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December 30, 1998  
Project 20805-130.007

Mr. Paul Supple  
ARCO Products Company  
P.O. Box 6549  
Moraga, California 94570

Re: Quarterly Groundwater Monitoring Report, Third Quarter 1998, for ARCO Service Station No 2185, located at 9800 East 14th Street, Oakland, California

Dear Mr. Supple:

Pinnacle Environmental Solutions, a division of EMCON (Pinnacle), is submitting the attached report which presents the results of the third quarter 1998 groundwater monitoring program at ARCO Products Company (ARCO) Service Station No. 2185, located at 9800 East 14th Street, Oakland, California. The monitoring program complies with the Alameda County Health Care Services Agency (ACHCSA) requirements regarding underground tank investigations.

### LIMITATIONS

No monitoring event is thorough enough to describe all geologic and hydrogeologic conditions of interest at a given site. If conditions have not been identified during the monitoring event, results should not be construed as a guarantee of the absence of such conditions at the site, but rather as the product of the scope and limitations of work performed during the monitoring event.

Please call if you have questions.

Sincerely,

Pinnacle

*Joel Giffman*  
Glen VanderVeen for G.V.  
Project Manager

*Jay R. Johnson*  
Jay R. Johnson, R.G.  
Senior Project Supervisor

Attachment: Quarterly Groundwater Monitoring Report, Third Quarter 1998

cc: ~~Barney Chan~~, ACHCSA



Date: December 30, 1998

## ARCO QUARTERLY GROUNDWATER MONITORING REPORT

Station No.: 2185 Address: 9800 East 14th Street, Oakland, California  
Pinnacle Project No. 20805-130.007  
ARCO Environmental Engineer/Phone No.: Paul Supple /(925) 299-8891  
Pinnacle Project Manager/Phone No.: Glen VanderVeen /(925) 977-9020  
Primary Agency/Regulatory ID No.: ACHCSA /Barney Chan

### WORK PERFORMED THIS QUARTER (THIRD - 1998):

1. Prepared and submitted quarterly groundwater monitoring report for second quarter 1998.
2. Performed quarterly groundwater monitoring and sampling for third quarter 1998.
3. Confirmed MTBE concentrations in well MW-8, using EPA method 8260.

### WORK PROPOSED FOR NEXT QUARTER (FOURTH - 1998):

1. Prepare and submit quarterly groundwater monitoring report for third quarter 1998.
2. Perform quarterly groundwater monitoring and sampling for fourth quarter 1998.

### QUARTERLY MONITORING:

Current Phase of Project: Quarterly Groundwater Monitoring  
Frequency of Sampling: Annual (1st Quarter): MW-1, MW-4, MW-7, MW-10  
Quarterly: MW-2, MW-3, MW-5, MW-6, MW-8, MW-9  
Frequency of Monitoring: Quarterly (groundwater)  
Is Floating Product (FP) Present On-site:  Yes  No  
Bulk Soil Removed to Date : 2,550 cubic yards of TPH impacted soil  
Bulk Soil Removed This Quarter : None  
Water Wells or Surface Waters,  
within 2000 ft., impacted by site: None  
Current Remediation Techniques: None  
Average Depth to Groundwater: 10.3 feet  
Groundwater Flow Direction and Gradient  
(Average): 0.009 ft/ft toward west

### ATTACHMENTS:

- Table 1 - Historical Groundwater Elevation and Analytical Data, Petroleum Hydrocarbons and Their Constituents
- Figure 1 - Groundwater Analytical Summary Map
- Figure 2 - Groundwater Elevation Contour Map
- Appendix A - Sampling and Analysis Procedures
- Appendix B - Certified Analytical Reports and Chain-of-Custody Documentation
- Appendix C - Field Data Sheets

**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
**Petroleum Hydrocarbons and Their Constituents**  
**1995 - Present\***

**ARCO Service Station 2185**  
**9800 East 14th Street, Oakland, California**

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Groundwater Direction	Flow	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 6240/6260
MW-1	03-15-95	29.15	8.50	20.65	ND	NW		0.01	03-15-95	<50	<0.5	<0.5	<0.5	<0.5	--	--
MW-1	05-30-95	29.15	10.28	18.87	ND	SW		0.005	05-30-95	Not sampled: well sampled annually, during the first quarter						
MW-1	09-20-95	29.15	11.70	17.45	ND	WSW		0.005	09-20-95	Not sampled: well sampled annually, during the first quarter						
MW-1	11-07-95	29.15	12.12	17.03	ND	WSW		0.004	11-07-95	Not sampled: well sampled annually, during the first quarter						
MW-1	02-28-96	29.15	8.54	20.61	ND	NW		0.009	02-28-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-1	05-30-96	29.15	10.05	19.10	ND	W		0.007	05-31-96	Not sampled: well sampled annually, during the first quarter						
MW-1	08-20-96	29.15	11.35	17.80	ND	SW		0.005	08-20-96	Not sampled: well sampled annually, during the first quarter						
MW-1	11-19-96	29.15	11.20	17.95	ND	WSW		0.005	11-19-96	Not sampled: well sampled annually, during the first quarter						
MW-1	03-25-97	29.15	10.12	19.03	ND	WNW		0.006	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-1	06-17-97	29.15	11.27	17.88	ND	W		0.001	06-17-97	Not sampled: well sampled annually, during the first quarter						
MW-1	08-07-97	29.15	11.83	17.32	ND	SW		0.005	08-07-97	Not sampled: well sampled annually, during the first quarter						
MW-1	11-18-97	29.15	11.80	17.35	ND	SW		0.004	11-18-97	Not sampled: well sampled annually, during the first quarter						
MW-1	02-25-98	29.15	7.02	22.13	ND	NW		0.011	02-25-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-1	05-11-98	29.15	9.17	19.98	ND	WNW		0.01	05-11-98	Not sampled: well sampled annually, during the first quarter						
MW-1	07-29-98	29.15	10.46	18.69	ND	W		0.009	07-29-98	Not sampled: well sampled annually, during the first quarter						
MW-2	03-15-95	28.47	8.37	20.10	ND	NW		0.01	03-15-95	2100	7.4	<2.5	130	39	--	--
MW-2	05-30-95	28.47	9.95	18.52	ND	SW		0.005	05-30-95	1700	3.3	<2.5	120	31	--	--
MW-2	09-20-95	28.47	11.37	17.10	ND	WSW		0.005	09-21-95	1200	1	<1	68	16	--	--
MW-2	11-07-95	28.47	11.73	16.74	ND	WSW		0.004	11-07-95	1100	<3	<3	74	14	<20	--
MW-2	02-28-96	28.47	8.12	20.35	ND	NW		0.009	02-29-96	2200	<3	<3	130	27	<20	--
MW-2	05-30-96	28.47	9.89	18.58	ND	W		0.007	05-31-96	970	<9	<1	29	3	△	--
MW-2	08-20-96	28.47	11.05	17.42	ND	SW		0.005	08-20-96	670	<1	<1	16	1	△	--
MW-2	11-19-96	28.47	10.96	17.51	ND	WSW		0.005	11-19-96	990	<1	<1	46	3	△	--
MW-2	03-25-97	28.47	9.84	18.63	ND	WNW		0.006	03-25-97	540	<1	<1	<1	<1	△	--
MW-2	06-17-97	28.47	10.99	17.48	ND	W		0.001	06-17-97	510	<7	0.9	1.1	△	△	--
MW-2	08-07-97	28.47	11.50	16.97	ND	SW		0.005	08-07-97	280	<0.5	<0.5	<0.5	<0.5	△	--
MW-2	11-18-97	28.47	11.41	17.06	ND	SW		0.004	11-18-97	<50	<0.5	<0.5	<0.5	<0.5	△	--
MW-2	02-25-98	28.47	6.33	22.14	ND	NW		0.011	02-25-98	850	<0.5	1.1	13	1.4	△	--
MW-2	05-11-98	28.47	8.89	19.58	ND	WNW		0.01	05-11-98	290	<0.5	<0.5	<0.5	<0.5	△	--
MW-2	07-29-98	28.47	10.22	18.25	ND	W		0.009	07-29-98	310	<0.5	0.5	<0.5	1.1	△	--

**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
**Petroleum Hydrocarbons and Their Constituents**  
**1995 - Present\***

**ARCO Service Station 2185**  
**9800 East 14th Street, Oakland, California**

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Flow	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240/8260
		ft-MSL	feet	ft-MSL	feet	MWN									
MW-3	03-15-95	28.57	8.47	20.10	ND	NW	0.01	03-15-95	2000	<2.5	<2.5	88	82	--	--
MW-3	05-30-95	28.57	10.03	18.54	ND	SW	0.005	05-30-95	2000	3.2	<2.5	70	46	--	--
MW-3	09-20-95	28.57	11.30	17.27	ND	WSW	0.005	09-21-95	2100	12	<3	77	38	280	--
MW-3	11-07-95	28.57	11.65	16.92	ND	WSW	0.004	11-07-95	3000	18	<3	120	62	--	430[1]
MW-3	02-28-96	28.57	8.35	20.22	ND	NW	0.009	02-29-96	5100	83	<5	160	57	640	--
MW-3	05-30-96	28.57	9.77	18.80	ND	W	0.007	05-31-96	2100	41	<5	57	15	890	--
MW-3	08-20-96	28.57	11.00	17.57	ND	SW	0.005	08-20-96	2500	94	<2.5	62	14	2200	--
MW-3	11-19-96	28.57	10.92	17.65	ND	WSW	0.005	11-19-96	2400	84	<2.5	73	22	1300	--
MW-3	03-25-97	28.57	9.90	18.67	ND	WNW	0.006	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	48	--
MW-3	06-17-97	28.57	10.95	17.62	ND	W	0.001	06-17-97	<200	<2	<2	<2	<2	200	--
MW-3	08-07-97	28.57	11.44	17.13	ND	SW	0.005	08-07-97	<500	<5	<5	<5	<5	490	--
MW-3	11-18-97	28.57	11.35	17.22	ND	SW	0.004	11-18-97	200	9	<2	7	<2	300	--
MW-3	02-25-98	28.57	6.98	21.59	ND	NW	0.011	02-25-98	250	<2	<2	7	<2	370	--
MW-3	05-11-98	28.57	9.07	19.50	ND	WNW	0.01	05-11-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-3	07-29-98	28.57	10.06	18.51	ND	W	0.009	07-29-98	<50	<0.5	<0.5	<0.5	<0.5	51	--
MW-4	03-15-95	29.21	8.69	20.52	ND	NW	0.01	03-15-95	<50	<0.5	<0.5	<0.5	<0.5	--	--
MW-4	05-30-95	29.21	10.57	18.64	ND	SW	0.005	05-30-95	Not sampled: well sampled annually, during the first quarter						
MW-4	09-20-95	29.21	12.02	17.19	ND	WSW	0.005	09-20-95	Not sampled: well sampled annually, during the first quarter						
MW-4	11-07-95	29.21	12.42	16.79	ND	WSW	0.004	11-07-95	Not sampled: well sampled annually, during the first quarter						
MW-4	02-28-96	29.21	8.66	20.55	ND	NW	0.009	02-28-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-4	05-30-96	29.21	10.34	18.87	ND	W	0.007	05-31-96	Not sampled: well sampled annually, during the first quarter						
MW-4	08-20-96	29.21	11.67	17.54	ND	SW	0.005	08-20-96	Not sampled: well sampled annually, during the first quarter						
MW-4	11-19-96	29.21	11.50	17.71	ND	WSW	0.005	11-19-96	Not sampled: well sampled annually, during the first quarter						
MW-4	03-25-97	29.21	10.42	18.79	ND	WNW	0.006	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-4	06-17-97	29.21	11.60	17.61	ND	W	0.001	06-17-97	Not sampled: well sampled annually, during the first quarter						
MW-4	08-07-97	29.21	12.17	17.04	ND	SW	0.005	08-07-97	Not sampled: well sampled annually, during the first quarter						
MW-4	11-18-97	29.21	12.05	17.16	ND	SW	0.004	11-18-97	Not sampled: well sampled annually, during the first quarter						
MW-4	02-25-98	29.21	6.91	22.30	ND	NW	0.011	02-25-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-4	05-11-98	29.21	9.45	19.76	ND	WNW	0.01	05-11-98	Not sampled: well sampled annually, during the first quarter						
MW-4	07-29-98	29.21	10.80	18.41	ND	W	0.009	07-29-98	Not sampled: well sampled annually, during the first quarter						

**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
**Petroleum Hydrocarbons and Their Constituents**  
**1995 - Present\***

**ARCO Service Station 2185**  
**9800 East 14th Street, Oakland, California**

Well Designation	Water Level Field Date	Top of Casing Elevation ft-MSL	Depth to Water feet	Groundwater Elevation ft-MSL	Floating Product Thickness feet	Flow Groundwater Direction MWN	Hydraulic Gradient ft/ft	Water Sample Field Date	TPHG LUFT Method µg/L	Benzene EPA 8020 µg/L	Toluene EPA 8020 µg/L	Ethylbenzene EPA 8020 µg/L	Total Xylenes EPA 8020 µg/L	MTBE EPA 8020 µg/L	MTBE EPA 8240/8260 µg/L
MW-5	03-15-95	28.12	8.47	19.65	ND	NW	0.01	03-15-95	170	5.6	<0.5	17	11	--	--
MW-5	05-30-95	28.12	9.69	18.43	ND	SW	0.005	05-30-95	53	0.6	<0.5	4.8	2.8	--	--
MW-5	09-20-95	28.12	10.90	17.22	ND	WSW	0.005	09-21-95	1500	47	2	120	86	70	--
MW-5	11-07-95	28.12	11.20	16.92	ND	WSW	0.004	11-07-95	140	4.5	<0.5	8.3	16	10	--
MW-5	02-28-96	28.12	8.15	19.97	ND	NW	0.009	02-29-96	900	11	<1	59	29	99	--
MW-5	05-30-96	28.12	9.48	18.64	ND	W	0.007	05-31-96	Not sampled: well sampled semi-annually, during the first and third quarters						
MW-5	08-20-96	28.12	10.58	17.54	ND	SW	0.005	08-20-96	67	0.7	<0.5	3.6	0.6	27	--
MW-5	11-19-96	28.12	10.50	17.62	ND	WSW	0.005	11-19-96	Not sampled: well sampled semi-annually, during the first and third quarters						
MW-5	03-25-97	28.12	9.58	18.54	ND	WNW	0.006	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-5	06-17-97	28.12	10.52	17.60	ND	W	0.001	06-17-97	Not sampled: well sampled semi-annually, during the first and third quarters						
MW-5	08-07-97	28.12	11.00	17.12	ND	SW	0.005	08-07-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-5	11-18-97	28.12	10.93	17.19	ND	SW	0.004	11-18-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-5	02-25-98	28.12	6.75	21.37	ND	NW	0.011	02-25-98	370	2	6	11	9	270	--
MW-5	05-11-98	28.12	9.11	19.01	ND	WNW	0.01	05-11-98	<50	<0.5	<0.5	<0.5	<0.5	9	--
MW-5	07-29-98	28.12	9.89	18.23	ND	W	0.009	07-29-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-6	03-15-95	27.79	7.75	20.04	ND	NW	0.01	03-15-95	3600	77	<5	420	180	--	--
MW-6	05-30-95	27.79	9.48	18.31	ND	SW	0.005	05-30-95	5000	68	<5	530	250	--	--
MW-6	09-20-95	27.79	10.75	17.04	ND	WSW	0.005	09-21-95	3300	36	<5	360	120	<30	--
MW-6	11-07-95	27.79	11.06	16.73	ND	WSW	0.004	11-07-95	3500	33	<5	410	110	<30	--
MW-6	02-28-96	27.79	7.86	19.93	ND	NW	0.009	02-29-96	520	33	<5	480	160	<30	--
MW-6	05-30-96	27.79	9.35	18.44	ND	W	0.007	05-31-96	Not sampled: well sampled semi-annually, during the first and third quarters						
MW-6	08-20-96	27.79	10.43	17.36	ND	SW	0.005	08-20-96	1900	3.4	<2.5	150	21	<12	--
MW-6	11-19-96	27.79	10.36	17.43	ND	WSW	0.005	11-19-96	Not sampled: well sampled semi-annually, during the first and third quarters						
MW-6	03-25-97	27.79	9.35	18.44	ND	WNW	0.006	03-25-97	1100	<2	<2	5	5	<10	--
MW-6	06-17-97	27.79	10.37	17.42	ND	W	0.001	06-17-97	Not sampled: well sampled semi-annually, during the first and third quarters						
MW-6	08-07-97	27.79	10.85	16.94	ND	SW	0.005	08-07-97	53	<0.5	<0.5	<0.5	<0.5	<3	--
MW-6	11-18-97	27.79	10.75	17.04	ND	SW	0.004	11-18-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-6	02-25-98	27.79	6.30	21.49	ND	NW	0.011	02-25-98	3500	<5	18	190	54	<30	--
MW-6	05-11-98	27.79	8.55	19.24	ND	WNW	0.01	05-11-98	730	<1	<1	4	<1	<6	--
MW-6	07-29-98	27.79	9.71	18.08	ND	W	0.009	07-29-98	77	<0.5	<0.5	<0.5	<0.5	<3	--

**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
**Petroleum Hydrocarbons and Their Constituents**  
**1995 - Present\***

**ARCO Service Station 2185**  
**9800 East 14th Street, Oakland, California**

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Flow	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240/8260
		ft-MSL	feet	ft-MSL	feet	MWN									
MW-7	03-15-95	27.88	8.13	19.75	ND	NW	0.01	03-15-95	150**	<0.5	<0.5	<0.5	<0.5	--	--
MW-7	05-30-95	27.88	10.14	17.74	ND	SW	0.005	05-30-95	110**	<0.5	<0.5	<0.5	<0.5	--	--
MW-7	09-20-95	27.88	11.52	16.36	ND	WSW	0.005	09-20-95	<400**	<0.8	<0.5	<0.5	<0.5	<7	--
MW-7	11-07-95	27.88	11.70	16.18	ND	WSW	0.004	11-07-95	<500	2	<1	<1	<1	<20	--
MW-7	02-28-96	27.88	8.19	19.69	ND	NW	0.009	02-29-96	<300**	<0.5	<0.5	<0.5	<0.5	<6	--
MW-7	05-30-96	27.88	9.98	17.90	ND	W	0.007	05-31-96	<100**	<0.5	<0.5	<0.5	<0.5	<3	--
MW-7	08-20-96	27.88	11.15	16.73	ND	SW	0.005	08-20-96	<200**	<0.5	<0.5	<0.5	<0.5	<5	--
MW-7	11-19-96	27.88	10.92	16.96	ND	WSW	0.005	11-19-96	Not sampled: well sampled annually, during the first quarter						
MW-7	03-25-97	27.88	9.88	18.00	ND	WNW	0.006	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-7	06-17-97	27.88	11.13	16.75	ND	W	0.001	06-17-97	Not sampled: well sampled annually, during the first quarter						
MW-7	08-07-97	27.88	11.65	16.23	ND	SW	0.005	08-07-97	Not sampled: well sampled annually, during the first quarter						
MW-7	11-18-97	27.88	11.46	16.42	ND	SW	0.004	11-18-97	Not sampled: well sampled annually, during the first quarter						
MW-7	02-25-98	27.88	6.35	21.53	ND	NW	0.011	02-25-98	<50	<0.5	0.5	<0.5	0.7	14	--
MW-7	05-11-98	27.88	9.15	18.73	ND	WNW	0.01	05-11-98	Not sampled: well sampled annually, during the first quarter						
MW-7	07-29-98	27.88	10.56	17.32	ND	W	0.009	07-29-98	Not sampled: well sampled annually, during the first quarter						
MW-8	03-15-95	NR	8.43	NR	ND	NR	NR	03-15-95	280	<0.5	<0.5	0.7	0.7	--	--
MW-8	05-30-95	NR	9.86	NR	ND	NR	NR	05-30-95	390	<0.5	<0.5	<2	1.6	--	--
MW-8	09-20-95	28.08	11.07	17.01	ND	WSW	0.005	09-21-95	470	<0.5	<0.5	3	1.2	52	--
MW-8	11-07-95	28.08	11.40	16.68	ND	WSW	0.004	11-07-95	280	<0.5	<0.5	0.6	<0.5	94	--
MW-8	02-28-96	28.08	8.30	19.78	ND	NW	0.009	02-29-96	160	<0.5	<0.5	<0.9	<0.6	32	--
MW-8	05-30-96	28.08	9.68	18.40	ND	W	0.007	05-31-96	100	<0.5	<0.5	<0.6	<0.5	16	--
MW-8	08-20-96	28.08	10.72	17.36	ND	SW	0.005	08-20-96	140	<0.5	<0.5	<0.5	<0.5	190	--
MW-8	11-19-96	28.08	10.58	17.50	ND	WSW	0.005	11-19-96	Not sampled: well sampled semi-annually, during the first and third quarters						
MW-8	03-25-97	28.08	9.73	18.35	ND	WNW	0.006	03-25-97	63	<0.5	<0.5	<0.5	<0.5	38	--
MW-8	06-17-97	28.08	10.67	17.41	ND	W	0.001	06-17-97	Not sampled: well sampled semi-annually, during the first and third quarters						
MW-8	08-07-97	28.08	11.15	16.93	ND	SW	0.005	08-07-97	53	<0.5	<0.5	<0.5	<0.5	390	--
MW-8	11-18-97	28.08	11.05	17.03	ND	SW	0.004	11-18-97	<500	<5	<5	<5	<5	640	--
MW-8	02-25-98	28.08	7.25	20.83	ND	NW	0.011	02-25-98	<50	<0.5	0.7	<0.5	0.9	56	--
MW-8	05-11-98	28.08	9.00	19.08	ND	WNW	0.01	05-11-98	<50	<0.5	<0.5	<0.5	<0.5	18	--
MW-8	07-29-98	28.08	10.03	18.05	ND	W	0.009	07-29-98	<50	<0.5	<0.5	<0.5	<0.5	19	21[2]

**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
**Petroleum Hydrocarbons and Their Constituents**  
**1995 - Present\***

**ARCO Service Station 2185**  
**9800 East 14th Street, Oakland, California**

Well Designation	Water Level Field Date	Top of Casing Elevation ft-MSL	Depth to Water feet	Groundwater Elevation ft-MSL	Floating Product Thickness feet	Flow Groundwater Direction MWN	Hydraulic Gradient ft/ft	Water Sample Field Date	TPHG LUFT Method µg/L	Benzene EPA 8020 µg/L	Toluene EPA 8020 µg/L	Ethylbenzene EPA 8020 µg/L	Total Xylenes EPA 8020 µg/L	MTBE EPA 8020 µg/L	MTBE EPA 8240/8260 µg/L
MW-9	09-20-95	27.73	11.67	16.06	ND	WSW	0.005	09-20-95	<50	<0.5	<0.5	<0.5	<0.5	<4	--
MW-9	11-07-95	27.73	11.70	16.03	ND	WSW	0.004	11-07-95	<50	<0.5	<0.5	<0.5	<0.5	<4	--
MW-9	02-28-96	27.73	9.23	18.50	ND	NW	0.009	02-29-96	<50	<0.5	<0.5	<0.5	<0.5	<5	--
MW-9	05-30-96	27.73	10.50	17.23	ND	W	0.007	05-31-96	<50	0.6	<0.5	<0.5	<0.5	<8	--
MW-9	08-20-96	27.73	11.33	16.40	ND	SW	0.005	08-20-96	<50	<0.5	<0.5	<0.5	<0.5	<7	--
MW-9	11-19-96	27.73	11.20	16.53	ND	WSW	0.005	11-19-96	Not sampled: well sampled annually, during the first quarter						
MW-9	03-25-97	27.73	10.41	17.32	ND	WNW	0.006	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<6	--
MW-9	06-17-97	27.73	11.30	16.43	ND	W	0.001	06-17-97	Not sampled: well sampled annually, during the first quarter						
MW-9	08-07-97	27.73	11.70	16.03	ND	SW	0.005	08-07-97	Not sampled: well sampled annually, during the first quarter						
MW-9	11-18-97	27.73	11.42	16.31	ND	SW	0.004	11-18-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-9	02-25-98	27.73	8.72	19.01	ND	NW	0.011	02-25-98	<50	<0.5	<0.5	<0.5	<0.5	<8	--
MW-9	05-11-98	27.73	10.05	17.68	ND	WNW	0.01	05-11-98	<50	<0.5	<0.5	<0.5	<0.5	5	--
MW-9	07-29-98	27.73	11.04	16.69	ND	W	0.009	07-29-98	<50	<0.5	<0.5	<0.5	<0.5	6	--
MW-10	09-20-95	27.55	10.65	16.90	ND	WSW	0.005	09-21-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-10	11-07-95	27.55	10.85	16.70	ND	WSW	0.004	11-07-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-10	02-28-96	27.55	9.38	18.17	ND	NW	0.009	02-29-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-10	05-30-96	27.55	9.99	17.56	ND	W	0.007	05-31-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-10	08-20-96	27.55	10.47	17.08	ND	SW	0.005	08-20-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-10	11-19-96	27.55	10.44	17.11	ND	WSW	0.005	11-19-96	Not sampled: well sampled annually, during the first quarter						
MW-10	03-25-97	27.55	10.02	17.53	ND	WNW	0.006	03-25-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--
MW-10	06-17-97	27.55	10.40	17.15	ND	W	0.001	06-17-97	Not sampled: well sampled annually, during the first quarter						
MW-10	08-07-97	27.55	10.75	16.80	ND	SW	0.005	08-07-97	Not sampled: well sampled annually, during the first quarter						
MW-10	11-18-97	27.55	10.67	16.88	ND	SW	0.004	11-18-97	Not sampled: well sampled annually, during the first quarter						
MW-10	02-25-98	27.55	9.02	18.53	ND	NW	0.011	02-25-98	<50	<0.5	1.4	<0.5	1.8	12	--
MW-10	05-11-98	27.55	9.63	17.92	ND	WNW	0.01	05-11-98	Not sampled: well sampled annually, during the first quarter						
MW-10	07-29-98	27.55	10.15	17.40	ND	W	0.009	07-29-98	Not sampled: well sampled annually, during the first quarter						

**Table 1**  
**Historical Groundwater Elevation and Analytical Data**  
**Petroleum Hydrocarbons and Their Constituents**  
**1995 - Present\***

**ARCO Service Station 2185**  
**9800 East 14th Street, Oakland, California**

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Floating Product Thickness	Flow Groundwater Direction	Hydraulic Gradient	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8020	Toluene EPA 8020	Ethylbenzene EPA 8020	Total Xylenes EPA 8020	MTBE EPA 8020	MTBE EPA 8240/8260
		ft-MSL	feet	ft-MSL	feet	MWN	ft/ft		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L

ft-MSL: elevation in feet, relative to mean sea level

MWN: ground-water flow direction and gradient apply to the entire monitoring well network

ft/ft: foot per foot

TPHG: total petroleum hydrocarbons as gasoline, California DHS LUFT Method

µg/L: micrograms per liter

EPA: United States Environmental Protection Agency

MTBE: Methyl tert-butyl ether

ND: none detected

NR: not reported; data not available or not measurable

W: west

--: not analyzed or not applicable

[1]: confirmed by EPA method 8240

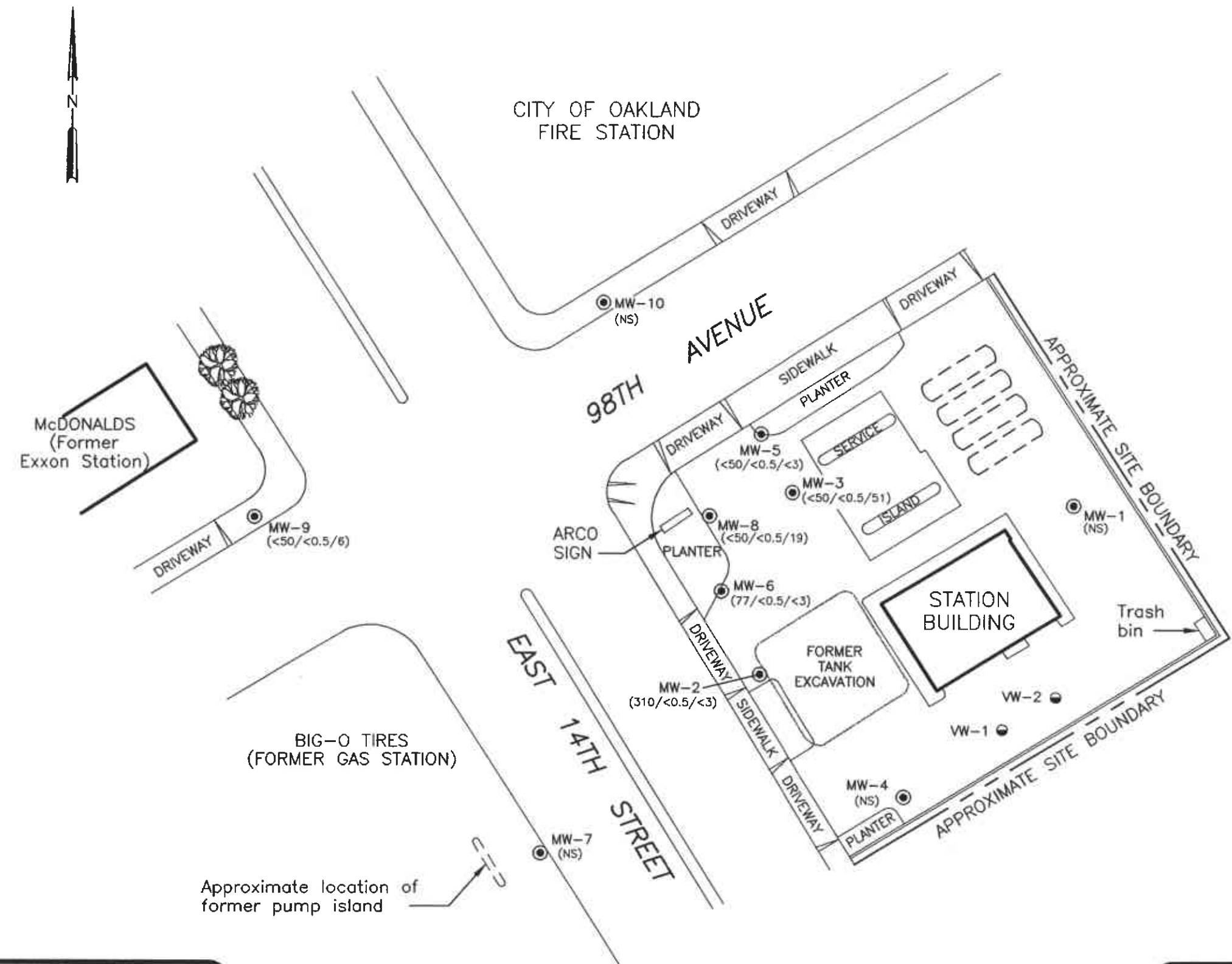
[2]: confirmed by EPA method 8260

\*: For previous historical groundwater elevation and analytical data please refer to *Fourth Quarter 1995 Groundwater Monitoring Program Results, ARCO Service Station 2185, Oakland, California*, (EMCON, February 27, 1996).

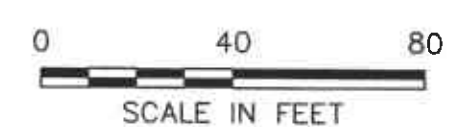
\*\* : chromatogram does not match the typical gasoline fingerprint



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 IMAGE Files: <No Images>  
 XREF Files: <No Xrefs>  
 Dimscale: 40 Ltscale: 40 Psttscale: 0  
 SANJOSE/CADD: N:\DWG\PINACL\2185\2185CHEM.DWG Mon, 30/Nov/98 09:36am kblack



- EXPLANATION**
- ⊙ Groundwater monitoring well
  - Vapor extraction well
  - Existing underground gasoline storage tank
  - (310/<0.5/<3) Concentration of total petroleum hydrocarbons as gasoline (TPHG), benzene, and MTBE in groundwater (ug/L); samples collected 7/29/98
  - < Not detected at or above the indicated laboratory detection limit
  - NS Not sampled

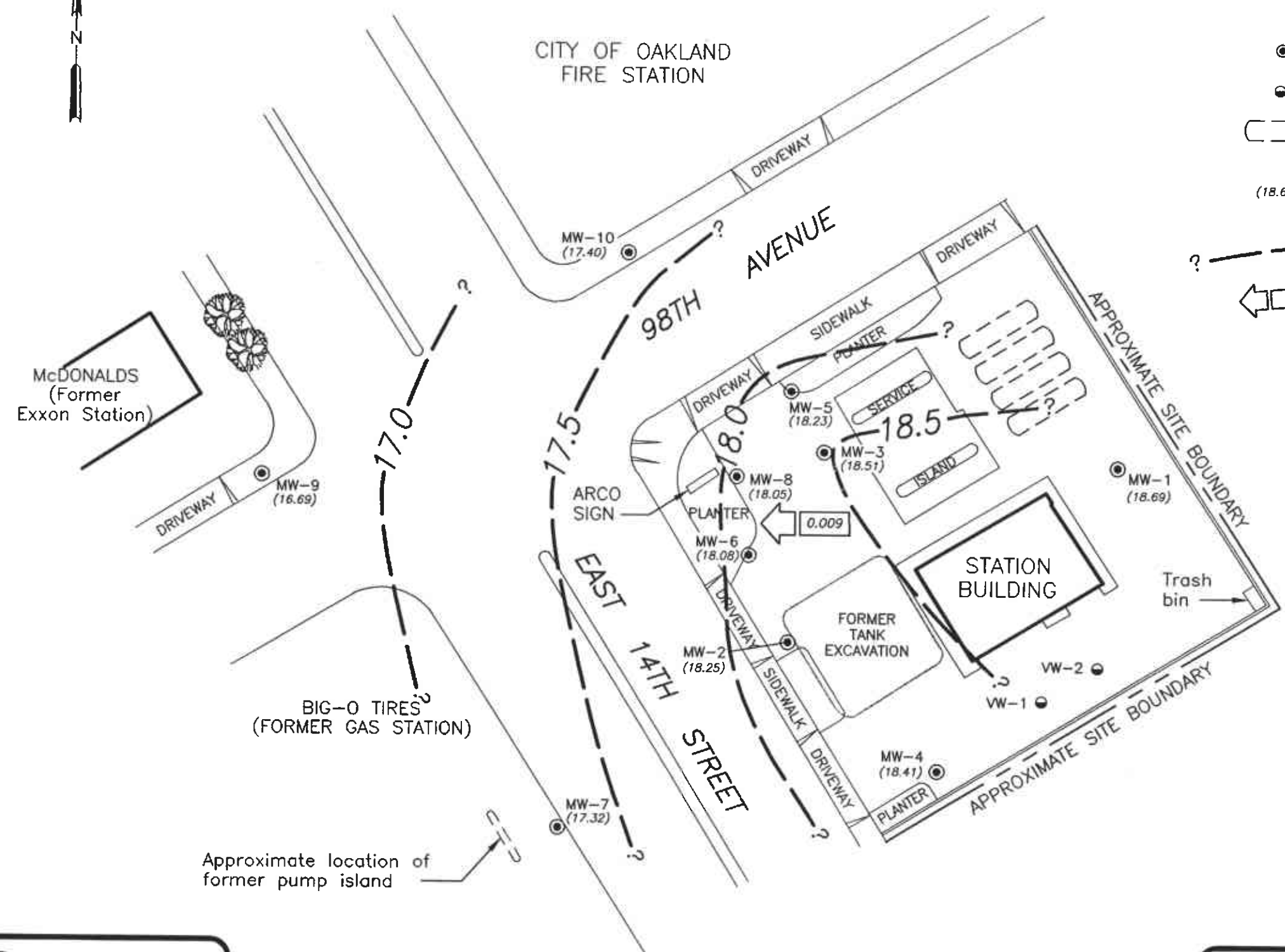
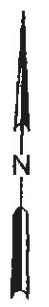


Base map modified from RESNA, 1994.



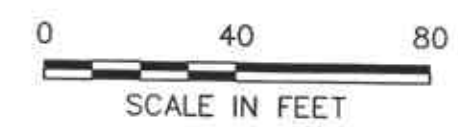
DATE	NOV. 1998
DWN	KAB
APP	
REV	
PROJECT NO.	20805-130.007

**FIGURE 1**  
 ARCO PRODUCTS COMPANY  
 SERVICE STATION 2185, 9800 E. 14TH STREET  
 OAKLAND, CALIFORNIA  
**GROUNDWATER ANALYTICAL SUMMARY**  
 THIRD QUARTER 1998



EXPLANATION

- Groundwater monitoring well
- Vapor extraction well
- ⎓ Existing underground gasoline storage tank
- (18.69) Groundwater elevation (Ft.-MSL); measured 7/29/98
- ?--- Groundwater elevation contour (Ft.-MSL)
- ← Approximate direction of groundwater flow showing gradient



Base map modified from RESNA, 1994.

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XREF Files: <No Xrefs>  
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SANUOSE/CADD: N:\DWG\PINACL\2185\2185COW.DWG Tue, 15/Dec/98 02:57pm ktrayer

**Pinnacle**  
ENVIRONMENTAL SOLUTIONS  
A DIVISION OF EMCON

DATE	OCT. 1998
DWN	KAB
APP	
REV	
PROJECT NO.	20805-130.007

**FIGURE 2**  
ARCO PRODUCTS COMPANY  
SERVICE STATION 2185, 9800 E. 14TH STREET  
OAKLAND, CALIFORNIA  
**GROUNDWATER ELEVATION CONTOURS**  
THIRD QUARTER 1998

**APPENDIX A**  
**SAMPLING AND ANALYSIS PROCEDURES**

## APPENDIX A

### SAMPLING AND ANALYSIS PROCEDURES

---

The sampling and analysis procedures for water quality monitoring programs are contained in this appendix. The procedures provided for consistent and reproducible sampling methods, proper application of analytical methods, and accurate and precise analytical results. Finally, these procedures provided guidelines so that the overall objectives of the monitoring program were achieved.

The following documents have been used as guidelines for developing these procedures:

- Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities, Environmental Protection Agency (EPA)-530/SW-611, August 1977
- Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Technical Enforcement Guidance Document, Office of Solid Waste and Emergency Response (OSWER) 9950.1, September 1986
- Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, 3rd edition, November 1986
- Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water, EPA-600/4-82-057, July 1982
- Methods for Organic Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised March 1983
- Leaking Underground Fuel Tank (LUFT) Field Manual, California State Water Resources Control Board, revised October 1989

### Sample Collection

Sample collection procedures include equipment cleaning, water level and total well depth measurements, and well purging and sampling.

## Equipment Cleaning

Before the sampling event was started, equipment that was used to sample groundwater was disassembled and cleaned with detergent water and then rinsed with deionized water. During field sampling, equipment surfaces that were placed in the well or came into contact with groundwater during field sampling were steam cleaned with deionized water before the next well was purged or sampled.

## Water Level, Floating Hydrocarbon, and Total Well Depth Measurements

Before purging and sampling occurred, the depth to water, floating hydrocarbon thickness, and total well depth were measured using an oil/water interface measuring system. The oil/water interface measuring system consists of a probe that emits a continuous audible tone when immersed in a nonconductive fluid, such as oil or gasoline, and an intermittent tone when immersed in a conductive fluid, such as water. The floating hydrocarbon thickness and water level were measured by lowering the probe into the well. Liquid levels were recorded relative to the tone emitted at the groundwater surface. The sonic probe was decontaminated by being rinsed with deionized water or steam cleaned after each use. A bottom-filling, clear Teflon<sup>®</sup> bailer was used to verify floating hydrocarbon thickness measurements of less than 0.02 foot. Alternatively, an electric sounder and a bottom-filling Teflon bailer may have been used to record floating hydrocarbon thickness and depth to water.

The electric sounder is a transistorized instrument that uses a reel-mounted, two-conductor, coaxial cable that connects the control panel to the sensor. Cable markings are stamped at 1-foot intervals. The water level was measured by lowering the sensor into the monitoring well. A low-current circuit was completed when the sensor contacted the water, which served as an electrolyte. The current was amplified and fed into an indicator light and audible buzzer, signaling when water had been contacted. A sensitivity control compensated for highly saline or conductive water. The electric sounder was decontaminated by being rinsed with deionized water after each use. The bailer was lowered to a point just below the liquid level, retrieved, and observed for floating hydrocarbon.

Liquid measurements were recorded to the nearest 0.01 foot on the depth to water/floating product survey form. The groundwater elevation at each monitoring well was calculated by subtracting the measured depth to water from the surveyed elevation of the top of the well casing. (Every attempt was made to measure depth to water for all wells on the same day.) Total well depth was then measured by lowering the sensor to the bottom of the well. Total well depth, used to calculate purge volumes and to determine whether the well screen was partially obstructed by silt, was recorded to the nearest 0.1 foot on the depth to water/floating product survey form.

## Well Purging

If the depth to groundwater was above the top of screens of the monitoring wells, then the wells were purged. Before sampling occurred, a polyvinyl chloride (PVC) bailer, centrifugal pump, low-flow submersible pump, or Teflon bailer was used to purge standing water in the casing and gravel pack from the monitoring well. Monitoring wells were purged according to the protocol presented in Figure A-1. In most monitoring wells, the amount of water purged before sampling was greater than or equal to three casing volumes. Some monitoring wells were expected to be evacuated to dryness after removing fewer than three casing volumes. These low-yield monitoring wells were allowed to recharge for up to 24 hours. Samples were obtained as soon as the monitoring wells recharged to a level sufficient for sample collection. If insufficient water recharged after 24 hours, the monitoring well was recorded as dry for the sampling event.

Groundwater purged from the monitoring wells was transported in a 500-gallon water trailer, 55-gallon drum, or a 325-gallon truck-mounted tank to EMCON's San Jose or Sacramento office location for temporary storage. EMCON arranged for transport and disposal of the purged groundwater through Integrated Waste Stream Management, Inc.

Field measurements of pH, specific conductance, and temperature were recorded in a waterproof field logbook. Figure A-2 shows an example of the water sample field data sheet on which field data are recorded. Field data sheets were reviewed for completeness by the sampling coordinator after the sampling event was completed.

The pH, specific conductance, and temperature meter were calibrated each day before field activities were begun. The calibration was checked once each day to verify meter performance. Field meter calibrations were recorded on the water sample field data sheet.

## Well Sampling

A Teflon bailer was the only equipment acceptable for well sampling. When samples for volatile organic analysis were being collected, the flow of groundwater from the bailer was regulated to minimize turbulence and aeration. Glass bottles of at least 40-milliliters volume and fitted with Teflon-lined septa were used in sampling for volatile organics. These bottles were filled completely to prevent air from remaining in the bottle. A positive meniscus formed when the bottle was completely full. A convex Teflon septum was placed over the positive meniscus to eliminate air. After the bottle was capped, it was inverted and tapped to verify that it contained no air bubbles. The sample containers for other parameters were filled, filtered as required, and capped.

When required, dissolved concentrations of metals were determined using appropriate field filtration techniques. The sample was filtered by emptying the contents of the Teflon bailer into a pressure transfer vessel. A disposable 0.45-micron acrylic copolymer filter was threaded onto the transfer vessel at the discharge point, and the vessel was sealed. Pressure was applied to the vessel with a hand pump and the filtrate directed into the appropriate containers. Each filter was used once and discarded.

## **Sample Preservation and Handling**

The following section specifies sample containers, preservation methods, and sample handling procedures.

### **Sample Containers and Preservation**

Sample containers vary with each type of analytical parameter. Container types and materials were selected to be nonreactive with the particular analytical parameter tested.

### **Sample Handling**

Sample containers were labeled immediately prior to sample collection. Samples were kept cool with cold packs until received by the laboratory. At the time of sampling, each sample was logged on an ARCO chain-of-custody record that accompanied the sample to the laboratory.

Samples that required overnight storage prior to shipping to the laboratory were kept cool (4° C) in a refrigerator. The refrigerator was kept in a warehouse, which was locked when not occupied by an EMCON employee. A sample/refrigerator log was kept to record the date and time that samples were placed into and removed from the refrigerator.

Samples were transferred from EMCON to an ARCO-approved laboratory by courier or taken directly to the laboratory by the environmental sampler. Sample shipments from EMCON to laboratories performing the selected analyses routinely occurred within 24 hours of sample collection.

## **Sample Documentation**

The following procedures were used during sampling and analysis to provide chain-of-custody control during sample handling from collection through storage. Sample documentation included the use of the following:

- Water sample field data sheets to document sampling activities in the field
- Labels to identify individual samples
- Chain-of-custody record sheets for documenting possession and transfer of samples
- Laboratory analysis request sheets for documenting analyses to be performed

## Field Logbook

In the field, the sampler recorded the following information on the water sample field data sheet (see Figure A-2) for each sample collected:

- Project number
- Client's name
- Location
- Name of sampler
- Date and time
- Well accessibility and integrity
- Pertinent well data (e.g., casing diameter, depth to water, well depth)
- Calculated and actual purge volumes
- Purging equipment used
- Sampling equipment used
- Appearance of each sample (e.g., color, turbidity, sediment)
- Results of field analyses (temperature, pH, specific conductance)
- General comments

The water sample field data sheet was signed by the sampler and reviewed by the sampling coordinator.

## Labels

Sample labels contained the following information:

- Project number
- Sample number (i.e., well designation)
- Sample depth
- Sampler's initials
- Date and time of collection
- Type of preservation used (if any)

## Sampling and Analysis Chain-of-Custody Record

The ARCO chain-of-custody record initiated at the time of sampling contained, at a minimum, the sample designation (including the depth at which the sample was collected), sample type, analytical request, date of sampling, and the name of the sampler. The record sheet was signed, timed, and dated by the sampler when transferring the samples. The number of custodians in the chain of possession was minimized. A copy of the ARCO chain-of-custody record was returned to EMCON with the analytical results.



## Groundwater Sampling and Analysis Request Form

A groundwater sampling and analysis request form (see Figure A-3) was used to communicate to the environmental sampler the requirements of the monitoring event. At a minimum, the groundwater sampling and analysis request form included the following information:

- Date scheduled
- Site-specific instructions
- Specific analytical parameters
- Well number
- Well specifications (expected total depth, depth of water, and product thickness)



OWT

# MONITORING WELL PURGING PROTOCOL

MEASURE AND RECORD DEPTH TO WATER AND WELL TOTAL DEPTH

CHECK FOR FLOATING PRODUCT

YES

MEASURE AND DOCUMENT FLOATING PRODUCT THICKNESS. DO NOT SAMPLE WELL FOR DISSOLVED CONSTITUENTS.

NO

CALCULATE PURGE VOLUME BY USING THE FOLLOWING EQUATION:  
 $P = \pi r^2 \times 7.48 \times h$

where:

P = calculated purge volume (gallons)

$\pi = 3.14$

r = radius of well casing in feet

h = height of water column in feet

WELL EVACUATED TO PRACTICAL LIMITS OF DRYNESS BEFORE REMOVING CALCULATED PURGE VOLUME

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.

NO

YES

FINAL TWO SETS OF GROUNDWATER STABILIZATION INDICATOR PARAMETER MEASUREMENTS MEET THE FOLLOWING CRITERIA:

pH = ± 0.1 pH units

COND. = ± 10 %

TEMP. = ± 1.0 °F

WELL RECHARGES TO A LEVEL SUFFICIENT FOR SAMPLE COLLECTION WITHIN 24 HOURS OF EVACUATION TO DRYNESS.

YES

NO

YES

NO

WELL PURGING CRITERIA MET; PROCEED TO WELL SAMPLING.

CONTINUE PURGING; EVACUATE ADDITIONAL CASING VOLUME OF WATER. MONITORING INDICATOR PARAMETERS FOR STABILITY.

FIELD TEST FIRST RECHARGE WATER FOR INDICATOR PARAMETERS, THEN PROCEED TO WELL SAMPLING.

RECORD WELL AS DRY FOR PURPOSES OF SAMPLING.



EMCON

MONITORING WELL PURGING PROTOCOL

FIGURE

A-1



OWT

# WATER SAMPLE FIELD DATA SHEET

Rev. 5/96

PROJECT NO : \_\_\_\_\_  
PURGED BY : \_\_\_\_\_  
SAMPLED BY : \_\_\_\_\_

SAMPLE ID : \_\_\_\_\_  
CLIENT NAME : \_\_\_\_\_  
LOCATION : \_\_\_\_\_

TYPE: Groundwater \_\_\_\_\_ Surface Water \_\_\_\_\_ Leachate \_\_\_\_\_ Other \_\_\_\_\_

CASING DIAMETER (inches): 2 \_\_\_\_\_ 3 \_\_\_\_\_ 4 \_\_\_\_\_ 4.5 \_\_\_\_\_ 6 \_\_\_\_\_ Other \_\_\_\_\_

CASING ELEVATION (feet/MSL) : \_\_\_\_\_ VOLUME IN CASING (gal.) : \_\_\_\_\_  
DEPTH OF WELL (feet) : \_\_\_\_\_ CALCULATED PURGE (gal.) : \_\_\_\_\_  
DEPTH OF WATER (feet) : \_\_\_\_\_ ACTUAL PURGE VOL. (gal.) : \_\_\_\_\_

DATE PURGED : \_\_\_\_\_ END PURGE : \_\_\_\_\_  
DATE SAMPLED : \_\_\_\_\_ SAMPLING TIME : \_\_\_\_\_

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	TURBIDITY (visual/NTU)	TIME (2400 HR)
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

OTHER: \_\_\_\_\_ ODOR: \_\_\_\_\_  
(COBALT 0-100) (NTU 0-200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): \_\_\_\_\_

### PURGING EQUIPMENT

### SAMPLING EQUIPMENT

\_\_\_\_\_ 2" Bladder Pump \_\_\_\_\_ Bailer (Teflon)  
\_\_\_\_\_ Centrifugal Pump \_\_\_\_\_ Bailer (PVC)  
\_\_\_\_\_ Submersible Pump \_\_\_\_\_ Bailer (Stainless Steel)  
\_\_\_\_\_ Well Wizard™ \_\_\_\_\_ Dedicated  
Other: \_\_\_\_\_

\_\_\_\_\_ 2" Bladder Pump \_\_\_\_\_ Bailer (Teflon)  
\_\_\_\_\_ Bomb Sampler \_\_\_\_\_ Bailer (Stainless Steel)  
\_\_\_\_\_ Dipper \_\_\_\_\_ Submersible Pump  
\_\_\_\_\_ Well Wizard™ \_\_\_\_\_ Dedicated  
Other: \_\_\_\_\_

WELL INTEGRITY: \_\_\_\_\_ LOCK: \_\_\_\_\_

REMARKS: \_\_\_\_\_

pH, E.C., Temp. Meter Calibration: Date: \_\_\_\_\_ Time: \_\_\_\_\_ Meter Serial No.: \_\_\_\_\_  
E.C. 1000 \_\_\_\_\_ / \_\_\_\_\_ pH 7 \_\_\_\_\_ / \_\_\_\_\_ pH 10 \_\_\_\_\_ / \_\_\_\_\_ pH 4 \_\_\_\_\_ / \_\_\_\_\_  
Temperature °F \_\_\_\_\_

SIGNATURE: \_\_\_\_\_ REVIEWED BY: \_\_\_\_\_ PAGE \_\_\_\_\_ OF \_\_\_\_\_



WATER SAMPLE FIELD DATA SHEET

FIGURE  
A-2



OWT

EMCON - SACRAMENTO  
GROUNDWATER SAMPLING AND ANALYSIS REQUEST FORM

PROJECT NAME :

SCHEDULED DATE :

SPECIAL INSTRUCTIONS / CONSIDERATIONS :

[Empty box for special instructions]

Project Authorization: \_\_\_\_\_  
EMCON Project No.: \_\_\_\_\_  
OWT Project No.: \_\_\_\_\_  
Task Code: \_\_\_\_\_  
Originals To: \_\_\_\_\_  
cc: \_\_\_\_\_

Well Lock Number (s)

CHECK BOX TO AUTHORIZE DATA ENTRY

Site Contact: \_\_\_\_\_

Well Number or Source	Casing Diameter (inches)	Casing Length (feet)	Depth to Water (feet)	Name	Phone #
				ANAYSES REQUESTED	

Laboratory and Lab QC Istructions:



SAMPLING AND ANALYSIS REQUEST FORM

FIGURE  
A-3

**APPENDIX B**

**CERTIFIED ANALYTICAL REPORTS,  
AND CHAIN OF CUSTODY DOCUMENTATION**



August 13, 1998

Service Request No.: S9802012

Glen Vanderveen  
PINNACLE  
144 A Mayhew Wy.  
Walnut Creek, CA 94596

**RE: 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND**

Dear Mr. Vanderveen:

The following pages contain analytical results for sample(s) received by the laboratory on July 31, 1998. Results of sample analyses are followed by Appendix A which contains sample custody documentation and quality assurance deliverables requested for this project. The work requested has been assigned the Service Request No. listed above. To help expedite our service, please refer to this number when contacting the laboratory.

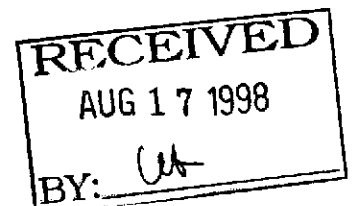
Analytical results were produced by procedures consistent with Columbia Analytical Services' (CAS) Quality Assurance Manual (with any deviations noted). Signature of this CAS Analytical Report below confirms that pages 2 through 14, following, have been thoroughly reviewed and approved for release in accord with CAS Standard Operating Procedure ADM-DatRev3.

Please feel welcome to contact me should you have questions or further needs.

Sincerely,

Steven L. Green  
Project Chemist

Greg Anderson  
Regional QA Coordinator



**COLUMBIA ANALYTICAL SERVICES, Inc.**

**Acronyms**

<b>A2LA</b>	American Association for Laboratory Accreditation
<b>ASTM</b>	American Society for Testing and Materials
<b>BOD</b>	Biochemical Oxygen Demand
<b>BTEX</b>	Benzene, Toluene, Ethylbenzene, Xylenes
<b>CAM</b>	California Assessment Metals
<b>CARB</b>	California Air Resources Board
<b>CAS Number</b>	Chemical Abstract Service registry Number
<b>CFC</b>	Chlorofluorocarbon
<b>CFU</b>	Colony-Forming Unit
<b>COD</b>	Chemical Oxygen Demand
<b>DEC</b>	Department of Environmental Conservation
<b>DEQ</b>	Department of Environmental Quality
<b>DHS</b>	Department of Health Services
<b>DLCS</b>	Duplicate Laboratory Control Sample
<b>DMS</b>	Duplicate Matrix Spike
<b>DOE</b>	Department of Ecology
<b>DOH</b>	Department of Health
<b>EPA</b>	U. S. Environmental Protection Agency
<b>ELAP</b>	Environmental Laboratory Accreditation Program
<b>GC</b>	Gas Chromatography
<b>GC/MS</b>	Gas Chromatography/Mass Spectrometry
<b>IC</b>	Ion Chromatography
<b>ICB</b>	Initial Calibration Blank sample
<b>ICP</b>	Inductively Coupled Plasma atomic emission spectrometry
<b>ICV</b>	Initial Calibration Verification sample
<b>J</b>	Estimated concentration. The value is less than the MRL, but greater than or equal to the MDL. If the value is equal to the MRL, the result is actually <MRL before rounding.
<b>LCS</b>	Laboratory Control Sample
<b>LUFT</b>	Leaking Underground Fuel Tank
<b>M</b>	Modified
<b>MBAS</b>	Methylene Blue Active Substances
<b>MCL</b>	Maximum Contaminant Level. The highest permissible concentration of a substance allowed in drinking water as established by the U. S. EPA.
<b>MDL</b>	Method Detection Limit
<b>MPN</b>	Most Probable Number
<b>MRL</b>	Method Reporting Limit
<b>MS</b>	Matrix Spike
<b>MTBE</b>	Methyl tert-Butyl Ether
<b>NA</b>	Not Applicable
<b>NAN</b>	Not Analyzed
<b>NC</b>	Not Calculated
<b>NCASI</b>	National Council of the paper industry for Air and Stream Improvement
<b>ND</b>	Not Detected at or above the method reporting/detection limit (MRL/MDL)
<b>NIOSH</b>	National Institute for Occupational Safety and Health
<b>NTU</b>	Nephelometric Turbidity Units
<b>ppb</b>	Parts Per Billion
<b>ppm</b>	Parts Per Million
<b>PQL</b>	Practical Quantitation Limit
<b>QA/QC</b>	Quality Assurance/Quality Control
<b>RCRA</b>	Resource Conservation and Recovery Act
<b>RPD</b>	Relative Percent Difference
<b>SIM</b>	Selected Ion Monitoring
<b>SM</b>	Standard Methods for the Examination of Water and Wastewater, 18th Ed., 1992
<b>STLC</b>	Solubility Threshold Limit Concentration
<b>SW</b>	Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Ed., 1986 and as amended by Updates I, II, IIA, and IIB.
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>TDS</b>	Total Dissolved Solids
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<b>TRPH</b>	Total Recoverable Petroleum Hydrocarbons
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<b>TTLC</b>	Total Threshold Limit Concentration
<b>VOA</b>	Volatile Organic Analyte(s)

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

**Client:** ARCO Products Company  
**Project:** 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9802012  
**Date Collected:** 7/29/98  
**Date Received:** 7/31/98

BTEX, MTBE and TPH as Gasoline

**Sample Name:** MW-2(23)  
**Lab Code:** S9802012-001  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	8/6/98	310	
Benzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/6/98	0.5	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/6/98	1.1	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	8/6/98	ND	



COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

**Client:** ARCO Products Company  
**Project:** 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9802012  
**Date Collected:** 7/29/98  
**Date Received:** 7/31/98

BTEX, MTBE and TPH as Gasoline

**Sample Name:** MW-6(26)  
**Lab Code:** S9802012-002  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	8/6/98	77	
Benzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	8/6/98	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company  
Project: 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND  
Sample Matrix: Water

Service Request: S9802012  
Date Collected: 7/29/98  
Date Received: 7/31/98

BTEX, MTBE and TPH as Gasoline

Sample Name: MW-9(20)  
Lab Code: S9802012-003  
Test Notes:

Units: ug/L (ppb)  
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	8/6/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	8/6/98	6	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

**Client:** ARCO Products Company  
**Project:** 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9802012  
**Date Collected:** 7/29/98  
**Date Received:** 7/31/98

BTEX, MTBE and TPH as Gasoline

**Sample Name:** MW-5(25)  
**Lab Code:** S9802012-004  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	8/6/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	8/6/98	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

**Client:** ARCO Products Company  
**Project:** 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9802012  
**Date Collected:** 7/29/98  
**Date Received:** 7/31/98

BTEX, MTBE and TPH as Gasoline

**Sample Name:** MW-3(22)  
**Lab Code:** S9802012-005  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	8/6/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	8/6/98	51	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

**Client:** ARCO Products Company  
**Project:** 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9802012  
**Date Collected:** 7/29/98  
**Date Received:** 7/31/98

BTEX, MTBE and TPH as Gasoline

**Sample Name:** MW-8(21)  
**Lab Code:** S9802012-006  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	8/6/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	8/6/98	19	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

**Client:** ARCO Products Company  
**Project:** 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9802012  
**Date Collected:** NA  
**Date Received:** NA

BTEX, MTBE and TPH as Gasoline

**Sample Name:** Method Blank  
**Lab Code:** S980805-WB1  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	8/5/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/5/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/5/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/5/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/5/98	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	8/5/98	ND	

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** ARCO Products Company  
**Project:** 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9802012  
**Date Collected:** NA  
**Date Received:** NA

BTEX, MTBE and TPH as Gasoline

**Sample Name:** Method Blank  
**Lab Code:** S980806-WB1  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
TPH as Gasoline	EPA 5030	CA/LUFT	50	1	NA	8/6/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	8/6/98	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	8/6/98	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

**Client:** ARCO Products Company  
**Project:** 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9802012  
**Date Collected:** NA  
**Date Received:** NA  
**Date Extracted:** NA  
**Date Analyzed:** NA

Surrogate Recovery Summary  
BTEX, MTBE and TPH as Gasoline

**Prep Method:** EPA 5030  
**Analysis Method:** 8020 CA/LUFT

**Units:** PERCENT  
**Basis:** NA

Sample Name	Lab Code	Test Notes	Percent Recovery	
			4-Bromofluorobenzene	a,a,a-Trifluorotoluene
MW-2(23)	S9802012-001		81	110
MW-6(26)	S9802012-002		104	96
MW-9(20)	S9802012-003		91	85
MW-5(25)	S9802012-004		101	87
MW-3(22)	S9802012-005		106	87
MW-8(21)	S9802012-006		109	85
MW-6(26)	S9802012-002MS		94	99
MW-6(26)	S9802012-002DMS		98	102
Method Blank	S980805-WB1		98	90
Method Blank	S980506-WB1		100	91

CAS Acceptance Limits: 69-116 69-116



**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** ARCO Products Company  
**Project:** 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9802012  
**Date Collected:** NA  
**Date Received:** NA  
**Date Extracted:** NA  
**Date Analyzed:** 8/6/98

Matrix Spike/Duplicate Matrix Spike Summary  
 TPH as Gasoline

**Sample Name:** MW-6(26)  
**Lab Code:** S9802012-002MS, S9802012-002DMS  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

**Percent Recovery**

Analyte	Prep Method	Analysis Method	Spike Level		Sample Result	Spike Result				CAS		Relative Percent Difference	Result Notes
			MRL	DMS		MS	DMS	MS	DMS	MS	DMS		
Gasoline	EPA 5030	CA/LUFT	50	250	77	310	310	93	93	75-135		<1	

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** ARCO Products Company  
**Project:** 20805-130.006/TO#22312.00/RAT8/2185 OAKLAND

**Service Request:** S9802012  
**Date Analyzed:** 8/5/98

Initial Calibration Verification (ICV) Summary  
 BTEX, MTBE and TPH as Gasoline

**Sample Name:** ICV **Units:** ug/L (ppb)  
**Lab Code:** ICV1 **Basis:** NA  
**Test Notes:**

ICV Source:

Analyte	Prep Method	Analysis Method	True Value	Result	CAS Percent Recovery		Result Notes
					Acceptance Limits	Percent Recovery	
TPH as Gasoline	EPA 5030	CA/LUFT	250	250	90-110	100	
Benzene	EPA 5030	8020	25	26	85-115	104	
Toluene	EPA 5030	8020	25	25	85-115	100	
Ethylbenzene	EPA 5030	8020	25	25	85-115	100	
Xylenes, Total	EPA 5030	8020	75	80	85-115	107	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	25	25	85-115	100	

# ARCO Products Company

Division of Atlantic/Richfield Company

Task Order No. 22312.00

## Chain of Custody

ARCO Facility no. <u>2185</u>	City (Facility) <u>Oakland</u>	Project manager (Consultant) <u>Glen Vanderveen</u>	Laboratory Name <u>CAS</u>
ARCO engineer <u>Paul Supple</u>	Telephone no. (ARCO)	Telephone no. (Consultant) <u>(408) 453-7300</u>	Contract Number
Consultant name <u>EMCON</u>		Address (Consultant) <u>1971 Ringwood Ave. San Jose, CA 95131</u>	Fax no. (Consultant) <u>(408) 437-9526</u>

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH/PAHs/414g MTBE EPA M602/8020/8015	TPH Modified 8015	Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SM 503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCUP Metals <input type="checkbox"/> VOAs <input type="checkbox"/>	Semi Metals <input type="checkbox"/> VOAs <input type="checkbox"/>	CMM Metals EPA 6010/7000	TLCO STLO	Lead Org/DHSD	Lead EPA 7420/7421D	8260 for MTBE	
			Soil	Water	Other	Ice	Acid																			
MW-2 (23)		2		X		X	HCL	7-29-98	1016		X															
MW-6 (26)		2		X		X	HCL		1029		X															
MW-9 (20)		3		X		X	HCL		1101		X															
MW-5 (25)		2		X		X	HCL		1122		X															
MW-3 (22)		2		X		X	HCL		1135		X															
MW-8 (21)		2		X		X	HCL		1122		X													X		

Method of shipment  
Sampler will deliver

Special Detection Limit/reporting  
Lowest Possible

Special QA/QC  
As Normal

Remarks  
RAT 8  
2-40ml HCL  
VOAs  
#70905-130,006  
Lab Number  
5940 2012

Turnaround Time:

Priority Rush 1 Business Day

Rush 2 Business Days

Expedited 5 Business Days

Standard 10 Business Days

8-13-98

Condition of sample:				Temperature received:			
Relinquished by sampler	Date	Time	Received by	Date	Time	Received by	
	<u>7-30-98</u>	<u>1343</u>	<u>Tom Nelson</u>	<u>7/31/98</u>	<u>9:45 AM</u>		
Relinquished by	Date	Time	Received by	Date	Time	Received by laboratory	
Relinquished by	Date	Time	Received by laboratory	Date	Time		

PK 107



September 2, 1998

Service Request No.: S9802207

Glen Vanderveen  
PINNACLE  
144 A Mayhew Wy.  
Walnut Creek, CA 94596

**RE: 20805-130.005/TO#22312.00/RAT8/2185 OAKLAND**

Dear Mr. Vanderveen:

The following pages contain analytical results for sample(s) received by the laboratory on July 31, 1998. Results of sample analyses are followed by Appendix A which contains sample custody documentation and quality assurance deliverables requested for this project. The work requested has been assigned the Service Request No. listed above. To help expedite our service, please refer to this number when contacting the laboratory.

Analytical results were produced by procedures consistent with Columbia Analytical Services' (CAS) Quality Assurance Manual (with any deviations noted). Signature of this CAS Analytical Report below confirms that pages 2 through 6, following, have been thoroughly reviewed and approved for release in accord with CAS Standard Operating Procedure ADM-DatRev3.

Please feel welcome to contact me should you have questions or further needs.

Sincerely,

Steven L. Green  
Project Chemist

*Bernadette J Cox for*  
**RECEIVED**  
Greg Anderson SEP 08 1998  
Regional QA Coordinator  
BY: *UK*

**COLUMBIA ANALYTICAL SERVICES, Inc.**

**Acronyms**

<b>A2LA</b>	American Association for Laboratory Accreditation
<b>ASTM</b>	American Society for Testing and Materials
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<b>CAM</b>	California Assessment Metals
<b>CARB</b>	California Air Resources Board
<b>CAS Number</b>	Chemical Abstract Service registry Number
<b>CFC</b>	Chlorofluorocarbon
<b>CFU</b>	Colony-Forming Unit
<b>COD</b>	Chemical Oxygen Demand
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<b>DEQ</b>	Department of Environmental Quality
<b>DHS</b>	Department of Health Services
<b>DLCS</b>	Duplicate Laboratory Control Sample
<b>DMS</b>	Duplicate Matrix Spike
<b>DOE</b>	Department of Ecology
<b>DOH</b>	Department of Health
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<b>ELAP</b>	Environmental Laboratory Accreditation Program
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<b>GC/MS</b>	Gas Chromatography/Mass Spectrometry
<b>IC</b>	Ion Chromatography
<b>ICB</b>	Initial Calibration Blank sample
<b>ICP</b>	Inductively Coupled Plasma atomic emission spectrometry
<b>ICV</b>	Initial Calibration Verification sample
<b>J</b>	Estimated concentration. The value is less than the MRL, but greater than or equal to the MDL. If the value is equal to the MRL, the result is actually <MRL before rounding.
<b>LCS</b>	Laboratory Control Sample
<b>LUFT</b>	Leaking Underground Fuel Tank
<b>M</b>	Modified
<b>MBAS</b>	Methylene Blue Active Substances
<b>MCL</b>	Maximum Contaminant Level. The highest permissible concentration of a substance allowed in drinking water as established by the U. S. EPA.
<b>MDL</b>	Method Detection Limit
<b>MPN</b>	Most Probable Number
<b>MRL</b>	Method Reporting Limit
<b>MS</b>	Matrix Spike
<b>MTBE</b>	Methyl tert-Butyl Ether
<b>NA</b>	Not Applicable
<b>NAN</b>	Not Analyzed
<b>NC</b>	Not Calculated
<b>NCASI</b>	National Council of the paper industry for Air and Stream Improvement
<b>ND</b>	Not Detected at or above the method reporting/detection limit (MRL/MDL)
<b>NIOSH</b>	National Institute for Occupational Safety and Health
<b>NTU</b>	Nephelometric Turbidity Units
<b>ppb</b>	Parts Per Billion
<b>ppm</b>	Parts Per Million
<b>PQL</b>	Practical Quantitation Limit
<b>QA/QC</b>	Quality Assurance/Quality Control
<b>RCRA</b>	Resource Conservation and Recovery Act
<b>RPD</b>	Relative Percent Difference
<b>SIM</b>	Selected Ion Monitoring
<b>SM</b>	Standard Methods for the Examination of Water and Wastewater, 18th Ed., 1992
<b>STLC</b>	Solubility Threshold Limit Concentration
<b>SW</b>	Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Ed., 1986 and as amended by Updates I, II, IIA, and IIB.
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>TDS</b>	Total Dissolved Solids
<b>TPH</b>	Total Petroleum Hydrocarbons
<b>tr</b>	Trace level. The concentration of an analyte that is less than the PQL but greater than or equal to the MDL. If the value is equal to the PQL, the result is actually <PQL before rounding.
<b>TRPH</b>	Total Recoverable Petroleum Hydrocarbons
<b>TSS</b>	Total Suspended Solids
<b>TTLC</b>	Total Threshold Limit Concentration
<b>VOA</b>	Volatile Organic Analyte(s)

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:  
Project:  
Sample Matrix:

ARCO Products Company  
20805-130.005/TO#22312.00/RAT8/2185 OAKLAND  
Water

Service Request: S9802207  
Date Collected: 7/29/98  
Date Received: 7/31/98

EPA Method 8260  
Volatile Organic Compounds

Sample Name: MW-8(21)  
Lab Code: S9802207-001  
Test Notes: H1

Units: ug/L (ppb)  
Basis: NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Methyl tert-Butyl Ether	NONE	8260	0.5	1	NA	8/26/98	21	

H1

The request for analysis was made after the recommended hold time.

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

**Client:** ARCO Products Company  
**Project:** 20805-130.005/TO#22312.00/RAT8/2185 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9802207  
**Date Collected:** NA  
**Date Received:** NA

EPA Method 8260  
Volatile Organic Compounds

**Sample Name:** Method Blank  
**Lab Code:** S980826-WB1  
**Test Notes:**

**Units:** ug/L (ppb)  
**Basis:** NA

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Methyl tert-Butyl Ether	NONE	8260	0.5	1	NA	8/26/98	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

**Client:** ARCO Products Company  
**Project:** 20805-130.005/TO#22312.00/RAT8/2185 OAKLAND  
**Sample Matrix:** Water

**Service Request:** S9802207  
**Date Collected:** NA  
**Date Received:** NA  
**Date Extracted:** NA  
**Date Analyzed:** NA

Surrogate Recovery Summary  
Volatile Organic Compounds

Prep Method: NONE  
Analysis Method: 8260

Units: PERCENT  
Basis: NA

Sample Name	Lab Code	Test Notes	P e r c e n t R e c o v e r y		
			Pentafluorobenzene	Toluene-D8	4-Bromofluorobenzene
MW-8(21)	S9802207-001		92	100	101
Method Blank	S980826-WB1		98	99	97

CAS Acceptance Limits:      82-119                      88-112                      86-114





# ARCO Products Company

Division of Atlantic/Richfield Company

Task Order No. **77312.00**

# Chain of Custody

ARCO Facility no. **2185** City (Facility) **Oakland** Project manager (Consultant) **Glen Vanderveen**  
 ARCO engineer **Paul Supple** Telephone no. (ARCO) Telephone no. (Consultant) **(408) 453-7300** Fax no. (Consultant) **(408) 437-9526**  
 Consultant name **EMCON** Address (Consultant) **971 Ringwood Ave. San Jose, CA 95131**

Laboratory Name **CAS**  
 Contract Number

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX EPA 801/802	BTEX/TPH/Inhalables/PM10 EPA 808/809/810/815	TPH Modified 8015 Gas <input type="checkbox"/> Plead <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SM 506E	EPA 801/8010	EPA 824/8240	EPA 825/8270	TCLP Metals <input type="checkbox"/> VOCs <input type="checkbox"/> VOA <input type="checkbox"/>	CAMP Metals EPA 8010/7000 TLCU <input type="checkbox"/> STLCU <input type="checkbox"/>	Lead <input type="checkbox"/> Organics <input type="checkbox"/> Lead EPA 7420/7421/0	8260 for <input type="checkbox"/> MTSE <input type="checkbox"/>	
			Soil	Water	Other	Ice	Acid															
MW-2(23)	X	2		X		X	HCL	7-29-98	1016		X											
MW-6(26)	X	2		X		X	HCL		1029		X											
MW-9(20)	X	2		X		X	HCL		1101		X											
MW-5(25)	X	2		X		X	HCL		1122		X											
MW-3(22)	X	2		X		X	HCL		1135		X											
MW-8(21)	X	2		X		X	HCL		1122		X										X	

Method of shipment  
**Sampler will deliver**

Special Detection Limit/reporting  
**Lowest Possible**

Special QA/QC  
**As Normal**

Remarks  
**RAT 8**  
**2-40ml HCL**  
**VOAs**  
**#70905-130.006**  
 Lab Number  
**5980-2012**

Turnaround Time:  
 Priority Rush 1 Business Day   
 Rush 2 Business Days   
 Expedited 5 Business Days   
 Standard 10 Business Days

Date **8-13-98**

Condition of sample: \_\_\_\_\_ Temperature received: \_\_\_\_\_

Relinquished by sampler	Date	Time	Received by	Date	Time
<i>[Signature]</i>	7-30-98	1343	<i>[Signature]</i>	7/31/98	9:45 AM
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by laboratory	Date	Time

**RLK 107**

**APPENDIX C**  
**FIELD DATA SHEETS**

**FIELD REPORT  
DEPTH TO WATER / FLOATING PRODUCT SURVEY**

PROJECT # : 21775-236.003

STATION ADDRESS : 9800 East 14th Street, Oakland

DATE : 7/29/98

ARCO STATION # : 2185

FIELD TECHNICIAN : Patrick Jimison/ Brice Hendricks

DAY : Wednesday

DTW Order	WELL ID	Well Box Seal	Type Of Well Lid	Gasket Present	Lock Number	Type Of Well Cap	FIRST DEPTH TO WATER (feet)	SECOND DEPTH TO WATER (feet)	DEPTH TO FLOATING PRODUCT (feet)	FLOATING PRODUCT THICKNESS (feet)	WELL TOTAL DEPTH (feet)	COMMENTS
1	MW-10		9/16"		3900	LWC	10.15	10.15			22.9	
2	MW-4	/	H <sub>2</sub> O 15/16"	/	ARCO	LWC	10.80	10.80			23.8	
3	MW-1	/	H <sub>2</sub> O 15/16"	/	ARCO	LWC	<del>10.46</del>	<del>10.46</del>			<del>23.6</del>	
4	MW-2	/	H <sub>2</sub> O 15/16"	/	ARCO	LWC	10.22	10.22			24.6	D.O. = 0.7 Temp = 19.5 °C G
5	MW-6	/	H <sub>2</sub> O 15/16"	/	ARCO	LWC	9.71	9.71			27.8	D.O. = 0.6 Temp = 19.5 °C G
6	MW-9	/	<del>15/16"</del>	/	3900	LWC	11.04	11.04			21.2	D.O. = 0.5 Temp = 19.0 °C G
7	MW-7	/	H <sub>2</sub> O 5/16"	/	3616	LWC	10.56	10.56			25.7	
8	MW-5	/	H <sub>2</sub> O 15/16"	/	ARCO	LWC	9.89	9.89			26.9	D.O. = 0.6 Temp = 18.0 °C G
9	MW-3	/	H <sub>2</sub> O 15/16"	/	ARCO	LWC	10.06	10.06			23.3	D.O. = 0.5 Temp = 18.5 °C G
10	MW-8	/	H <sub>2</sub> O 15/16"	/	ARCO	LWC	10.03	10.03			22.6	D.O. = 0.7 Temp = 19.0 °C G
												(low)

**SURVEY POINTS ARE TOP OF WELL CASINGS**





# WATER SAMPLE FIELD DATA SHEET

Rev. 1

**OWT**

PROJECT NO: 21775-236.003

SAMPLE ID: MW-3 (22')

PURGED BY: P. Jimison

CLIENT NAME: ARLO # 2185

SAMPLED BY: ↓

LOCATION: 12.14<sup>th</sup> St. Oakland

TYPE: Groundwater  Surface Water  Leachate  Other

CASING DIAMETER (inches): 2  3  4  4.5  6  Other

CASING ELEVATION (feet/MSL):          VOLUME IN CASING (gal.): 8.7

DEPTH OF WELL (feet): 27.3 CALCULATED PURGE (gal.): 26.1

DEPTH TO WATER (feet): 10.05 ACTUAL PURGE VOL. (gal.):         

DATE PURGED: 7-29-98 END PURGE: No Purge

DATE SAMPLED: ↓ SAMPLING TIME: 1135

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1135</u>	<u>-</u>	<u>6.62</u>	<u>459</u>	<u>67.7</u>	<u>clear</u>	<u>Low</u>

OTHER:          ODOR: N/A

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1):          (COBALT 0-100) (NTU 0-200)

### PURGING EQUIPMENT

### SAMPLING EQUIPMENT

2" Bladder Pump  Bailer (Teflon)

Centrifugal Pump  Bailer (PVC)

Submersible Pump  Bailer (Stainless Steel)

Well Wizard<sup>®</sup>  Dedicated

Other:         

2" Bladder Pump  Bailer (Teflon)

Bomb Sampler  Bailer (Stainless Steel)

Dipper  Submersible Pump

Well Wizard<sup>®</sup>  Dedicated

Other: Disposable Bailer

WELL INTEGRITY: Good LOCK:         

REMARKS: DTW was below the top of the screen. Took

Grab Sample.

Hose in the well.

pH, E.C., Temp. Meter Calibration:          Date:          Time:          Meter Serial No.:         

E.C. 1000          pH 7          pH 10          pH 4         

Temperature °F         

SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 2 OF 6



OWT

# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

PROJECT NO: 21775-236.003  
PURGED BY: P. Johnson  
SAMPLED BY: ↓

SAMPLE ID: Mw-5 (25')  
CLIENT NAME: ARLO # 2185  
LOCATION: 12.14th St. Oakland

TYPE: Groundwater  Surface Water \_\_\_\_\_ Leachate \_\_\_\_\_ Other \_\_\_\_\_  
CASING DIAMETER (inches): 2 \_\_\_\_\_ 3 \_\_\_\_\_ 4  4.5 \_\_\_\_\_ 6 \_\_\_\_\_ Other \_\_\_\_\_

CASING ELEVATION (feet/MSL): \_\_\_\_\_ VOLUME IN CASING (gal.): 11.1  
DEPTH OF WELL (feet): 26.9 CALCULATED PURGE (gal.): 33.3  
DEPTH TO WATER (feet): 9.89 ACTUAL PURGE VOL. (gal.): \_\_\_\_\_

DATE PURGED: 7-29-98 END PURGE: No Purge  
DATE SAMPLED: ↓ SAMPLING TIME: 1122

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1122</u>	<u>—</u>	<u>6.68</u>	<u>470</u>	<u>66.0</u>	<u>Clear</u>	<u>low</u>

OTHER: \_\_\_\_\_ ODOR: None  
(COBALT 3-100) (NTU 0-200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): \_\_\_\_\_

### PURGING EQUIPMENT

2" Bladder Pump  
 Centrifugal Pump  
 Submersible Pump  
 Well Wizard<sup>®</sup>  
Other: \_\_\_\_\_

Bailer (Teflon)  
 Bailer (PVC)  
 Bailer (Stainless Steel)  
 Dedicated

### SAMPLING EQUIPMENT

2" Bladder Pump  
 Bomb Sampler  
 Dipper  
 Well Wizard<sup>®</sup>  
Other: Disposable Bailer

Bailer (Teflon)  
 Bailer (Stainless Steel)  
 Submersible Pump  
 Dedicated

WELL INTEGRITY: Good LOCK: \_\_\_\_\_

REMARKS: DTW was below the top of the screen. Took Grab Sample  
Hose in the well.

pH, E.C., Temp. Meter Calibration: Date: \_\_\_\_\_ Time: \_\_\_\_\_ Meter Serial No.: \_\_\_\_\_  
E.C. 1000 \_\_\_\_\_ pH 7 \_\_\_\_\_ pH 10 \_\_\_\_\_ pH 4 \_\_\_\_\_  
Temperature °F \_\_\_\_\_

SIGNATURE: \_\_\_\_\_ REVIEWED BY: JA PAGE 3 OF 6



# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

**OWT**

PROJECT NO: 21775-236.003

SAMPLE ID: MW-6 (26')

PURGED BY: P. J. ...

CLIENT NAME: ARCO # 2185

SAMPLED BY: ↓

LOCATION: E. 14<sup>th</sup> St., Oakland

TYPE: Groundwater 8 Surface Water \_\_\_\_\_ Leachate \_\_\_\_\_ Other \_\_\_\_\_

CASING DIAMETER (inches): 2 \_\_\_\_\_ 3 \_\_\_\_\_ 4 4.0 4.5 \_\_\_\_\_ 6 \_\_\_\_\_ Other \_\_\_\_\_

CASING ELEVATION (feet/MSL): \_\_\_\_\_ VOLUME IN CASING (gal.): 11.8

DEPTH OF WELL (feet): 27.8 CALCULATED PURGE (gal.): 35.4

DEPTH TO WATER (feet): 9.71 ACTUAL PURGE VOL. (gal.): \_\_\_\_\_

DATE PURGED: 7-29-98 END PURGE: No Purge

DATE SAMPLED: ↓ SAMPLING TIME: 1029

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1029</u>	_____	<u>6.55</u>	<u>578</u>	<u>67.3</u>	<u>Clear</u>	<u>low</u>
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

OTHER: \_\_\_\_\_ ODOR: Strong

(COBALT 0-100) \_\_\_\_\_ (NTU 0-200) \_\_\_\_\_

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): \_\_\_\_\_

### PURGING EQUIPMENT

### SAMPLING EQUIPMENT

2" Bladder Pump  Bailer (Teflon)

Centrifugal Pump  Bailer (PVC)

Submersible Pump  Bailer (Stainless Steel)

Well Wizard<sup>®</sup>  Dedicated

Other: \_\_\_\_\_

2" Bladder Pump  Bailer (Teflon)

Bomb Sampler  Bailer (Stainless Steel)

Dipper  Submersible Pump

Well Wizard<sup>®</sup>  Dedicated

Other: Disposable Bailer

WELL INTEGRITY: Good 13/16" LOCK: \_\_\_\_\_

REMARKS: DW was below the top of the screen. Took Grab sample.

those in well.

pH, E.C., Temp. Meter Calibration: Date: \_\_\_\_\_ Time: \_\_\_\_\_ Meter Serial No.: \_\_\_\_\_

E.C. 1000 \_\_\_\_\_ pH 7 \_\_\_\_\_ pH 10 \_\_\_\_\_ pH 4 \_\_\_\_\_

Temperature °F \_\_\_\_\_

SIGNATURE: \_\_\_\_\_ REVIEWED BY: JA PAGE 4 OF 6





# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

**OWT**

PROJECT NO: 21775-230.003

SAMPLE ID: MW-8 (21')

PURGED BY: B. Hendrick

CLIENT NAME: Arco 2185

SAMPLED BY: [Signature]

LOCATION: Oakland

TYPE: Groundwater  Surface Water  Leachate  Other

CASING DIAMETER (inches): 2 1.75 3  4  4.5  6  Other

CASING ELEVATION (feet/MSL): — VOLUME IN CASING (gal.): 8.1

DEPTH OF WELL (feet): 22.6 CALCULATED PURGE (gal.): 24.6

DEPTH TO WATER (feet): 10.03 ACTUAL PURGE VOL. (gal.): 25.0

DATE PURGED: 7/29/98 END PURGE: 1114

DATE SAMPLED: [Signature] SAMPLING TIME: 1122

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1109</u>	<u>10.0</u>	<u>6.55</u>	<u>560</u>	<u>69.5</u>	<u>Orange</u>	<u>Low</u>
<u>1112</u>	<u>20.0</u>	<u>6.71</u>	<u>559</u>	<u>67.9</u>	<u>Brown</u>	<u>↓</u>
<u>1114</u>	<u>25.0</u>	<u>6.80</u>	<u>553</u>	<u>67.5</u>	<u>↓</u>	<u>↓</u>

OTHER: [Signature] ODOR: None (COBALT 3-100) [Signature] (NTU 0-200) [Signature]

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1):  

**PURGING EQUIPMENT**

2" Bladder Pump       Bailer (Teflon)  
 Centrifugal Pump       Bailer (PVC)  
 Submersible Pump       Bailer (Stainless Steel)  
 Well Wizard<sup>®</sup>       Dedicated  
 Other:  

**SAMPLING EQUIPMENT**

2" Bladder Pump       Bailer (Teflon)  
 Bomb Sampler       Bailer (Stainless Steel)  
 Dipper       Submersible Pump  
 Well Wizard<sup>®</sup>       Dedicated  
 Other:  

WELL INTEGRITY: Good 15/16" LOCK:  

REMARKS:    
   
 

pH, E.C., Temp. Meter Calibration: Date: 7/29/98 Time: 1055 Meter Serial No.:    
E.C. <sup>1413</sup> 1413, 1413 pH 7 7.08, 7.00 pH 10 9.86, 10.00 pH 4 3.93, 4.00  
Temperature °F 80.6

SIGNATURE: BH REVIEWED BY: [Signature] PAGE 5 OF 6



# WATER SAMPLE FIELD DATA SHEET

Rev. 1/97

PROJECT NO: 21775-236,007  
PURGED BY: P. J. Mison  
SAMPLED BY: ↓

SAMPLE ID: MW-9 (20')  
CLIENT NAME: ARCO # 2185  
LOCATION: E. 14<sup>th</sup> St. Oakland

TYPE: Groundwater  Surface Water  Leachate  Other   
CASING DIAMETER (inches): 2  3  4  4.5  6  Other

CASING ELEVATION (feet/MSL): — VOLUME IN CASING (gal.): 1.7  
DEPTH OF WELL (feet): 21.2 CALCULATED PURGE (gal.): 5.1  
DEPTH TO WATER (feet): 11.04 ACTUAL PURGE VOL. (gal.): —

DATE PURGED: 7-29-98 END PURGE: No Purge  
DATE SAMPLED: ↓ SAMPLING TIME: 1101

TIME (2400 HR)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1101</u>	<u>—</u>	<u>6.43</u>	<u>536</u>	<u>67.7</u>	<u>LT Gray</u>	<u>moderate</u>

OTHER: — ODOR: None  
(COBALT 0-100) (NTU 0-200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): —

**PURGING EQUIPMENT**

2" Bladder Pump       Bailer (Teflon)  
 Centrifugal Pump       Bailer (PVC)  
 Submersible Pump       Bailer (Stainless Steel)  
 Well WizardO       Dedicated  
 Other: —

**SAMPLING EQUIPMENT**

2" Bladder Pump       Bailer (Teflon)  
 Bomb Sampler       Bailer (Stainless Steel)  
 Dipper       Submersible Pump  
 Well WizardO       Dedicated  
 Other: Disposable Bailer

WELL INTEGRITY: Good LOCK: —

REMARKS: DTW was below the screen - took grab sample.

pH, E.C., Temp. Meter Calibration: Date: 7/29/98 Time: 14:00 Meter Serial No.: —  
E.C. 1000 — pH 4 1  
Temperature °F —

SIGNATURE: [Signature] REVIEWED BY: [Signature] PAGE 6 OF 6