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

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

SUPPLEMENTAL SUBSURFACE AND REMEDIAL INVESTIGATION

at

ARCO Station 2152
22141 Center Street
Castro Valley, California 7/91

AGS 69013-6

Report prepared for

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

by

RESNA/Applied GeoSystems

Mike Hodges
Mechanical Engineer

Greg Barclay
General Manager

REGISTERED PROFESSIONAL ENGINEER
JOAN E. TIERNAN
No. C 044600
Exp. 3-31-94
CIVIL
STATE OF CALIFORNIA

Joan Tiernan
Registered Civil Engineer #044600

July 2, 1991

TABLE OF CONTENTS

PLATES

TABLE OF CONTENTS
(continued)

PLATES
(continued)

TABLES

APPENDICES

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

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

REPORT
SUPPLEMENTAL SUBSURFACE AND REMEDIAL INVESTIGATION
at
ARCO Station 2152
22141 Center Street
Castro Valley, California

For ARCO Products Company

INTRODUCTION

At the request of ARCO Products Company (ARCO), RESNA/Applied GeoSystems (AGS) conducted a supplemental subsurface and remedial investigation to evaluate the extent of gasoline hydrocarbons in the soil near the former underground gasoline-storage tanks and product lines onsite at ARCO Station 2152, located at 22141 Center Street, Castro Valley, California, and to evaluate soil vapor extraction as a soil remediation alternative at the site. The work was performed to further assess soil quality after elevated concentrations of gasoline hydrocarbons were discovered in the soil beneath the former gasoline-storage tanks and product lines at the site in August and September 1989 (AGS, January 1990). The present investigation included drilling nine soil borings (B-8, B-9, and B-12 through B-18), constructing 4-inch diameter vadose zone monitoring wells (VW-3 through VW-5) in three of the borings, performing laboratory analyses on selected soil samples from the borings, and performing a vapor extraction test (VET) utilizing the vapor wells at the site. This report summarizes previous work performed by AGS at the site, and presents the results and conclusions of this investigation. This work represents the remaining portion of work previously outlined in the Work Plan (AGS, April 1990), and Addendum to Work Plan

(AGS, May 1990), which was not performed during the initial Environmental Subsurface Investigation (AGS, November 1990). The Work Plan and Addendum were previously approved by Alameda County Health Care Services Agency (ACHCSA) as stated in their letter dated May 31, 1990.

SITE DESCRIPTION AND BACKGROUND

General

ARCO Station 2152 is an operating service station located southwest of the intersection of Center Street and Grove Way in Castro Valley, California. The location of the site is shown on the Site Vicinity Map, Plate 1. The site is a relatively flat, asphalt- and concrete-covered lot at an elevation of approximately 217 feet above mean sea level. Local topography near the vicinity at the site slopes gently to the southwest. Residential areas are southeast and west-southwest of the site, and commercial developments are northwest across Grove Way and northeast across Center Street.

From data supplied by ARCO, one underground 12,000-gallon gasoline-storage tank (designated T1) and four underground 6,000-gallon gasoline-storage tanks (T2 through T5) previously existed at the site. Former tank T1 was installed in 1983 and stored unleaded supreme gasoline, tanks T2 through T4 were installed in 1976 and stored unleaded regular gasoline, and tank T5 was installed in 1976 and stored leaded regular gasoline. These tanks were removed, and three underground fiberglass 12,000-gallon gasoline-storage tanks were installed in the former tank pit at the site, in August 1989. The product dispenser lines and product line sump associated with the former tanks were replaced in October 1989. The

approximate locations of the former tanks, existing tanks, and other pertinent site facilities are shown on the Generalized Site Plan, Plate 2.

Geology and Hydrogeology

Regionally, the site is in the Castro Valley Basin with the Diablo Range to the east and the Hayward Fault to the west. The site lies within an area of unconsolidated Pleistocene alluvium consisting of a heterogenous mixture of poorly consolidated clay, silt, sand, and gravel derived from the Diablo Range (Helley, et. al., 1979). Earth materials encountered during our previous subsurface investigations at the site consisted of silty to sandy clay and clayey sand to sandy gravel. Ground water was encountered within clayey sand to sandy gravel at depths of approximately 52 to 58 feet. Hard dry claystone was encountered at bedrock depths of approximately 58 to 60 feet (AGS, November 1990). The direction of ground-water flow is toward the southwest based on ground-water monitoring data collected from the wells at the site between June 1990 and January 1991 (AGS, March 1991).

PREVIOUS WORK

Prior to the present investigation, AGS performed environmental investigations related to the removal of five underground gasoline-storage tanks and subsequent limited subsurface environmental investigations. The results of these investigations are presented in the reports listed in the reference section. Quarterly ground-water monitoring of four wells is also ongoing at the site. A brief summary of previous work and quarterly monitoring at the site is included in Appendix A.

FIELD WORK

Drilling

A well construction permit was acquired from the Alameda County Flood Control and Water Conservation District (ACFCWD - Zone 7) prior to drilling. A copy of the permit is included in Appendix B. Nine soil borings (B-8, B-9, and B-12 through B-18) were drilled on January 14 through 17, and February 21, 1991. A summary of the field methods and procedures employed by AGS is included in Appendix C. The work for this investigation was performed in accordance with the Site Safety Plan (AGS, March 1991).

Borings B-12 and B-14 were drilled northwest and northeast of the former tank pit to delineate the lateral extent of gasoline hydrocarbons in soil in these areas. Borings B-15 through B-18 were drilled in the area of and southwest of the former product lines to evaluate the extent of gasoline hydrocarbons in soil in these areas and in the downgradient direction of ground-water flow from these areas. Because elevated concentrations of gasoline hydrocarbons were detected in the subsurface soil beneath the former tank pit, borings B-8 and B-9 (VW-3 and VW-4) were drilled through polyvinyl chloride (PVC) conductor casing, which had been installed by others within the tank pit during tank replacement activities. In September 1989, B-8 and B-9 were installed to evaluate the lateral and vertical extent of gasoline hydrocarbons in soil in the tank pit and to provide for future vapor extraction.

Soil Sampling and Description

Soil samples were classified in accordance with the Unified Soil Classification System, Plate 3, and collected and described as indicated on the Logs of Borings, Plates 4 through 17. These soil samples were collected at maximum 5-foot intervals and at the bottoms of the borings.

The earth materials encountered during this investigation consisted primarily of silty to sandy clay and clayey sand to sandy gravel (see Logs of Borings and Geologic Cross Sections A-A' through D-D,' Plates 18 through 21). In general, silty to sandy clay with some interbeds of clayey sand to sandy gravel up to 20 feet thick was encountered beneath the surface asphalt and minor fill between depths of approximately 1-1/2 feet to 42 feet. In addition, the tank pit is backfilled with pea gravel to approximately 20 feet below grade. Clayey sand to sandy gravel was encountered between the depths of approximately 42 to 58 feet. Ground water was encountered within the clayey sand to sandy gravel at depths of approximately 52 to 56 feet. Hard, dry claystone bedrock was encountered beneath the clayey sand to sandy gravel to the bottom of the deepest boring.

One composite soil sample was collected from the stockpiled drill cuttings generated during the drilling of borings B-8, B-9, and B-12 through B-16 on January 29, 1991 and one composite sample was collected from the stockpiled drill cuttings generated during the drilling of borings B-17 and B-18 on April 11, 1991. The method used to obtain these samples is described in Appendix C.

Construction of Vapor Wells

Three vadose-zone wells (VW-3 through VW-5) were constructed in soil borings B-8, B-9, and B-13, respectively, for purposes of monitoring hydrocarbon vapors, to conduct a VET in order to determine the radius-of-influence for each vapor test well, and to determine the feasibility of a full scale vapor extraction system (VES). Wells VW-3 and VW-4 were constructed through 12-inch diameter PVC conductor casing previously installed within the tank pit during tank replacement activities at the site. The wells were completed with 4-inch-diameter PVC casing. Well casings were set in the wells to depths of approximately 32 to 39 feet. The screened casings for the monitoring wells consist of 4-inch-diameter machine-slotted PVC with 0.020-inch-wide slots set from the total depth of the well to approximately 24 to 28 feet below the ground surface. Solid PVC casing was set from the top of the screened casing to a few inches below the ground surface (see Plates 4 through 7, 10, and 11 for well construction details).

Vapor Extraction Test

AGS performed a VET onsite on February 15, 1991. The VET had two objectives: (1) to collect operational data to evaluate the efficiency and practicality of vapor extraction as a soil remediation alternative; and (2) to select the most appropriate off-gas treatment alternative, if the operational data suggest that vapor-extraction is recommended. The VET was performed in accordance with Bay Area Air Quality Management District (BAAQMD) guidelines.

The vapor-extraction equipment consisted primarily of: (1) six-cylinder internal combustion (I.C.) engine to treat off-gas emissions; (2) instrumentation for measuring air flow, air

velocity, air pressure, temperature, electrical current, and volatile organic compound (VOC) concentrations; and (3) PVC piping, fittings, and wellhead connections.

Five vapor-extraction wells installed onsite were used for the VET; two of the wells were existing (VW-1 and VW-2, installed in June 1990) and three were new (VW-3 through VW-5). The location of these wells is shown on Plate 2. Two tests were performed for a total of approximately six hours. The first test used well VW-5 as the extraction well, and wells VW-1, VW-2, VW-3 and VW-4 were the observation wells. In the second test, well MW-1 VW-1? was used as the extraction well, and the observation wells were VW-2 through VW-5.

AGS first operated the vapor-extraction equipment on vapor-extraction well VW-5 for approximately two hours while monitoring the change in vacuum at wells VW-2, VW-3, VW-4, and VW-1. The distances between vapor-extraction well VW-5 and VW-2, VW-3, VW-4, and VW-1 are 29.0, 27.7, 48.5, and 61.9 feet respectively. Air flow rate, vacuum, VOC concentration, and temperature were monitored at the influent to the I.C. engine. Vacuum air flow rate from VW-5 was greater than 50 cubic feet per minute (cfm), and the extraction point vacuum ranged from 40-42 inches of water. One influent air sample was collected after system steady state was achieved about 15 minutes after startup and a second influent and an effluent sample were taken after two hours of operation. The effluent sample was taken to verify the destruction efficiency of the I.C. engine of both benzene and total petroleum hydrocarbons reported as gasoline (TPHg). After 120 minutes, this test run was completed; and then the vapor extraction equipment was relocated and operated on VW-1, VW-2, and VW-3 for 20 minutes each, and air samples taken for analysis.

AGS then operated the vapor-extraction equipment on vapor-extraction well VW-1 for approximately two hours while monitoring the change in vacuum at wells VW-2, VW-3,

VW-4, and VW-5. The distances between vapor-extraction well VW-1 and VW-2, VW-3, VW-4, and VW-5 are 61.3, 34.5, 17.7 and 61.9 feet respectively. Air flow rate, vacuum, pressure, VOC concentration, and temperature were monitored at the influent to the I.C. engine. Vacuum air flow rate at VW-1 was greater than 50 cfm, and the intake vacuum at VW-1 ranged from 42-48 inches of water. One influent air sample was collected after system stabilization, and a second influent sample were taken after two hours of operation.

Air Sampling

Air samples were collected through a 1/4-inch Teflon sample line connected to a stainless steel well head fitting and collected in Tedlar air sample bags. Teflon tubing was used to minimize sample loss through adsorption and the possibility of distorted results from sample lines contaminated by a previous test run. The samples were sealed in the bags and labeled with the sample number, date, time, and sampler's name. The samples were immediately placed on ice for transport to a State Certified analytical laboratory under Chain of Custody documentation.

LABORATORY ANALYTICAL METHODS

Soil Samples

Thirty-seven soil samples collected from borings B-8, B-9, and B-12 through B-18 were selected for laboratory analysis based on areas where the presence of gasoline hydrocarbons were suspected and at 5-foot intervals and/or changes in stratigraphic units as recommended by ACHCSA for definition of hydrocarbons in soil. The samples were submitted with Chain of Custody Records to the following State certified laboratories: Applied Analytical in

Fremont, California (Hazardous Waste Testing Laboratory Certification No. 1211); Anametrix, Inc., in San Jose, California (Certification No. 1234); and Sequoia Analytical in Redwood City, California (Certification No. 1210). The soil samples were analyzed for TPHg and the purgeable gasoline constituents benzene, toluene, ethylbenzene, and total xylenes (BTEX) by Environmental Protection Agency (EPA) Methods 5030/8015 and 5030/8020. In addition, five soil samples from borings B-17 and B-18 were analyzed for organic lead by the California LUFT method.

Two composite soil samples collected from the stockpiled cuttings at the site were analyzed for TPHg and BTEX by EPA Methods 5030/8015 and 5030/8020, and organic lead by the California LUFT method at Anametrix, Inc. and Mobile Chem Labs in Martinez, California (Certification No. 358).

Air Samples

Eight air samples were submitted under Chain of Custody to state-certified Superior Analytical Laboratory, Inc. in San Francisco, California (Certification Nos. 319 & 220). Air samples were analyzed for TPHg using Modified EPA SW-846 Methods 5030/8015, and for BTEX using EPA SW-846 Methods 5030/8020.

LABORATORY AND FIELD RESULTS

Laboratory Results of Soil Samples

Results of laboratory analysis of soil samples are summarized in Cumulative Results of Laboratory Analysis of Soil Samples, Table 1. Copies of laboratory reports and Chain-of-

Custody documents for soil samples obtained during this investigation are included in Appendix D. The results are as follows:

- laboratory analysis of soil samples collected from borings B-8 and B-9, drilled through the conductor casing in the former tank pit, indicated nondetectable concentrations of TPHg (below method detection limit [mdl] of 1.0 parts per million [ppm]), with the exception of 680 ppm TPHg reported in a sample collected from a depth of 22 feet in boring B-9;

- laboratory analysis of soil samples collected from borings B-12, B-13, and B-14, drilled north and northeast of the former tank pit, indicated nondetectable concentrations of TPHg at depths of approximately 15 to 45 feet;

- laboratory analysis of soil samples collected from borings B-15 through B-18, drilled at and downgradient (southwest) of the former product lines, indicated nondetectable concentrations of TPHg, with the exception of 1.7 ppm TPHg reported in a sample collected from a depth of 2 feet in boring B-16, and 50 ppm, 220 ppm, and 170 ppm from depths of 4, 8, and 15-1/2 feet in boring B-18. Laboratory analysis for organic lead of samples from borings B-17 and B-18 indicated nondetectable (mdl of 0.5 ppm) concentrations; and

- the results of laboratory analyses of two stockpile composite samples indicated nondetectable concentrations of TPHg, BTEX, and organic lead.

The results of this and previous results of sampling for TPHg are summarized in the Geologic Cross Sections A-A' through D-D', in Plates 18 through 21. The locations of the geologic sections are shown on Plate 2.

Vapor Extraction Test Field Results

Field monitoring results taken during the VET are summarized in Table 2. Two VET test runs were conducted. The first test run utilized vapor well VW-5 as the extraction well, and

the four observation wells were VW-1, through VW-4. The second test run used well VW-1 as the extraction point and the four observation wells were VW-2 through VW-5.

Test Run 1

In the first test run, the distance between the extraction well (VW-5) and the observation wells was: 29 feet to VW-2, 27.7 feet to VW-3, 48.8 feet to VW-4, and 61.9 feet to VW-1. All wells were screened at approximately the same depth although subsurface geology differed in some wells: VW-1 at 24 to 40 feet in a gravelly sand and clayey gravel; VW-2 at 24 to 38 feet in a silty clay; VW-3 was screened at 24-39 feet in a silty clay; VW-4 at 24 to 32 feet in a gravelly and clayey sand; and VW-5 was screened at 27-38 feet below grade in a silty clay.

With the vapor-extraction equipment operating on vapor-extraction well VW-5, the highest change in vacuum was observed in vapor-extraction well VW-3 at 0.04 inches of water column at a distance of approximately 27.7 feet from VW-5, while VW-5 was undergoing a vacuum pressure of 40 to 42 inches of water column at a flow rate of over 50 cfm. None of the other observation wells (VW-2, VW-4, and VW-1) showed any vacuum impact. This may be due in part to the fact that they were farther from extraction well VW-5 than was VW-3, which showed good vacuum impact. In addition, VW-3 is located in the tank pit which is backfilled with pea gravel to a depth of 20 feet. Pea gravel is highly porous to air flow. Since silty clay has poor porosity for air flow it is possible that the vacuum impact observed between VW-5 and VW-3 is due to vertical air flow through the silty clay layer at VW-3 which is just below the pea gravel, followed by horizontal air flow through the pea gravel to well VW-5 at 27 feet away.

Test Run Two

After the first test run was completed, the vapor extraction equipment was relocated to VW-1, VW-2, and VW-3 for air sampling purposes; and then the equipment was set up for the second test run at the new extraction point VW-1. VW-1 is situated near the pea gravel backfill in the tank pit and is screened in a highly porous gravelly sand to sandy gravel soil. With the vapor-extraction equipment operating on vapor-extraction well VW-1, all observation wells except VW-2 showed vacuum impact. The highest change in vacuum was observed in vapor-extraction well VW-4 at 0.09 inches of water column at a distance of approximately 17.7 feet from VW-1 (as seen in Table 2), while VW-1 was undergoing a vacuum pressure of approximately 48 inches of water column at a flow rate of over 50 cfm. Once again, VW-2 showed no vacuum impact. VW-2 is screened in a silty clay and is located about 5 to 7 feet from the pea gravel backfill in the tank pit. Thus, it appears that horizontal flow in the silty clay layer, at least in the vicinity of VW-2, is restricted to less than about 7 to 10 feet. VW-3 is screened in silty clay but is located in the pea gravel and screened just below the pea gravel so good vertical flow to the gravel occurs. VW-4 is screened in gravel and is near the tank pit pea gravel so good horizontal air flow occurs. VW-5 is screened in silty clay but is only about 2 feet from the pea gravel in the tank pit which provides good horizontal air flow. Both VW-2 and VW-5 were about the same distance from the extraction point (approximately 61 feet), yet VW-2 showed no vacuum impact. This again suggests that air flow in the silty clay layer is less than 7 to 10 feet.

Thus, the pea gravel backfill in the tank pit, which is present to a depth of about 20 feet, greatly enhances subsurface air flow, resulting in a vacuum impact, across the pea gravel, of greater than 61 feet. During the VET, the vacuum impact at 40 to 48 inches of water

and an air flow rate greater than 50 cfm was determined to be less than 10 feet in the silty clay layer present at depths of about 0 to 40 feet below grade.

Air Sample Analytical Results

Table 3 also presents the results of analysis of air samples collected at the extraction wells VW-1 (after 5 minutes and after 2 hours) and VW-5 (after 15 minutes and after 2 hours) and also at the observation wells (after 20 minutes) (samples VW-1 through VW-3) at the top of the table; in addition one sample was taken of the treated off-gas from the I.C. engine exhaust (sample VW-5-eff). The results of laboratory analysis were reported by the laboratory in milligrams per cubic meter (mg/m^3); the BTEX values were converted to parts per billion by volume (ppbv) using the respective molecular weight of each constituent; the TPHg values were converted to parts per million by volume (ppmv) using a molecular weight of 100. The results in Table 3 indicate that the highest TPHg concentration was detected at vapor well VW-3 at 3,400 ppmv after 20 minutes of equipment run time; while the lowest TPHg concentration was nondetectable in the I.C. engine treated off-gas and in well VW-1 after 5 minutes. BTEX concentrations ranged from nondetectable to 6,100 ppbv of xylene in well VW-5 after 15 minutes of system run time.

CONCLUSIONS AND DISCUSSION

Based on the results of this supplemental subsurface and remedial investigation, the conclusions are as follows:

- Elevated concentrations of gasoline hydrocarbons previously reported beneath the former gasoline-storage tanks and product line sump appear to be limited laterally to the tank pit area and have been delineated onsite.

- The lateral and vertical extents of gasoline hydrocarbons beneath the former product lines and downgradient of the former product lines nearest Grove Way (northern portion of the site) have been delineated, as suggested by nondetectable concentrations of TPHg and BTEX (with the exception of 0.007 total xylenes) reported in the samples from borings B-15 and B-17. The lateral extent of gasoline hydrocarbons in soil downgradient of the former product lines along Center Street has been delineated, based on nondetectable concentrations of TPHg and BTEX in samples from boring B-16; however, the vertical extent of gasoline hydrocarbons in soil beneath these product lines is not delineated based on reported concentrations of TPHg (50, 220, and 170 ppm) at 4, 8, and 15-1/2 feet, respectively, in boring B-18.

- The vacuum impact across the 20 foot deep pea gravel backfill in the tank pit was determined to be greater than 61 feet at a VET vacuum of 40 to 48 inches of water and an extraction point flow rate greater than 50 cfm. The pea gravel exhibits very high porosity to air flow and impacted VET test results.

- The vacuum impact in the silty clay (native soil) below the tank pit backfill was determined to be less than 10 feet at the same vacuum and air flow rates above.

- Well VW-2 showed no measurable vacuum impact in either test run primarily because it is screened in silty clay and is not sufficiently close to the pea gravel backfill to be impacted at the vacuums and air flow rates tested.

- It is important to realize that it is not practical to induce a significant vacuum or an extraction flow rate over an area that includes clean soil. Ideally, a well designed and placed vapor-extraction system should only affect the area of concern. The change in vacuum observed at the vapor-extraction monitoring wells were produced with vapor-extraction flow rates and extraction pressures that are less than an operational vapor-extraction system. This suggests that the use of vapor extraction at this site is a practical and efficient choice as a soil remediation alternative. Three existing 4-inch diameter vapor-extraction wells (VW-3, VW-4, and VW-5); and one 2-inch vapor extraction well (VW-2), can be used in a vapor-extraction system to affect areas of concern. It is estimated that an extraction rate of approximately 100 cfm and 100 inches of water column vacuum from each vapor-extraction well will create a capture radius of influence of approximately 20 feet from most wells (Plate 22), based on a four-month operation period for the vapor-extraction system.

- The use of a vapor extraction system (VES) at this site is a feasible method of soil remediation.

- The estimated effective radius of influence of the wells is approximately 20 feet, with the exception of VW-2, which is likely less than 10 feet.
- It is estimated that the VES will need to operate at least four months before extracted vapor concentrations are nondetectable.

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 gasoline hydrocarbon-impacted soil and ground water at this ARCO site. No soil engineering or geotechnical recommendations are implied or should be inferred. Evaluation of the 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. May 26, 1989. Limited Environmental Site Assessment, 22141 Center Street, Castro Valley, California, AGS Report 69013-1.

Applied GeoSystems. January 18, 1990. Limited Subsurface Environmental Investigation Related to Underground Tank Removal, 22141 Center Street, Castro Valley, California: AGS Report 69013-2.

Applied GeoSystems. March 20, 1990. Site Safety Plan, 22141 Center Street, Castro Valley, California: AGS 69013-7S.

Applied GeoSystems. April 1, 1990. Work Plan - Initial Subsurface Investigation at ARCO Station No. 2152, 22141 Center Street, Castro Valley, California: AGS 69013-3W.

Applied GeoSystems. May 8, 1990. Site Safety Plan, 22141 Center Street, Castro Valley, California: AGS 69013-3S.

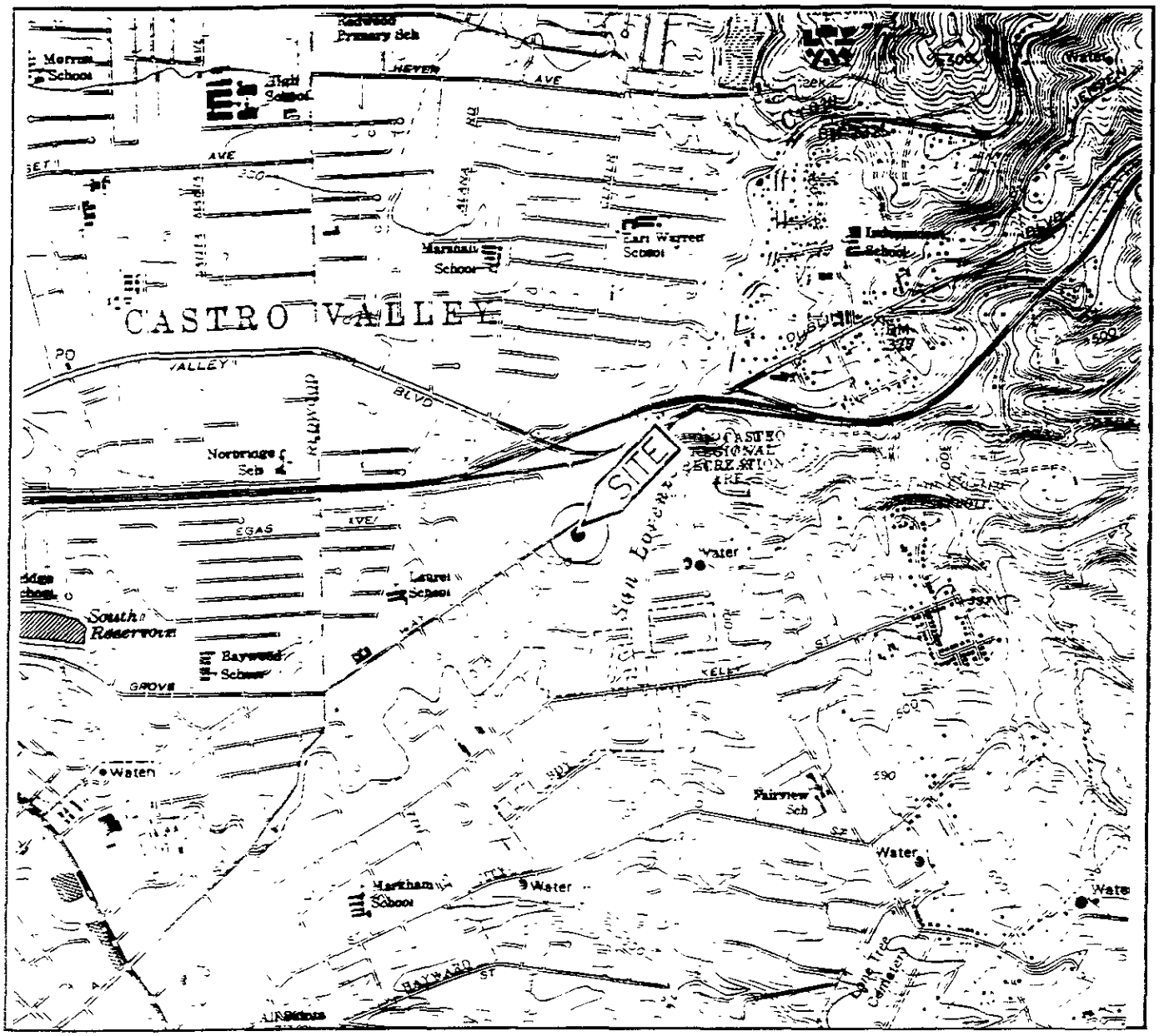
Applied GeoSystems. May 14, 1990. Addendum to Work Plan - Initial Subsurface Investigation at ARCO Station No. 2152, 22141 Center Street, Castro Valley, California: AGS 69013-3WA.

Applied GeoSystems. November 13, 1990. Environmental Subsurface Investigation, 22141 Center Street, Castro Valley, California: AGS Report 69013-4.

Applied GeoSystems. March 24, 1991. Letter Report - Quarterly Ground-Water Monitoring, First Quarter 1991, 22141 Center Street, Castro Valley, California: AGS Report 69013-5.

Helley, E.S., K.R. Lajoie, W.E. Spangle, and M.L. Blair, M.L. 1979. Flatland deposits of the San Francisco Bay region, California. U.S. Geological Survey Professional Paper 943.

Hickenbottom, K. and Muir, K. 1988. Geohydrology And Groundwater-Quality Overview Of The East Bay Plain Area, Alameda County, California 205 (j) Report. Alameda County Flood Control and Water Conservation District, California.



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

Approximate Scale

2000 1000 0 2000 4000

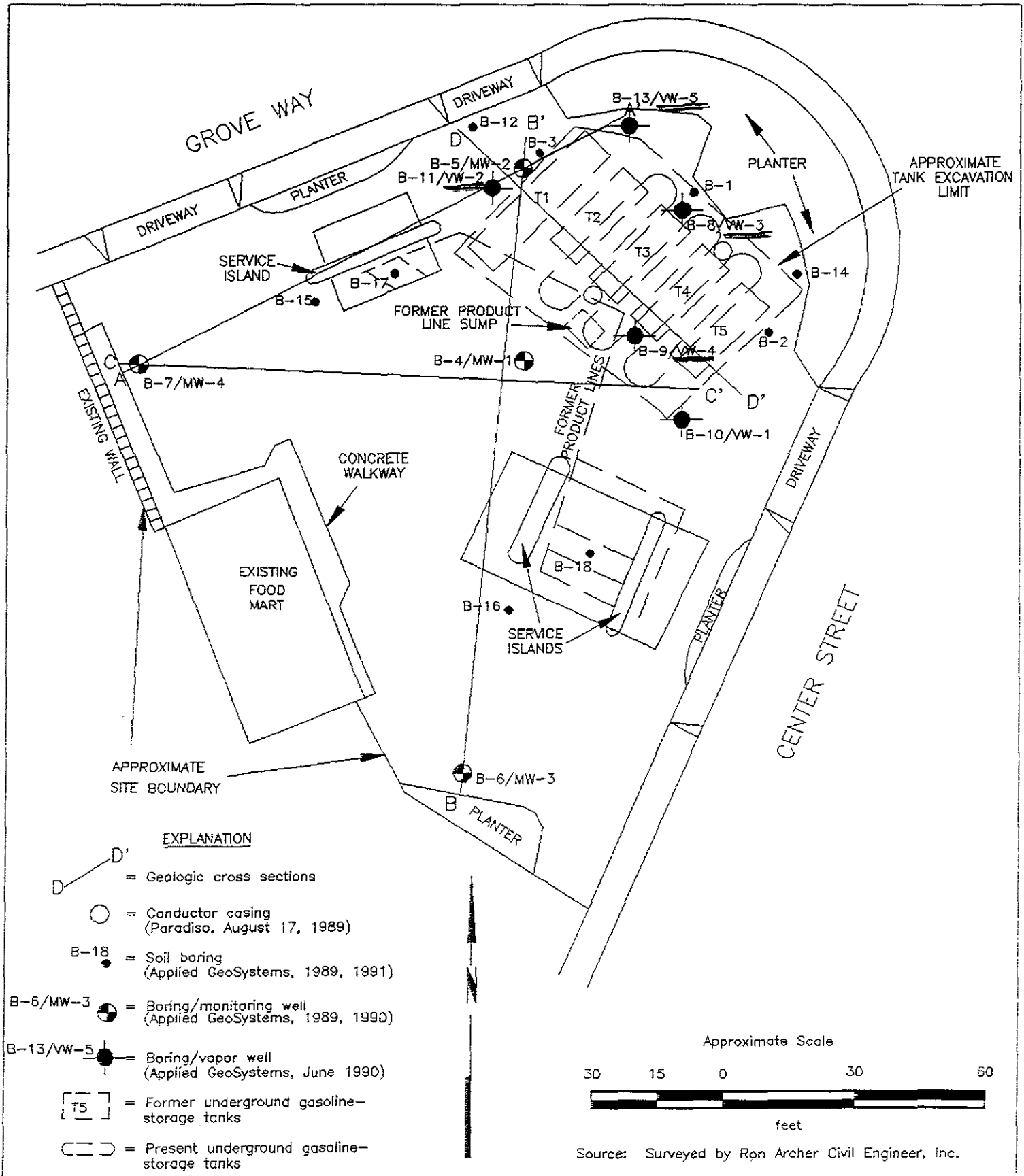
feet

Applied GeoSystems

SITE VICINITY MAP
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE
1

PROJECT 89013-6



Applied GeoSystems

PROJECT 69013-6

GENERALIZED SITE PLAN
ARCO Station 2152
22141 Center Street
Castro Valley, 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.

Applied GeoSystems

PROJECT 69013-6

UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 3

Depth of boring: 41-1/2 feet Diameter of boring: 10 inches Date drilled: 1-14-91

Well depth: 39 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 24 to 39 feet Slot size: 0.020-inch

Drilling Company: Exploration GeoServices Driller: Mike and John

Method Used: Hollow-Stem Auger Field Geologist: Steve Bittman

Signature of Registered Professional:

Registration No.: CE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Pea gravel to 19-1/2 feet.	
2						
4						
6						
8					NOTE: 12-inch diameter Schedule 80 PVC conductor casing from surface to depth of 14 feet installed during previous tank removal operations; well installed through conductor casing on date drilled.	
10						
12						
14						
16						
18					Bottom of tank pit backfill.	
20	S-20	10 19 21	3	CH	Silty clay, brown, damp, high plasticity, very stiff. (Section continues downward)	

Applied GeoSystems

PROJECT: 69013-6

LOG OF BORING B-8/VW-3

ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 4

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				CH	Silty clay, brown, damp, high plasticity, very stiff	
24	S-25	10 19 21	4			
26				ML/CL	Silty clay with stringers of fine sand, brown, damp, medium plasticity, hard.	
28						
30						
32	S-33	10 29 35	140		Very stiff; noticeable product odor.	
34						
36						
38	S-39	11 15 16	13	CL	Sandy clay, brown, damp, medium plasticity, very stiff; noticeable product odor.	
40	S-41	10 13 15	0			
42					Total Depth = 41-1/2 feet.	
44						
46						
48						
50						

Applied GeoSystems

PROJECT 69013-6

LOG OF BORING B-8/VW-3

ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 5

Depth of boring: 33-1/2 feet Diameter of boring: 10 inches Date drilled: 1-15-91

Well depth: 32 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 24 to 32 feet Slot size: 0.020-inch

Drilling Company: Exploration GeoServices Driller: Mike and John

Method Used: Hollow-Stem Auger Field Geologist: Steve Bittman

Signature of Registered Professional:

Registration No.: CE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Pea gravel to 21 feet.	
2						
4						
6						
8						
10					NOTE: 12-inch diameter Schedule 80 PVC conductor casing from surface to depth of 14 feet installed during previous tank removal operations; well installed through conductor casing on date drilled.	
12						
14						
16						
18						
20					(Section continues downward)	

Applied GeoSystems

PROJECT: 69013-6

LOG OF BORING B-9/VW-4

ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 6

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
					Pea gravel to 21 feet.	
22	S-22	9 27 39	700	SC	Clayey sand, fine-grained, brown, damp, very dense; noticeable product odor.	
24						
26	S-26	28 31 42	81			
28	S-29	15 30 40	85		Gravelly sand, gray, damp, very dense; noticeable product odor.	
30	S-31	16 37 50	5	SW CL	Silty clay, brown, damp, low plasticity, hard; noticeable product odor.	
32	S-33	13 21 30	0			
34					Total Depth = 33-1/2 feet.	
36						
38						
40						
42						
44						
46						
48						
50						

Applied GeoSystems

PROJECT 69013-6

LOG OF BORING B-9/VW-4

ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 7

Depth of boring: 47-1/2 feet Diameter of boring: 8 inches Date drilled: 1-16-91

Well depth: N/A Material type: N/A Casing diameter: N/A

Screen interval: N/A Slot size: N/A

Drilling Company: Exploration GeoServices Driller: Mike and John

Method Used: Hollow-Stem Auger Field Geologist: Steve Bittman

Signature of Registered Professional: _____

Registration No.: _____ State: _____

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0						
					Asphalt.	
				GW	Sandy gravel, brown, damp, loose: Fill.	
2				CH	Silty clay, dark brown, damp, high plasticity, stiff.	
4		15				
		45				
	S-5	50	0	CL	Silty clay, brown, dry, low plasticity, hard.	
6						
8						
		20				
10	S-10	30	0		Damp.	
		30				
12						
				SC	Clayey sand, fine-grained, brown, damp, hard.	
14		15				
		24				
	S-15	30	0			
16						
18						
		8				
		17			Moist, dense.	
20	S-20	30	1			
					(Section continues downward)	

Applied GeoSystems

PROJECT: 69013-6

LOG OF BORING B-12
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 8

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				SC	Clayey sand, fine-grained, brown, moist, dense.	
24	S-25	13 32 46	2	CL	Silty clay, brown, damp, low plasticity, hard.	
26						
28						
30	S-30	12 15 28	10		Noticeable product odor.	
32						
34	S-35	12 16 29	13			
36						
38						
40	S-40	15 17 22	110		Very stiff; noticeable product odor.	
42						
44	S-45	16 27 31	4	SC	Clayey sand, fine-grained, brown, damp, dense; noticeable product odor.	
46	S-47	10 25 29	9		Medium-grained.	
48					Total Depth = 47-1/2 feet.	
50						

Applied GeoSystems

PROJECT 69013-6

LOG OF BORING B-12
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 9

Depth of boring: 45-1/2 feet Diameter of boring: 8 inches Date drilled: 1-17-91

Well depth: 38 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 28 to 38 feet Slot size: 0.020-inch

Drilling Company: Exploration GeoServices Driller: Mike and John

Method Used: Hollow-Stem Auger Field Geologist: Steve Bittman

Signature of Registered Professional:

Registration No.: CE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0						
					Asphalt.	
				GW	Sandy gravel, brown, damp, loose: Fill.	
2				CH	Silty clay, dark brown, moist, high plasticity, stiff.	
4		23				
	S-5	38	0		Brown, damp, hard.	
		50				
6						
8				CL	Silty clay, dark brown, moist, low plasticity, hard.	
		18				
10	S-10	34	0			
		50				
12						
14		6				
	S-15	12	0			
		17		CL	Sandy clay, brown, damp, low plasticity, very stiff.	
16						
18						
		8				
20	S-20	9	0			
		14				

(Section continues downward)

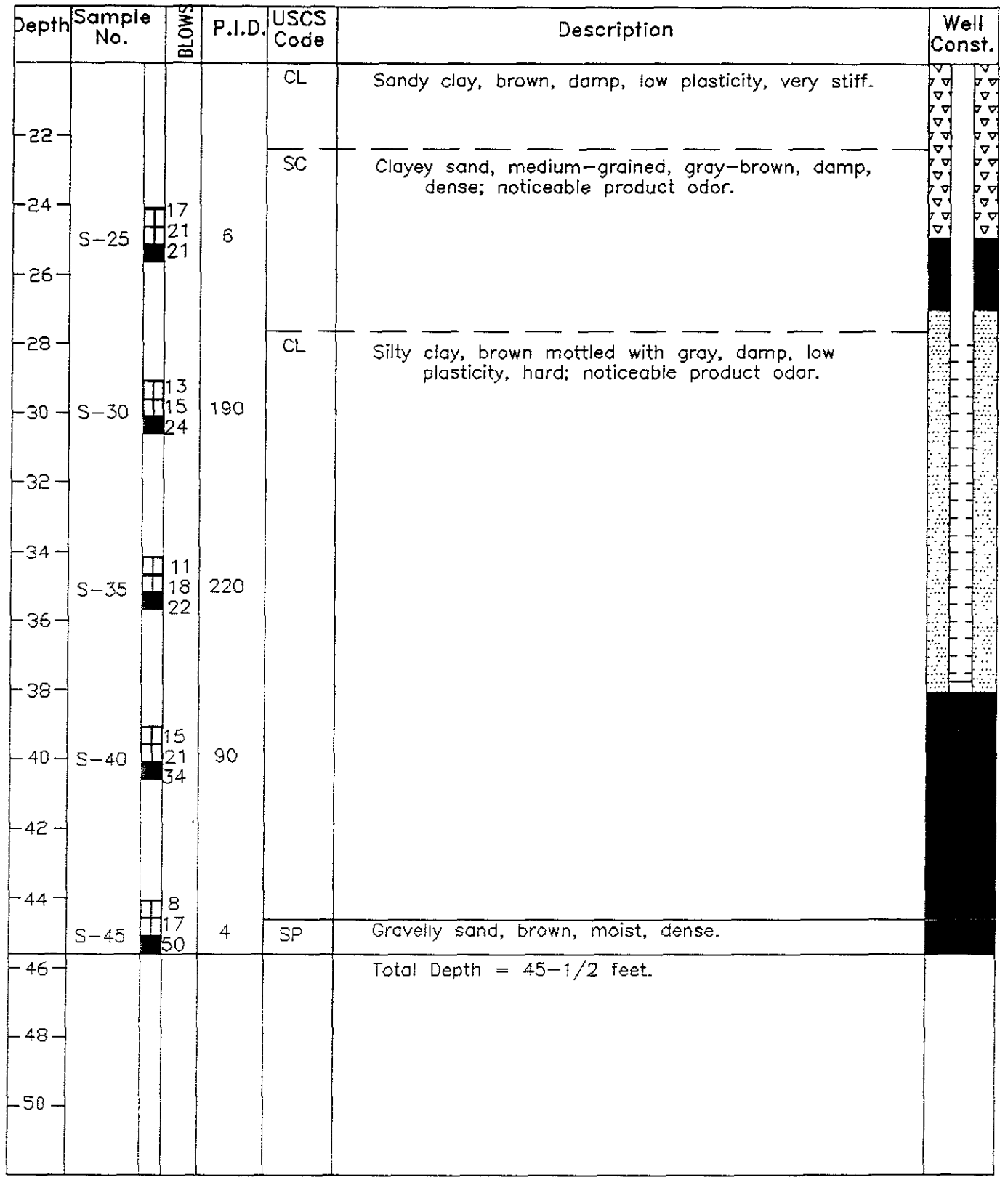
Applied GeoSystems

PROJECT: 69013-6

LOG OF BORING B-13/VW-5

ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 10



Applied GeoSystems

PROJECT 69013-6

LOG OF BORING B-13/VW-5

ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 11

Depth of boring: 45-1/2 feet Diameter of boring: 8 inches Date drilled: 1-17-91

Well depth: N/A Material type: N/A Casing diameter: N/A

Screen interval: N/A Slot size: N/A

Drilling Company: Exploration GeoServices Driller: Mike and John

Method Used: Hollow-Stem Auger Field Geologist: Steve Bittman

Signature of Registered Professional: _____

Registration No.: _____ State: _____

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt.	
				GW	Sandy gravel, brown, damp, loose: Fill.	
2				CH	Silty clay, brown, damp, high plasticity, hard.	
4	S-5	8 15 34	0			
6						
8						
10	S-10	16 29 10	0	CL	Silty clay, slightly sandy, brown, low plasticity, hard.	
12				ML	Clayey silt, brown, moist, low plasticity, hard.	
14	S-15	8 13 22	1			
16						
18				CH	Silty clay, brown, moist, high plasticity, very stiff.	
20	S-20	8 8 13	0			

(Section continues downward)

Applied GeoSystems

PROJECT: 69013-6

LOG OF BORING B-14

ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 12

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				CH	Silty clay, brown, moist, high plasticity, very stiff.	
24	S-25	10 20 31	0	SP	Gravelly sand, medium-grained with subrounded gravel to 1/4", brown, damp, very dense.	
26						
28						
30	S-30	10 24 32	0		Increase gravel size.	
32						
34	S-35	12 23 35	2	CL	Silty clay, brown mottled with gray, damp, low plasticity, hard.	
36						
38						
40	S-40	29 48 50	55		Noticeable product odor.	
42						
44	S-45	30 50 50	0	GC	Clayey gravel with some sand, brown, damp, very dense.	
46					Total Depth = 45-1/2 feet.	
48						
50						

Applied GeoSystems

PROJECT 69013-6

LOG OF BORING B-14

ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 13

Depth of boring: 10–1/2 feet Diameter of boring: 8 inches Date drilled: 1–17–91

Well depth: N/A Material type: N/A Casing diameter: N/A

Screen interval: N/A Slot size: N/A

Drilling Company: Exploration GeoServices Driller: Mike and John

Method Used: Hollow–Stem Auger Field Geologist: Steve Bittman

Signature of Registered Professional: _____

Registration No.: _____ State: _____

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt.	
		7		GW	Sandy gravel, brown, damp, loose: Fill.	
2	S–2	12 15	0	CH	Silty clay, gray, damp, high plasticity, very stiff.	
4		50		ML	Clayey silt, brown, dry, low plasticity, hard.	
	S–5	50 50	0			
6						
8						
		15				
10	S–10	37 50	0			
					Total Depth = 10–1/2 feet.	
12						
14						
16						
18						
20						

Applied GeoSystems

PROJECT: 69013–6

LOG OF BORING B–15

ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 14

Depth of boring: 10–1/2 feet Diameter of boring: 8 inches Date drilled: 1–17–91

Well depth: N/A Material type: N/A Casing diameter: N/A

Screen interval: N/A Slot size: N/A

Drilling Company: Exploration GeoServices Driller: Mike and John

Method Used: Hollow–Stem Auger Field Geologist: Steve Bittman

Signature of Registered Professional: _____

Registration No.: _____ State: _____

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0						
					Asphalt.	
		2		GW	Sandy gravel, brown, damp, loose: Fill.	
		4				
2	S–2	4	26	CH	Silty clay, gray, moist, high plasticity, stiff; obvious product odor.	
4		8				
	S–5	17			Brown, damp, hard.	
		35	0			
6						
8						
		10		CL	Silty clay, brown, damp, low plasticity, hard.	
10	S–10	15				
		45	0			
					Total Depth = 10–1/2 feet.	
12						
14						
16						
18						
20						

Applied GeoSystems

PROJECT: 69013–6

LOG OF BORING B–16

ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 15

Depth of boring: 21–1/2 feet Diameter of boring: 6 inches Date drilled: 2–21–91

Well depth: N/A Material type: N/A Casing diameter: N/A

Screen interval: N/A Slot size: N/A

Drilling Company: Gregg Drilling Co. Driller: Pierce

Method Used: Hollow–Stem Auger Field Geologist: Mike Barminski

Signature of Registered Professional: _____

Registration No.: _____ State: _____

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0						
2					Pea gravel to 5 feet.	
4					Bottom of pea gravel backfill.	
6	S–5 S–5.5 S–6		1.1	CL	Silty clay, brown, damp, low plasticity, hard.	
8						
10	S–10 S–10.5 S–11		3.6		With sand.	
12						
14						
16	S–15 S–15.5 S–16		2.2			
18						
20	S–20.5 S–21		1.3		Mottled brown and green, very hard.	
					Total Depth = 21–1/2 feet.	

Applied GeoSystems

PROJECT: 69013–6

LOG OF BORING B – 17
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 16

Depth of boring: 22 feet Diameter of boring: 8 inches Date drilled: 2-21-91

Well depth: N/A Material type: N/A Casing diameter: N/A

Screen interval: N/A Slot size: N/A

Drilling Company: Garret Drilling Co. Driller: Pierce

Method Used: Hollow-Stem Auger Field Geologist: Mike Barminski

Signature of Registered Professional:

Registration No.: State:

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Cement	
2					Pea gravel to 5 feet. Bottom of pea gravel backfill.	
4	S-3.5		138	CL	Silty clay, brown mottled black, dry, low plasticity, hard; noticeable product odor.	
6						
8	S-8		133	CL	Sandy clay, red-brown, damp, low plasticity, hard; noticeable product odor.	
10						
12	S-12.5		1078			
14	S-14				Brown, medium plasticity.	
16	S-15 S-15.5 S-16 S-17		27.1		Low plasticity.	
18				GW	Sandy gravel, brown to dark gray, moist to very moist, dense.	
20	S-21 S-21.5		1.3			

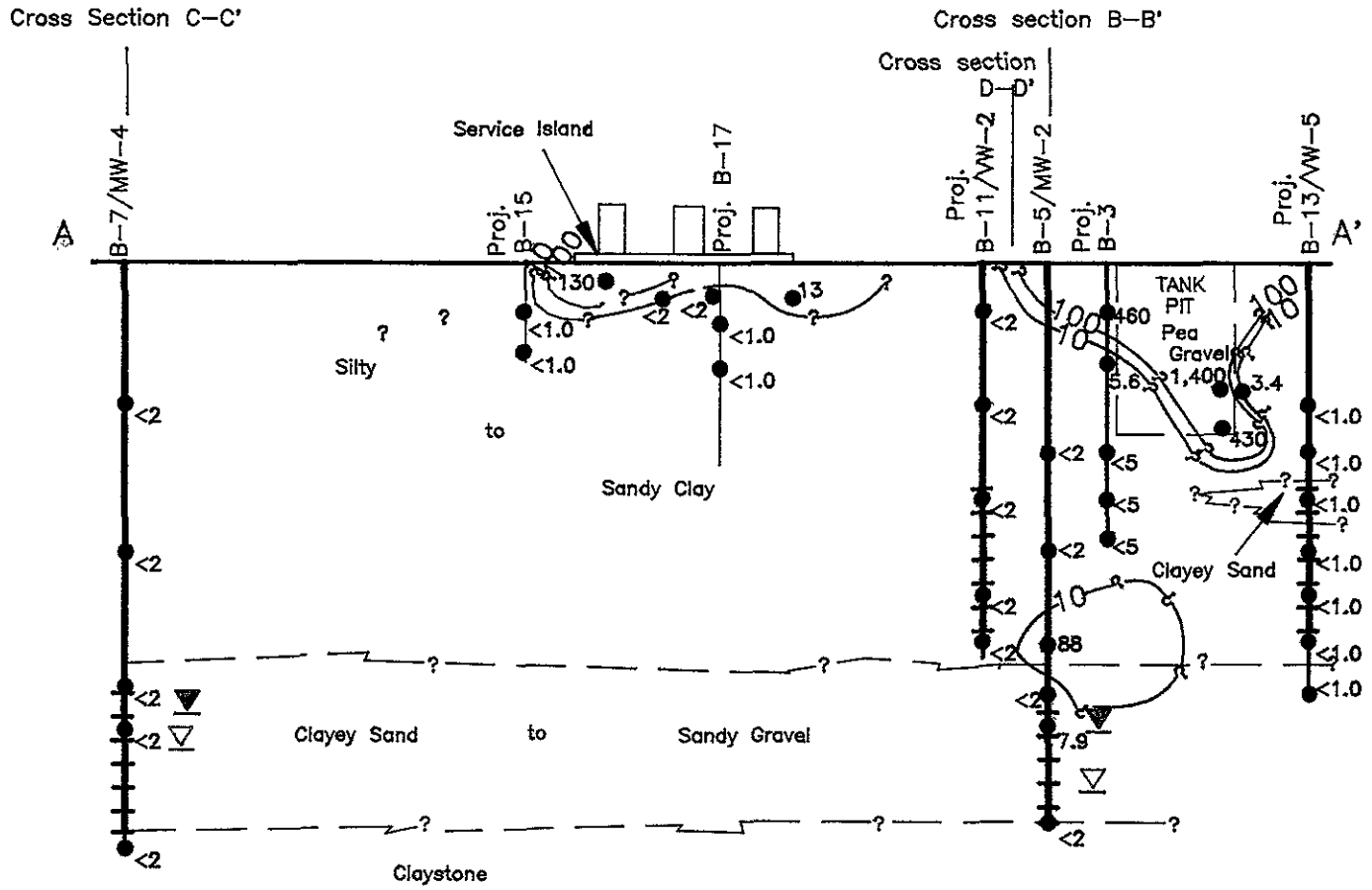
Total Depth = 22 feet.

Applied GeoSystems

PROJECT: 69013-6

LOG OF BORING B- 18
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 17



EXPLANATION

100 = Line of equal concentration of TPHg in parts per million

1,400 = 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 (1/8/91)

Approximate Horizontal and Vertical Scale

20 10 0 20 40

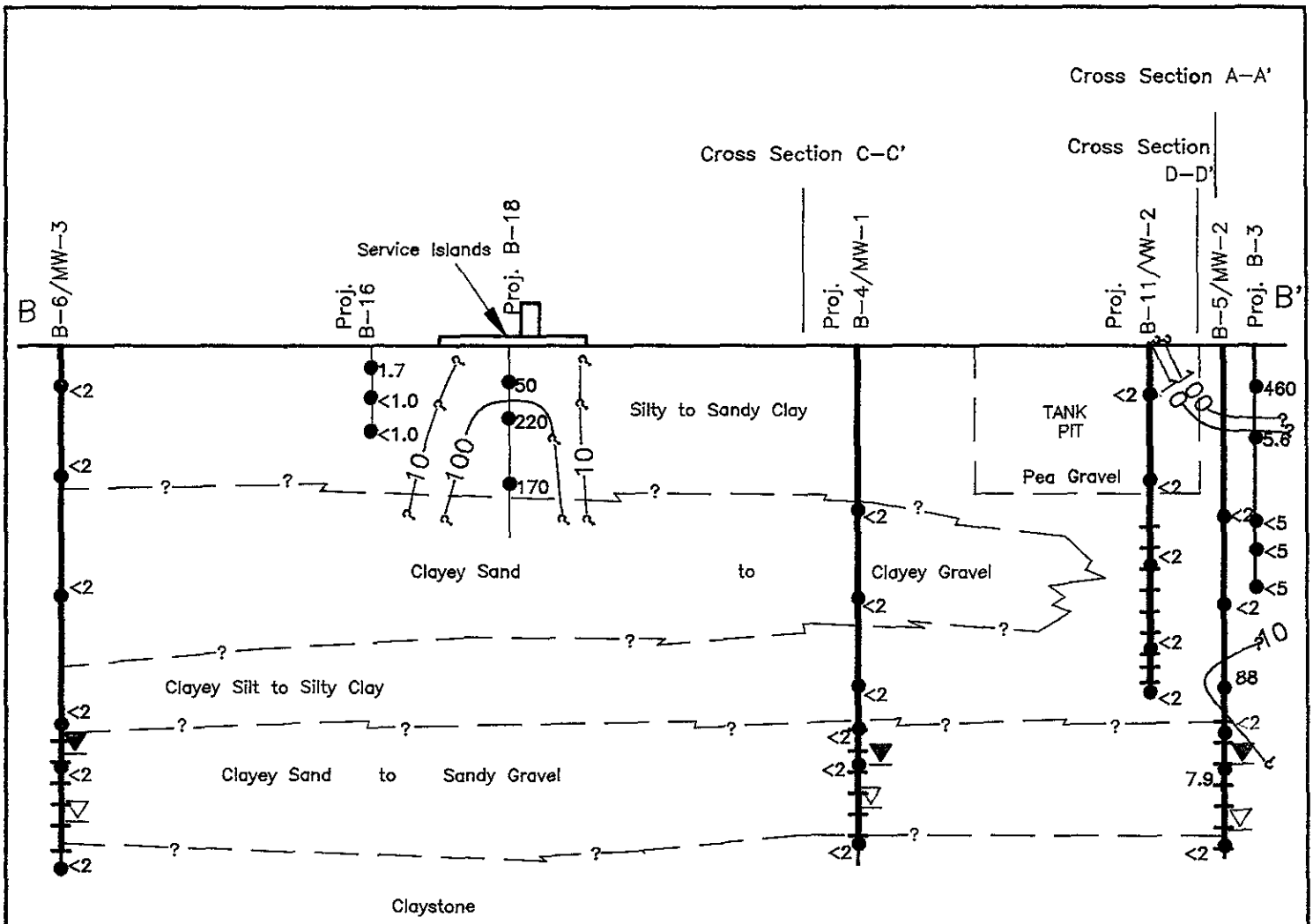
feet

Applied GeoSystems

PROJECT 69013-6

GEOLOGIC CROSS SECTION A-A'
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 18



EXPLANATION

100 = Line of equal concentration of TPHg in parts per million

88 = 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 (1/8/91)

Approximate Horizontal and Vertical Scale

20 10 0 20 40

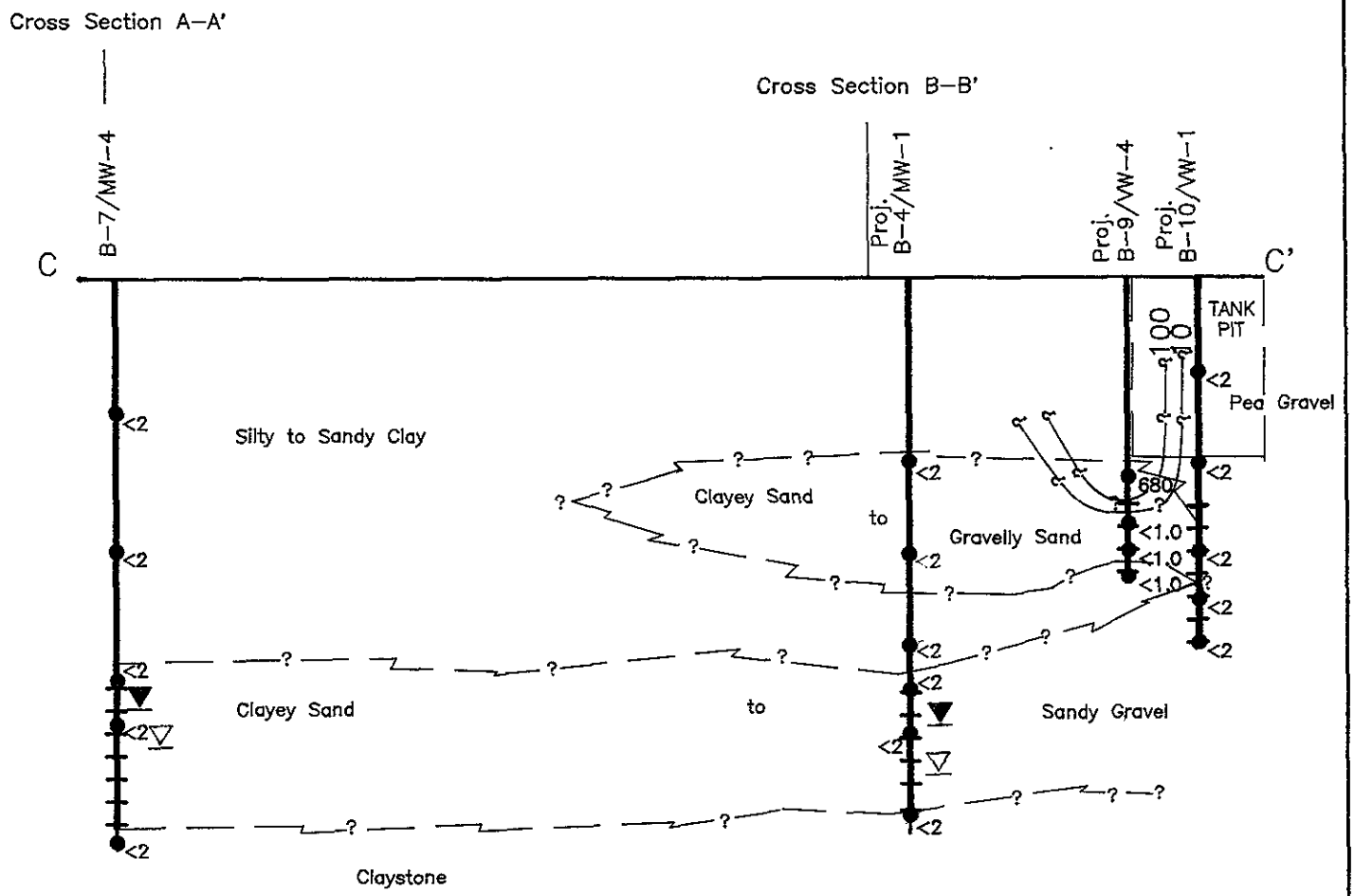
feet

Applied GeoSystems

PROJECT 69013-6

GEOLOGIC CROSS SECTION B-B'
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 19



EXPLANATION

100 = Line of equal concentration of TPHg in parts per million

<2 = 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 (1/8/91)

Approximate Horizontal and Vertical Scale

20 10 0 20 40

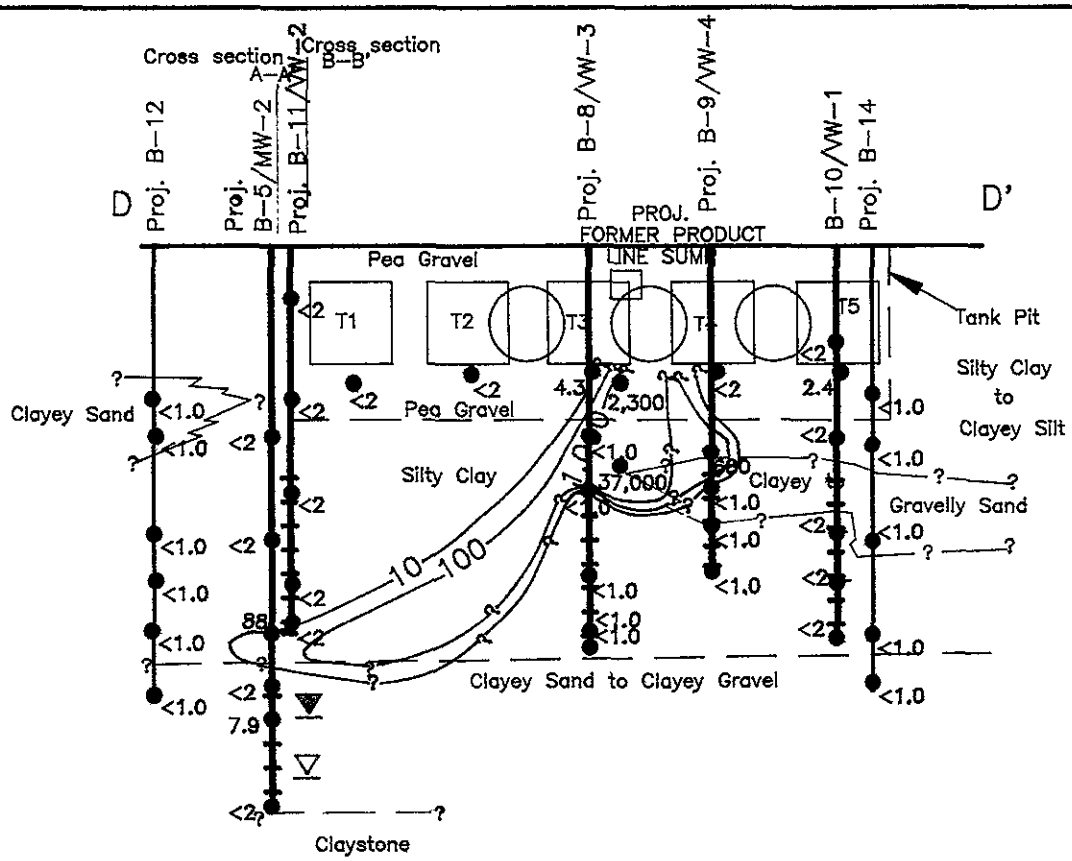
feet

Applied GeoSystems

PROJECT 69013-6

GEOLOGIC CROSS SECTION C-C'
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 20



EXPLANATION

= Existing underground gasoline storage tanks

T5 = Former underground gasoline storage tanks

1,000 = Line of equal concentration of TPHg

37,000 = Concentration of TPHg in ppm for soil sample collected 8/89

88 = 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 (1/8/91)

Approximate Horizontal and Vertical Scale

20 10 0 20 40

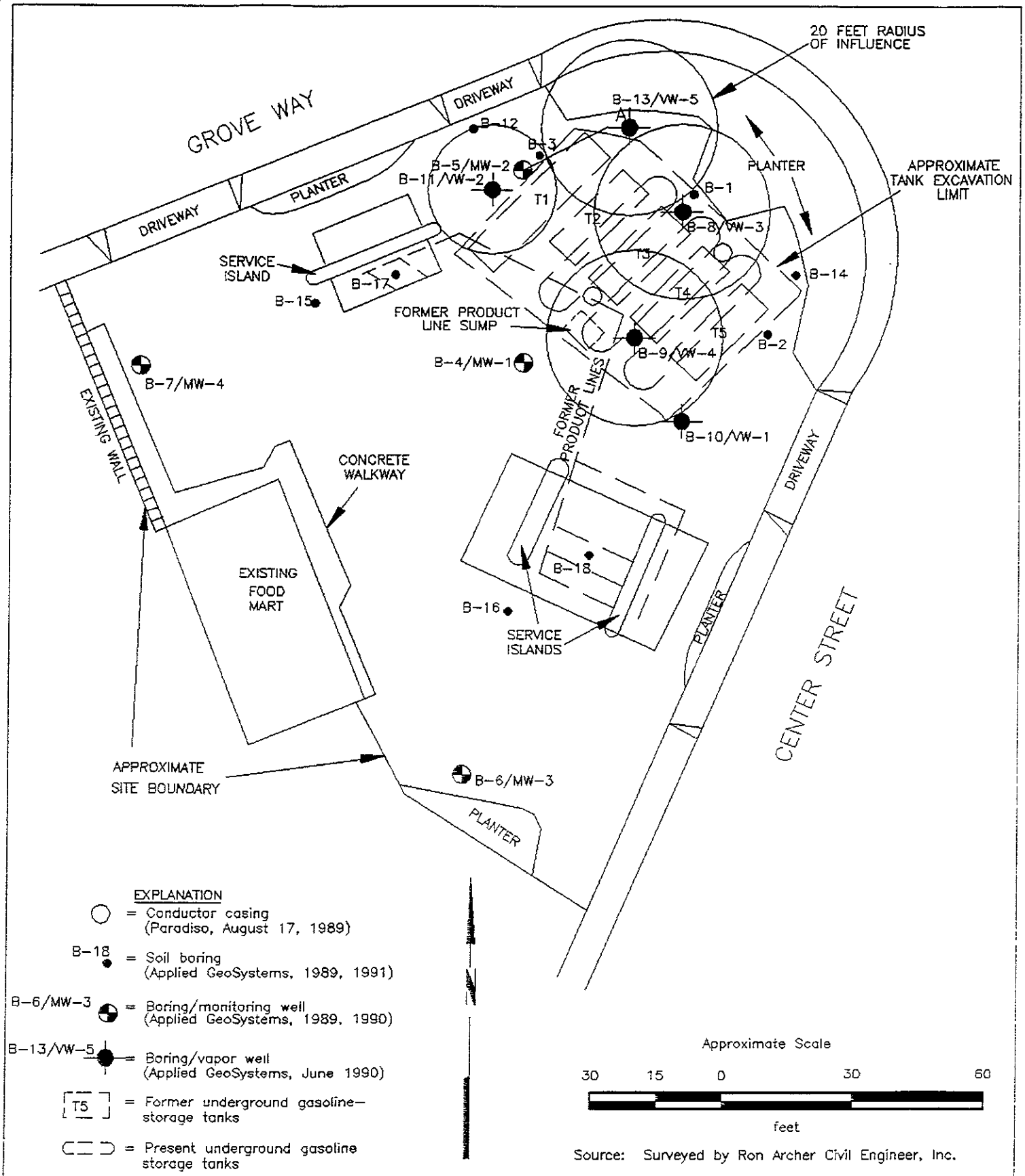
feet

Applied GeoSystems

PROJECT 69013-6

GEOLOGIC CROSS SECTION D-D'
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 21



Applied GeoSystems

PROJECT 69013-6

ESTIMATED RADIUS OF INFLUENCE MAP
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 22

TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES
ARCO Station 2152
Castro Valley, California
Page 1 of 3

Date	Sample ID	TPHg	B	T	E	X
4/13/89	S-10-B1	<2.0	<0.050	<0.050	<0.050	<0.050
4/13/89	S-20-B1	<2.0	0.11	0.15	<0.050	0.19
4/13/89	S-25-B1	<2.0	0.22	0.34	0.088	0.38
4/13/89	S-30-B1	5.1	0.42	0.89	0.11	0.56
4/13/89	S-35-B1	5.1	0.40	0.72	0.094	0.42
4/13/89	S-40-B1	<2.0	0.10	<0.050	<0.050	<0.050
4/13/89	S-45-B1	<2.0	<0.050	<0.050	<0.050	<0.050
4/13/89	S-10-B2	<2.0	<0.050	<0.050	<0.050	<0.050
4/13/89	S-20-B2	<2.0	<0.050	<0.050	<0.050	<0.050
4/13/89	S-25-B2	<2.0	<0.050	<0.050	<0.050	<0.050
4/13/89	S-30-B2	<2.0	<0.050	<0.050	<0.050	<0.050
4/13/89	S-5-B3	460	5.1	34	9.6	51
4/13/89	S-10-B3	5.6	<0.050	0.11	<0.050	1.0
4/13/89	S-20-B3	<2.0	<0.050	<0.050	0.055	0.068
4/13/89	S-25-B3	<2.0	<0.050	<0.050	0.17	0.16
4/13/89	S-30-B3	<2.0	<0.050	<0.050	<0.050	<0.050
6/15/90	S-20-B4	<2.0	<0.050	<0.050	<0.050	<0.050
6/15/90	S-29.5-B4	<2.0	<0.050	<0.050	<0.050	<0.050
6/15/90	S-40-B4	<2.0	<0.050	<0.050	<0.050	<0.050
6/15/90	S-44.5-B4	<2.0	<0.050	<0.050	<0.050	<0.050
6/15/90	S-49.5-B4	<2.0	<0.050	<0.050	<0.050	<0.050
6/15/90	S-59-B4	<2.0	<0.050	<0.050	<0.050	<0.050
6/14/90	S-20-B5	<2.0	<0.050	<0.050	<0.050	0.077
6/14/90	S-30-B5	<2.0	0.17	<0.050	<0.050	0.16
6/14/90	S-40-B5	88	2.1	7.2	1.8	13
6/14/90	S-45-B5	<2.0	<0.050	<0.050	<0.050	<0.050
6/14/90	S-49.5-B5	7.9	<0.050	<0.050	<0.050	0.096
6/14/90	S-59-B5	<2.0	<0.050	<0.050	<0.050	<0.050
6/12/90	S-5-B6	<2.0	<0.050	<0.050	<0.050	<0.050
6/12/90	S-15-B6	<2.0	<0.050	<0.050	<0.050	<0.050
6/12/90	S-29.5-B6	<2.0	<0.050	<0.050	<0.050	<0.050
6/12/90	S-44.5-B6	<2.0	<0.050	<0.050	<0.050	<0.050
6/12/90	S-49.5-B6	<2.0	<0.050	<0.050	<0.050	<0.050
6/12/90	S-62-B6	<2.0	<0.050	<0.050	<0.050	<0.050

See notes on page 3 of 3.

TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES
ARCO Station 2152
Castro Valley, California
Page 2 of 3

Date	Sample ID	TPHg	B	T	E	X
6/13/90	S-5-B7	<2.0	<0.050	<0.050	<0.050	<0.050
6/13/90	S-15-B7	<2.0	<0.050	<0.050	<0.050	<0.050
6/13/90	S-30-B7	<2.0	<0.050	<0.050	<0.050	<0.050
6/13/90	S-44.5-B7	<2.0	<0.050	0.10	<0.050	0.093
6/13/90	S-49-B7	<2.0	<0.050	<0.050	<0.050	<0.050
6/13/90	S-61-B7	<2.0	<0.050	<0.050	<0.050	<0.050
1/16/91	S-20-B8	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-15-B8	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-33-B8	<1.0	0.006	<0.005	<0.005	<0.005
1/16/91	S-39-B8	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-22-B9	680	<0.005	19	16	91
1/16/91	S-26-B9	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-29-B9	<1.0	0.006	<0.005	<0.005	<0.005
1/16/91	S-33-B9	<1.0	<0.005	<0.005	<0.005	<0.005
6/18/90	S-10-B10	<2.0	<0.05	<0.05	<0.05	<0.05
6/18/90	S-20-B10	<2.0	<0.05	<0.05	<0.05	<0.05
6/18/90	S-30-B10	<2.0	<0.05	<0.05	<0.05	<0.05
6/18/90	S-35-B10	<2.0	<0.05	<0.05	<0.05	<0.05
6/18/90	S-40-B10	<2.0	<0.05	<0.05	<0.05	<0.05
6/18/90	S-5-B11	<2.0	<0.05	<0.05	<0.05	<0.05
6/18/90	S-15-B11	<2.0	<0.05	<0.05	<0.05	<0.05
6/18/90	S-25-B11	<2.0	<0.05	<0.05	<0.05	<0.05
6/18/90	S-35-B11	<2.0	<0.05	<0.05	<0.05	<0.05
6/18/90	S-40-B11	<2.0	<0.05	<0.05	<0.05	<0.05
1/16/91	S-15-B12	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-30-B12	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-35-B12	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-40-B12	<1.0	0.028	<0.005	<0.005	<0.005
1/16/91	S-47-B12	<1.0	0.028	<0.005	<0.005	0.006
1/16/91	S-15-B13	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-20-B13	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-25-B13	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-30-B13	<1.0	0.033	<0.005	<0.005	0.018
1/16/91	S-35-B13	<1.0	0.030	<0.005	<0.005	<0.005
1/16/91	S-40-B13	<1.0	0.096	<0.005	<0.005	<0.005
1/16/91	S-45-B13	<1.0	<0.005	<0.005	<0.005	<0.005

See notes on page 3 of 3.

TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES
ARCO Station 2152
Castro Valley, California
Page 3 of 3

Date	Sample ID	TPHg	B	T	E	X
1/16/91	S-15-B14	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-20-B14	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-30-B14	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-40-B14	<1.0	<0.005	<0.005	<0.005	0.007
1/16/91	S-45-B14	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-5-B15	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-10-B15	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-2-B16	1.7	0.037	<0.005	0.080	<0.005
1/16/91	S-5-B16	<1.0	<0.005	<0.005	<0.005	<0.005
1/16/91	S-10-B16	<1.0	<0.005	<0.005	<0.005	<0.005
2/14/91	S-5½-B17*	<1.0	<0.005	<0.005	<0.005	0.007
2/14/91	S-10-B17*	<1.0	<0.005	<0.005	<0.005	<0.005
2/14/91	S-4-B18*	50	0.12	1.2	0.62	4.3
2/14/91	S-8-B18*	220	0.31	7.3	5.5	36
2/14/91	S-15½-B18*	170	0.84	9.0	4.4	24
1/29/91	S-0129-SP1,2,3,4*	<0.5	<0.005	<0.005	<0.005	<0.005
4/11/91	S-0411-1A,B,C,D	<1.0	<0.0050	<0.0050	<0.0050	<0.0050

Results in parts per million (ppm).
TPHg: Total petroleum hydrocarbons as gasoline (analyzed by EPA Method 5030).
B:benzene T:toluene E:ethylbenzene X:total xylene isomers
BTEX analyzed by EPA Method 8020.
*: Selected samples analyzed for Organic Lead (by California Luft method [12/87]) and nondetectable concentrations (see lab sheets for detection limits) were reported in all samples.

Sample ID: S-40-B11

- S — Soil Sample
- 40 — Approximate sample depth in feet
- B11 — Boring number

S-0129-SP1,2,3,4

- S — Soil Sample
- 0129 — Sample date
- SP1,2,3,4 — Composite sample

TABLE 2
VAPOR-EXTRACTION TEST FIELD MONITORING DATA
ARCO Station 2152
Castro Valley, California

Extraction Point VW-5

Influent Air Stream				Monitoring Wells			
Flow	Concentration	Vacuum	Temp.	VW-2 Vacuum	VW-3 Vacuum	VW-4 Vacuum	VW-1 Vacuum
>50	<400	40	72	<0.01	.04	<0.01	<0.01
>50	400	42	72	<0.01	.04	<0.01	<0.01
>50	400	42	72	<0.01	.04	<0.01	<0.01
>50	<400	42	72	<0.01	.04	<0.01	<0.01
>50	<400	42	72	<0.01	.04	<0.01	<0.01
Distance from extraction well VW-5 (feet):				29.0	27.7	48.4	61.9

Extraction Point VW-1

Influent Air Stream				Monitoring Wells			
Flow	Concentration	Vacuum	Temp.	VW-2 Vacuum	VW-3 Vacuum	VW-4 Vacuum	VW-5 Vacuum
>50	200	42	72	<0.01	<0.01	.08	.01
>50	200	48	72	<0.01	<0.01	.09	.01
>50	<200	48	72	<0.01	<0.01	.08	.01
>50	<200	48	70	<0.01	0.01	.08	.01
>50	<200	48	70	<0.01	0.01	.08	.01
Distance from extraction well VW-1 (feet):				61.3	34.5	17.7	61.9

Flow measured in cubic feet per minute (cfm).
Concentration measured in parts per million by volume (ppmv) on Photoionization Meter.
Vacuum measured in inches of water column vacuum.
Temperature measured in degrees Fahrenheit.

TABLE 2
VAPOR-EXTRACTION TEST FIELD MONITORING DATA
ARCO Station 2152
Castro Valley, California

Vapor Sample number	Taken from	Elapsed time	Benzene	Toluene	Ethyl-benzene	Xylenes	TPH
AS-0215-1	VW-1 inf	20	<85	340	140	840	43
AS-0215-2	VW-2 inf	20	<85	13,000	2,500	5,800	3,400
AS-0215-3	VW-3 inf	20	<85	<250	68	430	<30
AS-0215-4	VW-5 inf	15	3,600	480	1,600	6,100	170
AS-0215-5	VW-5 inf	120	400	<250	230	880	36
AS-0215-6	VW-5 eff	125	<85	<250	230	1,700	<30
AS-0215-7	VW-1 inf	5	92	<250	140	1,000	<30
AS-0215-8	VW-1 inf	120	<85	620	270	1,400	110

All measurements are in parts per billion by volume (ppbv); except 1) Time, which is measured in minutes, and 2) TPH, which is measured in parts per million by volume (ppmv).

APPENDIX A

Previous Work

PREVIOUS WORK

May 1989 Limited Site Assessment

AGS performed a limited site assessment (AGS, May 26, 1989) to evaluate the presence of gasoline hydrocarbons in soil near the underground gasoline-storage tanks prior to ARCO's planned tank replacement at the site. The work involved drilling three soil borings (B-1 through B-3) close to the fill ends of the tanks. The locations of these borings are shown on Plate 2. Results of laboratory analysis of soil samples from the borings indicated nondetectable concentrations (<5.0 ppm) of gasoline hydrocarbons, with the exception of two samples collected from depths of 30 and 35 feet in boring B-1 (5.1 ppm TPHg) and two samples collected from depths of 5 and 10 feet in boring B-3 (460 and 5.6 ppm TPHg, respectively). Ground water was not encountered in the borings to a depth of 45 feet. Results of laboratory analyses of soil samples collected during the drilling are summarized in Table 1, Cumulative Results of Laboratory Analysis of Soil Samples.

August through October 1989 Tank Removal and Replacement

The former underground gasoline-storage tanks and product-dispenser lines were removed from the site by Paradiso Construction Company on August 17, 1989 and from September 9 through October 4, 1989, respectively (AGS, January 1990). No holes were noted in the tanks during removal. AGS was present to collect soil samples from the former tank pit from depths of 14 to 22 feet. The results of the laboratory analyses of soil samples from the gasoline-tank pit indicated elevated concentrations (up to 37,000 ppm) of TPHg in soil at depths of 14 and 22 feet beneath the former product line sump. AGS also collected soil samples from beneath the former product-dispenser lines. TPHg concentrations ranging from <2.0 ppm to 73 ppm were reported in 11 soil samples collected from beneath the lines at a depth of approximately three feet, and TPHg concentrations of 100 to 190 ppm were reported in soil samples from the southwestern ends of the dispenser islands near Grove Way and Center Street. Results of laboratory analyses of the samples collected from the former tank pit and beneath the former product lines are presented on Tables A1 and A2, respectively, in this Appendix A.

Approximately 1,850 cubic yards of soil excavated from the gasoline-tank pit and the product-dispenser line trenches was aerated onsite between August 21 and October 10, 1989 in accordance with Regulation 8, Rule 40 of the BAAQMD. AGS collected composite soil samples from the aerated soil to verify TPHg concentrations of 100 ppm or lower. Paradiso arranged for the soil to be transported to Redwood Landfill in Novato, California by Conrad Trucking of Escalon, California. Three new 12,000-gallon fiberglass tanks were

installed at the site by others along with new product delivery lines in September 1989. It is understood that four 12-inch diameter polyvinyl chloride (PVC) conductor casings were positioned between the tanks to provide access for future exploratory drilling and/or well installation.

It was concluded that the vertical extent of gasoline hydrocarbons in soil beneath the former tanks had not been delineated. It was also concluded that the lateral extent of gasoline hydrocarbons in the area of the former tanks above depths of approximately 14 feet appeared to be limited to the tank-pit area, with the possible exception of the northwestern side of the tank pit, and that the extent of gasoline hydrocarbons was not delineated near the southwestern ends of the dispenser islands.

June through September 1990 Subsurface Investigation

In June 1990, AGS conducted a subsurface investigation to evaluate the extent of gasoline hydrocarbons in soil and ground water beneath the site. This work included drilling six soil borings (B-4 through B-7, B-10, and B-11), constructing four 4-inch-diameter ground-water monitoring wells (MW-1 through MW-4), constructing two 2-inch-diameter vadose zone monitoring wells (VW-1 and VW-2), collecting soil samples for laboratory analysis, developing the wells, collecting water samples for laboratory analysis, evaluating the ground-water flow direction and gradient, performing a well search, and preparing a report documenting the findings and conclusions. The results of this investigation were as follows:

- first encountered ground water is at a depth of approximately 50 feet and the direction of ground-water flow is toward the southwest. Sampling of wells MW-1 through MW-4 indicated nondetachable concentrations of TPHg and BTEX. The results of ground-water sampling at the site are shown on Table A-3 in Appendix A.

- soil has not been impacted in the areas of borings B-4 through B-7, B-10 and B-11, with the exception of boring B-5, where 88 ppm TPHg and 7.9 ppm TPHg were reported in samples from 40 and 49-1/2 feet, respectively. The results of laboratory analysis of soil samples are shown on Table 1.

- a well research with Alameda County Public Works Department (ACPWD) indicated 11 wells within 1/2-mile of the site. Four of these wells are used for irrigation; four wells for ground-water monitoring; and one well for domestic purposes. The uses of the other two wells are unknown. The irrigation wells are between 24 and 260 feet deep; have reported water levels of 5 to 35 feet below the ground surface; and are constructed of 4- to 8-inch diameter casing. The exact locations of two of these

irrigation wells are unknown. The monitoring wells are located north of the site at a Texaco retail station and are listed as 30 to 45 feet deep; have reported water levels of 20 to 28 feet below the ground surface; and were constructed of 2- or 4-inch diameter casing in December 1987. The domestic well is 365 feet deep; has a reported water level of 208 feet below the ground surface; and was constructed of 10-inch diameter casing in July 1976. The location of this domestic well is unknown, but it is listed as being situated in a section approximately 1/4-mile southwest of the site. No location for one of the wells of unknown use was available.

Based on the results of the subsurface investigation, it was concluded that:

- elevated concentrations of gasoline hydrocarbons previously reported beneath the former gasoline-storage tanks and product line sump appear to be limited laterally to the tank pit area, with the possible exception of the areas northwest of the tank pit near boring B-3, and the northeastern corner of the tank pit;

- the vertical extent of gasoline hydrocarbons in soil beneath the former tank pit, and the lateral and vertical extent of gasoline hydrocarbons by the dispenser islands have not been delineated;

- the June 25 and 26, 1990 ground-water sampling episode indicated the presence of low levels of gasoline hydrocarbons as suggested by concentrations of TPHg (27 to 64 ppb) in wells MW-1 through MW-3, benzene (0.63 and 0.65 ppb) in wells MW-1 and MW-3, and toluene (1.5 ppb) and total xylenes (2.0 ppb) in well MW-3. These levels are below regulatory action levels. The September 26, 1990 sampling indicated nondetectable levels of gasoline hydrocarbons in MW-1 through MW-4 (see Table A3 in Appendix A).

1st Quarter 1991 Quarterly Monitoring

Quarterly monitoring at the site has been performed since June 1990, when wells were installed. Quarterly monitoring for the first quarter 1991 was performed on January 8, 1991 (AGS, March 1991). Laboratory analysis of ground-water samples obtained from wells MW-1 through MW-4 during this episode of quarterly ground-water monitoring by AGS reported nondetectable levels of gasoline hydrocarbons in the water samples collected from these four wells. These results are reported in Table A3, Cumulative Results of Laboratory Analyses of Ground-Water. The ground-water gradient evaluated from ground-water elevation data collected between June 1990 and January 1991 has remained consistent since June 1990, approximately 0.004 to the southwest.

TABLE A1
RESULTS OF LABORATORY ANALYSES OF TANK-PIT SOIL SAMPLES
ARCO Station 2152
Castro Valley, California

Date	Sample #	TPHg	B	T	E	X
Tank-Pit Excavation						
08/18/89	S-14-T1S	<2	0.24	<0.05	<0.05	<0.05
08/18/89	S-13-T2S	<2	<0.05	<0.05	<0.05	<0.05
08/18/89	S-13-T3S	4.3	0.09	<0.05	<0.05	<0.05
08/18/89	S-13-T4S	<2	<0.05	<0.05	<0.05	<0.05
08/18/89	S-13-T5S	2.4	<0.05	<0.05	<0.05	<0.05
08/18/89	S-14-T1N	1,400	0.72	6.1	11	130
08/18/89	S-13-T2N	<2	0.076	<0.05	1.1	8.5
08/18/89	S-13-T3N	12	0.29	0.29	0.22	1.3
08/18/89	S-13-T4N	4.4	<0.05	<0.05	<0.05	0.23
08/18/89	S-13-T5N	700	4.6	2.0	4.6	83
08/18/89	S-18-T1N	430	<0.05	<0.05	1.1	8.5
08/18/89	S-18-T2N	<2	0.076	<0.05	<0.05	0.092
08/18/89	S-19-T3N	93	0.11	0.11	0.74	3.5
08/18/89	S-19-T4N	<2	<0.05	<0.05	<0.05	<0.05
08/18/89	S-19-T5N	3,800	<0.05	15	18	150
08/24/89	S-22-T5N	6.5	<0.05	0.36	0.093	0.82
08/22/89	S-14-NW1	<2	<0.05	<0.05	<0.05	<0.05
08/22/89	S-14-EW1	<2	<0.05	<0.05	<0.05	<0.05
08/30/89	S-14-NW2	3.4	<0.005	<0.005	<0.005	.030
08/30/89	S-14-WW1	<1	<0.005	<0.005	<0.005	<0.005
08/30/89	S-14-SF1	<1	<0.005	<0.005	<0.005	<0.005
08/30/89	S-14-SF2	<1	<0.005	<0.005	<0.005	<0.005
08/30/89	S-14-VR1	2,300	<2	<2	19	146
08/30/89	S-22-VR1	37,000	<40	510	38	2,600

Results in milligrams per kilogram (mg/kg) or parts per million (ppm).
TPHg: Total petroleum hydrocarbons as gasoline
B: Benzene T: Toluene E: Ethylbenzene X: Total xylenes
<: Less than the detection limit for the analysis method.

Sample Identification: S-14-T1S
- S: Soil sample
- 14: Approximate sample depth in feet below grade
- T1: Area of sample (See Plate A1)

TABLE A2
RESULTS OF LABORATORY ANALYSES OF PRODUCT-LINE SOIL SAMPLES
ARCO Station 2152
Castro Valley, California

Date	Sample #	TPHg	B	T	E	X
Center Street Dispensers						
09/06/89	S-4-PL3	43	1.0	3.2	0.74	4.0
09/06/89	S-2-PL9	4.9	0.24	0.18	0.16	0.64
09/06/89	S-4-PL10	3.4	0.21	0.18	0.11	0.25
09/06/89	S-3.5-PL11	43	1.0	3.2	0.74	4.0
09/06/89	S-2-PL12	73	0.13	<0.050	0.60	3.6
09/11/89	S-3-PL14	<2	<0.050	<0.050	<0.050	<0.050
09/11/89	S-3.5-PL15	<2	<0.050	<0.050	<0.050	0.087
09/15/89	S-3-PL16	21	0.14	0.84	0.42	2.5
09/15/89	S-3-PL17	190	0.85	7.4	2.3	14
09/15/89	S-3-PL18	100	0.72	3.3	1.2	7.2
09/15/89	S-2.5-PL19	<2	<0.050	<0.050	<0.050	<0.050
09/15/89	S-3-PL20	<2	<0.050	<0.050	<0.050	<0.050
09/15/89	S-5-PL21	<2	<0.050	<0.050	<0.050	<0.050
09/15/89	S-3-PL22	<2	<0.050	<0.050	<0.050	<0.050
Grove Street Dispensers						
09/06/89	S-1.5-PL1	130	1.6	3.8	2.4	13
09/19/89	S-4-PL22	13	0.20	0.97	0.16	1.2
10/04/89	S-3-PL25	<2	<0.050	<0.05	<0.050	<0.050
10/04/89	S-3-PL26	<2	<0.050	<0.050	<0.050	<0.050

Results in milligrams per kilogram (mg/kg) or parts per million (ppm).
TPHg: Total petroleum hydrocarbons as gasoline
B: Benzene T: Toluene E: Ethylbenzene X: Total xylenes
<: Less than the detection limit for the analysis method.
Sample identification:

S-4-PL3
- S: Soil sample
- 4: Approximate sample depth in feet below grade
- PL3: Area of sample (See Plate A2)

TABLE A3
CUMULATIVE RESULTS OF LABORATORY ANALYSES
OF GROUND WATER
ARCO Station 2152
Castro Valley, California

Well	Date	TPHg	B	T	E	X
MW-1	06/26/90	64	0.63	<0.50	<0.50	<0.50
	09/26/90	<50	<0.50	<0.50	<0.50	<0.50
	01/08/91	<50	<0.50	<0.50	<0.50	<0.50
MW-2	06/26/90	27	<0.50	<0.50	<0.50	<0.50
	09/26/90	<50	<0.50	<0.50	<0.50	<0.50
	01/08/91	<50	<0.50	<0.50	<0.50	<0.50
MW-3	06/25/90	52	0.65	1.5	<0.50	2.0
	09/26/90	<50	<0.50	<0.50	<0.50	<0.50
	01/08/91	<50	<0.50	<0.50	<0.50	<0.50
MW-4	06/25/90	<20	<0.50	<0.50	<0.50	<0.50
	09/26/90	<50	<0.50	<0.50	<0.50	<0.50
	01/08/91	<50	<0.50	<0.50	<0.50	<0.50

Results in parts per billion (ppb).
TPHg: Total petroleum hydrocarbons as gasoline
B:benzene T:toluene E:ethylbenzene X:total xylene isomers

APPENDIX B

Permit

ZONE 7

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

997 PARKSIDE DRIVE , PLEASANTON, CALIFORNIA 94588 , (415) 484-2600

3 January 1991

Applied GeoSystems
3315 Almaden Expressway, Ste. 34
San Jose, CA 95118

Gentlemen:

Enclosed is Groundwater Protection Ordinance permit 91001 for a monitoring well construction project at 22141 Center Street in Castro Valley for Arco Products Company.

Please note that permit condition A-2 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,

J. Killingstad, Chief
Water Resources Engineering

WH:mm
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

LOCATION OF PROJECT 22141 Center St
Castro Valley, CA
(ARCO AM PM)

CLIENT
Name ARCO Products Co
Address Box 5811 Phone (415) 571-2435
City San Mateo CA Zip 94402

APPLICANT
Name Steve Bittman
Applied GeoSystems
Address 3315 Almaden Expy Phone
City San Jose, CA Zip 95118

TYPE OF PROJECT

Well Construction		Geotechnical Investigation	
Cathodic Protection	___	General	___
Water Supply	___	Contamination	___
Monitoring	X	Well Destruction	___

PROPOSED WATER SUPPLY WELL USE
Domestic ___ Industrial ___ Other ___
Municipal ___ Irrigation ___

DRILLING METHOD:
Mud Rotary ___ Air Rotary ___ Auger X
Cable ___ Other ___

DRILLER'S LICENSE NO. C57 484288

WELL PROJECTS
Drill Hole Diameter 10 in. Maximum
Casing Diameter 4 in. Depth 50 ft.
Surface Seal Depth 10 ft. Number 2

GEOTECHNICAL PROJECTS
Number of Borings ___ Maximum
Hole Diameter ___ in. Depth ___ ft.

ESTIMATED STARTING DATE Jan 14 1990
ESTIMATED COMPLETION DATE Jan 17 1991

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

APPLICANT'S SIGNATURE Steve Bittman Date 12-28-90

FOR OFFICE USE

PERMIT NUMBER 91001
LOCATION NUMBER ___

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. 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 drilling logs and location sketch for geotechnical projects.
3. 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.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

C. GEOTECHNICAL. Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material. In areas of known or suspected contamination, tremied cement grout shall be used in place of compacted cuttings.

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

E. WELL DESTRUCTION. See attached.

Approved Wyman Hong Date 2 Jan 91
Wyman Hong

121989

APPENDIX C

Field Protocol

FIELD PROTOCOL

Site Safety Plan

Field work performed by Applied GeoSystems at the site on behalf of ARCO Products Company (ARCO) was conducted in accordance with Applied GeoSystems Site Safety Plan 69013-3S, dated May 8, 1990. This plan describes safety requirements for the evaluation of gasoline hydrocarbons in soil and ground water, including drilling of soil borings and installing of monitoring wells at the site. The Site Safety Plan is applicable to personnel of Applied GeoSystems and its subcontractors. Applied GeoSystems personnel (and subcontractors of Applied GeoSystems) scheduled to perform the work at the site were briefed on the contents of the Site Safety Plan before the work began. A copy of the Site Safety Plan was available at the site for reference by appropriate parties during the work. The Staff Geologist of Applied GeoSystems was the Site Safety Officer.

Drilling of Borings for Soil Sample Collection

The borings were drilled with a truck-mounted drill rig using six to 10-inch-diameter, hollow stem augers to depths of approximately 40 feet below ground surface. Drilling equipment was steam-cleaned prior to use and between borings at the site. The drilling was performed under the direction of an Applied GeoSystems field geologist who maintained a continuous log of the materials encountered and classified them by the Unified Soil Classification System, Plate 3.

Soil samples were collected by advancing the boring to a point immediately above the sampling depth and driving a California-modified split-spoon sampler (2-1/2-inch inside-diameter) through the hollow center of the auger into the soil with a standard 140-pound hammer repeatedly dropped 30 inches. The sampler was driven 18 inches, and the number of blows to drive the sampler each 6-inch increment was counted and recorded as an indication of the relative consistency of the soil.

The samples were removed from the sampler and one of the brass sleeves was promptly sealed with aluminum foil and plastic caps, and wrapped with aluminized tape. This soil sample was then labeled and placed in iced storage for laboratory analysis. A second brass-sleeved soil sample was sealed and stored separately to be available for sieve analysis.

The sampler was cleaned prior to use at the site and between sampling intervals using Alconox, and rinsed with deionized water. Brass sleeves were steam-cleaned prior to being used for soil sampling.

Field Analysis

Soil samples from each sampling interval were evaluated for concentrations of organic vapor in the field using a Thermo Environmental Instruments Inc. Model 580A Portable Organic Vapor Meter (OVM). The OVM was field calibrated to isobutylene before being used on soil samples. A portion of soil from each sample interval was placed and sealed in a resealable, zipper-type plastic bag to allow volatilization of hydrocarbons. Vapor readings were collected by placing the OVM intake port in the headspace inside the plastic bag. Field instruments such as the OVM are capable of measuring relative concentrations of vapor content, but cannot be used to measure concentrations of hydrocarbons in soil with the accuracy of laboratory analysis. The OVM readings are presented on the Logs of Borings.

Drill Cuttings

Drill cuttings generated from borings B-8, B-9, and B-12 through B-16 and drill cuttings generated from borings B-17 and B-18 were stockpiled on and covered by plastic sheets. Based on the results of laboratory testing of two composite samples from the stockpiles, on February 7, 1991, Balch Petroleum, Inc. of Milpitas, California, was present at the site to remove approximately three cubic yards of soil generated from soil borings B-8, B-9, and B-12 through B-16 to a Class III landfill, and on May 13, 1991, Caballero Trucking, San Jose, California was present at the site to remove approximately two cubic yards of soil generated from soil borings B-17 and B-18 to a Class III landfill.

Sampling of Stockpiled Soil

Composite soil samples were obtained by first evaluating relatively high, average, and low areas of hydrocarbon concentration by digging approximately one foot into the stockpile and placing the intake probe of the OVM against the surface of the soil; and then collecting one sample from the "high" reading area, and three from the "average" areas. Samples were collected by removing the top one to two feet of soil, then driving steam-cleaned brass sleeves into the soil. The samples were handled and transported to the laboratory as described above. Compositing was performed at the laboratory.

Vapor Extraction Well Construction

The three vapor extraction wells were constructed using clean 4-inch diameter, threaded Schedule 40 polyvinyl chloride (PVC) casing. Each well was screened from approximately 32 to 40 feet) using machine slotted PVC casing with 0.020-inch wide slots. Blank PVC casing was used in each well from ground surface to a depth of approximately 25 feet. No chemical cements, glues, or solvents were used in well construction. Each casing bottom was sealed with a threaded end-plug.

The annular space of each well was backfilled with No. 2 sand (or similar) to approximately two feet above the top of the screened casing. A 1 to 2 foot thick bentonite plug was placed above the san as a seal against cement entering the filter pack. The remaining annulus was backfilled with an 11 sack sand cement slurry to approximately 1 foot below the existing grade.

An aluminum traffic rated utility box with PVC apron was placed over each wellhead and set in concrete placed flush with the surrounding surface. Each wellhead was sealed with a water tightly licking cap and securing with a lock.

Applied GeoSystems

CHAIN-OF-CUSTODY RECORD

PROJ. NO.	PROJECT NAME
69013-6	ARCO 2152
P O NO	SAMPLERS (Signature)
	Mike Bamish

COPY

DATE MM/DD/YY	TIME	Soil	No. of Containers	TPHgasoline (8015)	BTEX (602/8020)	TPHdiesel (8015)	ORG. Pb					Preserved?	REMARKS	LABORATORY I.D. NUMBER
2-14-91		S-4-B18	1	X	X							Ice		
↓		S-8-B18	1	X	X									
													composite 5 samples for ORG-Pb	
2-21-91		S-15½ B18	1	X	X									
		S-5½-B17	1	X	X									
↓		S-10-B17	1	X	X							↓		

RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED BY (Signature):
Mike Bamish	2/22/91 1305	EXPRESS-IT Courier
RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED BY (Signature):
RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED FOR LABORATORY BY (Signature):
EXPRESS IT	2/22/91	

Laboratory: Applied Analytical

Turn Around: 1 week

SEND RESULTS TO:

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

Proj. Mgr.: Steve Brittman

APPLIED ANALYTICAL

Environmental Laboratories

2501 Arbor St. Suite 100
Fremont, CA 94538
Bus (415) 623-0775
Fax (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention: Mr. Steve Bittman
Applied GeoSystems
3315 Almaden Expressway
San Jose, CA 95118
Project: AGS 69013-6

Date Sampled: 01-17-91
Date Received: 01-21-91
BTEX Analyzed: 01-29-91
TPHg Analyzed: 01-29-91
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-5-B16 S1101296	ND	ND	ND	ND	ND	NR
S-10-B16 S1101297	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

January 30, 1991
Date Reported

APPLIED ANALYTICAL

Environmental Laboratories

4250 Arbrae St Suite 100
Fremont, CA 94538
Bus. (415) 623-0775
Fax: (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention:	Mr. Steve Bittman	Date Sampled:	02-14-91
	Applied GeoSystems	Date Received:	02-22-91
	3315 Almaden Expressway	BTEX Analyzed:	02-28-91
	San Jose, CA 95118	TPHg Analyzed:	02-28-91
Project:	AGS 69013-6	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-4-B18 S1102402	0.12	1.2	0.62	4.3	50	NR
S-8-B18 S1102403	0.31	7.3	5.5	36	220	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 5, 1991
Date Reported

APPLIED ANALYTICAL

Environmental Laboratories

4250 Alpine St., Suite 100
Fremont, CA 94538
Bus: (415) 623-0775
Fax: (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention:	Mr. Steve Bittman	Date Sampled:	02-21-91
	Applied GeoSystems	Date Received:	02-22-91
	3315 Almaden Expressway	BTEX Analyzed:	03-01-91
	San Jose, CA 95811	TPHg Analyzed:	03-01-91
Project:	AGS 69013-6	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-15 1/2-B18 S1102404	0.84	9.0	4.4	24	170	NR
S-5 1/2-B17 S1102405	ND	ND	ND	0.007	ND	NR
S-10-B17 S1102406	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 5, 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)

CHAIN-OF-CUSTODY RECORD

PROJ. NO	PROJECT NAME
69013-4	Arco #2152
P.O NO.	SAMPLERS (Signature)
	AWS-ES

DATE MM/DD/YY	TIME		No. of Containers	TPHgasoline (8015)	BTEX (602/8020)	TPHdiesel (8015)	Organic Pb					Preserved?	REMARKS	LABORATORY I.D. NUMBER
2/14/91		S-4-B18					X							
		S-8-B18	Composite S				X							
		S-15½-B18	samples for				X							B031010
		S-5½-B17	Organic Pb.				X							
		S-10-B17					X							

RELINQUISHED BY (Signature)	DATE / TIME	RECEIVED BY (Signature)
[signature]	2-26-91 4:35	Michelle C Yeast
RELINQUISHED BY (Signature)	DATE / TIME	RECEIVED BY (Signature)
Michelle C Yeast		Anthony Enerio
RELINQUISHED BY (Signature)	DATE / TIME	RECEIVED FOR LABORATORY BY (Signature)
Anthony Enerio	2/27 11:10	[signature]

Laboratory: Mobile Chem

Turn Around: 1 week

SEND RESULTS TO:
Applied Analytical
42501 Albrae Street
Fremont, California

(415) 623-0775

Proj. Mgr.: Laura Kuch

MOBILE CHEM LABS INC.

5021 Blum Road, Suite 3 • Martinez, CA 94553
Phone (415) 372-3700 • Fax (415) 372-6955

RECEIVED
MAR 8 1991
APPLIED GEOSYSTEMS
SAN JOSE BRANCH

69013-6/011689

Applied GeoSystems, Inc.
42501 Albrae Street, Suite 100
Fremont, CA 94639
ATTN: Laura Kuck
Project Manager

Date Sampled: 02-14-91
Date Received: 02-27-91
Date Reported: 03-01-91

ORGANIC LEAD

Sample Number	Sample Description	Detection Limit ppm	SOIL RESULTS ppm
	Project No.: 69013-6 ARCO #2512		
B031010	S-4-B18, S-8-B18, S-15 1/2-B18, S-5 1/2-B17, S-10-B17	0.5	<0.5

QA/QC: Sample blank is none detected

Note: California LUFT 12/87
(ppm) = (mg/kg)

MOBILE CHEM LABS

Ronald G. Evans
Lab Director

Applied GeoSystems

CHAIN-OF-CUSTODY RECORD

PROJ. NO.	PROJECT NAME
5101	[illegible]
P.O NO.	SAMPLERS (Signature)
	[signature]

DATE MM/DD/YY	TIME		No. of Containers	TPHgasoline (8015)	BTEX (602/8020)	TPHdiesel (8015)	[illegible]					Preserved?	REMARKS	LABORATORY I.D. NUMBER
[illegible]		[illegible]	4	X	X		X					[illegible]		
		[illegible]												
		[illegible]												

RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED BY (Signature):
[signature]	1-30 | 13:10	[signature]
RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED BY (Signature):
RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED FOR LABORATORY BY (Signature):

Laboratory:

Turn Around: [illegible]

SEND RESULTS TO:

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

Proj. Mgr.: [illegible]

ANAMETRIX INC

REPORT

STEVE BITTMAN
APPLIED GEO SYSTEMS - SAN JOSE
3315 ALMADEN EXPRESSWAY, SUITE 34
SAN JOSE, CA 95118

Workorder # : 9101298
Date Received : 01/30/91
Project ID : 69013-6
Purchase Order: N/A

The following samples were received at Anametrix, Inc. for analysis :

ANAMETRIX ID	CLIENT SAMPLE ID
9101298- 1	S-0129-SP1,2,3,4

This report consists of 6 pages not including the cover letter, and is organized in sections according to the specific Anametrix laboratory group or section which performed the analysis(es) and generated the data. The Report Summary that precedes each section will help you determine which Anametrix group is responsible for those test results, and will bear the signatures of the department supervisor and the chemist who have reviewed the analytical data. Please refer all questions to the department supervisor who signed the form.

Anametrix is certified by the California Department of Health Services (DHS) to perform environmental testing under Certificate Number 1234. A detailed list of the approved fields of testing can be obtained by calling our office, or the DHS Environmental Laboratory Accreditation Program at (415)540-2800.

If you have any further questions or comments on this report, please give us a call as soon as possible. Thank you for using Anametrix.

Burt Sutherland
Laboratory Director

Date

REPORT SUMMARY
ANAMETRIX, INC. (408)432-8192

STEVE BITTMAN
APPLIED GEO SYSTEMS - SAN JOSE
3315 ALMADEN EXPRESSWAY, SUITE 34
SAN JOSE, CA 95118

Workorder # : 9101298
Date Received : 01/30/91
Project ID : 69013-6
Purchase Order: N/A
Department : GC
Sub-Department: TPH

SAMPLE INFORMATION:

ANAMETRIX SAMPLE ID	CLIENT SAMPLE ID	MATRIX	DATE SAMPLED	METHOD
9101298- 1	S-0129-SP1,2,3,4	SOIL	01/29/91	TPHg/BTEX

REPORT SUMMARY
ANAMETRIX, INC. (408)432-8192

STEVE BITTMAN
APPLIED GEO SYSTEMS - SAN JOSE
3315 ALMADEN EXPRESSWAY, SUITE 34
SAN JOSE, CA 95118

Workorder # : 9101298
Date Received : 01/30/91
Project ID : 69013-6
Purchase Order: N/A
Department : GC
Sub-Department: TPH

QA/QC SUMMARY :

- No QA/QC problems encountered for samples.

Department Supervisor 2-6-91 Date

Chemist 2.6.91 Date

ANALYSIS DATA SHEET - TOTAL PETROLEUM HYDROCARBONS
(GASOLINE WITH BTEX)
ANAMETRIX, INC. - (408) 432-8192

Anametrix W.O.: 9101298
Matrix : SOIL
Date Sampled : 01/29/91

Project Number : 69013-6
Date Released : 02/06/91

COMPOUNDS	Reporting Limit (mg/Kg)	Sample I.D.# S-0129-SP1,2,3,4 -01	Sample I.D.# 04B0205A BLANK -02
Benzene	0.005	ND	ND
Toluene	0.005	ND	ND
Ethylbenzene	0.005	ND	ND
Total Xylenes	0.005	ND	ND
TPH as Gasoline	0.5	ND	ND
% Surrogate Recovery		105%	104%
Instrument I.D.		HP4	HP4
Date Analyzed		02/05/91	02/05/91
RLMF		1	1

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.
RLMF - Reporting Limit Multiplication Factor.
Anametrix Control limits for surrogate recovery are 53-147%.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

Analyst 2.6.91 Date

Supervisor 2-6-91 Date

REPORT SUMMARY
ANAMETRIX, INC. (408)432-8192

STEVE BITTMAN
APPLIED GEO SYSTEMS - SAN JOSE
3315 ALMADEN EXPRESSWAY, SUITE 34
SAN JOSE, CA 95118

Workorder # : 9101298
Date Received : 01/30/91
Project ID : 69013-6
Purchase Order: N/A
Department : METALS
Sub-Department: METALS

SAMPLE INFORMATION:

ANAMETRIX SAMPLE ID	CLIENT SAMPLE ID	MATRIX	DATE SAMPLED	METHOD
9101298- 1	S-0129-SP1,2,3,4	SOIL	01/29/91	ORG Pb

REPORT SUMMARY
ANAMETRIX, INC. (408)432-8192

STEVE BITTMAN
APPLIED GEO SYSTEMS - SAN JOSE
3315 ALMADEN EXPRESSWAY, SUITE 34
SAN JOSE, CA 95118

Workorder # : 9101298
Date Received : 01/30/91
Project ID : 69013-6
Purchase Order: N/A
Department : METALS
Sub-Department: METALS

QA/QC SUMMARY :

- No QA/QC problems encountered for samples.

Department Supervisor 2-06-91 Date

Chemist 2/06/91 Date

ANALYSIS DATA SHEET - ORGANIC LEAD
ANAMETRIX, INC. - (408) 432-8192

Anametrix W.O.: 9101298
Matrix : SOIL
Date Sampled : 01/29/91
Project Number: 69013-6

Date Prepared : 02/04/91
Date Analyzed : 02/04/91
Date Released : 02/06/91
Instrument I.D.: AA1

		ELEMENTS	Organic Lead		
		EPA METHOD	LUFT		
		REPORTING LIMIT	0.08		
ANAMETRIX ID	CLIENT ID		(mg/Kg)		
9101298-01	S-0129-SP1,2,3,4		ND		
OMB0204S	METHOD BLANK		ND		

ND : Not detected at or above the practical quantitation limit for the method.

Organic Lead by Leaking Underground Fuel Tank (LUFT) Manual, 1987 California State Water Resources Control Board.

Chemist 2/06/91 Date

Mona Kamal 2/06/91
Chemist Date

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 2152-91-2A

Chain of Custody

ARCO Facility no 2152	City (Facility) CASTRO VALLEY	Project manager (Consultant) STEVE BLHMAN	Laboratory name SEQUOIA
ARCO engineer Chuck CARMEL	Telephone no (ARCO)	Telephone no. (Consultant) 408 264 7723	Fax no (Consultant) 4082642435
Consultant name APPlied GeoSYSTEMS	Address (Consultant) 3315 ALMADEN EXPY S34 S.J. CA. 95118		Contract number 07-073

Method of shipment: Sequoia Field Tech

Sample I.D.	Lab no	Container no	Matrix: Soil	Water	Other	Preservation: Ice	Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐
S-0411-1A		Composite	X			X		4-11-91	4:00PM		X				1042595					
S-0411-1B			X			X		4-11-91	4:00PM		X									
S-0411-1C			X			X		4-11-91	4:00PM		X									
S-0411-1D			X			X		4-11-91	4:00PM		X									

Special detection Limit/reporting

Special QA/QC

Remarks: RUN one Composite sample, AGS Project No. 69013-6

Lab number

Turnaround time

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☒

Condition of sample: Good

Temperature received: COOL

	Date	Time	
Relinquished by sampler: Michael Gamino	4/15/91	2:20pm	Received by: Kim Van Stambrook
Relinquished by: Kim Van Stambrook	4.15.91	4:30pm	Received by:
Relinquished by:	Date	Time	Received by laboratory: [signature] Date 4/15/91 Time 1630

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering, Pink copy — Consultant

APPC-3292 (2-91)

SEQUOIA ANALYTICAL

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

Applied GeoSystems
3315 Almaden Expressway, Ste 34
San Jose, CA 95118
Attention: Steve Bittman

Project: #69013-06, Arco 2152: Castro Valley

Enclosed are the results from 1 soil samples received at Sequoia Analytical on April 15,1991. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
1042595 A - D	Soil Comp., S-0411, A-D	4/11/91	EPA 5030/8015/8020

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Bjorn A. Bjorkman
Project Manager

SEQUOIA ANALYTICAL

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

Applied GeoSystems	Client Project ID:	#69013-06, Arco 2152: Castro Valley	Sampled:	Apr 11, 1991
3315 Almaden Expressway, Ste 34	Sample Descript.:	Soil Comp., S-0411, A-D	Received:	Apr 15, 1991
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Apr 23, 1991
Attention: Steve Bittman	Lab Number:	104-2595 A - D	Reported:	Apr 26, 1991

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

Analyte	Detection Limit mg/kg (ppm)	Sample Results mg/kg (ppm)
Low to Medium Boiling Point Hydrocarbons	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes	0.0050	N.D.

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

SEQUOIA ANALYTICAL

Bjorn A. Bjorkman
Project Manager

SEQUOIA ANALYTICAL

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

Applied GeoSystems
3315 Almaden Expressway, Ste 34
San Jose, CA 95118
Attention: Steve Bittman

Client Project ID: #69013-06, Arco 2152: Castro Valley

QC Sample Group: 104-2595

Reported: Apr 26, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	G.Meyer	G.Meyer	G.Meyer	G.Meyer
Reporting Units:	ng	ng	ng	ng
Date Analyzed:	Apr 23, 1991	Apr 23, 1991	Apr 23, 1991	Apr 23, 1991
QC Sample #:	GBLK042391	GBLK042391	GBLK042391	GBLK042391
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	100	100	100	300
Conc. Matrix Spike:	89	88	88	270
Matrix Spike % Recovery:	89	88	88	90
Conc. Matrix Spike Dup.:	94	94	94	280
Matrix Spike Duplicate % Recovery:	94	94	94	93
Relative % Difference:	5.5	6.6	6.6	3.6

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Bjorn A. Bjorkman
Project Manager

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

APPENDIX D

Laboratory Data Sheets
and
Chain of Custody Records

Applied GeoSystems

CHAIN-OF-CUSTODY RECORD

PROJ. NO.	PROJECT NAME
69013-6	ARCO 2152
P.O. NO	SAMPLERS (Signature)
	Steve Bittner

DATE (MM/DD/YY)	TIME		No. of Containers	TPHgasoline (8015)	BTEX (602/8020)	TPHdiesel (8015)	Preserved?	REMARKS	LABORATORY I.D. NUMBER
1-16-91		S-20-B8	1	X	X		Ice		
		S-25-B8							
		S-33-B8							
		S-39-B8							
		S-41-B8							
1-14-91		S-22-B9							
1-14-91		S-26-B9							
1-15-91		S-29-B9							
1-15-91		S-33-B9							
1-16-91		S-15-B12							
		S-20-B12							
		S-30-B12							
		S-35-B12							
		S-40-B12							
		S-47-B12							
1-17-91		S-15-B13							
		S-20-B13							
		S-25-B13							

RELINQUISHED BY (Signature)	DATE / TIME	RECEIVED BY (Signature)
Steve Bittner	1-18 4:00	Suzanne Loiterton
RELINQUISHED BY (Signature)	DATE / TIME	RECEIVED BY (Signature)
Suzanne Loiterton		
RELINQUISHED BY (Signature)	DATE / TIME	RECEIVED FOR LABORATORY BY (Signature)
		1-21-91 8:30

Laboratory:

Note Sampling Dates!!

Turn Around: 2 weeks

SEND RESULTS TO:

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

Proj. Mgr.: Steve Bittner

Applied GeoSystems

CHAIN-OF-CUSTODY RECORD

PROJ. NO.	PROJECT NAME
69013-6	ARCO 2152
P.O. NO	SAMPLERS (Signature)
	Ste. Bittman

DATE (MM/DD/YY)	TIME		No. of Containers	TPHgasoline (8015)	BTEX (602/8020)	TPHdiesel (8015)	Preserved?	REMARKS	LABORATORY I.D. NUMBER
1-17-91		S-30-B13	1	X	X		Ice		
		S-35-B13							
		S-40-B13							
		S-45-B13							
1-17-91		S-15-B14							
		S-20-B14							
		S-30-B14							
		S-40-B14							
		S-45-B14							
		S-5-B15							
		S-10-B15							
		S-2-B16							
		S-5-B16							
		S-10-B16							

RELINQUISHED BY (Signature)	DATE / TIME	RECEIVED BY (Signature)
Ste. Bittman	1-18 4:00	
RELINQUISHED BY (Signature)	DATE / TIME	RECEIVED BY (Signature)
RELINQUISHED BY (Signature)	DATE / TIME	RECEIVED FOR LABORATORY BY (Signature): 1-21-91 8:30

Laboratory:

Note Sampling Dates !!

Turn Around: 2 weeks

SEND RESULTS TO:

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

Proj. Mgr.: Ste. Bittman

APPLIED ANALYTICAL

Environmental Laboratories

2501 Alpine St. Suite 100
Fremont, CA 94538
Bus (415) 623-0775
Fax: (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention: Mr. Steve Bittman
Applied GeoSystems
3315 Almaden Expressway
San Jose, CA 95118
Project: AGS 69013-6

Date Sampled: 01-16-91
Date Received: 01-21-91
BTEX Analyzed: 01-25-91
TPHg Analyzed: 01-25-91
TPHd Analyzed: NR
Matrix: Soil

	Benzene ppm	Toluene ppm	Ethyl-benzene ppm	Total Xylenes ppm	TPHg ppm	TPHd ppm
Detection Limit:	0.005	0.005	0.005	0.005	1.0	10
SAMPLE Laboratory Identification						
S-20-B8 S1101266	ND	ND	ND	ND	ND	NR
S-25-B8 S1101267	ND	ND	ND	ND	ND	NR
S-33-B8 S1101268	0.006	ND	ND	ND	ND	NR
S-39-B8 S1101269	ND	ND	ND	ND	ND	NR
S-41-B8 S1101270	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

January 30, 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

2501 Alcrae St Suite 100
Fremont, CA 94538
Bus: (415) 623-0775
Fax. (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention: Mr. Steve Bittman
Applied GeoSystems
3315 Almaden Expressway
San Jose, CA 95118
Project: AGS 69013-6

Date Sampled: 01-14/15/16-91
Date Received: 01-21-91
BTEX Analyzed: 01-25-91
TPHg Analyzed: 01-25-91
TPHd Analyzed: NR
Matrix: Soil

	Benzene ppm	Toluene ppm	Ethyl-benzene ppm	Total Xylenes ppm	TPHg ppm	TPHd ppm
Detection Limit:	0.005	0.005	0.005	0.005	1.0	10
SAMPLE Laboratory Identification						
S-22-B9 S1101271	ND	19	16	91	680	NR
S-26-B9 S1101272	ND	ND	0.008	0.011	ND	NR
S-29-B9 S1101273	ND	ND	ND	ND	ND	NR
S-33-B9 S1101274	ND	ND	ND	ND	ND	NR
S-15-B12 S1101275	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

January 30, 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

2501 Alcrae St Suite 100
Fremont CA 94538
Bus (415) 623-0775
Fax: (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention:	Mr. Steve Bittman	Date Sampled:	01-16-91
	Applied GeoSystems	Date Received:	01-21-91
	3315 Almaden Expressway	BTEX Analyzed:	01-25-91
	San Jose, CA 95118	TPHg Analyzed:	01-25-91
Project:	AGS 69013-6	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-20-B12 S1101276	ND	ND	ND	ND	ND	NR
S-30-B12 S1101277	ND	ND	ND	ND	ND	NR
S-35-B12 S1101278	ND	ND	ND	ND	ND	NR
S-40-B12 S1101279	0.028	ND	ND	ND	ND	NR
S-47-B12 S1101280	ND	ND	ND	0.006	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

January 30, 1991
Date Reported

APPLIED ANALYTICAL

Environmental Laboratories

4250 Alvarado St. Suite 100
Fremont, CA 94538
Bus (415) 623-0775
Fax (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention: Mr. Steve Bittman
Applied GeoSystems
3315 Almaden Expressway
San Jose, CA 95118
Project: AGS 69013-6

Date Sampled: 01-17-91
Date Received: 01-21-91
BTEX Analyzed: 01-29-91
TPHg Analyzed: 01-29-91
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-15-B13 S1101281	ND	ND	ND	ND	ND	NR
S-20-B13 S1101282	ND	ND	ND	ND	ND	NR
S-25-B13 S1101283	ND	ND	ND	ND	ND	NR
S-30-B13 S1101284	0.033	ND	ND	0.018	ND	NR
S-35-B13 S1101285	0.030	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

January 30, 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

2501 Arbrae St Suite 100
Fremont CA 94538
Bus: (415) 623-0775
Fax (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention: Mr. Steve Bittman
Applied GeoSystems
3315 Almaden Expressway
San Jose, CA 95118
Project: AGS 69013-6

Date Sampled: 01-17-91
Date Received: 01-21-91
BTEX Analyzed: 01-29-91
TPHg Analyzed: 01-29-91
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-40-B13 S1101286	0.096	ND	ND	ND	ND	NR
S-45-B13 S1101287	ND	ND	ND	ND	ND	NR
S-15-B14 S1101288	ND	ND	ND	ND	ND	NR
S-20-B14 S1101289	ND	ND	ND	ND	ND	NR
S-30-B14 S1101290	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

January 30, 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

4250 Arorae St Suite 100
Fremont, CA 94538
Bus (415) 623-0775
Fax (415) 651-8647

ANALYSIS REPORT

1020lab.frm

Attention:	Mr. Steve Bittman	Date Sampled:	01-17-91
	Applied GeoSystems	Date Received:	01-21-91
	3315 Almaden Expressway	BTEX Analyzed:	01-29-91
	San Jose, CA 95118	TPHg Analyzed:	01-29-91
Project:	AGS 69013-6	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-40-B14 S1101291	ND	ND	ND	0.007	ND	NR
S-45-B14 S1101292	ND	ND	ND	ND	ND	NR
S-5-B15 S1101293	ND	ND	ND	ND	ND	NR
S-10-B15 S1101294	ND	ND	ND	ND	ND	NR
S-2-B16 S1101295	0.037	ND	0.080	ND	1.7	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

January 30, 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)