Weiss Associates Environmental and Geologic Services

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June 30, 1994

Mark Miller
Chevron U.S.A. Products Company
P.O. Box 5004
San Ramon, California 94583-0804

Re: Remediation System Performance Review
Chevron Service Station #9-0504
15900 Hesperian Blvd.
San Lorenzo, California
WA Job #4-551-54

Dear Mr. Miller:

As requested, this letter presents Weiss Associates' (WA) remediation system performance review for Chevron Service Station #9-0504, located at 15900 Hesperian Boulevard in San Lorenzo, California (Figure 1). Our review includes ground water and gasoline removal estimates and offers recommendations on remediation optimization. Attached figures show the treatment system's layout, ground water volumes pumped, hydrocarbon concentration trends and cumulative gasoline removal.

REMEDIATION SYSTEM DESCRIPTION

In 1992, WA designed and installed a ground water remediation system for Chevron. The system extracts ground water from extraction wells C-1 and C-2 with electric submersible pumps. Extracted ground water is treated using two 1,000 lb aqueous-phase carbon vessels connected in series (Figure 2). As permitted by the Oro Loma Sanitary District, treated ground water is discharged to the sanitary sewer (Figure 3). WA has operated the system since we completed installation in August 1992. Treated ground water consistently has no detectable concentrations of gasoline hydrocarbons.

PERFORMANCE SUMMARY

This section describes the remediation system performance since WA started remediation on August 13, 1992.

Ground Water Pumping Rate

Since commencing with ground water pumping in August of 1992, well yields have been less than expected due to high sediment loading rates resulting in clogged pump discharge lines and several pump failures. The average ground water pumping rate since system start up has been about 1.15 gals per minute (gpm). To mitigate the sedimentation problem and increase ground water pumping rates, wells C-1 and C-2 were redeveloped and the extraction pumps replaced several times (Table 1). Recently, since redeveloping the wells and performing more frequent pump cleaning, the ground water extraction rate has increased to about 5.7 gpm over the April 21 to May 11, 1994 reporting period. To date a total of about one million gallons of hydrocarbon bearing ground water have been pumped. (Table 1 and Figure 4).

Hydrocarbon Concentration Trends

Treatment system influent total petroleum hydrocarbons as gasoline (TPH-G) concentrations in ground water extracted from wells C-1 and C-2 have ranged from 100 to 12,000 parts per billion (ppb), with the most recent analytic result indicating about 2,100 ppb (Table 2 and Figure 5). Extracted ground water TPH-G concentrations have fluctuated. However, TPH-G concentrations in other site wells have fluctuated widely as well.

Analytic results from the most recent quarterly monitoring report indicate that extraction wells C-2 and C-1 contained about 12,000 and 530 ppb TPH-G, respectively[1]. No other site monitoring wells contained higher hydrocarbon concentrations than well C-2.

Gasoline Mass Removed

The ground water extraction and treatment system has removed about 26 lbs of gasoline since August 13, 1992 (Figure 6). This corresponds to an average removal rate of about 0.04 lbs of gasoline per day. Currently the system is removing about 0.14 lbs of gasoline per day. We attribute the recent increased gasoline removal rate to the increased ground water extraction rate.

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1 Weiss Associates, May 13, 1994, Quarterly Monitoring Report for Chevron Service Station #9-0504, San Lorenzo, California.

RECOMMENDATION

To expedite site remediation, WA recommends turning off extraction well C-1 to test the response in well C-2's pumping rate. Wells C-1 and C-2 are situated on the down gradient edge of the site about 40 ft apart. If the wells are hydraulically connected, reducing the pumping rate in well C-1 should result in a slight increase in C-2's ground water yield. The pump currently installed in well C-2 is capable of pumping up to about 7 gpm. Since extraction well C-2 hydrocarbon concentrations are much greater than well C-1, the gasoline removal rate should increase.

WA numerically modeled ground water capture at the site before installing the remediation system[2]. We predicted that the system would adequately capture subsurface hydrocarbons by pumping both wells at 2 gpm. We believe hydraulic capture would not change significantly if we extract 4 gpm from one of the extraction wells instead of 2 gpm from both.

Additionally, after reaching a steady pumping rate from C-2 only, WA could reevaluate hydraulic capture based on actual dynamic water level data to determine if the pumping strategy is effective.

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2 Weiss Associates, March 4, 1992, Remediation Work Plan for Chevron Service Station #9-0504, San Lorenzo, California.

WA trusts that this report satisfies your project management needs. Please call to discuss the project if you wish.

Sincerely,
Weiss Associates

Everett Sorensen, P.E.
Senior Environmental Engineer

Michael Cooke
Project Geologist

EAS/MC:nsh

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Attachments:
Figure 1 - Site Location Map
Figure 2 - Treatment System Schematic
Figure 3 - Monitoring and Extraction Well Locations
Figure 4 - Ground Water Volume Pumped
Figure 5 - TPH-G Concentration in Extracted Ground Water
Figure 6 - Cumulative Gasoline Mass Removed
Table 1 - Performance Summary
Table 2 - Summary of Analytic Results

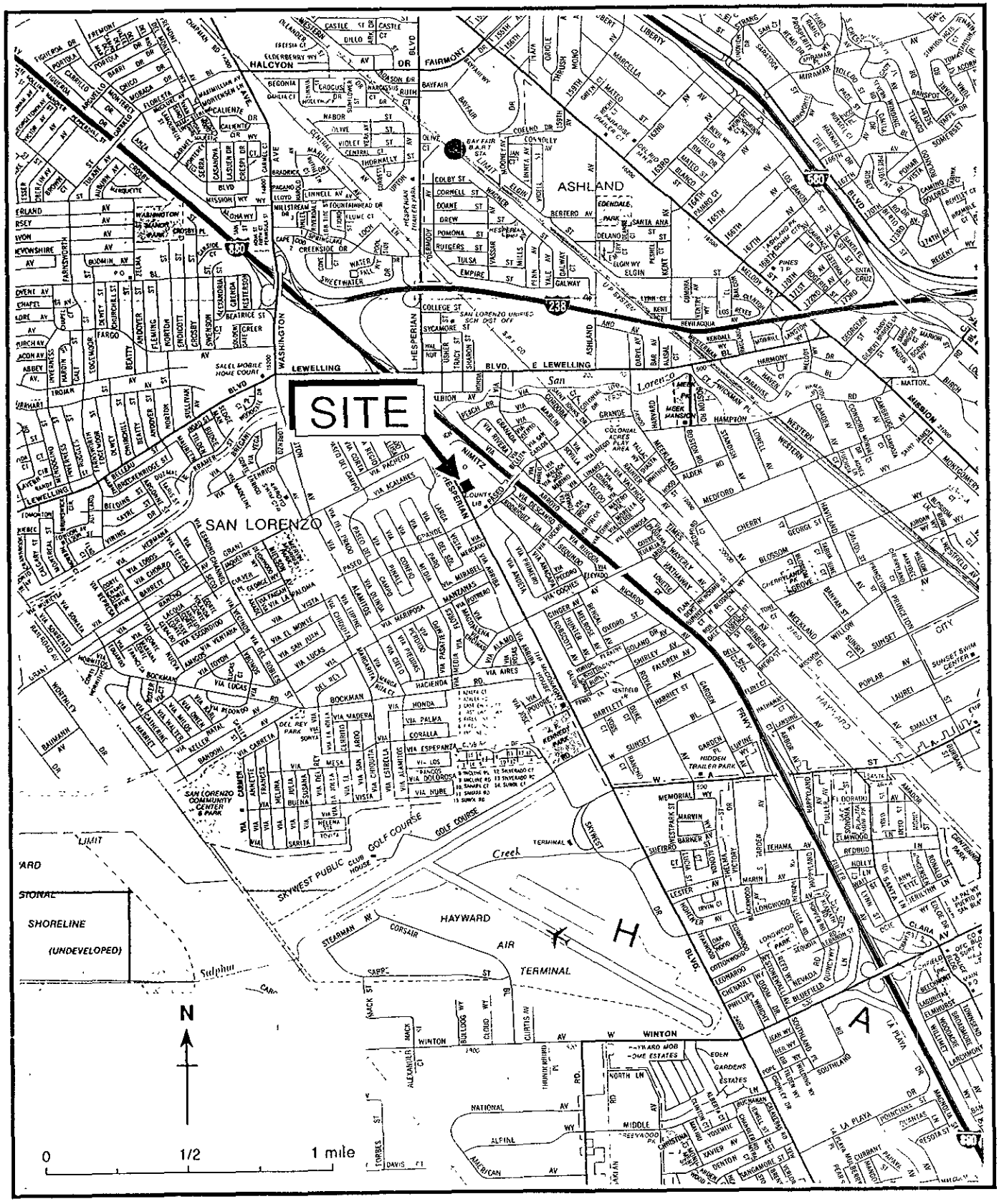

Figure 1. Site Location Map, Chevron Service Station #9-0504, 15900 Hesperian Blvd., San Lorenzo, California

6/18/91

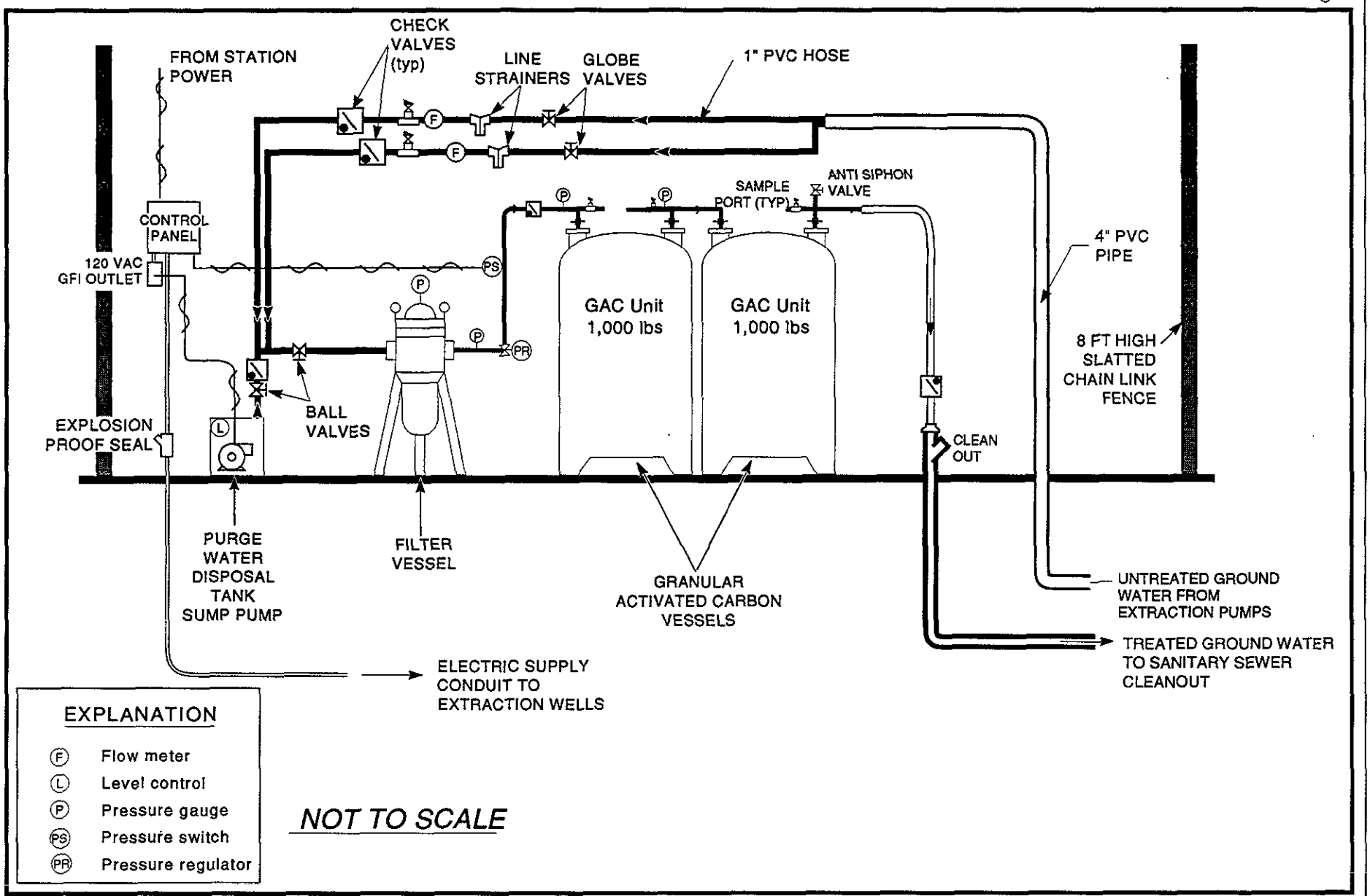

Figure 2. Ground Water Treatment System Schematic - Chevron Service Station #9-0504, 15900 Hesperian Boulevard, San Lorenzo, California

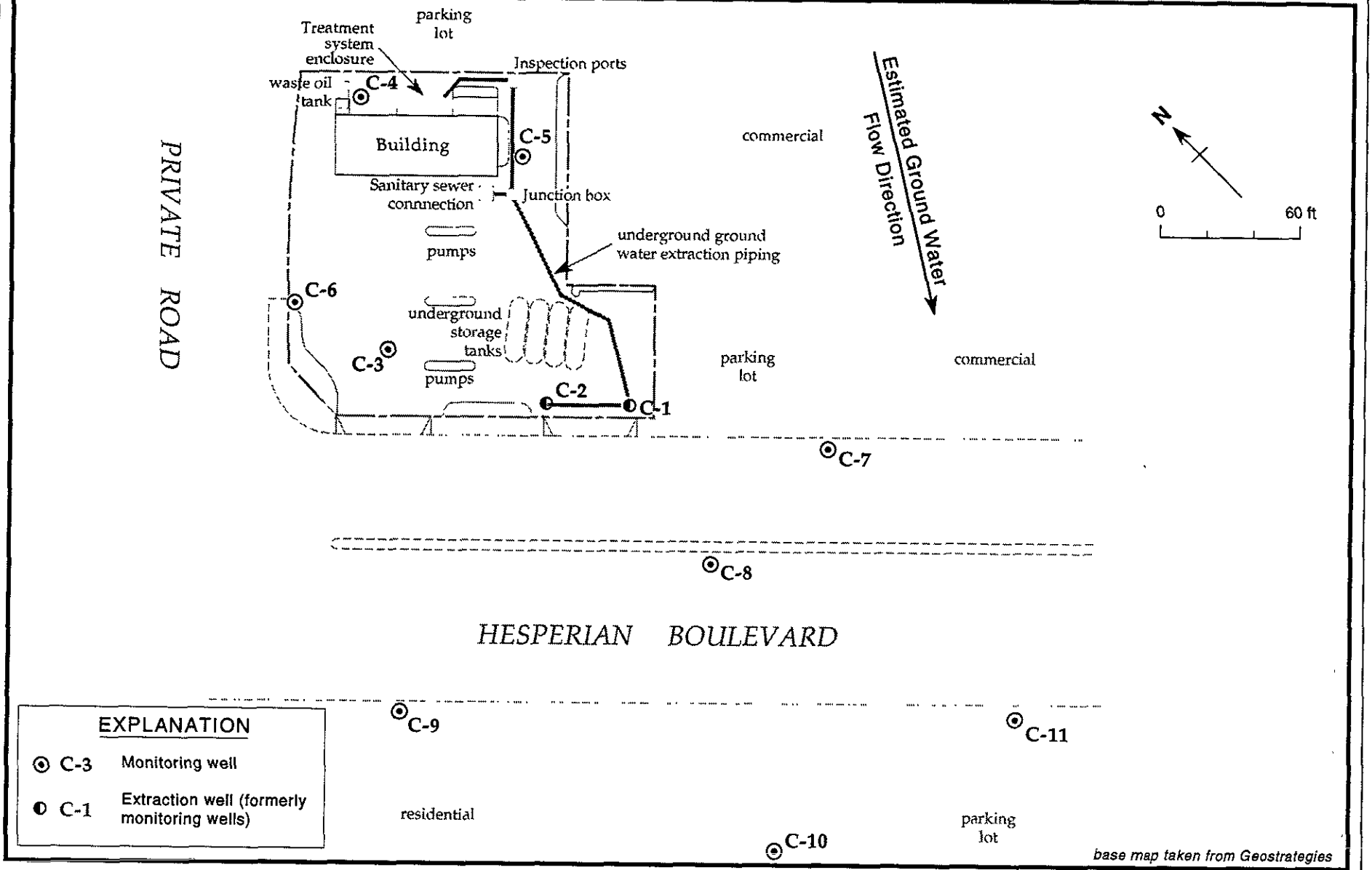

Figure 3. Monitoring and Extraction Well Locations - Chevron Service Station #9-0504, 15900 Hesperian Boulevard, San Lorenzo, California

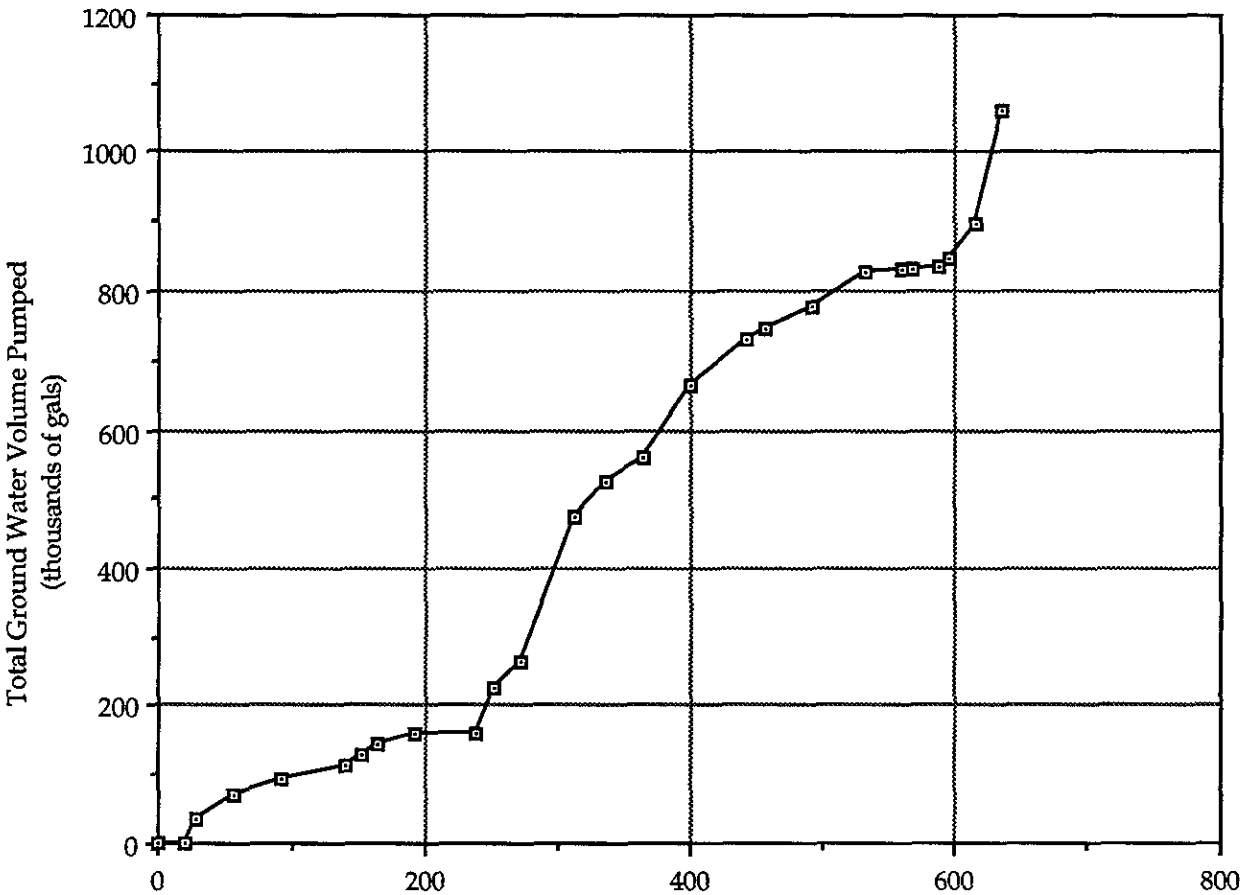

Figure 4. Ground Water Volume Pumped--Chevron Service Station #9-0504, 15900 Hesperian Blvd., San Lorenzo, CA.

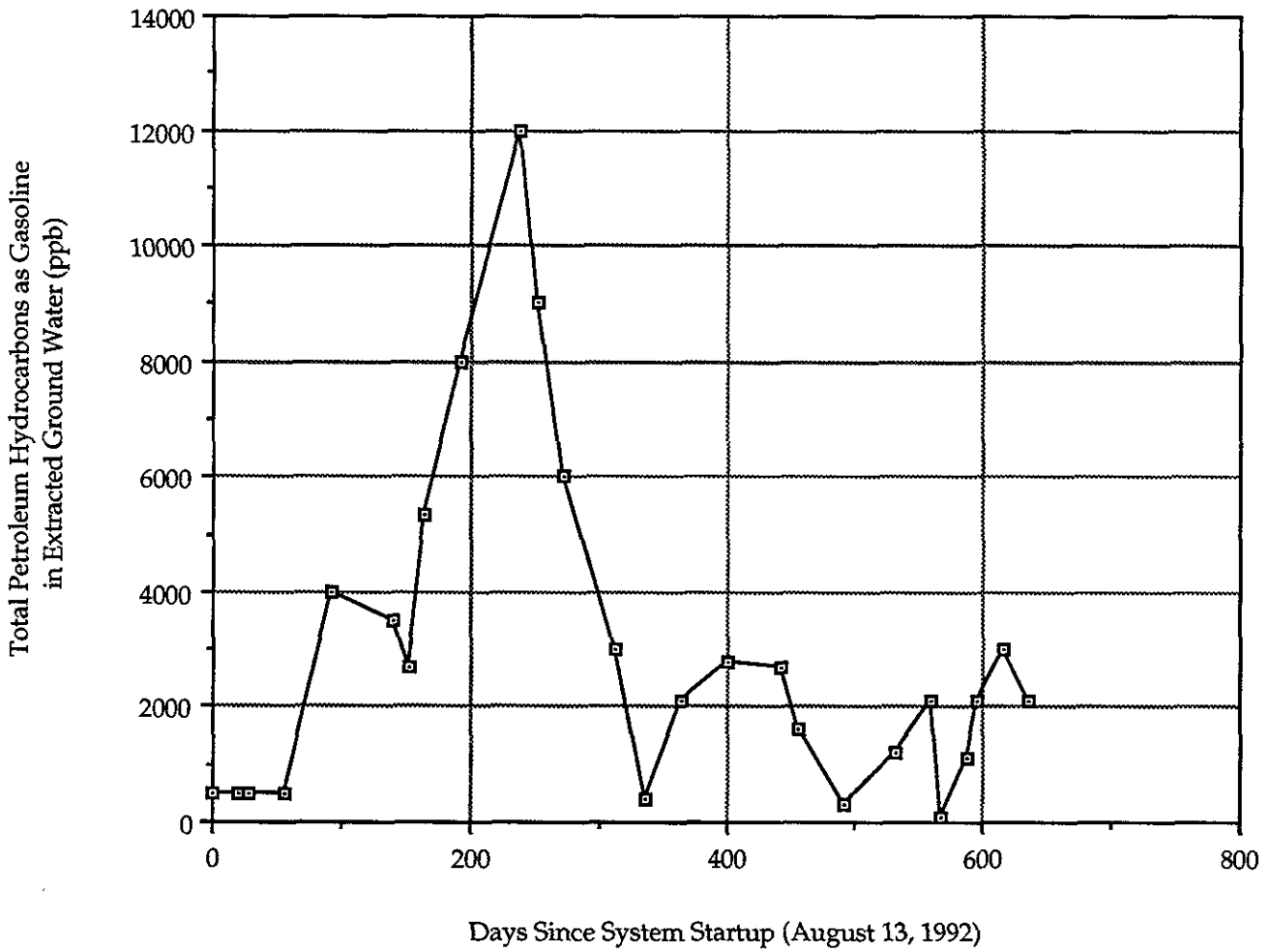

Figure 5. TPH-G Concentration in Extracted Ground Water--Chevron Service Station #9-0504, 15900 Hesperian Blvd., San Lorenzo, CA.

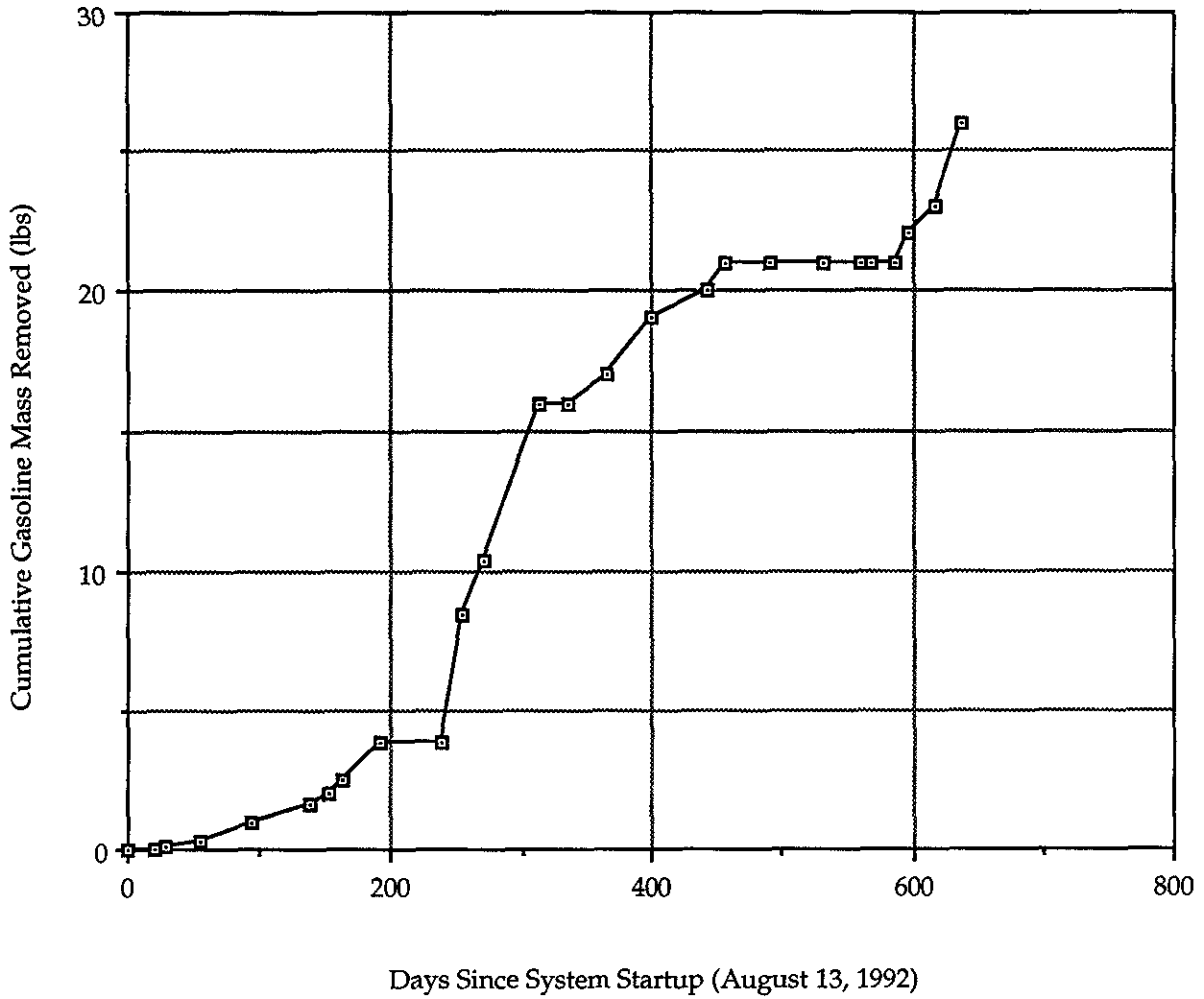

Figure 6. Cumulative Gasoline Mass Removed--Chevron Service Station #9-0504, 15900 Hesperian Blvd., San Lorenzo, CA. (Gasoline removed is the product of ground water mass and hydrocarbon concentration)

Table 1. Performance Summary, Chevron Service Station #9-0504, 15900 Hesperian Boulevard, San Lorenzo, CA

DATE	C-1 TOTALIZER READING (gal)	C-2 TOTALIZER READING (gal)	TOTAL FLOW (gal)	FLOW BETWEEN READINGS (gal)	DAYS BETWEEN READINGS	AVERAGE FLOW (gpm)	COMMENTS
08/13/92	0	0	0	0	0	0	Start three-hour test
08/13/92	345	340	685	685	0	0	End three-hour test
09/02/92	403	394	797	112	20	0.00	System start-up
09/09/92	14,184	19,440	33,624	32,827	7	3.26	
10/06/92	18,939	51,734	70,673	37,049	27	0.95	
11/13/92	21,498	70,892	92,390	21,717	38	0.40	System off from 11/9/92 to 11/13/92.
12/29/92	21,877	89,606	111,483	19,093	46	0.29	
01/12/93	39,537	89,914	129,451	17,968	14	0.89	
01/22/93	52,064	89,918	141,982	12,531	10	0.87	Pump in well C-2 pulled for repairs.
02/19/93	71,129	89,944	161,073	19,091	28	0.47	Pump in well C-2 reinstalled, system left off.
02/23/93	71,131	89,956	161,087	14	4	0.00	Pump in C-1 pulled, leak at C-2 wellhead repaired, system off.
04/07/93	71,131	89,956	161,087	0	43	0.00	Replaced pump head in well C-1, replaced GWE hose on wells C-1 and and C-2, system restarted.
04/22/93	85,505	138,926	224,431	63,344	15	2.93	
05/10/93	102,220	160,262	262,482	38,051	18	1.47	
06/21/93	296,350	176,421	472,771	210,289	42	3.48	C-2 pump clogged at check valve, blockage cleared
07/14/93	334,827	190,316	525,143	52,372	23	1.58	System off on arrival. Pump C-2 pulled for motor replacement.
08/12/93	370,703	190,316	561,019	35,876	29	0.86	Installed new pump motor in C-2. C-1 intake clogged, blockage cleared.
09/16/93	391,322	273,667	664,989	103,970	35	2.06	Pump in C-1 pulled for repairs.
10/27/93	---	---	---	---	--	---	Suction pump tested in well C-1.
10/28/93 a	391,497	337,589	729,086	64,097	42	1.06	
11/11/93	391,497	354,342	745,839	16,753	14	0.83	
12/16/93	391,721	383,756	775,477	29,638	35	0.59	New pump installed in C-1. Pump C-2 requires replacement.
01/26/94	443,890	383,760	827,650	52,173	41	0.88	System off due to on site construction. No samples taken.

-- Table 1. Continued on Next Page --

Table 1. Performance Summary, Chevron Service Station #9-0504, 15900 Hesperian Boulevard, San Lorenzo, CA

DATE	C-1 TOTALIZER READING (gal)	C-2 TOTALIZER READING (gal)	TOTAL FLOW (gal)	FLOW BETWEEN READINGS (gal)	DAYS BETWEEN READINGS	AVERAGE FLOW (gpm)	COMMENTS
02/23/94	447,989	383,760	831,749	4,099	28	0.10	System off occasionally during reporting period due to on site construction. C-2 vault damaged during construction.
03/04/94	448,763	383,760	832,523	774	9	0.06	Analytic results from 2/24/94 showed breakthrough to effluent. System resampled.
03/22/94	449,785	383,760	833,545	1,022	18	0.04	Pump C-2 defective, requires replacement.
03/31/94	463,264	383,756	847,020	13,475	9	1.04	
04/21/94	512,306	384,122	896,428	49,408	21	1.63	Well C-2 pump replaced
05/11/94	615,815	443,362	1,059,177	162,749	20	5.65	

Notes:
a = Change in C-1 totalizer between 9/16/93 and 10/28/93 due to suction pump test on 10/27/93.
gal = gallons
gpm = gallons per minute
-- = not available

Table 2. Summary of Analytic Results, Chevron Service Station #9-0504 Hesperian Blvd., San Lorenzo, California

DATE SAMPLED		LAB	SYSTEM INFLUENT TPH-G	B	E	T	X	SYSTEM MIDPOINT First Carbon Effluent TPH-G	B	E	T	X	SYSTEM EFFLUENT Second Carbon Effluent TPH-G	B	E	T	X	pH	COD mg/l	TSS mg/l
			<-----parts per billion (ppb)----->										<-----parts per billion (ppb)----->							
08/14/92	a	SPA/CEC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<50	<0.5	<0.5	<0.5	<0.5	4.2	17	<4
09/09/92		SPA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<50	NA	NA	NA	NA	NA	NA	NA
10/06/92		SPA/CEC	480	34	1.5	10	33	<50	<0.5	<0.5	<0.5	<0.5	<50	<0.5	<0.5	<0.5	<0.5	7.1	<5	<4
11/13/92		SPA/CEC	4,000	96	30	99	310	<50	<0.5	<0.5	<0.5	<0.5	<50	<0.5	<0.5	<0.5	<0.5	6.9	<5	<4
12/29/92	b	SPA/CEC	3,500	340	52	110	400	<50	<0.5	<0.5	<0.5	<0.5	<50	<0.5	<0.5	<0.5	<0.5	6.8	<5	<4
01/12/93	c	SPA/GTEL	2,700	150	32	88	340	<50	<0.5	<0.5	<0.5	<0.5	<50	<0.5	<0.5	<0.5	<0.5	6.8	5	500
02/19/93		SPA/GTEL	8,000	390	180	420	1,300	<50	<0.5	<0.5	<0.5	<0.5	<50	<0.5	<0.5	<0.5	<0.5	7.3	<5	<4
04/07/93		SPA/GTEL	12,000	360	420	440	2,200	<50	<0.5	<0.5	<0.5	<1.5	<50	<0.5	<0.5	<0.5	<1.5	6.9	<5	<4
05/10/93		SPA/SA	6,000	170	150	83	780	<50	<0.5	<0.5	<0.5	<1.5	<50	<0.5	<0.5	<0.5	<1.5	NA	<5	<4
06/21/93		SPA/SA	3,000	120	91	54	550	<50	<0.5	<0.5	<0.5	<1.5	<50	<0.5	<0.5	<0.5	<1.5	7.0	<20	<4
07/14/93	c	SPA/GTEL	400	31	4.7	0.6	110	<50	<0.5	<0.5	<0.5	<1.5	<50	<0.5	<0.5	<0.5	<1.5	6.7	<5	<4
08/12/93	c	SPA/SA	2,100	89	130	86	790	<50	<0.5	<0.5	<0.5	<1.5	<50	<0.5	<0.5	<0.5	<1.5	6.6	25	<4
09/16/93	d	SPA	2,800	76	10	38	550	<50	<0.5	<0.5	<0.5	<1.5	<50	<0.5	<0.5	<0.5	<1.5	NA	NA	NA
10/28/93		SPA	2,700	62	47	11	350	<50	<0.5	<0.5	<0.5	<1.5	<50	<0.5	<0.5	<0.5	<1.5	6.8	<20	<4
11/11/93		SPA	1,600	67	25	22	400	<50	<0.5	<0.5	<0.5	<1.5	<50	<0.5	<0.5	<0.5	<1.5	NA	NA	NA
12/16/93	e	SPA	300	9.2	16	4	74	<50	<0.5	<0.5	<0.5	<1.5	<50	0.5	<0.5	<0.5	<1.5	NA	NA	NA
01/26/94		SPA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
02/23/94	e	SPA	2,100	36	81	0.8	360	<50	0.6	<0.5	<0.5	<1.5	<50	1.5	<0.5	<0.5	<1.5	NA	NA	NA
03/04/94		SPA	100	2.5	<0.5	0.5	7.9	<50	<0.5	<0.5	<0.5	<1.5	<50	<0.5	<0.5	<0.5	<1.5	NA	NA	NA
04/21/94		SPA	3,000	87	130	22	730	<50	<0.5	<0.5	<0.5	0.6	<50	<0.5	<0.5	<0.5	<0.5	7.41	28	ND
05/11/94		SPA/SA	2,100	67	31	17	470	<50	1.4	<0.5	<0.5	4.3	<50	<0.5	<0.5	<0.5	<0.5	NA	28	NA

-- Table 2. continued next page --

Table 2. Summary of Analytic Results, Chevron Service Station #9-0504 Hesperian Blvd., San Lorenzo, California
(continued)

Abbreviations:

TPH-G = Total petroleum hydrocarbons as gasoline by modified EPA Method 8015
B = Benzene by EPA Method 8020
E = Ethylbenzene by EPA Method 8020
T = Toluene by EPA Method 8020
X = Xylenes by EPA Mehtod 8020
COD = Chemical oxygen demand by EPA Method 410.4
TSS = Total suspended solids by EPA Method 160.1
<n = Not detected at detection limit of n ppb
SPA = Superior Precision Analytical Laboratory, Martinez, California
CEC = Clayton Environmental Consultants, Pleasanton, California
GTEL = GTEL Environmental Laboratories, Inc., Concord, California
SA = Sequoia Analytical, Redwood City, California
mg/l = milligrams per liter
NA = Not analyzed

Notes:

a = Initial three-hour test sample.
Additonal analysis performed prior to system start-up:
Cyanide by EPA method 335.2, CEC results <0.01
Phenolics By EPA method 420.1, CEC results <0.005
Metals by EPA SW methods 486, 6000 and 7000 series, SPA results for all metals <n, per laboratory detection limits

b = system extraction from well C-2 only.

c = system extraction from well C-1 only.

d = Sampling requirements for pH, COD, and TSS changed from monthly to quarterly.

e = Analytic results indicate breakthrough in effluent. Resample necessary to determine validity of analytic results.

f = Samples not taken because on site construction caused the power to be turned off and the sewer connection to be dismantled.