CONVERSE ENVIRONMENTAL WEST

55 Hawthorne Street, Suite 500
San Francisco, California 94105-3906

Telephone **415 543-4200**
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December 30, 1989
88-44-361-01-347

Ms. Dyan Whyte
Water Resource Control Engineer
San Francisco Bay Regional Water Quality Control Board
1800 Harrison, Room 700
Oakland, California 94607

Subject: Shell Oil Company - Quarterly Report
500 40th Street
Oakland, California

Dear Ms. Whyte:

Enclosed please find one copy of the Shell Oil Company Quarterly Report of Activities for Quarter 4, 1989 prepared by Converse Environmental West (CEW) - San Francisco.

Please call if you have any questions.

Very truly yours,

Converse Environmental West

Robin M. Breuer

Robin M. Breuer
Project Manager

RMB:fs

Enclosure

cc: **Mr. Rafat Shahid** - Alameda County Health Services Agency (w/ encl.)
Ms. Diane Lundquist - Shell Oil Company (w/ encl.)
Mr. Douglas W. Charlton - CEW (w/o encl.)

500 40th St.\Whyte347.ltr

FORMER GASOLINE STATION

SHELL OIL COMPANY
500 40th Street
Oakland, California

December 30, 1989

CEW Project No. 88-44-361-01

DOUGLAS W. CHARLTON
Principal Geologist

This report has been prepared by the staff of **Converse Environmental West (CEW)** under the professional supervision of the Engineer and/or Geologist whose seal(s) and signature(s) appear hereon.

The findings, recommendations, specifications or professional opinions are presented, within the limits prescribed by the Client, after being prepared in accordance with generally accepted professional engineering and geologic practice. We make no other warranty, either expressed or implied.

Converse Environmental West

REPORT OF ACTIVITIES

SHELL OIL COMPANY FACILITY
500 40th Street
Oakland, California

For Quarter 4 1989
Submitted: December 30, 1989

RWQCB Representative:	Ms. Dyan Whyte Waste Water Control Engineer San Francisco Bay RWQCB 1800 Harrison Street, Seventh Floor Oakland, California 94607
LIA Representative:	Mr. Rafat Shahid Alameda County Health Services Agency Hazardous Materials 80 Swan Way, Room 200 Oakland, California 94621
Shell Engineer:	Ms. Diane Lundquist Environmental Engineer
Converse Project Manager:	Ms. Robin M. Breuer, Project Manager 55 Hawthorne Street, Suite 500 San Francisco, California 94105 (415) 543-4200
Registered Geologist in Charge:	Douglas W. Charlton, Principal Geologist 55 Hawthorne Street, Suite 500 San Francisco, California 94105 (415) 543-4200
Site Owners:	Joseph Heung Yu Chan Olivia Wai Yee Cheng Chan Ivy Tak Tsing Wong Shirley Tak Hing Kwong Magdalen Tak Fan Chan

1. SITE DESCRIPTION

1.1 Maps

Site Location Vicinity Map: Drawing 1
Plot Plan - Former Service Station Configuration: Drawing 2
Plot Plan - Quarter 4 1989 Plot Plan: Drawing 3
Plot Plan - Proposed Wells: Drawing 4

1.2 Neighborhood Topography

Slopes gently westward towards San Francisco Bay.

1.3 Primary Surface Waters Nearby

San Francisco Bay is located approximately 1.5 miles to the west.

1.4 Water Table Information

Quarter 4 1989 Depth to Water: Approximately 12' below grade.
Depth to Highest High Water: Approximately 11' below grade by redox boundary in soils.

2. INVESTIGATION HISTORY

2.1 Soil Borings Drilled to Period Start

B-1 through B-11 (IT 1982-84)
MW-2 through MW-5 (CEW 5/89)

2.2 Soil Borings Abandoned to Period Start

B-1 through B-11 (Date Unknown).

2.3 Groundwater Wells Drilled to Period Start

B-1 through B-11 (IT 1982-84)
MW-2 through MW-5 (CEW 5/89)

2.4 Groundwater Wells Abandoned to Period Start

B-6 was abandoned by IT in June, 1986. No records are available for abandonment of the other B-series wells. These wells are covered with pavement or buildings, and they can not be located.

2.5 Investigative History Summary

A chronological summary of site activities is presented below:

DATE	DESCRIPTION OF ACTIVITY
7/82	IT installed 8 six inch diameter groundwater monitoring wells to 30 feet below ground surface (bgs) onsite. The wells were screened from 5 to 30 feet bgs. Combustible vapors were detected in the storm sewer system in the BART Station across the street.
7/82	IT Progress Report 1: Well installations and constructions were reported, and free product was noted in wells B-7 and B-8. Groundwater gradient was shown to be westward, towards the BART Station.
11/82	IT Progress Report 6: Groundwater gradient still towards well B-3. From September 1 to November 19, 1982, IT removed 35 pints of product from B-4. Well tops of casings (TOCs) were re-surveyed and groundwater gradient was confirmed toward B-3. Maximum product thickness was in B-4, at several inches.
12/82	IT Progress Report 7: Product thickness increased in B-3 in apparent response to rising water table. Product in B-4 remained at several inches.
1/83	IT Progress Report 8: Product in B-4 had diminished to film thickness.
2/83	IT Progress Report 9: Rainfall records were researched, and the relationship between rainfall, water table and product removed was charted by graph. Amount of product in B-4 appeared to vary inversely with water table; as water table rose with winter rains, the amount product in B-4 dropped. IT proposed that product was displaced downgradient as water table rose.
3/83	IT Progress Report 10: Vapor concentrations of TPH (expressed as percent lower explosive limit) were rising in wells B-1, B-2, B-3 and B-7. No product was measurable in B-4.
6/83	Rapid reappearance of product in well B-4, from negligible in May to 4+ feet by June 30 and 6.34 feet on July 15. Increase was also measured B-3, to a thickness of 0.66 feet in July. IT concluded that a reservoir of product existed in the tank backfill, and that as water table dropped in summer time this reservoir was allowed to escape by way of gravel lenses which were saturated at high water table seasons.
7/83	IT installed 8 inch diameter monitoring wells B-9 and B-10 to 20 feet bgs in native soils next to the tank backfill.

DATE	DESCRIPTION OF ACTIVITY (continued)
8/83	IT Progress Report 11: IT repeated the concept that product was released in surges through gravel lenses exposed to the water table during summer.

10/17/89	CEW installed boring CSB-1; soils sampled and analyzed; and bored OMW-9. During well drilling, Loma Prieta Earthquake struck. Oakland municipal services were severely disrupted.
10/21/89	OMW-9 pilot boring sealed.
11/13/89	OMW-9 boring reamed and the well installed. OMW-10 installed; soils sampled and analyzed. Proposed well OMW-8 boring attempted and abandoned; location was in sewer main backfill.
11/17/89	Discharge permit application for interim groundwater treatment system submitted to EBMUD.
12/01/89	OMW-6 developed.
12/10/89	OMW-10 and OMW-9 developed.
10/89-12/89	Ongoing unsuccessful attempts to gain right-of-entry for installation of extraction wells EW-11 and EW-12, as the commencement of onsite groundwater remediation. This process has continued without resolution since August, 1989.

3.5 Soil Analyses and Results

Soil samples from the Q4/89 borings were properly packaged and transferred to a California State-certified analytical laboratory under proper chain of custody and preservation (see Appendix E). The samples were analyzed for TPH (as gasoline, diesel, and motor oil) and BTEX using EPA Methods 3550, 5050, 8015, and for Pb using EPA Methods 3050 and 7421. Analytical results are summarized in Table 4 and included as Attachment 2.

3.6 Groundwater Analyses and Results

Groundwater samples were collected from the four onsite wells (MW-2 through MW-5), properly packaged and transferred to a California State-certified analytical laboratory under proper chain-of-custody and preservation (see Appendices E and F). All monthly samples were analyzed for TPH (as gasoline, diesel and motor oil), and BTEX (EPA Methods 3150, 5030, 8015 and 602). The analytical results are summarized in Table 5. Certified results from all analyses are enclosed as Attachment 3.

Groundwater samples were not collected from the offsite wells because the site sampling schedule (all wells) is advanced to January 15, 1990. Thus, a full sampling round will occur in two weeks. The results of this monitoring will be presented in discussion text and potentiometric and isopleth maps in the January 1990 monthly report for the site due January 31, 1990.

3.7 Physical Monitoring Results

The four onsite wells were physically monitored for depth to water table, and measurement of floating product, if any. A summary of these results is presented in Table 6.

Physical monitoring of the offsite wells and the onsite wells together and full surveying of the site, will occur by January 15, 1990. The results of this work will be presented in the January 1990 monthly report.

4. REVIEW OF DATA AND INTERPRETATIONS

4.1 Groundwater Elevation and Gradient (See Drawing 5)

- As of Q4/89, groundwater gradient is southward, approximately 0.004 ft/ft.

4.2 Geology

- The subsurface geology is predominantly silty clay with trace to slight amounts of sand and gravel.

- Sand and gravel zones form thin layers at various depths.

- Coarse-grained soils and sediments probably provide the dominant pathways for groundwater flow.

4.3 Distribution of Fuel Contamination in Soil (See Drawings 6 and 7)

- TPH-g contamination is negligible onsite, with 28 ppm in MW-3, the only detectable amount. However, TPH-g is locally present, offsite, occurring at a maximum concentration of 210 ppm at 10 ft bgs in OMW-9 (Drawing 6). Apparently, an offsite source of soil TPH-g contamination exists; conversely, no onsite source of TPH-g is inferred (Table 4).

- The maximum TPH-g soil contamination is more than 5 ft above the Q4/89 water table.

- TPH-mo occurs in soil onsite at low concentration (<20 ppm) in MW-2 and MW-5. No soil TPH-mo was detected in Q4/89 soil borings. The source of the trace TPH-mo contamination is unknown, and not necessarily related to the Shell property (Table 4).

- No detectable amounts of TPH-d are present in onsite soil boring samples (Table 4). However, minor amounts of TPH-d (≤40 ppm) occur in offsite soil samples, with highest concentrations in OMW-9, coincident with the TPH-g anomaly. No source of TPH-d in soil is inferred by available data.

- Pb concentrations are low for all soil samples.

4.4 Distribution of Dissolved Fuel Contamination in Groundwater (See Drawings 8 and 9)

- The maximum TPH-g, and TPH-d concentrations remained detected at MW-3 at Q4/89.

- The maximum TPH-g in groundwater was 7.6 ppm, and the TPH-g/TPH-d ratio for detectable dissolved hydrocarbons was approximately 2:1 to 5:1.

- More precise interpretation and/or correlation of groundwater and soil contamination patterns will likely be possible with sampling and analyses of offsite groundwater in Quarter 1, 1990.

4.5 Distribution of Floating Product on Groundwater

- No floating product was present in the onsite wells in Q4/89.

5. WORK PLANNED BUT NOT COMPLETED

- OMW-6 was not installed as a well because its pilot boring punctured a sewer main. This well was not relocated, pending the results of offsite water quality monitoring.

- Extraction wells and remediation equipment were not installed because right-of-entry was not provided by the neighbor adjacent to the west of the site. This right-of-entry is needed for drilling equipment to access wellhead collar locations as specified in engineering design.

- Offsite wells were not sampled in December 1989, to allow for groundwater physical and water quality monitoring of offsite and onsite wells to coincide, starting January 1990.

6. WORK PLANNED FOR NEXT QUARTER

6.1 Groundwater Sampling and Analyses

Groundwater will be sampled and analyzed quarterly, according to the schedule established in the Work Plan. Groundwater will be analyzed for TPH-g, TPH-d, TPH-mo, and BTEX.

6.2 Onsite Well Installation

A Right-of-Entry Agreement from the property owners at 518 40th Street is needed prior to installation of extraction wells EW-1, EW-2 and EW-3 (see Drawing 4). As of the date of this report, the property owners have failed to provide access.

In Quarter 1 1990, Shell will seek RWQCB intervention to compel the owners of 518 40th Street to provide Right-of-Entry for subsurface investigations.

Installation of the three onsite wells will proceed immediately when the Agreement is secured.

6.3 Onsite Interim Groundwater Remediation

Installation and operation of an interim onsite groundwater remediation system will commence upon completion of wells EW-1, EW-2 and EW-3. The equipment and process of the proposed system was described in a letter (Attachment 4) to the RWQCB dated October 24, 1989. A permit for discharge of treated groundwater was submitted to EBMUD on November 17, 1989.

6.4 Offsite Well Installation

One offsite well, OMW-8, will be installed down-gradient on BART property adjacent to 40th Street (see Drawing 4), pending approval by that agency.

6.5 Reporting

Monthly reports will be submitted by the last day of each calendar month.

TABLE 1: Detailed Summary of Field Activities
500 40th Street
Oakland, California

STATION	DATE	ACTIVITY
500 40th Street	09/11/89	Sampled groundwater MW-2, MW-3, MW-4
500 40th Street	09/19/89	MW-5 soil sampled and installed
500 40th Street	09/21/89	MW-5 soil samples picked up by NET
500 40th Street	10/04/89	MW-5 final soil analytical results received
500 40th Street	10/16/89	Drill/Sample/Install OMW-6
500 40th Street	10/16/89	OMW-6 soil sampled and installed
500 40th Street	10/16/89	Vickers cores five holes in street for offsite wells
500 40th Street	10/17/89	Drill/Sample OMW-7. Hit sewer line. Earthquake at 5:04 pm
500 40th Street	10/17/89	Pilot drill/sample OMW-9 prior to earthquake
500 40th Street	10/17/89	MW-6 soil samples picked up by NET
500 40th Street	10/17/89	OMW-9 soil sampled. Hole left open following earthquake
500 40th Street	10/17/89	OMW-7 soil sampled. This boring damaged sewer line
500 40th Street	10/18/89	Drill crew sent home post quake. Plumbers continue to work
500 40th Street	10/19/89	Sewer line repaired and water restored. Hole fill pending
500 40th Street	10/20/89	Moved drums to rear and cleaned alley
500 40th Street	10/21/89	Filled OMW-9 with bentonite

TABLE 1: Detailed Summary of Field Activities (cont'd)
500 40th Street
Oakland, California

STATION	DATE	ACTIVITY
500 40th Street	10/23/89	OMW-7 and OMW-9 soil samples picked up by NET
500 40th Street	10/23/89	Covered sewer excavation with plywood, soil with plastic
500 40th Street	10/24/89	Sewer soil pile sampled
500 40th Street	10/24/89	Sewer soil pile samples picked up by NET
500 40th Street	10/24/89	Sampled sewer soil pile for analysis
500 40th Street	10/26/89	Sewer repair passed inspection
500 40th Street	10/30/89	Hole filled, concrete removed to dump by MRS
500 40th Street	10/31/89	Compaction insepcted in PM. Passed, okay to concrete
500 40th Street	11/03/89	OMW-6 final soil analytical results received
500 40th Street	11/06/89	Analytical report received; OMW-7 and OMW-9 soil
500 40th Street	11/08/89	Sewer soil pile (SP) final soil analytical results received
500 40th Street	11/13/89	OMW-9 soil sampled and installed
500 40th Street	11/13/89	OMW-10 installed and sampled
500 40th Street	11/13/89	OMW-10 soil sampled and well installed
500 40th Street	11/14/89	OMW-10 soil samples picked up by NET
500 40th Street	11/16/89	OMW-7 and OMW-9 final soil analytical results received
500 40th Street	11/22/89	OMW-10 preliminary soil analytical results fax-received

TABLE 2: Summary of Soil Borings Drilled

Boring No.	Date Drilled	T.D. (ft. bgs.)	Unsaturated Soil Samples (ft. bgs)	Saturated Soil Samples (ft. bgs)	Highest OVM**
MW-2	5/22/89	25	5,10,15	None	1000 at 11'
MW-3	5/23/89	21	5,10,15	None	750 at 11'
MW-4	5/23/89	20	5,10	15	Not taken*
MW-5	9/19/89	20	4,8,12,16	None	0
OMW-6	**9/19/89**	**20**	**5,10,15**	**None**	**82 at 10'**
OMW-9	**9/19/89**	**20**	**5,10,15,20**	**None**	**126 at 10'**
OMW-10	**9/19/89**	**20**	**5,10,15**	**None**	**0**
CSB-1	**9/19/89**	**20**	**5,10,15,20**	**None**	**0**

* Equipment difficulties
** ppm total volatile hydrocarbons

TABLE 3: Summary of Groundwater Monitoring Well Installations

Well No.	Date Installed	Diameter Well Bore (in.)	Initial Water Table (ft. bgs)	Static Water Table (ft. MSL)	T.D. (ft. bgs)	Screen (ft. bgs)	Bentonite Seal (ft. bgs)	Grout Seal (ft. bgs)
MW-2	5/22/89	12	15.5	NA*	25	20.0-9.0	9.0-7.0	7.0-0
MW-3	5/23/89	12	15.3	NA	21	19.0-9.5	9.5-8.0	8.0-0
MW-4	5/23/89	12	13.0	NA	20	15.5-9.5	9.5-7.5	7.5-0
MW-5	9/19/89	12	18.5	NA	20	20.0-10.0	9.0-8.0	8.0-0
OMW-6	**10/16/89**	**12**	**NS**	**NS***	**25**	**20.5-10.5**	**9.0-8.0**	**8.0-1**
OMW-9	**11/13/89**	**12**	**NS**	**NS**	**30**	**17.5-7.5**	**7.5-6.5**	**8.0-0**
OMW-10	**11/13/89**	**12**	**13.0**	**NS**	**24**	**16.5-6.0**	**6.0-5.0**	**5.0-1**

* NA = Not available until wellheads are surveyed.
* NS = Not sounded.

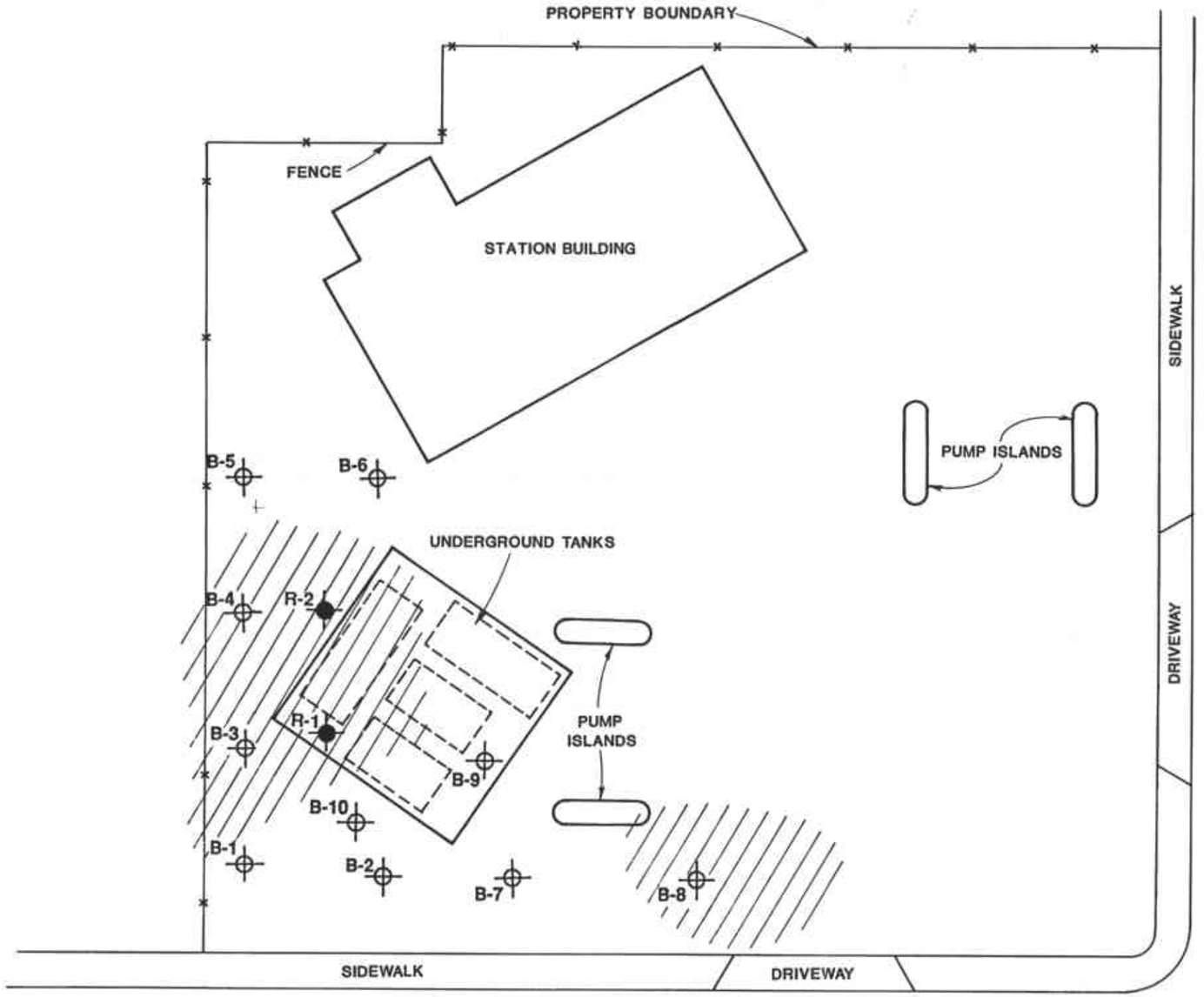
TABLE 4: Soil Analytical Results (ppm)

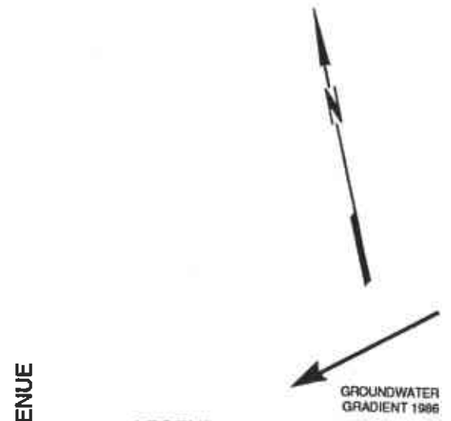
Boring No.	Sample Depth (ft. bgs)	TPH-g	TPH-d	TPH-mo	Benzene	Toluene	Ethyl-benzene	Xylene	Total Lead
MW-2	5,10,15	<10	<10	<10	<0.025	0.028	<0.075	<0.075	0.4
MW-2	10	<10	<10	18	<0.025	<0.025	<0.075	<0.075	1.0
MW-3	10	28	<10	<10	0.054	0.032	<0.075	0.099	<0.2
MW-3	5,10,15	<10	<10	<10	<0.025	<0.025	<0.075	<0.075	<0.2
MW-4	10	<10	<10	<10	<0.025	<0.025	<0.075	<0.075	<0.2
MW-4	5,10	<10	<10	<10	<0.025	<0.025	<0.075	<0.075	<0.2
MW-5	4	<10	<10	<10	<0.025	<0.025	<0.075	<0.075	12
MW-5	8	<10	<10	27	<0.025	<0.025	<0.075	<0.075	5.3
MW-5	12	<10	<10	13	<0.025	<0.025	<0.075	<0.075	3.3
MW-5	16	<10	<10	<10	<0.025	<0.025	<0.075	<0.075	5.7
OMW-6	**5**	**<10**	**1.0**	**<10**	**<0.025**	**<0.025**	**<0.075**	**<0.075**	**4.3**
OMW-6	**10**	**18**	**17**	**<10**	**0.028**	**0.040**	**0.10**	**0.45**	**3.2**
OMW-6	**15**	**<10**	**<1**	**<10**	**<0.025**	**<0.025**	**<0.075**	**<0.075**	**3.6**
CSB-1	**5**	**<10**	**<1**	**<10**	**<0.025**	**<0.025**	**<0.075**	**<0.075**	**22**
CSB-1	**10**	**<10**	**<1**	**<10**	**<0.025**	**<0.025**	**<0.075**	**<0.075**	**3.2**
CSB-1	**15**	**<10**	**<1**	**<10**	**<0.025**	**<0.025**	**<0.075**	**<0.075**	**4.0**
CSB-1	**20**	**<10**	**<1**	**<10**	**<0.025**	**<0.025**	**<0.075**	**<0.075**	**4.9**
OMW-9	**5**	**<10**	**<1**	**<10**	**<0.025**	**<0.025**	**<0.075**	**<0.075**	**3.7**
OMW-9	**10**	**210**	**40**	**<10**	**0.064**	**0.46**	**1.1**	**6.3**	**2.6**
OMW-9	**15**	**11**	**<1**	**<10**	**<0.025**	**<0.025**	**<0.075**	**<0.075**	**4.3**
OMW-9	**20**	**<10**	**<1**	**<10**	**<0.025**	**<0.025**	**<0.075**	**<0.075**	**3.1**
OMW-10	**5**	**<1**	**<1**	**<10**	**<0.0025**	**<0.0025**	**<0.0025**	**<0.0025**	**5.5**
OMW-10	**10**	**<1**	**<1**	**<10**	**0.020**	**0.0044**	**0.0084**	**0.024**	**4.3**
OMW-10	**15**	**<1**	**<1**	**<10**	**<0.0025**	**<0.0025**	**<0.0025**	**<0.0025**	**6.9**

TABLE 5: Groundwater Analytical Results (ppm)

Well No.	Sample Date	TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Xylenes	Lead
MW-2	6/20/89	0.8	<0.01	0.046	0.0068	0.0027	0.056	NA
MW-2	7/18/89	1.4	0.4	0.033	0.0056	0.024	0.073	0.003
MW-2	8/08/89	0.23	0.50	0.0045	<0.0005	<0.0015	0.011	NA
MW-2	9/11/89	0.50	0.31	0.019	0.0023	<0.0015	0.010	NA
MW-2	**10/10/89**	**2.0**	**0.81**	**0.077**	**0.0084**	**0.024**	**0.15**	**NA**
MW-3	6/20/89	2.3	<0.1	0.18	0.15	0.054	0.80	NA
MW-3	7/18/89	1.5	9.1	0.085	0.034	0.010	0.12	0.002
MW-3	8/08/89	2.5	0.71	0.13	0.073	0.0035	0.33	NA
MW-3	9/11/89	1.9	0.23	0.18	0.074	0.0037	0.11	NA
MW-3	**10/10/89**	**2.6**	**1.2**	**0.069**	**0.055**	**0.0063**	**0.30**	**NA**
MW-4	6/20/89	<0.05	<0.01	<0.0005	<0.0015	<0.0015	<0.0015	NA
MW-4	7/18/89	<0.05	<0.05	<0.0005	<0.0015	<0.0015	<0.0015	**0.003**
MW-4	8/08/89	<0.05	<0.05	<0.0005	<0.0005	<0.0015	<0.0015	NA
MW-4	9/11/89	<0.05	<0.05	<0.0005	<0.0005	<0.0015	<0.0015	NA
MW-4	**10/10/89**	**<0.05**	**<0.05**	**<0.0005**	**<0.0005**	**<0.0015**	**<0.0015**	**NA**
MW-5	**10/10/89**	**<0.05**	**<0.05**	**<0.0005**	**<0.0005**	**<0.0015**	**<0.0015**	**NA**

NA - Not Analyzed.



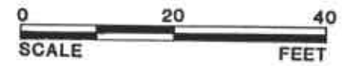


LEGEND

B-1 GROUNDWATER MONITORING WELLS (IT) (IT, 1982)(ABANDONED, 1987)

R-1 EXTRACTION WELLS (IT)

HISTORIC RECORDS OF FLOATING PRODUCT



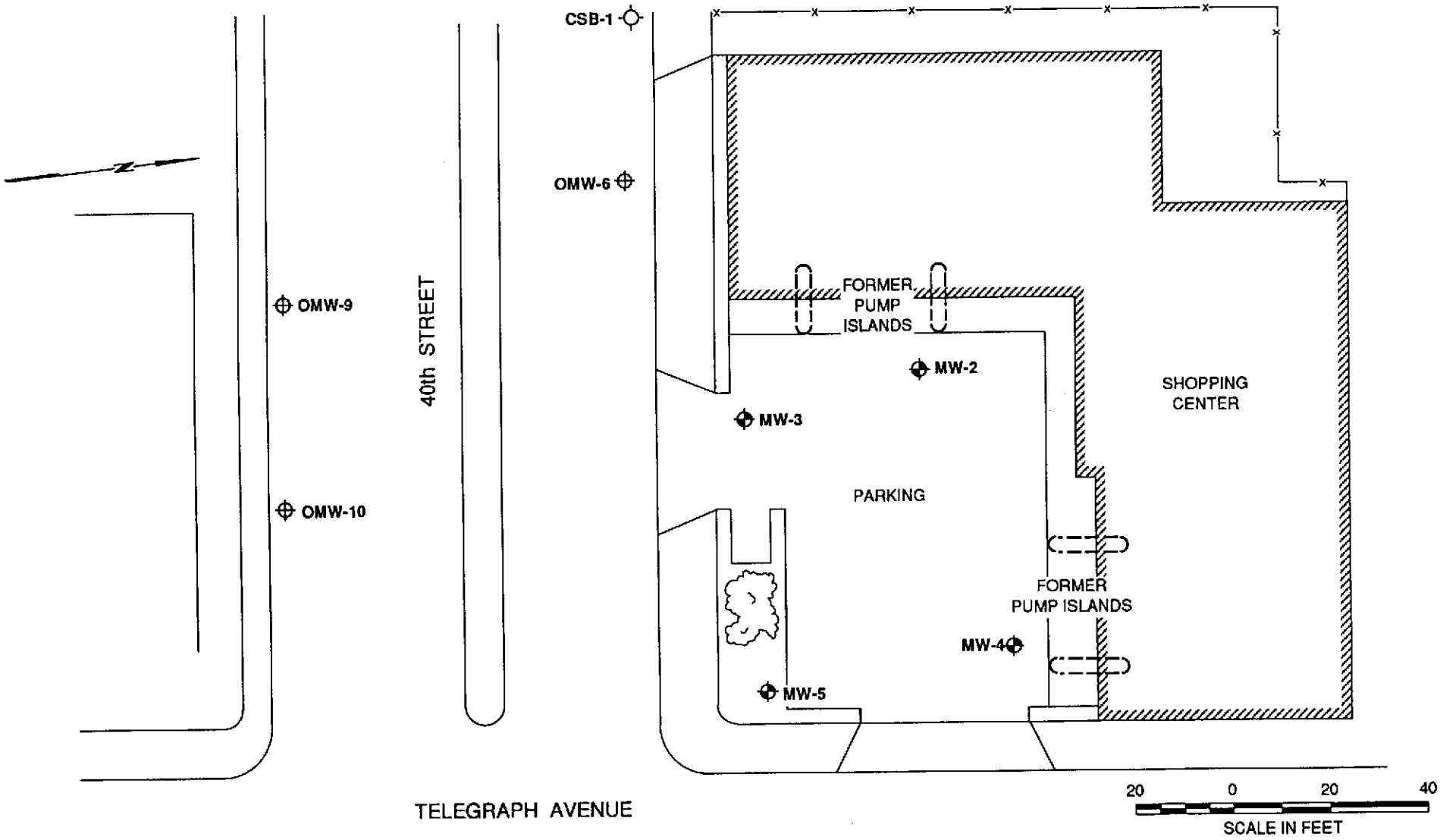
Base Map: after Pacific Environmental Group, Inc. and IT Corporation

1986-1987 PLOT PLAN - BEFORE CONSTRUCTION OF SHOPPING CENTER

SHELL OIL COMPANY
500 40th Street
Oakland, California

Converse Environmental Consultants California

Scale	AS SHOWN
Date	6/14/89
Prepared By	KGC
Checked By	RMB
Approved By	DWC
Project No.	88-44-361-01
Drawing No.	2



LEGEND:

SB-1 ○ SOIL BORING

MW-1 ⊕ GROUNDWATER MONITORING WELL

OMW-1 ⊕ OFFSITE GROUNDWATER MONITORING WELL

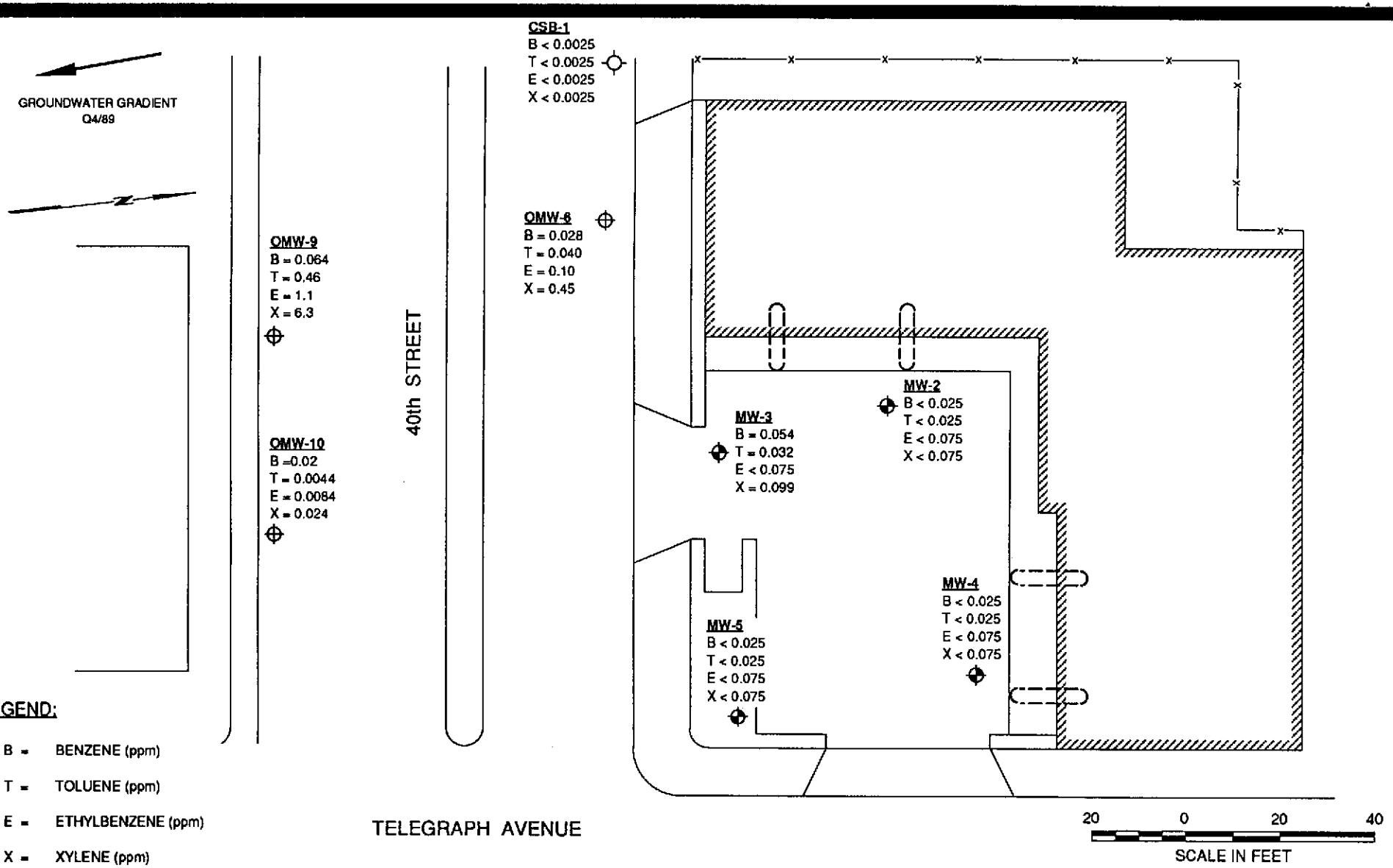
Base Map: Surveyed with EDM, Converse 1989.

PLOT PLAN Q4/89

SHELL OIL COMPANY
500 40th Street
Oakland, California

Converse Environmental West

Scale: AS SHOWN	Project No.: 88-44-361-01
Prepared by: LQL	Date: 12/29/89
Checked by: MIY	Drawing No.: 3
Approved by:	



LEGEND:

- B = BENZENE (ppm)
- T = TOLUENE (ppm)
- E = ETHYLBENZENE (ppm)
- X = XYLENE (ppm)
- SB-1 ○ SOIL BORING
- MW-1 ⊕ GROUNDWATER MONITORING WELL
- OMW-6 ⊕ OFFSITE GROUNDWATER MONITORING WELL

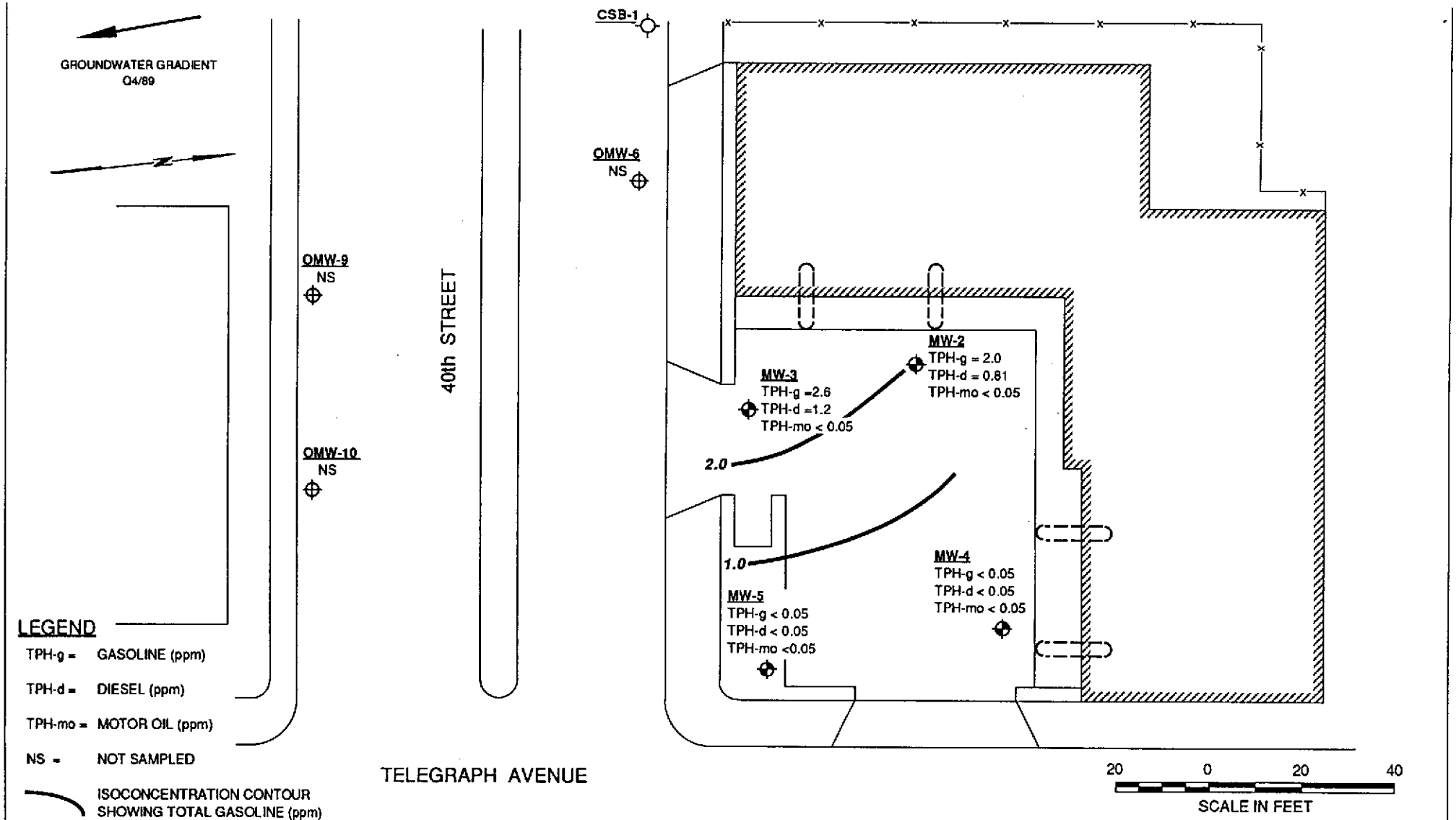
Base Map: Surveyed with EDM, Converse 1989.

PLAN: BTEX IN SOIL AT 10'-12' BGS Q4/89

SHELL OIL COMPANY
500 40th Street
Oakland, California

Converse Environmental West

Scale: AS SHOWN	Project No.: 88-44-361-01
Prepared by: LQL	Date: 12/27/89
Checked by: MIY	Drawing No.: 7
Approved by:	



LEGEND

TPH-g = GASOLINE (ppm)

TPH-d = DIESEL (ppm)

TPH-mo = MOTOR OIL (ppm)

NS = NOT SAMPLED

ISOCONCENTRATION CONTOUR SHOWING TOTAL GASOLINE (ppm)

SB-1 SOIL BORING

MW-1 GROUNDWATER MONITORING WELL

OMW-6 OFFSITE GROUNDWATER MONITORING WELL

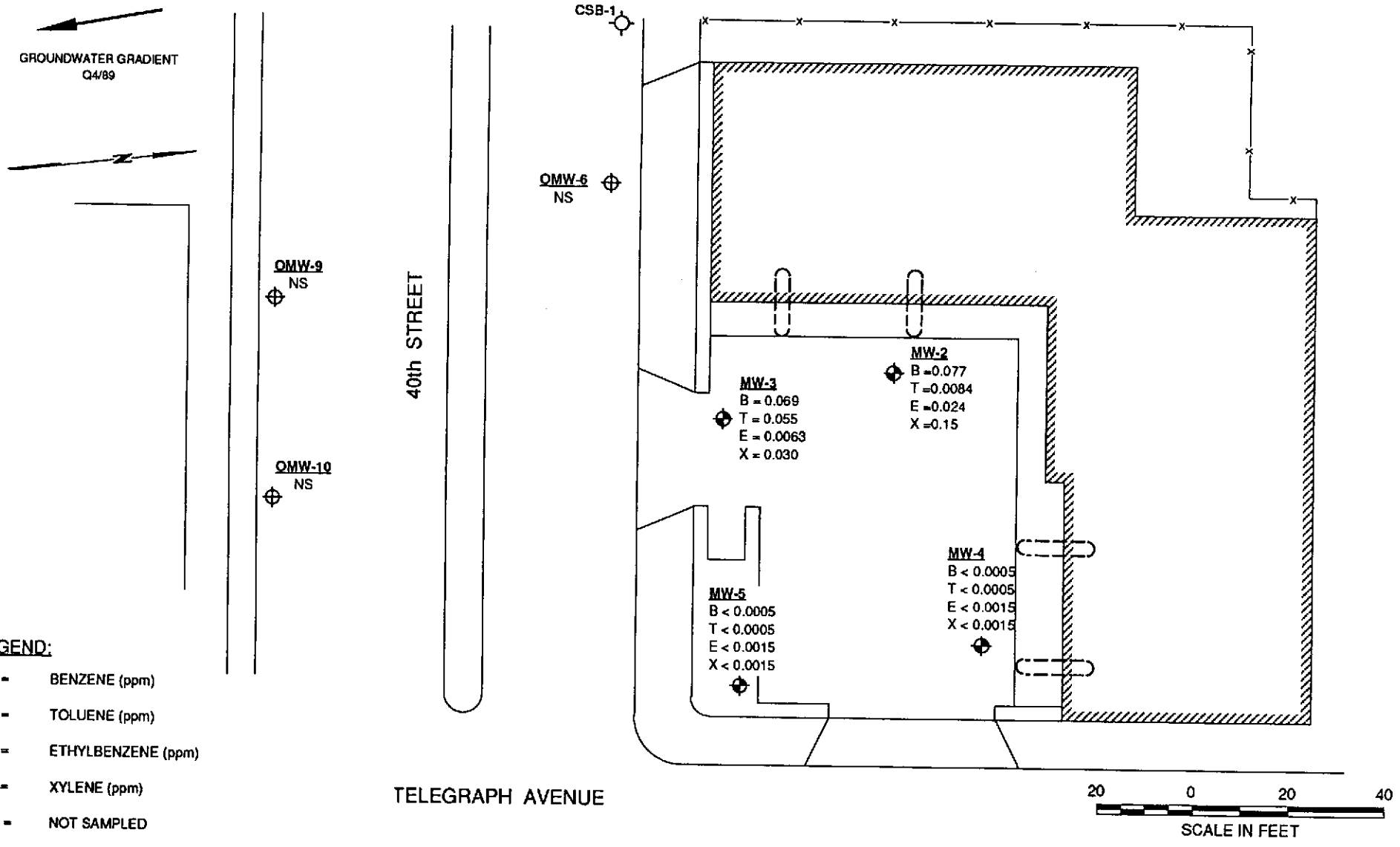
Base Map: Surveyed with EDM, Converse 1989.

PLAN: TPH IN GROUNDWATER Q4/89

SHELL OIL COMPANY
500 40th Street
Oakland, California

Converse Environmental West

Scale	AS SHOWN
Prepared by	LQL
Checked by	MIY
Approved by	
Project No.	88-44-361-01
Date	12/27/89
Drawing No.	8



LEGEND:

- B = BENZENE (ppm)
- T = TOLUENE (ppm)
- E = ETHYLBENZENE (ppm)
- X = XYLENE (ppm)
- NS = NOT SAMPLED
- SB-1 ⊕ SOIL BORING
- MW-1 ⊕ GROUNDWATER MONITORING WELL
- OMW-9 ⊕ OFFSITE GROUNDWATER MONITORING WELL

Base Map: Surveyed with EDM, Converse 1989.

PLAN: BTEX IN GROUNDWATER Q4/89

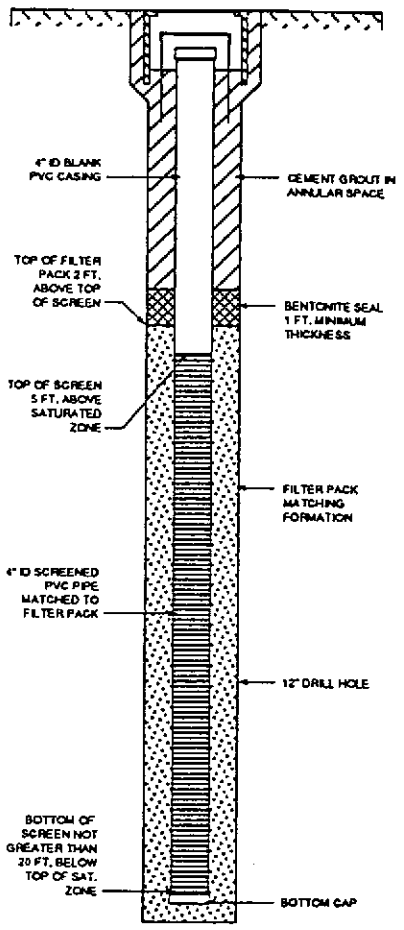
SHELL OIL COMPANY
500 40th Street
Oakland, California

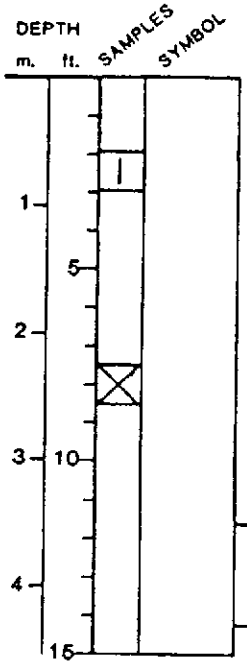
Converse Environmental West

Scale: AS SHOWN	Project No.: 88-44-361-01
Prepared by: LQL	Date: 12/27/89
Checked by: MIY	Drawing No.: 9
Approved by:	

MAJOR DIVISIONS			SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than half is larger than No. 200 sieve	GRAVELS More than half coarse fraction is larger than No. 4 sieve	Clean gravels with little or no fines	GW	Well graded gravels, gravel – sand mixtures
			GP	Poorly graded gravels, gravel – sand mixtures
		Gravels with over 12% fines	GM	Silty gravels, poorly graded gravel – sand – silt mixtures
			GC	Clayey gravels, poorly graded gravel – sand – clay mixtures
	SANDS More than half coarse fraction is smaller than No. 4 sieve	Clean sands with little or no fines	SW	Well graded sands, gravelly sands
			SP	Poorly graded sands, gravelly sands
		Sands with over 12% fines	SM	Silty sands, poorly graded sand – silt mixtures
			SC	Clayey sands, poorly graded sand – clay mixtures
FINE GRAINED SOILS > half is smaller than No. 200 sieve	SILTS AND CLAYS Liquid limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic clays and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine, sandy or silty soils, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils

WELL CONSTRUCTION





SAMPLE TYPE

DRIVE SAMPLE, 2.5" ID Sampler, driven with 140 lb. weight, 30" drop

NO RECOVERY

Water level at time of drilling

Stabilized water level on date noted

Note:

Soil conditions indicated by boring logs apply only at the location of the particular boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at the boring location with the passage of time. Data presented in the logs represent a simplification of the actual conditions encountered.

UNIFIED SOIL CLASSIFICATION AND BORING LOG SYMBOLS

Scale | Project No.

Prepared by | Date

Checked by | Drawing No.

Approved by | A 1

Converse Environmental Consultants California

LOG OF BORING NO. CSB-1

DATE DRILLED: 10-17-89	ELEVATION:	WL TAKEN: n/a	EQUIPMENT: 3 3/4"x 8" Hollow-Stem Auger

DEPTH (ft)	SAMPLE	WATER LEVEL	SYMBOL	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION		BLOWS/FT.	O.V.M. (ppm)	DRY DENSITY lb/ft³	TESTS
				moist	loose	dark brown / dark gray	Gravelly SAND and SILT, some Rubble, some Asphalt. (Fill)	SW				
				moist	medium	dark brown	Silty CLAY, trace Gravel, trace Sand.	CL				
	1			very moist	medium		Decreasing Gravel and Sand, bits of brick in cuttings.		8	0		
5												
								CL				
	2			moist	medium	light gray	Silty CLAY, some Sand and Gravel. No odor.		18	0		
10												
						light brown		CL				
	3			moist	medium	light brown mottled gray	Silty CLAY, some fine Sand, trace Gravel.		16	0		
15												
	4			moist	stiff	light brown	Fine Sandy CLAY. No odor.	CL	17	0		
20												

REGISTERED PROFESSIONAL GEOLOGIST
Douglas W. Charlton
No. 4110
STATE OF CALIFORNIA

SHELL OIL COMPANY
500 40th Street
Oakland, California

Project No.
88-44-361-01

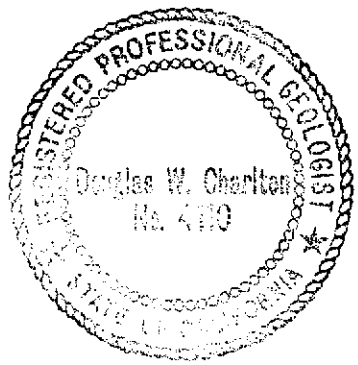
Converse Environmental West

Drawing No.
A-2

LOG OF BORING NO. CSB-1

continued - page 2

DEPTH (ft)	SAMPLE	WATER LEVEL	SYMBOL	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION	BLOWS/FT.	O.V.M. (ppm)	DRY DENSITY lb/ft³	TESTS
				moist	stiff	light brown	Fine Sandy CLAY. CL No odor.				
	5				medium	light brown	Silty CLAY, water bearing lenses. No odor. CL	13	0		
25							Total Depth of Boring: 25 ft. Below Ground Surface.				
30											
35											
40											



SHELL OIL COMPANY
500 40th Street
Oakland, California

Project No.
88-44-361-01

Converse Environmental West

Drawing No.
A-3

LOG OF BORING NO. OMW-6

DATE DRILLED: 10-16-89	ELEVATION:	WL TAKEN: n/a	EQUIPMENT: 3 3/4"x 8" Hollow-Stem Auger

DEPTH (ft)	SAMPLE	WATER LEVEL	SYMBOL	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION		WELL CONSTRUCTION	BLOWS/FT.	O.V.M. (ppm)	T.P.H. (ppm)
				moist	loose	light brown	Gravelly SAND (Fill).	SW				
				moist	medium	dark black	Silty CLAY, trace Gravel. Slight petroleum odor.	CL			2.6	
5	1			moist	medium	olive mottled black	Silty CLAY, decreasing Gravel. Slight petroleum odor.	CL		14	0	
10	2			moist	medium	olive brown mottled gray	Sandy CLAY, some Silt. Trace shell fragments. Strong petroleum odor.	CL		10	82	
15	3			moist	medium		Black tubelets.	CL		10	0	
		▽				tan brown						
20	4			wet	stiff		Silty CLAY, trace Sand.	CL		20	0	

REGISTERED PROFESSIONAL GEOLOGIST
Douglas W. Charlton
No. 4110
STATE OF CALIFORNIA

SHELL OIL COMPANY
500 40th Street
Oakland, California

Project No.
88-44-361-01

Converse Environmental West

Drawing No.
A-4

LOG OF BORING NO. OMW-6

continued - page 2

DEPTH (ft)	SAMPLE	WATER LEVEL	SYMBOL	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION	WELL CONSTRUCTION	BLOWS/FT.	O.V.M. (ppm)	T.P.H. (ppm)
				wet	stiff	tan brown	Silty CLAY, trace Sand. CL			0	
							Silty CLAY.				
25				moist	stiff	lt brown	Sandy CLAY lens. No odor. CL		8	0	
							Total Depth of Boring: 25 ft Below Ground Surface.				
30											
35											
40											

REGISTERED PROFESSIONAL GEOLOGIST
Douglas W. Chastain
No. 4116
STATE OF CALIFORNIA

SHELL OIL COMPANY
500 40th Street
Oakland, California

Project No.
88-44-361-01

Converse Environmental West

Drawing No.
A-5

LOG OF BORING NO. OMW-9

DATE DRILLED: 10-17-89	ELEVATION:	WL TAKEN: n/a	EQUIPMENT: 3 3/4"x 8" Hollow-Stem Auger

DEPTH (ft)	SAMPLE	WATER LEVEL	SYMBOL	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION	WELL CONSTRUCTION	BLOWS/FT.	O.V.M. (ppm)	T.P.H. (ppm)
				moist	loose	light brown	Silty SAND and GRAVEL. SM/GM (Fill)				
				moist	medium	black	Silty CLAY, trace fine Sand. CL				
5	1			moist	medium	dark olive	Fine Sandy CLAY, trace Gravel. Petroleum odor. CL		15	0	
10	2			slightly moist	stiff	light olive	Fine Sandy CLAY, some angular Gravel. Strong Petroleum odor. CL		11	126	
15	3			slightly moist	stiff	tan brown	Fine Sandy CLAY, trace Gravel, mottled gray. CL		13	0	
	4			wet	loose	lt. brwn	F. SAND and GRAVEL lens. SP/GP		25	0	
20				moist	medium	black	Silty CLAY, some decaying shells. No odor. CL				

SHELL OIL COMPANY
500 40th Street
Oakland, California

Project No.
88-44-361-01

Drawing No.
A-6

Converse Environmental West

LOG OF BORING NO. OMW-9

continued – page 2

DEPTH (ft)	SAMPLE	WATER LEVEL	SYMBOL	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION		WELL CONSTRUCTION	BLOWS/FT.	O.V.M. (ppm)	T.P.H. (ppm)
				moist	medium	black	Silty CLAY, some decaying shells. No odor.	CL				
25	5			very moist	medium	light tan brown	Very fine Sandy CLAY, gray mottles.	CL		18	0	
										16		
				wet	medium	light tan brown	Clayey fine SAND, thin lenses of Sandy Clay.	SC		12		
										14		
								SC		7		
30				very moist		light brown	Silty fine SAND, rust mottles.			10		
							Total Depth of Boring: 30 ft Below Ground Surface.					
35												
40												

REGISTERED PROFESSIONAL GEOLOGIST
By Charles W. Charlton
No. 4110
STATE OF CALIFORNIA

SHELL OIL COMPANY
500 40th Street
Oakland, California

Project No.
88-44-361-01

Converse Environmental West

Drawing No.
A-7

LOG OF BORING NO. OMW-10

DATE DRILLED: 11-13-89	ELEVATION:	WL TAKEN: n/a	EQUIPMENT: 3 3/4"x 8" Hollow-Stem Auger

DEPTH (ft)	SAMPLE	WATER LEVEL	SYMBOL	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION	WELL CONSTRUCTION	BLOWS/FT.	O.V.M. (ppm)	T.P.H. (ppm)
						light brown	Silty SAND and GRAVEL SM/GM baserock.				
				moist	medium	black	Silty CLAY, CL trace fine Sand, stained olive.			0	
							Increasing staining.				
	1			slightly moist	medium	dark gray	Fine Sandy CLAY, CL trace Gravel, stained olive. No odor.		18	0	
5							Increasing SAND and GRAVEL.				
	2			slightly moist	medium	dark gray	Fine to medium Sandy CLAY, CL little Gravel. Mottled olive and rust stains.		14	0	
10											
						light brown				0	
	3			moist	stiff		Silty CLAY, trace fine Sand.		16		
15											
				wet		lt. brwn.	F to m Sndy GRVL, tr Cly. GW		23	0	
20				v. moist	medium		F. Sandy CLAY, tr. Gravel. CL				

SHELL OIL COMPANY
500 40th Street
Oakland, California

Project No.
88-44-361-01

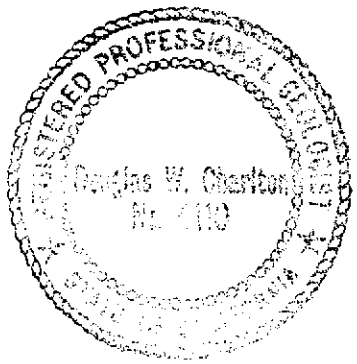
Drawing No.
A-8

Converse Environmental West

LOG OF BORING NO. OMW-10

continued - page 2

DEPTH (ft)	SAMPLE	WATER LEVEL	SYMBOL	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION	WELL CONSTRUCTION	BLOWS/FT.	O.V.M. (ppm)	T.P.H. (ppm)
				v. moist		lt. brwn.	F. Sandy CLAY, tr. Gravel. CL		22		
				moist			Clayey f. SAND, lt. Grvl. SC				
				moist	medium		F. Sandy CLAY, lt. Gravel. CL		25	0	
				v. moist	m. dense	lt. brwn.	Fine Sandy GRAVEL. GP				
	P			moist	medium	gray brown	Fine Sandy CLAY. CL Fine Sandy CLAY, rust stains.		7 10	 0	
25							Total Depth of Boring: 24 ft Below Ground Surface.				
30											
35											
40											



SHELL OIL COMPANY
500 40th Street
Oakland, California

Project No.
88-44-361-01

Converse Environmental West

Drawing No.
A-9

NATIONAL ENVIRONMENTAL TESTING, INC.

NET Pacific, Inc.
435 Tesconi Circle
Santa Rosa, CA 95401
Tel: (707) 526-7200
Fax: (707) 526-9623

NOTE: CORRECTED LAB DATA TO BE MAILED BY JUDY 12/4/89. BTEX DATA PG. 4.

Marc Yalom
Converse Consultants
55 Hawthorne St, Ste 500
San Francisco, CA 94105

11-29-89
NET Pacific Log No: 8583
Series No: 103.1
Client Ref: Proj#88-44-361-01-11

Subject: Analytical Results for "Shell - 500 40th St., Oakland" Received 11-15-89.

Dear Mr. Yalom:

Sample analysis in support of the project referenced above has been completed and results are presented on following pages. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Submitted by:

Judy Ridley
Client Service Representative

Approved by:

Jules Skamarack
Laboratory Manager

/sm
Enc: Sample Custody Document

KEY TO ABBREVIATIONS and METHOD REFERENCES

Abbreviations

mean : Average; sum of measurements divided by number of measurements.

mg/Kg (ppm) : Concentration in units of milligrams of analyte per kilogram of sample, wet-weight basis (parts per million).

mg/L : Concentration in units of milligrams of analyte per liter of sample.

mL/L/hr : Milliliters per liter per hour.

MPN/100 mL : Most probable number of bacteria per one hundred milliliters of sample.

N/A : Not applicable.

NA : Not analyzed.

ND : Not detected; the analyte concentration is less than applicable listed reporting limit.

NR : Not requested.

NTU : Nephelometric turbidity units.

RPD : Relative percent difference, 100 [Value 1 - Value 2]/mean value.

SNA : Standard not available.

ug/Kg (ppb) : Concentration in units of micrograms of analyte per kilogram of sample, wet-weight basis (parts per billion).

ug/L : Concentration in units of micrograms of analyte per liter of sample.

umhos/cm : Micromhos per centimeter.

Method References

Methods 601 through 625: see "Guidelines Establishing Test Procedures for the Analysis of Pollutants" U.S. EPA, 40 CFR, Part 136, rev. 1988.

Methods 1000 through 9999: see "Test Methods for Evaluating Solid Waste", U.S. EPA SW-846, 3rd edition, 1986.

* Reporting Limits are a function of the dilution factor for any given sample. To obtain the actual reporting limits for this sample, multiply the stated reporting limits by the dilution factor.

SAMPLE DESCRIPTION: OMW-10 #1 5'11-13-89
LAB NO.: (-39686)

Parameter	Reporting Limit	Results	Units
Lead (EPA 7421)	0.2	5.5	ppm
PETROLEUM HYDROCARBONS VOLATILE (SOIL)		--	
DILUTION FACTOR *		--	
DATE ANALYZED		1	
METHOD GC FID/5030		11-20-89	
as Gasoline	1	--	
METHOD 8020		ND	ppm
Benzene	2.5	--	
Ethylbenzene	2.5	ND	ppm
Toluene	2.5	ND	ppm
Xylenes, total	2.5	ND	ppm
PETROLEUM HYDROCARBONS EXTRACTABLE (SOIL)		ND	ppm
DILUTION FACTOR *		--	
DATE EXTRACTED		--	
DATE ANALYZED		1	
METHOD GC FID/3550		11-16-89	
as Diesel	1	11-17-89	
as Motor Oil	10	--	
		ND	ppm
		ND	ppm

SAMPLE DESCRIPTION: OMW-10 #2 10'11-13-89
LAB NO.: (-39687)

Parameter	Reporting Limit	Results	Units
Lead (EPA 7421)	0.2	4.3	ppm
PETROLEUM HYDROCARBONS VOLATILE (SOIL)		--	
DILUTION FACTOR *		--	
DATE ANALYZED		1	
METHOD GC FID/5030		11-20-89	
as Gasoline	1	--	
METHOD 8020		ND	ppm
Benzene	.002.5	--	
Ethylbenzene	.0002.5	.020	ppm
Toluene	.0002.5	.0008.4	ppm
Xylenes, total	.0002.5	.0004.4	ppm
PETROLEUM HYDROCARBONS EXTRACTABLE (SOIL)		.024	ppm
DILUTION FACTOR *		--	
DATE EXTRACTED		1	
DATE ANALYZED		11-16-89	
METHOD GC FID/3550		11-17-89	
as Diesel	1	--	
as Motor Oil	10	ND	ppm
		ND	ppm

SAMPLE DESCRIPTION: OMW-10 #3 15'11-13-89
LAB NO.: (-39688)

Parameter	Reporting Limit	Results	Units
Lead (EPA 7421)	0.2	6.9	ppm
PETROLEUM HYDROCARBONS VOLATILE (SOIL)		--	
DILUTION FACTOR *		--	
DATE ANALYZED		1	
METHOD GC FID/5030		11-20-89	
as Gasoline	1	--	
METHOD 8020		ND	ppm
Benzene	2.5	--	
Ethylbenzene	2.5	ND	ppm
Toluene	2.5	ND	ppm
Xylenes, total	2.5	ND	ppm
PETROLEUM HYDROCARBONS EXTRACTABLE (SOIL)		ND	ppm
DILUTION FACTOR *		--	
DATE EXTRACTED		--	
DATE ANALYZED		1	
METHOD GC FID/3550		11-16-89	
as Diesel	1	11-17-89	
as Motor Oil	10	--	
		ND	ppm
		ND	ppm

Converse Consultants

P.M.: Marc Yalom

9583

CHAIN OF CUSTODY RECORD

Project No.	Project Name
88-99-361-01-11	500 40th St, Oakland

Samplers: (signature) Gerald P Manuell

Station No.	Date	Time	Comp.	Grab	Station Location	Number of Containers	TPH-D	TPH-G	TPH Mo for Oil	Pb	BTEX	Remarks
OMW 10	11-13-89				Drive 1 @ 5'	1	X	X	X	X	X	STAT.
OMW 10	11-13				Drive 2 @ 10'	1	X	X	X	X	X	
OMW 10	11-13				Drive 3 @ 15'	1	X	X	X	X	X	

Relinquished by: (signature) Gerald P Manuell	Date/Time 11-14-89 | 12:00	Received by: (signature) Jeff Winkler 11/14 12:30	Relinquished by: (signature) Jeff Winkler	Date/Time |	Received by: (signature)
Relinquished by: (signature)	Date/Time |	Received by: (signature)	Relinquished by: (signature)	Date/Time |	Received by: (signature)
Relinquished by Courier: (signature)	Date/Time |	Received by Mobile Lab: (signature)	Relinquished by Mobile Lab: (signature)	Date/Time |	Received by Courier: (signature)
Method of Shipment		Shipped by: (signature)	Courier from Airport: (signature) (VIA NCS)	Received for Laboratory: (signature)	Date/Time 11/15/89 | 0900

CSB-1

Parameter	Reporting Limit (ppm)	Descriptor, Lab No. and Results OMW7 #1 5' 10-17-89 (-38060)	OMW7 #2 10' 10-17-89 (-38061)	OMW7 #3 15' 10-17-89 (-38062)	OMW7 #4 20' 10-17-89 (-38063)
METHOD 7421					
Lead	0.2	22	3.2	4.0	4.9
PETROLEUM HYDROCARBONS		—	—	—	—
VOLATILE (SOIL)		—	—	—	—
DILUTION FACTOR *		1	1	1	1
DATE ANALYZED		10-31-89	10-31-89	10-31-89	10-31-89
METHOD GC FID/5030		—	—	—	—
as Gasoline	10 1	ND	ND	ND	ND
METHOD 8020		—	—	—	—
Benzene	0.025 .0025	ND	ND	ND	ND
Ethylbenzene	0.075	ND	ND	ND	ND
Toluene	0.025	ND	ND	ND	ND
Xylenes, total	0.075	ND	ND	ND	ND
PETROLEUM HYDROCARBONS		—	—	—	—
EXTRACTABLE (SOIL)		—	—	—	—
DILUTION FACTOR *		1	1	1	1
DATE EXTRACTED		10-25-89	10-25-89	10-25-89	10-25-89
DATE ANALYZED		10-26-89	10-26-89	10-26-89	10-26-89
METHOD GC FID/3550		—	—	—	—
as Diesel	1	ND	ND	ND	ND
as Motor Oil	10	ND	ND	ND	ND

Parameter	Reporting Limit (ppm)	Descriptor, Lab No. and Results: OMW9 #1 5' 10-17-89 (-38064)	OMW9 #2 10' 10-17-89 (-38065)	OMW9 #3 15' 10-17-89 (-38066)	OMW9 #4 20' 10-17-89 (-38067)
Lead	0.2	3.7	2.6	4.3	3.1
PETROLEUM HYDROCARBONS		—	—	—	—
VOLATILE (SOIL)		—	—	—	—
DILUTION FACTOR *		1	1	1	1
DATE ANALYZED		10-31-89	10-31-89	10-31-89	10-31-89
METHOD GC FID/5030		—	—	—	—
as Gasoline	10	ND	210	11	ND
METHOD 8020		—	—	—	—
Benzene	0.025	ND	0.064	ND	ND
Ethylbenzene	0.075	ND	1.1	ND	ND
Toluene	0.025	ND	0.46	ND	ND
Xylenes, total	0.075	ND	6.3	ND	ND
PETROLEUM HYDROCARBONS		—	—	—	—
EXTRACTABLE (SOIL)		—	—	—	—
DILUTION FACTOR *		1	1	1	1
DATE EXTRACTED		10-25-89	10-25-89	10-25-89	10-25-89
DATE ANALYZED		10-26-89	10-26-89	10-26-89	10-26-89
METHOD GC FID/3550		—	—	—	—
as Diesel	1	ND	40	ND	ND
as Motor Oil	10	ND	ND	ND	ND

APPENDIX A

Hollow-Stem Auger Drilling and Soil Sampling

HOLLOW-STEM AUGER DRILLING AND SOIL SAMPLING

Borings shall be drilled with a hollow-stem auger and sampled with a modified California-type split-spoon sampler. Soil samples shall be of sufficient volume to perform the analyses which may be required, including replicate analyses. Aside from deionized water or distilled water, no fluids will be used in drilling.

Undisturbed (intact) soil samples shall be recovered from soil borings without introducing liquids into the borings. Soil samples as core or cuttings shall be taken continuously from ground surface to termination depth (TD), or through the aquifer zone of interest for lithologic logging.

Soils from all borings shall be described in detail using the Unified Soil Classification System and shall be logged by a professional geologist, civil engineer, or engineering geologist who is registered or certified by the State of California and who is experienced in the use of the Unified Soil Classification System. A technician trained and experienced in the use of the Unified Soil Classification System who is working under the direct supervision of one of the aforementioned professionals shall be qualified to log borings, provided the aforementioned professional reviews the logs and assumes responsibility for the accuracy and completeness of the logs.

All wet zones above the free water zone shall be noted and accurately logged.

If evidence of contamination is detected by sight, smell, or other field analytical methods, drilling shall be halted until the responsible professional determines if drilling deeper is advisable.

All drilling tools shall be thoroughly decontaminated with trisodium phosphate (TSP) or steam cleaner immediately before starting each boring.

Soil samples shall be taken in decontaminated brass sampling tubes in the split-spoon. The brass sleeves will be cut apart using a clean knife. The ends of the tubes will be covered tightly with teflon wrap, capped with tight-fitting plastic caps, wrapped with plastic electricians' tape, and properly labeled.

APPENDIX B

Standards for Backfilling Borings and Sealing Wells

STANDARDS FOR BACKFILLING BORINGS AND SEALING WELLS

INTRODUCTION

As standard practice, all borings and observation and monitoring wells shall be backfilled or sealed with "relatively impervious" grout to prevent surface contamination or cross-contamination between aquifers. Borings will be sealed from termination depth to the surface and observation and monitoring wells shall be backfilled and sealed above the water table. This practice will reduce liability if it is determined and proven that groundwater contamination occurred along a "vertical pathway" in an improperly sealed or filled boring or well.

In hazardous and potentially hazardous waste sites where deep borings or wells are installed, appropriate geologic information will be reviewed to determine if multiple aquifer system(s) exist(s). If such system(s) exist(s), drilling and sealing techniques will be used to prevent contamination of a lower aquifer by upper, potentially contaminated aquifer(s). Grout seals will be installed according to the following techniques through all thicknesses of impermeable zones which separate aquifer.

Borehole grouting shall consist of backfilling with bentonite pellets, cement/bentonite grout, or a thick bentonite slurry, depending upon the depth of the boring, depth to ground water, and type of drilling equipment used. Details of currently acceptable sealing methods are outlined below.

GENERAL SPECIFICATIONS

- All grouting and well construction and sealing and abandonment of borings shall be consistent with local ordinances.

- Cement/bentonite grout used to seal wells will be of a hard consistency that can resist traffic loads, but not installed to create a "concrete pile" that will obstruct further earthwork. Bentonite slurry, which does not support surface loads, will not be used for sealing wells.

GROUTING/SEALING TECHNIQUES

Dry Holes and Borings Containing Less Than 5 Feet of Water

Option 1: Backfill boring with bentonite pellets or granules in about 2-foot lifts. Add a gallon of water to hole after each lift.

Option 2: Pour in a mixture of cement/bentonite group (9 parts cement, 1 part bentonite powder plus water as needed to make mixture consistency of pancake batter).

Option 3: Pour in a thick mixture of bentonite and water. Soil cuttings can be used to bulk this mixture is soil is not contaminated and chunks are small and well-mixed in slurry.

Borings Containing More Than 5 Feet of Water

Option 1: Pump out water and use criteria for "dry hole."

Option 2: Pump cement/bentonite grout to bottom of hole or use tremie. Do not pour grout through water.

Option 3: Pump or tremie bentonite slurry. This alternative is particularly efficient if you are using rotary wash equipment since all you have to do is thicken the drilling mud and pump it through the drill rod.

Monitoring/Observation Well Sealing (Single Aquifer)

A. Place sand pack around well casing to about 2 feet above slotted interval. Anticipate fluctuation of water level so screened interval covers maximum water elevation.

B. Place 2-foot thick bentonite pellet seal above sand pack. Add a bucket of clean water to swell pellets.

C. Pour cement/bentonite grout or bentonite slurry above pellet seal to ground surface.

APPENDIX C

Groundwater Monitoring Well Construction

GROUNDWATER MONITORING WELL CONSTRUCTON

BOREHOLE DESIGN

Casing Diameter: The minimum diameter of well casings shall be 2 inches (nominal). Four-inch diameter well casings shall be preferred.

Borehole Diameter: The diameter of the borehole shall be a minimum of 4 inches and a maximum of 12 inches greater than the diameter of the well casing.

Shallow (Unconfined) Zone Wells: When groundwater is encountered or known to be within 45 feet of the ground surface, the borehole will be advanced through the aquifer to a competent aquitard. A competent aquitard is defined as being greater than 5 feet thick. To test the competency of the aquitard, the borehole will be drilled five feet into it. Once confirmed, the excess borehole shall be sealed with bentonite, concrete, or cement. The screened interval will begin 5 feet above the saturated zone and extend the full thickness of the aquifer or 20 feet into the saturated zone, whichever is reached first. The well screen will not extend into the aquitard, nor shall the screened interval exceed 25 feet in length.

If an aquitard is found to be less than 5 feet thick, it is assumed to represent a local lens. If the aquifer is greater than 20 feet thick and no competent aquitard is present, the well screen will be placed in the interval of 5 feet above and not more than 20 feet below the top of the saturated zone.

Deep (Confined) Zone Wells: Any monitoring well to be screened below the upper aquifer shall be installed as double-cased well. A steel conductor casing shall be placed through the upper water-bearing zone to prevent aquifer cross-contamination.

The conductor casing shall be installed in the following manner: a large diameter borehole (typically 18 inches) shall be drilled until it is determined that the first competent aquitard has been reached. A low carbon steel conductor casing shall be placed in the borehole to the depth drilled. Centralizers shall be used to center the casing in the borehole. The annular space between the conductor casing and the formation shall be cement-grouted from bottom to top by tremie pipe method. The grout shall be allowed to set for a minimum of 72 hours.

Drilling may continue inside the conductor casing, with a drill bit of smaller diameter than the conductor casing. If additional known aquifers are to be fully penetrated, the procedure can be repeated with successively small diameter conductor casings.

The bottom of the well screen in a confined aquifer shall be determined by presence or lack of a competent (5 foot) aquitard as described above. The screened interval in a confined zone shall extend across the entire saturated zone of the aquifer or to a length of 20 feet, which ever is less. The screened zone and filter pack shall not cross connect to another aquifer.

CONSTRUCTION MATERIALS

Casing Materials: Well casing shall be constructed of materials that have the least potential for affecting the quality of the sample, have sufficient strength, and resist rapid deterioration from corrosion. The most suitable material for a particular installation will depend upon the parameters to be monitored. Acceptable materials include PVC, stainless steel, or low carbon steel.

Casing Joints: Joints shall be connected by flush threaded couplers. Organic bonding compounds and solvents will not be used on joints.

Well Screen Slots: Well screen shall be factory slotted. The size of the slots shall be selected to allow sufficient groundwater flow to the well for sampling, minimize the passage of formation materials into the well, and ensure sufficient structural integrity to prevent the collapse of the intake structure.

Casing Bottom Plug: The bottom of the well casing will be permanently plugged, either by flush threaded screw-on or friction cap. Friction caps shall be secured with stainless steel set screws. No organic solvents or cements will be applied.

Filter Pack Material: Filter pack envelope materials shall be durable, waterworn, and washed clean of silt, dirt, and foreign matter. Sand size particles shall be screened silica sand. Particles shall be well rounded and graded to an appropriate size for retention of aquifer materials.

Bentonite Seal Material: Bentonite shall be pure and free of additives that may effect groundwater quality. Bentonite shall be hydrated with clean water.

Grout Seal Material: Cement grout shall consist of a proper mixture of Type I/II Portland cement, hydrated with clean water. Up to 3% bentonite may be added to the mixture to control shrinkage.

CONSTRUCTION PROCEDURES

Decontamination: All downhole tools, well casings, casing fittings, screens, and all other components that are installed in the well shall be thoroughly cleaned immediately before starting each well installation. When available, each component shall be cleaned with a high temperature, high pressure washer for a minimum of 5 minutes. When a washer is not available, components shall be cleaned with clean water and detergent or tri-sodium phosphate, rinsed in clean water, then rinsed in distilled water.

Soil and water sampling equipment and materials used to construct the wells shall not donate to, capture, mask, nor alter the chemical composition of the soils and ground water.

Drilling Methods: Acceptable drilling methods include solid and hollow stem auger, percussion, direct circulation (mud) rotary, and air circulation direct, and reverse rotary. The best alternative is that which minimizes the introduction of foreign materials or fluids.

If drilling mud is employed, drilling fluid additives shall be limited to inorganic and non-hazardous compounds. Compressed air introduced to the borehole shall be adequately filtered to remove oil and particulates.

Soil Sampling Methods: Soil sampling shall be recovered according to protocols described in CEW Standard Operating Procedure: Soil Sampling of Boreholes.

Casing Installation: The casing will be set under tension to ensure straightness. Centralizers should be used where necessary to avoid unnecessary curvature or stress to the casing.

Sand Pack Installation: The sand pack will be installed so as to avoid bridging and the creation of void spaces. The tremie pipe method will be used where installatoin conditions or local regulations require. Drilling mud, when used, must be thinned prior to pack placement. The sand pack shall cover the entire screened interval and rise a minimum of two feet above the highest perforation.

Bentonite Seal Placement: The bentonite seal will be placed by a method that prevents bridging. Bentonite pellets can be placed by free fall if proper sinking through annular water can be assured. Bentonite slurry will be placed by the tremie pipe method from the bottom upward. The bentonite seal should be not less than 1 foot in thickness above the sand pack.

Grout Seal Placement: The cement grout mixture shall be hydrated with clean water and thoroughly mixed prior to placement. If substantial groundwater exists in the borehole, the grout shall be placed by tremie pipe method from the bottom upward. In a dry borehole, the grout may be surface poured. Grout will be placed in one continuous lift and will extend to the surface or to the well vault if the wellhead is completed below grade. A minimum of 5 feet of grout seal will be installed, unless impractical due to the shallow nature of the well.

Surface Completion: The wellhead will be protected from fluid entry, accidental damage, unauthorized access, and vandalism. A watertight cap shall be installed on the top of the well casing. Access to the casing should be controlled by a keyed lock.

Wellheads completed below grade will be completed in a concrete and/or steel vault, installed to drain surface runoff away from the vault opening.

Well Identification: Each well will be identified by well number, owner, and type of installation. Construction data, including depth, hole and casing diameter and screened interval will be noted.

APPENDIX D

Well Development

WELL DEVELOPMENT

INTRODUCTION

Newly installed groundwater monitoring wells will be developed to restore natural hydraulic conductivity of the formation, remove sediments from the well casing and filter pack, stabilize the filter pack and aquifer material, and ensure turbidity-free groundwater samples.

Wells may be developed by bailing, mechanical pumping, air lift, pumping, surging, swabbing, or an effective combination of methods. Wells will be developed until the well is free of sand, silt, and turbidity.

In some cases where low permeability formations are involved or the drilling mud used fails to respond to cleanup, initial development pumping may immediately dewater the well casing and thereby inhibit development. When this occurs, clean, potable grade water may be introduced into the well, followed by surging of the introduced waters with a surge block. This operation will be followed by pumping. The procedure may be repeated as required to establish full development.

METHODOLOGY

Seal Stabilization: Cement and bentonite annular seals shall set and cure not less than 24 hours prior to well development.

Decontamination: All well development tools and equipment shall be thoroughly cleaned immediately before starting each well installation. When available, each component shall be cleaned with a high temperature, high pressure washer for a minimum of 5 minutes. When a washer is not available, components shall be cleaned with clean water and detergent or tri-sodium phosphate, rinsed with clean water, then rinsed with distilled water.

Development equipment shall not donate to, capture, mask, nor alter the chemical composition of the soils and ground water.

Introduction of Water: Initial development of wells in low permeability formations may de-water the casing and filter pack. When this occurs, clean, potable water can be introduced in to the well to enhance development.

Bailing: Development will begin by bailing to remove heavy sediments from the well casing. Care shall be taken to not damage the well bottom cap during lowering of the bailer.

Surging: Care shall be exercised when using surge block to avoid damaging the well screen and casing. When surging wells screened in coarse (sandy/gravelly) aquifers, the rate of surge block lifting shall be slow and constant. When surging wells screened in fine

(silty) aquifers, more vigorous lifting may be require. Between surging episodes, wells will be bailed to remove accumulated sediments.

Pumping: Development pumping rates shall be less than the recharge rate of the well in order to avoid de-watering.

Discharged Water Containment and Disposal: All water and sediment generated by well development shall be collected in 55-gallon steel drums. Development water will be temporarily contained onsite, pending sampling and laboratory analysis. All development water will be transported offsite by a licensed transporter to a licensed hazardous waste disposal or treatment facility. No development water shall be released to the environment.

MEASUREMENTS

Discharged Water Parameters: During development, discharged water shall be measured for the following parameters:

Parameter	Units of Measurement
pH	Units
Electrical Conductivity	umhos
Temperature	Degrees F or C
Turbidity	Nephelometric Turbidity Units (NTU's)
Sediment Production	_____
Depth to Water in Casing	Feet/Tenths
Volume of Water Discharged	Gallons

Sediment Production: Sediment production from the well shall be measured using Imhoff Cone.

Turbidity: The development water turbidity shall be measured using a nephelometer. Turbidity at the conclusion of development should be less than 5 NTU's.

Measurement Frequency: Parameters shall be measured not less than every 3 pre-development casing volumes of water discharged.

Documentation: All parameter measurements shall be documented in writing on CEW Development Logs (example attached). Additional documentation shall include the well owners name, the well designation, the date of development, pre- and post-development depths to water, methods of development, general development and notes and comments.

APPENDIX E

Groundwater Sampling

GROUNDWATER SAMPLING

Groundwater samples shall be collected for laboratory analysis by the following procedures:

1. Before sampling or purging begins, all bailers, pumps, cables and lines will be steam-cleaned. An established and designated cleaning area will be kept clean by lining with visqueen or using a cleaning rack.

2. A pre-purge sample shall first be obtained with a bailer from as deep in the well as possible. Standard "Water Sampling Field Survey Forms" will be filled out for this and all future samples, to include the following information:

   - Depth to water and total depth of water column, measured and recorded before purging begins;

   - Conductivity, checked and recorded for every 5 gallons of purged water (for small volumes); and

   - Purged volume (as appropriate), with stabilized readings for pH, conductivity and temperature.

The well shall then be bailed or pumped to remove four to ten well volumes prior to sampling. The well will be purged until conductivity has been stabilized. "Stabilized" is defined as three consecutive readings within 15% of one another. A casing volume will be based on actual measurements made on the day of sampling, i.e., the total depth minus depth to water on day of sampling, time the cross-sectioned area of the casing.

If the well is emptied before four to ten well volumes are removed, the sample shall be taken when the water level in the well recovers to 80% of its initial water level or better.

Whenever possible, samples will be collected within 24 hours after purging; ideally, samples will be collected immediately after purging.

Following the required volume of evacuation from the well, the sample shall be obtained with a teflon or stainless steel bailer on a 60-pound monofilament or polypropylene (washed) line. Care will be taken to properly clean cables with braided stainless steel cable or plastic coverings, if used. Air lift sampling and bladder pumps shall not be used.

Unless specifically waived or changed by the local, prevailing regulatory agency, water samples shall be handled and preserved according to the latest EPA methods as described in the Federal Register (Volume 44, No. 233, Monday, December 3, 1979, Page 69544, Table II) for the type of analysis to be performed.

Purge water will be properly disposed of or temporarily contained in steel barrels pending chemical analysis to designate proper disposal procedure.

APPENDIX F

Chain-of-Custody

CHAIN-OF-CUSTODY

SAMPLE COLLECTION, HANDLING AND IDENTIFICATION

Sample collection, handling, and identification will follow the guidelines set by the California Department of Health Services. Field records will be completed when the sample is collected and will be signed or initialed, including the date and time, by the sample collector(s). Field records will contain the following information:

1. Unique sample or log number;
2. Date and time;
3. Source of sample (including name, location and sample type);
4. Preservative used;
5. Analyses required;
6. Name of collector(s);
7. Pertinent field data (pH, DO, C1, residual, etc.); and
8. Serial number on seals and transportation cases.

Each sample will be identified by affixing a pressure sensitive, gummed label, or standardized tag on the container(s). This label will contain the sample identification number, date and time of sample collection, source of sample preservative used, and the collector(s) initial(s). Analysis required will be identified. Where a label is not available, the same information will be affixed to the sample contained with an indelible, waterproof, marking pen.

The sample container will be placed in a transportation case along with the chain-of-custody record form, pertinent field records, and analyses request form. The transportation case will then be sealed and labeled. Records will be filled out legibly in pen.

TRANSFER OF CUSTODY AND SHIPMENT

When transferring the possession of the samples, the transferee will sign and record the date and time on the chain-of-custody record. Custody transfer, if made to a sample custodian in the field, will account for each individual sample, although samples may be transferred as a group.

The field custodian or field inspector will be responsible for properly packaging and dispatching samples to the appropriate laboratory for analysis. This responsibility includes filling out, dating, and signing the appropriate portion of the chain-of-custody record.

All packages sent to the laboratory will be accompanied by the chain-of-custody record and other pertinent forms. A copy of these forms will be retained by the originating office.

Mailed packages can be registered with return receipt requested. If packages are sent by common carrier, receipts should be retained as part of the permanent chain-of-custody documentation.

Samples to be shipped will be sealed locked so evidence of tampering may be readily detected.

LABORATORY CUSTODY PROCEDURES

Chain-of-custody procedures will be followed in the laboratory from the time of sample receipt to the time the sample is discarded.

The sample control officer (SCO) will be the designated custodian, and an alternate is designated to act as custodian in the custodian's absence. All incoming samples are received by the SCO, who shall indicate receipt by signing the accompanying custody forms and who shall retain the signed forms as permanent records.

The SCO will maintain a permanent log book to record, for each sample, the person delivering the sample, the person receiving the sample, date and time received, source of sample, sample identification or log number, how transmitted to the laboratory, and condition received (sealed, unsealed, broken container, or other pertinent remarks). A standardized format will be established for log book entries.

A clean, dry, isolated room, building, and/or refrigerated space that can be securely locked from the outside, will be designated as a "sample storage security area."

The SCO will ensure that heat-sensitive, light-sensitive samples, radioactive, or other sample materials having unusual physical characteristics, or requiring special handling, are properly stored and maintained prior to analysis.

Only the custodian will distribute samples to the section leaders who are responsible for the laboratory performing the analysis.

The laboratory area will be maintained as a secured area, restricted to authorized personnel only.

Laboratory personnel will be responsible for the care and custody of the sample once it is received by them. These personnel shall be prepared to testify that the sample was in their possession and view, or secured in the laboratory at all times, from the moment it was received from the SCO, until the time that the analyses are completed.

Once the sample analyses are completed, the unused portion of the sample, together with all identifying labels, will be returned to the SCO. The returned tagged sample will be retained in the custody room until permission to destroy the sample is received by the SCO.

Samples will be destroyed only upon the order of the Laboratory Director, in consultation with previously-designated Project Manager, and/or client, or when it is certain that the information is no longer required or the samples have deteriorated. The same procedure will apply to tags and laboratory records.

APPENDIX G

Drum Handling Procedures

OUTLINE OF DRUM HANDLING PROCEDURES

1. Complete drummed worksheets onsite, forward a copy to Shell.

2. Test material per Shell's site-specific test requirements.

3. Classify Material as: Clean/Non-Hazardous/Hazardous

4. Labeling of Drums

   - Pending Label: Used to describe material pending final analytical testing. Labels must be immediately affixed to drum during field work.

   - Non-Hazardous Label: Required within 48 hours after analytical results are received.

   - Hazardous Label: Required within 48 hours after analytical results are received.

   - For Pick-Up Label: Must be affixed to drum prior to Shell Hazardous Waste Coordinator arranged pick-up date.

5. Remove within 14 days of date of generation. Empty drums, where material was disposed in bulk, must be removed the same day they are emptied.

6. Dispose of Material:

   - Clean: Any local landfill
   - Non-Hazardous: Class III landfill. If a Class III landfill will not accept, contact Shell Hazardous Waste Coordinator for assistance
   - Hazardous: Class I landfill arranged by Shell Hazardous Waste Coordinator.

   Mail or FAX completed Hazardous Waste Pick-Up Forms to the Shell Hazardous Waste Coordinator with a copy of the analytical results and worksheets.

7. If required, contact the Shell Hazardous Waste Coordinator:

   Shell Oil Company
   Hazardous Waste Coordinator
   Anna Sampson
   P.O. Box 6249
   Carson, California 90749
   Phone: (213) 816-2037
   FAX: (213) 816-2114

8. Manifests may be signed by the onsite contractor or consultant, station dealer, or other authorized Shell Oil representatives. The transporter CAN NOT sign the manifest.

   IT IS THE RESPONSIBILITY OF THE CONTRACTOR/CONSULTANT TO ARRANGE FOR A PERSON TO SIGN THE MANIFEST ON THE DAY OF PICK-UP.

9. Reporting

   All reports must be received by the Shell Hazardous Waste Coordinator within 7 working days of disposal. Reports shall include the following:

   - Completed drummed soil and water worksheets.
   - Attach a copy of the analytical results.
   - State how and where material was disposed.
   - If drums are emptied and material was disposed in bulk, state how empty drums were handled.
   - The signed blue and yellow copies of the hazardous waste manifest.

SOIL:

1. Test Requirements and Methods: Per Shell's site-specific test requirements

   - TPH: EPA Method 8015

   - BTEX: EPA Method 8020

   - Lead:

     -One composite sample from each boring
     -See attached decision tree
     -Total Lead - EPA Method 7421
     -Inorganic (soluble) Lead - DOS Title 22, Waste Extraction Test, §22-66700

   - Ignitable:

     -One composite sample from each boring
     -Bunsen Burner Test Flame Test

2. Classification:

   - Clean: TPH, BTEX, and Lead non-detectable

   - Non-Hazardous if any are true:

     -TPH less than 1000 ppm

- Non-Hazardous:

  -Water with dissolved product and detectable TPH and BTEX
  -Water with free product
  -Free product only

3. Responsibility for Disposal:

   - Clean: Consultant/Contractor

   - Non-Hazardous: Consultant/Contractor or Shell Hazardous Waste Coordinator

4. Types of Drums: DOT-17C or DOT-17E for liquid or slurry

5. Disposal Facility:

   - Clean Water: Into dealer's sanitary sewer or with proper approval from Water Board to storm sewer

   - Non-Hazardous:

     Water with TPH and BTEX only -

     -Into dealer's sanitary sewer with approval from the POTW
     -Contact Shell Hazardous Waste Coordinator to arrange disposal

     Water with free product -

     -Contact Shell Hazardous Waste Coordinator to arrange disposal

   - Hazardous:

     Free product only -

     -Contact Shell Hazardous Waste Coordinator to arrange disposal