Chevron U.S.A. Inc.
2410 Camino Ramon, San Ramon, California • Phone (415) 842-9500
Mail Address: P.O. Box 5004, San Ramon, CA 94583-0804

90 APR 19 AM 11:27

Marketing Operations

D. Moller
Manager, Operations
S. L. Patterson
Area Manager, Operations
C. G. Trimbach
Manager, Engineering

April 17, 1990

Mr. Rafat Shahid
Alameda County
Environmental Health
80 Swan Way, Room 200
Oakland, California 94621

Reviewed 5-3-90
RE

Re: Chevron Service Station #9-0504
15900 Hesperian Boulevard
San Lorenzo, CA

Dear Mr. Shahid:

Enclosed we are forwarding a Work Plan prepared by our consultant GeoStrategies, Inc., which describes additional work steps we propose to take at the above referenced site. We would appreciate your review and concurrence. Chevron will proceed under self direction unless otherwise informed by your office.

I declare under penalty of perjury that the information contained in the attached report is true and correct, and that any recommended actions are appropriate under the circumstances, to the best of my knowledge.

If you have any questions or comments please do not hesitate to call me at (415) 842 - 9625.

Very truly yours,

C. G. Trimbach

JMR/jmr
Enclosure

By John Randall

cc: Mr. Lester Feldman
RWQCB-Bay Area
1800 Harrison Street
Suite # 700
Oakland, CA 94612

Jerry Mitchell, GeoStrategies

GeoStrategies Inc.

WORK PLAN

Chevron Service Station No. 0504
15900 Hesperian Boulevard
San Lorenzo, California

Report No. 7259-3

April 4, 1990

KLD APR 16 '90

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

April 4, 1990

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

Attn: Mr. Jerry Mitchell

Re: WORK PLAN
Chevron Service Station No. 0504
15900 Hesperian Boulevard
San Lorenzo, California

Gentlemen:

This work plan has been prepared for the Chevron Service Station at the above referenced location (Plate 1). The purpose of the proposed work is to ascertain the areal extent of the hydrocarbon plume.

BACKGROUND

Gettler-Ryan Inc. (G-R) installed five ground-water monitoring wells (C-1 through C-5) in December 1983 at the site. GeoStrategies Inc. (GSI) installed three additional wells (C-6, C-7, and C-8) in November 1989. The monitoring well locations are presented on Plate 2.

The site appears to be underlain by a shallow low permeability aquifer, with groundwater beneath the site flowing south-southwest (Plate 3). G-R conducted groundwater sampling on December 8, 1989. Floating hydrocarbons were observed in Wells C-1 and C-2, and a sheen was observed in Well C-3. Chemical analyses revealed dissolved fuel contaminants in Wells C-3, C-7, and C-8. A summary of the groundwater chemical analytical data is presented on Table 1. Presence of contaminants in Wells C-7 and C-8 indicates the plume has migrated off-site to the south in the downgradient direction. At this time, the floating hydrocarbons appear to be limited to the southern part of the site (Plate 4). A copy of the G-R groundwater sampling report and certified analytical results are presented in Appendix A.

TECHNICAL APPROACH

GSI has reviewed the available site information, and recommends that four monitoring wells be installed at the locations shown on Plate 2. The wells are arrayed to ascertain the areal extent of the dissolved contaminant plume south of the site. The following work tasks are recommended.

TASK 1. Four exploratory borings will be drilled using hollow-stem augers at the locations shown on Plate 2. The borings will be advanced through the upper shallow aquifer to the stiff clay stratum approximately 25 feet deep. Boreholes will be lithologically logged at intervals of 5 feet as a minimum, and additional samples collected at lithologic changes. All four boreholes will be converted to 2-inch-diameter monitoring wells using Schedule 40 PVC 0.020-inch screen, installed to fully penetrate the aquifer. A proposed well detail is presented as Plate 5. All field work will be performed according to the GSI Field Methods and Procedures presented in Appendix B.

TASK 2. All newly installed ground-water monitoring wells will be sampled according to G-R sampling protocol in Appendix B. Ground-water samples will be analyzed for Total Petroleum Hydrocarbons calculated as Gasoline (TPH-Gasoline) and Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) using EPA Method 8015 (Modified) and EPA Method 8020. Analysis will be performed by Superior Analytical Laboratory, a State-certified environmental analytical laboratory.

TASK 3. A half-mile radius well survey to identify groundwater wells (if any) located near the site will be performed.

TASK 4. A report will be prepared documenting the results of this investigation. This report will include potentiometric maps, chemical concentration maps as well as a summary of the available chemical analytical data.

Based on the results of this investigation and beneficial usage survey, an evaluation of the applicability of soil and groundwater remediation will be made. Should the evaluation indicate that soil and groundwater remediation be necessary, a remediation plan will be submitted.

If you have any questions please call.

GeoStrategies Inc. by,

Melissa Wann
Project Geologist

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

MW/CMP/mlg

Plate 1. Vicinity Map
Plate 2. Site Plan
Plate 3. Potentiometric Map
Plate 4. Chemical Concentration Map
Plate 5. Proposed Well Design

Appendix A. G-R Ground-water Sampling Report
Appendix B. GSI Field Methods and Procedures

TABLE 1

GROUND-WATER ANALYSES DATA

WELL NO	SAMPLE DATE	ANALYZED DATE	TPH-G (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)	TPH-D (PPB)	OIL&GREASE (PPB)	WELL ELEV (FT)	STATIC WATER ELEV (FT)	PRODUCT THICKNESS (FT)	DEPTH TO WATER (FT)
C-1	08-Dec-89	----	----	----	----	----	----	----	----	33.93	20.80	0.01	13.14
C-2	08-Dec-89	----	----	----	----	----	----	----	----	34.21	20.89	0.15	13.44
C-3	08-Dec-89	15-Dec-89	680.	6.	1.	31.	58.	N/A	N/A	35.46	21.02	----	14.44
C-4	08-Dec-89	15-Dec-89	<500.	<0.5	<0.5	<0.5	<0.5	<1000.	<5000.	35.78	21.09	----	14.69
C-5	08-Dec-89	15-Dec-89	<500.	<0.5	<0.5	<0.5	<0.5	N/A	N/A	35.31	21.09	----	14.22
C-6	08-Dec-89	15-Dec-89	<500.	<0.5	<0.5	<0.5	<0.5	N/A	N/A	36.89	20.94	----	15.95
C-7	08-Dec-89	15-Dec-89	1700.	32.	12.	17.	150.	N/A	N/A	32.75	20.63	----	12.12
C-8	08-Dec-89	15-Dec-89	4800.	62.	11.	95.	180.	N/A	N/A	33.82	20.37	----	13.45
CD-3	08-Dec-89	16-Dec-89	710.	6.	1.	32.	61.	N/A	N/A	----	----	----	----
TB	08-Dec-89	16-Dec-89	<500.	<0.5	<0.5	<0.5	<0.5	N/A	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

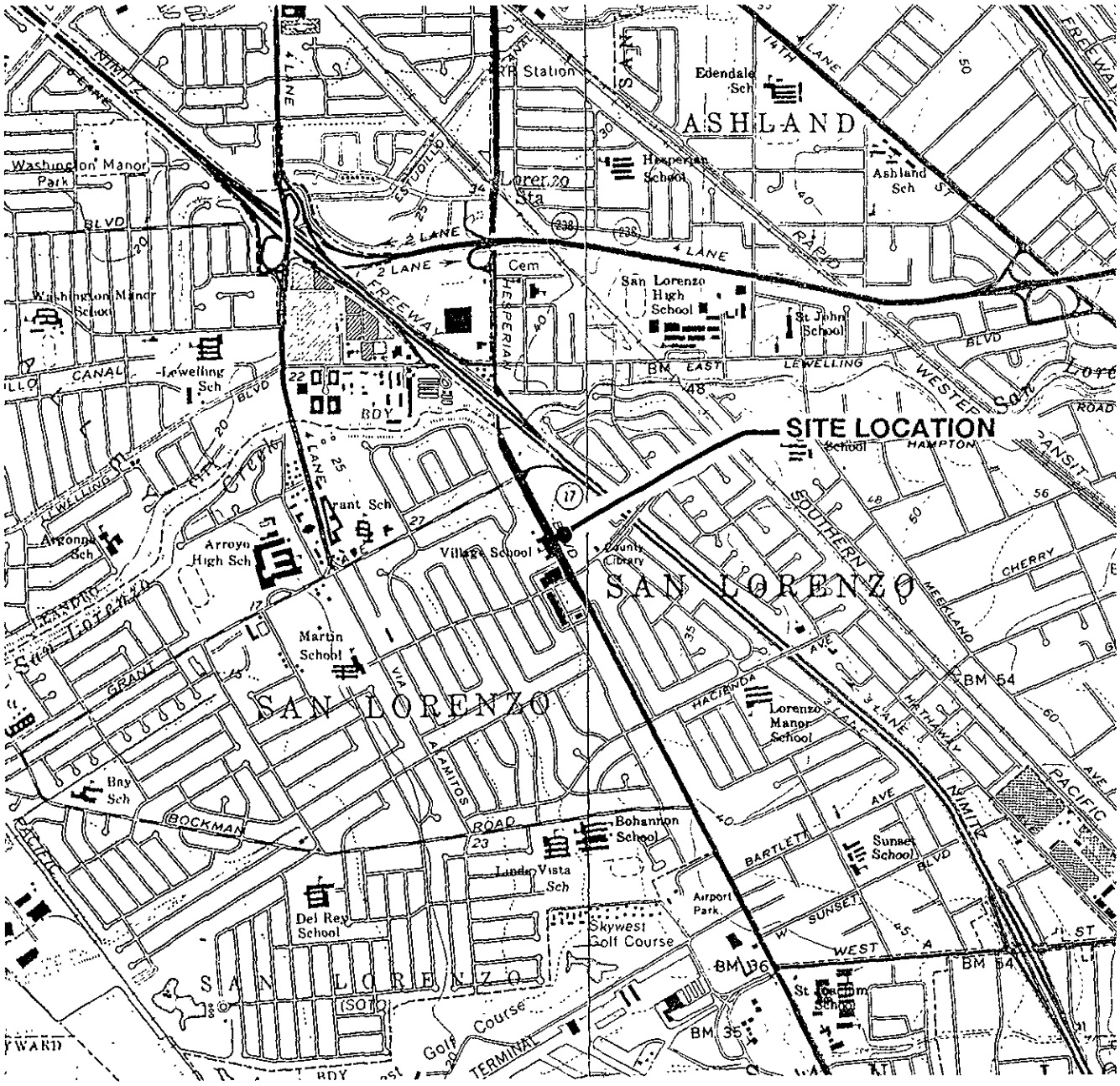
Toluene 100 ppb

TPH-G = Total Petroleum Hydrocarbons as Gasoline
TPH-D = Total Petroleum Hydrocarbons as Diesel
PPB = Parts Per Billion
CD = Duplicate Sample
TB = Trip Blank
N/A = Not Analyzed

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 MCL are subject to change pending State review

Project No. 7259-1

ILLUSTRATIONS



Base Map: *USGS Topographic Map*

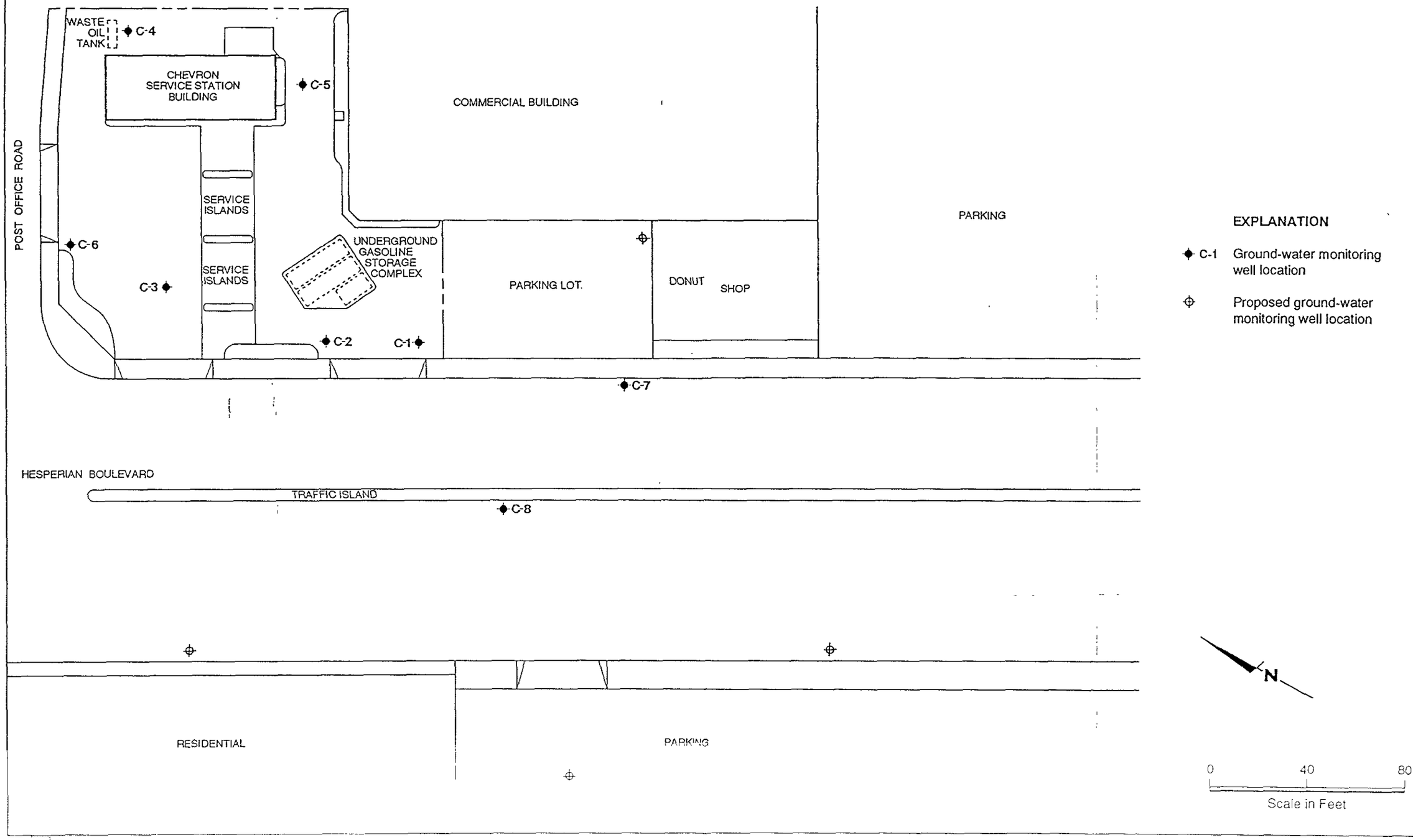
Approx. SCALE: 1" = 2000'

GeoStrategies Inc.

Vicinity Map
Chevron Service Station #0504
15900 Hesperian Boulevard
San Lorenzo, California

PLATE
1

JOBNUMBER	REVIEWEDBYRG/CEG	DATE	REVISEDDATE	REVISEDDATE
7259		10/89		

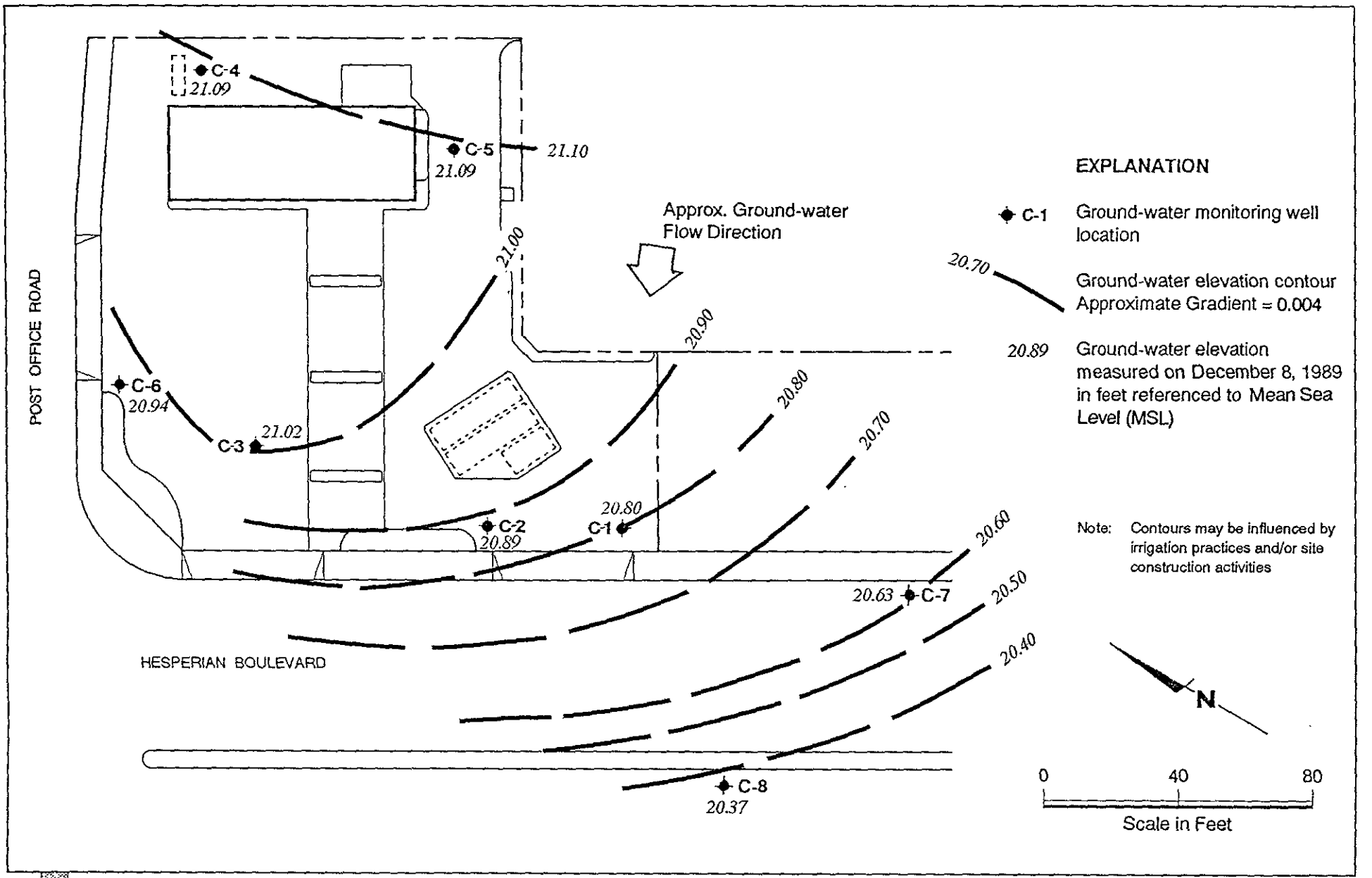


GSI GeoStrategies Inc.

Site Plan
Chevron Service Station #0504
15900 Hesperian Boulevard
San Lorenzo, California

PLATE 2

JOB NUMBER	REVIEWED BY/DATE	DATE	REVISED DATE	REVISED DATE
7259	Chuf 6/26/90	1/90		

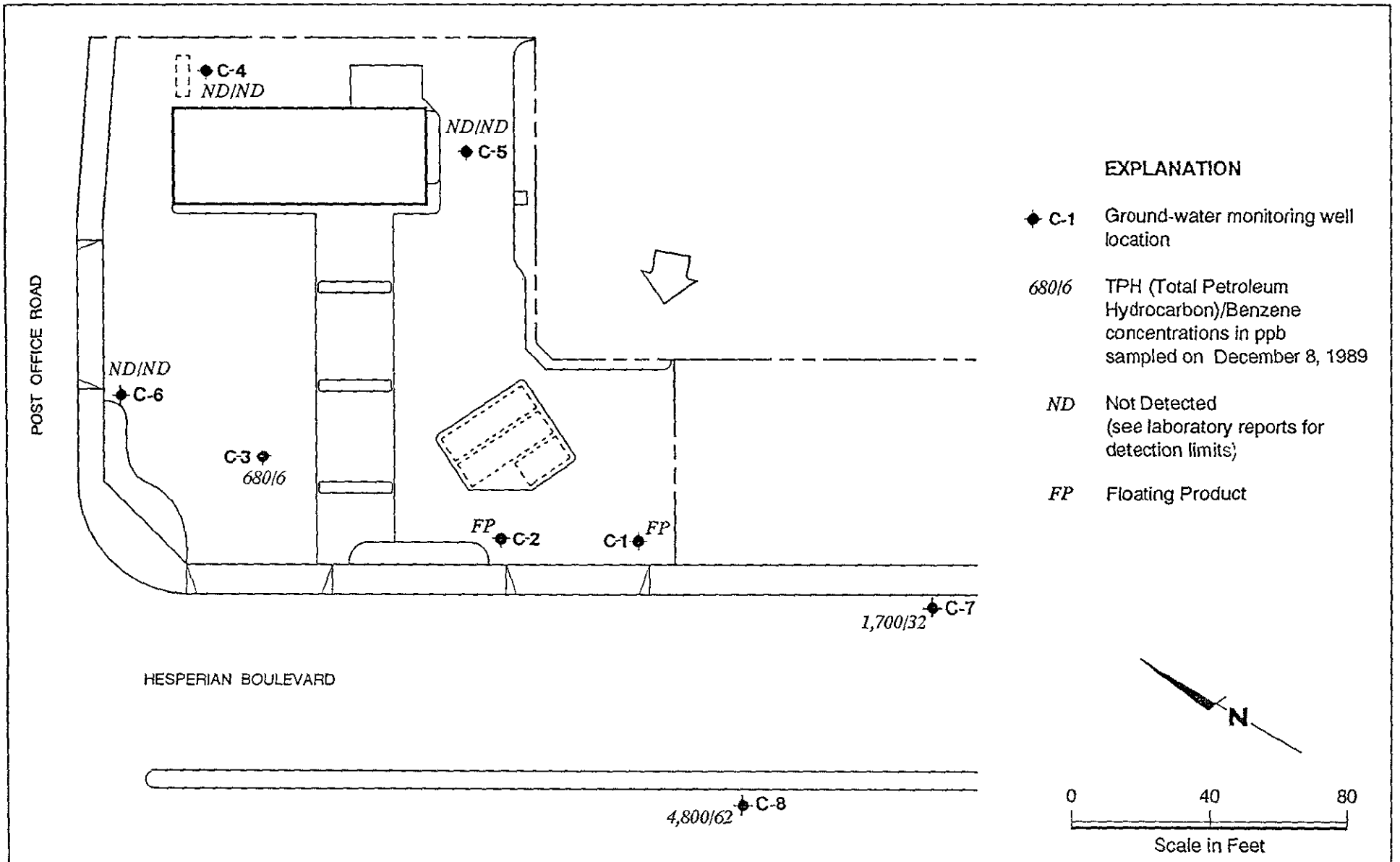


GeoStrategies Inc.

Potentiometric Map
Chevron Service Station #0504
15900 Hesperian Boulevard
San Lorenzo, California

PLATE
3

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7259	CMP CEG 1202	1/90		



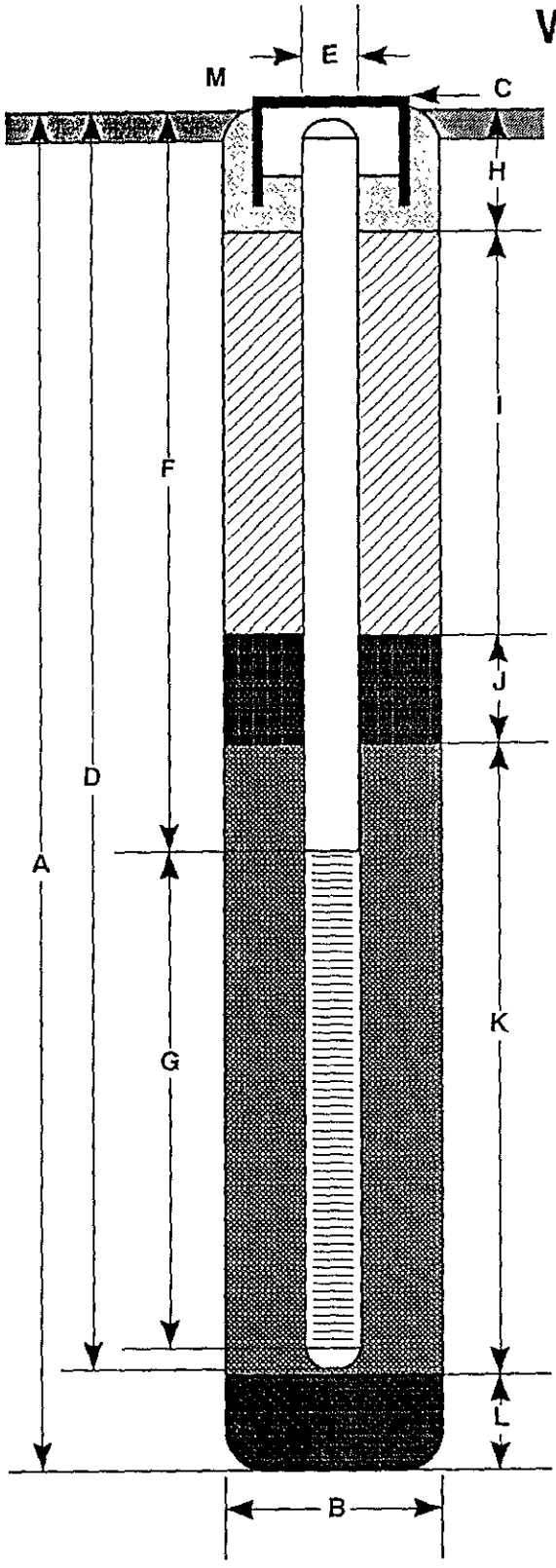
GeoStrategies Inc.

TPH/Benzene Concentration Map
Chevron Service Station #0504
15900 Hesperian Boulevard
San Lorenzo, California

PLATE
4

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7259	CMP CEG 12/92	1/90		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 25 ft.

B Diameter of Boring 10 in.
Drilling Method Hollow-Stem Auger

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

D Casing Length 25 ft.
Material Schedule 40 PVC

E Casing Diameter 2 in.

F Depth to Top Perforations 7 ft.

G Perforated Length 18 ft.
Perforated Interval from 7 to 25 ft.
Perforation Type Factory Slot
Perforation Size 0.020 in.

H Surface Seal from 0.0 to 1.5 ft.
Seal Material Cement

I Backfill from 1.5 to 4.0 ft.
Backfill Material Cement Grout

J Seal from 4.0 to 5.0 ft.
Seal Material Bentonite Pellets

K Gravel Pack from 5.0 to 25 ft.
Pack Material Lonestar #2/12 Sand

L Bottom Seal ft.
Seal Material

M

Note: All depths are approximate and based on anticipated site subsurface conditions. Design is subject to change based on actual field conditions.

GSI GeoStrategies Inc.

Proposed Well Construction Detail
Chevron Service Station #504
15900 Hesperian Boulevard
San Lorenzo, California

PLATE 5

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7259		03/90		

APPENDIX A
GETTLER-RYAN
GROUNDWATER SAMPLING REPORTS

gettler — ryan inc.

January 5, 1990

GROUNDWATER SAMPLING REPORT

Chevron U.S.A. Inc.
Post Office Box 5004
San Ramon, California 94583-0804

Referenced Site: Chevron Service Station #0504
15900 Hesperian Blvd.
San Lorenzo, California

Sampling Date: December 8, 1989

This report presents the results of the groundwater sampling and analytical program conducted by Gettler-Ryan Inc. on December 8, 1989 at the referenced location. The site is occupied by an operating service station located on the northeast corner of Hesperian Boulevard and Post Office Road. The service station has underground storage tanks containing regular leaded, unleaded and super unleaded gasoline products, and waste oil.

There are currently six groundwater monitoring wells on site and two off site at the locations shown on the attached site map. Prior to sampling, all monitoring wells were inspected for total well depth, water levels, and presence of separate phase hydrocarbons using an electronic interface probe. A clean acrylic bailer was used to visually confirm the presence and thickness of separate phase hydrocarbons. Groundwater depths ranged from 12.12 to 15.95 feet below grade. Separate phase hydrocarbons were observed in wells C-1 and C-2.

The wells were then purged and sampled. 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. The purge water was drummed for proper disposal. Details of the final well purging results are presented on the attached Table of Monitoring Data.

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. 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). The samples were labeled, stored on blue ice, and transported to the laboratory for analysis. Chain of custody records were established noting sample identification numbers, time, date, and custody signatures.

1992 national avenue • hayward, california 94545-1787 • (415) 783-7500

The samples were analyzed at Superior Analytical Laboratory located at 1385 Fairfax Street, Suite D., San Francisco, California. The laboratory is assigned a California DHS-HMTL Certification number of 220. 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.	C-1	C-2	C-3 CD-3	C-4	C-5	C-6
Casing Diameter (inches)	3	3	3	3	3	2
Total Well Depth (feet)	----	----	19.4	20.4	19.3	24.7
Depth to Water (feet)	13.14 **	13.44 **	14.44	14.69	14.22	15.95
Free Hydrocarbons (feet)	0.01	0.15	sheen	none	none	none
Reason Not Sampled	free product	free product	----	----	----	----
Calculated 4 Case Vol.(gal.)	----	----	7.5	8.6	7.8	5.9
Did Well Dewater?	----	----	no	no	no	no
Volume Evacuated (gal.)	----	----	9	10	10	15
Purging Device	----	----	Bailer	Bailer	Bailer	Bailer
Sampling Device	----	----	Bailer	Bailer	Bailer	Bailer
Time	----	----	10:58	12:12	12:48	11:37
Temperature (F)*	----	----	64.5	69.0	70.1	69.4
pH*	----	----	7.15	6.86	6.84	7.00
Conductivity (umhos/cm)*	----	----	379	1337	1175	1278

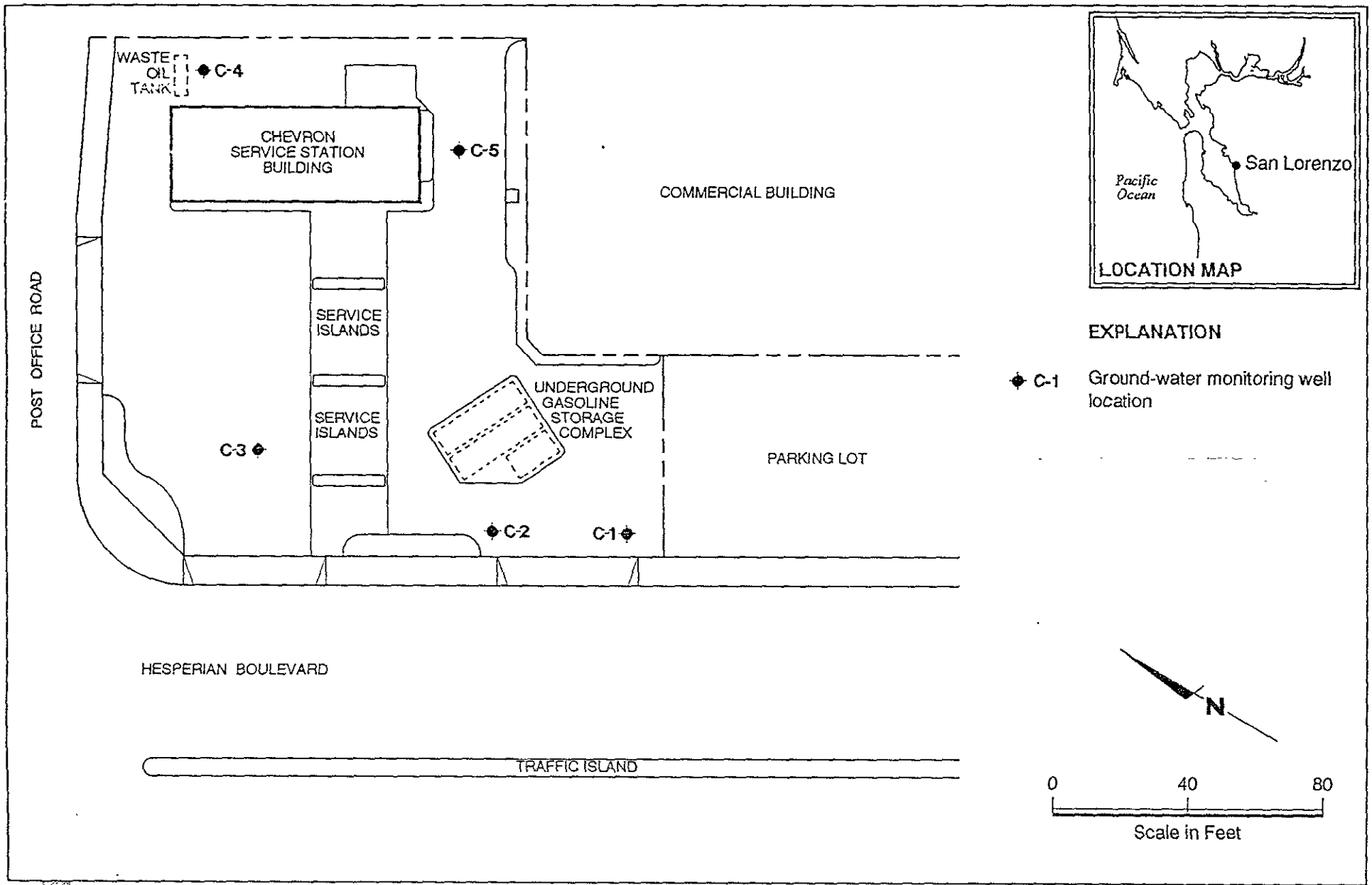
* Indicates Stabilized Value

** Not corrected for separate phase hydrocarbons

TABLE OF MONITORING DATA
GROUNDWATER WELL SAMPLING REPORT

WELL I.D.	C-7	C-8
Casing Diameter (inches)	2	2
Total Well Depth (feet)	25.2	24.5
Depth to Water (feet)	12.12	13.45
Free Hydrocarbons (feet)	none	none
Reason Not Sampled	----	----
Calculated 4 Case Vol.(gal.)	8.9	7.5
Did Well Dewater?	no	no
Volume Evacuated (gal.)	22	19
Purging Device	Bailer	Bailer
Sampling Device	Bailer	Bailer
Time	09:42	08:41
Temperature (F)*	68.7	69.6
pH*	6.89	6.86
Conductivity (umhos/cm)*	1270	1427

* Indicates Stabilized Value



GeoStrategies Inc.

Site Plan
Chevron Service Station #0504
15900 Hesperian Boulevard
San Lorenzo, California

PLATE
1

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
259		10/89		

SUPERIOR ANALYTICAL LABORATORY, INC.
1385 FAIRFAX ST., STE. D. • SAN FRANCISCO, CA 94124 • PHONE (415) 647-2081

RECEIVED
JAN 5 1990

GETTLER-RYAN INC.
GENERAL CONTRACTORS

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 10338
CLIENT: Chevron USA
CLIENT JOB NO.: 3259

DATE RECEIVED: 12/11/89
DATE REPORTED: 12/18/89

Lab Number	Customer Sample Identification	Date Sampled	Date Analyzed
10338- 1	C-3	12/08/89	12/15/89
10338- 2	C-4	12/08/89	12/15/89
10338- 3	C-5	12/08/89	12/15/89
10338- 4	C-6	12/08/89	12/15/89
10338- 5	C-7	12/08/89	12/15/89
10338- 6	C-8	12/08/89	12/15/89
10338- 7	CD-3	12/08/89	12/16/89
10338- 8	TRIP	12/08/89	12/16/89

Laboratory Number:	10338 1	10338 2	10338 3	10338 4	10338 5
ANALYTE LIST	Amounts/Quantitation Limits (ug/l)				
OIL AND GREASE:	NA	ND<5000	NA	NA	NA
TPH/GASOLINE RANGE:	680	ND<500	ND<500	ND<500	1700
TPH/DIESEL RANGE:	NA	ND<1000	NA	NA	NA
BENZENE:	6	ND<0.5	ND<0.5	ND<0.5	32
TOLUENE:	1	ND<0.5	ND<0.5	ND<0.5	12
ETHYL BENZENE:	31	ND<0.5	ND<0.5	ND<0.5	17
XYLENES:	58	ND<0.5	ND<0.5	ND<0.5	150

Laboratory Number:	10338 6	10338 7	10338 8
ANALYTE LIST	Amounts/Quantitation Limits (ug/l)		
OIL AND GREASE:	NA	NA	NA
TPH/GASOLINE RANGE:	4800	710	ND<500
TPH/DIESEL RANGE:	NA	NA	NA
BENZENE:	62	6	ND<0.5
TOLUENE:	11	1	ND<0.5
ETHYL BENZENE:	95	32	ND<0.5
XYLENES:	180	61	ND<0.5

RECEIVED
JAN 2 1990

SUPERIOR ANALYTICAL LABORATORY, INC.
1385 FAIRFAX ST., STE. D. • SAN FRANCISCO, CA 94124 • PHONE (415) 647-2081

GETTLER-RYAN INC.
GENERAL CONTRACTORS

CERTIFICATE OF ANALYSIS

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
Diesel by Modified EPA SW-846 Method 8015
Gasoline by Purge and Trap: EPA MEthod 8015/5030
ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

QA/QC INFORMATION
SET: 10338

NA = ANALYSIS NOT REQUESTED
ND = ANALYSIS NOT DETECTED ABOVE QUANTITATION LIMIT

ug/L = part per billion (ppb)

OIL AND GREASE ANALYSIS By Standard Methods Method 503E:
Duplicate RPD NA
Minimum Detection Limit in Water: 5000ug/L

Modified EPA Method 8015 for Extractable Hydrocarbons:
Minimum Quantitation Limit for Diesel in Water: 1000ug/L
Daily Standard run at 200mg/L; RPD Diesel =<15%
MS/MSD Average Recovery =95%: Duplicate RPD =14%

8015/5030 Total Purgable Petroleum Hydrocarbons:
Minimum Quantitation Limit for Gasoline in Water: 500ug/L
Daily Standard run at 2mg/L; RPD Gasoline = <15%
MS/MSD Average Recovery = 95%: Duplicate RPD = 0%

8020/BTXE
Minimum Quantitation Limit in Water: 0.50ug/L
Daily Standard run at 20ug/L; RPD = <15%
MS/MSD Average Recovery = 104%: Duplicate RPD = <7%

Richard Srna, Ph.D.
Laboratory Director

10558 JH

Chain-of-Custody Record

Chevron U.S.A. Inc.
P.O. Box 5004
San Ramon, CA 94583
FAX (415) 842-9591

Chevron Facility Number: 0504
Consultant Release Number: 2451960
Consultant Project Number: 3259
Consultant Name: Gettler Ryan Inc
Address: 1992 National Ave, Hayward
Fax Number: 415 783-1089
Project Contact (Name): Jerry Mitchell
(Phone): 415 783-7500

Chevron Contact (Name): John Randall
(Phone):
Laboratory Name: Superior Analytical
Contract Number: 247 2450
Samples Collected by (Name): Phil Dye
Collection Date: 12-8-89
Signature: Phillip J Dye

	Sample Number	Lab Number	Number of Containers	Matrix S = Soil W = Water A = Air C = Charcoal	Type G = Grab C = Composite	Time	Sample Preservation	Iced	Modified EPA 8015 Total Petro. Hydrocarb. as Gasoline	Modified EPA 8015 Total Petro. Hydrocarb. as Gasoline + Diesel	503 Oil and Grease	Arom. Volatiles - BTXE Soil: 8020/Wtr.: 602	Arom. Volatiles - BTXE Soil: 8240/Wtr.: 624	Total Lead DHS-Luft	EDB DHS-AB 1803	Total Petro Hydrocarbs as Waste Oil			Remarks
#1	C-3		3	water	well	10:58	HCL	Y	✓			✓							
#2	C-4		~~5~~ 3			12:12			✓			✓				✓			
#3	C-5		3			12:48			✓			✓							
#4	C-6		3			11:37			✓			✓							
#5	C-7	KM 12/8	~~5~~ 2			09:42			✓			✓							
#6	C-8		3			08:41			✓			✓							
#7	CD-3		3			—			✓			✓							
#8	Trip		1	↓	↓	—	↓		✓			✓							

Relinquished By (Signature)	Organization	Date/Time	Received By (Signature)	Organization	Date/Time	Turn Around Time (Circle Choice)
Phillip J Dye	G/R	12-8/1855		G/R	12-8-89 12:48	24 Hrs
Relinquished By (Signature)	Organization	Date/Time	Received By (Signature)	Organization	Date/Time	48 Hrs
	G/R	12-8/89 1:43pm				5 Days
Relinquished By (Signature)	Organization	Date/Time	Received For Laboratory By (Signature)		Date/Time	10 Days
					12/8/89 1:50	

Need results no later than 12-18-89

Printed in U.S.A.

APPENDIX B

GEOSTRATEGIES INC.
FIELD METHODS AND PROCEDURES

FIELD METHODS AND PROCEDURES

EXPLORATION DRILLING

Mobilization

Prior to any drilling activities, GSI will verify that necessary drilling permits have been secured.

Utility locations will be located and drilling will be conducted so as not to disrupt activities at a project site. GSI will obtain and review available public data on subsurface geology and if warranted, the location of wells within a half-mile of the project site will be identified. Drillers will be notified in advance so that drilling equipment can be inspected prior to performing work.

Drilling

The subsurface investigations are typically performed to assess the lateral and vertical extent of petroleum hydrocarbons present in soils and ground water. Drilling methods will be selected to optimize field data requirements as well as be compatible with known or suspected subsurface geologic conditions.

Monitoring wells are installed using a truck-mounted hollow-stem auger drill rig or mud-rotary drill rig. Typically, the hollow-stem rig is used for wells up to 100 feet, if subsurface conditions are favorable. Wells greater than 100-feet deep are typically drilled using mud-rotary techniques. When mud rotary drilling is used, an electric log will be performed for additional lithological information. Also during mud rotary drilling, precautions will be taken to prevent mud from circulating contaminants by using a conductor casing to seal off contaminated zones. Samples will be collected for lithologic logging by continuous chip, and where needed by drive sample or core as specified by the supervising geologist.

Soil Sampling

Shallow soil borings will be drilled using a truck-mounted hollow-stem auger drilling rig, unless site conditions favor a different drilling method. Drilling and sampling methods will be consistent with ASTM Method D-1452-80. The auger size will be a minimum 6-inch nominal outside-diameter (O.D). No drilling fluids will be used during this drilling method. The augers and other tools used in the bore hole will be steam cleaned before use and between borings to minimize the possibilities of cross-contamination between borings.

Soil samples are typically collected at 5-foot intervals as a minimum from ground surface to total depth of boring. Additional soil samples will be collected based on significant lithologic changes and/or potential chemical content. Soil samples from each sampling interval will be lithologically described by a GSI geologist (Figure 1). Soil colors will be described using the Munsell Color Chart. Rock units will be logged using appropriate lithologic terms, and colors described by the G.S.A. Rock Color Chart.

Head-space analyses will be performed to check for the evidence of volatile organic compounds. Head-space analyses will be performed using an organic vapor analyzer; either an OVA, HNU, or OVM. Organic vapor concentrations will be recorded on the GSI field log of boring (Figure 1). The selection of soil samples for chemical analysis are typically based on the following criteria:

1) Soil discoloration
2) Soil odors
3) Visual confirmation of chemical in soil
4) Depth with respect to underground tanks (or existing grade)
5) Depth with respect to ground water
6) OVA reading

Soil samples (full brass liners) selected for chemical analysis are immediately covered with aluminum foil and the liner ends are capped to prevent volatilization. The samples are labeled and entered onto a Chain-of-Custody form, and placed in a cooler on blue ice for transport to a State-certified analytical laboratory.

Soil cuttings are stockpiled on-site. Soils are sampled and analyzed for site-specific chemical parameters. Disposition of soils is dependent of chemical analytical results of the samples.

Soil Sampling - cont.

Soil borings not converted to monitoring wells will be backfilled (sealed) to ground surface using either a neat cement or cement-bentonite grout mixture. Backfilling will be tremied by continuously pumping grout from the bottom to the top of the boring where depth exceeds 20' or as required by local permit requirements.

All field and office work, including exploratory boring logs, are prepared under the direction of a registered geologist.

Monitoring Well Installation

Monitoring well casing and screen will be constructed of Schedule 40, flush-joint threaded polyvinylchloride (PVC). The well screen will be factory mill-slotted unless additional open area is required (eg. conversion to an extraction well in a low-yield aquifer). The screen length will be placed adjacent to the aquifer material to a minimum of 2-feet above encountered water. No screen shall be placed in a borehole that potentially creates hydraulic interconnection of two or more aquifer units. Screen slot size and well sand pack will be compatible with encountered aquifer materials, as confirmed by sieve analysis.

Monitoring wells will be completed below grade (Figure 2) unless special conditions exist that require above-grade completion design. In the event a monitoring well is required in an aquifer unit beneath an existing aquifer, the upper aquifer will be sealed off by installing a steel conductor casing with an annular neat cement or cement-bentonite grout seal. This seal will be continuously tremied pumped from the bottom of the annulus to ground surface.

The monitoring well sand pack will be placed adjacent to the entire screened interval and will extend a recommended minimum distance of 2-feet above the top of the screen. No sand pack will be placed that interconnects two or more aquifer units. A minimum 2-foot bentonite pellet or bentonite slurry seal will be placed above the sand pack. Sand pack, bentonite, and cement seal levels will be confirmed by sounding the annulus with a calibrated weighted tape. The remaining annular space above the bentonite seal will be grouted with a bentonite-cement mixture and will be tremie-pumped from the bottom of the annular space to the ground surface. The bentonite content of the grout will not exceed 5 percent by weight. A field log of boring and a field well completion form will be prepared by GSI for each well installed.

Decontamination of drilling equipment before drilling and between wells will consist of steam cleaning, and/or Alconox wash.

Well Development

Monitoring wells will be developed using a submersible pump, bladder pump or bailer. All well developing equipment will be decontaminated prior to development using a steam cleaner and/or Alconox detergent wash. Wells will be developed until discharge water is visibly clear and free of sediment. The adequacy of well development will be assessed by the GSI geologist. Indicator parameters (pH, specific conductance, and temperature) will be monitored and recorded during well development. Field instrument calibrations will be performed according to manufacturer's specifications.

Well Surveying

Monitoring wells will be surveyed to obtain top of box elevations to the nearest ±0.01 foot. Water level measurements will be recorded to the nearest ±0.01 foot and referenced to mean sea level (MSL). If additional wells are required, then existing and newly installed wells are surveyed relative to MSL.

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 Gettler-Ryan Inc. sampling procedures and consistent with current regulatory guidance. If site specific work and sampling plans are required, those plans will be developed from these 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, Section 2647 (October, 1986)
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)
Santa Clara Valley Water District	Guidelines for Preparing or Reviewing Sampling Plans for Soil and Groundwater Investigation of Fuel Contamination Sites (January, 1989)
Santa Clara Valley Water District	Investigation and Remediation at Fuel Leak sites: Guidelines for Investigation and Technical Report Preparation (March 1989)
American Petroleum Institute	Groundwater Monitoring & Sample Bias; API Publication 4367, Environmental Affairs Department, June 1983
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.

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.

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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) samples 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.

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 3). 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 3. 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 4). 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 4. Collected field data during purging activities will be entered on the G-R Well Sampling Field Data Sheet shown in Figure 3. 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

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Chain-of-Custody

A Chain-of-Custody record (Figure 5) 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 HC1 to pH<2	14 days (maximum)
Benzene Toluene Ethylbenzene Xylenes (BTEX)	EPA 8020	mg/l ug/l mg/l	50 ml. vial glass, Teflon lined septum 1 l glass, Teflon	cool, 4 C HC1 to pH<2	7 days (w/o preservative) 14 days (w preservative)
Oil & Grease	SM 503E	ug/l	lined septum	H2SO4 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	14 days (maximum)
Semi-Volatile Organics	8270	mg/l ug/l	40 ml. vial glass, Teflon lined septum	cool , 4 C	14 days (maximum)
Specific Conductance (Field test)		umhos/cm			
pH (Field test)		pH units			
Temperature (Field test)		Deg F			

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FIELD EXPLORATORY BORING LOG

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

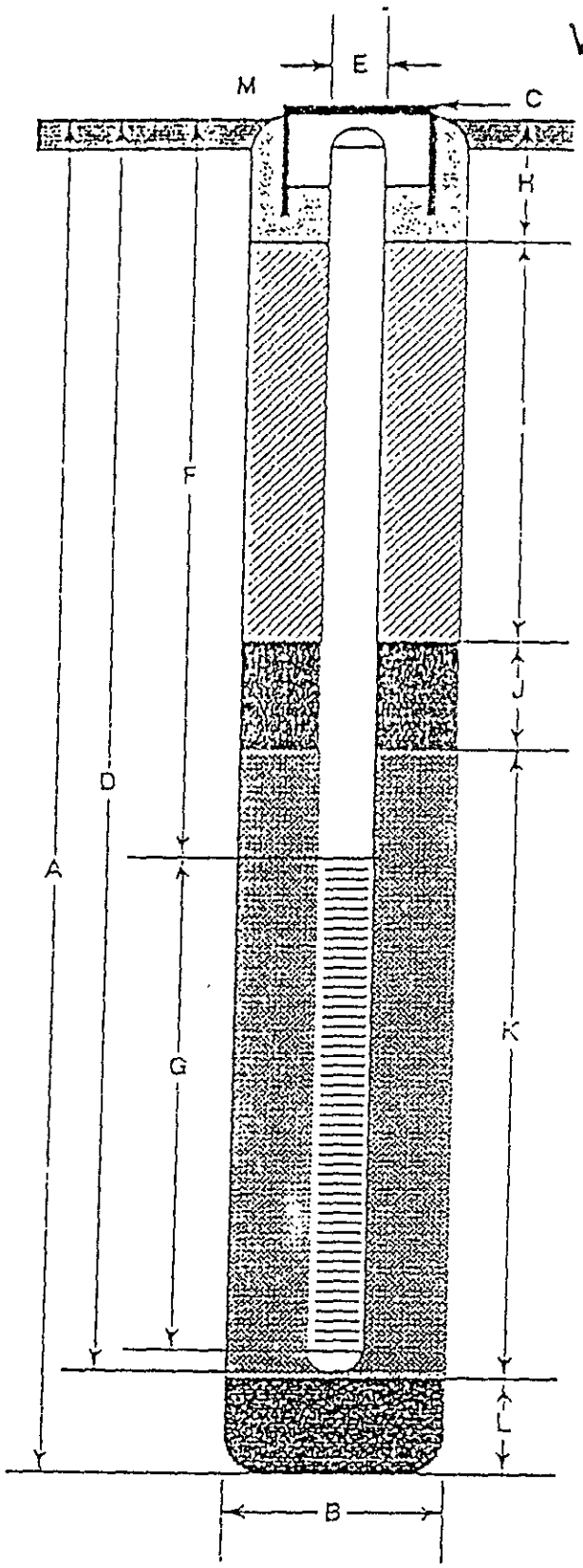
Water Level				
Time				
Date				

FID (ppm)	Blowcnt. or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description

Remarks:

FIGURE 1

WELL CONSTRUCTION DETAIL



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 _____

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Well Construction Detail

WELL NO.

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

FIGURE 2

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FIELD DATA SHEET

COMPANY _____ JOB # _____

LOCATION _____ DATE _____

CITY _____ TIME _____

Well ID. _____ Well Condition _____

Well Diameter _____ in. Hydrocarbon Thickness _____ ft.

Total Depth _____ 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	

Depth to Liquid- _____ ft.

(# 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 _____

FOREMAN _____ ASSISTANT _____

FIGURE 3

Monitoring Well Sampling Protocol Schematic

Sampling Crew Reviews Project Sampling Requirments/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

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

V = Purge volume (gallons)
π = 3.14159
h = Height of Water Colum (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 Initials Measured Water Colum Height in Feet within 24 hrs. of Evacuation.

↓

Measure Groundwater Stability Indicator Parameters (pH, Temp., Conductivity)

↓

Collect Sample and Complete Chain-of-Custody

↓

Preserve Sample According to Required Chemical Analysis

↓

Transport to Anayltical 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%
Temperaure:	1.0 degree 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

FIGURE 4

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ENVIRONMENTAL DIVISION

Chain of Custody

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 _____

FIGURE 5