TRANSMITTAL FORM

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

Date	Project No.
10/25/89	69038-1

Subject: Arco Station 4494
566 Hegenberger Road,
Oakland, Ca.

TO Ms. Katherine Chesick
Alameda County Health Care Services
Dept. of Environmental Health
80 Swan Way, Room 200
Oakland, Ca. 94621

FROM Bill Dugan

TITLE Project Geologist

WE ARE SENDING YOU ☒ Attatched ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Reports ☐ Specifications
☐ Letters ☐ Change orders ☐ _____

COPIES	DATED	NO.	DESCRIPTION
1	9/29/89		Work plan for Initial Subsurface Investigation at the above subject.

THESE ARE TRANSMITTED as checked below:

☐ For review and comment ☐ Approved as submitted ☐ Resubmit ____ copies for approval
☐ As requested ☐ Approved as noted ☐ Submit ____ copies for distribution
☒ For approval ☐ Returned for corrections ☐ Return ____ corrected prints
☐ For your files ☐ _____

REMARKS Attached is an additional coppy of the work plan for the site. Also, you will find a $500.00 check to cover the cost of your review for the work plan.

COPIES: 1 to AGS project file no. _____

10/26/89

LDR

TRANSMITTAL FORM

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

TO Mr. Gerald Winn
Department of Enviromental Health
470 27th Street
Oakland, California 94612

FROM William R. Dugan
TITLE Assistant Project Geologist

Date	Project No.
9/29/89	69038-1

Subject:
ARCO Service Station
No. 4494, located at
566 Hegenberger Road,
Oakland, California.

10/3/89

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TRANSMITTAL FORM

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

Date	Project No.
9/29/89	69038-1

Subject: ARCO Service Station No. 4494, located at 566 Hegenberger Road, Oakland, California.

TO Ms. Katherine Chesick
Alameda County Health Care Services Agency
80 Swan Way, Room 200
Oakland, California 94621

FROM William R. Dugan

TITLE Assistant Project Geologist

WE ARE SENDING YOU ☒ Attatched ☐ Under separate cover via _____ the following items:

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COPIES	DATED	NO.	DESCRIPTION
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REMARKS _____

ALAMEDA COUNTY
DEPT. OF ENVIRONMENTAL HEALTH
HAZARDOUS MATERIALS

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

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WORK PLAN
INITIAL SUBSURFACE INVESTIGATION
at
ARCO Service Station No. 4494
566 Hegenberger Road
Oakland, California

AGS Job No. 69038-1

Work Plan prepared for

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

by
Applied GeoSystems

William R. Dugan
Assistant Project
Geologist

Greg Barclay /r.m.
Greg Barclay
Project Branch
Manager

Michael N. Clark by r.a.
Michael N. Clark
C.E.G. 1264

September 29, 1989

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

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

September 29, 1989
AGS 69038-1

Mr. Kyle Christie
Environmental Engineer
ARCO Products Company
P.O. Box 5811
San Mateo, California 94402

Subject: Work Plan for Initial Subsurface Investigation at ARCO Service Station No. 4494, 566 Hegenberger Road, Oakland, California.

Mr. Christie:

As requested, this Work Plan summarizes the results of a previous environmental investigation performed by Pacific Environmental Group, Inc., Santa Clara, California, and discusses the additional work required by the Alameda County Health Care Services Agency in their August 10, 1989, letter to ARCO Products Company (ARCO). The proposed work is limited to investigation of hydrocarbons related to the underground waste-oil tank formerly located at the site. Our proposed work includes drilling three soil borings, constructing three 4-inch-diameter monitoring wells in the borings, developing the wells, collecting water samples for laboratory analysis, evaluating the ground-water gradient, and preparing a report documenting our findings, conclusions, and recommendations.

This work is necessary to evaluate possible ground-water hydrocarbon contamination related to the former underground waste-oil tank at the site. The work is described in detail in the attached Work Plan, which includes a preliminary estimated schedule for the work.

Copies of this Work Plan should be sent to the following regulators:

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

Ms. Katherine Chesick
Alameda County Health Care Services Agency
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94621

Mr. Gerald Winn
Department of Environmental Health
470 27th Street, Oakland
California 94612

Please call if you have any questions regarding the contents of this Work Plan.

Sincerely,
Applied GeoSystems

William R. Dugan
Assistant Project
Geologist

cc: Mr. Chris Winsor, ARCO Products Company

TABLE OF CONTENTS

TABLES

PLATES

APPENDIX A

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

WORK PLAN
INITIAL SUBSURFACE INVESTIGATION
at
ARCO Service Station No. 4494
566 Hegenberger Road
Oakland, California

For ARCO Products Company

INTRODUCTION

This Work Plan summarizes previous work conducted by Pacific Environmental Group (Pacific), Santa Clara, California, and describes the work proposed to perform a subsurface investigation limited to evaluation of potential hydrocarbon contamination in ground water related to the former underground waste-oil tank at the subject site. A preliminary schedule for performing the work at the site is also included. Pacific previously evaluated the extent of soil hydrocarbon contamination near the former waste-oil tank and supervised the excavation of soil impacted by hydrocarbons near the former tank. Pacific reported that most of the hydrocarbon contaminated soil was removed, with the exception of the soil on the eastern side wall of their excavation (Pacific, 1989). ARCO Products Company (ARCO) requested that Applied GeoSystems prepare this Work Plan for submittal to the Regional Water Quality Control Board, and the Alameda County Health Care Services

Agency (ACHCSA). This work plan has been prepared in response to a letter from the ACHCSA to ARCO, dated August 10, 1989.

The scope of work includes:

(1) preparing a site safety plan;

(2) performing a 1/2-mile-radius well search using information supplied by the Alameda County Flood Control and Water Conservation District (Zone 7) and the California Department of Water Resources (DWR);

(3) drilling three soil borings (B-1 through B-3) to a depth of approximately 25 feet;

(4) collecting and logging soil samples at least every 5 feet in the borings;

(5) analyzing selected soil samples from the borings for total petroleum hydrocarbons as diesel (TPHd), total petroleum hydrocarbons as gasoline (TPHg), total petroleum oil and grease (TOG), benzene, ethylbenzene, toluene, and total xylene (BETX), and lead, cadmium, total chromium, and zinc;

(6) constructing a 4-inch-diameter ground-water monitoring well in each boring;

(7) surveying the wells and measuring ground-water levels in the wells to enable interpretation of the ground-water gradient;

(8) collecting and analyzing water samples from monitoring wells MW-1 through MW-3 for TPHg, TPHd, TOG, volatile organic compounds (VOC), base neutral and acid extractables, and lead, cadmium, total chromium, and zinc;

(9) preparing a report summarizing our field and laboratory procedures, findings, conclusions, and recommendations.

SITE DESCRIPTION AND BACKGROUND

The site is an operating gasoline station in a commercial area and is located at 566 Hegenberger Road, on the northeastern corner of Hegenberger Road and Edes Avenue in Oakland, California. The site location is shown on the Site Vicinity Map (Plate P-1). The elevation of the site is approximately 5 feet above mean sea level.

It is our understanding, from information supplied by Pacific, that one 280-gallon waste-oil storage tank was located west of the station building. On December 16, 1989, the 280-gallon waste-oil storage tank was excavated and removed from the site. It is also our understanding, from information supplied by ARCO, that three 10,000-gallon underground gasoline storage tanks are at the site: one tank used to store regular gasoline, one tank used to store super-unleaded gasoline, and one tank used to store unleaded gasoline. The locations of the former underground waste-oil tank, the underground gasoline storage tanks, and selected site features are shown on the Generalized Site Plan (Plate P-2).

PREVIOUS WORK

Previous work performed at the site in December 1988 and January 1989 by Pacific and Crosby & Overton, Inc. (C&O), Oakland, California, included soil excavation, removal of the 280-gallon waste-oil tank, and collection of soil samples for laboratory analysis. The waste- oil tank pit was excavated and the tank removed from the pit by C&O on December 16, 1988. During the removal of the waste-oil tank, Pacific noted that the tank displayed no sign of leakage from either the fill pipe or the tank, but reported a strong product odor in the soil beneath the tank (Pacific, May 3, 1989).

The tank pit was excavated to a depth of 7 feet below grade. Pacific collected a soil sample from beneath the fill end of the tank (WO-1) at this depth (2 feet below the bottom of the former waste-oil tank). Pacific also collected a soil sample (WO-2) at a depth of 10 feet directly beneath the location of sample WO-1.

The soil samples were analyzed for (1) TOG, (2) high boiling hydrocarbons (HBHC) calculated as oil and diesel, (3) semi-volatile organic compounds, (4) VOC, and (5) cadmium, chromium, lead, and zinc at International Technology Corporation (Hazardous Waste Testing Laboratory Certificate 137) in San Jose, California. The results of these analyses are shown in Table 1 and Table 2.

TABLE 1
SUMMARY OF ANALYTICAL RESULTS
Low Boiling Hydrocarbons, High Boiling Hydrocarbons, Oil & Grease
Soil Samples From Waste Oil Tank Excavation
Sampled by Pacific Environmental Group

SAMPLE	DEPTH (FT)	LBHC-g	HBHC-d	HBHC-o	OIL & GREASE
12/16/88					
WO-1	7	11.	370.*	4800.	4500.
WO-2	10	<5.	<10.	<10.	<20.
(Side Walls)					
1/4/89					
WOSW-E	7	NT	<10.	50.	190.
WOSW-S	7	NT	<10.	<10.	<10.
WOSW-W	7	NT	<10.	<10.	<10.
WOSW-N	7	NT	<33.*	400.	200.
1/16/89					
WOSW-N2	7	NT	<10.	<10.	10.

Results in parts per million (ppm).
LBHC-g: Low boiling hydrocarbons as gasoline.
HBHC-d: High boiling hydrocarbons as diesel.
HBHC-o: High boiling hydrocarbons as oil.
NT: Not Tested
*: Chromatographic pattern of compounds detected and calculated as diesel does not match that of the diesel standard used for calibration.

Sample Identification: WOWS-N2
- WO — waste oil sample
- WS — area of sample
- N2 — area of sample

TABLE 2
Summary of Analytical Results
Volatile Organic Compounds, Semi-volatile organic Compounds, Metals
Soil Samples from Waste Oil Tank Excavation
Sampled by Pacific Environmental Group on December 16, 1988
(Page 1 of 2)

SAMPLE ID:	WO-1	WO-2	DESIGNATED LEVEL*
Volatile Organic Compounds - HSL			
Xylene	.008	ND	
Other tested compounds	ND	ND	
Volatile Organic Compounds - Non-HSL**			
1,2,5-Trimethylbenzene	.05	ND	
1,2,4-Trimethylbenzene	.03	ND	
Diethylbenzene	.02	ND	
Methyl(1-methylethyl)benzene	.03	ND	
2-ethyl-1,4-dimethylbenzene	.03	ND	
Other tested compounds	ND	ND	
Semi-volatile Organic Compounds - HSL			
2-Methylnapthalene	ND	.9	(NO DATA)
Other tested compounds	ND	ND	

See notes page 2 of 2.

TABLE 2
Summary of Analytical Results
Volatile Organic Compounds, Semi-volatile organic Compounds, Metals
Soil Samples from Waste Oil Tank Excavation
Sampled by Pacific Environmental Group on December 16, 1988
(Page 2 of 2)

SAMPLE ID:	WO-1	WO-2	DESIGNATED LEVEL*
Metals			
Cadmium	ND	ND	
Chromium	48.	44.	500.
Lead	150.	ND	
Zinc	76.	45.	200.

Results in parts per million (ppm).
ND: None detected. See Certified Analytical Report for detection limits.
HSL: Compounds on the hazardous substances list.
**: Estimate only. See Certified Analytical Report.
*: Levels to protect drinking water when compounds occur in a solid, for a hypothetical "average" site. Converted to parts per million.
Source: "Water Quality Goals and Hazardous and Designated Levels for Chemical Constituents," California Regional Water Quality Control Board (prepared by Jon Marshack), September 1986.

Because of the concentrations of TOG (4,500 ppm) and HBHC (370 ppm) detected in sample WO-1, the entire pit was further excavated on January 4, 1989, to a depth of 10 feet below grade where Pacific reported no noticeable hydrocarbon odor in the soil. To define the lateral extent of hydrocarbons in the soil after the excavation was extended, Pacific collected four side-wall samples (W0SW-E, WOSW-S, WOSW-W, and WOSW-N) at a depth of 7 feet. Results of laboratory analysis of these samples indicated (1) concentrations

Sample taken?

of TOG at 190 ppm, <10ppm, <10 ppm, and 200 ppm, and (2) HBHC (calculated as oil) at 50 ppm, <10 ppm, <10 ppm, and 400 ppm, respectively. The results of these analyses are also shown in Table 1 (Pacific 1989).

On January 18, 1989, C&O laterally extended the waste-oil tank excavation 3-1/2 feet on the north side to remove hydrocarbon contamination beyond WOSW-N. Additional excavation of the eastern wall was not possible because of the wall's proximity to the station building. On January 18, 1989, side-wall sample WOSW-N2 was obtained by Pacific from the north wall side of the extended pit at an approximate depth of 7 feet. Results of laboratory analysis of this sample indicated 10 ppm TOG, and <10 ppm HBHC (calculated as oil) (Pacific, May 3, 1989). Pacific concluded that most of the soil impacted by petroleum hydrocarbons near the former waste-oil tank, with the exception of the soil on the eastern side wall of the excavation was removed (Pacific, 1989).

The excavation was reportedly backfilled with clean fill material to the original grade. Pacific concluded that due to the proximity of the excavation to the station building, further excavation would have threatened the stability of the station building. The tank and stockpiled soil were disposed of as hazardous wastes by C&O and ARCO at the Chemical Waste Management, Inc., Kettleman Hills facility. Pacific included no recommendations in their May 3, 1989 report.

REGIONAL AND LOCAL HYDROGEOLOGY

The ARCO station is located within the East Bay Plain situated between the northwestern portion of the San Leandro Cone, and the southwestern portion of the Oakland alluvial Plain. The eastern side of the plain in the Oakland area is marked by the active Hayward Fault, which is located along the base of the Diablo Range escarpment, approximately 2-1/2 miles east of the site. The site is located less than 1,800 from a San Francisco Bay tidal canal. The earth materials underlying the site area have been mapped as Quaternary bay mud deposits composed of dark plastic clay and silty clay rich in organic material (Helley, et al., 1979).

The inferred direction of ground-water flow in the vicinity of the site is to the west to southwest based on regional and local topography and drainage patterns. Ground water was not encountered in the 10 feet deep waste-oil tank pit excavated by C&O; however, ground water is inferred to be shallow beneath the site based on the low elevation of the site, and the proximity of the site to the San Francisco Bay.

PROPOSED WORK

We propose the following tasks for the initial subsurface work at the site. The following work descriptions and letter designations correlate to time frames on the attached Preliminary Schedule (Plate P-3).

A Submit a work plan to regulators for review.

A Prepare a site safety plan.

A Obtain permits for installation of monitoring wells at site.

B Perform a 1/2-mile-radius well search using information supplied by Zone 7 and the DWR.

C Drill three soil borings to a depth approximately 10 to 15 feet below first-encountered ground water (or to the first-encountered confining layer below first-encountered ground water) and construct three 4-inch-diameter wells in the borings at the locations shown on Plate P-2.

C Collect and classify relatively undisturbed soil samples from at least 5-foot intervals from the ground surface to the total depths of the borings.

D Develop the new wells (MW-1, MW-2, and MW-3) and collect water samples from the wells.

D Contract with a licensed surveyor to survey each well to National Geodetic Vertical Datum and evaluate the local ground-water gradient.

D Analyze selected soil samples from the borings for TPHd, TPHg, BETX, TOG, lead, cadmium, total chromium, and zinc (in a State-certified laboratory);

D Analyze water samples from well MW-1 through MW-3 for TPHg, TPHd, TOG, VOC, base neutral and acid extractables, lead, cadmium, total chromium, and zinc (in a State-certified laboratory).

E Prepare a report summarizing our findings, conclusions, and recommendations.

Site Safety Plan

The field work we perform at the site on behalf of ARCO will be conducted in accordance with our site safety plan. The plan will describe the basic safety requirements for the subsurface environmental assessment, drilling soil borings, and installation of monitoring wells at the site. The site safety plan is applicable to personnel and subcontractors of Applied GeoSystems. Personnel scheduled to work at the site will be briefed on the contents of the site safety plan before work begins. A copy of the plan will be kept at the site and available for reference by appropriate parties during work. The Staff Geologist will act as the Site Safety Officer.

Well Research

Information regarding water wells in the vicinity of the site will be researched at Zone 7 and DWR to evaluate ground-water usage in the vicinity of the site. The research will be performed for an area of approximately 1/2-mile radius of the site.

Soil Borings

Prior to drilling the borings and constructing monitoring wells at the site, permits will be acquired from Zone 7. The three borings will be drilled with a CME-50 (or equivalent) truck-mounted drill rig using 10-inch-diameter, hollow-stem augers. The augers and downhole drilling equipment will be steam-cleaned prior to drilling each boring to minimize the possibility of cross-contamination. Earth materials encountered in the borings will be continuously logged by a geologist as drilled, and described on boring logs.

→ 10-15 per p.10 ??

The borings will extend no more than 20 feet below the depth at which water is encountered, or into the confining layer below the first-encountered water-bearing zone. Each boring will be completed into a monitoring well screened within the first-encountered water-bearing zone.

Rational for Boring and Well Locations

The locations of the borings and wells are based on results of laboratory analyses of soil samples collected at the site and on the inferred direction of ground-water flow. Boring B-1 (well MW-1) will be located within five feet (south) of the former waste-oil tank to enable evaluation of potential ground-water contamination downgradient of the former waste-oil tank. Borings B-2 (well MW-2) and B-3 (MW-3) will be located approximately

→ west to southwest per p.9

120 feet northeast, and approximately 120 feet northwest, respectively, of the former underground waste-oil tank to enable evaluation of the ground-water gradient and potential ground-water contamination upgradient of the former waste-oil tank. Water levels measured in monitoring wells MW-1, MW-2, and MW-3 will be used to interpret the ground-water gradient (magnitude and direction) of the first-encountered water-bearing zone beneath the site.

Disposal of Soil Cuttings

Drill cuttings evaluated in the field as having hydrocarbon contamination concentrations of 100 parts per million (ppm) or greater will be separated from those evaluated as having hydrocarbon contamination concentrations less than 100 ppm. Soil cuttings will be placed on, and covered by plastic sheets. A composite soil sample will be collected from the soil cuttings pile and analyzed to confirm the level of contamination present, prior to the disposal of the pile. This sample will be analyzed for TPHg and TPHd and BETX. Disposal of cuttings generated during the work will remain the responsibility of ARCO.

Soil Sampling

Soil samples for laboratory analysis will be collected at 5-foot intervals from each boring, at or near changes in earth materials, and in the confining layer below the first-encountered

ground water, if such a confining layer is found. These soil samples will be collected by advancing the boring to a point immediately above the sampling depth and then driving a California-modified, split-spoon sampler containing brass sleeves into the soil through the hollow center of the auger. The sampler will be driven 18 inches with a standard 140-pound hammer repeatedly dropped 30 inches. The number of blows to drive the sampler each successive 6 inches will be counted and recorded to evaluate the relative consistency of the soil. During drilling, the soil samples will be evaluated for the presence of hydrocarbons. Field evaluation will be based on the presence of soil discoloration and measurements from an OVM. The OVM measurements will be recorded.

The samples selected for laboratory analysis will be removed from the sampler and promptly sealed in their brass sleeves with aluminum foil, plastic caps, and aluminized duct tape. The samples will then be labeled, placed in iced storage, and delivered to a laboratory that is certified by the State to perform the analyses requested. Chain of Custody Records will be kept throughout handling of the samples tested.

Well Construction and Development

Ground-water monitoring wells will be constructed in the soil borings to evaluate the presence of hydrocarbons in the ground water within the first-encountered water-bearing zone at the site. The wells will be constructed of 4-inch-diameter, thread-jointed, polyvinyl

chloride (PVC) casing. No chemical cements, glues, or solvents will be used in well construction. The bottom of each casing will have a threaded end-plug, and the top will have a locking plug.

The screened portion of each well will consist of factory-perforated casing. Selection of well screen will be based on particle-size analysis performed in the field as the soil is described by the geologist. The screened section will be constructed to allow monitoring during seasonal fluctuations of ground-water levels.

The annular space of each well will be backfilled with a sand filter pack to approximately 2 feet above the perforations. The filter pack will also be selected based on particle-size analysis of the stratigraphic units encountered. A 1-foot-thick bentonite plug will be placed above the sand as a seal against cement entering the filter pack. The remaining annulus will be backfilled with a slurry of water, neat cement and bentonite to approximately 1 foot below the ground surface.

An aluminum utility box with a PVC apron will be placed over each wellhead and set in concrete placed flush with the surrounding ground surface. The wellhead cover will have a watertight seal to protect the ground-water monitoring well against surface-water infiltration, and will require a special wrench to open. This design discourages vandalism and reduces the possibility of accidental disturbance of the well. The wells will be

developed by bailing or surge pumping. A record of the quantity, turbidity, color, and other observations of extracted well-development water will be included in our report.

Ground-Water Sampling

The wells will be allowed to equilibrate for at least 48 hours after development. The liquid in the wells will then be checked for visual evidence of hydrocarbon contamination. Any subjective evidence of product detected in the well will be recorded. If floating product is encountered in a well, the well will not be purged or sampled. If no floating product is observed in a well, the well will be purged prior to collecting a sample of the formation water. The well will be purged of at least 3 well volumes of water. The temperature, pH, and conductivity of purged ground water will be allowed to stabilize prior to sampling the well. The well will then be sampled using a Teflon bailer cleaned with Alconox and rinsed with tap water and deionized water.

how check for free product?

The water samples will be sealed in laboratory-cleaned, 40-milliliter glass vials with Teflon-lined lids. The samples will then be labeled and promptly placed in iced storage. A Chain of Custody Record will be initiated by the geologist and kept throughout handling of the samples, and will accompany the samples to a laboratory certified by the State of California for the analyses requested.

Laboratory Analyses

Selected soil and ground-water samples will be analyzed in a State-certified laboratory according to the following guidelines:

(a) Selected soil samples from borings B-1 through B-3 will be analyzed for total petroleum hydrocarbons as diesel (TPHd) using EPA Method 3550/8015, total petroleum hydrocarbons as gasoline (TPHg) using modified EPA Method 5030/8015, total petroleum oil and grease (TOG) using Standard Method 503E, benzene, ethylbenzene, toluene, and total xylene (BETX) using modified EPA Method 3550/8020, and lead, cadmium, total chromium, and zinc using EPA Method 6010;

(b) Ground-water samples from well MW-1 through MW-3 will be analyzed for TPHg using modified EPA Method 5030/8015, TPHd using modified EPA Method 3510/8015, TOG using Standard Method 503E, volatile organic compounds (VOC) using EPA Method 624, base neutral and acid extractables, including polychlorobiphenols (PCBs), pentachlorophenol, poly neutral aeromatics (PNA) and creosote using modified EPA Method 625, and lead, cadmium, total chromium, and zinc using EPA Method 6010.

Interpretation of Ground-Water Gradient

Ground-water elevations will be measured to enable interpretation of the ground-water gradient beneath the site. The elevation of the top of each well casing will be referenced to National Geodetic Vertical Datum by a licensed land surveyor. The static water levels will be measured with a water-level indicator to the nearest 0.01 foot to calculate the differences in water-level elevations between the wells. The water-level elevation

differences will be used to construct a ground-water gradient map. The ground-water gradient and direction of ground-water flow will be interpreted from this map.

Report and Work Plan Preparation

A report will be provided summarizing the results, interpretations, and recommendations for further delineation work, as necessary. The report will also contain copies of well permits, boring logs, chain of custody forms, and laboratory data sheets. Information gathered during any phase of work will be considered confidential and released only upon the authorization of ARCO.

SCHEDULE OF OPERATIONS

The appropriate well permits have been obtained for drilling the wells. Drilling of the borings and constructing monitoring wells will commence approximately 7 days after approval of this work plan by the ACHCSA and ARCO. A preliminary schedule for the proposed work is presented on Plate P-3.

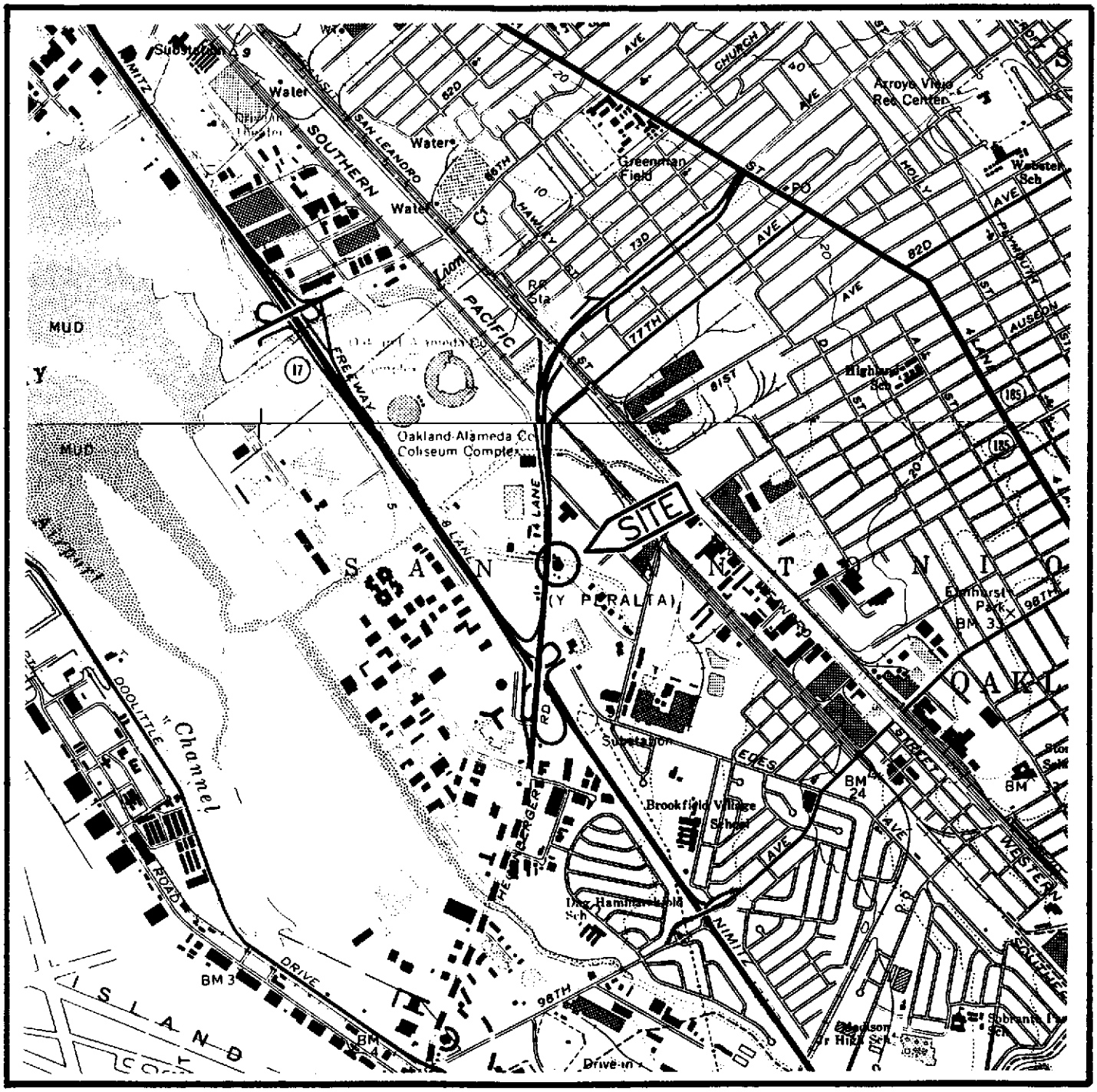
PROJECT STAFF

Mr. Michael N. Clark, a Certified Engineering Geologist (C.E.G. 1264) in the State of California, will be in overall charge of this project. Mr. Greg Barclay, Project Branch Manager, will provide supervision of field and office operations of the project. Mr. William R. Dugan, Assistant Project Geologist, will be responsible for day-to-day field and office operations of the project. Applied GeoSystems employs a staff of geologists and technicians who will assist as needed to see the project to completion.

REFERENCES CITED

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

Pacific Environmental Group, May 3, 1989. ARCO Station No. 4494, Hegenberger Road, California. Project 330-41.01.



Source: U.S. Geological Survey
7.5-Minute Quadrangle
Oakland East/San Leandro, California
Photorevised 1980

N

Approximate Scale

2000 1000 0 2000 4000

feet

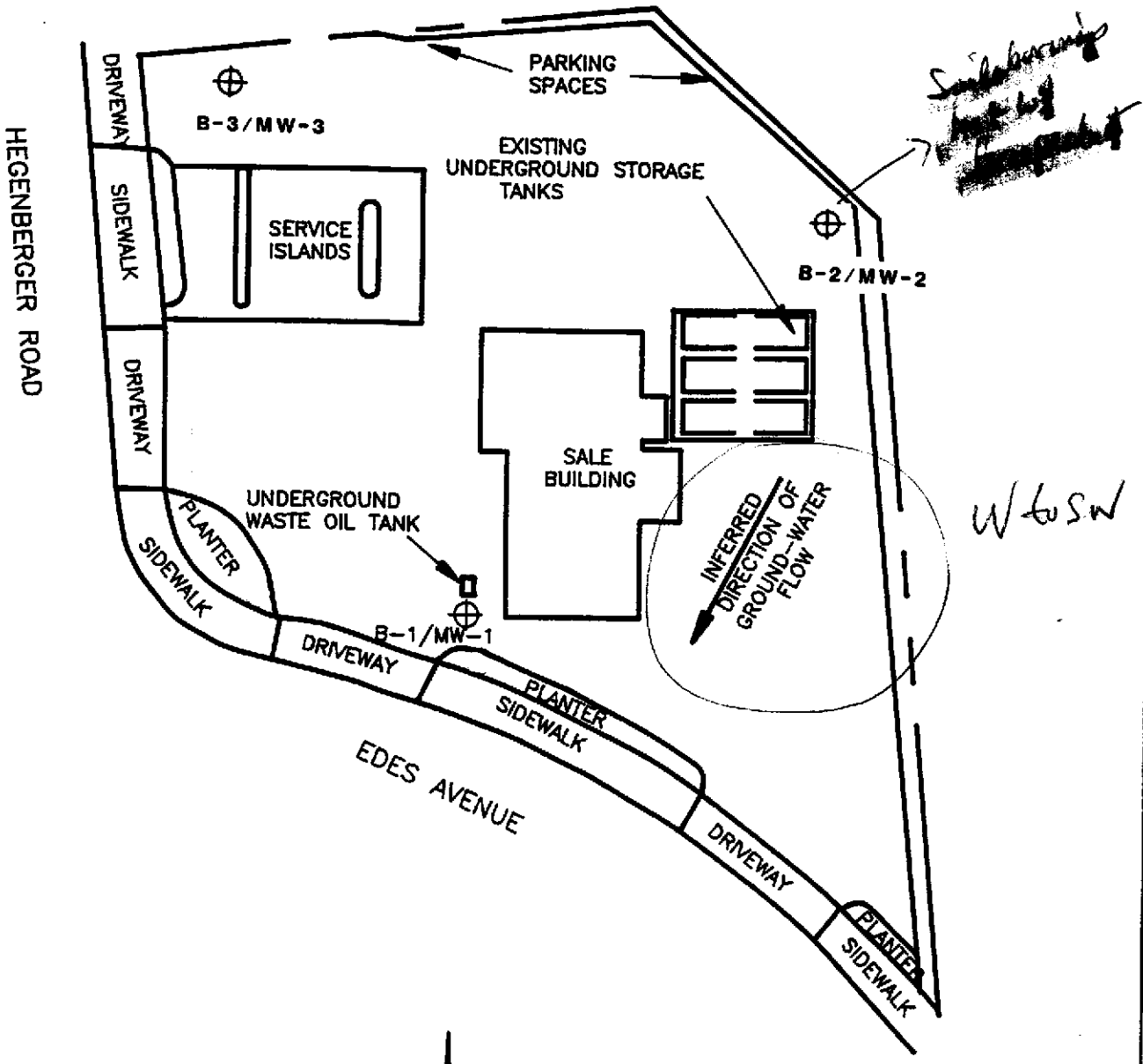
Applied GeoSystems

PROJECT NO. 69038-1

SITE VICINITY MAP
Arco Service Station No.4494
566 Hegenberger Road
Oakland, California

PLATE

P - 1



B-3/MW-3 ⊕ = Proposed monitoring well

Approximate Scale

40 20 0 40 80

feet

Source: Modified from plan supplied by Arco Products Company

Applied GeoSystems

PROJECT NO. 60038-1

GENERALIZED SITE PLAN
Arco Service Station No. 4494
566 HEGENBERGER ROAD
Oakland, California

PLATE

P - 2

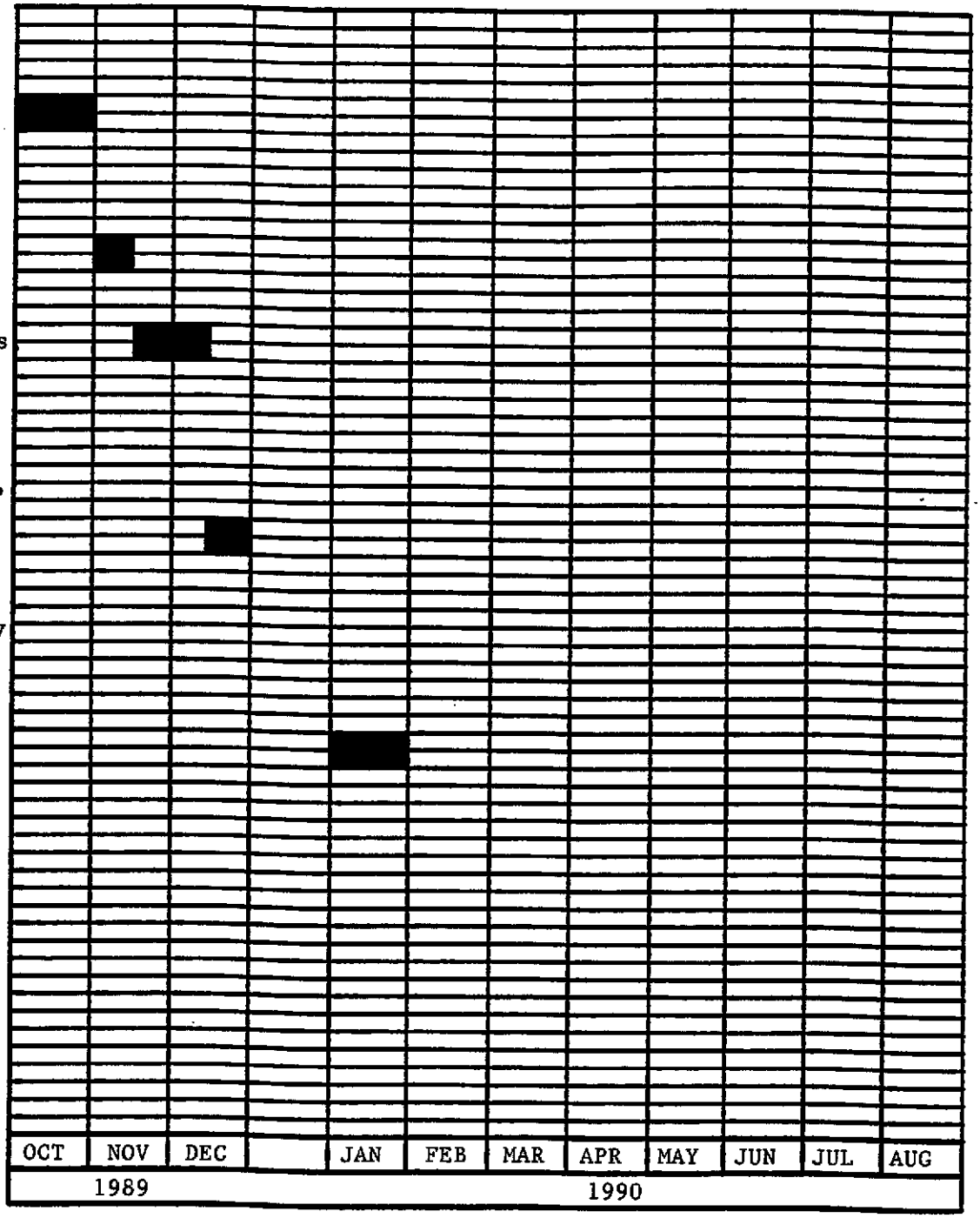
(A) Submit work plan to regulators for review and update the existing site safety plan, and permit proposed monitoring wells.

(B) Well Research

(C) Drill soil borings, collect soil samples and install monitoring wells.

(D) Develop monitoring wells, survey wells, analyze selected soil and groundwater samples in approved state-certified laboratory

(E) Prepare a report, summarizing our findings, conclusions, and recommendations.



Applied GeoSystems

PROJECT NO. 69038-1

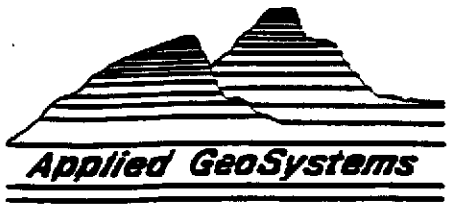
PRELIMINARY SCHEDULE
ARCO Station No. 4494
566 Hegenberger Road
Oakland, California

PLATE
P-3

APPENDIX A

CHAIN OF CUSTODY RECORD

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



SAMPLER (signature):

Phone:

LABORATORY:

TURNAROUND TIME:

Project Leader:

Phone No.

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Service Used

Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
	Received for laboratory by:		

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

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt