Applied GeoSystems

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

TRANSMITTAL

TO: MR. GIL WISTAR
ALAMEDA COUNTY HEALTH AGENCY
DEPARTMENT OF ENVIRONMENTAL HEALTH
80 SWAN WAY, ROOM 200
OAKLAND, CA 94621

DATE: 9/24/90
PROJECT NUMBER: 60000-3
SUBJECT: WORK PLAN

FROM: STEVE BITTMAN
TITLE: ASSISTANT PROJECT GEOLOGIST

WE ARE SENDING YOU [X] Attached [ ] Under separate cover via _____ the following items:

[ ] Shop drawings [ ] Prints [X] Reports [ ] Specifications

[ ] Letters [ ] Change Orders [ ] _____

COPIES	DATED	NO.	DESCRIPTION
1	9/20/90	60000-3	WORK PLAN SUBSURFACE INVESTIGATION AT ARCO STATION 771, 899 RINCON AVENUE, LIVERMORE, CA.

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 [ ] Return for corrections [ ] Return ___ corrected prints

[X] For your files [ ] _____

REMARKS: PER ARCO'S AUTHORIZATION, REPORT HAS BEEN FORWARDED FOR YOU REVIEW.

90 SEP 25 AM 10:39

Copies: 1 to AGS project file no. 60000-3 SJ READER"S FILE

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
SUPPLEMENTAL SUBSURFACE INVESTIGATION
at
ARCO Station 771
899 Rincon Avenue
Livermore, California

AGS 60000-3

Work Plan prepared for

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

by
Applied GeoSystems

Steve Bittman
Assistant Project Geologist

Diane M. Barclay
C.E.G. 1366

REGISTERED GEOLOGIST
DIANE M. BARCLAY
No. EG1366
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

September 20, 1990

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

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

September 20, 1990
AGS 60000-3

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

Subject: Transmittal of Work Plan 60000-3, Supplemental Subsurface Investigation at ARCO Station 771, 899 Rincon Avenue, Livermore, California.

Mr. Christie:

As requested by ARCO Products Company (ARCO), this Work Plan summarizes the results of a previous environmental investigation performed by Applied GeoSystems at the subject site. The Work Plan also describes the work proposed to evaluate the lateral and vertical extent of gasoline hydrocarbons detected in soil and ground-water near the area of four underground gasoline storage-tanks onsite. The proposed work includes drilling three soil borings onsite, constructing and developing 4-inch-diameter monitoring wells in the borings, collecting soil and ground-water samples for laboratory analysis, evaluating the ground-water flow direction and gradient, and preparing a report documenting our methods, findings and conclusions. Recommendations will be included in a cover letter enclosed with the report as requested by ARCO.

This work is required by the Alameda County Health Agency (ACHA) as outlined during a telephone conversation between Applied GeoSystems and Mr. Gil Wistar of the ACHA on July 25, 1990. The work necessary to satisfy these requirements is described in detail in the attached Work Plan, which includes a preliminary time schedule for the work.

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

Mr. Gil Wistar
Alameda County Health Agency
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94621

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

Mr. Randy Griffith
Livermore Fire Department
4550 East Avenue
Livermore, California 94550

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

Sincerely,
Applied GeoSystems

Steve Bittman

Steve Bittman
Assistant Project
Geologist

CONTENTS

TABLES

PLATES

APPENDICES

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
SUPPLEMENTAL SUBSURFACE INVESTIGATION
at
ARCO Station 771
889 Rincon Avenue
Livermore, California

For ARCO Products Company

INTRODUCTION

This Work Plan summarizes work previously conducted by Applied GeoSystems at ARCO Station 771, and describes the work proposed to evaluate the lateral and vertical extent of gasoline hydrocarbons detected in soil and ground-water in the area near four underground gasoline storage-tanks onsite. Preparation of this Work Plan was initiated after concentrations of total petroleum hydrocarbons as gasoline (TPHg) up to 190 parts per million (ppm) were discovered in the soil during the drilling of three soil borings adjacent to the four underground gasoline-storage tanks at the site in February 1990. ARCO Products Company (ARCO) requested that Applied GeoSystems prepare this Work Plan for submittal to the Alameda County Health Agency (ACHA), California Regional Water Quality Control Board (RWQCB), and the Livermore Fire Department after a Work Plan was requested by Mr. Gil Wistar of the ACHA on July 25, 1990.

The proposed work includes performing well research, drilling three soil borings onsite, constructing and developing 4-inch monitoring wells in the borings, collecting soil and ground-water samples for laboratory analyses, evaluating the ground-water flow direction and gradient, and preparing a report summarizing our methods, findings and conclusions. A preliminary time schedule for performing the proposed work is included. We understand that ARCO intends to replace the tanks at the site during 1991.

SITE DESCRIPTION

ARCO Station 771, 899 Rincon Avenue, Livermore, California, is an operating gasoline station and mini-market in a commercial and residential area. Residential homes lie to the north of the site, and east of the site across Rincon Avenue. A shopping center is to the south and west of the site. The site location is shown on the Site Vicinity Map (Plate 1). The elevation of the site is approximately 450 feet above mean sea level.

It is our understanding from information provided by ARCO that one 10,000-gallon underground gasoline-storage tank (designated T1), one 6,000-gallon underground gasoline-storage tank (designated T2) and two 4,000-gallon underground gasoline-storage tanks (designated T3 and T4) are present at the site. We also understand that tanks T2, T3, and T4 were installed approximately 25 years ago, tank T1 was installed approximately 15 years

ago, and that no other compounds are known to have been stored in the tanks. The locations of these tanks and other site features are shown on the Generalized Site Plan (Plate 2).

PREVIOUS WORK

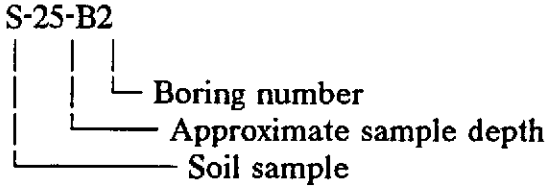
Limited Site Assessment - February 1990

Applied GeoSystems performed a limited site assessment (Applied GeoSystems, 1990) to evaluate the presence of gasoline hydrocarbons in the subsurface soil in the area adjacent to the four underground gasoline-storage tanks prior to ARCO's planned tank replacement at the site. This work involved drilling three soil borings, collecting and laboratory analyzing 12 soil samples from the borings, and preparing a report. The locations of the borings are shown on Plate 2. Ground water was encountered at a depth of approximately 33 feet below the ground surface in boring B-1. Borings B-2 and B-3 were terminated above ground water. Results of laboratory analyses of soil samples indicated the highest concentration of hydrocarbons (190 ppm TPHg) in the sample collected from a depth of approximately 32 feet in boring B-3. An approximately 1/8-inch thick layer of floating product was noted on the surface of a ground-water "grab" sample obtained from boring B-1. The results of laboratory analyses of soil samples collected during the drilling are summarized in Table 1.

TABLE 1
RESULTS OF LABORATORY ANALYSES
OF SOIL SAMPLES
ARCO Station 771
899 Rincon Avenue
Livermore, California

Sample Identification	Date	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes
S-10-B1	2/1/90	<1.0	<0.005	<0.005	<0.005	<0.005
S-19.5-B1	2/1/90	<1.0	0.022	0.024	<0.005	0.022
S-24.5-B1	2/1/90	<1.0	0.022	0.015	0.010	0.048
S-29.5-B1	2/1/90	<1.0	<0.005	<0.005	<0.005	<0.005
S-10-B2	2/1/90	<1.0	<0.005	<0.005	<0.005	<0.005
S-20-B2	2/1/90	<1.0	0.016	0.020	<0.005	0.025
S-25-B2	2/1/90	1.4	<0.01	<0.01	<0.01	0.018
S-31-B2	2/1/90	<1.0	<0.005	<0.005	<0.005	<0.005
S-10-B3	2/2/90	<1.0	<0.005	<0.005	<0.005	<0.005
S-19.5-B3	2/2/90	<1.0	0.028	<0.005	<0.005	0.017
S-25-B3	2/2/90	4.5	0.047	<0.01	0.011	0.038
S-32.5-B3	2/2/90	190	<1.0	<1.0	<1.0	1.7

Results in parts per million (ppm)
TPHg = Total Petroleum Hydrocarbons as gasoline
< = Indicates less than the detection limit for the specified method of analysis.



REGIONAL AND LOCAL HYDROGEOLOGY

The site is in the north-central portion of the Livermore Valley, within the Coast Ranges Geomorphic Province of Northern California. The Livermore Valley is approximately 13 miles long in an east-west direction, approximately 4 miles wide, and is surrounded by hills of the Diablo Range (California Department of Water Resources, 1974). The valley slopes gently toward the west. The principal streams in the area are the Arroyo Valle and Arroyo Mocho, which flow toward the western end of the valley. Arroyo Mocho is approximately 1/10 mile south-southwest of the site, and Arroyo Valle is approximately 2-3/4 miles southwest of the site.

The Livermore Valley ground-water basin is divided into sub-basins on the basis of fault traces or other hydrogeologic discontinuities (California Department of Water Resources, 1974). The ground-water system in Livermore Valley is a multi-layered system with an unconfined aquifer overlying a sequence of leaky or semiconfined aquifers. Ground water in the basin flows downslope toward the east-west-trending axis of the valley and then flows generally to the west. Regional ground water is inferred to flow to the west-northwest and is approximately 30 feet below the ground surface (Alameda County Flood Control, Zone 7, 1986).

PROPOSED WORK

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

(A) Update the existing Site Safety Plan.

(A) Obtain permits for installation of monitoring wells at the site.

(B) Perform well research.

(C) Drill three borings (B-4 through B-6) to a maximum depth of approximately 50 feet below grade, and construct and develop 4-inch-diameter ground-water monitoring wells (MW-1 through MW-3) in the borings.

(C) Collect and classify relatively undisturbed soil samples.

(D) Analyze selected soil samples from the borings in a state certified laboratory.

(D) Collect and analyze water samples from the monitoring wells in a state certified laboratory.

(D) Survey the wells using a licensed land surveyor, and measure ground-water levels in the wells to enable interpretation of the ground-water gradient.

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

Field methods used in the drilling of borings, sampling of soil, construction and development of wells, and sampling of ground-water are described in the attached Field Protocol, Appendix A. Other details regarding the proposed work are described below.

Well Research

Information regarding water wells and their usage near the site will be researched using information supplied by the Alameda County Flood Control and Water Conservation District Zone 7 (ACFCWCD), and the California Department of Water Resources (DWR). This will be done for an area within approximately a 1/2 mile radius of the site.

Rationale for Soil Boring/Monitoring Well Locations

The rationale for the proposed locations of the soil borings/monitoring wells is based on hydrocarbon concentrations reported in soil samples collected during our previous investigation and on future site work planned by ARCO. According to ARCO, the existing underground gasoline-storage tanks are scheduled for replacement in 1991. Locations of soil borings/monitoring wells are therefore not proposed immediately adjacent to the underground gasoline-storage tanks since they would likely be damaged or destroyed during removal of the tanks.

- Boring B-4/MW-1 will be located near the ~~eastern~~ western end (within approximately 20 to 25 feet) of the existing underground gasoline-storage tanks to evaluate the lateral and vertical extent of hydrocarbons in the soil and the presence of hydrocarbons in the ground water in the inferred downgradient direction of ground-water flow from the tanks.

- Boring B-5/MW-2 will be located near the southeastern corner of the underground gasoline-storage tanks to evaluate the vertical and lateral extent of hydrocarbons in the soil and the presence of hydrocarbons in the ground water in the inferred upgradient direction of ground-water flow.

- Boring B-6/MW-3 will be located in the inferred downgradient direction of ground-water flow from the dispenser island to evaluate the vertical and lateral extent of hydrocarbons in the soil and the presence of hydrocarbons in the ground-water in this area.

- Monitoring wells MW-1, MW-2, and MW-3 will also be used to interpret the ground-water gradient (magnitude and direction) of the first-encountered ground water beneath the site.

Laboratory Analysis

Selected soil samples collected from the borings will be analyzed for TPHg by modified Environmental Protection Agency (EPA) Method 3050/8015, and for BTEX by EPA Method 5030/8020. Water samples collected from MW-1 through MW-3 will be analyzed for TPHg by modified EPA Method 5030/8015 and for BTEX by EPA Method 602. The concentrations detected and detection limits will be stated on the laboratory reports.

Report Preparation

A report will be provided summarizing the methods, results, interpretations, and conclusions. 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 ACHA and ARCO. A preliminary time schedule for the proposed work is presented in Plate 3.

PROJECT STAFF

Ms. Diane M. Barclay, a Certified Engineering Geologist (C.E.G. 1366) in the State of California, will be in overall charge of this project. Mr. Greg Barclay, Branch Manager, will provide supervision of field and office operations of the project. Mr. Steve Bittman, 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.

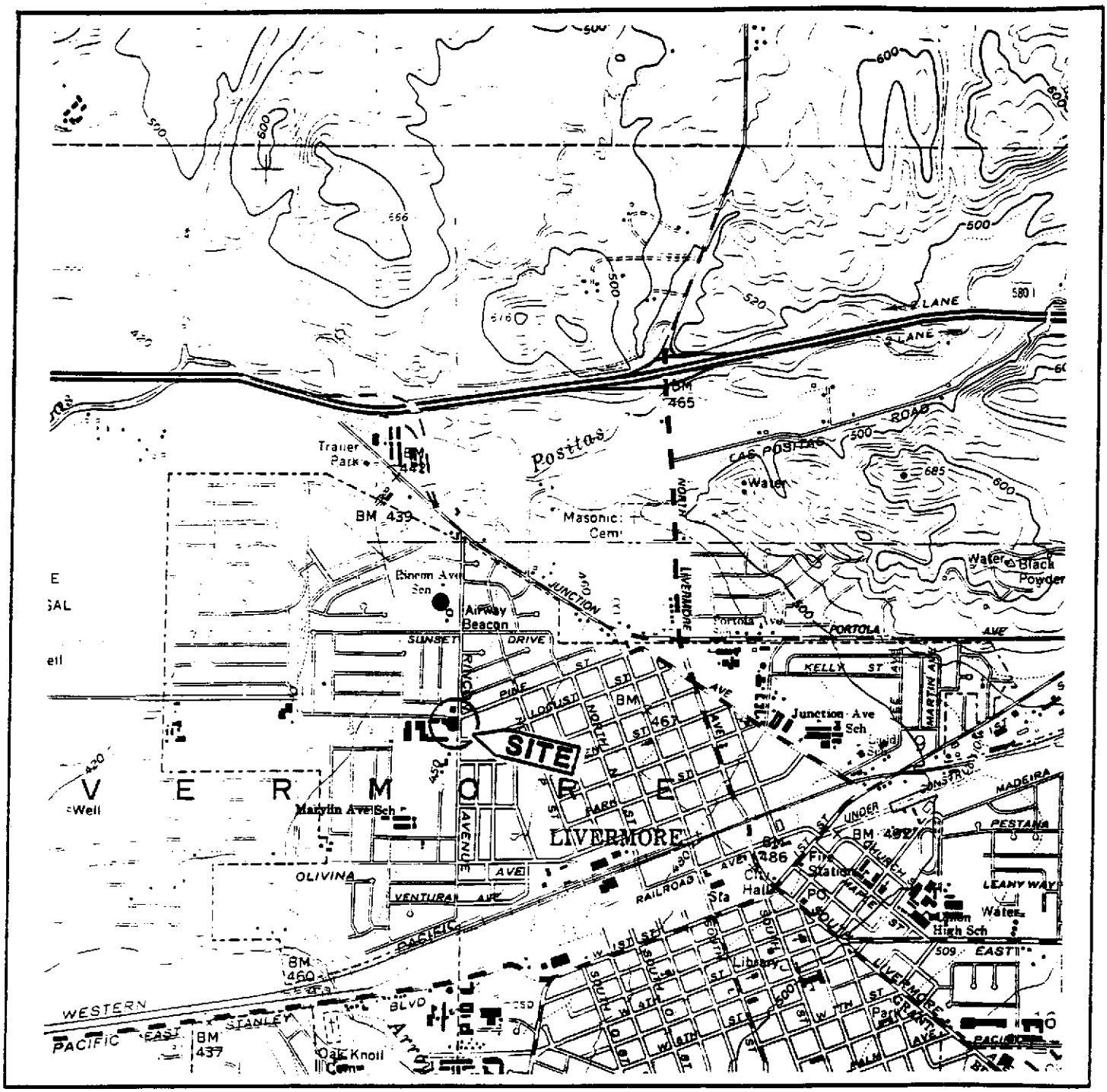
REFERENCES

Alameda County Flood Control and Water Conservation District, Zone 7, Water Resources Engineering. 1986. Water Level Contours. 1 inch = 3000 feet scale map.

Applied GeoSystems. June 22, 1990. Limited Environmental Site Assessment, ARCO Station 771, Livermore, California, AGS Report No. 60000-1.

Brown and Caldwell. September 16, 1987. Soil Sample Results for Waste Oil Tank Removal, ARCO Station 771: Report No. 17/3456-02/3.

California Department of Water Resources. 1974. Evaluation of Ground-Water Resources Engineering Livermore and Sunol Valleys: Bulletin No. 118-2, Appendix A.



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

Approximate Scale

2000 1000 0 2000 4000

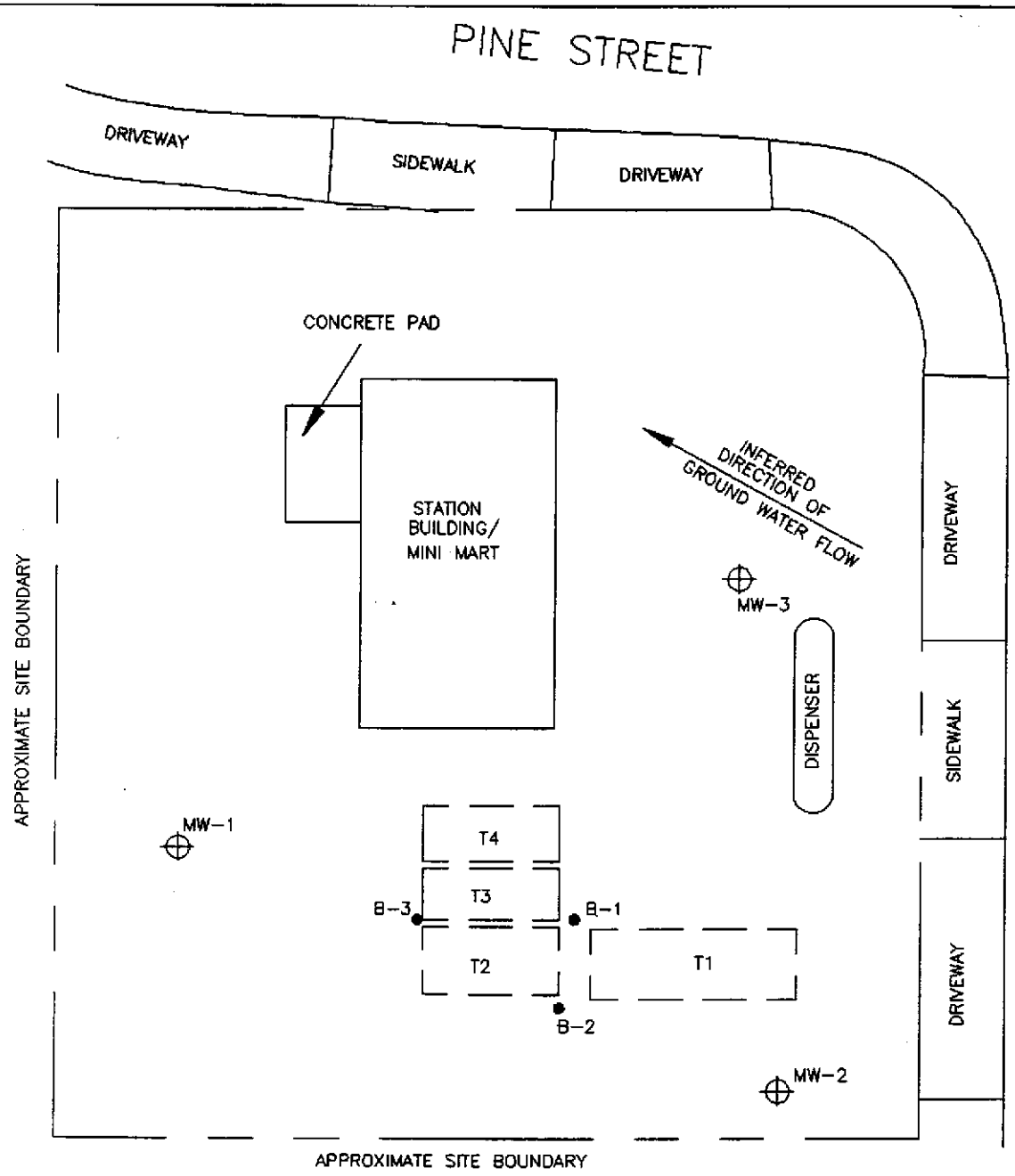
feet

Applied GeoSystems

PROJECT 60000-3

SITE VICINITY MAP
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 1



EXPLANATION

MW-3 ⊕ = Proposed Monitoring Wells

B-3 ● = Soil boring

T4 = Underground gasoline-storage tank

N

Approximate Scale

20 10 0 20 40

feet

Source: Modified from plan supplied by ARCO.

Applied GeoSystems

PROJECT 60000-3

GENERALIZED SITE PLAN
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
2

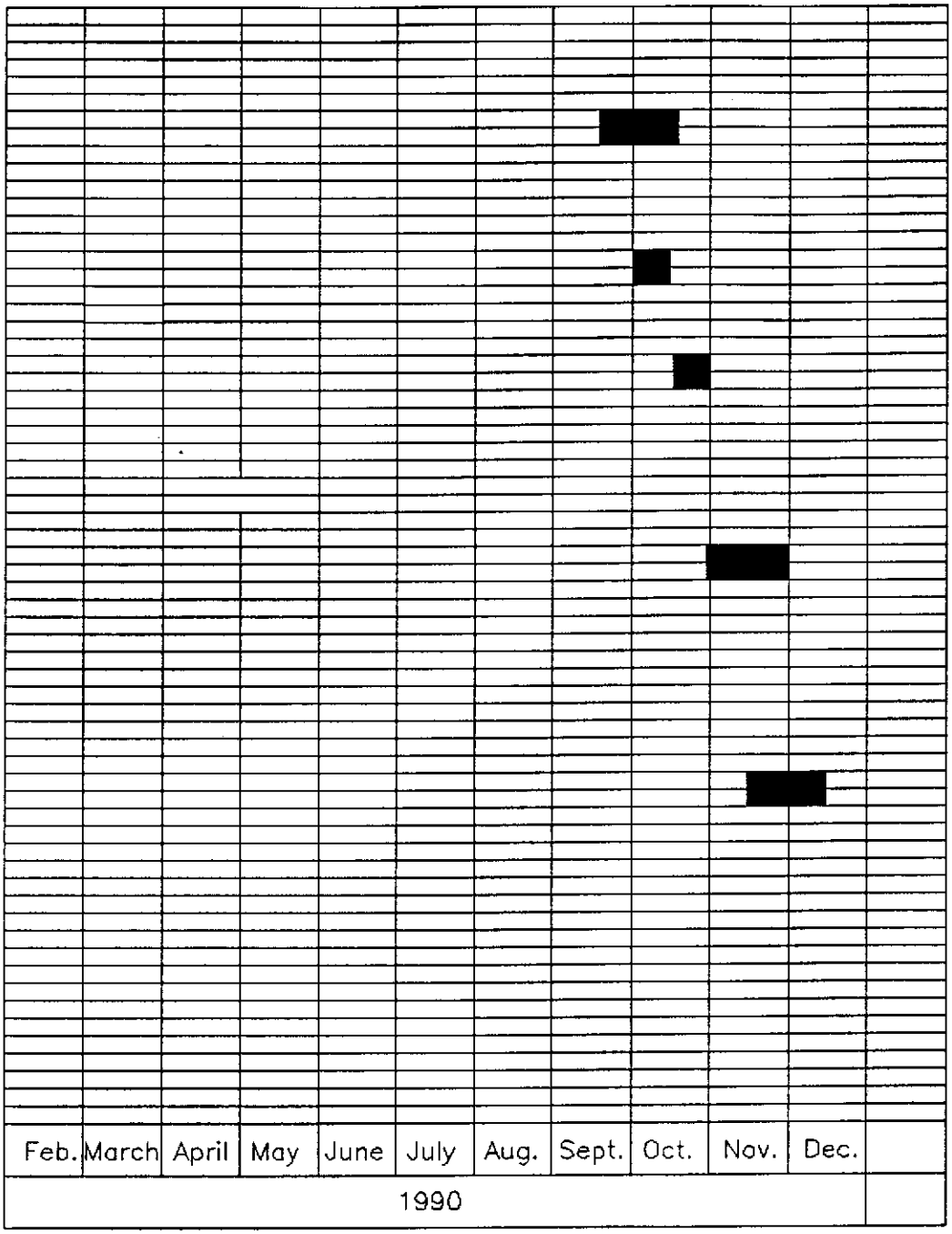
(A) Update the existing site safety plan, and permit proposed monitoring wells.

(B) Well research.

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

(D) Survey wells measure ground–water levels, collect water samples, analyze selected soil and ground–water samples in approved state–certified laboratory.

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



Applied GeoSystems

PROJECT **60000-3**

PRELIMINARY TIME SCHEDULE
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
3

APPENDIX A

FIELD PROTOCOL

The following presents Applied GeoSystems' protocol for a typical site investigation involving gasoline hydrocarbon-impacted soil and/or ground water.

Site Safety Plan

The Site Safety Plan describes the safety requirements for the evaluation of gasoline hydrocarbons in soil and ground-water 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 are be briefed on the contents of the Site Safety Plan before work begins. A copy of the Site Safety Plan is available for reference by appropriate parties during the work. A site Safety Officer is assigned to the project.

Soil Borings

Prior to the drilling of borings and construction of monitoring wells, permits are acquired from the appropriate regulatory agency. In addition to the above-mentioned permits, encroachment permits from the City or State are acquired if drilling of borings offsite in the City or State streets is necessary. Copies of the permits are included in the appendix of the project report. Prior to drilling, Underground Services Alert is notified of our intent to drill, and known underground utility lines and structures are approximately marked.

The borings are drilled by a truck-mounted drill rig equipped with 8- or 10-inch-diameter, hollow-stem augers. The augers are steam-cleaned prior to drilling each boring to minimize the possibility of cross-contamination. After drilling the borings, monitoring wells are constructed in the borings, or neat-cement grout with bentonite is used to backfill the borings to the ground surface.

Borings for ground-water monitoring wells are drilled to a depth of no more than 20 feet below the depth at which a saturated zone is first encountered, or a short distance into a stratum beneath the saturated zone which is of sufficient moisture and consistency to be judged as a perching layer by the field geologist, whichever is shallower. Drilling into a

deeper aquifer below the shallowest aquifer can begin only after a conductor casing is properly installed and allowed to set, to seal the shallow aquifer.

Soil Sampling

Soil samples for laboratory analysis are collected at 5-foot intervals from each boring, at or near stratigraphic 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 are 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 is 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 is counted and recorded to evaluate the relative consistency of the soil. During drilling, the soil samples are subjectively evaluated for the presence of hydrocarbons. Subjective evaluation is based on the presence of soil discoloration and measurements from a portable organic vapor meter (OVM). Field instruments such as the OVM are capable of evaluating relative hydrocarbon vapor concentrations, but cannot be used to measure hydrocarbon concentrations with the precision of laboratory analysis. The OVM measurements are recorded.

Samples selected for laboratory analysis are removed from the sampler and promptly sealed in their brass sleeves with aluminum foil, plastic caps, and aluminized duct tape. The samples are then 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 are kept throughout handling of the samples tested.

Disposal of Soil Cuttings

Drill cuttings subjectively evaluated as having hydrocarbon concentrations of 100 parts per million (ppm) or greater are separated from those subjectively evaluated as having hydrocarbon concentrations less than 100 ppm. Soil cuttings are placed on and covered by plastic sheets. Subjective evaluation is based on the presence of soil discoloration and on measurements from an OVM. The drill cuttings should be disposed of at an appropriate landfill. Disposal of cuttings generated during the work remains the responsibility of ARCO.

Ground-Water Monitoring Well Construction

Monitoring wells are constructed in selected borings using clean 4-inch-diameter, thread-jointed, Schedule 40 polyvinyl chloride (PVC) casing. No chemical cements, glues, or solvents are used in well construction. Each casing bottom is sealed with a threaded end-plug, and each casing top with a locking plug. The screened portions of the wells are constructed of machine-slotted PVC casing with 0.020-inch-wide (typical) slots for initial site wells. Slot size for subsequent wells may be based on sieve analysis and/or well development data. The screened sections in ground-water monitoring wells are placed to allow monitoring during seasonal fluctuations of ground-water levels.

The annular space of each well is backfilled with No. 2 by 12 sand, or similar sorted sand, to approximately two feet above the top of the screened casing for initial site wells. The sand pack grain size for subsequent wells may be based on sieve analysis and/or well development data. A 1- to 2-foot-thick bentonite plug is placed above the sand as a seal against cement entering the filter pack. The remaining annulus is then backfilled with a slurry of water, neat cement, and bentonite to approximately one foot below the ground surface.

An aluminum utility box with a PVC apron is placed over each wellhead and set in concrete placed flush with the surrounding ground surface. Each wellhead cover has a seal to protect the monitoring well against surface-water infiltration and requires a special wrench to open. The design discourages vandalism and reduces the possibility of accidental disturbance of the well.

Ground-Water Monitoring Well Development

The monitoring wells are developed by bailing or over-pumping and surge-block techniques. The wells are either bailed or pumped, allowed to recharge, and bailed or pumped again until the water removed from the wells is determined to be clear. Turbidity measurements (in NTU's) are recorded during well development and are used in evaluating well development. The development method used, initial turbidity measurement, volume of water removed, final turbidity measurement, and other pertinent field data and observations are included in reports. The wells are allowed to equilibrate for at least 48 hours after development prior to sampling. Water generated by well development will be stored in 17E Department of Transportation (DOT) 55-gallon drums on site and will remain the responsibility of the client.

Measurement of Ground-Water Levels

Ground-water elevations are measured to enable interpretation of the ground-water gradient beneath the site. The elevation of the top of each well casing is referenced to National Geodetic Vertical Datum by a licensed land surveyor. The static water level in each well is measured to the nearest 0.01-foot using a Solinst® electric water-level sounder or oil/water interface probe (if the wells contain floating product) cleaned with Alconox® and water before use in each well.

Ground-Water Sampling

The liquid in the wells is examined for visual evidence of hydrocarbons by gently lowering approximately half the length of a Teflon® bailer (cleaned with Alconox® and water) past the air/water interface. The sample is then retrieved and inspected for floating product, sheen, emulsion, color, and clarity. The thickness of floating product detected is recorded to the nearest 1/8-inch.

Wells which do not contain floating product are purged using a submersible pump. The pump, cables, and hoses are cleaned with Alconox® and water prior to use in each well. The wells are purged until withdrawal is of sufficient duration to result in stabilized pH, temperature, and electrical conductivity of the water, as measured using portable meters calibrated to a standard buffer and conductivity standard. If the well becomes dewatered, the water level is allowed to recover to at least 80 percent of the initial water level. Prior to the collection of each ground water sample, the Teflon® bailer is cleaned with Alconox® and rinsed with tap water and deionized water, and the latex gloves worn by the sampler changed. Hydrochloric acid is added to the sample vials as a preservative (when applicable). A sample method blank is collected by pouring distilled water into the bailer and then into sample vials. A sample of the formation water is then collected from the surface of the water in each of the wells using the Teflon® bailer. The water samples are then gently poured into laboratory-cleaned, 40-milliliter (ml) glass vials, 500 ml plastic bottles or 1-liter glass bottles (as required for specific laboratory analysis) and sealed with Teflon®-lined caps, and inspected for air bubbles to check for headspace, which would allow volatilization to occur. The samples are then labeled and promptly placed in iced storage. A field log of well evacuation procedures and parameter monitoring is maintained. Water generated by the purging of wells is stored in 17E DOT 55-gallon drums onsite and remains the responsibility of the client. A Chain of Custody Record is initiated by the geologist and kept throughout handling of the samples, and accompanies the samples to a laboratory certified by the State of California for the analyses requested.