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November 13, 1998
Project 20805-190.001

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

Re: Quarterly Groundwater Monitoring Report, Second Quarter 1998, for ARCO Service Station No. 0374, located at 6407 Telegraph Avenue, Oakland, California

Dear Mr. Supple:

Pinnacle Environmental Solutions, a division of EMCON (Pinnacle), is submitting the attached report which presents the results of the second quarter 1998 groundwater monitoring program at ARCO Products Company (ARCO) Service Station No. 0374, located at 6407 Telegraph Avenue, Oakland, California. The monitoring program complies with the Regional Water Quality Control Board - San Francisco Bay Region requirements regarding underground tank investigations.

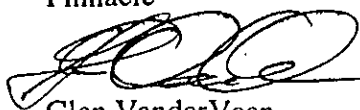
LIMITATIONS

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.

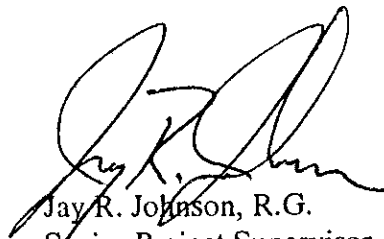
Please call if you have questions.

Sincerely,

Pinnacle



Glen VanderVeen
Project Manager



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

Attachment: Quarterly Groundwater Monitoring Report, Second Quarter 1998

cc: Ms. Susan Hugo, Alameda County Health Care Services Agency
Mr. John Kaiser, Regional Water Quality Control Board - S.F. Bay Region



ATTACHMENTS:

- Table 1 - Groundwater Elevation and Analytical Data
- Figure 1 - Groundwater Analytical Summary Map
- Figure 2 - Groundwater Elevation Contour Map
- Appendix A - Sampling and Analysis Procedures
- Appendix B - Certified Analytical Report and Chain-of-Custody Documentation
- Appendix C - Field Data Sheets
- Appendix D - Remedial System Performance Summary

Table 1
Groundwater Elevation and Analytical Data
Total Purgeable Petroleum Hydrocarbons
(TPPH as Gasoline, BTEX Compounds, and MTBE)

ARCO Service Station 0374
6407 Telegraph Avenue at Alcatraz Avenue
Oakland, California

Well Number	Date Gauged/ Sampled	Well Elevation (feet, MSL)	Depth to Water (feet, TOC)	Groundwater Elevation (feet, MSL)	TPPH as Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethyl- benzene (ppb)	Xylenes (ppb)	MTBE (ppb)	Dissolved Oxygen (ppm)	Purged/ Not purged (P/NP)
MW-1	01/31/96	158.91	6.34	152.57	----- Well Sampled Annually -----							
	04/10/96		5.82	153.09	----- Well Sampled Annually -----							
	07/16/96		7.23	151.68	<50	<0.5	<0.5	<0.5	<0.5	340	NM	
	10/14/96		8.34	150.57	----- Well Sampled Annually -----							
	03/27/97		6.37	152.54	----- Well Sampled Annually -----							
	05/27/97		7.30	151.61	----- Well Sampled Annually -----							
	08/12/97		8.22	150.69	<50	<0.5	<0.5	<0.5	<0.5	620	NM	
	11/17/97		7.98	150.93	----- Well Sampled Annually -----							
	03/16/98		4.94	153.97	----- Well Sampled Annually -----							
	05/12/98		5.28	153.63	----- Well Sampled Annually -----							
MW-2	01/31/96	157.92	6.51	151.41	----- Well Sampled Annually -----							
	04/10/96		6.94	150.98	----- Well Sampled Annually -----							
	07/16/96		7.73	150.19	<50	1.2	<0.5	<0.5	<0.5	33	NM	
	10/14/96		8.35	149.57	----- Well Sampled Annually -----							
	03/27/97		7.40	150.52	----- Well Sampled Annually -----							
	05/27/97		7.82	150.10	----- Well Sampled Annually -----							
	08/12/97		8.29	149.63	<50	<0.5	<0.5	<0.5	<0.5	23	NM	
	11/17/97		8.05	149.87	----- Well Sampled Annually -----							
	03/16/98		6.45	151.47	----- Well Sampled Annually -----							
	05/12/98		6.93	150.99	----- Well Sampled Annually -----							
MW-3*	01/31/96	153.64	7.02	146.62	140	20	0.87	11	14	NA	NM	
	04/10/96		7.82	145.82	84	2.4	<0.5	1.9	1.1	NA	NM	
	07/16/96		6.80	146.84	<50	2.2	<0.5	<0.5	<0.5	<2.5	NM	
	10/14/96		7.67	145.97	<50	1.2	<0.5	<0.5	0.81	2.9	NM	
	03/27/97		7.62	146.02	<50	0.94	<0.5	0.9	0.63	<2.5	NM	
	05/27/97		6.72	146.92	----- Well Sampled Semiannually -----							
	08/12/97		8.20	145.44	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM	
	11/17/97		7.64	146.00	----- Well Sampled Semiannually -----							
	03/18/98		5.14	148.50	<50	<0.5	<0.5	<0.5	<0.5	<3	4.0	P
	05/12/98		5.53	148.11	----- Well Sampled Semiannually -----							
MW-4	01/31/96	156.53	5.64	150.89	230	23	2.2	3.7	32	NA	NM	
	04/10/96		6.66	149.87	7,300	1,600	350	350	830	NA	NM	
	07/16/96		7.73	148.80	5,600	1,100	160	240	520	150	NM	
	10/14/96		8.55	147.98	4,500	860	72	160	340	<62	NM	
	03/27/97		7.15	149.38	25,000	5,200	760	850	2,600	<250	NM	
	05/27/97		7.75	148.78	----- Well Sampled Semiannually -----							
	08/12/97		8.46	148.07	4,800	950	40	140	210	170	NM	
	11/17/97		8.24	148.29	----- Well Sampled Semiannually -----							
	03/16/98		5.32	151.21	<50	<0.5	<0.5	<0.5	<0.5	<3	1.5	P
	05/12/98		6.38	150.15	----- Well Sampled Semiannually -----							

Pinnacle

Table 1
Groundwater Elevation and Analytical Data
Total Purgeable Petroleum Hydrocarbons
(TPPH as Gasoline, BTEX Compounds, and MTBE)

ARCO Service Station 0374
6407 Telegraph Avenue at Alcatraz Avenue
Oakland, California

Well Number	Date Gauged/ Sampled	Well Elevation (feet, MSL)	Depth to Water (feet, TOC)	Groundwater Elevation (feet, MSL)	TPPH as Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethyl- benzene (ppb)	Xylenes (ppb)	MTBE (ppb)	Dissolved Oxygen (ppm)	Purged/ Not purged (P/NP)	
MW-5	01/31/96	151.33	8.64	142.69	<50	<0.5	<0.5	<0.5	<0.5	NA	NM		
	04/10/96		N/A	--	<50	<0.5	<0.5	<0.5	<0.5	NA	NM		
	07/16/96		8.15	143.18	<50	0.79	1.3	<0.5	<0.5	<2.5	NM		
	10/14/96		7.92	143.41	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM		
	03/27/97		7.75	143.58	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM		
	05/27/97		8.16	143.17	<50	<0.5	<0.5	<0.5	<0.5	<2.5	NM		
	08/12/97		----- Well Inaccessible -----										
	11/17/97		8.75	142.58	<50	<0.5	<0.5	<0.5	<0.5	<2.5	4.0	NP	
	03/16/98		6.90	144.43	<50	<0.5	<0.5	<0.5	<0.5	<3	1.5	P	
	05/12/98		7.24	144.09	<50	<0.5	<0.5	<0.5	<0.5	<3	2.2	P	
MW-6	01/31/96	153.84	5.15	148.69	----- Well Sampled Annually -----								
	04/10/96		4.58	149.26	----- Well Sampled Annually -----								
	07/16/96		4.96	148.88	<50	<0.5	<0.5	<0.5	<0.5	150	NM		
	10/14/96		6.15	147.69	----- Well Sampled Annually -----								
	03/27/97		4.40	149.44	----- Well Sampled Annually -----								
	05/27/97		4.90	148.94	----- Well Sampled Annually -----								
	08/12/97		5.43	148.41	<50	<0.5	<0.5	<0.5	<0.5	39	NM		
	11/17/97		5.87	147.97	----- Well Sampled Annually -----								
	03/16/98		4.52	149.32	----- Well Sampled Annually -----								
	05/12/98		4.42	149.42	----- Well Sampled Annually -----								

MTBE = Methyl tert-butyl ether.

MSL = Mean sea level.

TOC = Top of casing.

ppb = Parts per billion.

ppm = Parts per million.

< = Less than laboratory detection limit stated to the right.

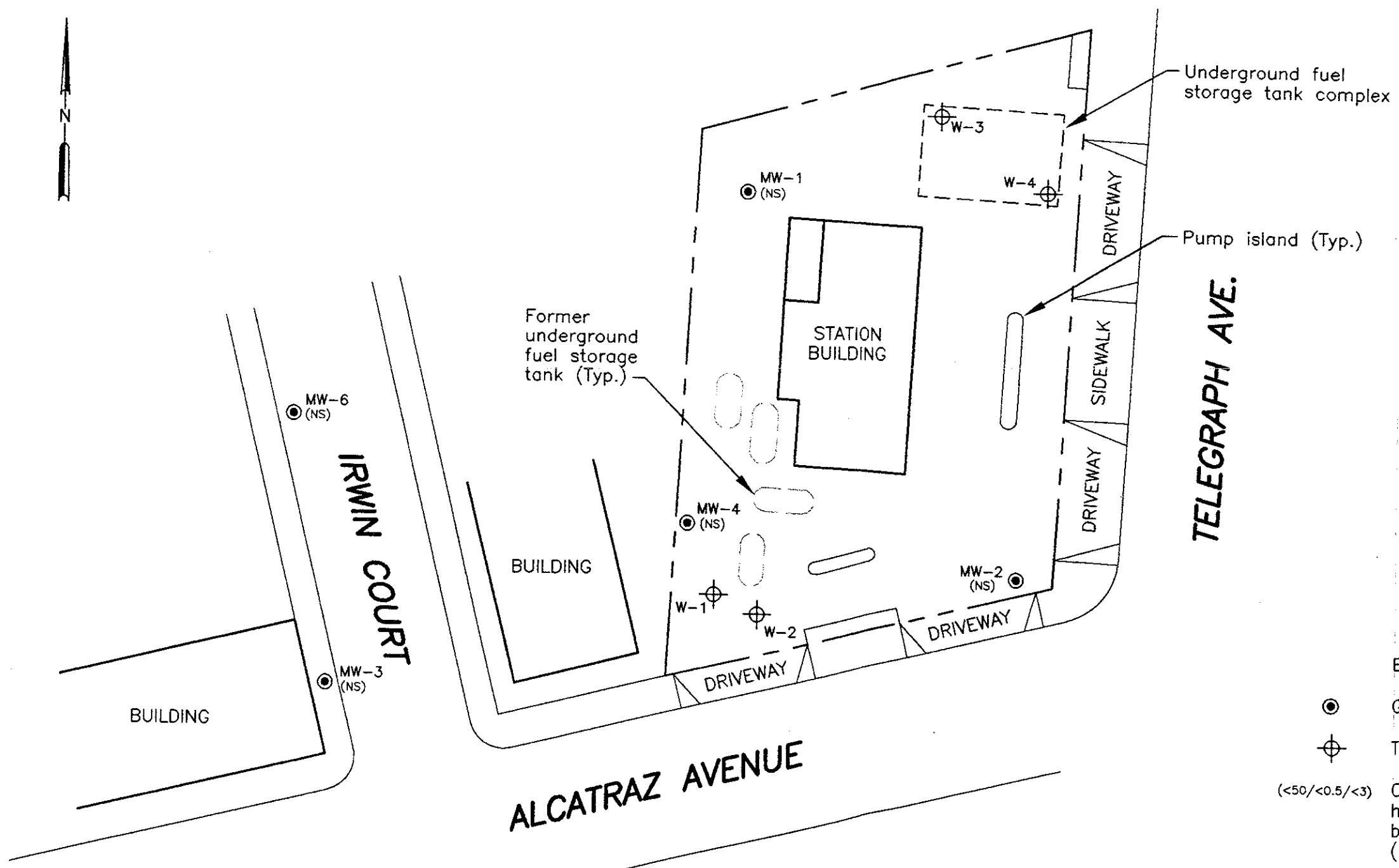
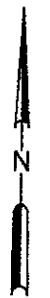
NA = Not analyzed.

NM = Not measured.

NS = Not sampled.

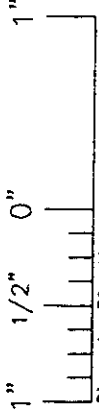
N/A = Not available.

* = ORCs installed in well beginning 11/14/95. Please refer to Appendix D for details.

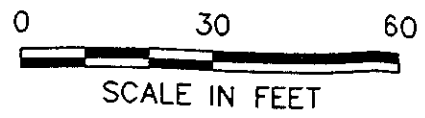


- ELEVATION
- Groundwater monitoring well
 - ⊕ Tank pit groundwater monitoring well
 - (<50/<0.5/<3) Concentration of total petroleum hydrocarbons as gasoline (TPHG), benzene, and MTBE in groundwater (ug/L); samples collected 5/12/98
 - < Not detected at or above the indicated laboratory detection limit
 - NS Not sampled

IMAGE Files: <No Images>
 XREF Files: <No Xrefs>
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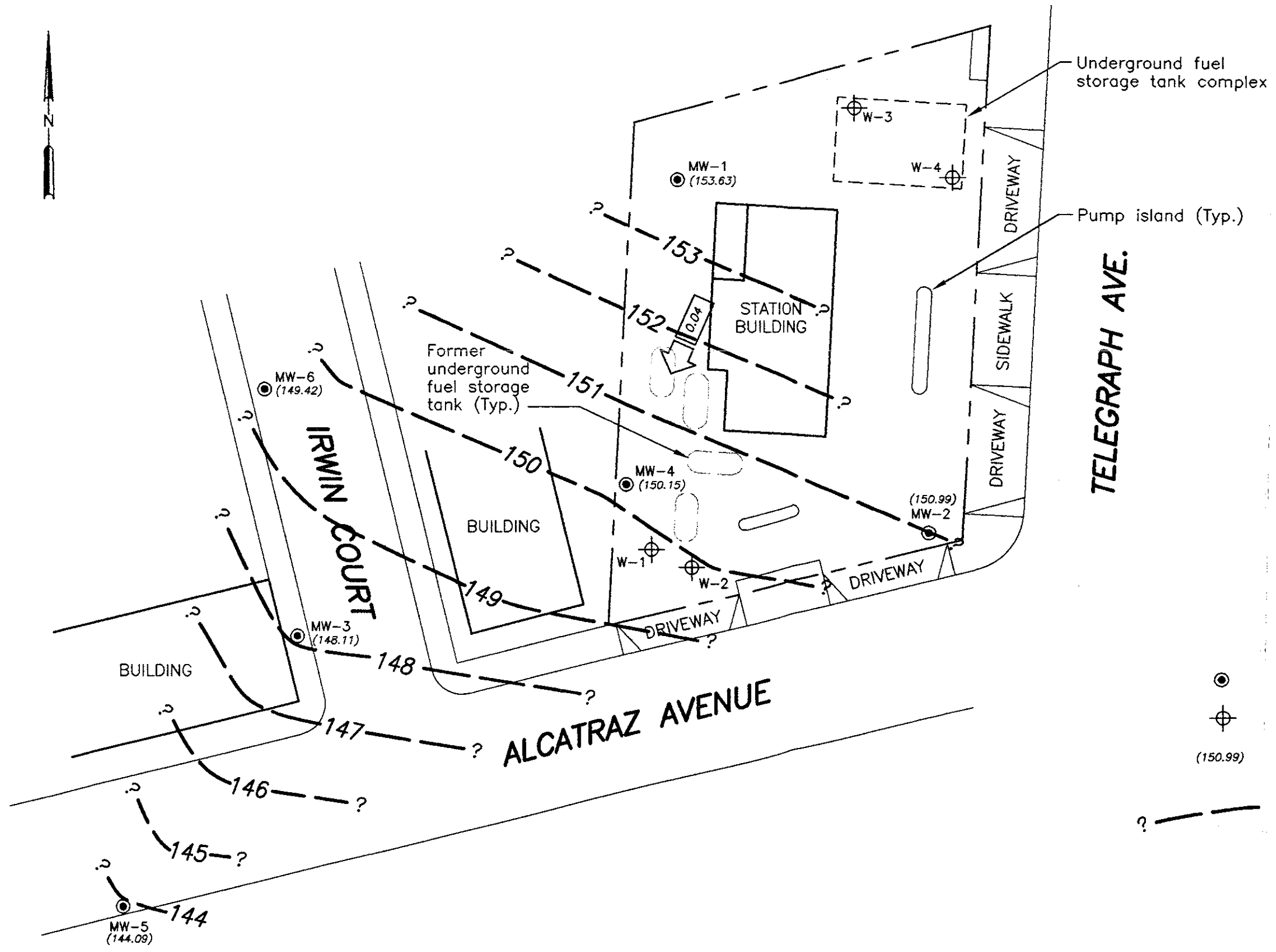
MW-5
 (<50/<0.5/<3)



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DATE OCT. 1998
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 PROJECT NO.
 20805-190.001

FIGURE 1
 ARCO PRODUCTS COMPANY
 SERVICE STATION 374, 6407 TELEGRAPH AVE.
 OAKLAND, CALIFORNIA
GROUNDWATER ANALYTICAL SUMMARY
SECOND QUARTER 1998

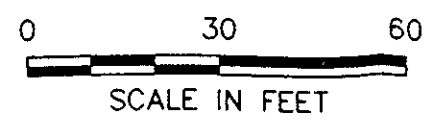


- ELEVATION
- Groundwater monitoring well
 - ⊕ Tank pit groundwater monitoring well
 - (150.99) Groundwater elevation (Ft.-MSL); measured 5/12/98
 - ? - - - Groundwater elevation contour (Ft.-MSL)

1" 1/2" 0" 1"

IMAGE Files: <No Images>
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 Dimscale: 30 Ltscale: 30 Pltscale: 1
 SANJOSE/CADD: N:\DWG\PINACL\374\374GWC.DWG Fri, 16/Oct/98 01:41pm kblick

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FIGURE 2
 ARCO PRODUCTS COMPANY
 SERVICE STATION 374, 6407 TELEGRAPH AVE.
 OAKLAND, CALIFORNIA
GROUNDWATER ELEVATION CONTOURS
SECOND 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[®] 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)



MONITORING WELL PURGING PROTOCOL

OWT

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

YES

NO

WELL PURGING CRITERIA MET: PROCEED TO WELL SAMPLING.

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

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

YES

NO

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

WATER SAMPLE FIELD DATA SHEET

Rev. 5/98



OWT

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: _____
 DATE SAMPLED: _____

END PURGE: _____
 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 :

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: _____
Name Phone #

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

Laboratory and Lab QC Instructions:



EMCON

SAMPLING AND ANALYSIS REQUEST FORM

FIGURE
A-3

APPENDIX B

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



May 27, 1998

Service Request No.: S9801194

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

RE: 21775-261.003/TO#22312.00/RAT8/374 OAKLAND

Dear Mr. Vanderveen:

The following pages contain analytical results for sample(s) received by the laboratory on May 12, 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 8, 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,

A handwritten signature in cursive script that reads "Bernadette J. Cox for".

Steven L. Green
Project Chemist

A handwritten signature in cursive script that reads "Greg Anderson".

Greg Anderson
Regional QA Coordinator

COLUMBIA ANALYTICAL SERVICES, Inc.

Acronyms

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

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 21775-261.003/TO#22312.00/RAT8/374 OAKLAND
Sample Matrix: Water

Service Request: S9801194
Date Collected: 5/12/98
Date Received: 5/12/98

BTEX, MTBE and TPH as Gasoline

Sample Name: MW-5(23)
Lab Code: S9801194-001
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	5/14/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	5/14/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	5/14/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	5/14/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	5/14/98	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	5/14/98	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: ARCO Products Company
Project: 21775-261.003/TO#22312.00/RAT8/374 OAKLAND
Sample Matrix: Water

Service Request: S9801194
Date Collected: NA
Date Received: NA

BTEX, MTBE and TPH as Gasoline

Sample Name: Method Blank
Lab Code: S980514-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	5/14/98	ND	
Benzene	EPA 5030	8020	0.5	1	NA	5/14/98	ND	
Toluene	EPA 5030	8020	0.5	1	NA	5/14/98	ND	
Ethylbenzene	EPA 5030	8020	0.5	1	NA	5/14/98	ND	
Xylenes, Total	EPA 5030	8020	0.5	1	NA	5/14/98	ND	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	3	1	NA	5/14/98	ND	

APPENDIX A

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 21775-261.003/TO#22312.00/RAT8/374 OAKLAND
Sample Matrix: Water

Service Request: S9801194
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-5(23)	S9801194-001		101	86
BATCH QC	S9801158-001MS		98	96
BATCH QC	S9801158-001DMS		97	103
Method Blank	S980514-WB1		107	91

CAS Acceptance Limits: 69-116 69-116

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 21775-261.003/TO#22312.00/RAT8/374 OAKLAND
Sample Matrix: Water

Service Request: S9801194
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 5/14/98

Matrix Spike/Duplicate Matrix Spike Summary
 TPH as Gasoline

Sample Name: BATCH QC
Lab Code: S9801158-001MS, S9801158-001DMS
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	MS	DMS		MS	DMS	MS	DMS	MS	DMS		
Gasoline	EPA 5030	CA/LUFT	50	250	250	ND	240	240	96	96	75-135	<1		

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO Products Company
Project: 21775-261.003/TO#22312.00/RAT8/374 OAKLAND

Service Request: S9801194
Date Analyzed: 5/14/98

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

Sample Name: ICV
Lab Code: ICV1
Test Notes:

Units: ug/L (ppb)
Basis: NA

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	240	90-110	96	
Benzene	EPA 5030	8020	25	27	85-115	108	
Toluene	EPA 5030	8020	25	27	85-115	108	
Ethylbenzene	EPA 5030	8020	25	28	85-115	112	
Xylenes, Total	EPA 5030	8020	75	85	85-115	113	
Methyl <i>tert</i> -Butyl Ether	EPA 5030	8020	25	23	85-115	92	

APPENDIX C
FIELD DATA SHEETS

EMCON - Groundwater Sampling and Analysis Request Form

PROJECT NAME : **ARCO STATION 0374**
 6407 Telegraph Ave, Oakland, CA

Sampling Project # : **21775-261.003**
 Reporting Project#: ?
 OWT Project#: **71028**
 Project Manager: **Glen Vanderveen**

DATE REQUESTED : **12-May-98**

Groundwater Monitoring Instructions	Treatment System Instructions
<p>Quarterly Monitoring - Third Month of the Quarter Perform a water level survey prior to sampling (see ARCO SOP) Well survey points are top of well casings. Purge three (3) casing volumes. You will have to bring a trailer for purge water transport. Wells MW-5 and MW-6 are in the street. Sample each well with a Teflon bailer.</p> <p>Sample ID's on the C-O-C and the sample bottles must include the depth at which the sample was collected [i.e. MW-1 (30)]</p>	<p>Lisle Rath Pager # (408) 798-2928</p>

Site Contact: Mr. S. Sud Site Phone: (510) 658-7508 Well Locks: ?

Well ID or Source	Casing Diameter (inches)	Casing Length (feet)	Top Of Screen (feet)	Analyses Requested
MW-1	4.0	26.8	<input type="text"/>	Depth to Water Depth to Floating Product Floating Product Thickness Total Depth Well Integrity
MW-6	4.0	14.7	<input type="text"/>	
MW-5	4.0	23.0	<input type="text"/>	
MW-2	4.0	26.3	<input type="text"/>	
MW-3	4.0	26.8	<input type="text"/>	
MW-4	4.0	26.6	<input type="text"/>	
Above wells in indicated order				If depth to water is below the top of the screen take a grab sample. If the water level is above the top of the screen purge as normal.
MW-5		(See Above)		Add: Dissolved Oxygen (Field Measurement) TPHG/ BTEX/ MTBE by (EPA 8020) (Fill 2- 40ml HCL VOAs)

Laboratory Instructions:

Provide lowest detection limits possible.
 Please use the EMCON Reporting Project Number (?) on the CAR.

ND = None Detected IP = Intermittent Product

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

PROJECT # : 21775-261.003

STATION ADDRESS : 6407 Telegraph Ave, Oakland, CA

DATE : 5/12/98

ARCO STATION # : 374

FIELD TECHNICIAN : Mike Ross

DAY : Tuesday

DTW Order	WELL ID	Well Box Seal	Well Lid Secure	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-1	OK	Hex	NO	ARCO	LWC	5.28	5.28	NR	NR	26.8	MISSING 2 Bolts
2	MW-6	OK	15/16" Hex	BS	ARCO	LWC	4.42	4.42	NR	NR	14.7	
3	MW-5	OK	1 1/2" Hex	BS	ARCO	LWC	7.24	7.24	NR	NR	23.1	1 BOLT STRIPPED
4	MW-2	OK	Hex	NO	ARCO	LWC	6.93	6.93	NR	NR	26.3	MISSING 1 BOLT
5	MW-3	OK	Hex	NO	ARCO	LWC	5.53	5.53	NR	NR	26.8	
6	MW-4	OK	Hex	NO	ARCO	LWC	6.38	6.38	NR	NR	27.0	

SURVEY POINTS ARE TOP OF WELL CASINGS

WATER SAMPLE FIELD DATA SHEET

Rev 1/97



PROJECT NO 21775-261003
 PURGED BY M. Ross
 SAMPLED BY M. Ross

SAMPLE ID MW-5(23)
 CLIENT NAME Area 0374
 LOCATION Oakland, Ca.

TYPE Groundwater Surface Water Leachate Other
 CASING DIAMETER (inches) 2 3 4 4.5 6 Other
1.96

CASING ELEVATION (feet/MSL) <u>NR</u>	VOLUME IN CASING (gal) <u>10.33</u>
DEPTH OF WELL (feet) <u>23.1</u>	CALCULATED PURGE (gal) <u>31.00</u>
DEPTH OF WATER (feet) <u>7.28</u>	ACTUAL PURGE VOL (gal) <u>25.0</u>

DATE PURGED 5/12/99 END PURGE 1249
 DATE SAMPLED 5/12/99 SAMPLING TIME 1300

TIME (2400 HR)	VOLUME (gal)	pH (units)	EC (µmhos/cm@25°C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1242</u>	<u>10.5</u>	<u>6.79</u>	<u>633</u>	<u>66.9</u>	<u>clr</u>	<u>clr</u>
<u>1245</u>	<u>21.0</u>	<u>6.82</u>	<u>605</u>	<u>66.6</u>	<u>clr</u>	<u>clr</u>
<u>1249</u>	<u>well dried</u>	<u>dried</u>	<u>0</u>	<u>25.0</u>	<u>6 colors</u>	
<u>1300</u>	<u>recharge</u>	<u>7.04</u>	<u>21.10</u>	<u>65.9</u>	<u>clr</u>	<u>clr.</u>

OTHER: D.O. 2.2 mg/L ODOR None NR NR
(COBALT 0-100) (NTU 0-200)

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

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
<input type="checkbox"/> 2" Bladder Pump	<input type="checkbox"/> Bailer (Teflon)	<input checked="" type="checkbox"/> 2" Bladder Pump	<input checked="" type="checkbox"/> Bailer (Teflon)
<input checked="" type="checkbox"/> Centrifugal Pump	<input type="checkbox"/> Bailer (PVC)	<input type="checkbox"/> Bomb Sampler	<input type="checkbox"/> Bailer (Stainless Steel)
<input type="checkbox"/> Submersible Pump	<input type="checkbox"/> Bailer (Stainless Steel)	<input type="checkbox"/> Dipper	<input type="checkbox"/> Submersible Pump
<input type="checkbox"/> Well Wizard™	<input type="checkbox"/> Dedicated	<input type="checkbox"/> Well Wizard™	<input type="checkbox"/> Dedicated
Other _____		Other <u>DISPOSABLE</u>	

WELL INTEGRITY: OK LOCK: Area

REMARKS: _____

pH, EC, Temp Meter Calibration Date 5/12/98 Time 1240 Meter Serial No 600112
 EC 1000 971 / 1000 pH 7 736 / 1700 pH 10 992 / 1000 pH 4 1 / 400
 Temperature °F 68.8
 SIGNATURE M. Ross REVIEWED BY GA PAGE 1 OF 1

APPENDIX D
REMEDIAL SYSTEM PERFORMANCE SUMMARY

APPENDIX D

REMEDIAL SYSTEM PERFORMANCE SUMMARY

GWE System

Groundwater extraction (GWE) was conducted between December 21, 1993, and October 13, 1995. No evidence of additional plume migration has been observed since system deactivation. The GWE system was comprised of a pneumatic pump in Well W-2 and three 200-pound granular activated carbon vessels arranged in series to treat the extracted groundwater. Extracted and treated groundwater was discharged into the East Bay Municipal Utility District (EBMUD) Permit Account Number 502-85611. Based on verbal approval from the ACHCSA, indicating that GWE would no longer be required at the site, the EBMUD permit was relinquished on June 14, 1996. Overall, approximately 0.1 million gallons of groundwater were extracted and less than 0.05 gallon of benzene was removed.

Please refer to the *Second Quarter 1997 Groundwater Monitoring Report*, for historical GWE system performance and analytical data.

Intrinsic Bioremediation Evaluation

Intrinsic bioremediation indicator parameters (bioparameters) were monitored during the third quarter 1996 groundwater monitoring event. Groundwater samples from Wells MW-3, MW-4, and MW-5 were analyzed for total alkalinity, dissolved oxygen (DO), ferrous iron, nitrate, sulfate, methane, biological oxygen demand (BOD), chemical oxygen demand (COD), and carbon dioxide (CO₂). Intrinsic bioremediation evaluation data are presented in Table D-1.

It is generally accepted that depleted concentrations of electron acceptors (DO, nitrate, and sulfate), and elevated concentrations of bioremediation byproducts (CO₂, methane, and ferrous iron) within the hydrocarbon-impacted plume compared to background levels indicate that intrinsic bioremediation is occurring. Collected data follow a trend that indicates the occurrence of intrinsic bioremediation.

Bioremediation Enhancement Program

On November 14, 1995, at the request of ARCO, twelve oxygen releasing compound (ORC) socks manufactured by Regensis Bioremediation Products, Inc. were installed below the groundwater surface in Well MW-3. ORC is a formulation of very fine, insoluble magnesium peroxide that releases oxygen at a slow, controlled rate when hydrated. ORC product literature was presented in PEG's fourth quarter 1995 report.

Data collected from Well MW-3 indicate that concentrations of TPPH-g and benzene have declined since ORC units were installed. ORC units are changed when dissolved oxygen data indicate that they have been depleted.

Conclusions

As indicated above, GWE at the site has been terminated with verbal approval from ACHCSA. Bioremediation enhancement program will continue during third quarter 1998.

Attachments: Table D-1 - Intrinsic Bioremediation Evaluation Data

Table D-1
Intrinsic Bioremediation Evaluation and Enhancement Data

ARCO Service Station 0374
6407 Telegraph Avenue at Alcatraz Avenue
Oakland, California

Well	Date Sampled	Field Analyses					Laboratory Analyses									
		Groundwater Temperature (deg F)	pH (units)	Conductivity (µmhos)	D.O. (mg/L)	Ferrous Iron (mg/L)	Total Alkalinity (mg CaCO ₃ /L)	B.O.D. (mg/L)	Carbon Dioxide (mg/L)	C.O.D. (mg/L)	Methane (%)	Nitrate as Nitrate (mg/L)	Nitrite as Nitrite (mg/L)	Sulfate (mg/L)	TPH as Gasoline (µg/L)	Total BTEX (µg/L)
MW-3	11/14/95	65.5*	6.76*	508*	7.17	N/A	NS	NS	NS	NS	NS	6.6	<1.0	NS	140	46
	06/06/96	66.2	7.38	700	12.28	N/A	NS	NS	NS	NS	NS	NS	NS	NS	84†	5.4†
	07/16/96	67.8	7.08	1,010	8.73	0.0	280	1.8	270	44	<0.020	<1.0	NS	78	<50	2.2
	01/21/97	59	N/A	N/A	11.15	0.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	08/12/97	74.4	6.65	600	6.7	1.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	11/17/97	N/A	N/A	N/A	12.0	0.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	03/16/98	68.5	7.75	806	4.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	05/12/98	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-4	07/16/96	69.5	6.72	1,370	3.20	4.20	420	NS	470	NS	0.11	<1.0	NS	18	5,600	2,020
	03/16/98	66.2	6.89	1,411	1.50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	05/12/98	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-5	07/16/96	70.4	6.85	690	6.80	0.0	170	NS	180	NS	<0.020	<1.0	NS	35	<50	1.1
	03/16/98	69.5	7.19	584	1.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
	05/12/98	65.9	7.04	619	2.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND
MW-6	06/06/96	N/A	N/A	N/A	3.47	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	03/16/98	N/A	N/A	N/A	N/A	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	05/12/98	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

D.O. = Dissolved oxygen
B.O.D. = Biochemical oxygen demand
C.O.D. = Chemical oxygen demand
TPPH = Total purgeable petroleum hydrocarbons
BTEX = Benzene, toluene, ethylbenzene, and xylenes
deg F = Degrees Fahrenheit
µmhos = Micromhos
mg/L = Milligrams per liter

µg/L = Micrograms per liter
NM = not measured
NS = Not sampled
ND = Not detected
N/A = Not available
* = Field measurements collected on November 2, 1995.
** = ORC installed following data collection.
† = From April 10, 1996 groundwater monitoring event.