TRANSMITTAL FORM

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

Date	Project No.
4/5/90	69013-3W
Subject: WORK PLAN	

TO MR. SCOTT SEERY
ALAMEDA COUNTY HEALTH CARE SERVICES AGENCY
DEPARTMENT OF ENVIRONMENTAL HEALTH
80 SWAN WAY, ROOM 200
OAKLAND, CA 94621

FROM STEVE BITTMAN

TITLE STAFF GEOLOGIST

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

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1	4/1/90		TRANSMITTAL OF WORK PLAN NO. 69013-3W, INITIAL SUBSURFACE INVESTIGATION
			AT ARCO STATION NO. 2152, 22141 CENTER STREET, CASTRO VALLEY, CA.

THESE ARE TRANSMITTED as checked below:

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April 10, 1990
AGS 69013-3W

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

Subject: Transmittal of Work Plan No. 69013-3W, Initial Subsurface Investigation at ARCO Station No. 2152, 22141 Center Street, Castro Valley, 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 (AGS Report No. 69013-2, January 18, 1990) at the subject site and proposes additional work to evaluate the extent of gasoline hydrocarbons detected in the soil beneath the former underground gasoline-storage tank pit and product dispenser lines. The proposed work includes: (1) drilling four additional soil borings in the area of the underground gasoline storage tanks and constructing two 4-inch-diameter ground-water monitoring wells and two 4-inch-diameter vapor extraction wells in the borings; (2) drilling two soil borings in the inferred down gradient direction of the underground storage tanks and constructing two ground-water monitoring wells in the borings; (3) drilling one soil boring near the southeastern corner of the underground storage tanks; (4) drilling two shallow soil borings in the area of the dispenser islands; (5) collecting soil samples for laboratory analysis; (6) developing the wells; (7) collecting water samples for laboratory analysis; (8) evaluating the ground-water flow direction and gradient; and (9) preparing a report documenting our findings, conclusions, and recommendations.

This work is required by the Alameda County Health Care Services Agency as outlined in a letter to you dated December 26, 1989. 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. Scott O. Seery
Alameda County Health Care Services 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. Robert Bowman
Castro Valley Fire Department
20336 San Miguel Avenue
Castro Valley California 94550

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

Sincerely,
Applied GeoSystems

Steve Bittman
Staff Geologist

TRANSMITTAL FORM

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

Date	Project No.
4/11/90	69013-3W

Subject: REVISED TRANSMITTAL OF WORK PLAN

TO MR. SCOTT SEERY
ALAMEDA COUNTY HEALTH CARE SERVICES AGENCY
DEPARTMENT OF ENVIRONMENTAL HEALTH
80 SWAN WAY, ROOM 200
OAKLAND, CA 94621

FROM STEVE BITTMAN

TITLE STAFF GEOLOGIST

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COPIES	DATED	NO.	DESCRIPTION
1	4/10/90		REVISED--TRANSMITTAL OF WORK PLAN NO. 69013-3W, INITIAL SUBSURFACE
			INVESTIGATION AT ARCO STATION NO. 2152, 22141 CENTER STREET, CASTRO
			VALLEY, CA.

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WORK PLAN
INITIAL SUBSURFACE INVESTIGATION
at
ARCO Station No. 2152
22141 Center Street
Castro Valley, California

AGS Job 69013-3W

Work Plan prepared for

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

by
Applied GeoSystems

Steve Bittman
Staff Geologist

Michael N. Clark
C.E.G. 1264

April 1, 1990

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

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

April 1, 1990
AGS 69013-3W

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

Subject: Transmittal of Work Plan No. 69013-3W, Initial Subsurface Investigation at ARCO Station No. 2152, 22141 Center Street, Castro Valley, 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 (AGS Report No. 69013-2, January 18, 1990) at the subject site and proposes additional work to evaluate the extent of gasoline hydrocarbons detected in the soil beneath the former underground gasoline-storage tank pit and product dispenser lines. The proposed work includes drilling three additional soil borings in the area of the underground gasoline-storage tanks, constructing three 4-inch-diameter monitoring wells in the borings by the gasoline tanks, drilling shallow borings in the area of the dispenser islands and by the northwestern side of the tank pit, collecting soil samples for laboratory analysis, developing the wells, collecting water samples for laboratory analysis, evaluating the ground-water flow direction and gradient, and preparing a report documenting our findings, conclusions, and recommendations.

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Sincerely,
Applied GeoSystems

Steve Bittman
Staff Geologist

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PLATES

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 Station No. 2152
22141 Center Street
Castro Valley, California

For ARCO Products Company

INTRODUCTION

This Work Plan summarizes work previously conducted by Applied GeoSystems at ARCO Station No. 2152 and describes the work proposed to evaluate the lateral and vertical extent of hydrocarbons in the soil and ground water beneath the site. Preparation of this Work Plan was initiated after concentrations of total petroleum hydrocarbons as gasoline (TPHg) above regulatory guidelines were discovered in the soil beneath two of the gasoline tanks and beneath the vapor recovery system during tank replacement activities at the site. A preliminary time schedule for performing the proposed work at the site is included. ARCO Products Company (ARCO) requested that Applied GeoSystems prepare this Work Plan for submittal to the Alameda County Health Care Services Agency, California Regional Water Quality Control Board (RWQCB), and the Castro Valley Fire Department.

The proposed work includes:

(1) Updating the Site Safety Plan discussing the precautions and protective equipment for work at the site;

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

(3) Drilling four borings (B-4 through B-7) to a maximum depth of approximately 70 feet below grade; two in the area of the gasoline-tank pit, and two in the inferred down gradient direction of groundwater flow;

(4) Drilling two borings (B-8 and B-9) to a maximum depth of approximately 50 feet below grade in the area of the gasoline-tank pit;

(5) Drilling one soil boring (B-10) to a maximum depth of approximately 50 feet below grade southeast of the tank pit near an area of reported hydrocarbon contamination;

(6) Drilling three (or two??) shallow soil borings (B-11 through B-13) to a depth of approximately 10 feet below grade near the dispenser islands and northwest

of the former location of tank T1 in areas of previously reported hydrocarbon contamination;

(7) Collecting and logging soil samples at least every five feet in the borings;

(8) Analyzing selected soil samples from each boring for total petroleum hydrocarbons as gasoline (TPHg), and the gasoline constituents benzene, toluene, ethylbenzene and total xylenes (BTEX);

(9) Constructing 4-inch-diameter ground-water monitoring wells in soil borings B-4 through B-7 to monitor and evaluate the extent of hydrocarbons in the ground water;

(10) Constructing 4-inch-diameter vadose-zone wells in soil borings B-8 and B-9 for purposes of possible hydrocarbon vapor extraction from the soil in areas of detected hydrocarbon contamination;

(11) Survey the ground-water monitoring wells using a licensed land surveyor, and measuring ground-water levels in the wells to enable interpretation of the ground-water gradient;

(12) Collecting and analyzing water samples from the ground-water monitoring wells at the site; and

(13) Preparing a report summarizing our field and laboratory procedures, findings and conclusions.

SITE DESCRIPTION

ARCO Service Station No. 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. Residential areas are southeast and southwest of the site, and commercial developments are northwest across Grove Way and northeast across Center Street. Local topography near the vicinity of the site slopes gently to the southwest. The site contains three underground fiberglass 12,000-gallon gasoline-storage tanks installed in August 1989. These tanks replaced four underground 6,000-gallon gasoline-storage tanks (T2 through T5), installed in 1976, a vapor recovery system installed in 1976, and one 12,000-gallon gasoline-storage tank (T1) installed in 1983. The new tanks were installed in the original tank pit. It is our understanding, based on information supplied by ARCO, that former tank T1 stored unleaded supreme

gasoline, tanks T2 through T4 stored unleaded regular gasoline, and tank T5 stored leaded regular gasoline. The approximate locations of the former tanks, new tanks, and other site facilities are shown on the Generalized Site Plan (Plate 2).

PREVIOUS WORK AT THE SITE

Limited Site Assessment - May 1989

Applied GeoSystems performed a limited site assessment (Applied GeoSystems Report No. 69013-1, dated May 26, 1989) to evaluate the extent of potential soil contamination near the underground storage tanks prior to ARCO's planned tank replacement at the site. This work was performed using ARCO's guidelines for preliminary tank replacement assessments, and involved drilling three soil borings close to the fill end of the tanks. The locations of the borings are shown on Plate 2. Ground water was not encountered in the borings to a depth of 45 feet. The results of laboratory analyses of soil samples collected during the drilling are summarized in Table 1.

TABLE 1
RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES
ARCO Station No. 2152
22141 Center Street
Castro Valley, California
Page 1 of 2

Date	Sample Identifier	TPHg	B	T	E	X
4/13/89	S-10-B1	ND	ND	ND	ND	ND
4/13/89	S-20-B1	ND	0.11	0.15	ND	0.19
4/13/89	S-25-B1	ND	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	ND	0.10	ND	ND	ND
4/13/89	S-45-B1	ND	ND	ND	ND	ND
4/13/89	S-10-B2	ND	ND	ND	ND	ND
4/13/89	S-20-B2	ND	ND	ND	ND	ND
4/13/89	S-25-B2	ND	ND	ND	ND	ND
4/13/89	S-30-B2	ND	ND	ND	ND	ND

See notes on page 2 of 2.

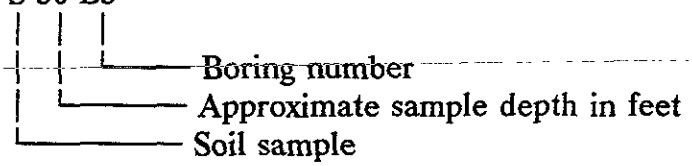
TABLE 1
RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES
ARCO Station No. 2152
22141 Center Street
Castro Valley, California
Page 2 of 2

Date	Sample Identifier	TPHg	B	T	E	X
4/13/89	S-5-B3	460	5.1	34	9.6	51
4/13/89	S-10-B3	5.6	ND	0.11	ND	1.0
4/13/89	S-20-B3	ND	ND	ND	0.055	0.068
4/13/89	S-25-B3	ND	ND	ND	0.17	0.16
4/13/89	S-30-B3	ND	ND	ND	ND	ND

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 xylene isomers
ND: Less than the detection limit of the specified analysis.

Analytical Methods: TPHg: EPA 5030/8015
BTEX: EPA 8020

Sample identification: S-30-B3



Tank Removal and Replacement - August through October 1989

On August 17, 1989, a field geologist from Applied GeoSystems was present at the site to observe removal of five underground storage tanks (designated T1 through T5), examine their outer surfaces, and collect soil samples from beneath each tank (Applied GeoSystems Report No. 69013-2, January 18, 1989). Tanks T1 through T5 were removed, and three 12,000-gallon fiberglass replacement storage tanks were installed in the original pit which was backfilled with pea-gravel. Four 12-inch-diameter PVC conductor casings were installed between the replacement tanks to provide access for future drilling activities. A summary of observations during tank inspection is presented in Table 2.

TABLE 2
SUMMARY OF OBSERVATIONS DURING TANK INSPECTION
ARCO Station No. 2152
22141 Center Street
Castro Valley, California

Tank T1	(gasoline): fiberglass, 12,000-gallon-capacity, ruptured upon removal, no holes observed in two separate pieces removed.
Tank T2	(gasoline): steel, tar-coated, 6,000-gallon-capacity, slightly rusted, no holes observed, dissolved tar coating at fill end.
Tank T3	(gasoline): steel, tar-coated, 6,000-gallon-capacity, slightly rusted, no holes observed, dissolved tar coating at fill end.
Tank T4	(gasoline): steel, tar-coated, 6,000-gallon-capacity, slightly rusted, no holes observed, dissolved tar coating at fill end.
Tank T5	(gasoline): steel, tar-coated, 6,000-gallon-capacity, slightly rusted, no holes observed, dissolved tar coating at fill end.

Soil Sampling Beneath Tanks

A total of 24 samples of native soil were collected from the gasoline-tank pit at depths of 13 to 22 feet. Samples were initially collected from beneath the fill port and opposite end of each tank at a depth of approximately 13 feet. Additionally, one soil sample was collected from beneath the northeastern ends of each tank at a depth of approximately 18 feet. One additional soil sample was collected from beneath T5 at a depth of 22 feet. Soil samples also were collected from the walls of the excavation at the northern and eastern

corners of the pit (corresponding to the fill-port ends of tanks T1 and T5) and from beneath the vapor-recovery system, which was located in the southern-central portion of the pit. One soil sample was collected from the bottom of the pit in both the south corner and the west corner respectively. Soil sample locations from inside the tank pit are presented in Tank Pit Soil Sampling Locations, (Plate 3).

Soil Sampling Beneath Product Lines

During the removal of the product-transfer lines, an area between the Center Street islands measuring approximately 35 feet by 20 feet by 3 feet deep was excavated and a total of 14 soil samples collected from the bottom of the excavation in the areas of existing and abandoned product lines. Two soil samples were collected from beneath the existing product lines feeding the single dispenser island near Grove Way and two samples collected from beneath two abandoned lines adjacent to the Grove Way dispenser island. The locations where samples were collected along the former locations of the product lines are presented in Product-Line Soil Sample Locations, (Plate 4).

Laboratory Analyses

Forty-two soil samples collected from the gasoline-tank pit and beneath the product lines were analyzed for TPHg by modified Environmental Protection Agency (EPA) Method

5030/8015 and for purgeable gasoline constituents benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) by EPA Method 8020. The results of the laboratory analyses of soil samples from the gasoline-tank pit are presented in Table 3 and on Plate 3. Laboratory results of analysis of samples collected from the product-line trenches are presented in Table 4 and are also shown on Plate 4.

TABLE 3
RESULTS OF LABORATORY ANALYSES OF TANK-PIT SOIL SAMPLES
ARCO Station No. 2152
22141 Center Street
Castro Valley, California
(Page 1 of 2)

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

See Note on Page 2 of 2.

TABLE 3
RESULTS OF LABORATORY ANALYSES OF TANK-PIT SOIL SAMPLES
ARCO Station No. 2152
22141 Center Street
Castro Valley, California
(Page 2 of 2)

Date	Sample #	TPHg	B	T	E	X
Tank-Pit Excavation (Continued)						
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	380	2,600

Results in parts per million (ppm).
TPHg: Total petroleum hydrocarbons as gasoline
B: Benzene T: Toluene E: Ethylbenzene X: Total xylenes.
<: Less than the method detection limit.
Sample ID: S-14-T1S
- S: Soil sample
- 1: Approximate sample depth in feet
- T: Area of sample (See Plate 4)

TABLE 4
RESULTS OF LABORATORY ANALYSES OF PRODUCT-LINE SOIL SAMPLES
ARCO Station No. 2152
22141 Center Street
Castro Valley, California
(Page 1 of 2)

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

See Notes on Page 2 of 2.

TABLE 4
RESULTS OF LABORATORY ANALYSES OF PRODUCT-LINE SOIL SAMPLES
ARCO Station No. 2152
22141 Center Street
Castro Valley, California
(Page 2 of 2)

Date	Sample #	TPHg	B	T	E	X
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-5-PL21
| | └ Area of sample (See Plate 4)
| └── Approximate sample depth in feet below grade
└──── Soil sample

On the basis of the results of laboratory analyses of soil samples S-18-T1N and S-22-VR1, we concluded that the vertical extent of soil contamination beneath the northeastern end of tank T1 and beneath the former vapor recovery system had not been delineated. However, the lateral extent of hydrocarbon contamination in the area of the former tanks and vapor-recovery system 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.

This conclusion was based on the fact that nondetectable concentrations of TPHg were present in seven soil samples collected from the tank-pit floor and walls. This conclusion was supported further by results of analysis of soil samples collected from the three soil borings drilled in April 1989, indicating TPHg concentrations of 5.6 ppm and less at depths of 10 to 45 feet, and 460 ppm at a depth of 5 feet northwest of tank T1.

Results of laboratory analyses of soil samples collected from beneath the product-dispenser lines suggested that the majority of contaminated soil had been removed. This was based on TPHg concentrations ranging from <2 ppm to 73 ppm in 11 soil samples collected from beneath the lines at a depth of approximately 3 feet. However, TPHg concentrations of 100 to 190 ppm in samples from the southwestern ends of the dispenser islands near Grove Way and Center Street indicate that the vertical extent of gasoline had not been delineated in these areas.

The potential impact on ground water quality resulting from possible downward migration of hydrocarbons in the soil beneath former tanks and vapor recover system had also not been evaluated.

REGIONAL AND LOCAL HYDROGEOLOGY

Regionally, the site is in the Castro Valley Basin with the Diablo Range to the east, the Hayward Fault to the west, Lake Chabot to the north, and the city limit of Hayward to the south. The site area 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. This unit underlies the entire East Bay Plain west of the Hayward Fault, extends under San Francisco Bay, and is the major ground-water reservoir in the East Bay Plain Area. Wells completed in the site area where this alluvium is finer grained and thinner do not yield as much water as wells in the East Bay Plain itself (Hickenbottom, 1988). The inferred direction of ground-water flow is toward the southwest based on regional and local topography and surface drainage patterns.

The site is at an elevation of approximately 245 feet above mean sea level. The shallow soil at the site consists of silty clay with some sandy clay underlain by clayey gravel. Ground water was not encountered in the borings to an approximate maximum depth of 45 feet. Depth to ground water in the area of the site has been reported to be approximately 50 feet below the ground surface (Hickenbottom, 1988).

PROPOSED WORK

We propose the following tasks for the subsurface investigation at the site. The following work descriptions and letter designations correlate to time frames on the attached Preliminary Time Schedule (Plate 5):

(A) Submit a Work Plan to the local regulators for review.

(A) Prepare a Site Safety Plan.

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

(B) Perform a 1/2-mile radius well search using information supplied by ACFCWCD and the DWR.

(C) Drill two soil borings in the area of the underground storage tanks, and two borings in the inferred downgradient direction of ground-water flow at the proposed locations shown on Proposed Well Locations (Plate 6), and construct four 4-inch-diameter ground-water monitoring wells in the borings.

(C) Collect and classify relatively undisturbed soil samples at 5-foot intervals, at stratigraphic changes, and at the bottom of the boring if a confining layer is encountered.

(D) Develop the new wells (MW-1, MW-2, MW-3, and MW-4) and collect water samples from the wells.

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

(D) Analyze selected soil and ground-water samples for TPHg and BTEX in a State-certified laboratory. How so selected ?

(E) Drill two soil borings in the area of the underground storage tanks in the proposed locations shown on Plate 6, and construct two 4-inch-diameter vapor extraction wells (VEW-1 and VEW-2) in the borings.

(E) Analyze selected soil samples for TPHg and BTEX, in a State-certified laboratory. How so selected

(F) Drill one soil boring near the southeastern corner of the underground storage tanks as shown on Proposed Soil Boring Locations (Plate 7).

(F) Analyze selected soil samples for TPHg and BTEX, in a State-certified laboratory. How so selected?

(G) Drill three shallow soil borings near the southwestern ends of the dispenser islands and northwest of the former location of tank T-1 as shown on Plate 7.

(G) Analyze selected soil samples for TPHg and BTEX, in a State-certified laboratory. How so selected?

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

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 ACFCWCD, and the DWR, to evaluate ground-water usage in the vicinity of the site. The research will be performed for an area of approximately a 1/2-mile radius of the site.

Soil Borings and Wells

Prior to drilling the borings and constructing wells at the site, permits will be acquired from ACFCWCD. Soil borings completed with a ground-water monitoring well or a vapor extraction well will be drilled with a CME-55 (or equivalent) truck-mounted drill rig using 10-inch-diameter, hollow-stem augers. As shown on Plate 6, borings B-8 and B-9 (VEW-1 and VEW-2) will be located between existing buried gasoline tanks adjacent to the former vapor recovery system and at the northeastern end of the underground storage tank area. This will be accomplished by drilling through 12-inch-diameter PVC conductor casings installed during tank replacement activities. Earth materials encountered in the borings will be continuously logged by a geologist as drilled, and described on boring logs. Borings completed with a ground-water monitoring well 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 ground-water monitoring well will be screened within the first-

encountered water-bearing zone. Boring B-10 will be drilled with a CME-55 (or equivalent) truck-mounted drill rig using 6-inch-diameter, hollow-stem augers.

Rationale for Soil Boring/Monitoring Well Locations

The rationale for the proposed locations of the monitoring wells is based on hydrocarbon concentrations reported in soil samples collected during the previous investigation related to the replacement of the tanks at the site. Boring B-4 (well MW-1) will be located near the former location of the vapor recovery system to evaluate the vertical and lateral extent of hydrocarbons in the soil and the presence of hydrocarbons in the ground water. Concentrations of 37,000 ppm TPHg were previously detected in the soil in this area. Boring B-5 (well MW-2) will be located in the northern corner of the tank pit near tank T1 to evaluate the lateral and vertical extent of hydrocarbons in the soil and the presence of hydrocarbons in the ground water. A concentration of 430 ppm TPHg was previously detected in the soil near tank T1 at a depth of 18 feet. Borings B-6 and B-7 (wells MW-3 and MW-4) will be located south and southwest of the gasoline storage-tank area in the inferred downgradient direction of ground-water flow. Monitoring wells MW-1, MW-2, MW-3 and MW-4 will also be used to interpret the ground-water gradient (magnitude and direction) of the first-encountered ground water beneath the site.

Rationale for Soil Boring/Vapor Extraction Well Locations

Because of the high levels of hydrocarbon contamination present in the subsurface soil beneath the former tank pit, vapor extraction wells VEW-1 and VEW-2 will be installed in the tank pit near the former vapor recovery system and at the northeastern end of the underground storage tank area. Soil samples collected from these areas indicated that high levels of hydrocarbon contamination are present at a depth of up to 22 feet below the ground surface.

Shallow Soil Borings

Three shallow soil borings will be drilled near the southwestern ends of the dispenser islands and northwest of the former location of Tank T-1 to evaluate the extent of hydrocarbon contamination reported in samples collected from these areas. Two of the borings will be located by the dispenser islands near Grove Way and Center Street and will be drilled to an approximate depth of 10 feet. One boring will be drilled in boring B-3 to an approximate depth of 5 feet. The borings will be drilled with a rig capable of operating in the confined area beneath the dispenser island canopy. Proposed locations of the shallow soil borings are shown on Plate 7.

Soil Sampling

Soil samples for laboratory analysis will be 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 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 subjectively evaluated for the presence of hydrocarbons. Subjective evaluation will be 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 concentrations of vapor content, but cannot be used to measure concentrations of contamination with the precision of laboratory analysis. 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.

Disposal of Soil Cuttings

Drill cuttings subjectively evaluated as having hydrocarbon contamination concentrations of 100 parts per million (ppm) or greater will be separated from those subjectively evaluated as having hydrocarbon contamination concentrations less than 100 ppm. Soil cuttings will be placed on, and covered by plastic sheets. Subjective evaluation will be 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 will remain the responsibility of ARCO.

Monitoring Well Construction and Development

Ground-water monitoring wells will be constructed in soil borings B-4 through B-7 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 two 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 well head and set in concrete placed flush with the surrounding ground surface. The well-head cover will have a watertight seal to protect the ground-water monitoring well against surface-water infiltration, and will require a specially designed 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, and other observations of extracted well development water will be included in our report.

Vapor Extraction Well Construction

Vapor extraction wells will be constructed in borings B-8 and B-9 using clean 4-inch-diameter, thread-jointed, Schedule 40 PVC casing. No chemical cements, glues, or solvents will be used in well construction. Each casing bottom will be sealed with a threaded end-plug, and each casing top with a locking plug. The screened portions of the wells will be constructed of machine-slotted PVC casing with 0.020-inch-wide slots.

The annular space of each well will be backfilled with washed pea gravel to approximately two feet above the top of the screened casing. A one- to two-foot-thick bentonite plug will be placed above the pea gravel 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 one 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. Each wellhead cover has a watertight seal to protect the monitoring well against surface-water infiltration and requires a special wrench to open. This design discourages vandalism and reduces the possibility of accidental disturbance of the well.

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. The thickness of the floating product will be measured with an interface probe or petroleum finding paste. 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 three well volumes of water, or until the water is drawn down to the bottom of the well. 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.

The water samples will be sealed in laboratory-cleaned, 40-milliliter glass vials with Teflon-lined lids. The samples will then be labeled and immediately 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 Analysis

The soil samples collected in each borehole will be analyzed for TPH as gasoline by modified EPA Method 3050/8015, and for BTEX by EPA Method 8020. Water samples collected from each well will be analyzed for TPH as gasoline using modified EPA Method 8015, BTEX using EPA Method 602. The concentrations detected and detection limits will be stated on the laboratory reports.

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 Preparation

A report will be provided summarizing the results, interpretations, and conclusions, 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 ACFCWCD and ARCO. A preliminary time schedule for the proposed work is presented in Plate 5.

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, Branch Manager, will provide supervision of field and office operations of the project. Mr. Steve Bittman, Staff 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.

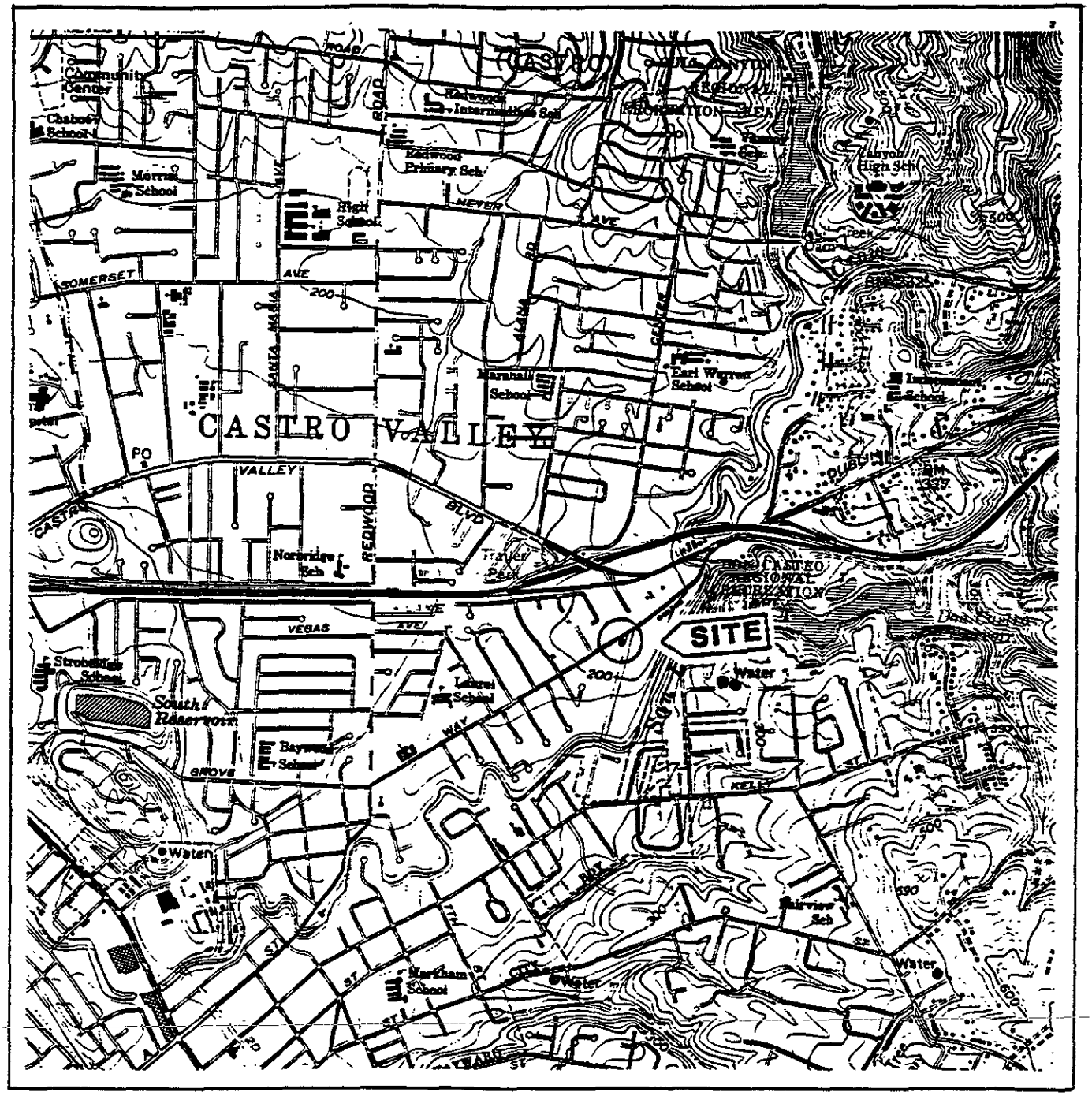
REFERENCES

Applied GeoSystems. January 18, 1989. Limited Subsurface Environmental Investigation Related to Underground Tank Removal, 22141 Center Street, Castro Valley, California: AGS Report No. 680015-2.

Applied GeoSystems. May 26, 1989. Limited Environmental Site Assessment, 22141 Center Street, Castro Valley, California, AGS Report No. 69013-1.

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

N

Approximate Scale
2000 1000 0 2000 4000
feet

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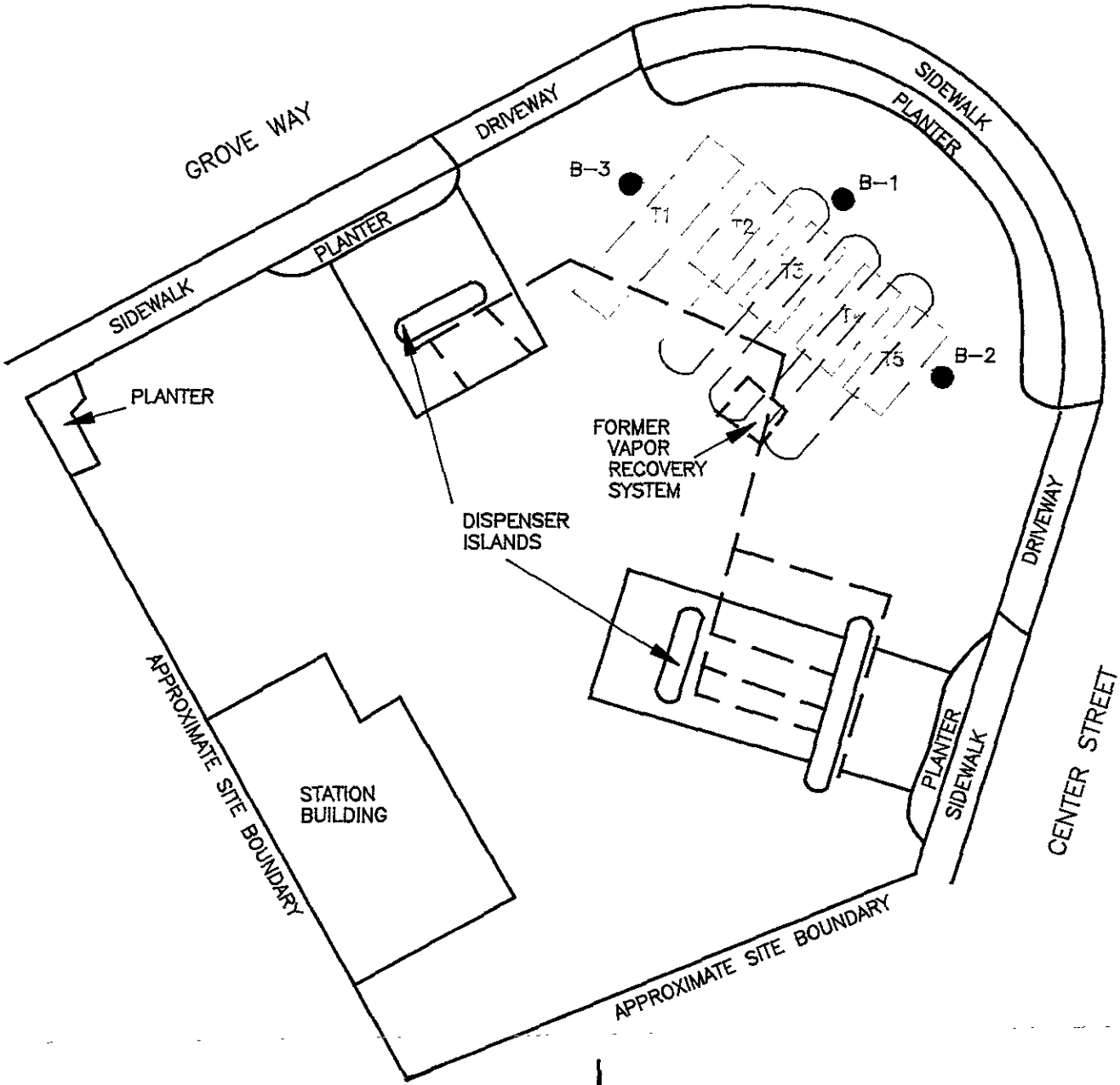
PROJECT 69013-3W

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

PLATE
1



EXPLANATION

B-3 ● = Soil boring location (AGS, April 1989)

T5 = Former underground gasoline-storage tanks

= Former product lines

= Present underground gasoline-storage tanks

Approximate Scale

30 15 0 30 60

feet

Source: Modified from plan supplied by ARCO.

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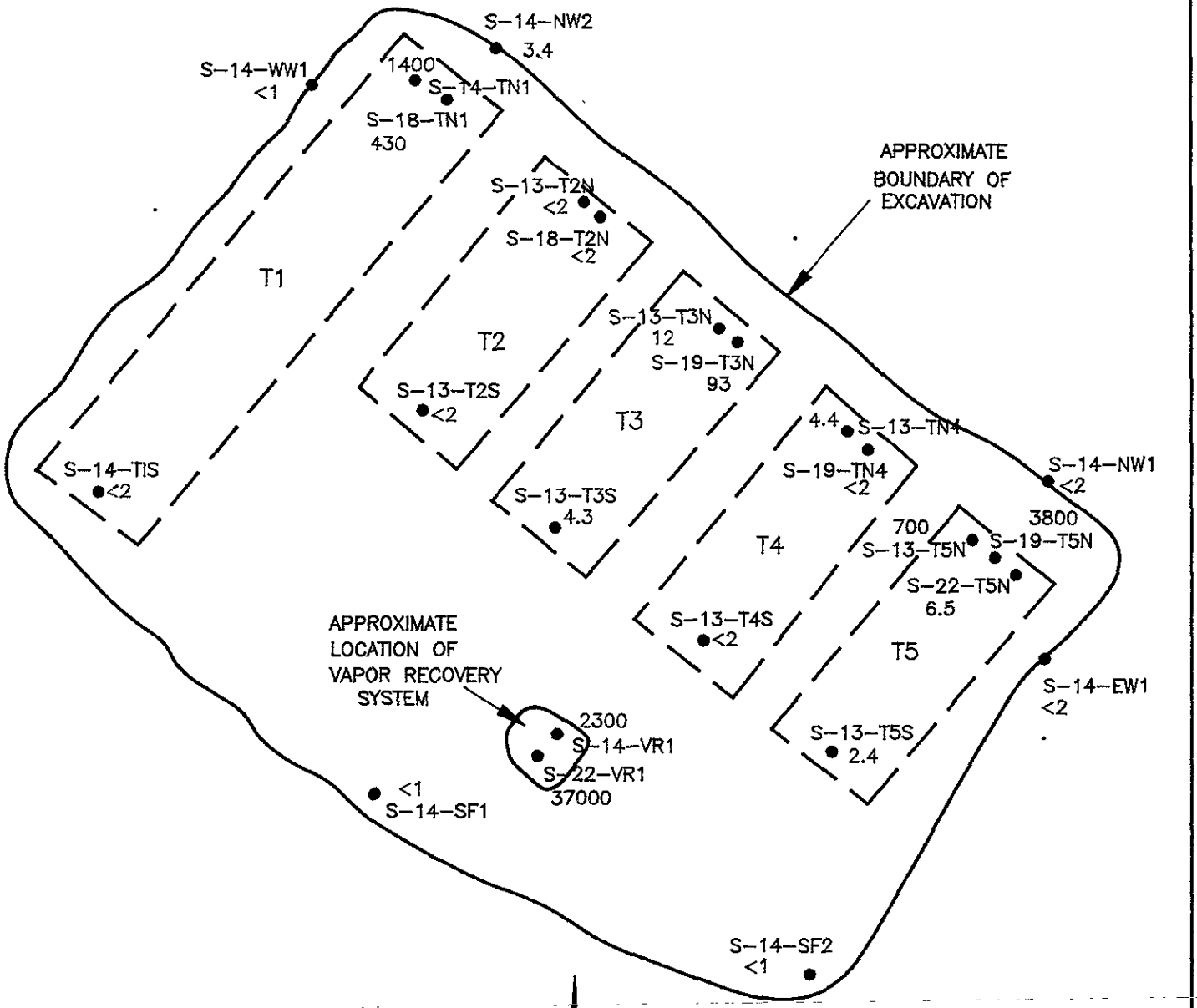
PROJECT 69013-3W

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

PLATE 2



EXPLANATION

T5 = Designated tank number

S-14-SF1 ● = Soil sample

37,000 = Concentration of TPHg in ppm

N

Approximate Scale

10 5 0 10 20

feet

Source: Modified from plan prepared by ARCO.

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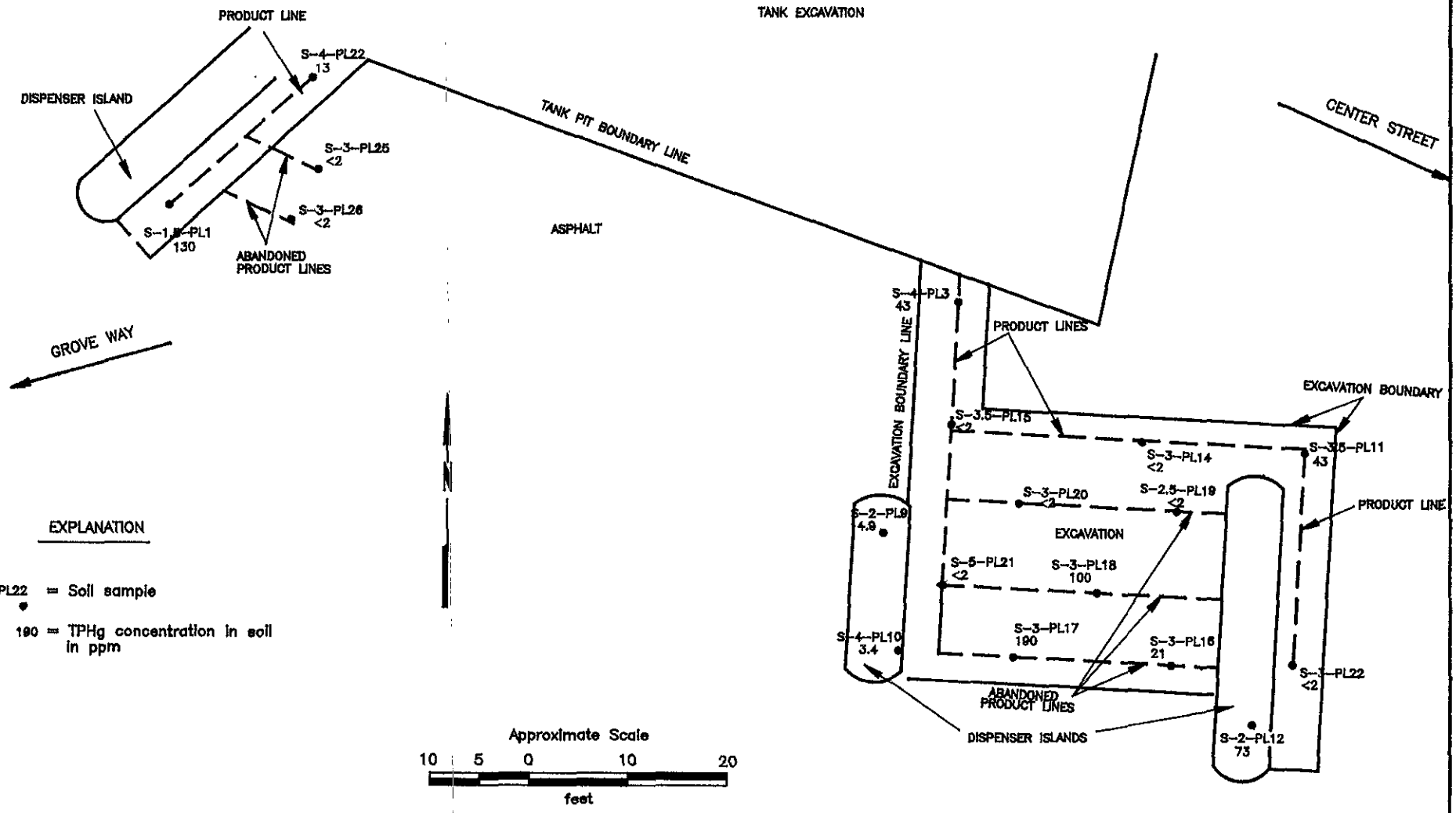
PROJECT 69013-3W

TANK PIT SOIL SAMPLING LOCATIONS
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 3



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PROJECT 69013-3W

PRODUCT-LINE SOIL SAMPLE LOCATIONS
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE 4

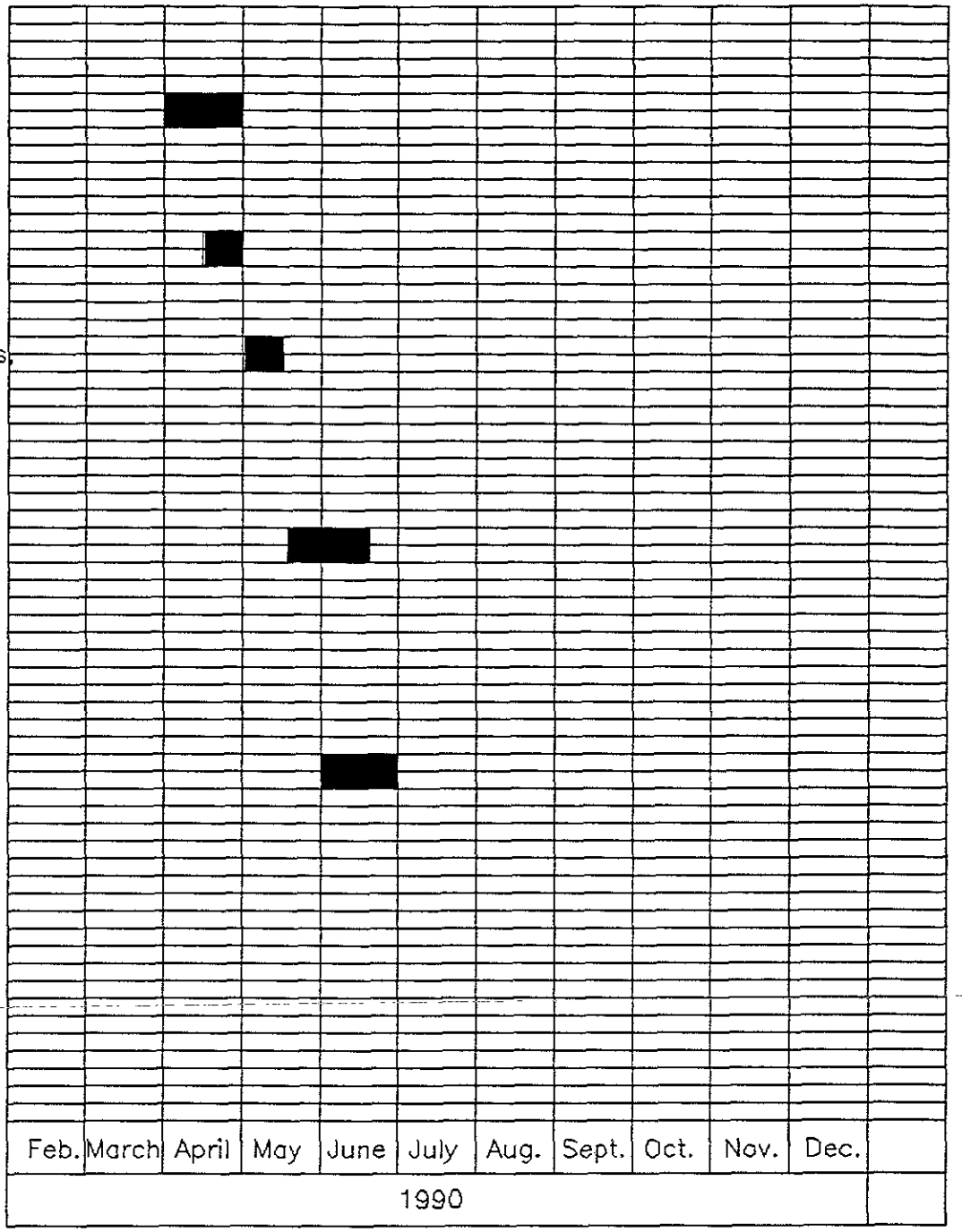
(A) Submit work plan to regulators for review and update the existing site safety plan, and permit proposed monitoring wells.

(B) Well research.

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

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

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



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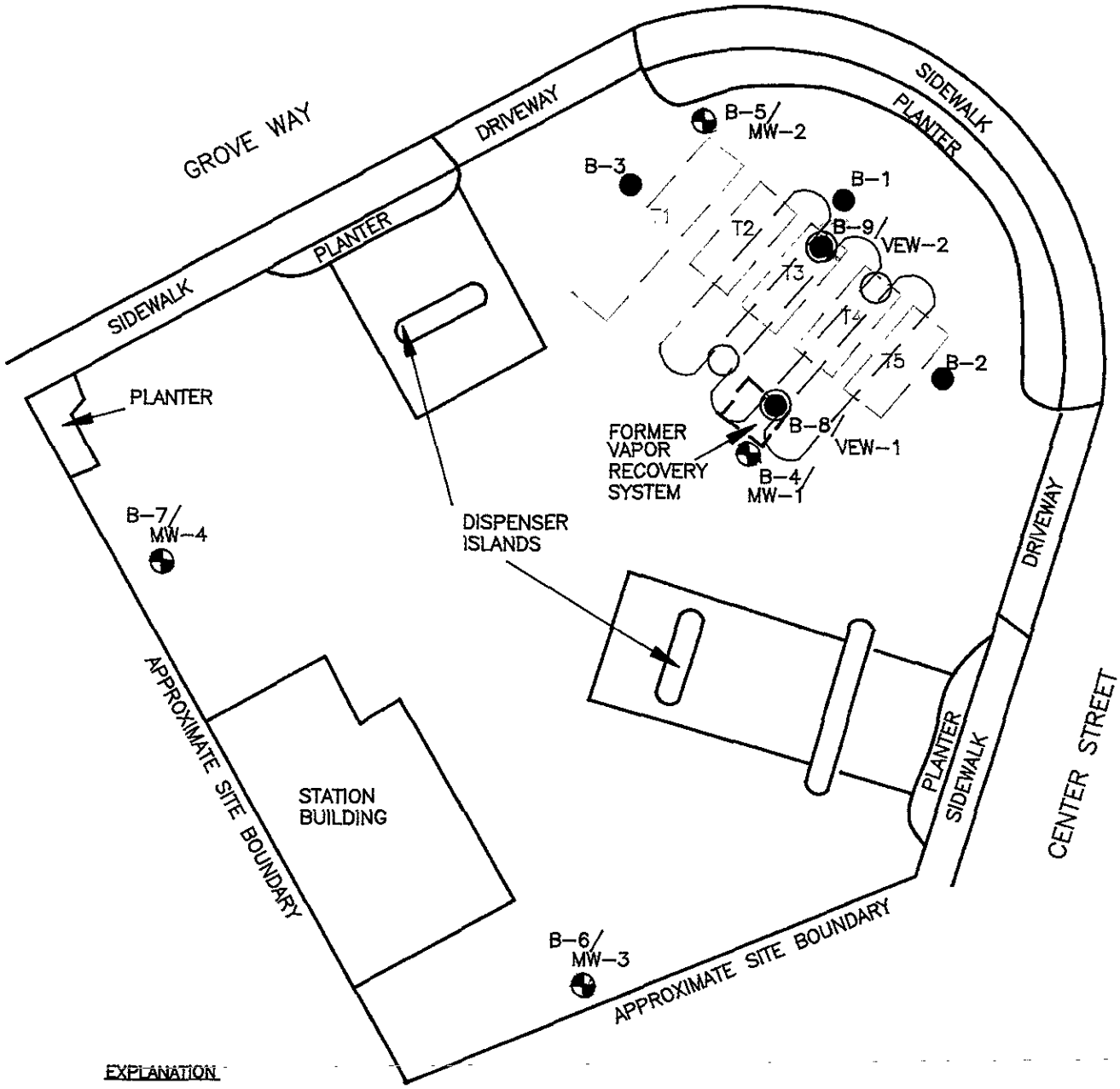
PROJECT 69013-3W

PRELIMINARY TIME SCHEDULE
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE
5



EXPLANATION

B-7/ MW-4 = Proposed monitoring well location

B-9/ VEW-2 = Proposed vapor extraction welocation

B-3 = Soil boring location (AGS, April 1989)

T5 = Former underground gasoline-storage tanks

= Conductor casings

= Present underground gasoline-storage tanks

N

Approximate Scale

30 15 0 30 60

feet

Source: Modified from plan supplied by ARCO.

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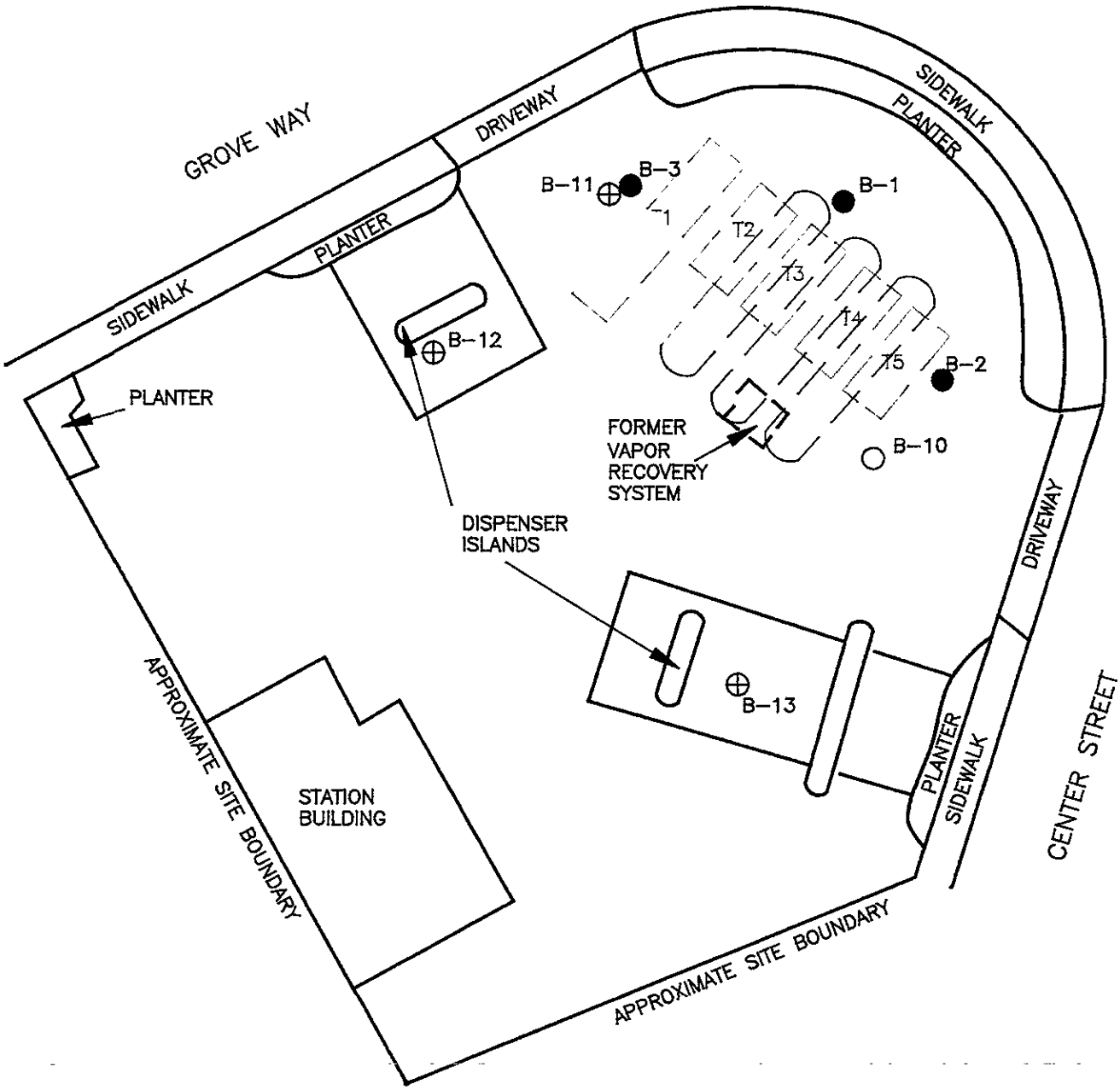
PROJECT 69013-3W

PROPOSED WELL LOCATIONS
ARCO Station 2151
22141 Center Street
Castro Valley, California

PLATE 6



EXPLANATION

B-10 ○ = Proposed soil boring location

B-13 ⊕ = Proposed shallow soil boring location

B-3 ● = Soil boring location (AGS, April 1989)

T5 = Former underground gasoline-storage tanks

= Present underground gasoline-storage tanks

Approximate Scale

30 15 0 30 60

feet

Source: Modified from plan supplied by ARCO.

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PROJECT 69013-3W

PROPOSED
SOIL BORING LOCATIONS
ARCO Station 2152
22141 Center Street
Castro Valley, California

PLATE
7