovery	:	79.3%
Time Sampled	:	17:00
Gallons per Well Casing Volume	:	3.17
Gallons Purged	:	20.0
Well Casing Volumes Purged	:	6.40
Approximate Pumping Rate (gpm)	:	0.40

1" = 30'



1" = 30'

0 15 30 60 90

Graphic Scale

REGISTERED PROFESSIONAL ENGINEER
RONALD R. ARCHER
No. 23721
EXP. 12/31/93
CIVIL
STATE OF CALIFORNIA

Ronald R. Archer

MONITOR WELL DATA TABLE

WELL DESIGNATION	ELEVATION	DESCRIPTION
MW-1	457.04 457.43	TOP OF PVC CASING TOP OF BOX
MW-2	457.74 458.00	TOP OF PVC CASING TOP OF BOX
MW-3	456.97 457.23	TOP OF PVC CASING TOP OF BOX
⚠1 MW-4	456.97 457.30	• TOP OF PVC CASING TOP OF BOX

OCTOBER 4, 1988 JOB NO. 1616
⚠1 REVISED FEBUARY 25, 1991

PLAT SHOWING EXISTING MONITOR WELLS LOCATED AT ARCO SELF SERVICE STATION NO.6113, AND MINI MART, AT 755 EAST STANLEY BOULEVARD, CITY OF LIVERMORE, ALAMEDA COUNTY, CALIFORNIA.

FOR: APPLIED GEOSYSTEMS. (SAN JOSE OFFICE)
PROJECT NO. 69028-2

BENCHMARK: TOP OF PIN SET IN CONCRETE IN A THE MOST WESTERLY MONUMENT AT THE INTERSECTION OF EAST STANLEY BOULEVARD AND FENTON AVENUE. ELEVATION TAKEN AS 455.896, CITY OF LIVERMORE DATUM.

RON ARCHER
CIVIL ENGINEER, INC.
CONSULTING • PLANNING • DESIGN • SURVEYING
1177 Main Ave., Suite E • Pleasanton, CA 94566

Applied GeoSystems

CHAIN-OF-CUSTODY RECORD

PROJ. NO.	PROJECT NAME
69028 4	Arco 6113
P.O. NO.	SAMPLERS (Signature)
	Marc A Bugge

DATE MM/DD/YY	TIME		No. of Containers	TPHgasoline (8015)	BTEX (602/8020)	TPHdiesel (8015)	TOG (5520 D/F)				Preserved?	REMARKS	LABORATORY I.D. NUMBER
				ANALYSIS									
2/14/91		S-14½-B4	1	X	X	X	X					Iced	
↓		S-19½-B4	1	X	X	X	X					↓	
↓		S-29-B4	1	X	X	X	X					↓	

RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED BY (Signature):
Marc A Bugge	2/15/91 8:00	Ken Matuk
RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED BY (Signature):
Ken Matuk		D. Goodspeed
RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED FOR LABORATORY BY (Signature):
	2-19 3:00	Cathy Green

Laboratory: Applied Analytical

Turn Around: 2 Week

SEND RESULTS TO:

Applied GeoSystems
3315 Almaden Expressway
Suite 34
San Jose, California 95118
(408) 264-7723

Proj. Mgr.: Marc Briggs

APPLIED ANALYTICAL

Environmental Laboratories

42501 Albrae St., Suite 100
Fremont, CA 94538
Bus: (415) 623-0775
Fax: (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention:	Mr. Marc Briggs	Date Sampled:	02-14-91
	Applied GeoSystems	Date Received:	02-19-91
	3315 Almaden Expressway	BTEX Analyzed:	02-23-91
	San Jose, CA 95811	TPHg Analyzed:	02-23-91
Project:	AGS 69028-4	TPHd Analyzed:	02-28-91
		Matrix:	Soil

	Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPHg	TPHd
	ppm	ppm	ppm	ppm	ppm	ppm
Detection Limit:	0.005	0.005	0.005	0.005	1.0	10
SAMPLE Laboratory Identification						
S-14 1/2-B4 S1102306	ND	ND	ND	ND	ND	ND
S-19 1/2-B4 S1102307	ND	ND	ND	ND	ND	ND
S-29-B4 S1102308	0.008	ND	ND	ND	ND	ND

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

ANALYTICAL PROCEDURES

BTEX– Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020/602, which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID) and a flame-ionization detector (FID) in series.

TPHg–Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are measured by extraction using EPA Method 5030, followed by analysis using modified EPA Method 8015, which utilizes a GC equipped with an FID.

TPHd–Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550 for soils and EPA Method 3510 for water, followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Laboratory Representative

March 4, 1991
Date Reported

APPLIED ANALYTICAL LABORATORY IS CERTIFIED BY THE STATE OF CALIFORNIA DEPARTMENT OF HEALTH SERVICES AS A HAZARDOUS WASTE TESTING LABORATORY (Certification No. 1211)

APPLIED ANALYTICAL

Environmental Laboratories

42501 Albrae St., Suite 100
Fremont, CA 94538
Bus: (415) 623-0775
Fax: (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention:	Mr. Marc Briggs	Date Sampled:	02-14-91
	Applied GeoSystems	Date Received:	02-19-91
	42501 Albrae Street	TOG Analyzed:	02-27-91
	Fremont, CA 94538	Matrix:	Soil
Project:	AGS 69028-4	Detection Limit:	50 mg/kg

SAMPLE Laboratory Identification	TOG (mg/kg)
S-14.5-B4 S1102306	ND
S-19.5-B4 S1102307	ND
S-29-B4 S1102308	ND

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

ANALYTICAL PROCEDURES

TPH as Oil and Grease -- Total Oil and Grease (TOG) of mineral or petroleum origin are measured by extraction and gravimetric analysis according to Standard Method 5520 E/F.

Laboratory Representative

March 4, 1991
Date Reported

APPLIED ANALYTICAL LABORATORY IS CERTIFIED BY THE STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES AS A HAZARDOUS WASTE TESTING LABORATORY
(Certification No. 1211)

Applied GeoSystems

CHAIN-OF-CUSTODY RECORD

9/245

PROJ. NO.	PROJECT NAME
69028-4	ARCO 6113
P.O. NO.	SAMPLERS (Signature)
	Marc A Briggs

DATE MM/DD/YY	TIME		No. of Containers	TPHgasoline (8015)	BTEX (602/8020)	TPHdiesel (8015)	TOG					Preserved? ICOD	REMARKS	LABORATORY I.D. NUMBER
2/21/91	12:45	W-RINSATE-MW3	1									HCl		
	12:45	W-22-MW3	3	X	X							HCl		
	12:45	W-22-MW3	2				X					X		
	14:30	W-RINSATE-MW2	1									HCl		
	14:30	W-23-MW2	4	X	X							HCl		
	14:30	W-23 MW2	2				X					X		
	16:15	W-RINSATE MW1	1									HCl		
	16:15	W-22-MW1	4	X	X							HCl		
	16:15	W 22-MW1	2				X					X		
	17:00	W-RINSATE-MW4	1									HCl		
	17:00	W-23 MW4	4	X	X							HCl		
2/21/91	17:00	W-23-MW4	2				X					X		
2/21/91		S-0221-SP1A,B,C,D	4	X	X								COMPOSITE	

RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED BY (Signature):
Stan Bottum	2-22 1205	EXPRESS-IT.
RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED BY (Signature):
RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED FOR LABORATORY BY (Signature):
	2/22	Anthony Meno

Laboratory: Applied Analytical

Turn Around: 2 Week

SEND RESULTS TO:

Applied GeoSystems
3315 Almaden Expressway
Suite 34
San Jose, California 95118
(408) 264-7723

Proj. Mgr.: MARC BRIGGS

APPLIED ANALYTICAL

Environmental Laboratories

42501 Albrae St., Suite 100
Fremont, CA 94538
Bus: (415) 623-0775
Fax: (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention:	Mr. Mark Briggs	Date Sampled:	02-21-91
	Applied GeoSystems	Date Received:	02-22-91
	3315 Almaden Expressway	BTEX Analyzed:	03-06-91
	San Jose, CA 95811	TPHg Analyzed:	03-06-91
Project:	AGS 69028-4	TPHd Analyzed:	NR
		Matrix:	Water

	Benzene ppb	Toluene ppb	Ethyl-benzene ppb	Total Xylenes ppb	TPHg ppb	TPHd ppb
Detection Limit:	0.5	0.5	0.5	0.5	50	100
SAMPLE Laboratory Identification						
W-22-MW3 W1102416	ND	ND	ND	ND	ND	NR
W-23-MW2 W1102419	ND	ND	ND	ND	ND	NR
W-22-MW1 W1102422	1.2	2.3	ND	2.2	ND	NR
W-23-MW4 W1102425	410	7.6	30	47	3500	NR

ppb = parts per billion = µg/L = micrograms per liter.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not requested.

ANALYTICAL PROCEDURES

BTEX– Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020/602, which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID) and a flame-ionization detector (FID) in series.

TPHg–Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are measured by extraction using EPA Method 5030, followed by analysis using modified EPA Method 8015, which utilizes a GC equipped with an FID.

TPHd–Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550 for soils and EPA Method 3510 for water, followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Laboratory Representative

March 7, 1991
Date Reported

APPLIED ANALYTICAL

Environmental Laboratories

42501 Albrae St., Suite 100
Fremont, CA 94538
Bus: (415) 623-0775
Fax: (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention:	Mr. Marc Briggs	Date Sampled:	02-21-91
	Applied GeoSystems	Date Received:	02-22-91
	3315 Almaden Expressway	TOG Analyzed:	02-25-91
	San Jose, CA 95118	Matrix:	Water
Project:	AGS 69028-4	Detection Limit:	5000 µg/L

SAMPLE Laboratory Identification	TOG (µg/L)
W-22-MW3 W1102417	ND
W-23-MW2 W1102420	ND
W-22-MW1 W1102423	ND
W-23-MW4 W1102426	ND

µg/L = micrograms per liter = ppb = parts per billion
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.

ANALYTICAL PROCEDURES

TPH as Oil and Grease – Total Oil and Grease (TOG) of mineral or petroleum origin are measured by extraction and gravimetric analysis according to Standard Method 5520 B/F.

Laboratory Representative

March 7, 1991
Date Reported

APPLIED ANALYTICAL LABORATORY IS CERTIFIED BY THE STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES AS A HAZARDOUS WASTE TESTING LABORATORY
(Certification No. 1211)

APPLIED ANALYTICAL

Environmental Laboratories

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Bus: (415) 623-0775
Fax: (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention: Mr. Marc Briggs
Applied GeoSystems
3315 Almaden Expressway
San Jose, CA 95811
Project: AGS 69028-4

Date Sampled: 02-21-91
Date Received: 02-22-91
BTEX Analyzed: 03-07-91
TPHg Analyzed: 03-07-91
TPHd Analyzed: NR
Matrix: Soil

	Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPHg	TPHd
	ppm	ppm	ppm	ppm	ppm	ppm
Detection Limit:	0.005	0.005	0.005	0.005	1.0	10
SAMPLE Laboratory Identification						
S-0221-SP1(A-D) S1102427	ND	ND	ND	ND	ND	NR

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

ANALYTICAL PROCEDURES

BTEX– Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020/602, which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID) and a flame-ionization detector (FID) in series.

TPHg–Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are measured by extraction using EPA Method 5030, followed by analysis using modified EPA Method 8015, which utilizes a GC equipped with an FID.

TPHd–Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550 for soils and EPA Method 3510 for water, followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Laboratory Representative

March 13, 1991
Date Reported