gettler — ryan inc.
general contractors

July 25, 1990

County of Alameda
Department of Environmental Health
Hazardous Materials Division
80 Swan Way, Room 200
Oakland, California 94621

Reference: ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

Gentlemen:

As requested by ARCO Products Company, we are forwarding a copy of the Site Update report dated July 24, 1990 documenting the groundwater sampling and site activities conducted during the second quarter 1990.

Please do not hesitate to call should you have any questions or comments.

Sincerely,

John P. Werfal
Project Manager

JPW/ch

enclosure

cc: Mr. Kyle Christie, ARCO Products Company
Mr. Tom Callaghan, Regional Water Quality Control Board

1992 national avenue • hayward, california 94545-1787 • 783-750

GeoStrategies Inc.

SITE UPDATE

ARCO Service Station No. 4931
731 West MacArthur Boulevard
Oakland, California

Report No. 7909-6

July 24, 1990

GeoStrategies Inc.
2140 WEST WINTON AVENUE
HAYWARD, CALIFORNIA 94545
(415) 352-4800

July 24, 1990

Gettler-Ryan Inc.
2150 West Winton Avenue
Hayward, California 94545

Attn: Mr. John Werfal

Re: SITE UPDATE
ARCO Service Station No. 4931
731 West MacArthur Boulevard
Oakland, California

Gentlemen:

This Site Update has been prepared by GeoStrategies Inc. (GSI) and presents the results of the April 4, 1990 ground-water sampling, performed by Gettler-Ryan Inc. (G-R), for the above referenced location (Plate 1). There are currently eleven ground-water monitoring wells (A-2 through A-12) at the site (Plate 2). Well A-10 was inaccessible at the time groundwater samples were collected. Potentiometric data were collected, wells were inspected for floating product, and ground-water samples were collected and analyzed according to current State of California Water Resources Control Board guidelines.

Depth to groundwater in the upper-most water bearing zone ranged from 7.03 to 11.35 feet below ground surface. A potentiometric map was prepared from these data (Plate 3). These data indicate that the shallow groundwater beneath the site flows to the west/southwest with an approximate hydraulic gradient of 0.03.

Floating product was observed in monitoring well A-8 with a measured thickness of 0.25 feet. A floating product sheen was observed in Well A-4 during this quarterly sampling.

Chemical analyses identified Total Petroleum Hydrocarbons calculated as Gasoline (TPH-Gasoline) at concentrations ranging from none detected (ND) to 40,000 parts per billion (ppb). Benzene concentrations were reported ranging from ND to 1100 ppb. Wells A-2, A-3, A-4, A-6, and A-9 contain benzene concentrations exceeding the current Regional Water Quality Control Board Maximum Contaminant Level. Wells A-5, A-7, A-11, and A-12 were reported as ND for all constituents analyzed. The chemical analytical data are summarized in Table 1. TPH-Gasoline and benzene chemical analytical data have been used to prepare isoconcentration maps (Plates 4 and 5) for this quarter. The historical chemical analytical data have been tabulated and are presented in Table 2.

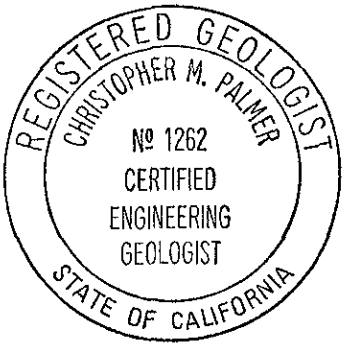
The analyses of the ground-water samples were performed by International Technology (IT) Analytical Services, a State-certified analytical laboratory located in San Jose, California. The IT Analytical Services certified analytical report is included in the attached G-R Groundwater Sampling Report. The G-R Groundwater Sampling Protocol has been attached to this report.

If you have any questions, please call.

GeoStrategies Inc. by,

David A. Ferreira
Geologist

Christopher M. Palmer
Senior Geologist
C.E.G. 1262, R.E.A. 285



DAF/CMP/mlg

Plate 1. Vicinity Map
Plate 2. Site Plan
Plate 3. Potentiometric Map
Plate 4. TPH-Gasoline Isoconcentration Map
Plate 5. Benzene Isoconcentration Map

Gettler-Ryan Inc. Groundwater Sampling Report (April 24, 1990)
Gettler-Ryan Inc. Sampling Protocol

Report No. 7909-6

TABLES

TABLE 1

GROUND-WATER ANALYSES DATA

WELL NO	SAMPLE DATE	ANALYZED DATE	TPH (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)	WELL ELEV (FT)	STATIC WATER ELEV (FT)	PRODUCT THICKNESS (FT)	DEPTH TO WATER (FT)
A-2	04-Apr-90	10-Apr-90	16000.	1100.	400.	380.	3900.	55.38	48.35	----	7.03
A-3	04-Apr-90	11-Apr-90	88.	1.2	2.0	0.8	4.	54.48	43.82	----	10.66
A-4	04-Apr-90	10-Apr-90	40000.	680.	320.	1400.	4900.	54.62	43.43	sheen	11.19
A-5	04-Apr-90	11-Apr-90	<50.	<0.5	<0.5	<0.5	<1.	54.15	43.22	----	10.93
A-6	04-Apr-90	12-Apr-90	100.	17.	7.1	5.5	18.	55.13	45.84	----	9.29
A-7	04-Apr-90	11-Apr-90	<50.	<0.5	<0.5	<0.5	<1.	54.67	45.52	----	9.15
A-8	04-Apr-90	----	----	----	----	----	----	53.61	42.46	0.25	11.35
A-9	04-Apr-90	10-Apr-90	620.	36.	13.	9.4	32.	52.96	44.18	----	8.78
A-10	04-Apr-90	----	----	----	----	----	----	54.16	----	----	N/A

CURRENT REGIONAL WATER QUALITY CONTROL BOARD MAXIMUM CONTAMINANT LEVELS
Benzene 1.0 ppb Xylenes 1,750 ppb Ethylbenzene 680 ppb

CURRENT DHS ACTION LEVELS
Toluene 100 ppb

TPH = Total Petroleum Hydrocarbons as Gasoline
PPB = Parts Per Billion TB = Trip Blank

Note: 1. All data shown as <x are reported as ND (none detected)
2. Static Water elevations referenced to mean sea level (MSL). Elevations are corrected for free product using a correction factor of 0.8.
3. DHS Action Levels and MCLs are subject to change pending State review
4. Well A-10 was inaccessible at time of sampling

Project No. 7909-6

TABLE 1

GROUND-WATER ANALYSES DATA

WELL NO	SAMPLE DATE	ANALYZED DATE	TPH (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)	WELL ELEV (FT)	STATIC WATER ELEV (FT)	PRODUCT THICKNESS (FT)	DEPTH TO WATER (FT)
A-11	04-Apr-90	11-Apr-90	<50.	<0.5	<0.5	<0.5	<1.	53.75	42.90	----	10.85
A-12	04-Apr-90	10-Apr-90	<50.	<0.5	<0.5	<0.5	<1.	52.05	41.75	----	10.30
TB	04-Apr-90	10-Apr-90	<50.	<0.5	<0.5	<0.5	<1.	----	----	----	----

TABLE 2

ANALYTICAL LOG

SAMPLE DATE	SAMPLE POINT	TPH (PPB)	BENZENE (PPB)	TOLUENE (PPB)	E.B. (PPB)	XYLENES * (PPB)
21-Mar-86	A-2	31000.	----	----	----	----
07-Jan-88	A-2	12000.	920.	1500.	----	4000.
20-Mar-89	A-2	22000.	1200.	1800.	1200.	7700.
24-May-89	A-2	9000.	460.	260.	250.	2400.
18-Aug-89	A-2	14000.	900.	200.	<200.	1300.
27-Oct-89	A-2	16000.	1200.	340.	90.	3100.
15-Jan-90	A-2	9900.	1100.	460.	150.	2900.
04-Apr-90	A-2	16000.	1100.	400.	380.	3900.
21-Mar-86	A-3	1000.	----	----	----	----
07-Jan-88	A-3	250.	2.3	8.	----	21.
20-Mar-89	A-3	230.	1.6	<1.	3.	3.
24-May-89	A-3	170.	0.9	2.	1.	<3.
18-Aug-89	A-3	180.	0.7	1.	<1.	<3.
27-Oct-89	A-3	120.	<0.5	<0.5	<0.5	<1.
15-Jan-90	A-3	<50.	<0.5	<0.5	<0.5	<1.
04-Apr-90	A-3	88.	1.2	2.0	0.8	4.
20-Mar-89	A-4	360000.	1500.	3700.	6500.	35000.
24-May-89	A-4	1500000.	1000.	2000.	6000.	23000.
04-Apr-90	A-4	40000.	680.	320.	1400.	4900.
21-Mar-86	A-5	88.	----	----	----	----
07-Jan-88	A-5	<50.	0.5	1.	----	4.
20-Mar-89	A-5	60.	0.5	1.	2.	10.
24-May-89	A-5	<50.	0.5	<1.	<1.	<3.
18-Aug-89	A-5	<50.	<0.5	<1.	<1.	<3.
27-Oct-89	A-5	<50.	<0.5	<0.5	<0.5	<1.
15-Jan-90	A-5	<50.	<0.5	<0.5	<0.5	<1.
04-Apr-90	A-5	<50.	<0.5	<0.5	<0.5	<1.
21-Mar-86	A-6	<10.	----	----	----	----
21-Mar-86	A-6	<10.	----	----	----	----
07-Jan-88	A-6	390.	54.	89.	----	110.
20-Mar-89	A-6	220.	33.	21.	9.	39.
24-May-89	A-6	110.	13.	6.	3.	13.
18-Aug-89	A-6	<50.	2.1	1.	<1.	<3.
27-Oct-89	A-6	55.	3.8	1.6	1.7	6.
15-Jan-90	A-6	100.	12.	2.5	5.5	18.
04-Apr-90	A-6	100.	17.	7.1	5.5	18.
07-Jan-88	A-7	<50.	<0.5	1.	----	4.
20-Mar-89	A-7	<50.	0.9	<1.	<1.	<3.
24-May-89	A-7	<50.	<0.5	<1.	<1.	<3.
18-Aug-89	A-7	<50.	<0.5	<1.	<1.	<3.

TABLE 2

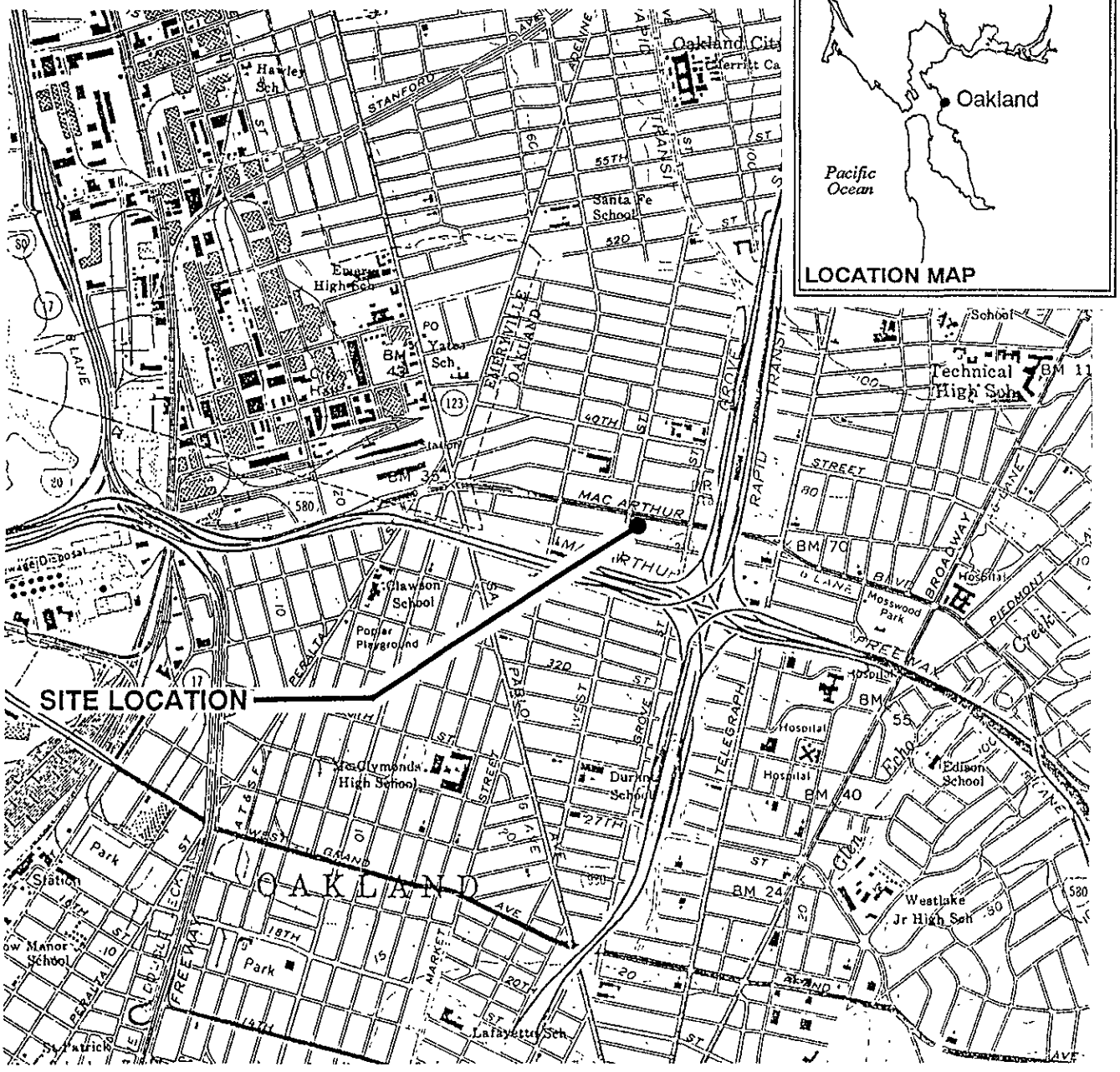
ANALYTICAL LOG

SAMPLE DATE	SAMPLE POINT	TPH (PPB)	BENZENE (PPB)	TOLUENE (PPB)	E.B. (PPB)	XYLENES * (PPB)
27-Oct-89	A-7	<50.	<0.5	<0.5	<0.5	<1.
15-Jan-90	A-7	<50.	<0.5	<0.5	<0.5	<1.
04-Apr-90	A-7	<50.	<0.5	<0.5	<0.5	<1.
07-Jan-88	A-9	300.	45.	14.	----	43.
21-Mar-89	A-9	50.	2.8	1.	1.	3.
24-May-89	A-9	120.	26.	12.	4.	79.
18-Aug-89	A-9	14000.	400.	800.	400.	2000.
27-Oct-89	A-9	1700.	150.	36.	30.	110.
15-Jan-90	A-9	860.	140.	58.	38.	140.
04-Apr-90	A-9	620.	36.	13.	9.4	32.
07-Jan-88	A-10	<50.	0.6	11.	----	4.
20-Mar-89	A-10	<50.	<0.5	<1.	<1.	<3.
24-May-89	A-10	<50.	<0.5	<1.	<1.	<3.
18-Aug-89	A-10	<50.	<0.5	<1.	<1.	<3.
27-Oct-89	A-10	<50.	<0.5	<0.5	<0.5	<1.
15-Jan-90	A-10	<50.	<0.5	<0.5	<0.5	<1.
07-Jan-88	A-11	<50.	1.1	2.	----	5.
20-Mar-89	A-11	<50.	<0.5	<1.	<1.	<3.
24-May-89	A-11	<50.	<0.5	<1.	<1.	<3.
18-Aug-89	A-11	<50.	<0.5	<1.	<1.	<3.
27-Oct-89	A-11	<50.	<0.5	<0.5	<0.5	<1.
15-Jan-90	A-11	<50.	<0.5	<0.5	<0.5	<1.
04-Apr-90	A-11	<50.	<0.5	<0.5	<0.5	<1.
07-Jan-88	A-12	<50.	<0.5	2.	----	<4.
20-Mar-89	A-12	<50.	<0.5	<1.	<1.	<3.
24-May-89	A-12	<50.	<0.5	<1.	<1.	<3.
18-Aug-89	A-12	<50.	<0.5	<1.	<1.	<3.
27-Oct-89	A-12	<50.	<0.5	<0.5	<0.5	<1.
15-Jan-90	A-12	<50.	<0.5	<0.5	<0.5	<1.
04-Apr-90	A-12	<50.	<0.5	<0.5	<0.5	<1.

* ETHYLBENZENE & XYLENES COMBINED IN 1986 AND 1988

ALL DATA SHOWN AS <X ARE REPORTED AS ND (NONE DETECTED)

ILLUSTRATIONS



Base Map: USGS Topographic Map

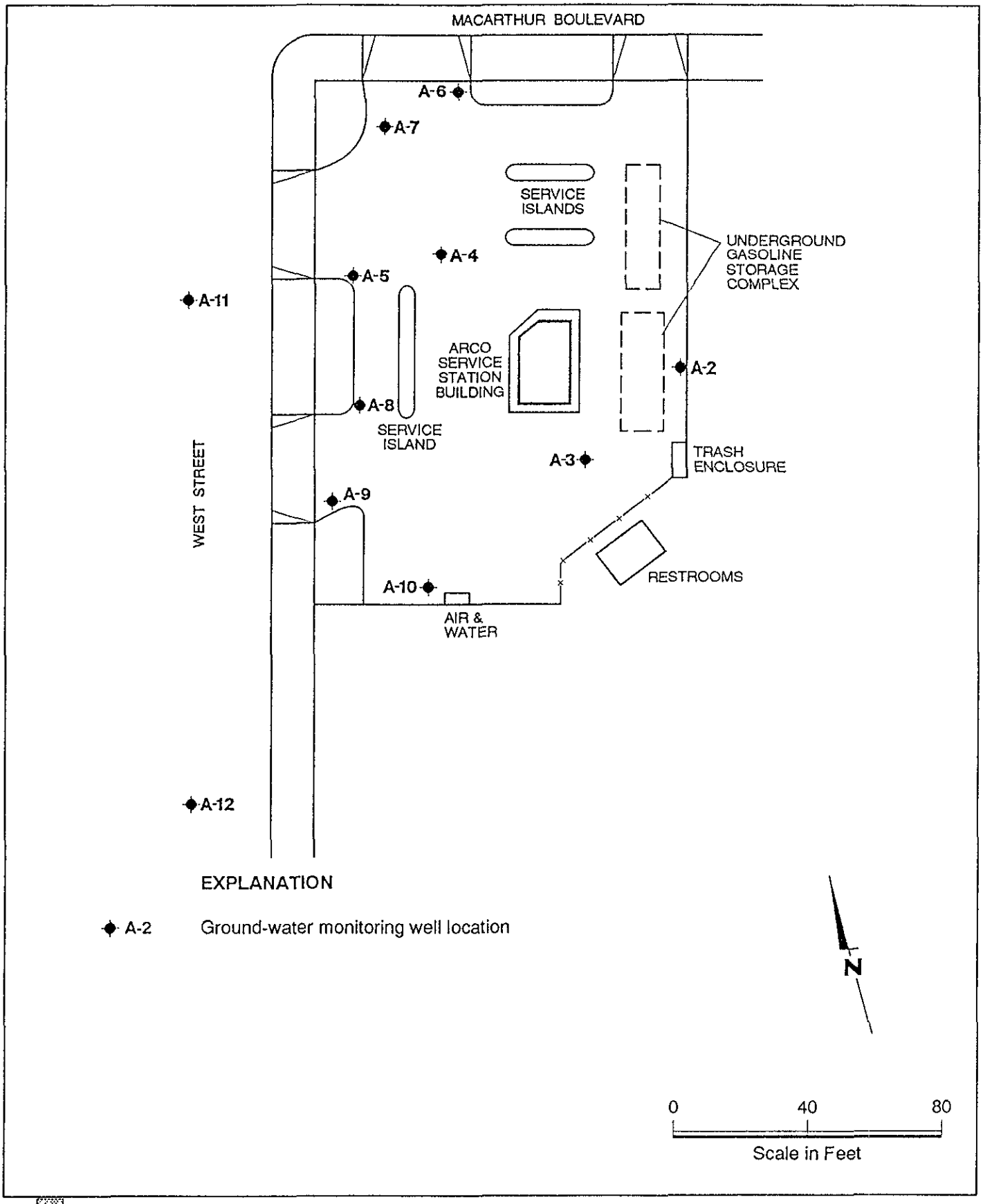
Approximate Scale : 1" = 2000'

GeoStrategies Inc.

Vicinity Map
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE
1

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7909		1/90		

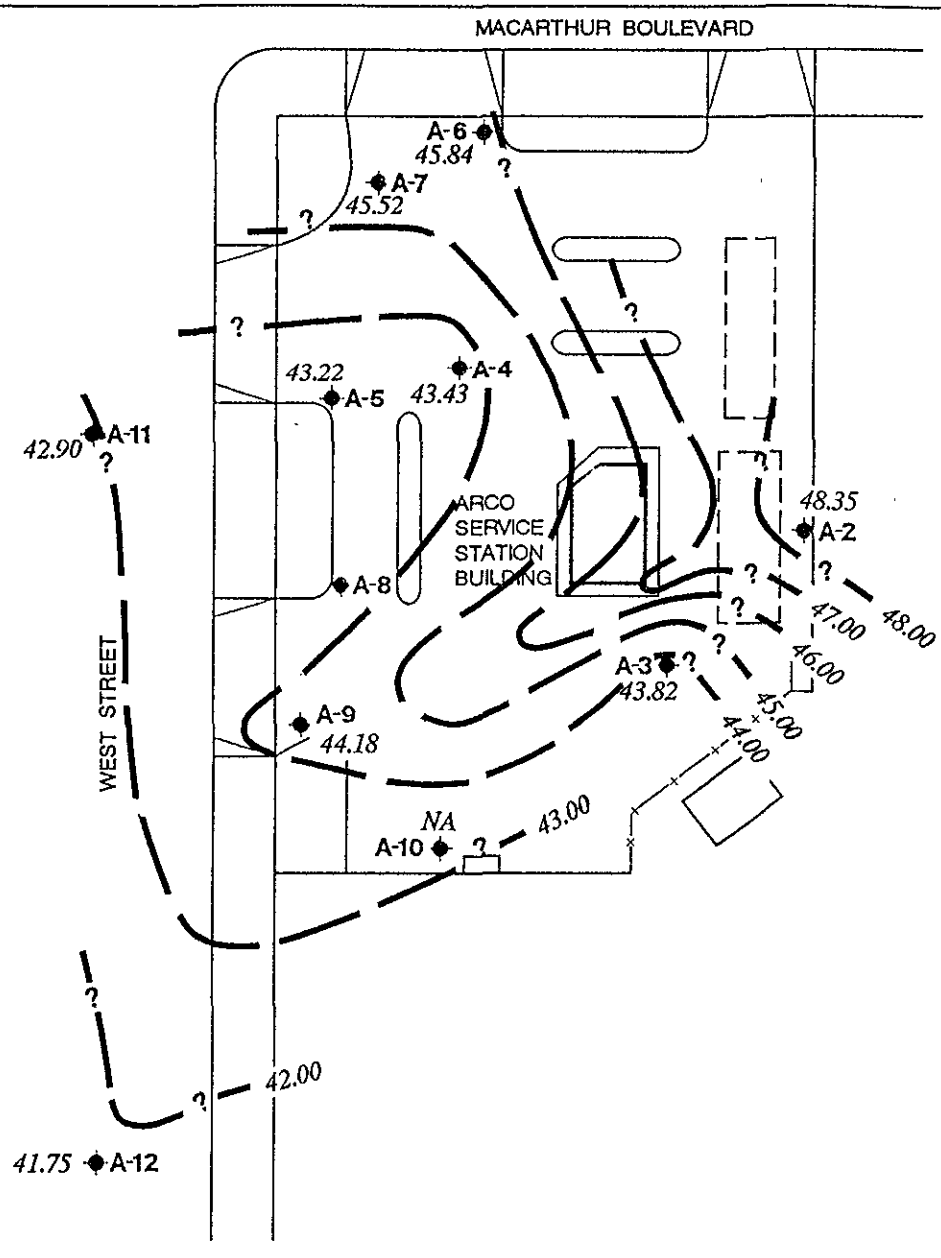


GeoStrategies Inc.

Site Plan
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE
2

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7909		5/90		



EXPLANATION

- A-2 — Ground-water monitoring well location
- 48.00 — Ground-water elevation contour, Approx. Gradient = 0.03
- 41.75 — Ground-water elevation in feet referenced to Mean Sea Level (MSL) measured on April 4, 1990
- NA — Not Accessible

Note: Contours may be influenced by irrigation practices and/or site construction activities

Well A-8 was not used in contouring

N

0 40 80

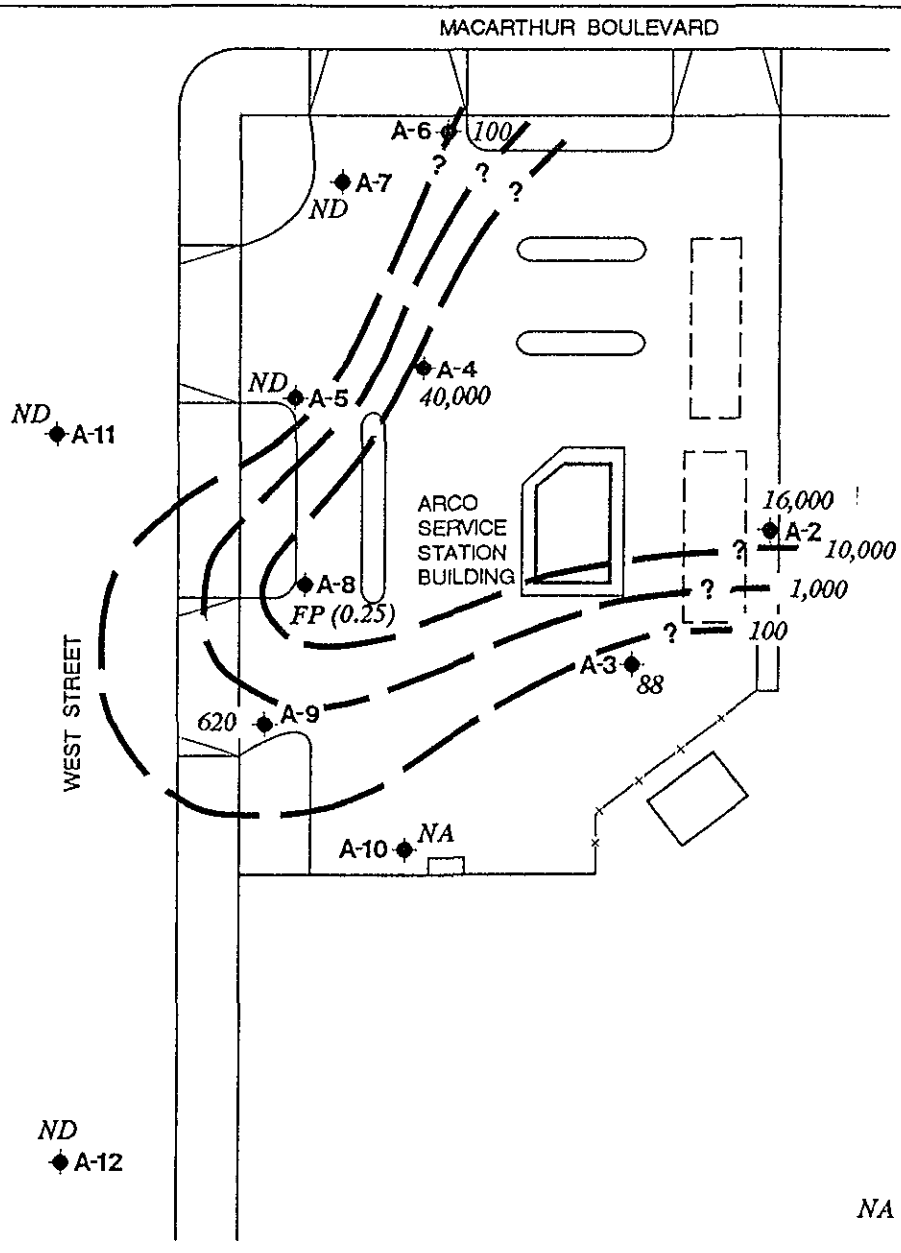
Scale in Feet

GeoStrategies Inc.

Potentiometric Map
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE 3

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7909		5/90		



NA Not Accessible

EXPLANATION

- A-2 — Ground-water monitoring well location
- 620 — TPH-G (Total Petroleum Hydrocarbons calculated as Gasoline) concentration in ppb sampled on April 4, 1990
- 100 — TPH-G isoconcentration contour
- ND — Not Detected (see laboratory reports for detection limits)
- FP (0.25) — Floating Product (thickness in feet)

N

0 40 80

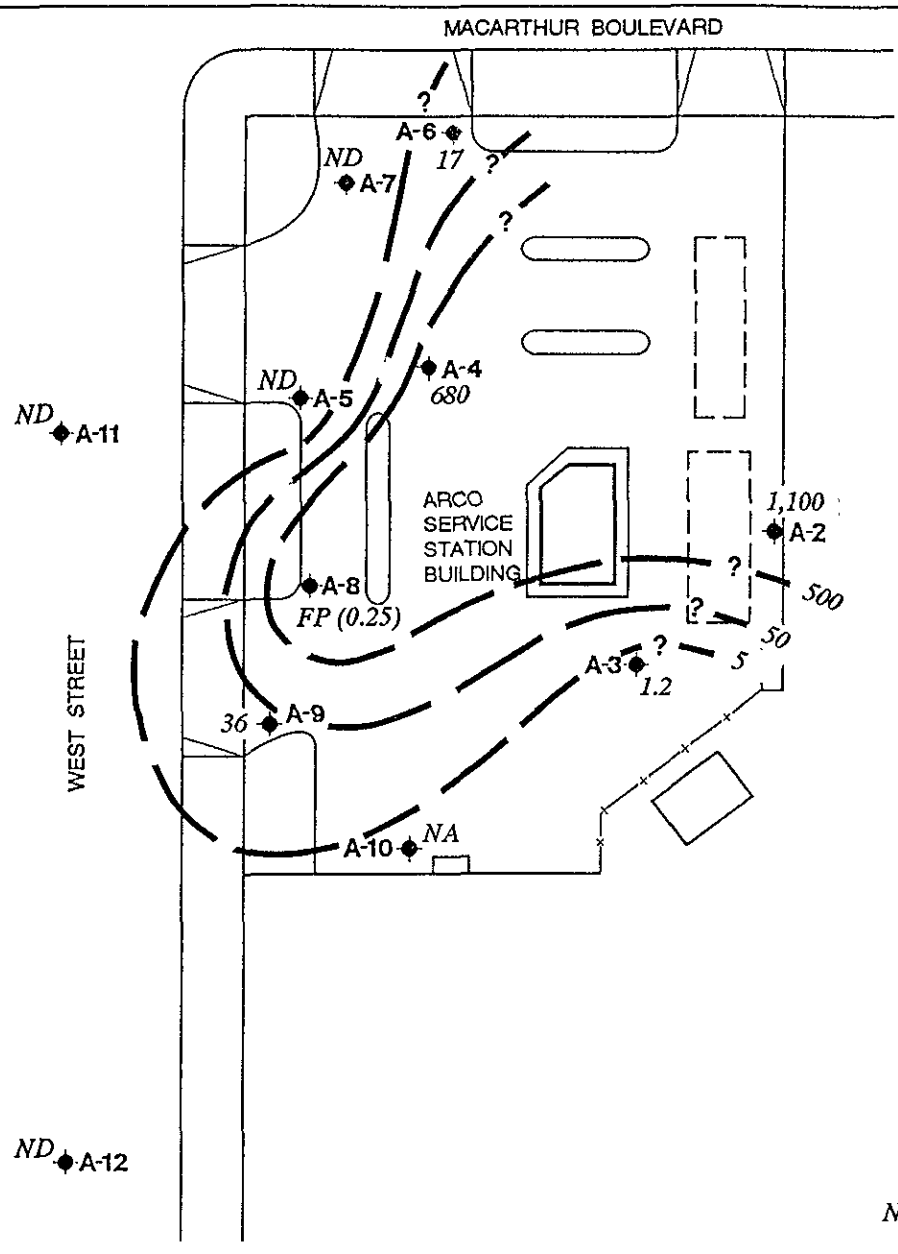
Scale in Feet

GeoStrategies Inc.

TPH-G Isoconcentration Map
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE 4

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7909		5/90		



NA Not Accessible

EXPLANATION

- A-2 — Ground-water monitoring well location
- 36 — Benzene concentration in ppb sampled on April 4, 1990
- 50 — Benzene isoconcentration contour
- ND — Not Detected (see laboratory reports for detection limits)
- FP (0.25) — Floating Product (thickness in feet)

N

0 40 80

Scale in Feet

GeoStrategies Inc.

Benzene Isoconcentration Map
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE 5

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7909		5/90		

ATTACHMENTS

gettler — ryan inc.

April 24, 1990

GROUNDWATER SAMPLING REPORT

ARCO Products Company
Post Office Box 5811
San Mateo, California 94402

Referenced Site: ARCO Service Station #4931
731 W MacArthur Blvd./West St.
Oakland, California

Sampling Date: April 4, 1990

This report presents the results of the quarterly groundwater sampling and analytical program conducted by Gettler-Ryan Inc. on April 4, 1990 at the referenced location. The site is occupied by an operating service station located on the southeast corner of West MacArthur Boulevard and West Street. The service station has underground storage tanks containing regular leaded, unleaded and super unleaded gasoline products.

There are currently nine groundwater monitoring wells on site and two off site at the locations shown on the attached site map. Prior to sampling, the wells were inspected for total well depth, water levels, and presence of separate phase product using an electronic interface probe. A clean acrylic bailer was used to visually confirm the presence and thickness of separate phase product. Groundwater depths ranged from 7.03 to 11.35 feet below grade. Well A-10 was inaccessible, being covered by an abandoned car. A product sheen was observed in well A-4. Separate phase product was apparent in Well A-8.

Wells that did not contain separate phase product were purged and sampled. The purge water was contained in drums for proper disposal. Standard sampling procedure calls for a minimum of four case volumes to be purged from each well. Each well was purged while pH, temperature, and conductivity measurements were monitored for stability. Details of the final well purging results are presented on the attached Table of Monitoring Data. In cases where a well dewatered or less than four case volumes were purged, groundwater samples were obtained after the physical parameters had stabilized. Under such circumstances the sample may not represent actual formation water due to the low flow conditions.

Samples were collected, using Teflon bailers, in properly cleaned and laboratory prepared containers. All sampling equipment was thoroughly cleaned after each well was sampled and steam cleaned upon completion of work at the site. The samples were labeled, stored on blue ice, and transported to the laboratory for analysis. A trip blank, supplied by the laboratory, was included and analyzed to assess quality control. Analytical results for the trip blank are included in the Certified Analytical Report (CAR's). Chain of custody records were established noting sample identification numbers, time, date, and custody signatures.

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The samples were analyzed at International Technology Corporation - Santa Clara Valley Laboratory located at 2055 Junction Avenue, San Jose, California. The laboratory is assigned a California DHS-HMTL Certification number of 137. The results are presented as a Certified Analytical Report, a copy of which is attached to this report.

Tom Paulson
Sampling Manager

attachments

TABLE OF MONITORING DATA
GROUNDWATER WELL SAMPLING REPORT

WELL I.D.	A-2	A-3	A-4	A-5	A-6	A-7
Casing Diameter (inches)	4	4	4	3	3	3
Total Well Depth (feet)	18.5	19.2	19.7	23.8	25.0	22.7
Depth to Water (feet)	7.03	10.66	11.19	10.93	9.29	9.15
Free Product (feet)	none	none	sheen	none	none	none
Reason Not Sampled	----	----	----	----	----	----
Calculated 4 Case Vol.(gal.)	30.3	22.6	22.5	19.6	23.6	20.4
Did Well Dewater?	yes	yes	yes	yes	yes	yes
Volume Evacuated (gal.)	9	9	11	13	20	13
Purging Device	Suction	Suction	Suction	Suction	Suction	Suction
Sampling Device	Bailer	Bailer	Bailer	Bailer	Bailer	Bailer
Time	11:16	11:00	10:38	10:37	10:10	10:12
Temperature (F)*	60.8	63.7	59.0	66.3	65.8	66.8
pH*	6.49	6.48	6.39	6.55	6.68	6.91
Conductivity (umhos/cm)*	689	770	1143	800	607	635

* Indicates Stabilized Value

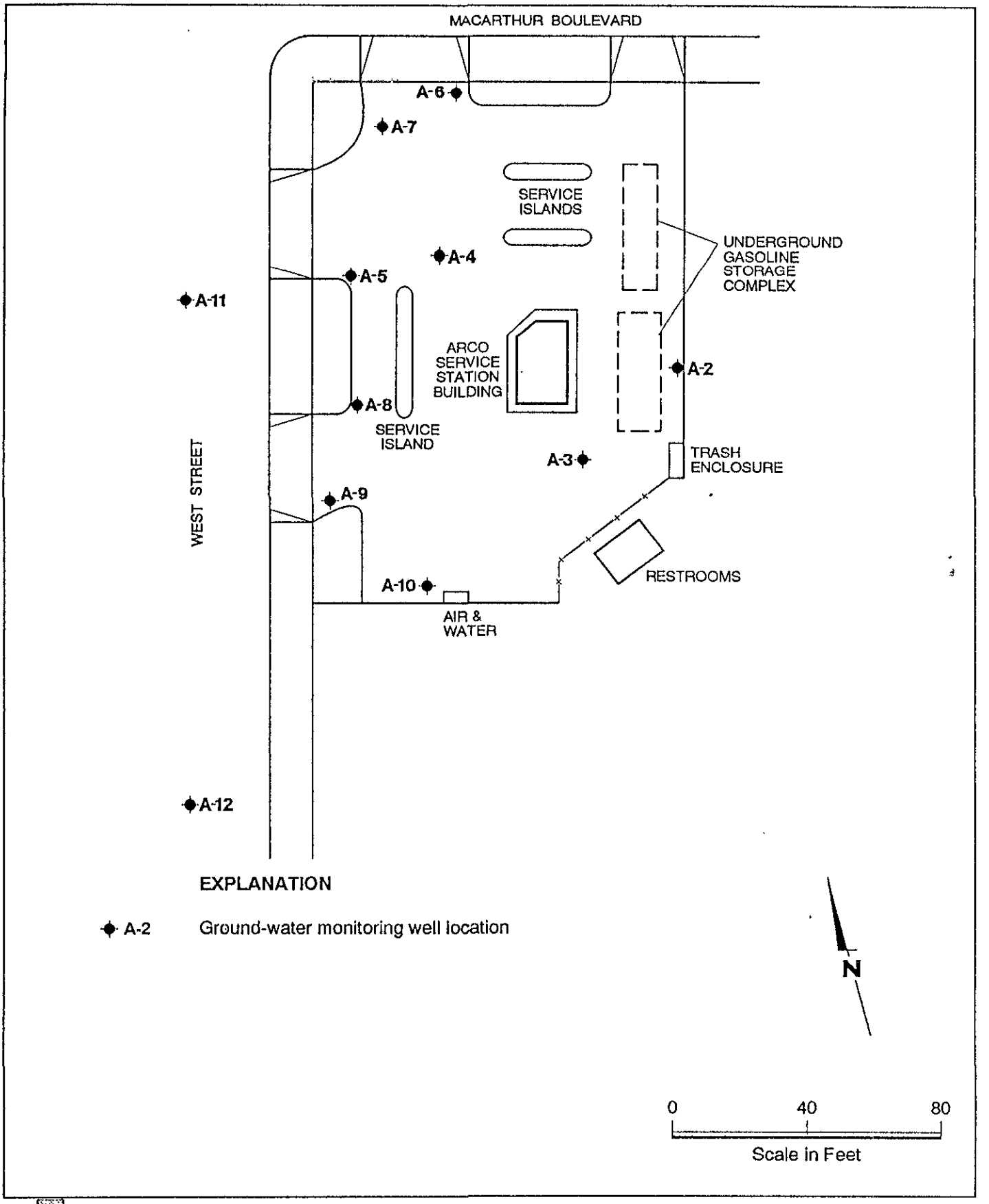
** Not corrected for presence of free product

TABLE OF MONITORING DATA
GROUNDWATER WELL SAMPLING REPORT

WELL I.D.	A-8	A-9	A-10	A-11	A-12
Casing Diameter (inches)	3	6	3	3	3
Total Well Depth (feet)	----	38.7	----	27.4	29.2
Depth to Water (feet)	11.35 **	8.78	----	10.85	10.30
Free Product (feet)	0.25	none	----	none	none
Reason Not Sampled	free product	----	obstructed	----	----
Calculated 4 Case Vol.(gal.)	----	179.0	----	25.1	28.7
Did Well Dewater?	----	no	----	yes	yes
Volume Evacuated (gal.)	----	224	----	21	21
Purging Device	----	Suction	----	Suction	Suction
Sampling Device	----	Bailer	----	Bailer	Bailer
Time	----	11:50	----	09:38	09:14
Temperature (F)*	----	64.8	----	64.9	64.8
pH*	----	6.30	----	6.84	7.19
Conductivity (umhos/cm)*	----	706	----	687	672

* Indicates Stabilized Value

** Not corrected for presence of free product



GeoStrategies Inc.

Site Plan
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
909				

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

Date: 04/23/90

Gettler-Ryan
2150 West Winton
Hayward, CA 94545
Tom Paulson

Work Order: T0-04-046 P.O. Number: 3909

This is the Certificate of Analysis for the following samples:

Client Work ID: GR3909, 731 W.MacArthur, Arco
Date Received: 04/05/90
Number of Samples: 10
Sample Type: aqueous

TABLE OF CONTENTS FOR ANALYTICAL RESULTS

Reviewed and Approved:

Suzanne Veaudry
Project Manager

Company: Gettler-Ryan
Date: 04/23/90
Client Work ID: GR3909, 731 W.MacArthur, Arco

Work Order: TO-04-046

TEST NAME: TPH Gas,BTEX by 8015/8020

SAMPLE ID: A-2
SAMPLE DATE: 04/04/90
LAB SAMPLE ID: T004046-01
SAMPLE MATRIX: aqueous
RECEIPT CONDITION: Cool pH < 2
TPH & BTEX EXTRACTION DATE: N/A
TPH & BTEX ANALYSIS DATE: 04/10/90

RESULTS in Micrograms per Liter:

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons, calculated as Gasoline	1000.	16000.
Benzene	10.	1100.
Toluene	10.	400.
Ethylbenzene	10.	380.
Xylenes (total)	20.	3900.

Company: Gettler-Ryan
Date: 04/23/90
Client Work ID: GR3909, 731 W.MacArthur, Arco

Work Order: TO-04-046

TEST NAME: TPH Gas,BTEX by 8015/8020

SAMPLE ID: A-3
SAMPLE DATE: 04/04/90
LAB SAMPLE ID: T004046-02
SAMPLE MATRIX: aqueous
RECEIPT CONDITION: Cool pH < 2
TPH & BTEX EXTRACTION DATE: N/A
TPH & BTEX ANALYSIS DATE: 04/11/90

RESULTS in Micrograms per Liter:

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons, calculated as Gasoline	50.	88.
Benzene	0.5	1.2
Toluene	0.5	2.0
Ethylbenzene	0.5	0.8
Xylenes (total)	1.	4.

INTERNATIONAL TECHNOLOGY CORPORATION

Company: Gettler-Ryan
Date: 04/23/90
Client Work ID: GR3909, 731 W.MacArthur, Arco

Work Order: TO-04-046

TEST NAME: TPH Gas,BTEX by 8015/8020

SAMPLE ID: A-4
SAMPLE DATE: 04/04/90
LAB SAMPLE ID: T004046-03
SAMPLE MATRIX: aqueous
RECEIPT CONDITION: Cool pH < 2
TPH & BTEX EXTRACTION DATE: N/A
TPH & BTEX ANALYSIS DATE: 04/10/90

RESULTS in Micrograms per Liter:

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons, calculated as Gasoline	2500.	40000.
Benzene	20.	680.
Toluene	20.	320.
Ethylbenzene	20.	1400.
Xylenes (total)	50.	4900.

Company: Gettler-Ryan
Date: 04/23/90
Client Work ID: GR3909, 731 W.MacArthur, Arco

Work Order: TO-04-046

TEST NAME: **TPH Gas,BTEX by 8015/8020**

SAMPLE ID: **A-5**
SAMPLE DATE: **04/04/90**
LAB SAMPLE ID: **T004046-04**
SAMPLE MATRIX: **aqueous**
RECEIPT CONDITION: **Cool pH < 2**
TPH & BTEX EXTRACTION DATE: **N/A**
TPH & BTEX ANALYSIS DATE: **04/11/90**

RESULTS in Micrograms per Liter:

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons, calculated as Gasoline	50.	None
Benzene	0.5	None
Toluene	0.5	None
Ethylbenzene	0.5	None
Xylenes (total)	1.	None

Company: Gettler-Ryan
Date: 04/23/90
Client Work ID: GR3909, 731 W.MacArthur, Arco

Work Order: TO-04-046

TEST NAME: TPH Gas,BTEX by 8015/8020

SAMPLE ID: A-6
SAMPLE DATE: 04/04/90
LAB SAMPLE ID: T004046-05
SAMPLE MATRIX: aqueous
RECEIPT CONDITION: Cool pH < 2
TPH & BTEX EXTRACTION DATE: N/A
TPH & BTEX ANALYSIS DATE: 04/12/90

RESULTS in Micrograms per Liter:

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons, calculated as Gasoline	50.	100.
Benzene	0.5	17.
Toluene	0.5	7.1
Ethylbenzene	0.5	5.5
Xylenes (total)	1.	18.

Company: Gettler-Ryan
Date: 04/23/90
Client Work ID: GR3909, 731 W.MacArthur, Arco

Work Order: TO-04-046

TEST NAME: TPH Gas,BTEX by 8015/8020

SAMPLE ID: A-7
SAMPLE DATE: 04/04/90
LAB SAMPLE ID: T004046-06
SAMPLE MATRIX: aqueous
RECEIPT CONDITION: Cool pH < 2
TPH & BTEX EXTRACTION DATE: N/A
TPH & BTEX ANALYSIS DATE: 04/11/90

RESULTS in Micrograms per Liter:

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons, calculated as Gasoline	50.	None
Benzene	0.5	None
Toluene	0.5	None
Ethylbenzene	0.5	None
Xylenes (total)	1.	None

Company: Gettler-Ryan
Date: 04/23/90
Client Work ID: GR3909, 731 W.MacArthur, Arco

Work Order: TO-04-046

TEST NAME: TPH Gas,BTEX by 8015/8020

SAMPLE ID: A-9
SAMPLE DATE: 04/04/90
LAB SAMPLE ID: T004046-07
SAMPLE MATRIX: aqueous
RECEIPT CONDITION: Cool pH < 2
TPH & BTEX EXTRACTION DATE: N/A
TPH & BTEX ANALYSIS DATE: 04/10/90

RESULTS in Micrograms per Liter:

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons, calculated as Gasoline	50.	620.
Benzene	0.5	36.
Toluene	0.5	13.
Ethylbenzene	0.5	9.4
Xylenes (total)	1.	32.

Company: Gettler-Ryan
Date: 04/23/90
Client Work ID: GR3909, 731 W.MacArthur, Arco

Work Order: TO-04-046

TEST NAME: TPH Gas,BTEX by 8015/8020

SAMPLE ID: A-11
SAMPLE DATE: 04/04/90
LAB SAMPLE ID: T004046-08
SAMPLE MATRIX: aqueous
RECEIPT CONDITION: Cool pH < 2
TPH & BTEX EXTRACTION DATE: N/A
TPH & BTEX ANALYSIS DATE: 04/11/90

RESULTS in Micrograms per Liter:

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons, calculated as Gasoline	50.	None
Benzene	0.5	None
Toluene	0.5	None
Ethylbenzene	0.5	None
Xylenes (total)	1.	None

Company: Gettler-Ryan
Date: 04/23/90
Client Work ID: GR3909, 731 W.MacArthur, Arco

Work Order: T0-04-046

TEST NAME: **TPH Gas,BTEX by 8015/8020**

SAMPLE ID: **A-12**
SAMPLE DATE: **04/04/90**
LAB SAMPLE ID: **T004046-09**
SAMPLE MATRIX: **aqueous**
RECEIPT CONDITION: **Cool pH < 2**
TPH & BTEX EXTRACTION DATE: **N/A**
TPH & BTEX ANALYSIS DATE: **04/10/90**

RESULTS in Micrograms per Liter:

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons, calculated as Gasoline	50.	None
Benzene	0.5	None
Toluene	0.5	None
Ethylbenzene	0.5	None
Xylenes (total)	1.	None

Company: Gettler-Ryan
Date: 04/23/90
Client Work ID: GR3909, 731 W.MacArthur, Arco Work Order: TO-04-046

TEST NAME: **TPH Gas,BTEX by 8015/8020**

SAMPLE ID: **Trip Blank**
SAMPLE DATE: **not spec**
LAB SAMPLE ID: **T004046-10**
SAMPLE MATRIX: **aqueous**
RECEIPT CONDITION: **Cool pH < 2**
TPH & BTEX EXTRACTION DATE: **N/A**
TPH & BTEX ANALYSIS DATE: **04/10/90**

RESULTS in Micrograms per Liter:

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons, calculated as Gasoline	50.	None
Benzene	0.5	None
Toluene	0.5	None
Ethylbenzene	0.5	None
Xylenes (total)	1.	None

Company: Gettler-Ryan
Date: 04/23/90
Client Work ID: GR3909, 731 W.MacArthur, Arco **Work Order: TO-04-046**

TEST CODE **TPHVB** TEST NAME **TPH Gas,BTEX by 8015/8020**

The method of analysis for low boiling hydrocarbons is taken from EPA Methods 8015, 8020 and 5030. The sample is examined using the purge and trap technique. Final detection is by gas chromatography using a flame ionization detector as well as a photoionization detector. The result for total low boiling hydrocarbons is calculated as gasoline and includes benzene, toluene, ethylbenzene and xylenes.

Kettler - Ryan Inc. TO-04-046 ENVIRONMENTAL DIVISION 0588 **Chain of Custody**

COMPANY ARCO Products Company, S.S. 4931 JOB NO.

JOB LOCATION 731 W. MacArthur Blvd. / West St.

CITY Oakland, CA PHONE NO. 783-7500

AUTHORIZED Tom Paulson DATE 4/4/90 P.O. NO. 3909

SAMPLE ID	NO. OF CONTAINERS	SAMPLE MATRIX	DATE/TIME SAMPLED	ANALYSIS REQUIRED	SAMPLE CONDITION LAB ID
A-2	3	Liquid	4-4 / 1116	THC (Gas) BTXE	OK Cool
A-3			/ 1110		
A-4			/ 1038		
A-5			/ 1037		
A-6			/ 1010		
A-7			/ 1012		
A-9			/ 1150		
A-11			/ 0938		
A-12			/ 0914		
Trip Blank	2		/ —		

RELINQUISHED BY: Philip J. Pye 4/4/90

RECEIVED BY: [signature] 4/5/90 07:30

RELINQUISHED BY: [signature] 4/5/90 15:10

RECEIVED BY:

RELINQUISHED BY:

RECEIVED BY LAB: [signature] 4-5-90 1515

DESIGNATED LABORATORY: IT SCV DHS #: 137

REMARKS: Normal TAT

DATE COMPLETED April 4, 1990 FOREMAN Philip J. Pye

ORIGINAL

GROUND-WATER SAMPLING AND ANALYSIS

Quality Assurance/Quality Control Objectives

The sampling and analysis procedures employed by Gettler-Ryan Inc. (G-R) for ground-water sampling and monitoring follow specific Quality Assurance/Quality Control (QA/QC) guidelines. Quality Assurance objectives have been established by G-R to develop and implement procedures for obtaining and evaluating water quality and field data in an accurate, precise, and complete manner so that sampling procedures and field measurements provide information that is comparable and representative of actual field conditions. Quality Control (QC) is maintained by G-R by using specific field protocols and requiring the analytical laboratory to perform internal and external QC checks. It is the goal of G-R to provide data that are accurate, precise, complete, comparable, and representative. The definitions for accuracy, precision, completeness, comparability, and representativeness are as follows:

- Accuracy - the degree of agreement of a measurement with an accepted referenced or true value.

- Precision - a measure of agreement among individual measurements under similar conditions. Usually expressed in terms of the standard deviation.

- Completeness - the amount of valid data obtained from a measurement system compared to the amount that was expected to meet the project data goals.

- Comparability - expresses the confidence with which one data set can be compared to another.

- Representativeness - a sample or group of samples that reflects the characteristics of the media at the sampling point. It also includes how well the sampling point represents the actual parameter variations which are under study.

As part of the G-R QA/QC program, applicable federal, state, and local reference guidance documents are followed. The procedures outlined in these regulations, manuals, handbooks, guidance documents, and journals are incorporated into the G-R sampling procedures to assure that; (1) ground-water samples are properly collected, (2) ground-water samples are identified, preserved, and transported in a manner such that they are representative of field conditions, and (3) chemical analysis of samples are accurate and reproducible.

Guidance and Reference Documents Used to Collect Groundwater Samples

These documents are used to verify G-R sampling procedures and are consistent with current regulatory guidance. If site specific work and sampling plans are required, those plans will be developed from these documents, and newly received applicable documents.

U.S.E.P.A. - 330/9-51-002	NEIC Manual for Groundwater/Subsurface Investigation at Hazardous Waste Sites
U.S.E.P.A. - 530/SW611	Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities (August, 1977)
U.S.E.P.A. - 600/4-79-020	Methods for Chemical Analysis of Water and Wastes (1983)
U.S.E.P.A. - 600/4-82-029	Handbook for Sampling and Sample Preservation of Water and Wastewater (1982)
U.S.E.P.A. - 600/4-82-057	Test Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (July, 1982)
U.S.E.P.A. - SW-846#, 3rd Edition	Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (November, 1986)
40 CFR 136.3e,Table II (Code of Federal Regulations)	Required Containers, Preservation Techniques, and Holding Times
Resources Conservation and Recover Act (OSWER 9950.1)	Groundwater Monitoring Technical Enforcement Guidance Document (September, 1986)
California Regional Water Quality Control Board (Central Valley Region)	A Compilation of Water Quality Goals (September, 1988); Updates (October, 1988)
California Regional Water Quality Control Board (North Coast, San Francisco Bay, and Central Valley)	Regional Board Staff Recommendations for Initial Evaluations and Investigation of Underground Tanks: Tri-Regional Recommendations (June, 1988)

Guidance and Reference Documents Used to Collect Groundwater Samples (cont.)

Regional Water Quality Control Board (Central Valley Region)	Memorandum: Disposal, Treatment, and Refuse of Soils Contaminated with Petroleum Fractions (August, 1986)
State of California Department of Health Services	Hazardous Waste Testing Laboratory Certification List (March, 1987)
State of California Water Resources Control Board	Leaking Underground Fuel Tank (LUFT) Field Manual (May, 1988), and LUFT Field Manual Revision (April, 1989)
State of California Water Resources Control Board	Title 23, (Register #85.#33-8-17-85), Subchapter 16: Underground Tank Regulations; Article 3, Sections 2632 and 2634; Article 4, Sections 2645, 2646, 2647, and 2648; Article 7, Sections 2670, 2671, and 2672 (October, 1986: including 1988 Amendments)
Alameda County Water District	Groundwater Protection Program: Guidelines for Groundwater and Soil Investigations at Leaking Underground Fuel Tank Sites (November, 1988)
American Public Health Association	Standard Methods for the Examination of Water and Wastewaters, 16th Edition
Analytical Chemistry (journal)	Principles of Environmental Analysis, Volume 55, Pages 2212-2218 (December, 1983)
Napa County	Napa County Underground Storage Tank Program: Guidelines for Site Investigations; February 1989.
Santa Clara Valley Water District	Guidelines for Preparing or Reviewing Sampling Plans for Soil and Groundwater Investigation of Fuel Contamination Sites (January, 1989)

Guidance and Reference Documents Used to Collect Groundwater Samples (cont.)

Santa Clara Valley Water District	Investigation and Remediation at Fuel Leak sites: Guidelines for Investigation and Technical Report Preparation (March 1989)
Santa Clara Valley Water District	Revised Well Standards for Santa Clara County (July 18, 1989)
American Petroleum Institute	Groundwater Monitoring & Sample Bias; API Publication 4367, Environmental Affairs Department, June 1983
American Petroleum Institute	A Guide to the Assessment and Remediation of Underground Petroleum Releases; API Publication 1628, February 1989
American Petroleum Institute	Literature Summary: Hydrocarbon Solubilities and Attenuations Mechanisms, API Publication 4414, August 1985
Site Specific (as needed)	General and specific regulatory documents as required.

Because ground-water samples collected by G-R are analyzed to the parts per billion (ppb) range for many compounds, extreme care is exercised to prevent contamination of samples. When volatile or semi-volatile organic compounds are included for analysis, G-R sampling crew members will adhere to the following precautions in the field:

1. A clean pair of new, disposable gloves are worn for each well being sampled.

2. When possible, samples are collected from known or suspected wells that are least contaminated (i.e. background) followed by wells in increasing order of contamination.

3. Ambient conditions are continually monitored to maintain sample integrity.

When known or potential organic compounds are being sampled for, the following additional precautions are taken:

1. All sample bottles and equipment are kept away from fuels and solvents. When possible, gasoline (used in generators) is stored away from bailers, sample bottles, purging pumps, etc.

2. Bailers are made of Teflon or Stainless Steel. Other materials such as plastic may contaminate samples with phthalate esters which interfere with many Gas Chromatography (GC) analyses.

3. Volatile organic ground-water samples are collected so that air passage through the sample does not occur or is minimal (to prevent volatiles from being stripped from the samples): sample bottles are filled by slowly running the sample down the side of the bottle until there is a positive convex meniscus over the neck of the bottle; the Teflon side of the septum (in cap) is positioned against the meniscus, and the cap screwed on tightly; the sample is inverted and the bottle lightly tapped. The absence of an air bubble indicates a successful seal; if a bubble is evident, the cap is removed, more sample is added, and the bottle is resealed.

4. Extra Teflon seals are brought into the field in case seals are difficult to handle and/or are dropped. Dropped seals are considered contaminated and are not used. When replacing seals or if seals become flipped, care is taken to assure that the Teflon seal faces down.

Sample analysis methods, containers, preservatives and holding times are shown on Table 1.

Laboratory and field handling procedures of samples are monitored by including QC samples for analysis with every submitted sample lot from a project site. QC samples may include any combination of the following:

A. Trip Blank: Used for purgeable organic compounds only; QC samples are collected in 40 milliliter (ml) sample vials filled in the analytical laboratory with organic-free water. Trip blanks are sent to the project site, and travel with project site samples. Trip blanks are not opened, and are returned from a project site with the project site samples for analysis.

B. Field Blank: Prepared in the field using organic-free water. These QC samples accompany project site samples to the laboratory and are analyzed for specific chemical parameters unique to the project site where they were prepared.

C. Duplicates: Duplicated samples are collected "second samples" from a selected well and project site. They are collected as either split samples or second-run samples collected from the same well.

D. Equipment Blank: Periodic QC sample collected from field equipment rinsate to verify decontamination procedures.

The number and types of QC samples are determined as follows:

A. Up to 2 wells - Trip Blank Only

B. 2 to 5 Wells - 1 Field Blank and 1 Trip Blank

C. 5 to 10 Wells - 1 Field blank, 1 Trip Blank, and 1 Duplicate

D. More than 10 Wells - 1 Field Blank, 1 Trip Blank, and 1 Duplicate per each 12 wells

E. If sampling extends beyond one day, quality control samples will be collected for each day.

Additional QC is performed through ongoing and random reviews of duplicate samples to evaluate the precision of the field sampling procedures and analytical laboratory. Precision of QC data is accomplished by calculating the Relative Percent Difference (RPD). The RPD is evaluated to assess whether values are within an acceptable range (typically ± 20% of duplicate sample).

SAMPLE COLLECTION

This section describes the routine procedures followed by G-R while collecting ground-water samples for chemical analysis. These procedures include decontamination, water-level measurements, well purging, physical parameter measurements, sample collection, sample preservation, sample handling, and sample documentation. Critical sampling objectives for G-R are to:

1. Collect ground-water samples that are representative of the sampled matrix and,

2. Maintain sample integrity from the time of sample collection to receipt by the analytical laboratory.

Sample analyses methods, containers, preservation, and holding times are presented in Table 1.

Decontamination Procedures

All physical parameter measuring and sampling equipment are decontaminated prior to sample collection using Alconox or equivalent detergent followed by steam cleaning with deionized water. Any sampling equipment surfaces or parts that might absorb specific contaminants, such as plastic pump valves, impellers, etc., are cleaned in the same manner.

Sample bottles, bottle caps, and septa used for sampling volatile organics are thoroughly cleaned and prepared in the laboratory. Sample bottles, bottle caps, and septa are protected from all potential chemical contact before actual usage at a sample location.

During field sampling, equipment placed in a well are decontaminated before purging or sampling the next well. The equipment are decontaminated by cleaning with Alconox or equivalent detergent followed by steam cleaning with deionized water.

Water-Level Measurements

Prior to purging and sampling a well, the static-water levels are measured in all wells at a project site using an electric sounder and/or calibrated portable oil-water interface probe (Figure 4). Both static water-level and separate-phase product thickness are measured to the nearest ±0.01 foot. The presence of separate-phase product is confirmed using a clean, acrylic or polyvinylchloride (PVC) bailer, measured to the nearest ±0.01 foot with a decimal scale tape.

Water-Level Measurements (continued)

The monofilament line used to lower the bailer is replaced between wells with new line to preclude the possibility of cross-contamination. Field observations (e.g. well integrity, product color, turbidity, water color, odors, etc.) are noted on the G-R Well Sampling Field Data Sheet shown in Figure 4. Before and after each use, the electric sounder, interface probe and bailer are decontaminated by washing with Alconox or equivalent detergent followed by rinsing with deionized water to prevent cross-contamination.

As mentioned previously, water-levels are measured in wells with known or suspected lowest dissolved chemical concentrations to the highest dissolved concentrations.

Well Purging

Before sampling occurs, well casing storage water and interstitial water in the artificial sand pack will be purged using (1) a positive displacement bladder pump constructed of inert, non-wetting, Teflon and stainless steel, (2) a pneumatic-airlift pumping system, (3) a centrifigal pumping system, or (4) a Teflon or Stainless steel bailer (Figure 5). Methods of purging will be assessed based on well size, location, accessibility, and known chemical conditions. Individual well purge volumes are calculated from borehole volumes which take into account the sand packed interval in the well annular space. As a general rule, a minimum of 3 and a maximum of 10 borehole volumes will be purged. Wells which dewater or demonstrate slow recharge periods (i.e. low-yield wells) during purging activities may be sampled after fewer purging cycles. If a low-yield (low recovery) well is to be sampled, sampling will not take place until at least 80 percent of the previously measured water column has been replaced by recharge, or as per local requirements. Physical parameter measurements (temperature, pH, and specific conductance) are closely monitored throughout the well purging process and are used by the G-R sampling crew as indicators for assessing sufficient purging. Purging is continued until all three physical parameters have stabilized. Specific conductance (conductivity) meters are read to the nearest ± 10 umhos/cm, and are calibrated daily. pH meters are read to the nearest ± 0.1 pH units and are calibrated daily. Temperature is read to the nearest 0.1 degree F. Calibration of physical parameter meters will follow manufacturers specifications. Monitoring wells will be purged according to the protocol presented in Figure 5. Collected field data during purging activities will be entered on the G-R Well Sampling Field Data Sheet shown in Figure 4. Copies of the G-R Field Data Sheets will be reviewed by the G-R Sampling Manager for accuracy and completeness.

DOCUMENTATION

Sample Container Labels

Each sample container will be labeled by an adhesive label, noted in permanent ink immediately after the sample is collected. Label information will include:

Sample point designation (i.e. well number or code)

Sampler's identification

Project number

Date and time of collection

Type of preservation used

Well Sampling Data Forms

In the field, the G-R sampling crew will record the following information on the Well Sampling Data Sheet for each sample collected:

Project number

Client

Location

Source (i.e. well number)

Time and date

Well accessibility and integrity

Pertinent well data (e.g. depth, product thickness, static water-level, pH, specific conductance, temperature)

Calculated and actual purge volumes

Chain-of-Custody

A Chain-of-Custody record (Figure 6) shall be completed and accompany every sample and every shipment of samples to the analytical laboratory in order to establish the documentation necessary to trace sample possession from time of collections. The record will contain the following information:

- Sample or station number or sample identification (ID)
- Signature of collector, sampler, or recorder
- Date and time of collection
- Place of collection
- Sample type
- Signatures of persons involved in chain of possession
- Inclusive dates of possession

Samples shall always be accompanied by a Chain-of-Custody record. When transferring the samples, the individual relinquishing and receiving the samples will sign, date, and note the time on the Chain-of-Custody record. G-R will be responsible for notifying the laboratory coordinator when and how many samples will be sent to the laboratory for analysis, and what types of analyses shall be performed.

TABLE 1

SAMPLE ANALYSIS METHODS, CONTAINERS, PRESERVATIONS, AND HOLDING TIMES

Parameter	Analytical Method	Reporting Units	Container	Preservation	Maximum Holding Time
Total Petroleum Hydrocarbons (Gasoline)	EPA 8015 (modified)	mg/l ug/l	40 ml. vial glass, Teflon	cool, 4 C HCl to pH<2	14 days (maximum)
Benzene Toluene Ethylbenzene Xylenes (BTEX	EPA 8020	mg/l ug/l	50 ml. vial glass, Teflon lined septum	cool, 4 C HCl to pH<2	7 days (w/o preservative) 14 days (w preservative)
Oil & Grease	SM 503E	mg/l ug/l	1 l glass, Teflon lined septum	H2SO4 or HCl to pH<2	28 days (maximum)
Total Petroleum Hydrocarbons (Diesel)	EPA 8015 (modified)	mg/l ug/l	40 ml. vial glass, Teflon lined septum	cool, 4 C	14 days (maximum)
Halogented Volatile Organics (chlorinated solvents)	8010	mg/l ug/l	40 ml. vial glass, Teflon lined septum	cool, 4 C	14 days (maximum)
Non chlorinated solvents	8020	mg/l ug/l	40 ml. vial glass, Teflon lined septum	cool, 4 C HCl to pH<2	14 days (maximum)
Volatile Organics	8240	mg/l ug/l	40 ml. vial glass, Teflon lined septum	cool, 4 C HCl to pH<2	14 days (maximum)
Semi-Volatile Organics	8270	mg/l ug/l	1 l amber glass, Teflon lined septum	cool, 4 C	7 days extract 40 days (maximum to analyze)
Specific Conductance (Field test)		umhos/cm			
pH (Field test)		pH units			
Temperature (Field test)		Deg F			

GeoStrategies Inc.

FIELD EXPLORATORY BORING LOG

FIGURE 1

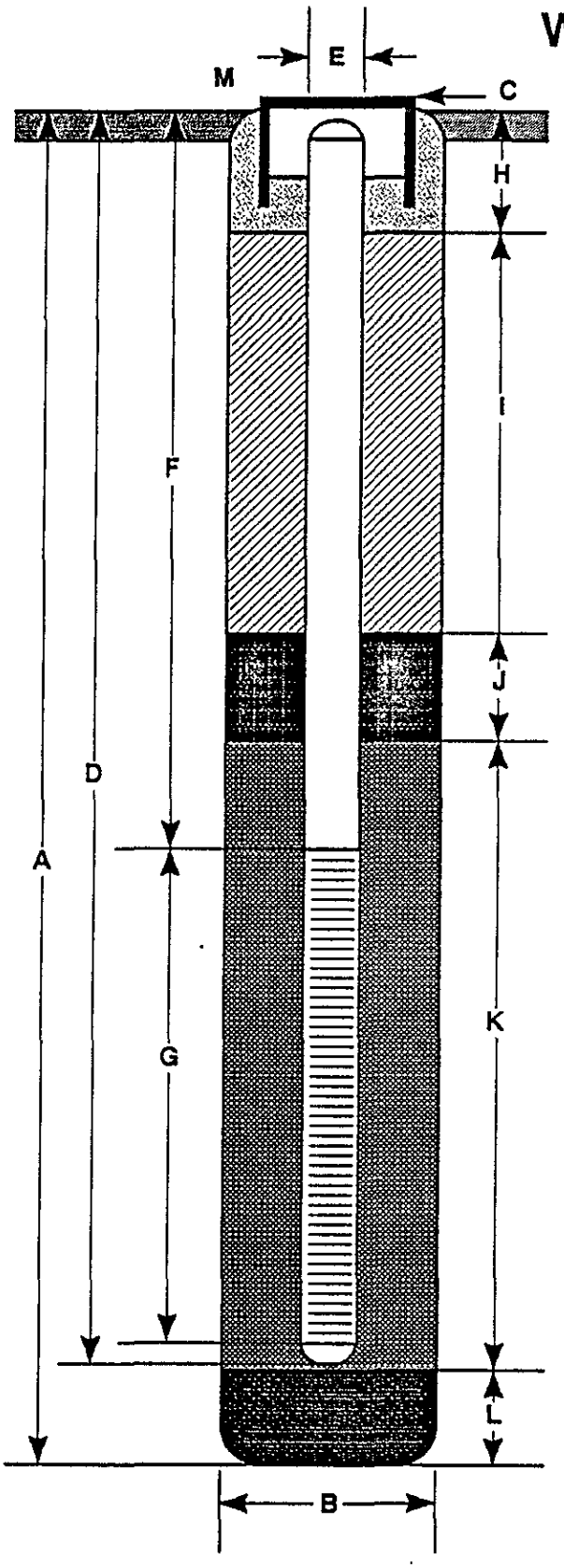
Field location of boring:	Project No.:	Date:	Boring No:
	Client:		
	Location:		
	City:		Sheet
	Logged by:	Driller:	of
	Casing installation data:		
Drilling method:			
Hole diameter:	Top of Box Elevation:		Datum:

								Water Level				
PID (ppm)	Blows/ft. or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Time				
								Date				
								Description				

Remarks:

WELL CONSTRUCTION DETAIL

FIGURE 2



A Total Depth of Boring _____ ft.

B Diameter of Boring _____ in.
Drilling Method _____

C Top of Box Elevation _____ ft.
☐ Referenced to Mean Sea Level
☐ Referenced to Project Datum

D Casing Length _____ ft.
Material _____

E Casing Diameter _____ in.

F Depth to Top Perforations _____ ft.

G Perforated Length _____ ft.
Perforated Interval from _____ to _____ ft.
Perforation Type _____
Perforation Size _____ in.

H Surface Seal from _____ to _____ ft.
Seal Material _____

I Backfill from _____ to _____ ft.
Backfill Material _____

J Seal from _____ to _____ ft.
Seal Material _____

K Gravel Pack from _____ to _____ ft.
Pack Material _____

L Bottom Seal _____ ft.
Seal Material _____

M _____

Note: Depths measured from initial ground surface

GeoStrategies Inc.

Well Construction Detail

WELL NO.

JOB NUMBER | REVIEWED BY RG/CEG | DATE | REVISED DATE | REVISED DATE

WELL DEVELOPMENT FORM FIGURE 3

Page_____ of_____

(to be filled out in office)

Client_____ SS#_____ Job#_____

Name_____ Location_____

Well#_____ Screened Interval_____ Depth_____

Aquifer Material_____ Installation Date _____

Drilling Method_____ Borehole Diameter_____

Comments regarding well installation:_____

(to be filled out in the field) Name_____

Date_____ Development Method_____

Total Depth_____ - Depth to liquid_____ = WaterColumn_____

Product thickness_____

_____ x _____ x _____ x 0.0408 = _____gals
Water Column Diameter (in.) #Vol

Purge Start_____ Stop_____ Rate_____ gpm

Gallons	Time	Clarity	Temp.	pH	Conductivity
0					

Total gallons removed_____ Development stop time_____

Depth to liquid _____at_____(time)

Odor of water_____ Water discharged to_____

Comments_____

GETTLER–RYAN INC.

General and Environmental Contractors

WELL SAMPLING FIELD DATA SHEET

FIGURE 4

COMPANY _____ JOB # _____

LOCATION _____ DATE _____

CITY _____ TIME _____

Well ID. _____ Well Condition _____

Well Diameter _____ in. Hydrocarbon Thickness _____ ft.

Total Depth _____ ft.

Depth to Liquid- _____ ft.

Volume Factor (VF)			
	2" = 0.17	6" = 1.50	12" = 5.80
	3" = 0.38	8" = 2.60	
	4" = 0.66	10" = 4.10	

(# of casing volumes) _____ x _____ x(VF) _____ = (Estimated Purge Volume) _____ gal.

Purging Equipment _____

Sampling Equipment _____

Starting Time _____ Purging Flow Rate _____ gpm.

(Estimated Purge Volume) _____ gal. / (Purging Flow Rate) _____ gpm. = (Anticipated Purging Time) _____ min.

Time	pH	Conductivity	Temperature	Volume

Did well dewater? _____ If yes, time _____ Volume _____

Sampling Time _____ Weather Conditions _____

Analysis _____ Bottles Used _____

Chain of Custody Number _____

COMMENTS _____

FIGURE 5

Monitoring Well Sampling Protocol Schematic

Sampling Crew Reviews Project Sampling Requirements/Schedule

↓

Field Decontamination and Instrumentation Calibration

↓

Check Integrity of Well (Inspect for Well Damage)

↓

Measure and Record Depth to Water and Total Well Depth (Electric Well Sounder)

↓

Check for Floating Product (Oil/Water Interface Probe)

Floating Product Present

↓

Confirm Product Thickness (Acrylic or PVC Bailer)

↓

Collect Free-Product Sample

↓

Dissolved Product Sample Not Required

↓

Record Data on Field Data Form

Floating Product Not Present

↓

Purge Volume Calculation

$V = \pi (r/12)^2 h(\_\% \text{ vol})(7.48) = \_\_\_ / \text{gallons}$

V = Purge volume (gallons)

$\pi = 3.14159$

h = Height of Water Column (feet)

r = Borehole radius (inches)

↓

Evacuate water from well equal to the calculated purge volume while monitoring groundwater stabilization indicator parameters (pH, conductivity, temperature) at intervals of one casing volume.

Well Dewaters after One Purge Volume (Low yield well)

↓

Well Recharges to 80% of Initial Measured Water Column Height in Feet within 24 hrs. of Evacuation.

↓

Measure Groundwater Stability Indicator Parameters (pH, Temperature, Conductivity)

↓

Collect Sample and Complete Chain-of-Custody

↓

Preserve Sample According to Required Chemical Analysis

↓

Transport to Analytical Laboratory

Well Readily Recovers

↓

Record Groundwater Stability Indicator Parameters from each Additional Purge Volume

Stability indicated when the following Criteria are met:

pH :	± 0.1 pH units
Conductivity:	± 10%
Temperature:	1.0 degrees F

Groundwater Stability Achieved

↓

Collect Sample and Complete Chain-of-Custody

↓

Preserve Sample According to Required Chemical Analysis

↓

Transport to Analytical Laboratory

Groundwater Stability Not Achieved

↓

Continue Purging Until Stability is Achieved

↓

Collect Sample and complete Chain-of-Custody

↓

Preserve Sample According to Required Chemical Analysis

↓

Transport to Analytical Laboratory

Gettler - Ryan Inc. ENVIRONMENTAL DIVISION

Chain of Custody
FIGURE 6

COMPANY _____ JOB NO. _____

JOB LOCATION _____

CITY _____ PHONE NO. _____

AUTHORIZED _____ DATE _____ P.O. NO. _____

SAMPLE ID	NO. OF CONTAINERS	SAMPLE MATRIX	DATE/TIME SAMPLED	ANALYSIS REQUIRED	SAMPLE CONDITION LAB ID

RELINQUISHED BY: _____ RECEIVED BY: _____

RELINQUISHED BY: _____ RECEIVED BY: _____

RELINQUISHED BY: _____ RECEIVED BY LAB: _____

DESIGNATED LABORATORY: _____ DHS #: _____

REMARKS: _____

DATE COMPLETED _____ FOREMAN _____