RESNA
Working To Restore Nature

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

TRANSMITTAL

Scott Seery

TO: ~~Mr. Rob Weston~~
Alameda County Health Care Services
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94612

DATE: June 10, 1993
PROJECT NUMBER: 62019.05
SUBJECT: ARCO Station No. 2162

FROM: Erin McLucas, Staff Geologist

WE ARE SENDING YOU:

COPIES	DATED	DESCRIPTION
1	6/8/93	Final Work Plan to perform an Additional Subsurface Investigation at ARCO Station No. 2162, 15135 Hesperian Boulevard, San Leandro, California.

THESE ARE TRANSMITTED as checked below:

[ ] For review and comment	[ ] Approved as submitted	[ ] Resubmit ___ copies for approval
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REMARKS:
Copies: 1 to RESNA project file no. 62019.05

Erin D. McLucas
Erin McLucas, Staff Geologist

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WORK PLAN
for
ADDITIONAL SUBSURFACE INVESTIGATION
at
ARCO Station 2162
15135 Hesperian Boulevard
San Leandro, California

62019.05

Prepared for
ARCO Products Company
P.O. Box 5811
San Mateo, California
by
RESNA Industries Inc.

June 7, 1993

Erin McLucas
Staff Geologist

John C. Young
Project Manager

James Nelson
Certified Engineering
Geologist No. 1463

REGISTERED GEOLOGIST
JAMES LEWIS NELSON
No. 1463
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

June 7, 1993

RESNA
Working To Restore Nature

3315 Almaden Expressway, Suite 34
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Phone: (408) 264-7723
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August 17, 1993
ssrysampl
62019.05

Mr. Scott Seery
Alameda County Health Care Services Agency
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94621

Subject: Addition to Work Plan for Additional Subsurface Investigation at ARCO Station 2162, 15135 Hesperian Boulevard, San Leandro, California.

Dear Mr. Seery:

As per your letter dated August 4, 1993, and our telephone conversation on August 5, 1993, RESNA Industries Inc. (RESNA) will submit selected soil and groundwater samples from proposed boring/well B-9/MW-5 for laboratory analysis for semi-volatile organic compounds (SVOC) using EPA Method 8270. If no SVOCs are detected in soil or groundwater during this drilling or groundwater sampling event, we will discontinue analysis for these compounds.

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

Sincerely.
RESNA Industries Inc.

Erin McLucas
Staff Geologist

cc: Mike Whelan, ARCO Products Company
John C. Young, RESNA

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Working To Restore Nature

93 AUG 20 PM 1:21

3315 Almaden Expressway, Suite 34
San Jose, CA 95118
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TRANSMITTAL

TO: Mr. Scott Seery
Alameda County Health Care Services
Department of Environmental Health
80 Swan Way, Room 200
Oakland, CA 94621

DATE: August 18, 1993
PROJECT NUMBER: 62019.05
SUBJECT: ARCO Station No. 2162

FROM: Erin McLucas

WE ARE SENDING YOU:

COPIES	DATED	DESCRIPTION
1	8/17/93	Addition to Work Plan for Additional Subsurface Investigation at ARCO Station No. 2162 15135 Hesperian Boulevard, San Leandro, California.

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REMARKS:
Copies: 1 to RESNA project file no. 62019.05

Erin McLucas, Staff Geologist

cc: Mr. Michael Whelan, ARCO Products Company
Mr. John Young, RESNA Industries Inc.

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3315 Almaden Expressway, Suite 34
San Jose, CA 95118
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WORK PLAN
for
ADDITIONAL SUBSURFACE INVESTIGATION
at
ARCO Station 2162
15135 Hesperian Boulevard
San Leandro, California

INTRODUCTION

At the request of ARCO Products Company (ARCO), RESNA Industries Inc. (RESNA) has prepared this Work Plan to perform an Additional Subsurface Investigation at the above referenced subject site for submittal to the Regional Water Quality Control Board (RWQCB), the Alameda County Health Care Services Agency (ACHCSA) and the City of San Leandro Fire Department (SLFD). The location of the subject site is shown on the Site Vicinity Map, Plate 1. The purpose of this additional subsurface investigation is to further evaluate the lateral and vertical extents of gasoline hydrocarbons in the soil and groundwater beneath the site and beneath the adjacent offsite to evaluate the gradient and flow direction of the first encountered groundwater. This Work Plan was initiated after gasoline hydrocarbons were encountered in the soil and groundwater during preliminary tank replacement assessment (ROUX, August 1991) and during RESNA's subsurface environmental investigation (RESNA, March 1993) and ongoing quarterly groundwater sampling.

RESNA's recommended approach and project tasks for this subsurface investigation include: obtaining permits and offsite access for three offsite wells from public and private owners; drilling and collecting soil samples for description and possible laboratory analyses from one onsite soil boring (B-9) and three offsite soil borings (B-10 through B-12); installing one 4-inch diameter groundwater monitoring well (MW-5) in boring B-9 and three 2-inch diameter groundwater monitoring wells (MW-6 through MW-8) in borings B-10 through B-12, as shown on Plate 2, Proposed Boring/Monitoring Well Locations; submitting selected soil samples to a State-certified laboratory for analyses; surveying the wells for top-of-casing elevations; developing the new wells; sampling the groundwater in the new wells; performing a well survey of wells within ½- mile radius of the site; conducting a records search; and preparing a report summarizing our findings, interpretations, and conclusions.

SITE DESCRIPTION AND BACKGROUND

General

ARCO Station 2162 is an operating auto repair and self-service gasoline station located in a residential area on the southwestern corner of the intersection of Hesperian Boulevard and Ruth Court in San Leandro, California. The location of the site is shown on the Site Vicinity Map, Plate 1. The site is at an elevation of approximately 30 feet above mean sea level (msl), and consists of a predominantly flat concrete- and asphalt-covered lot, which slopes gently (less than 1 percent) toward the southwest (U.S. Geological Survey, 1968). In December 1991, one 6,000-gallon steel gasoline underground storage tank (UST), two 8,000-gallon steel USTs, and one 12,000-gallon fiberglass UST (previously designated as T1 through T4) were removed and replaced with four 10,000-gallon double-walled fiberglass USTs at the subject site. Product delivery lines were also removed and replaced with double-walled product delivery lines. A 560-gallon underground waste-oil-storage tank was also removed and replaced with a 600-gallon underground waste-oil-storage tank during the same period. The locations of the newly installed tanks and other pertinent facilities at the site are shown on the Generalized Site Plan, Plate 2.

Regional Geology and Hydrogeology

The subject site is located on the East Bay Plain; an area of generally low relief lying between the San Francisco Bay to the west and the hills of the Diablo Range to the east. The eastern boundary of the plain in the San Leandro area is marked by the active Hayward Fault, which is located along the base of the Diablo Range escarpment. The Hayward Fault is a known groundwater barrier which locally influences groundwater flow near the base of the hills (Maslonkowski, 1984).

The East Bay Plain is underlain by about 1,000 feet of unconsolidated Quaternary sediments, consisting mostly of alluvial sand and silt deposits, and clay and silt deposited in shoreline and estuarine environments. The alluvial deposits consist of large coalescing fans (cones) of debris transported by streams and creeks that drained from the Diablo Range (Hickenbottom and Muir, 1988). The soils in the vicinity of the subject site have been mapped as younger alluviui deposits of The San Leandro Cone (Maslonkowski, 1984) and consist of unconsolidated clay, silt, sand and gravel (Helley and Lajoic, 1979).

Recharge to the groundwater in the area occurs mainly as a result of direct precipitation that falls on the plain and the adjacent hills. Water reaches the groundwater reservoir through seepage from streams, infiltration through the soil, and subsurface inflow from adjacent areas and bedrock units.

PREVIOUS ENVIRONMENTAL WORK

Preliminary Tank Replacement Assessment

A preliminary tank replacement assessment was conducted at the site by Roux on June 5, 1991 (Roux, August 28, 1991). This investigation included drilling and sampling seven borings and installing two vapor extraction wells as follows: five soil borings (B-1, B-1A through B-4) were drilled and sampled in the UST pit and upgradient, crossgradient, and downgradient of the USTs; two vapor extraction wells (VW-1 and VW-2) were installed on the southern portion of the site, downgradient of the USTs and the pump islands. Soil samples collected from the borings were monitored with an organic vapor meter (OVM) and selected soil samples were submitted to a State-certified laboratory for analysis under Chain of Custody protocol. The locations of the borings and vapor wells are shown on Plate 2.

The soil borings were drilled to total depths of between 9½ and 15 feet and the vapor extraction wells VW-1 and VW-2 were installed at a depth of 9 feet. Soil encountered in the borings consisted of interbedded silt and silty clay from ground surface to depths between 7 and 9 feet. A sand and gravel unit was encountered beneath the silt and clay unit. Groundwater was encountered in the borings at depths between 9 and 10 feet. A silt unit underlying the sand and gravel unit was encountered in boring B-4 at a depth of 13 feet (Roux, August 28, 1991).

Analytical results of a soil sample collected from boring B-1, located near the northeastern perimeter of the UST pit and generally upgradient, indicated nondetectable total petroleum hydrocarbons as gasoline (TPHg)(less than 1.0 part per million [ppm]) and benzene, toluene, ethylbenzene, and total xylenes (BTEX) (less than 0.0050 ppm). Analytical results of soil samples collected from boring B-4, located near the southeastern perimeter of the UST pit and generally crossgradient, indicated 2,400 ppm TPHg, 17 ppm benzene, 62 ppm toluene, 41 ppm ethylbenzene, and 260 ppm total xylenes at a depth of 7½ feet. Analytical results of soil samples collected from boring B-3, located directly southwest of the USTs indicated 1,400 ppm TPHg, 2.5 ppm benzene, 4.4 ppm toluene, 29 ppm ethylbenzene, and 190 ppm total xylenes at a depth of 7½ feet. Analytical results of soil samples collected directly

above first encountered groundwater at depths between 7½ and 9 feet from the boring for VW-1, located south of the pump islands, and in boring B-1A, located northeast of the USTs indicated detectable concentrations of TPHg and BTEX at depths of 7½ and 9 feet, just above first-encountered groundwater. The results of the laboratory analyses of soil samples from borings B-1, B-1A through B-4 and VW-1 are shown in Table 1, Cumulative Results of Laboratory Analyses of Soil Samples. No soil samples were analyzed from the boring for VW-2.

Limited Soil Performance Test

A "limited soil performance test" (LSPT) was performed onsite on June 6, 1991, by Roux (Roux, August 28, 1991). The LSPT was performed to evaluate the efficiency and practicality of vapor extraction as a soil and groundwater remediation alternative and to evaluate the most appropriate off-gas treatment alternative. During the LSPT, vapor extraction well VW-1 was used as the extraction well and well VW-2 was used as the observation well. No air samples were taken during the LSPT.

Based on the results of their LSPT, Roux estimated the radius of vacuum impact to be less than 20 feet at a flow rate of 260 cubic feet per hour or 3.6 cubic feet per minute (CFM). No influence was recorded in vapor extraction well VW-2 after 70 minutes. Roux concluded that at the screened depth of the vapor extraction wells, the silty clays beneath the site are not amenable to vapor extraction remediation techniques.

Underground Storage Tank Removal and Replacement

The gasoline and waste-oil USTs, and product lines were removed and replaced between December 1991 and February 1992 (Roux, July 7, 1992). The locations of the former UST and product line excavations are shown on Plate 2.

Soil samples were collected from the tank pit sidewalls and beneath the product lines and analyzed for TPHg and BTEX. Except for sample L-5, most of the seven product line trench bottom samples (L-1 through L-7) contained TPHg concentrations less than 20 ppm; sample L-5 contained a TPHg concentration of 110 ppm at a depth of 3 feet. Sidewall samples in the former tank pit excavation (SW-1 through SW-5) contained TPHg concentrations ranging from 140 ppm (SW-2) on the southwest sidewall at a depth of 10 feet, to 1,000 ppm (SW-5) in the northeast sidewall at a depth of 10 feet. One soil sample (WO-1) was obtained at a depth of approximately 10 feet beneath the former waste-oil tank

and analyzed for TPHg and total petroleum hydrocarbons as diesel (TPHd), BTEX, volatile organic compounds (VOCs), total oil and grease (TOG), and The Waste Extraction Test (WET) for cadmium (Cd), chromium (Cr), lead (Pb), nickel (Ni), and zinc (Zn) as described in the California Administrative Code, Title 22. The analytical results of sample WO-1 indicated concentrations of TPHg at 310 ppm, TPHd at 360 ppm, total BTEX at 17.48 ppm, TOG at 270 ppm, and WET constituents Cr at 49 ppm, Pb at 5.2 ppm, Ni at 59 ppm, and Zn at 58 ppm. VOCs and Cd were nondetectable.

As part of the tank replacement activities, piping for use in possible future remediation systems was also installed at the site.

Subsurface Investigation

After obtaining the proper permits, a subsurface investigation was performed by RESNA field personnel on September 8, 1992. The purpose of the investigation was to evaluate the vertical and lateral extent of gasoline hydrocarbons in soil and first-encountered groundwater and to evaluate the groundwater gradient and flow direction of groundwater beneath the site. Four borings were drilled at the northwestern, northeastern, southeastern, and southwestern corners of the site (B-5 through B-8, respectively) to total depths of between approximately 18½ and 21 feet. The borings were completed as 4-inch diameter groundwater monitoring wells MW-1 through MW-4, respectively.

Three lithologic units were encountered at the site. Beneath a section of asphalt and baserock covering the site, a clayey silty unit approximately 6 feet thick was encountered. **Underlying the clayey silt was a sandy silt to sandy gravel water-bearing unit between the depths of approximately 8 and 18½ feet.** The water-bearing unit was underlain by a potential perching silty clay to clayey silt unit of unknown thickness. Groundwater was first encountered within the silty sand to gravel unit at depths between approximately 10 and 11 feet. **The local groundwater appears to be unconfined due to the absence of an upper confining layer** and the apparent drop of static water levels below measured initial water levels in most of the completed wells.

Based on the results of this and previous environmental investigations, RESNA concluded the following:

- **The majority of gasoline hydrocarbons in the soil at the site appear to be located in the capillary fringe zone above first encountered groundwater at depths of approximately 5 to 7½ feet** below ground surface in the northern portion of the site, in the vicinity of, and crossgradient from, the former USTs; and

- Gasoline hydrocarbons appear to have been laterally delineated in the soil to less than 1.0 ppm TPHg and less than 0.0050 ppm BTEX in the vicinity of boring B-7, located in the southeastern corner of the site. Gasoline hydrocarbons appear to have been vertically delineated in the soil to less than 1.0 ppm TPHg in the vadose zone (at depths between 0 and 5 feet) and in the potential perching unit underlying the water bearing zone (at depths between 16½ and 18½ feet) in the northeastern, southeastern, and southwestern portions of the site and in the vadose zone in the northwestern portion of the site.

Monthly Groundwater Monitoring and Quarterly Sampling

The objectives of quarterly groundwater monitoring and quarterly sampling are to evaluate: 1) changes in the groundwater flow direction and gradient; and 2) changes in concentration of petroleum hydrocarbons in the local groundwater associated with the former gasoline USTs at the site.

RESNA initiated monthly groundwater monitoring of wells MW-1 through MW-4 on September 30, 1992 (RESNA, February 4, 1993). The interpreted groundwater gradient and flow direction was approximately 0.01 to the southwest. The DTW measurements and calculated water elevations are presented in Cumulative Groundwater Monitoring Data, Table 2.

Quarterly groundwater sampling was initiated by ARCO's contractor, EMCON Associates (EMCON), on October 16, 1992. The results of the laboratory analyses of samples are listed in Cumulative Results of Laboratory Analyses of Groundwater Samples, Table 3.

RESNA's interpretation of field and laboratory analyses data, which included evaluating trends in reported hydrocarbon concentrations in the local groundwater, the groundwater gradient, and direction of groundwater flow beneath the site are included in the Quarterly Groundwater Monitoring Reports listed in the References section of this Work Plan.

PROPOSED WORK

RESNA proposes the following project Steps 1 through 11 listed below as a method to evaluate the lateral and vertical extent of gasoline hydrocarbons in soil and groundwater in the area surrounding the subject site. Field work proposed in this Work Plan will be performed in accordance with the attached RESNA Field Protocol in Appendix A, and a site specific site safety plan.

RESNA recommends the following work at the site based on findings from previous investigations:

Step 1 Upon gaining regulatory approval of this Work Plan, submit a letter to the owner(s) of the adjacent property (west of ARCO Station 2162) requesting access to drill and install two groundwater monitoring wells (B-10/MW-6 and B-11/MW-7). Submit an excavation permit to the City of San Leandro for drilling and installation of groundwater monitoring well B-12/MW-8, and submit a well permit application to the Alameda County Flood Control and Water Conservation District (ACFCWCD) Zone 7.

Step 2 Update the Site Specific Safety Plan.

Step 3 Once offsite access and appropriate permits have been granted, drill and obtain soil samples for classification and possible laboratory analyses from four borings (B-9 through B-12) as shown on Plate 2. The borings will be drilled down into a possible confining layer beneath first encountered groundwater (total depths of approximately 30 feet). Install one 4-inch-diameter groundwater monitoring well (MW-5) in boring B-9 and three 2-inch diameter groundwater monitoring wells (MW-6 through MW-8) in borings B-10 through B-12, respectively. Submit selected soil samples from borings B-9 through B-12 to a State-certified laboratory for analyses for total petroleum hydrocarbons as gasoline (TPHg) and benzene, toluene, ethylbenzene, and total xylenes (BTEX) using Environmental

TPH-D
TPH-G
VOC
TOG
metals
(SIOC?)

Protection Agency (EPA) Methods 5030/8015/8020. Soil samples from boring B-9, located downgradient of the former waste-oil tank, will also be submitted for analyses of volatile organic compounds (VOCs) using EPA Method 8240, TOG using Standard Methods 5520D&F, total petroleum hydrocarbons as diesel (TPHd) using EPA Methods 3550/8015, and metals cadmium (Cd), chromium (Cr), lead (Pb), nickel (Ni), and zinc (Zn) using EPA Method 6010. Chain-of-Custody protocol will be followed for all samples submitted for analyses.

In the event that offsite access is not granted from adjacent private property owners to drill and install offsite wells B-10/MW-6 and B-11/MW-7, onsite boring B-9 and offsite boring B-12 will be drilled and groundwater wells MW-5 and MW-8 will be installed.

Step 4 Survey wellhead elevations to a U.S. Coast and Geodetic Survey Datum, by a State licensed surveyor.

Step 5 Develop monitoring wells MW-5 through MW-8.

Step 6 Measure depths-to-water levels (DTW), purge, and collect groundwater samples from monitoring wells MW-5 through MW-8. Submit groundwater samples from the wells to a State-certified laboratory for analysis for TPHg and BTEX using EPA Method 5030/8015/602. Groundwater samples from well MW-5 will also be submitted for analyses of VOCs using EPA Method 8240, TOG using Method 5520C&F, TPHd using EPA methods 3510/DHS LUFT Method, and metals Cd, Cr, Pb, Ni, and Zn using EPA Method 6010. Chain-of-Custody protocol will be followed for all samples submitted for analyses.

Step 7 Conduct a survey of public records to locate wells within a ½-mile radius of the site. The survey information, if available, will include well depth, well construction details, DTW measurements, owners, and well type (domestic supply, irrigation, commercial, cathodic, groundwater monitoring, and abandoned wells).

Step 8 Conduct a records search to identify potential offsite sources of hydrocarbons detected in the soil and groundwater at the subject site.

The search will consist of reviewing historical aerial photographs of the site vicinity and an environmental data report which identifies environmental problem sites and activities in the vicinity of the subject site.

Step 9 Prepare a draft report summarizing research conducted, field and laboratory procedures, findings, interpretations, and conclusions.

Step 10 Submit draft report to ARCO for review.

Step 11 Submit final report.

SCHEDULE

A Preliminary Time Schedule to perform Steps 1 through 11 is shown on Plate 3. This time schedule is an estimate and is subject to change should circumstances dictate. Gaining offsite access and associated encroachment permits may delay this project beyond the projected time. ARCO and the appropriate regulatory agencies will be informed should the estimated time for completion of the work proposed in the Work Plan be delayed. Time is estimated in weeks after gaining regulatory approval of the Work Plan and any changes which must be incorporated into this Work Plan due to regulatory request. RESNA can initiate work at the site within 1 to 2 weeks after receiving authorization to proceed. If ARCO has not received regulatory approval of this work plan within 60 days, they will proceed as stated in Title 23, Article 11, Chapter 16, Sections 2722 (b)(5) and 2726 (c).

DISTRIBUTION

It is recommended that copies of this Work Plan forwarded to:

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

Mr. Rob Weston
Alameda County Health Care Services Agency
Department of Environmental Health
80 Swan Way, room 200
Oakland, California 94612

Mr. Mike Bakaldin
City of San Leandro Fire Department
Hazardous Materials Division
835 East 14th Street
San Leandro, California 94577

REFERENCES

Department of Health Services, State of California. October 24, 1990. Summary of Drinking Water Standards.

Helley, E.J., and K.R. Lajoie, 1979, Flatland Deposits - Their Geology and Engineering Properties and Their Importance to Comprehensive Planning. USGS Professional Paper 943.

Hickenbottom, Kelvin and Muir, Kenneth, June 1988. Geohydrology and Groundwater Quality Overview of the East Bay Plain Area, Alameda County, California. Alameda County Flood Control and Water Conservation District, Report 205 (j).

Maslonkowski, D.P. 1984. Groundwater in the San Leandro and San Lorenzo Alluvial Cones of the East Bay Plan of Alameda County. Alameda County Flood control and Water Conservation District, California

RESNA, July 7, 1992. Work Plan for Subsurface Investigation at ARCO Station 2162, 15135 Hesperian Boulevard, San Leandro, California. 62019.01

RESNA, September 6, 1992. Site Safety Plan Subsurface Environmental Investigation at ARCO Station 2162, 15135 Hesperian Boulevard, San Leandro, California. 62019.02

RESNA, February 4, 1993. Quarterly Groundwater Monitoring, Fourth Quarter 1992 at ARCO Station 2162, 15135 Hesperian Boulevard, San Leandro, California. 62019.03

RESNA, March 10, 1993. Subsurface Environmental Investigation at ARCO Station 2162, 15135 Hesperian Boulevard, San Leandro, California. 62019.02

Roux Associates, August 28, 1991. Letter Report - Limited Soil Performance Test, ARCO Facility No. 2162, 15135 Hesperian Boulevard, San Leandro, California. Doc #A101W02.1.1

Roux Associates, August 28, 1991. Preliminary Tank Replacement Assessment, ARCO Facility No. 2162, 15135 Hesperian Boulevard, San Leandro, California. #A101W01.1.5

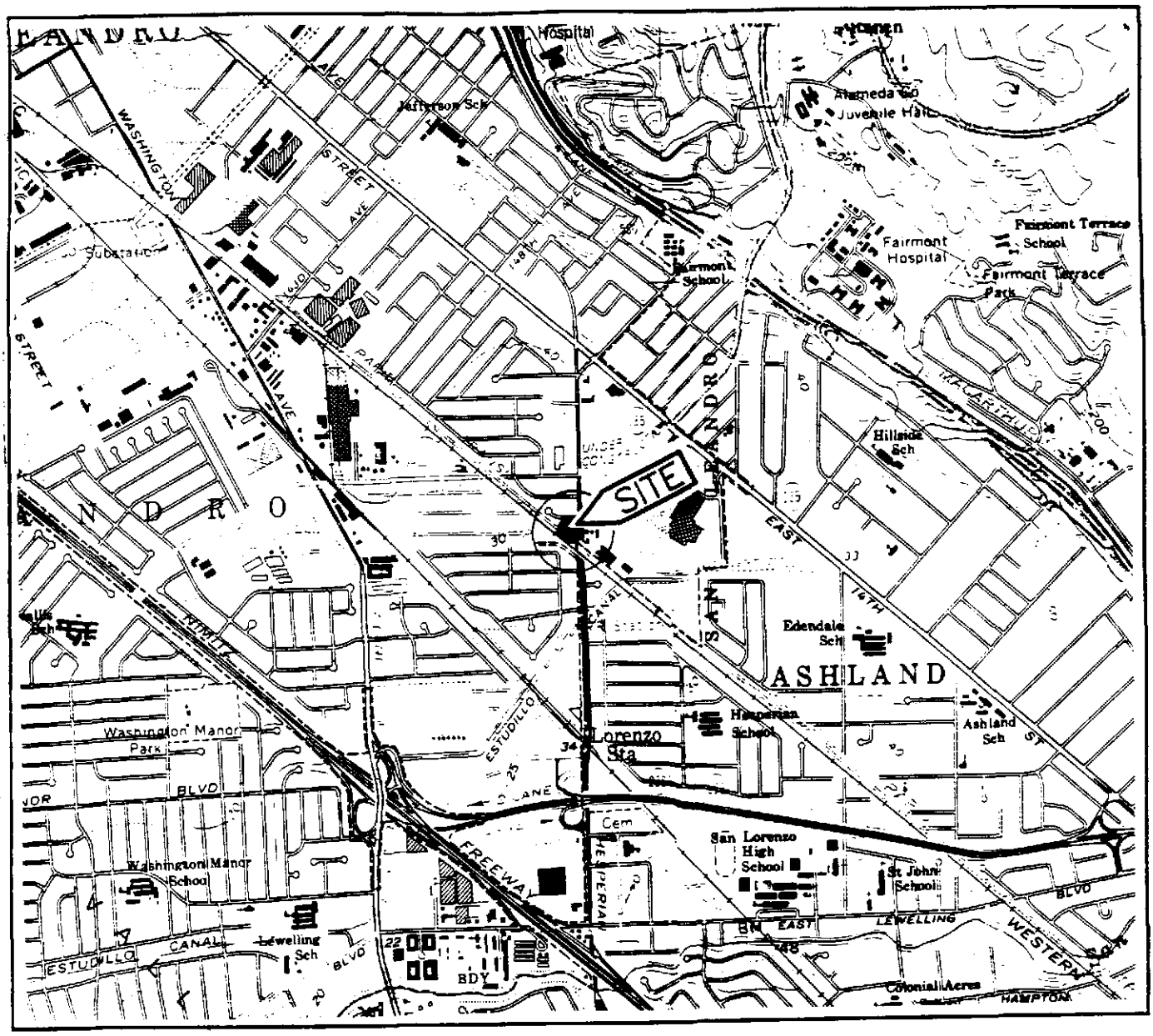
REFERENCES (cont.)

Roux Associates, August 28, 1991. Letter Report Limited Soil Performance Test, ARCO Facility No. 2162, 15135 Hesperian Boulevard, San Leandro, California. #A101W02.1.1

Roux Associates, July 7, 1992. Underground Storage Tank Replacement and Soil Sampling, ARCO Facility No. 2162, 15135 Hesperian Boulevard, San Leandro, California. #A117W01.1.8

Title 22, California Administrative Code, Section 66696. January 1988.

U.S. Geologic Survey, 1968, San Leandro, California, 7.5-minute topographic quadrangle map.



Base: U.S. Geological Survey
7.5-Minute Quadrangles
San Leandro/Hayward, California
Photorevised 1980

N

LEGEND

◉ = Site Location

Approximate Scale

2000 1000 0 2000 4000

feet

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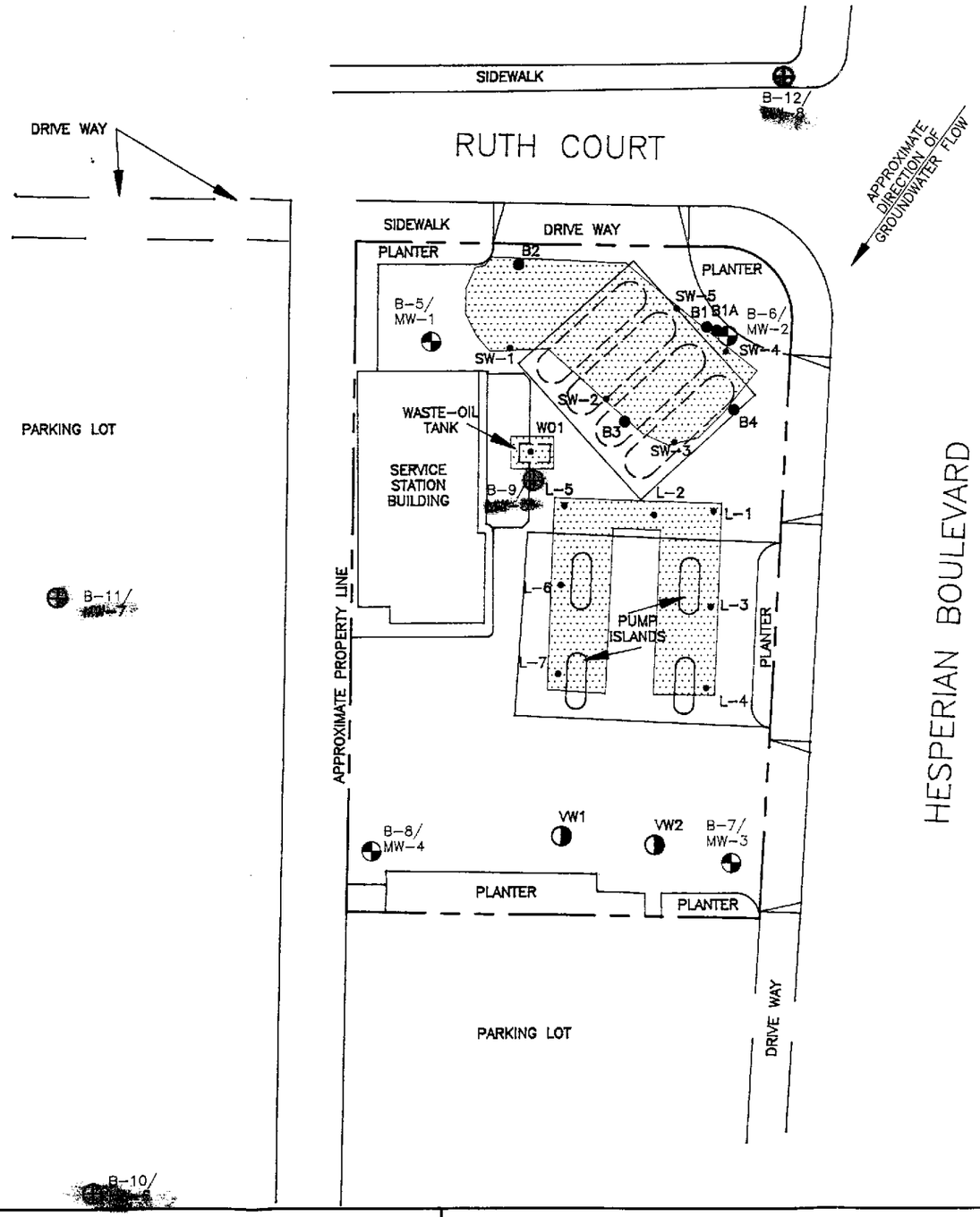
PROJECT 62019.05

SITE VICINITY MAP
ARCO Station 2162
15135 Hesperian Boulevard
San Leandro, California

PLATE

1



EXPLANATION

B-3/MW-4 = Monitoring well RESNA September 1992

VW2 = Vapor extraction well (Roux Associates, Inc., 1991)

B-12/MW-8 = Proposed boring/monitoring well

B4 = Soil boring (Roux Associates, Inc., 1991)

L-7 = Product line sample

SW-5 = Sidewall soil sample

= Former underground storage tank and product line excavations

= Existing underground storage tank

Approximate Scale

30 15 0 30 60

feet

Source: Modified from site plan provided by Roux Associates. and survey data from John Koch, licensed land surveyor (9/16/92)

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PROPOSED BORINGS/MONITORING WELLS
ARCO Station 2162
15135 Hesperian Boulevard
San Leandro, California

PLATE
2

STEP 1:
After receiving regulatory approval of workplan, request offsite access and submit permit applications

STEP 2:
Update site safety plan

STEP 3:
Drill borings and install wells
Submit soil samples for laboratory analyses and receive results

STEP 4:
Survey wells and receive results

STEP 5:
Develop wells

STEP 6:
Sample wells MW-5 thru MW-8 submit samples for laboratory analyses, receive results

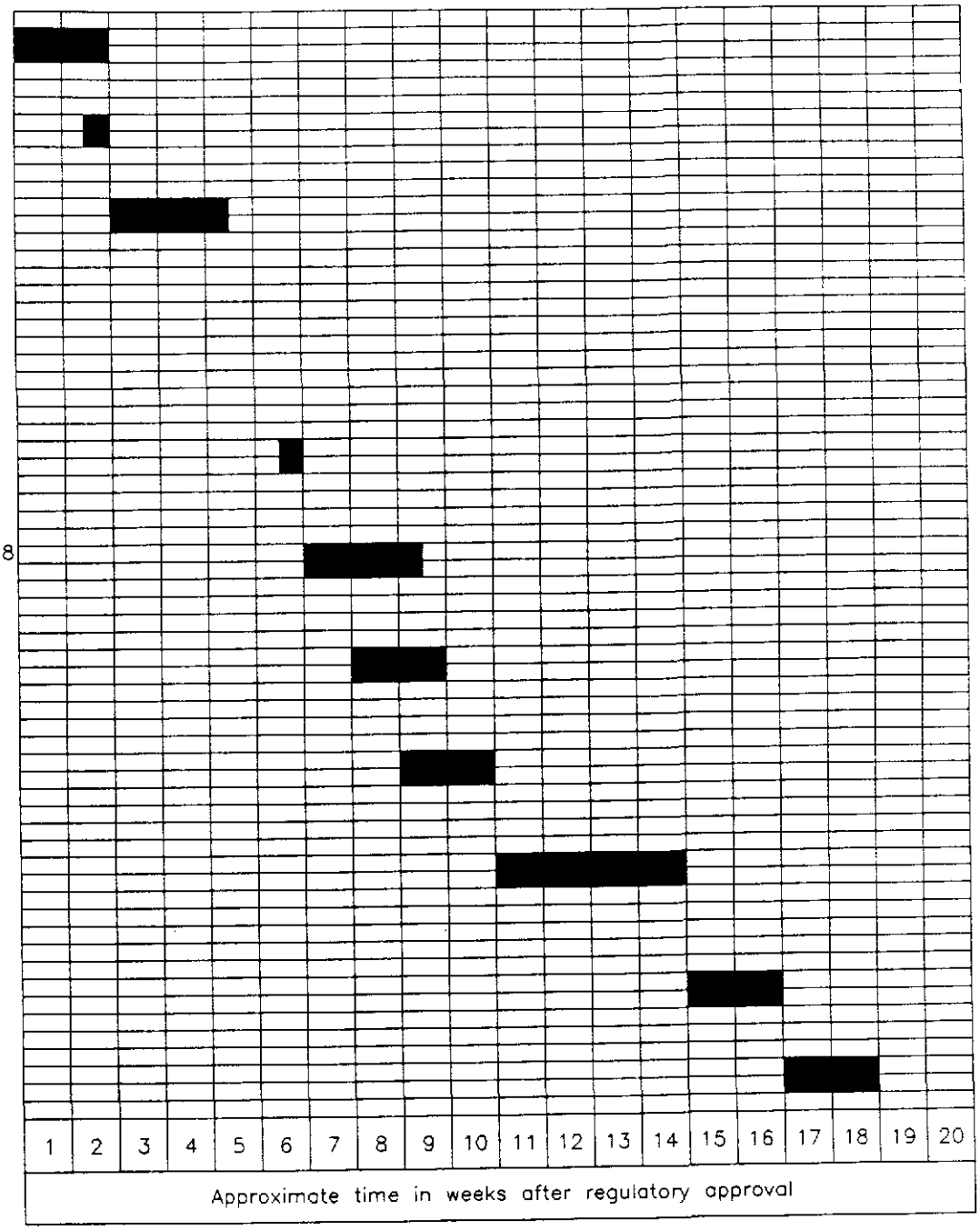
STEP 7:
Conduct a well survey

STEP 8:
Conduct a record search

STEP 9:
Prepare draft report

STEP 10:
ARCO review

STEP 11:
Finalize report



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PROJECT 62019.05

PRELIMINARY TIME SCHEDULE
ARCO Station 2162
15135 Hesperian Boulevard
San Leandro, California

PLATE
3

TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES
OF SOIL SAMPLES
ARCO Station 2162
15135 Hesperian Boulevard
San Leandro, California
(Page 1 of 3)

Sample Number	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes
June 1991					
Borings					
S-B1-5	<1.0	<0.0050	<0.0050	<0.0050	0.016
S-B1A-7.5	43	0.14	0.93	1.1	7.6
S-B2-5	1.3	<0.0050	<0.0050	<0.0050	<0.018
S-B2-9	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-B3-4	26	0.024	0.029	0.16	1.1
S-B3-7.5	1,400	2.5	4.4	29	190
S-B4-4.5	<1.0	0.025	0.013	0.0085	0.042
S-B4-7.5	2,400	17	62	41	260
S-VW1-6	2.8	0.033	0.0073	0.079	0.055
S-VW1-9	100	0.48	1.4	2.7	4.1
December 1991					
Tank Pit Sidewall					
SW-1 at 9	500	<0.0050	0.40	3.5	8.4
SW-2 at 10	140	0.10	0.38	3.0	7.2
SW-3 at 10	150	0.26	0.11	2.1	2.0
SW-4 at 10	610	0.47	7.1	11	82
SW-5 at 10	1,000	2.3	9.2	25	220
Waste-oil Sidewall					
WO-1 at 10	310	0.78	0.8	2.9	13

Sample Number	TPHd	TOG	VOCs	Cd	Cr	Pb	Ni	Zn
WO-1 at 10	360	270	ND	ND	49	5.2	59	58

See notes on page 3 of 3

TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES
OF SOIL SAMPLES
ARCO Station 2162
15135 Hesperian Boulevard
San Leandro, California
(Page 2 of 3)

Sample Number	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes
December 1991					
Soil Stockpile					
CS-1	1,300	0.98	3.7	5.0	110
CS-2	1,000	5.6	39	14	130
CS-3	200	0.36	0.91	1.5	20
CS-4	86	0.077	0.11	0.36	2.8
CS-5	100	0.14	0.27	0.65	4.8
CS-6	140	0.032	0.085	0.47	3.7
CS-7	110	ND	0.082	0.074	1.9
CS-8	270	0.12	0.1	0.22	13
CS-9	54	ND	ND	ND	0.24
CS-10	480	0.44	0.36	3.8	26
January 1992					
Soil Stockpile					
CS-11	51	0.11	ND	0.18	0.95
CS-12	6.2	0.016	0.013	0.016	0.16
CS-13	23	0.028	0.066	0.11	0.82
February 1992					
Product Lines					
L-1 at 3	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
L-2 at 3.5	4.4	0.082	0.013	0.21	0.30
L-3 at 3	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
L-4 at 3	<1.0	0.0063	0.0076	<0.0050	0.029
L-5 at 3	110	0.65	0.17	1.2	0.14
L-6 at 2.5	16	1.0	0.20	0.96	4.0
L-7 at 4	12	0.28	0.018	0.35	0.78
September 1992					
Borings					
S-4.5-B5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-10-B5	100	<0.0050	<0.0050	0.46	0.36
S-5-B6	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-10-B6	550	0.79	1.3	10	48
S-17-B6	<1.0	<0.0050	<0.0050	<0.0050	<0.0050

See notes on page 3 of 3

TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES
OF SOIL SAMPLES
ARCO Station 2162
15135 Hesperian Boulevard
San Leandro, California
(Page 3 of 3)

Sample Number	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes
S-5-B7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-10-B7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-16.5-B7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-5-B8	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-9.5-B8	2.0	<0.0050	<0.0050	<0.0050	<0.0050
S-11-B8	51	0.18	<0.0050	0.056	0.11
S-11.5-B8	91	1.4	0.11	0.22	0.86
S-18.5-B8	<1.0	<0.0050	<0.0050	<0.0050	<0.0050

Sample Number	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes	pH	I	R	Pb
September 1992 Soil Stockpile SP-0809 A-D	11	<0.0050	<0.0050	0.52	0.12	8.4	>100	None	0.11

All results in parts per million (ppm).
TPHg = Total petroleum hydrocarbons as gasoline.
I = Ignitability in °C
R = Reactivity to sulfide, cyanide, or water
Pb = lead
<:Below the reporting limits of the analytical method.

Sample designations:

S-B1-5
- Sample depth
- Boring number
- Soil sample

S-12-B5
- Boring number
- Sample depth in feet
- Soil sample

SP-0809 A-D
- Sample
- Date
- Soil pile sample

TABLE 2
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 2162
15135 Hesperian Boulevard
San Leandro, California

Well Date	Well Elevation	Depth to Water	Water Elevation	Floating Product
MW-1				
09/30/92	31.19	10.68	20.51	None
10/16/92		10.83	20.36	None
01/14/93		7.25	23.94	None
02/24/93		7.23	23.96	None
03/30/93		7.58	23.61	None
MW-2				
09/30/92	30.38	9.74	20.64	None
10/16/92		9.91	20.47	None
01/14/93		6.56	23.82	None
02/24/93		6.67	23.71	None
03/30/93		6.76	23.62	None
MW-3				
09/30/92	30.30	9.93	20.37	None
10/16/92		10.13	20.17	None
01/14/93		6.71	23.59	None
02/24/93		6.82	23.48	None
03/30/93		7.07	23.23	None
MW-4				
09/30/92	30.39	11.15	19.24	None
10/16/92		11.33	19.06	None
01/14/93		7.49	22.90	None
02/24/93		7.57	22.82	None
03/30/93		8.06	22.33	None

All measurements in feet.
Well elevation datum is top of casing (TOC) if feet above mean sea level (msl). Survey datum is City of San Leandro = 1973 Adjusted National Geodetic Vertical Datum.
Depth-to-water (DTW) = measured from top of casing.
Water elevation =TOC minus DTW.
Floating product = Subjective evidence of floating product noted.
Wells surveyed by John Koch, Licensed Surveyor, on 9/16/92.

TABLE 3
CUMULATIVE RESULTS OF LABORATORY ANALYSES
OF GROUNDWATER SAMPLES
ARCO Station 2162
15135 Hesperian Boulevard
San Leandro, California

Well / Date	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes
MW-1					
09/30/92	1,100	6.2	<0.50	6.9	<0.50
10/16/92	790	3.0	0.8	5.6	2.9
01/14/93	660	1.2	<1	15	4.6
MW-2					
09/30/92	1,000	9.6	<0.50	45	110
10/16/92	630	8.0	<1.0*	37	64
01/14/93	7,800	33	5	340	920
MW-3					
09/30/92	<50	<0.50	<0.50	<0.50	<0.50
10/16/92	<50	<0.50	<0.50	<0.50	<0.50
01/14/93	52	<0.5	<0.5	<0.5	<0.5
MW-4					
09/30/92	330	81	<0.50	<0.50	<0.50
10/16/92	250	44	<0.5	<0.5	0.7
01/14/93	260	29	0.6	0.5	1.1
MCL:	—	1	—	680	1,,750
DWAL:	—	—	100	—	——

Results in micrograms per liter (μ/L) = parts per billion (ppb).
TPHg: Total petroleum hydrocarbons as gasoline by EPA method 5030/8020/California DHS LUFT. BTEX:B: Benzene, T: Toluene, E: Ethylbenzene, X: Total Xylene isomers; measured by EPA method 5030/8020/California DHS LUFT Method
<: Results reported as less than the detection limit.
*: Raised method reporting limit (MRL) due to high analyte concentration requiring sample dilution.
MCL: State Maximum Contaminant Level (DHS October 1990).
DWAL: State recommended Drinking Water Action Level (DHS October 1990).

APPENDIX A

FIELD PROTOCOL

FIELD PROTOCOL

The following presents RESNA's protocol for a typical site investigation involving gasoline hydrocarbon-impacted soil and/or groundwater.

Site Safety Plan

The Site Safety Plan describes the safety requirements for the evaluation of gasoline hydrocarbons in soil, groundwater, and the vadose-zone at the site. The Site Safety Plan is applicable to personnel of RESNA and its subcontractors. RESNA personnel and subcontractors of RESNA scheduled to perform work at the site are briefed on the contents of the Site Safety Plan before work begins. A copy of the Site Safety Plan is available for reference by appropriate parties during the work. A Site Safety Officer is assigned to the project.

Soil Borings

Prior to the drilling of borings and construction of monitoring wells, permits are acquired from the appropriate regulatory agency. In addition to the above-mentioned permits, encroachment permits from the City or State are acquired if drilling of borings offsite in the City or State streets is necessary. Copies of the permits are included in the appendix of the project report. Prior to drilling, Underground Services Alert is notified of our intent to drill, and known underground utility lines and structures are approximately marked.

The borings are drilled by a truck-mounted drill rig equipped with 8- or 10-inch-diameter, hollow-stem augers. The augers are steam-cleaned prior to drilling each boring to minimize the possibility of cross-contamination. After drilling the borings, monitoring wells are constructed in the borings, or neat-cement grout with bentonite is used to backfill the borings to the ground surface.

Borings for groundwater monitoring wells are drilled to a depth of no more than 20 feet below the depth at which a saturated zone is first encountered, or a short distance into a stratum beneath the saturated zone which is of sufficient moisture and consistency to be judged as a perching layer by the field geologist, whichever is shallower. Drilling into a deeper aquifer below the shallowest aquifer can begin only after a conductor casing is properly installed and allowed to set, to seal the shallow aquifer.

Drill Cuttings

Drill cuttings subjectively evaluated as having hydrocarbon contamination at levels greater than 100 parts per million (ppm) are separated from those subjectively evaluated as having hydrocarbon contamination levels less than 100 ppm. Evaluation is based either on subjective evidence of soil discoloration, or on measurements made using a field calibrated OVM. Readings are taken by placing a soil sample into a ziplock type plastic bag and allowing volatilization to occur. The intake probe of the OVM is then inserted into the headspace created in the plastic bag immediately after opening it. The drill cuttings from the borings are placed in labeled 55-gallon drums approved by the Department of Transportation; or on plastic at the site, and covered with plastic. The cuttings remain the responsibility of the client.

Soil Sampling in Borings

Soil samples are collected at no greater than 5-foot intervals from the ground surface to the total depth of the borings. The soil samples are collected by advancing the boring to a point immediately above the sampling depth, and then driving a California-modified, split-spoon sampler containing brass sleeves through the hollow center of the auger into the soil. The sampler and brass sleeves are laboratory-cleaned, steam-cleaned, or washed thoroughly with Alconox® and water, prior to each use. The sampler is driven with a standard 140-pound hammer repeatedly dropped 30 inches. The number of blows to drive the sampler each successive six inches are counted and recorded to evaluate the relative consistency of the soil.

The samples selected for laboratory analysis are removed from the sampler and quickly sealed in their brass sleeves with aluminum foil, plastic caps, and aluminized duct tape. The samples are then be labeled, promptly placed in iced storage, and delivered to a laboratory certified by the State of California to perform the analyses requested.

One of the samples in brass sleeves not selected for laboratory analysis at each sampling interval is tested in the field using an OVM that is field calibrated at the beginning of each day it is used. This testing is performed by inserting the intake probe of the OVM into the headspace created in the plastic bag containing the soil sample as described in the Drill Cuttings section above. The OVM readings are presented in Logs of Borings included in the project report.

Logging of Borings

A geologist is present to log the soil cuttings and samples using the Unified Soil Classification System. Samples not selected for chemical analysis, and the soil in the sampler shoe, are extruded in the field for inspection. Logs include texture, color, moisture, plasticity, consistency, blow counts, and any other characteristics noted. Logs also include subjective evidence for the presence of hydrocarbons, such as soil staining, noticeable or obvious product odor, and OVM readings.

Monitoring Well Construction

Monitoring wells are constructed in selected borings using clean 2- or 4-inch-diameter, thread-jointed, Schedule 40 polyvinyl chloride (PVC) casing. No chemical cements, glues, or solvents are used in well construction. Each casing bottom is sealed with a threaded end-plug, and each casing top with a locking plug. The screened portions of the wells are constructed of machine-slotted PVC casing with 0.020-inch-wide (typical) slots for initial site wells. Slot size for subsequent wells may be based on sieve analysis and/or well development data. The screened sections in groundwater monitoring wells are placed to allow monitoring during seasonal fluctuations of groundwater levels.

The annular space of each well is backfilled with No. 2 by 12 sand, or similar sorted sand, to approximately two feet above the top of the screened casing for initial site wells. The sand pack grain size for subsequent wells may be based on sieve analysis and/or well development data. A 1- to 2-foot-thick bentonite plug is placed above the sand as a seal against cement entering the filter pack. The remaining annulus is then backfilled with a slurry of water, neat cement, and bentonite to approximately one foot below the ground surface.

An aluminum utility box with a PVC apron is placed over each wellhead and set in concrete placed flush with the surrounding ground surface. Each wellhead cover has a seal to protect the monitoring well against surface-water infiltration and requires a special wrench to open. The design discourages vandalism and reduces the possibility of accidental disturbance of the well.

Groundwater Monitoring Well Development

The monitoring wells are developed by bailing or over-pumping and surge-block techniques. The wells are either bailed or pumped, allowed to recharge, and bailed or pumped again until the water removed from the wells is determined to be clear. Turbidity measurements (in NTUs) are recorded during well development and are used in evaluating well development. The development method used, initial turbidity measurement, volume of water removed, final turbidity measurement, and other pertinent field data and observations are included in reports. The wells are allowed to equilibrate for at least 48 hours after development prior to sampling. Water generated by well development will be stored in 17E Department of Transportation (DOT) 55-gallon drums onsite and will remain the responsibility of the client.

Sample Labeling and Handling

Sample containers are labeled in the field with the job number, sample location and depth, and date, and promptly placed in iced storage for transport to the laboratory. A Chain of Custody Record is initiated by the field geologist and updated throughout handling of the samples, and accompanies the samples to a laboratory certified by the State of California for the analyses requested. Samples are transported to the laboratory promptly to help ensure that recommended sample holding times are not exceeded. Samples are properly disposed of after their useful life has expired.