Applied GeoSystems, Inc.
A RESNA Company

RESNA
Working To Restore Nature

3315 Almaden Expressway, Suite 34
San Jose, CA 95118
Phone: (408) 264-7723
Fax: (408) 264-2435

92 MAR -9 PM 2:10

TRANSMITTAL

TO: MS. SUSAN HUGO
ACHCSA-DEH
80 SWAN WAY, ROOM 200
OAKLAND, CALIFORNIA 94621

DATE: 4/6/92
PROJECT NUMBER: 60000.05
SUBJECT: ARCO STATION 771, 899 RINCON AVENUE, LIVERMORE, CALIFORNIA.

FROM: LOU LEET
TITLE: STAFF GEOLOGIST

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1	4/6/92	60000.05	FINAL-LETTER REPORT FOR FOURTH QUARTER 1991 GROUNDWATER MONITORING FOR THE ABOVE SUBJECT SITE.

THESE ARE TRANSMITTED as checked below:

[ ] For review and comment [ ] Approved as submitted [ ] Resubmit ___ copies for approval

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REMARKS: THIS REPORT HAS BEEN FORWARDED TO YOU AT THE REQUEST OF MR. MICHAEL WHELAN, ARCO PRODUCTS COMPANY.

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*Revision Date: 11/21/91
*File Name: TRANSMT.PRJ

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LETTER REPORT
QUARTERLY GROUNDWATER MONITORING
Fourth Quarter 1991
at
ARCO Station 771
899 Rincon Avenue
Livermore, California

60000.05

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April 5, 1992
0323CCAR
60000.05

Mr. Michael Whelan
ARCO Products Company
P.O. Box 5811
San Mateo, California 94402

Subject: Fourth Quarter 1991 Groundwater Monitoring Report for ARCO Station 771, 899 Rincon Avenue, Livermore, California.

Mr. Whelan:

As requested by ARCO Products Company (ARCO), this letter report summarizes the methods and results of fourth quarter 1991 groundwater monitoring performed by RESNA Industries, Inc. (RESNA) at the above-referenced site. The station is located on the southwestern corner of the intersection of Rincon Avenue and Pine Street in Livermore, California, as shown on the Site Vicinity Map, Plate 1. ARCO has requested that RESNA perform monthly water level measurements and quarterly groundwater sampling to monitor gasoline hydrocarbon concentrations associated with the gasoline-storage tanks at the site, and to evaluate trends related to fluctuations of these hydrocarbon concentrations.

Prior to this quarterly monitoring period, RESNA (formerly Applied GeoSystems [AGS]) performed environmental assessments and investigations related to the removal and replacement of four underground gasoline-storage tanks (USTs) at the site. In February 1990, RESNA performed an environmental site assessment (AGS, June 1990), which included the drilling of three borings (B-1 through B-3). In December 1990, RESNA performed a supplemental subsurface investigation which included three soil borings (B-4 through B-6) and installation of monitoring wells MW-1, MW-2, and MW-3 (AGS, April 1991). In January 1991, RESNA began quarterly monitoring of the onsite monitoring wells. In July 1991, RESNA performed an additional subsurface investigation which included soil borings (B-7 through B-11) and installation of monitoring wells MW-4 through MW-7 (RESNA, October 1991). The results of these environmental assessments and investigations are presented in the reports listed in the References Cited section located at the end of to this letter report. The locations of soil borings, groundwater monitoring wells, and pertinent site features are shown on the Generalized Site Plan, Plate 2.

Groundwater Sampling and Gradient Evaluation

RESNA personnel performed monthly monitoring of groundwater elevations and subjective analyses on October 30, November 13, and December 26, 1991; in addition, quarterly sampling was performed on October 30, 1991. Field work consisted of measuring depth-to-water (DTW) levels in wells MW-1 through MW-7, subjectively analyzing water from these wells for the presence of petroleum hydrocarbon sheen and floating product; removing floating product and sheen; and purging and sampling groundwater from monitoring wells MW-4, MW-6, and MW-7 for laboratory analysis. Wells MW-1, MW-2, and MW-5 were not sampled for laboratory analyses because the groundwater in these wells possessed floating product or sheen, and MW-3 was not sampled because the well was dry. The groundwater sampling protocol is presented in Appendix A.

The DTW levels, wellhead elevations, and groundwater elevations for this and previous groundwater monitoring at the site are summarized in Table 1. To estimate groundwater elevations in wells containing floating product we followed the procedure summarized in the Groundwater Sampling Protocol section in Appendix A. Groundwater elevations fluctuated up to 1.78 feet during this quarter. Groundwater elevations for wells MW-2 and MW-3 on November 13 and for wells MW-1 through MW-3 on October 30, 1991, were not determined because the wells contained [illegible] water, which appears to have collected in the slipcap at the bottom of the well pipe. This water does not appear to be representative of the local groundwater, and thus was not used to evaluate groundwater elevation. Interpretations of groundwater monitoring data indicated gradients of approximately 0.06 toward the north in October, 0.04 toward the north-northwest in November, and 0.03 toward the [illegible] northwest in December. These interpreted gradients are generally consistent with gradients interpreted from the third quarter groundwater monitoring data. Groundwater gradients for October 30, November 13, and December 26, 1991, are shown on the Groundwater Gradient Maps, Plates 3 through 5, respectively. Due to the uncertainty of estimating the depth to groundwater when free product is present (such as in wells MW-1, MW-2, and MW-5,) the gradients shown on Plates 5, 6, and 7 are considered approximate.

Subjective analyses of groundwater from the monitoring wells during this quarter indicated the presence of sheen in wells MW-2 and MW-5 and up to 0.20 feet of floating product in well MW-1. Subjective evidence of petroleum hydrocarbons was not observed in wells MW-3, MW-4, MW-6 and MW-7. Cumulative results of subjective analyses are presented in Table 1, Cumulative Groundwater Monitoring Data.

Monitoring wells MW-4, MW-6, and MW-7 were purged and sampled in accordance with the attached protocol (Appendix A). As mentioned previously, wells MW-1, MW-2, and MW-5 were not sampled due to the presence of free product or sheen. When present, free

product was bailed from the wells. Purge water was removed from the site by a licensed hazardous waste hauler. The Uniform Hazardous Waste Manifest that accompanied the purge water is attached in Appendix A.

Laboratory Analysis

Water samples collected from wells MW-4, MW-6, and MW-7 were sent to Sequoia Analytical in Redwood City, California (Hazardous Waste Testing Laboratory Certification No. 1210). The samples were analyzed for total petroleum hydrocarbons as gasoline (TPHg), and benzene, toluene, ethylbenzene, and total xylenes (BTEX) using modified Environmental Protection Agency (EPA) Methods 5030/8015/8020. The Chain of Custody Records and Laboratory Analysis Reports are attached in Appendix A. Results of these and previous water analyses are summarized in Table 2, Cumulative Results of Laboratory Analyses of Groundwater Samples. Concentration contours of TPHg and benzene are shown on Plates 6 and 7, respectively.

Results of this quarter's groundwater samples analyses indicate the following:

- TPHg was detected in groundwater at concentrations of 970 parts per billion (ppb) in MW-6, 19,000 ppb in MW-4, and 93,000 ppb in MW-7. TPHg concentrations have decreased in the groundwater from MW-4 and MW-6, and increased in the groundwater from MW-7 since the last quarterly monitoring.

- Benzene was detected in the groundwater at concentrations of 320 ppb in MW-4, 150 ppb in MW-6, and 1,800 ppb in MW-7. The concentrations of benzene in MW-4, MW-6, and MW-7 are greater than the Maximum Contaminant Level (MCL) of 1 ppb. Benzene concentrations have decreased in the groundwater from MW-4 and MW-6, and increased in the groundwater from MW-7 since the last quarterly monitoring.

- Toluene was detected in the groundwater at concentrations of 340 ppb in MW-4, 770 ppb in MW-7, and 4.4 ppb in MW-6. The concentrations of toluene in MW-4 and MW-7 are greater than the State Recommended Action Level (AL) of 100 ppb.

- Ethylbenzene was detected in the groundwater at concentrations of 780 ppb in well MW-7, 230 ppb in MW-4, and

4.9 ppb in MW-6. The concentration of ethylbenzene in MW-7 is greater than the MCL of 680 ppb.

- Total xylenes were detected in concentrations of 6,700 ppb in MW-7, 180 ppb in MW-4, and 6.6 ppb in MW-6. The concentration of total xylenes in MW-7 is greater than the MCL of 1,750 ppb.

Monitoring and Removal of Free Product

Floating product was measured and removed during monthly and quarterly monitoring. Quantities of floating product are presented in Table 3, Approximate Cumulative Product Recovered. The total recovered product for 1991 is approximately 2.77 gallons. As requested by ARCO, Horner EZY Floating Product Skimmers were installed in groundwater monitoring wells MW-1, MW-2, and MW-5 on January 8, 1992. During monthly site visits, product collected in the skimmers will be measured and removed. The skimmers will be adjusted according to changes in water elevations.

Conclusions and Recommendations

Groundwater at this site has been impacted by gasoline hydrocarbons. The extent of gasoline hydrocarbons has not been delineated. Because onsite monitoring wells situated near the southern and northwestern property boundaries possess floating product, sheen, or relatively high concentrations of petroleum hydrocarbon constituents it appears that the gasoline hydrocarbons may have migrated offsite. RESNA recommends continued monthly groundwater monitoring and quarterly groundwater sampling, including analyses for TPHg and BTEX; in addition, as requested by Ms. Susan Hugo of Alameda County Health Care Services Agency (ACHCSA), it is recommended that well MW-6 be analyzed for total oil and grease (TOG) and total petroleum hydrocarbons as diesel (TPHd). RESNA also recommends continued monthly product removal from the installed floating product skimmers and from any well containing floating product. Additional recommendations will be submitted under separate cover.

Schedule

As requested by ARCO, RESNA will continue to analyze monthly groundwater monitoring data and quarterly groundwater sampling results to evaluate changes in groundwater gradient over time and trends in gasoline hydrocarbons. RESNA will also continue to measure and remove floating product on a monthly basis. The next quarterly monitoring

episode is scheduled for March 1992. Underground gasoline-storage tanks and product delivery lines removal and replacement began in January 1992.

RESNA also recommends that copies of this letter report be forwarded to:

Ms. Susan Hugo
Alameda County Health Care Services Agency
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94621

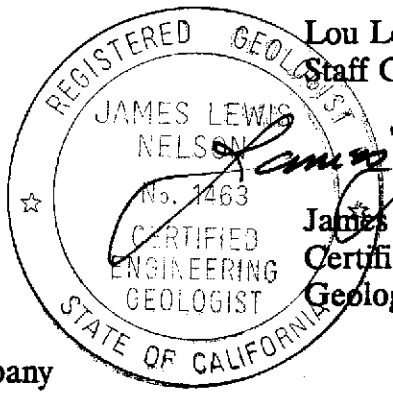
Mr. Eddy So
Regional Water Quality Control Board
San Francisco Bay Region
2101 Webster Street, Suite 500
Oakland, California 94612

Ms. Dannielle Stefani
Livermore Fire Department
4550 East Avenue
Livermore, California 94550

If you have any questions or comments, please call us at (408) 264-7723.

Sincerely,
RESNA

Lou Leet
Staff Geologist



James L. Nelson
Certified Engineering Geologist No. 1463

cc: W. C. Winsor, ARCO Product Company

Enclosures: References

Plate 1, Site Vicinity Map
Plate 2, Generalized Site Plan
Plate 3, Groundwater Gradient Map, October 30, 1991
Plate 4, Groundwater Gradient Map, November 13, 1991
Plate 5, Groundwater Gradient Map, December 26, 1991
Plate 6, TPHg Concentrations in Groundwater, October 30, 1991
Plate 7, Benzene Concentrations in Groundwater, October 30, 1991

Table 1, Cumulative Groundwater Monitoring Data
Table 2, Cumulative Results of Laboratory Analyses of Groundwater Samples
Table 3, Approximate Cumulative Product Recovered

Appendix A: Groundwater Sampling Protocol
Chain of Custody Record
Laboratory Analysis Reports
Uniform Hazardous Waste Manifest

REFERENCES CITED

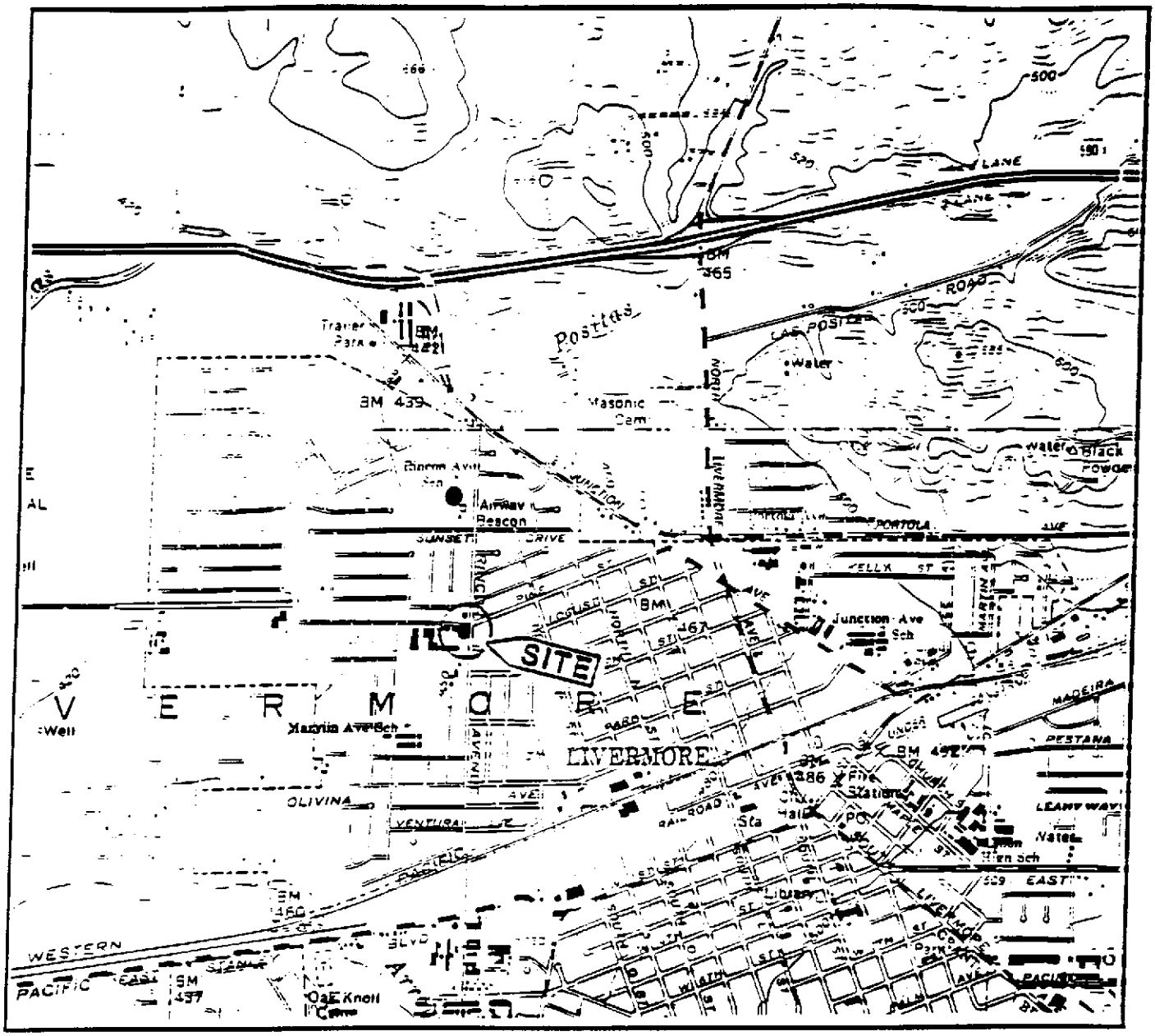
Applied GeoSystems, June 22, 1990. Limited Subsurface Environmental Assessment, ARCO Station No. 771, Livermore, California. AGS 60000-1.

RESNA/Applied Geosystems, April 12, 1991. Supplemental Subsurface Investigation at ARCO Station No. 771, Livermore, California. AGS 60000.

RESNA/Applied GeoSystems, July 12, 1991. Letter Report Quarterly Ground-Water Monitoring Second Quarter 1991 at ARCO Station 771, 899 Rincon Avenue, Livermore, California. AGS 60000.05

RESNA, October 17, 1991. Report on Additional Subsurface Investigation at ARCO Station 771, 899 Rincon Avenue, Livermore, California. 60000.06

RESNA, November 21, 1991. Letter Report Quarterly Ground-Water Monitoring Third Quarter 1991 at ARCO Station 771, 899 Rincon Avenue, Livermore, California. 60000.05



Base: U.S. Geological Survey
7.5-Minute Quadrangle
Livermore, California
Photorevised 1980

N

LEGEND

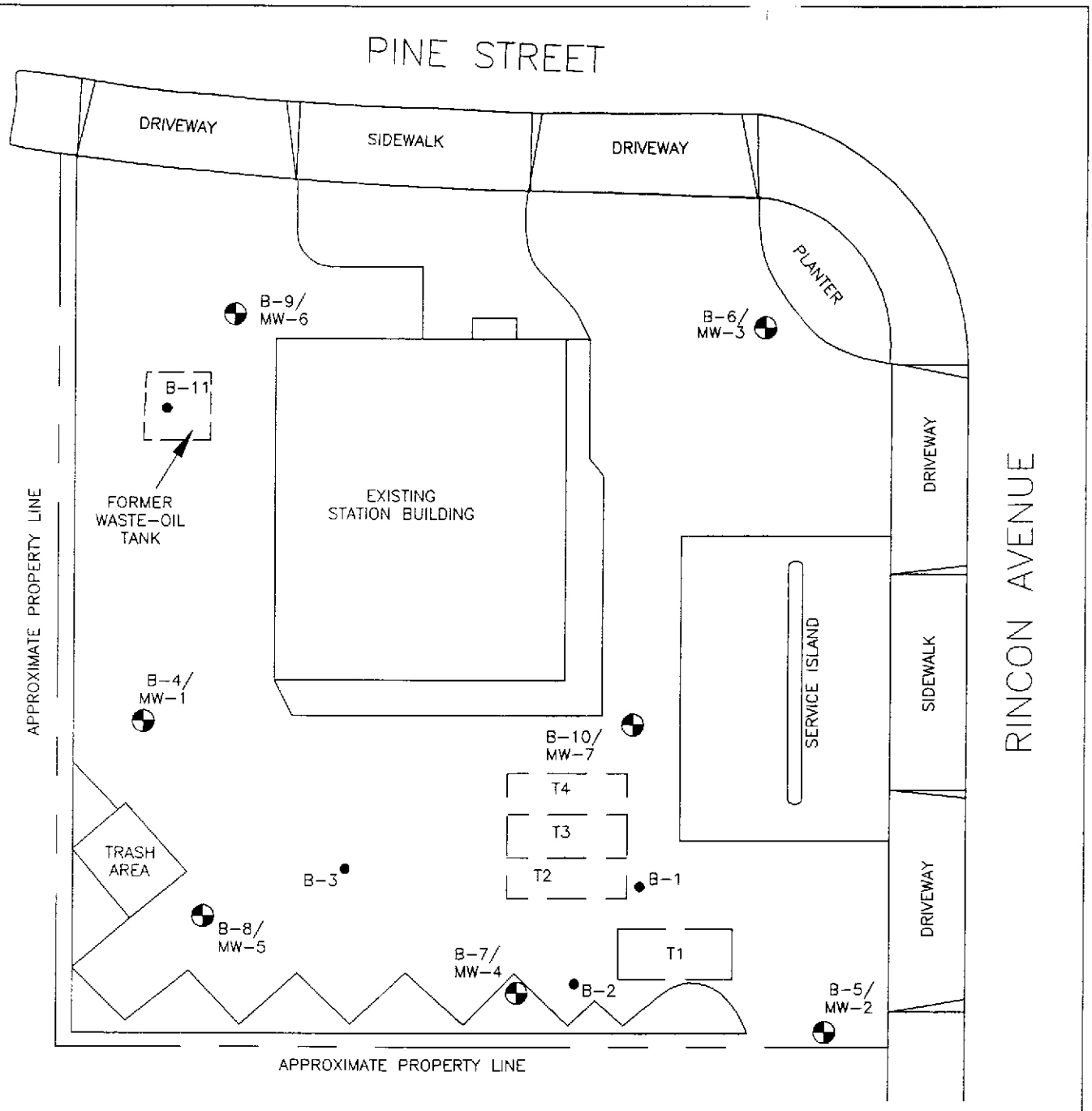
⊙ = Site Location

Approximate Scale

2000 1000 0 2000 4000

feet

RESNA	**SITE VICINITY MAP** **ARCO Station 771** **899 Rincon Avenue** **Livermore, California**	**PLATE** **1**
PROJECT 60000.05		



EXPLANATION

B-10/ MW-7 = Monitoring well (RESNA, December 1990, June and July 1991)

B-11 = Soil boring (RESNA, February 1990, July 1991)

T4 = Underground gasoline-storage tank

N

Approximate Scale

20 10 0 20 40

feet

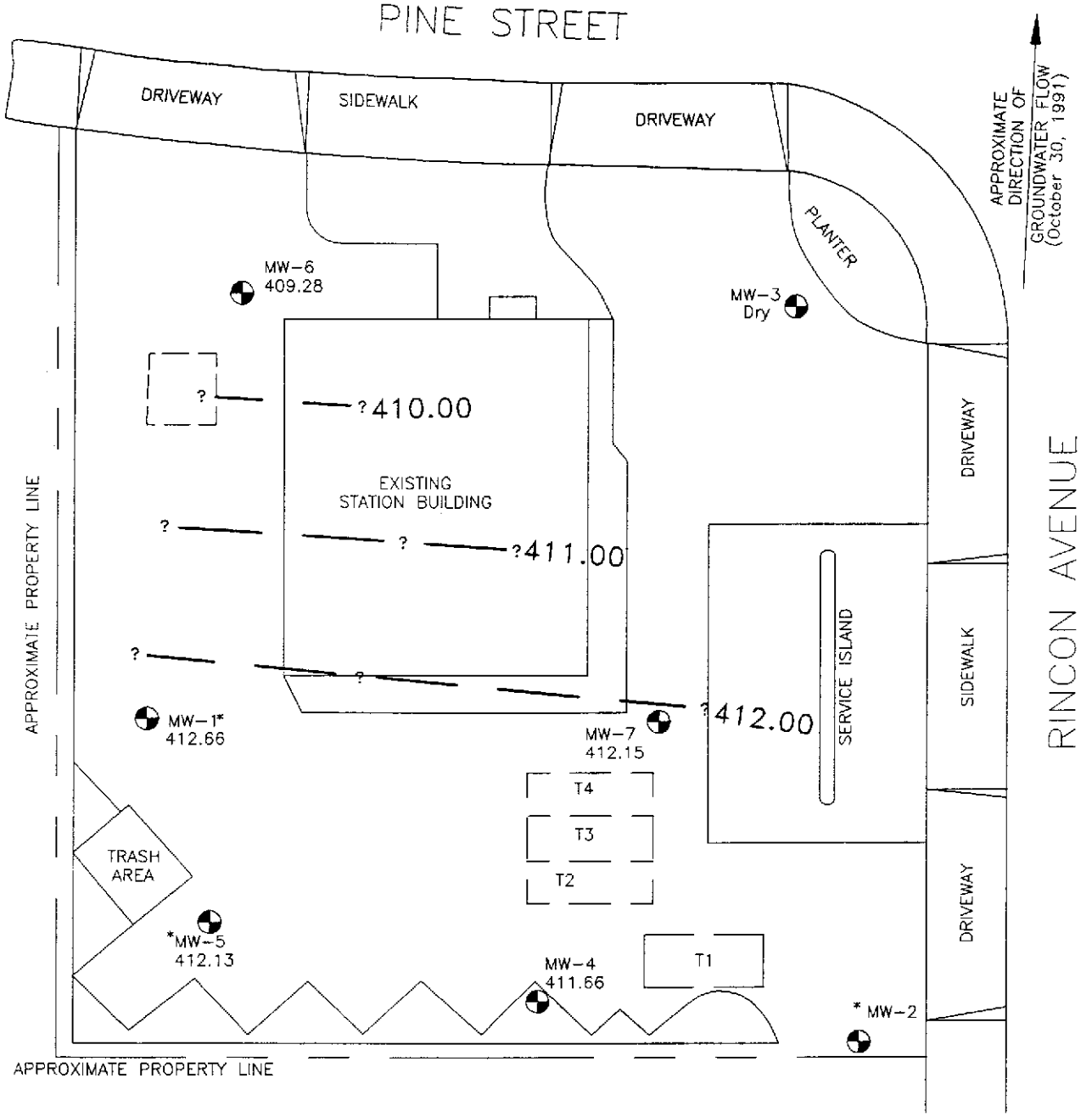
Source: Surveyed by John Koch, Licensed Land Surveyor.

RESNA

PROJECT 60000.05

GENERALIZED SITE PLAN
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 2



EXPLANATION

412.00 = Line of equal elevation of groundwater in feet above mean sea level (MSL)

412.66 = Elevation of groundwater in feet above MSL October 30, 1991

MW-7 = Monitoring well (RESNA, December 1990, June and July 1991)

T4 = Underground gasoline-storage tank

* = Product or product sheen

Approximate Scale

20 10 0 20 40

feet

NOTE: Groundwater monitoring well MW-2 was not used to interpret this groundwater gradient (see text for explanation).

Source: Surveyed by John Koch, Licensed Land Surveyor.

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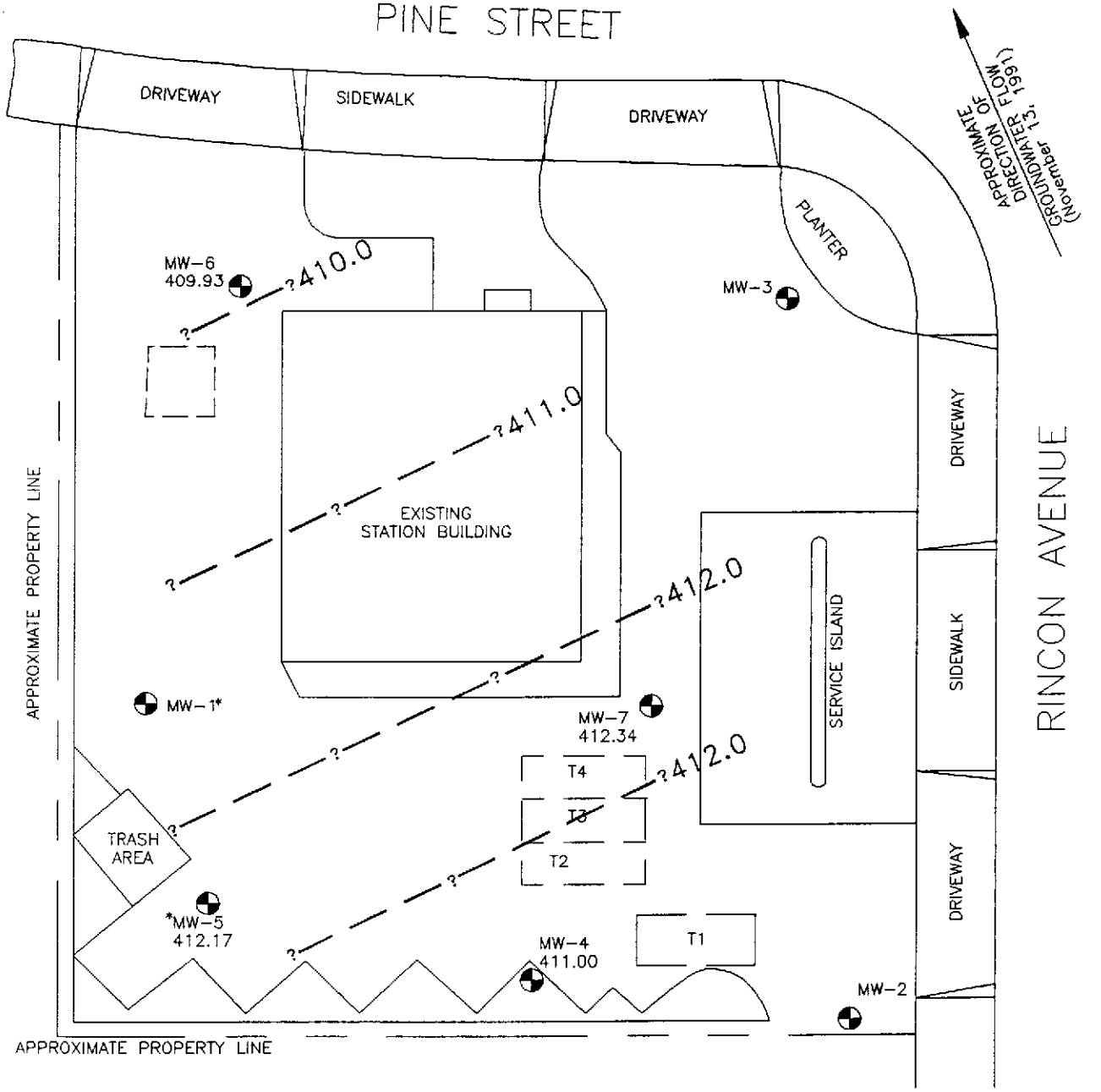
GROUNDWATER GRADIENT MAP
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 3



EXPLANATION

412.0 = Line of equal elevation of groundwater in feet above mean sea level (MSL)

412.34 = Elevation of groundwater in feet above MSL November 13, 1991

MW-7 = Monitoring well (RESNA, December 1990, June and July 1991)

T4 = Underground gasoline-storage tank

* = Product or product sheen

N

Approximate Scale

20 10 0 20 40

feet

Note: Groundwater monitoring wells MW-1, MW-2, and MW-3 were not used to interpret this groundwater gradient (see text for explanation).

Source: Surveyed by John Koch, Licensed Land Surveyor.

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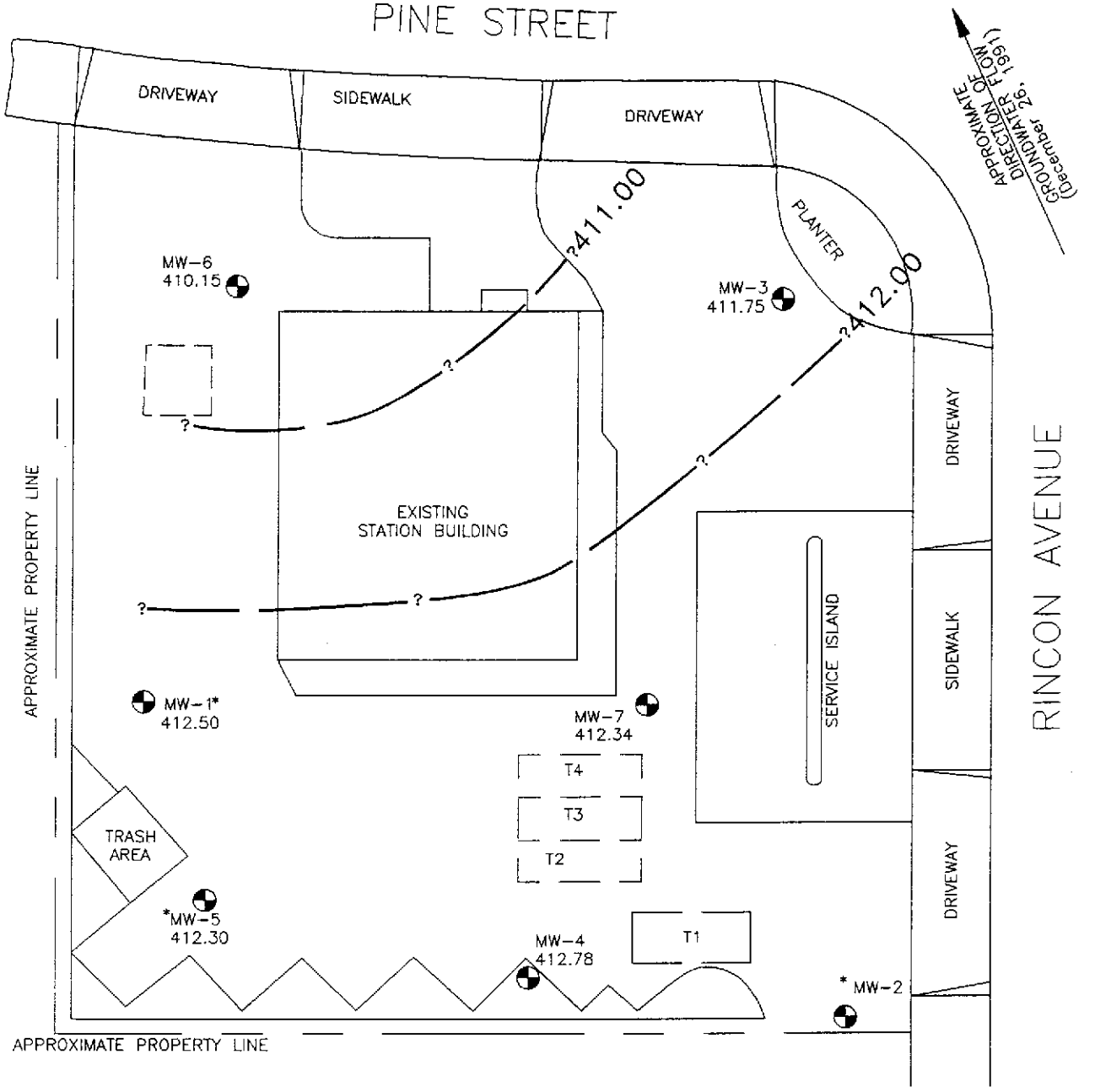
GROUNDWATER GRADIENT MAP
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 4



EXPLANATION

412.00 = Line of equal elevation of groundwater in feet above mean sea level (MSL)

412.78 = Elevation of groundwater in feet above MSL December 26, 1991

MW-7 = Monitoring well (RESNA, December 1990, June and July 1991)

T4 = Underground gasoline-storage tank

* = Product or product sheen

Approximate Scale

20 10 0 20 40

feet

NOTE: Groundwater monitoring well MW-2 was not used to interpret this groundwater gradient (see text for explanation).

Source: Surveyed by John Koch, Licensed Land Surveyor.

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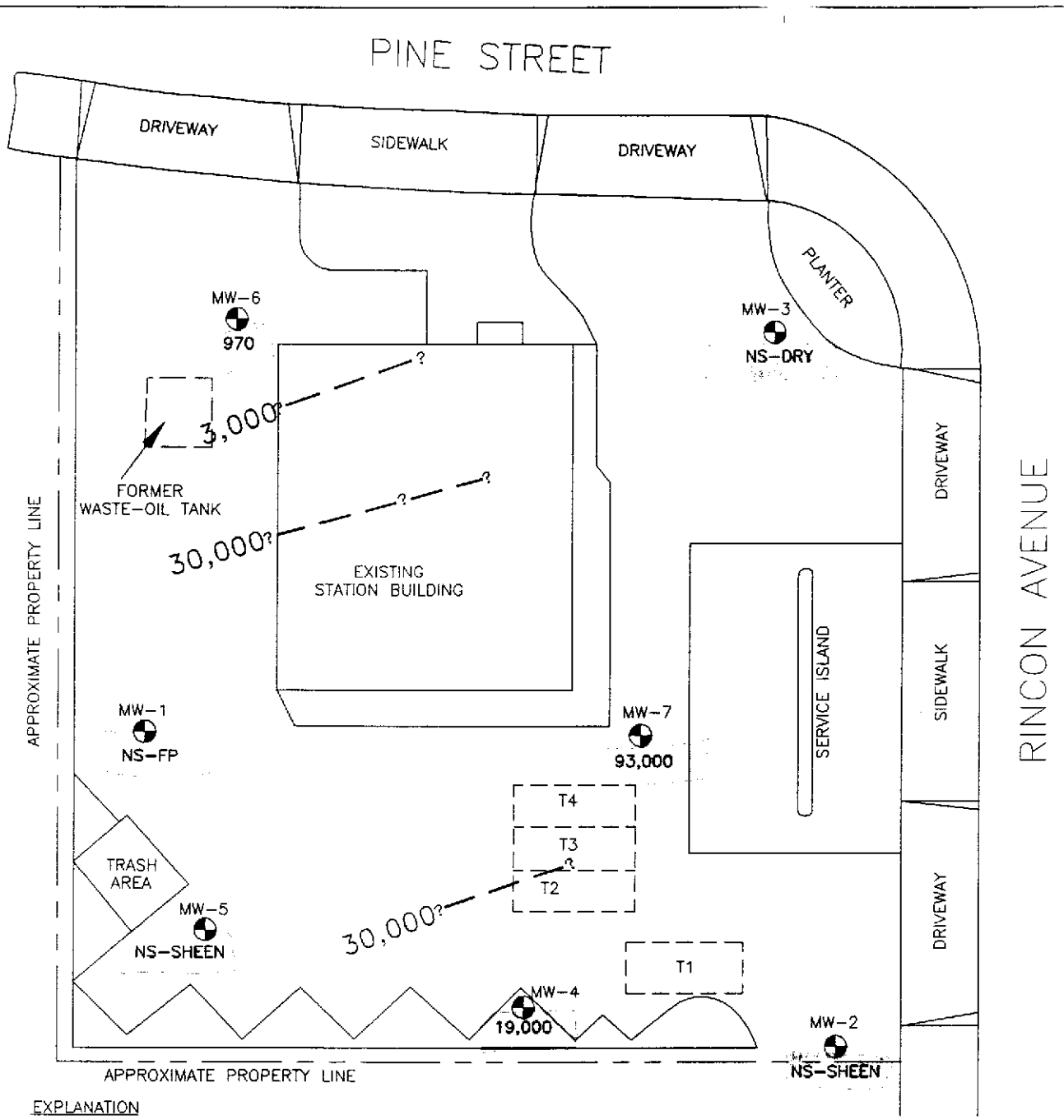
PROJECT 60000.05

GROUNDWATER GRADIENT MAP
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 5



EXPLANATION

30,000 = Line of equal concentration of TPHg in groundwater, in ppb

93,000 = Concentration of TPHg in groundwater, in ppb, October 30, 1991

MW-7 = Monitoring well (RESNA, December 1990, June and July 1991)

T4 = Underground gasoline-storage tank

NS = Not sampled due to presence of floating product or product sheen

FP = Floating Product

N

Approximate Scale

20 10 0 20 40

feet

Source: Surveyed by John Koch, Licensed Land Surveyor.

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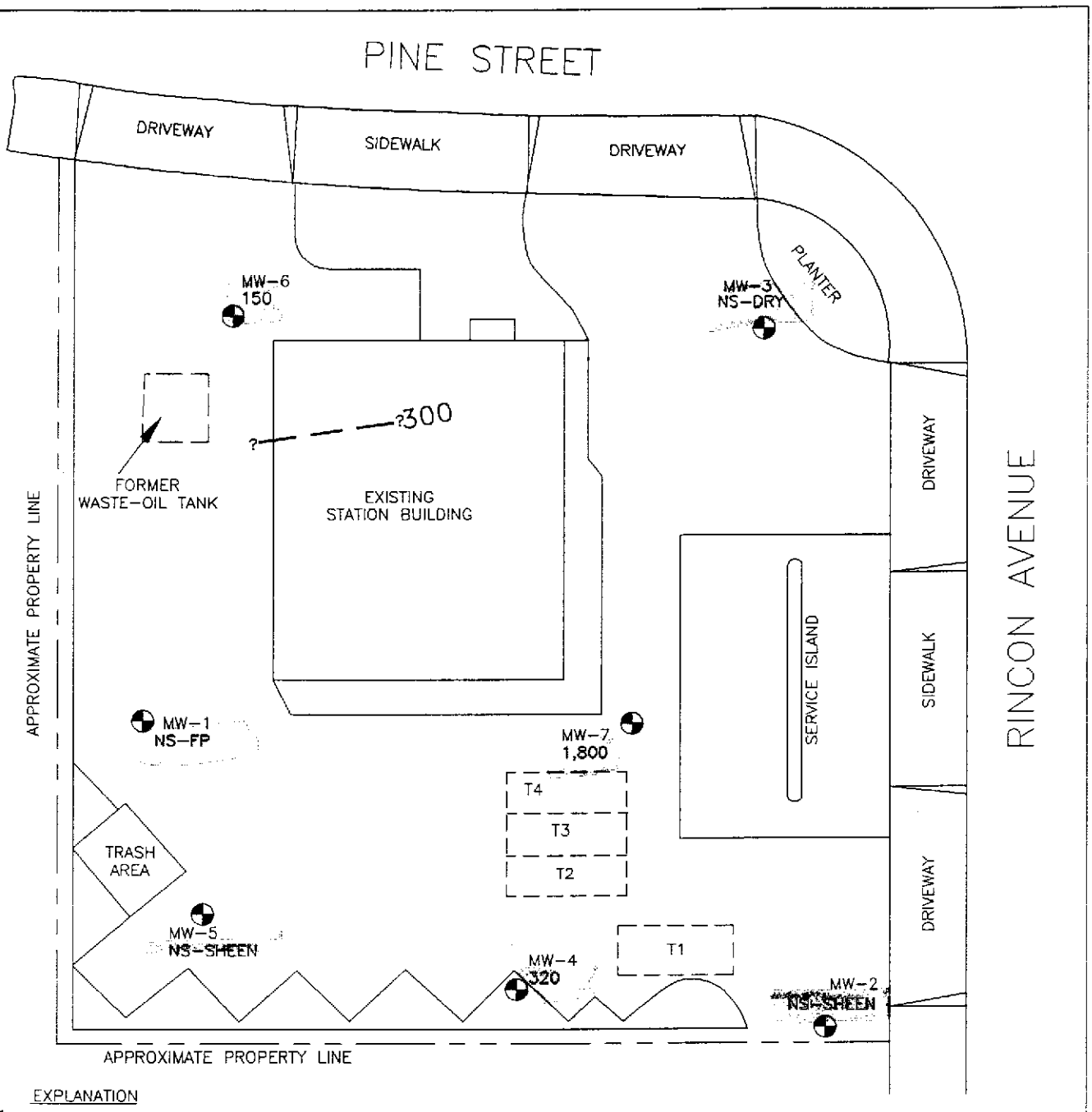
TPHg CONCENTRATIONS IN GROUNDWATER
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 6



EXPLANATION

300 = Line of equal concentration of Benzene in groundwater, in ppb

1,800 = Concentration of Benzene in groundwater, in ppb, October 30, 1991

MW-7 = Monitoring well (RESNA, December 1990, June and July 1991)

T4 = Underground gasoline-storage tank

NS = Not sampled due to presence of floating product or product sheen

FP = Floating product

Approximate Scale

20 10 0 20 40

feet

Source: Surveyed by John Koch, Licensed Land Surveyor.

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PROJECT 60000.05

BENZENE CONCENTRATIONS IN GROUNDWATER
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 7

TABLE 1
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 771
Livermore, California
(Page 1 of 2)

Well / Date	Well Elevation	Depth-to-Water	Water Elevation	Floating Product
MW-1				
01-15-91	451.80**	32.77	419.03	Sheen
02-27-91		32.23	419.57	None
03-20-91		27.38	424.42	Sheen
04-10-91		26.49	425.31	None
05-20-91	451.80***	NM	NM	Sheen
06-20-91		33.95	417.85	Sheen
07-25-91		36.59*	415.21*	0.10
08-13-91		37.72*	414.08*	0.20
09-12-91		39.25*	412.55*	0.23
10-30-91		39.14*	412.66*	0.20
11-13-91		Dry	Dry	None
12-26-91		39.30*	412.50	0.01
MW-2				
01-15-91	449.52**	30.89*	418.63*	0.16
02-27-91		29.11*	420.41*	0.02
03-20-91		24.57*	424.95*	0.02
04-10-91		22.85*	426.67*	0.05
05-20-91	449.51***	NM	NM	NM
06-20-91		31.42*	418.09*	0.15
07-25-91		33.69*	415.82*	0.49
08-13-91		34.80*	414.71*	0.47
09-12-91		36.39*	413.12*	0.45
10-30-91		Dry	Dry	None
11-13-91		Dry	Dry	None
12-26-91		36.45	413.06	Sheen
MW-3				
01-15-91	450.29**	32.34	417.95	None
02-27-91		31.78	418.51	None
03-20-91		27.74	422.55	None
04-10-91		25.05	425.24	None
05-20-91	450.28***	27.06	423.22	None
06-20-91		32.35	417.93	None
07-25-91		35.02	415.26	None
08-13-91		36.50	413.78	None
09-12-91		38.47	413.81	None
10-30-91		Dry	Dry	None
11-13-91		Dry	Dry	None
12-26-91		38.53	411.75	None

See notes on Page 2 of 2.

TABLE 1
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 771
Livermore, California
(Page 2 of 2)

Well / Date	Well Elevation	Depth-to-Water	Water Elevation	Floating Product
MW-4				
07-25-91	451.56***	36.07	415.49	None
08-13-91		37.54	414.02	None
09-12-91		38.73	412.83	None
10-10-91		39.90	411.66	None
11-13-91		40.56	411.00	None
12-26-91		38.78	412.78	None
MW-5				
07-25-91	451.41***	36.67	414.74	Sheen
08-13-91		37.98*	413.43*	0.01
09-12-91		39.01*	412.40*	0.05
10-30-91		38.28	412.13	Sheen
11-13-91		39.24	412.17	Sheen
12-26-91		39.11	412.30	Sheen
MW-6				
07-25-91	451.38***	37.68	413.70	None
08-13-91		39.17	412.21	None
09-12-91		41.14	410.24	None
10-30-91		42.10	409.28	None
11-13-91		41.45	409.93	None
12-26-91		41.23	410.15	None
MW-7				
07-25-91	450.65***	34.88	415.77	Sheen
08-13-91		36.17	414.48	None
09-12-91		37.81	412.84	None
10-30-91		38.50	412.15	None
11-13-91		38.31	412.34	None
12-26-91		37.90	412.75	None

Measurements in feet.
* = Floating product present in well; calculated DTW when floating product is present is calculated using the attached protocol (Appendix A).
** = Surveyed by Ron Archer, Civil Engineer, in January 1991.
*** = Surveyed by John Koch, Licensed Land Surveyor, in July 1991.
NM = Not measured (instrument failure–interface probe).

TABLE 2
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF GROUNDWATER SAMPLES
ARCO Station 771
Livermore, California

Sample	TPHg	B	T	E	X
MW-1					
01-15-91		Not sampled--sheen			
04-10-91	98,000	11,000	18,000	2,800	20,000
07-25-91		Not sampled--floating product			
10-30-91		Not sampled--floating product			
MW-2					
01-15-91		Not sampled--floating product			
04-10-91		Not sampled--floating product			
07-25-91		Not sampled--floating product			
10-30-91		Not sampled--sheen			
MW-3					
01-15-91	230	<0.5	<0.5	2.2	2.1
04-10-91	530	12	8.4	4.0	7.0
07-25-91	110	0.32	0.75	1.2	1.0
10-30-91		Not sampled--dry			
MW-4					
07-25-91	23,000	590	730	360	3,500
10-30-91	19,000	320	340	230	180
MW-5					
07-25-91	57,000	2,300	4,200	77	14,000
10-30-91		Not sampled--sheen			
MW-6					
07-25-91	10,000	3,000	200	340	1,000
10-30-91	970	150	4.4	4.9	6.6
MW-7					
07-25-91	45,000	1,500	2,700	1,200	9,200
10-30-91	93,000	1,800	770	780	6,700
MCLs	—	1	—	680	1,750
Als	—	—	100	—	—

Results in parts per billion (ppb).
TPHg: Total petroleum hydrocarbons as gasoline (measured by EPA Method 5030/8015).
B: Benzene T: toluene E: ethylbenzene X: total xylene isomers
BTEX: Measured by EPA Method 8020/602.
NS: Not sampled due to floating product or sheen.
<: Less than the laboratory detection limit.
MCL: State Maximum Contaminant Level in ppb.
AL: State Recommended Action Level in ppb.

TABLE 3
APPROXIMATE CUMULATIVE PRODUCT RECOVERED
ARCO Station 771
Livermore, California

Date	Floating Product Removed (gallons)
MW-1	
01-15-91	0.1 (sheen)
02-27-91	None present
03-20-91	0.1 (sheen)
04-10-91	None present
05-20-91	0.1 (sheen)
06-20-91	0.1 (sheen)
07-25-91	0.06
08-13-91	0.12
09-12-91	0.14
10-22-91	0.27
10-30-91	0.13
11-13-91	Dry
12-26-91	0.01
MW-2	
01-15-91	0.1
02-27-91	0.01
03-20-91	0.01
04-10-91	0.03
05-20-91	0.01
06-20-91	0.5
07-25-91	0.29
08-13-91	0.28
09-12-91	0.27
10-22-91	(sheen)
10-30-91	(sheen)
11-13-91	Dry
12-26-91	(sheen)
MW-5	
08-13-91	0.01
09-12-91	0.03
10-22-91	0.01
10-30-91	(sheen)
11-13-91	(sheen)
12-26-91	(sheen)
Total:	2.77 Gallons

APPENDIX A

GROUNDWATER SAMPLING PROTOCOL
CHAIN OF CUSTODY RECORD
LABORATORY ANALYSIS REPORTS
UNIFORM HAZARDOUS WASTE MANIFEST

GROUNDWATER SAMPLING PROTOCOL

The static water level in each well that contained water was measured with a Solinst® water-level indicator; this instrument is accurate to the nearest 0.01 foot. These groundwater depths were subtracted from wellhead elevations measured by Ron Archer, Civil Engineer, Inc., of Pleasanton, California, and John Koch of Oakland, California, licensed land surveyors, to calculate the differences in groundwater elevations.

The static water level in each well that was suspected to contain floating product was measured with an ORS® interface probe; this instrument is accurate to the nearest 0.01 foot. The probe contains two different sensor units, one for detecting the liquid/air interface, and one for distinguishing between water and hydrocarbon. The thickness of the floating product and the groundwater depths were recorded. The recorded thickness of the floating product was then multiplied by 0.80 to obtain an approximate value for the displacement of water by the floating product. This approximate displacement value is then subtracted from the measured depth to water to obtain a calculated depth to water. These calculated groundwater depths were subtracted from wellhead elevations to calculate the differences in groundwater elevations.

Water samples collected for subjective evaluation were collected by gently lowering approximately half the length of a new, disposable bailer past the air-water interface (if possible) and collecting a sample from near the surface of the water in the well. The samples were checked for evidence of free hydrocarbon product.

Before water samples were collected from the groundwater monitoring wells, the wells were purged until stabilization of the temperature, pH, and conductivity was obtained. Approximately 3 well casing volumes of water were purged before these characteristics stabilized. The quantity of water purged from the wells was calculated as follows:

1 well casing volume = $\pi r^2 h(7.48)$ where:

r = radius of the well casing in feet.

h = column of water in the well in feet (well depth - depth to water).

7.48 = conversion constant from cubic feet to gallons.

Gallons of water purged/gallons in 1 well casing volume = well casing volume removed.

After purging, each well was allowed to recharge to within 80% of the initial water level. Water samples were then collected with a new, disposable bailer. The water samples were

carefully poured into 40-milliliter glass vials, which were filled so as to produce a positive meniscus. Each sample container was preserved with hydrochloric acid, sealed with a cap containing a Teflon® septum, and subsequently examined for air bubbles to avoid headspace which would allow volatilization to occur. The samples were promptly transported in iced storage in a thermally-insulated ice chest, accompanied by a Chain of Custody Record, to a California-certified laboratory. Purge water was removed by H & H Ship Services, a licensed hazardous waste hauler. The Uniform Hazardous Waste Manifest is attached.

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 771-91-5

Chain of Custody

ARCO Facility no. 771-600000.05	City (Facility) LIVERMORE	Project manager (Consultant) JOEL COFFMAN / LOU LEET	Laboratory name SEQUOIA
ARCO engineer CHUCK CARMEL	Telephone no. (ARCO)	Telephone no. (Consultant) (408) 264-7723	Fax no. (Consultant) (408) 264-2435
Consultant name RESNA	Address (Consultant) 3315 ALMADEN EXPRESSWAY SUITE 34 SAN JOSE, CA		Contract number 07-073

Method of shipment: Sequoia Courier

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
W-39-MW7		3		X		X	X	10-30-91	15:02		X			1105914								
W-40-MW4		3		X		X	X	10-30-91	15:45		X			1105915								
W-42-MW6		3		X		X	X	10-30-91	16:00		X			1105916								

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number

Turnaround time

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☒

Condition of sample: good		Temperature received: Cool	
Relinquished by sampler: K. J. Leet	Date 10-31-91 Time 4 10	Received by: Don Doerge	
Relinquished by: Don Doerge	Date 10-31-91 Time 5:10	Received by:	
Relinquished by:	Date Time	Received by laboratory: K. Daniels	Date 10/31/91 Time 30

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

APPC-3292 (2-91)

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95112
Attention: Joel Coffman

Project: ARCO 771, Livermore

Enclosed are the results from 3 water samples received at Sequoia Analytical on October 31,1991. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
1105914	Water, W-39-MW7	10/30/91	EPA 5030/8015/8020
1105915	Water, W-40-MW4	10/30/91	EPA 5030/8015/8020
1105916	Water, W-42-MW6	10/30/91	EPA 5030/8015/8020

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Maria Lee

Maria Lee
Project Manager

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA	Client Project ID:	ARCO 771, Livermore	Sampled:	Oct 30, 1991
3315 Almaden Expwy., Suite 34	Matrix Descript:	Water	Received:	Oct 31, 1991
San Jose, CA 95112	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Nov 8-11, 1991
Attention: Joel Coffman	First Sample #:	110-5914	Reported:	Nov 13, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons µg/L (ppb)	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)
110-5914	W-39-MW7	93,000	1,800	770	780	6,700
110-5915	W-40-MW4	19,000	320	340	230	180
Detection Limits:		**12,000**	**120**	**120**	**120**	**120**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection. Because matrix effects and/or other factors required additional sample dilution, detection limits for this sample have been raised.

SEQUOIA ANALYTICAL

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA	Client Project ID:	ARCO 771, Livermore	Sampled:	Oct 30, 1991
3315 Almaden Expwy., Suite 34	Matrix Descript:	Water	Received:	Oct 31, 1991
San Jose, CA 95112	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Nov 7, 1991
Attention: Joel Coffman	First Sample #:	110-5916	Reported:	Nov 13, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons µg/L (ppb)	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)
110-5916	W-42-MW6	970	150	4.4	4.9	6.6
Detection Limits:		**300**	**3.0**	**3.0**	**3.0**	**3.0**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection. Because matrix effects and/or other factors required additional sample dilution, detection limits for this sample have been raised.

SEQUOIA ANALYTICAL

Maria Lee
Project Manager

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95112
Attention: Joel Coffman

Client Project ID: ARCO 771, Livermore
QC Sample Group: 110-5916
Reported: Nov 13, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	J. Jencks	J. Jencks	J. Jencks	J. Jencks
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Nov 7, 1991	Nov 7, 1991	Nov 7, 1991	Nov 7, 1991
QC Sample #:	GBLK110791	GBLK110791	GBLK110791	GBLK110791
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	30
Conc. Matrix Spike:	9.3	9.3	9.2	28
Matrix Spike % Recovery:	93	93	92	93
Conc. Matrix Spike Dup.:	9.0	9.1	9.0	27
Matrix Spike Duplicate % Recovery:	90	91	90	90
Relative % Difference:	3.3	2.2	2.2	3.6

SEQUOIA ANALYTICAL

Maria Lee
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95112
Attention: Joel Coffman

Client Project ID: ARCO 771, Livermore

QC Sample Group: 110-5915

Reported: Nov 13, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	A. Maralit	A. Maralit	A. Maralit	A. Maralit
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Nov 8, 1991	Nov 8, 1991	Nov 8, 1991	Nov 8, 1991
QC Sample #:	GBLK110891 MS/MSD	GBLK110891 MS/MSD	GBLK110891 MS/MSD	GBLK110891 MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	30
Conc. Matrix Spike:	10	10	10	31
Matrix Spike % Recovery:	100	100	100	103
Conc. Matrix Spike Dup.:	9.9	10	10	30
Matrix Spike Duplicate % Recovery:	99	100	100	100
Relative % Difference:	1.0	0.0	0.0	3.3

SEQUOIA ANALYTICAL

Maria Lee
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95112
Attention: Joel Coffman

Client Project ID: ARCO 771, Livermore

QC Sample Group: 110-5914

Reported: Nov 13, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	J. Jencks	J. Jencks	J. Jencks	J. Jencks
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Nov 11, 1991	Nov 11, 1991	Nov 11, 1991	Nov 11, 1991
QC Sample #:	GBLK111191 MS/MSD	GBLK111191 MS/MSD	GBLK111191 MS/MSD	GBLK111191 MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	30
Conc. Matrix Spike:	10	10	10	30
Matrix Spike % Recovery:	100	100	100	100
Conc. Matrix Spike Dup.:	10	9.8	9.8	30
Matrix Spike Duplicate % Recovery:	100	98	98	100
Relative % Difference:	0.0	2.0	2.0	0.0

SEQUOIA ANALYTICAL

Maria Lee
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

See Instructions on back of page 6.

Toxic Substances Control Program
Sacramento, California

Print or type. Form designed for use on elite (12-pitch typewriter).

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CAL000028370
Manifest Document No.: 00004
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
ARCO
P. O. Box 5811, San Mateo, CA 94402
4. Generator's Phone (415) 571-2434/571-2428

A. State Manifest Document Number: 91507457
B. State Generator's ID: HTH036-015660

5. Transporter 1 Company Name: H & H Ship Service Company
6. US EPA ID Number: CAD047711168
C. State Transporter's ID: 200587
D. Transporter's Phone: (415) 543-4835

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID
F. Transporter's Phone

9. Designated Facility Name and Site Address
H & H Ship Service Company
220 China Basin Street
San Francisco, CA 94107
10. US EPA ID Number: CAD047711168
G. State Facility's ID: CAD047711168
H. Facility's Phone: (415) 543-4835

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. OIL AND WATER NON-RCRA HAZARDOUS WASTE LIQUID	001	TT	00010	G	State: 134.135 EPA/Other:
b.					State: EPA/Other:
c.					State: EPA/Other:
d.					State: EPA/Other:

J. Additional Descriptions for Materials Listed Above
FUEL, OIL AND WATER
PROFILE #A0854

K. Handling Codes for Wastes Listed Above
a. 01
b.
c.
d.

15. Special Handling Instructions and Additional Information
JOB #9709
24 Hr. Emergency Contact: H & H #(415) 543-4835
APPROPRIATE PROTECTIVE CLOTHING AND RESPIRATOR.
JOB SITE: ARCO STATION, #0771
899 Rincon Avenue
Livermore, California

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

GENERATOR

Printed/Typed Name	Signature	Month	Day	Year
x AGENT for ARCO / EZEQUIEL C.		11	27	91

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
EDWARD G. MILANO	Edward G. Milano	11	27	91

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in item 19.

Printed/Typed Name	Signature	Month	Day	Year

DO NOT WRITE BELOW THIS LINE.

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

91507457

DHS 8022A (12/90)
EPA 8700—22

Blue: GENERATOR SENDS THIS COPY TO DHS WITHIN 30 DAYS.
To: P.O. Box 400, Sacramento, CA 95812-0400