

PACIFIC ENVIRONMENTAL GROUP, INC.

ENVIRONMENTAL PROTECTION

95 APR -7 AM 11: 08

NON-ATTAINMENT AREA MANAGEMENT PLAN

**SITE 6034
4700 FIRST STREET
LIVERMORE, CALIFORNIA**

OK of NAA. After 2 yrs of monitoring - Self Made is effective in increasing biodegradation of HCN if co-grant desired

Does issue NAA letter or just a letter require not further remediation except that proposed for MW2 and accept principal the NAA mgmt plan proposed.

PREPARED FOR

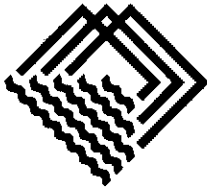
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APRIL 6, 1995

PREPARED BY

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PROJECT 310-105-3A**

9/15 - 10/15 10



SUMMARY OF NON-ATTAINMENT AREA MANAGEMENT PLAN

Site 6034 Livermore, California

- **Site 6034:**
UNOCAL service station located in Livermore, California.
- **Primary and Secondary Sources Removed:**
Five monitoring wells were installed, the contaminated soil was overexcavated and disposed of properly, 1,000 gallons of groundwater were pumped from the excavation, and the old tanks were replaced with new underground storage tanks in 1989. The old tanks showed no signs of damage or leaking.
- **Soil and Groundwater Hydrocarbon Concentrations:**
Soil: The soil concentrations had a maximum concentration of 0.14 ppm benzene and 790 ppm TPH-gas following excavation.

Groundwater: Groundwater has been and continues to be monitored and/or sampled quarterly or semi-annually since 1989. The maximum groundwater concentrations for BTEX and TPH are as follows; 540 ppb benzene, 1100 ppb toluene, 22000 ppb xylenes, 3000 ppb ethylbenzene, and 53000 ppb TPH-gas. These maximum concentrations were collected in 11/89 for benzene, xylenes, and TPH-gas. The others were collected in 4/93 for ethylbenzene and 7/92 for toluene. MTBE has also been detected in MW-5 with a maximum concentration of 2.2 ppb collected in July of 1993.

- **Soil Type & Depth to Water:**
The site geology consists Quaternary alluvium materials to a depth of 28.5 feet (') below grade. These materials consist of a gravel unit, 5' to 7' thick. This is underlain by a clay unit to a depth of 11' to 12.5' below grade. A second gravel unit is below the clay but varies in thickness. Near MW-1 and 2 it is approximately 6.5' to 8' thick, while near MW-3 it is nearly 12.5' thick. The second gravel unit is again underlain by a clay unit which contains local sand and gravel lenses and extends to a depth of 23.5' to 25' below grade. The depth to groundwater is from 14.5 to 17 feet. The overall groundwater flow direction is west-northwesterly, with a gradient of 0.006 ft/ft.
- **Plume Stability & Concentration Trends:**
The groundwater plume appears to be stable and not migrating as evidenced by the non-detectable concentrations of hydrocarbons in wells MW-6 and MW-7 since their

installation in 1991. The main plume is focused near MW-2 and MW-4. Since the groundwater flows west-northwesterly, the lack of hydrocarbons in MW-6 and 7 indicates the stability of the plume. MW-2, MW-4, MW-5, MW-6, and MW-7 will be the containment monitoring points. Monitoring wells MW-1 and MW-3 will be removed from the monitoring and sampling program. Significant plume migration unlikely.

- **Contaminant Pathway Analysis:**

Human Health: A qualitative risk assessment was performed on Site 6034 to determine if any potential pathways pose a risk to human health. There is little potential for humans to contact the plume because no drinking water wells are on the site and the NAA zone is capped with asphalt and concrete.

Environment: A qualitative risk assessment was performed on Site 6034 to determine if any potential pathways pose a risk to the environment. There is little risk to the environment due to limited interaction of wildlife with the NAA zone, the stability of the plume (thus nearby waterbodies should not be affected), and little volatilization should occur due to the site being capped by concrete and asphalt.

- **Nearby Beneficial Uses:**

No known water supply wells are within the proposed NAA. The drainage channel for Arroyo Seco is adjacent to and northwest of the site.

- **Compliance Monitoring Plan:**

In order to be certain that the groundwater plume is not migrating, a compliance monitoring program will be implemented. This program will reveal if water quality objectives for the previously listed contaminants are being achieved. **The monitoring wells with the highest hydrocarbon concentrations, (MW-2, MW-4 and MW-5) will be monitored bi-annually for one year and then annually for two years. The monitoring wells located downgradient from the groundwater plume (MW-6 and MW-7) will be monitored annually for two years. Monitoring wells, MW-1 and MW-3, will be removed from the monitoring and sampling program.**

- **Contingency Plan:**

A contingency plan has been established in the event that contaminant levels are found to be increasing through the compliance monitoring system of sampling and analysis. The contingency plan response will be proportional to the increase in contaminant concentration.

- **Description of the Non-Attainment Area Zone:**

The boundaries of the NAA zone are the eastern, northern, and western property boundaries. It is bordered to the south by MW-4 and the southern wall of the existing building on-site. The Non-Attainment Area can be seen in Figure 11.

- **Water Quality Goals:**

The water quality goals for the NAA are as follows:

BTEX - ND (<0.5 ppb)

TPH as gasoline - 100 ppb

- **Dissolved-Phase Cleanup:**

Contaminants' concentrations are stable, however due to the relatively high values of TPH-gas and BTEX a remediation process will be started, consisting of magnesium peroxide (MgO_2) addition to well MW-2. Results of the MgO_2 addition will be addressed under separate levels by Kaprealian Engineering, Inc.

Site 6034 proposes to meet the requirements for a Category 1 Non-Attainment Area, using RWQCB guidance. With this evaluation of past, present, and future actions at Site 6034, it is clear that this Non-Attainment Management Plan satisfies all the requirements designated by the Category 1 NAA and should be granted.

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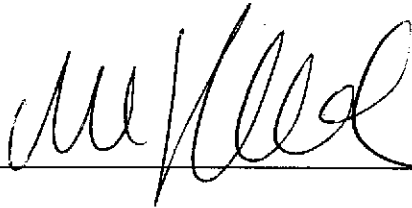
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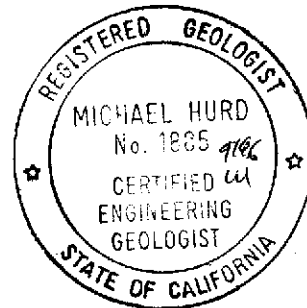
**PROFESSIONAL CERTIFICATION
NON-ATTAINMENT AREA MANAGEMENT PLAN
SITE 6034
LIVERMORE, CALIFORNIA**

Pacific Environmental Group, Inc. (PACIFIC) has prepared this Non-Attainment Area (NAA) Plan for the referenced site. This plan has been prepared according to the guidelines of the Groundwater Amendment to the Water Quality Control Plan, San Francisco Bay Region.

This NAA Plan has been prepared by the staff of PACIFIC under the professional supervision of the Senior Geologist whose seal and signature appears hereon.



Michael Hurd
Senior Geologist
CEG 1885



1.0 INTRODUCTION

Unocal is submitting this Non-Attainment Area (NAA) Plan for implementation at Site 6034. The plan provides for management and containment of the remaining human health and environmental risks at the referenced facility. Upon acceptance of the management plan by the RWQCB and the LOP, Unocal requests the issuance of a No Further Action letter (NFA) ~~that would identify no further requirements at the site beyond those stipulated within the management plan.~~

*Issued only
upon site
closure*

This plan is designed to fulfill the intent of State Water Resources Control Board (State Board) Resolution 68-16 which mandates protection of present and potential beneficial uses of groundwater by maintaining protection of all groundwater beyond the compliance points. The plan is also designed to fulfill the intent of State Board Resolution 88-63 which mandates that all groundwater be suitable (or be restored to suitability) for municipal supply by specifying deed or land use restriction such that natural processes are allowed to restore groundwater over the long term.

This document is composed of five parts with appendices:

- PART 1 as introduction.
- PART 2 is a summary of the site characterization data presented in tables and figures.
- PART 3 identifies the NAA, containment monitoring locations, risk management measures to protect human health and the environment, the compliance monitoring program, and incorporates a qualitative risk assessment of the NAA.
- PART 4 is an evaluation of the NAA plan to demonstrate the completeness of the site characterization and NAA measures for the protection of human health and the environment.
- PART 5 offers recommendations and conclusions for the site as a NAA.

The document is completed with references and appendices.

2.0 SITE CHARACTERIZATION DATA

This part of the NAA Plan for Site 6034 presents a summary of existing site conditions, including investigative results to date, potential beneficial uses of land, groundwater, surface water, and the suitability of implementing a NAA at this site. The site characterization data has been summarized in a pre-formatted table consistent with the guidelines given in ASTM ES 38. Where appropriate, appendices have been incorporated.

- TABLE 2-1
Site Description
- TABLE 2-2
Site Ownership & Activity Record
- TABLE 2-3
Summary of Current & Completed Site Activities
- TABLE 2-4
Hydrogeologic Conditions
- TABLE 2-5
Analytical Summary Sheets

**Table 2-1
Site Description
Site 6034
Livermore, California**

Information Requirement	Discussion	Reference
Site Address	4700 First Street Livermore, California	KEI 1/31/91
Site Owner/Contact	Unocal / Ms. Tina Berry	
Agency Contacts	Alameda County Health Care Services Agency Ms. Eva Chu	Unocal 1/10/95
Local Land Use	Commercial	KEI 7/24/90 Figures 1,2,and 3
Topography	Gently sloping to northwest	KEI 5/10/91
Surface Water Characterization	Site located adjacent to and northeast of the drainage channel for Arroyo Seco	KEI 5/10/91

Table 2-2
Site Ownership & Activity Record
Site 6034
Livermore, California

Information Requirement	Discussion	Reference
Materials Handling Activities	Dispensing of gasoline	KEI 8/15/89
Waste Disposal Practices	One waste oil tank	KEI 8/15/89
Site Ownership/Active?	Unocal / active	MPDS 8/16/94
Potential Sources and Spill Events including: location, type and volume of materials released, time and duration of release, and affected media (soil, groundwater, surface water, etc.)	Source Area; Underground storage tanks area; to unknown volume time or duration of release. Impacted soil and groundwater.	
Potential Off-Site Sources	Chevron station is directly upgradient from site. 18 monitoring wells are on and off Chevron site. Their groundwater extraction system has been shut down since 2/91. Pacific believes that Chevron plume impacted Unocal well MW-4 BP station also across street from Unocal site. It also contains monitoring wells. BP's station, a potential off-site source, is not directly upgradient from Unocal site.	KEI 7/24/90 1/31/91 8/12/92

Table 2-3
Summary of Current & Completed Site Activities
Site 6034
Livermore, California

Corrective Action Activities	Description	Reference
Underground tanks removed	2 gasoline tanks replaced and 1 waste oil tank replaced in 8/2/89	KEI 8/15/89
Overexcavation Performed	Waste oil tank pit overexcavated to a depth of 15'. 350 cubic yards were disposed of at a Class III facility. Fuel tank pit overexcavated to a depth of 17.5'.	KEI 3Q92 KEI 11/18/92
Groundwater Removed	1000 gallons of groundwater were pumped from fuel tank pit on 8/7/89.	KEI 8/15/89
Monitoring wells installed	4 monitoring wells installed 10/25/89 on-site 3 monitoring wells installed 4/2/91 on-site	KEI 12/18/89 5/10/91
Monitoring and sampling of wells.	All wells monitored and sampled quarterly except MW-1 which was not sampled (but still monitored) after 8/7/91 due to ND values. MW-3 sampled semi-annually since 12/1/93.	KEI 8/7/91 12/1/93 Attachment A

Table 2-4
Hydrogeologic Conditions
Site 6034
Livermore, California

Information Requirement	Discussion	Reference
Regional Geologic Framework through depth of principal aquifer and any other potentially impacted units	Area underlain by Quaternary-age alluvium. Also adjacent hillside areas northwest and southwest of the site are mapped as being underlain by the Livermore Gravel formation. The Livermore Gravel is typically composed of light reddish-gray cobble-pebble gravel, pebbly sand, silt and clay.	KEI 1/31/91
Site Geologic Framework Through Depth Of Principal Aquifer And Any Other Potentially Impacted Units	Site is underlain by Quaternary alluvium materials to total depth explored (28.5 feet (')). These materials consist of a gravel unit at the surface from 5' to 7' thick. This is underlain by a clay unit to a depth below grade of 11' to 12.5'. A second gravel unit underlies the clay but vary in thickness from 6.5' to 8' thick in the vicinity of MW-1 and 2, and about 12.5' thick near MW-3. The second gravel unit is underlain by a second clay unit which locally contains sand and gravel lenses and extends from depths below grade of about 23.5' to 25' and extends to maximum depth explored.	KEI 1/31/91
Unsaturated Zone Thickness And Geology	Unsaturated zone thickness 15-18'.	
Depth To Groundwater	Depth to groundwater varies from 14.5' to 17.5'.	KEI 12/18/89
Thickness Of Aquifer	Unknown	
Flow Direction And Gradient	Groundwater flow is west-northwest with a gradient of 0.006 ft/ft.	KEI 5/4/92 1/31/91 Figure 4.
Description Of Any Confining Units	None known	
Current Groundwater Quality (TDS)	Unknown	

**Table 2-5
Analytic Summary Sheets**

**Site 6034
Livermore, California**

Information Requirement	Media (Soil/ Groundwater)	Compounds Detected					
		Benzene	Toluene	Xylenes	Ethylbenzene	TPH-gas	MTBE
Analytic Method Used	Soil	EPA 8020	EPA 8020	EPA 8020	EPA 8020	EPA 8015	
	Groundwater	EPA 8020	EPA 8020	EPA 8020	EPA 8020	EPA 8015	Modified EPA 8020
Practical Quantification Limit	Soil ppm	.05	.05	.05	.05	1.0	
	Groundwater ppb	.05	.05	.05	.05	.50	0.6
Number of Samples Analyzed	Soil	41	41	41	41	41	
	Groundwater	109	109	109	109	109	5
Summary of analytic data	Soil Max Residual ppm	0.14 MW2 17' 10/25/89	0.23 MW2 17' 10/25/89	10 MW2 17' 10/25/89	2.7 MW2 17' 10/25/89	790 MW2 17' 10/25/89	
	Groundwater Max ppb date & location	540 MW2 11/18/89	1100 MW2 7/07/92	22000 MW2 11/18/89	3000 MW2 4/22/93	53000 MW2 11/18/89	2.2 MW5 7/20/93

		B	T	E	T	PH-6	MTBE
	Groundwater Max Current as of 1/95 ppb	6.8	7.3	1500	100	5100	Not Tested
	Groundwater Minimum current ppb	ND	ND	ND	ND	ND	
Background Concentrations	Groundwater ppb	ND	ND	ND	ND	ND	
Trend	Groundwater	Stable	Stable	Stable	Stable	Stable	

Reference: Figures 5 through 10

3. NON-ATTAINMENT AREA MANAGEMENT PLAN

This part provides the description of the NAA, the management measures for residual environmental and human health risks, the containment monitoring program, and the contingency plan. The section begins with a description of a NAA including the delineation of the NAA and identification of the containment monitoring points. In conjunction with this description of the NAA, management plan elements are incorporated for containing and managing remaining human health, water quality and groundwater pollution concerns. This section is constructed consistent with the guidelines within Criteria D for Category 1 NAAs and includes an assessment of human health and environmental risks, management measures for the NAA, contingency options, a commitment to mitigating measures, and a compliance monitoring plan.

3.1 Description of Non-Attainment Area

The NAA is a limited zone of groundwater pollution where concentrations above water quality objectives are permissible. At a minimum, the zone should encompass the pollutant plume in both the vadose soil and saturated groundwater region.

For Site 6034, the NAA coincides with the northern, western, and eastern property boundaries. The NAA is bordered to the south by MW-1 and MW-4, and the southern end of the existing building on the property. The NAA is represented on Figure 4.

The containment monitoring points for Site 6034 coincide with the downgradient extent of the NAA. The containment monitoring points are the existing monitoring wells MW-6 and MW-7. The containment monitoring wells can be seen on Figure 11.

3.2 Assessment of Human Health and Environmental Risks

The goal of the risk assessment process is to qualitatively assess the current and potential human health and environmental impacts of the proposed NAA for Site 6034. The intent is to identify obvious environmental impacts, potentially affected sensitive receptors (schools, homes, waterbodies, etc.), and any significant exposure pathways (drinking water wells, recreational use of streams, vapor transport, etc.). Given that this risk assessment is submitted in conjunction with the NAA plan that manages groundwater quality, the potential exposure pathway of constituents within the groundwater deserves special management. The purpose

of the qualitative risk assessment is to consider the risks posed by this and other potential exposure pathways, such as volatilization.

The qualitative risk assessment was completed in several steps. The contaminants addressed in the risk assessment were identified, then a site specific exposure pathway was analyzed for each chemical. The intent of the pathway assessment was to determine whether other pathways, aside from groundwater, could pose a human health or environmental risk that would require management. The pathway analysis was performed consistent with ASTM Emergency Standard ES 38, Guide for Risk-Based Corrective Action at Petroleum Release Sites.

To manage the risks associated with a NAA, groundwater cleanup levels were determined for application at the containment monitoring location. The groundwater cleanup levels conformed with the methodology prescribed by ASTM ES 38 and the Groundwater Amendment to the Water Quality Control Plan.

3.2.1 Selection of Constituents of Concern

The constituents of concern for NAA Site 6034 are TPH-gas, benzene, toluene, ethylbenzene, and xylenes (BTEX). Most of these constituents have been monitored and analyzed since 1989 and are currently only found in detectable levels in monitoring wells MW-2 and MW-4.

3.2.2 Exposure Pathway Analysis

Hydrocarbon impacted soil and groundwater at NAA Site 6034 has three possible source areas: (1) the former underground gasoline storage tanks, (2) the fuel lines and pump islands, (3) the waste oil tank and (4) upgradient sources. Within these areas, hydrocarbon releases may have occurred during damage of tanks, failure of either product and/or waste storage piping, or overfilling of tanks.

The possibility of the contaminants moving through the environment was assessed with the Risk Assessment: exposure pathway analysis, Figure 12. It is apparent from the figure that there is little opportunity for the contamination to migrate off-site or impact humans and the environment. The impacted soil was overexcavated and the remaining groundwater plume is in a very limited area. Also due to extensive monitoring and sampling of the site, the plume has been shown to not be migrating horizontally off-site. Volatilization should not be a factor due to the fact that the site is capped with asphalt and cement. There are no drinking water wells within the site boundaries and the nearest surface water, Arroyo Seco, is adjacent to and northwest of the site.

*Not necessarily
cracks, could into
at asphalt
cement are
found*

3.2.3 Water Quality Objectives for Containment Monitoring Locations

Water quality objectives for NAA Site 6034 are consistent with the State Water Resources Control Board Resolution 88-63. For this site, water quality objectives for the containment monitoring locations will be non-detectable levels for BTEX, and 100 ppb for TPH-gas.

3.3 Management Measures for the NAA

- Property Transfer Disclosures
- Indemnification Agreements
- Site Operation, Maintenance, Health and Safety Plans
- Utility Worker Notification

3.4 Commitment to Mitigating Measures

The Groundwater Basin Plan Amendment solicits a commitment to mitigating measures, such as participation in a regional groundwater monitoring or protection program. While this commitment is sought, there is not a need for this site to participate in a regional program because the program requirements have not yet been defined.

3.5 Compliance Monitoring Program

The intent of the compliance monitoring program is to demonstrate that water quality objectives are being achieved at the containment monitoring points. A monitoring program is presented in Table 3-2 and identifies the monitoring frequency and analytic parameters for the containment monitoring points. Monitoring wells MW-2, MW-4, MW-5, MW-6, and MW-7 will be monitored and sampled bi-annually for one year, annually for two years thereafter. The other wells will be dropped from the monitoring and sampling program. This schedule is based on the existing extensive monitoring data at the site. Reports outlining the results will be issued and will include a table and summary of the analytical data and a discussion and evaluation of the water quality data.

3.6 Contingency Plan

Contingency plan activities would be invoked in the event that the water quality objectives were exceeded at the compliance monitoring location. If an increase is observed within the compliance monitoring program, the corresponding monitoring well would be sampled again within one month of the original sampling date. If the event was validated, then the RWQCB and the LOP would be notified of the increase. The response to the increase in concentration would be proportional to its magnitude. For example, if separate-phase hydrocarbons were discovered, a bailing program would be immediately initiated. Conversely, if the measured

groundwater hydrocarbon concentration is slightly above the water quality objective, increased frequency of groundwater monitoring and sampling could be recommended.

In the event of a validated increase in concentration, the RWQCB and the LOP would be notified in writing within fifteen days of confirmation of the data and provided with a corrective action plan within sixty days of confirmation.

Table 3-1
Groundwater Quality Goals for Containment Monitoring
Site 6034
Livermore, California

Constituent	Numerical Limitation ($\mu\text{g/L}$)	Reference
BTEX	Non Detect	Res 68-16
TPH-gas	100 ppb	

- BTEX: Benzene, Toluene, Ethylbenzene, and Xylenes
- TPH-gas: Total Petroleum Hydrocarbons as gasoline

Table 3-2
Compliance Monitoring Program
Site 6034
Livermore, California

Monitoring Well Designation	Monitoring Frequency	Analytic Parameters (See Notes)	Comment
MW-2, 4, 5, 6, and 7	Bi-Annually for one year Annually two years thereafter	BTEX TPH-gas	

Reference to Analytic Parameters:

- BTEX: Benzene, Toluene, Ethylbenzene, and Xylenes
- TPH-Gas: Total Petroleum Hydrocarbons as Gasoline

4. EVALUATION AS A CATEGORY 1 NON-ATTAINMENT AREA

RWQCB guidance is applied in this section to demonstrate the adequacy of the site characterization work and the completeness of the NAA Management Plan. The qualifying criteria for a Category 1 NAA appear in the Groundwater Basin Plan Amendment and the RWQCB Staff Guidelines. The Basin Plan Amendment provides both general requirements and specific criteria.

4.1 General Category 1 NAA Requirements

Within the introductory discussion for Category 1 NAA, two general conditions are established for consideration as a NAA. These general conditions are reiterated and the consistency of the site conditions at Site 6034 to these requirements is presented.

- *Site Investigations Have Been Conducted Pursuant to Resolution 92-49:* Based on PACIFIC's review of existing information on the site, the investigation was performed in a phased approach following the initial discovery of hydrocarbons in soil and/or groundwater. Work was performed pursuant to work plans that were submitted to the regulatory agencies, including the Regional Water Quality Control Board. Reports submitted were signed (where appropriate) by qualified professionals.
- *Lateral and Vertical Definition of Soil and Groundwater Pollution Have Been Adequately Defined:* A review of existing soil and groundwater analytical data indicates that the soil and groundwater have been adequately defined.

4.2 Specific Category 1 NAA Criteria

Four specific criteria must be adequately addressed for RWQCB consideration of Site 6034 as a NAA. While the Groundwater Basin Plan Amendments offer the regulatory wording for these criteria, the RWQCB and LOPs have been provided additional guidance within a RWQCB staff memorandum from Steven Ritchie dated June 29, 1994. PACIFIC has evaluated the conditions at Site 6034 applying the staff guidelines. The summary of each is provided in the subsequent text and tables.

- *Criteria A: The discharger has demonstrated (e.g., pump tests, groundwater monitoring, transport modeling), and will verify (e.g., groundwater monitoring) that no significant pollutant migration will occur due to hydrogeologic or chemical characteristics.*

Based upon analysis of site conditions, no significant plume migration will occur due to hydrogeologic or chemical characteristics. This appraisal is presented within Table 4-1.

- *Criteria B: Adequate source removal and/or isolation is undertaken to limit future migration of pollutants to groundwater.*

Based upon evaluation of source removal activities, sufficient removal actions have been conducted to limit future migration of hydrocarbons to groundwater. This appraisal is presented within Table 4-2.

- *Criteria C: Dissolved-phase cleanup is not appropriate or cost effective due to limited water quality impacts or human health risks.*

Consideration of the feasibility of dissolved-phase clean-up at Site 6034 has been evaluated consistent with the RWQCB guidance, and has been found to not be cost effective. This appraisal is presented within Table 4-3.

Unocal will initiate a program of MgO_2 addition to well MW-2, to increase bio-degradation rates of hydrocarbons in groundwater.

- *Criteria D: An acceptable plan is submitted for containing and managing the remaining human health and environmental risks, if any, posed by residual soil and groundwater pollution. This plan should include as assessment of human health and environmental risks; management measures (e.g. deed notification or restrictions; indemnification agreements; site operation, maintenance, health and safety plans; utility worker notice; etc.) contingency options and a commitment to mitigating measures such as participation in a regional groundwater monitoring or protection program.*

The Non-Attainment Area Management Plan presented in Part 3 of this document has been written to specifically satisfy these guidelines and requirements. This appraisal is presented within Table 4-4.

Table 4-1
Evaluation of Criteria A for Category I Non-Attainment Areas

Criteria A. The discharger has demonstrated (e.g., pump tests, groundwater monitoring, transport modeling), and will verify (e.g., groundwater monitoring) that no significant pollutant migration will occur due to hydrogeologic or chemical characteristics.

<i>RWQCB Guidance for Evaluation of Criteria A</i>	Evaluation of Guidance	Reference
<i>The pollution plume is slow-moving or stable due to low permeability geologic materials or such factors as adsorption and biodegradation.</i>	Analysis has been performed to demonstrate a stable plume.	Table 2-5
<i>No significant potential horizontal migration pathways exist.</i>	Site hydrogeologic conditions indicate that no significant horizontal pathways exist.	Table 2-4
<i>The pollution plume shall be of limited horizontal extent [generally less than 500 feet] and limited to the upper water-bearing zones.</i>	The plume is approximately 200 feet.	Figure 5
<i>No significant vertical conduits shall exist within the plume area or the area between the plume and the compliance points.</i>		

Table 4-2
Evaluation of Criteria B for Category I Non-Attainment

Criteria B. Adequate source removal and/or isolation is undertaken to limit future migration of pollutants to groundwater.

<i>RWQCB Guidance for Evaluation of Criteria A</i>	Evaluation of Guidance	Reference
<i>Separate-phase hydrocarbons floating on the water table must be removed to the maximum extent feasible.</i>	No separate-phase hydrocarbons ever noted on site.	MPDS 1/13/95
<i>For shallow water table conditions, highly polluted soils in the vadose zone and the capillary fringe should be removed or treated to the maximum extent feasible to minimize continued leaching to groundwater.</i>	All highly polluted soils have been overexcavated and disposed of properly.	KEI Status Report 11/18/92
<i>For deeper groundwater conditions, hot spot or highly polluted soil removal or treatment shall be accomplished to the maximum extent feasible.</i>	NA	
<i>Vapor extraction and air sparging technology should be considered for source removal, as an alternative to soil removal, where soil conditions are appropriate.</i>	NA	
<i>After highly polluted source areas are removed or treated, further pollutant removal shall be considered by the discharger based upon an analysis of the degree of cleanup required to prevent plume migration to the containment monitoring point(s) above the agreed upon level.</i>	Soil concentrations are non-detect or low. Groundwater concentrations on downgradient property line are non-detectable. MgO ₂ will be added to well MW-2 to increase bio-degradation rates for hydrocarbons in groundwater.	KEI 5/10/91

<i>RWQCB Guidance for Evaluation of Criteria A</i>	Evaluation of Guidance	Reference
<i>Unsaturated zone pollutant removal or treatment must also be to a level that adequately protects public health.</i>	Overexcavation performed and soils disposed of properly.	KEI 11/18/92
<i>Capping, slurry walls, or other engineered methods may be proposed by the discharger to isolate the pollution and limit migration. A demonstration of effectiveness must be submitted.</i>	NA	

**Table 4-3
Evaluation of Criteria C for Category I Non-Attainment**

Criteria C. Dissolved-phase cleanup is not appropriate or cost effective due to limited water quality impacts or human health risks.

<i>RWQCB Guidance for Evaluation of Criteria A</i>	Evaluation of Guidance	Reference
<i>“Do the limited benefits justify the likely cost and time of cleanup.” It may be cost effective in some cases to apply short-term dissolved cleanup measures to achieve a significant reduction in maximum residual concentrations.</i>	The limited benefits and low concentrations do not justify the cost and time of cleanup.	
<i>The discharger shall provide qualitative risk and impact information including the type of factors contained in the discussion under the heading <u>Category I</u>.</i>	A qualitative risk assessment is provided.	Figure 12.

**Table 4-4
Evaluation of Criteria D for Category I Non-Attainment**

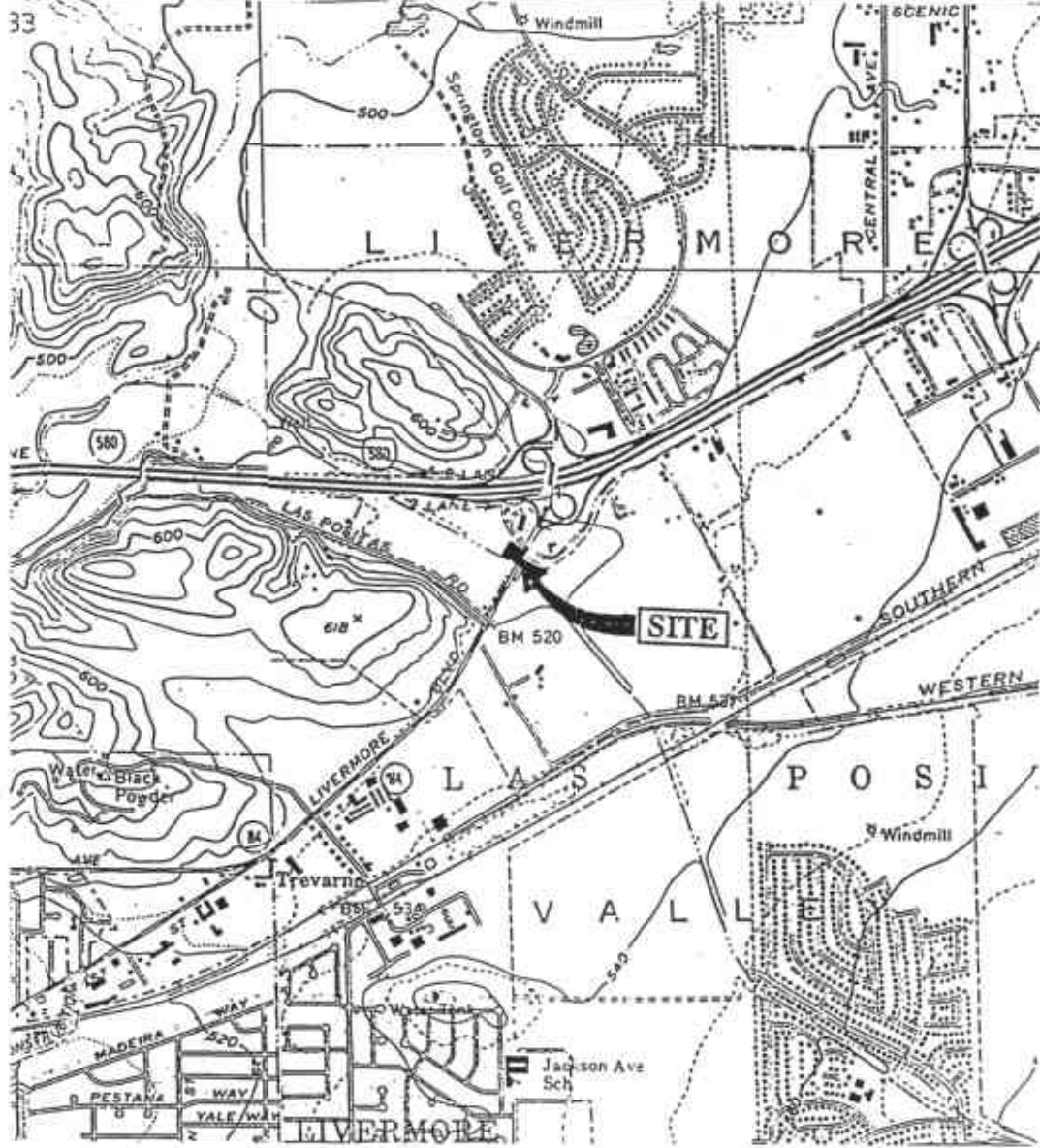
Criteria D. An acceptable plan is submitted for containing and managing the remaining human health and environmental risks, if any, posed by residual soil and groundwater pollution. This plan should include as assessment of human health and environmental risks; management measures (e.g. deed notification or restrictions; indemnification agreements; site operation, maintenance, health and safety plans; utility worker notice; etc.) contingency options and a commitment to mitigating measures such as participation in a regional groundwater monitoring or protection program.

<i>RWQCB Guidance for Evaluation of Criteria A</i>	<i>Evaluation of Guidance</i>	<i>Reference</i>
<i>The plan must contain information on site-specific conditions such as the current and anticipated land and water uses and the type of activity at the site and surrounding area.</i>	This information is addressed in the Site Characterization Summary.	Table 2-1 Figure 1
<i>The term "assessment of human health and environmental risks" means a qualitative assessment for most sites.</i>	A qualitative risk assessment has been performed consistent with this guidance.	Part 3.2.
<i>The management measures should be selected to match the appropriate site-specific conditions.</i>	Management measures were selected based upon site-specific conditions analyzed within the qualitative risk assessment.	Part 3.2
<i>For areas zoned commercial or industrial with numerous contributing sources, an acceptable plan may consider containing the residual groundwater pollution at the perimeter of the area in accordance with this policy.</i>	NA	

<i>RWQCB Guidance for Evaluation of Criteria A</i>	<i>Evaluation of Guidance</i>	<i>Reference</i>
<i>Management measures and mitigation for plume areas that cross property boundaries will require a more detailed evaluation by the discharger and shall involve notification and participation by all affected property owners.</i>	NA	
<i>The plan will include a compliance monitoring program. Based upon a demonstration of stable or decreasing trends in plume chemical concentration, the Board will review requests to discontinue compliance monitoring after 5 years of data, or less depending upon the site-specific conditions.</i>	A compliance monitoring program is included.	Part 3.5 Table 3-2

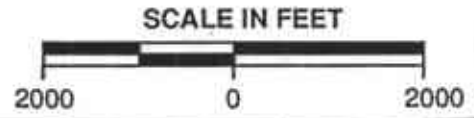
5. CONCLUSIONS AND RECOMMENDATIONS

Based upon the evaluation performed in Part 4, Site 6034 adequately satisfies the requirements to be designated a Category 1 NAA. Upon acceptance of this NAA application, Unocal would implement the NAA Management Plan described in Part 3. Beyond fulfilling the activities described in the management plan, Unocal requests the issuance of a No Further Action letter that would identify no further requirements at the site beyond those identified within the management plan. Unocal further requests that the approval modifications to the current groundwater monitoring program reflect the water quality objectives and containment monitoring program described on Tables 3-1 and 3-2.



QUADRANGLE
LOCATION

REFERENCES:
 USGS 7.5 MIN. TOPOGRAPHIC MAP
 TITLED: LIVERMORE, CALIFORNIA
 REVISED: 1980
 TITLED: ALTAMONT, CALIFORNIA
 REVISED: 1981

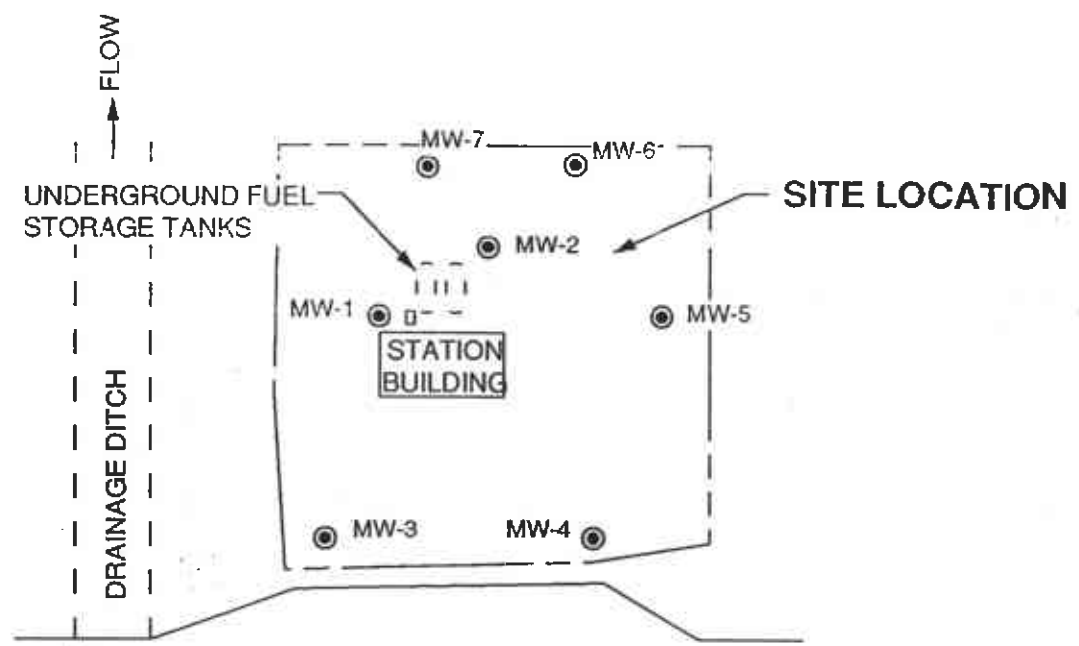


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UNOCAL SERVICE STATION 6034
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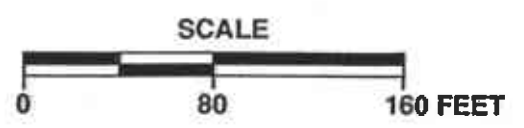
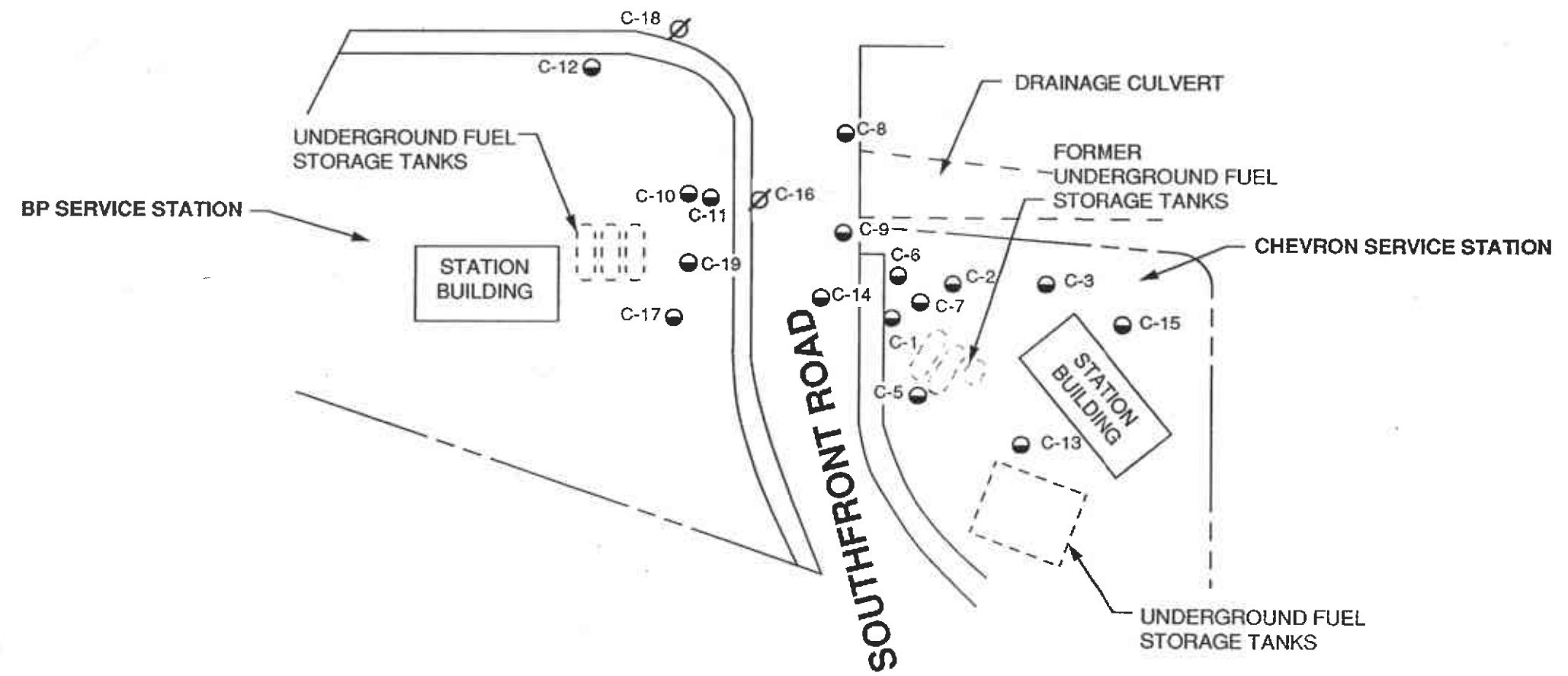
SITE LOCATION MAP

FIGURE:
1
PROJECT:
310-105.3A



- LEGEND**
- MW-1 ● GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION (UNOCAL)
 - C-2 ● GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION (CHEVRON)
 - C-18 ∅ ABANDONED GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION (CHEVRON)

FIRST STREET



UNOCAL SERVICE STATION 6034
4700 First Street at Southfront Road
Livermore, California

EXTENDED SITE MAP

FIGURE:
2
PROJECT:
310-105.3A



↑
FLOW

DRAINAGE DITCH

UNDERGROUND FUEL STORAGE TANKS

MW-7

MW-6

MW-2

MW-1

MW-5

STATION BUILDING

MW-3

MW-4

FIRST STREET

LEGEND

MW-1 ● GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION (UNOCAL)

SOURCE: MAP BY MPDS SERVICES, INC.



PACIFIC ENVIRONMENTAL GROUP, INC.

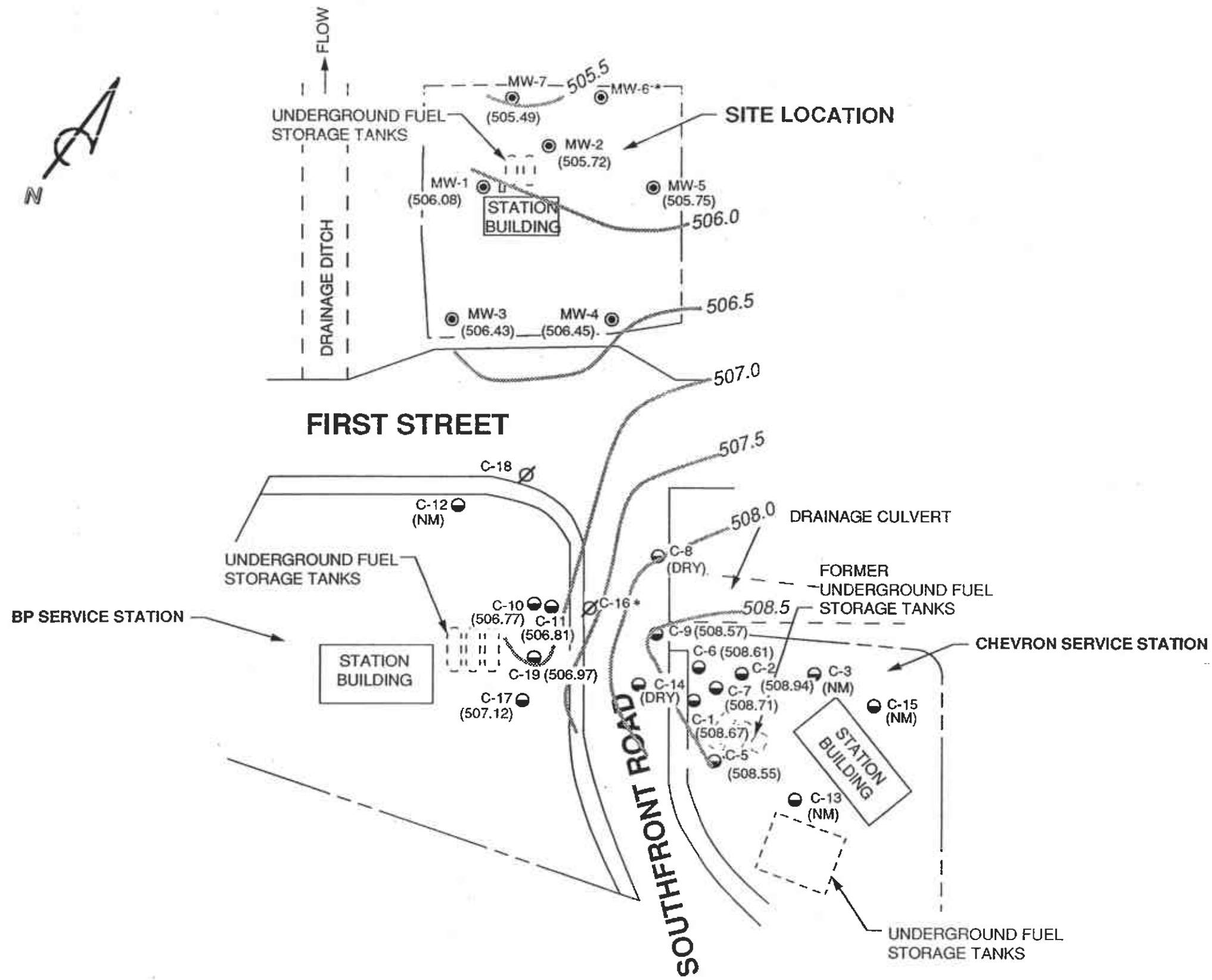
SCALE



UNOCAL SERVICE STATION 6034
4700 First Street at Southfront Road
Livermore, California

SITE PLAN VIEW

FIGURE:
3
PROJECT:
310-105.3A



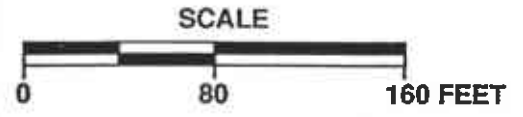
- LEGEND**
- MW-1 ● GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION (UNOCAL)
 - C-2 ● GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION (CHEVRON)
 - C-18 ∅ ABANDONED GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION (CHEVRON)
 - (507.17) GROUNDWATER ELEVATION IN FEET - MSL, 1-18-95
 - 507.0 ——— GROUNDWATER ELEVATION CONTOUR IN FEET - MSL 1-18-95
 - * WELL WAS INACCESSIBLE
 - (NM) NOT MEASURED



APPROXIMATE DIRECTION OF GROUNDWATER FLOW



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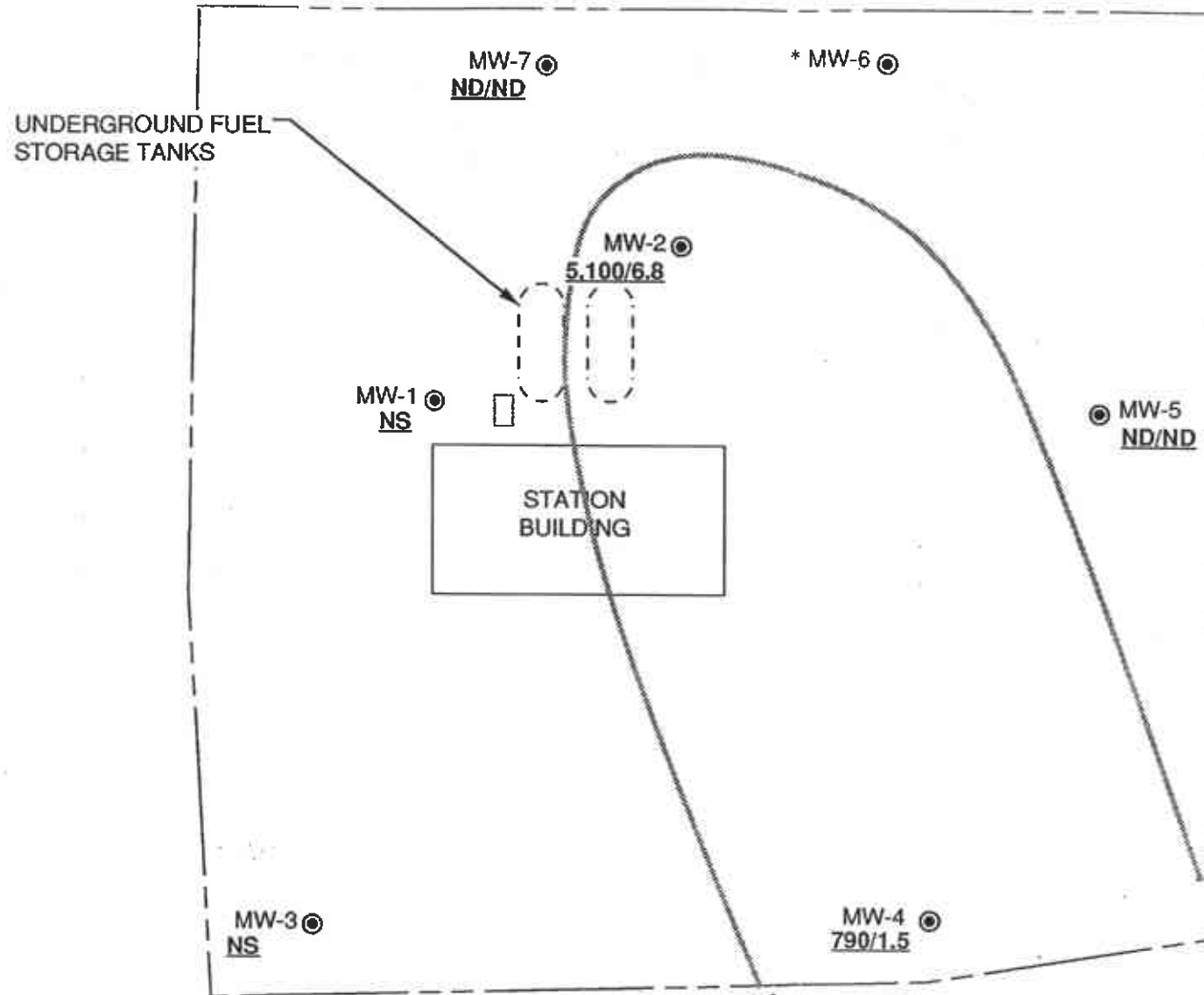
GROUNDWATER ELEVATION CONTOUR MAP

FIGURE:
4
PROJECT:
310-105.3A



FLOW ↑

DRAINAGE DITCH



LEGEND

MW-1 ● GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION (UNOCAL)

5,100/6.8 TPH-g/BENZENE CONCENTRATION IN GROUNDWATER, IN PARTS PER BILLION, 1-18-95

— DISSOLVED CONTAMINANT PLUME

ND NOT DETECTED

NS NOT SAMPLED

* WELL WAS INACCESSIBLE

NOTE: MW-4 POTENTIALLY IMPACTED BY CHEVRON



APPROXIMATE DIRECTION OF GROUNDWATER FLOW

FIRST STREET

SOURCE: MAP BY MPDS SERVICES, INC.



PACIFIC ENVIRONMENTAL GROUP, INC.

SCALE



UNOCAL SERVICE STATION 6034
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Livermore, California

DISSOLVED CONTAMINANT PLUME MAP

FIGURE:

5

PROJECT:

310-105.3A

Figure 6: Summary Plot of TPH-gas and Benzene Concentrations vs. Groundwater Elevation at Site 6034, MW-7

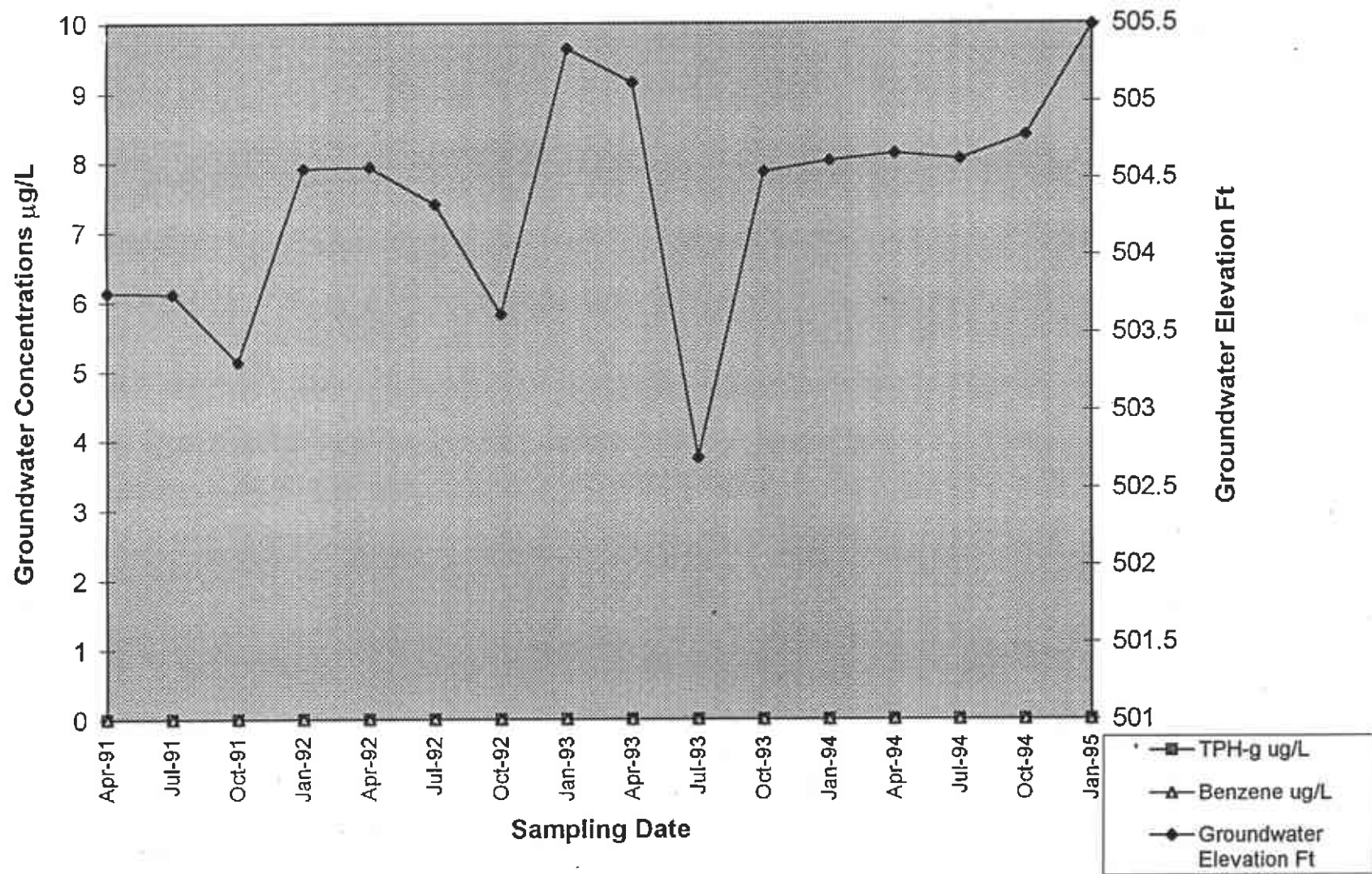


Figure 7: Summary Plot of Groundwater Elevation vs. TPH-gas Concentration at Site 6034, Well MW-4

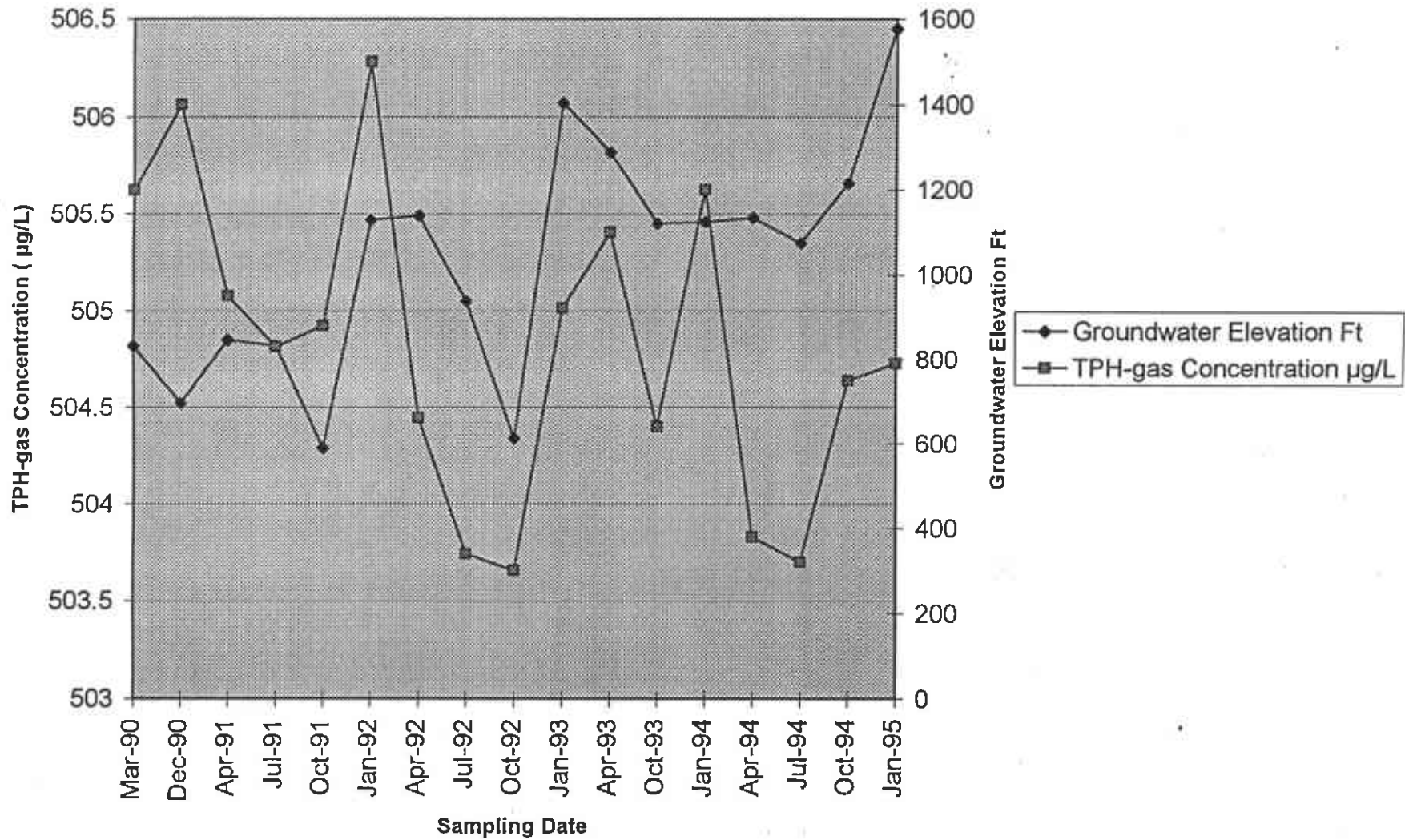


Figure 8: Summary Plot of Groundwater Elevations vs. TPH-gas Concentrations at Site 6034, MW-2

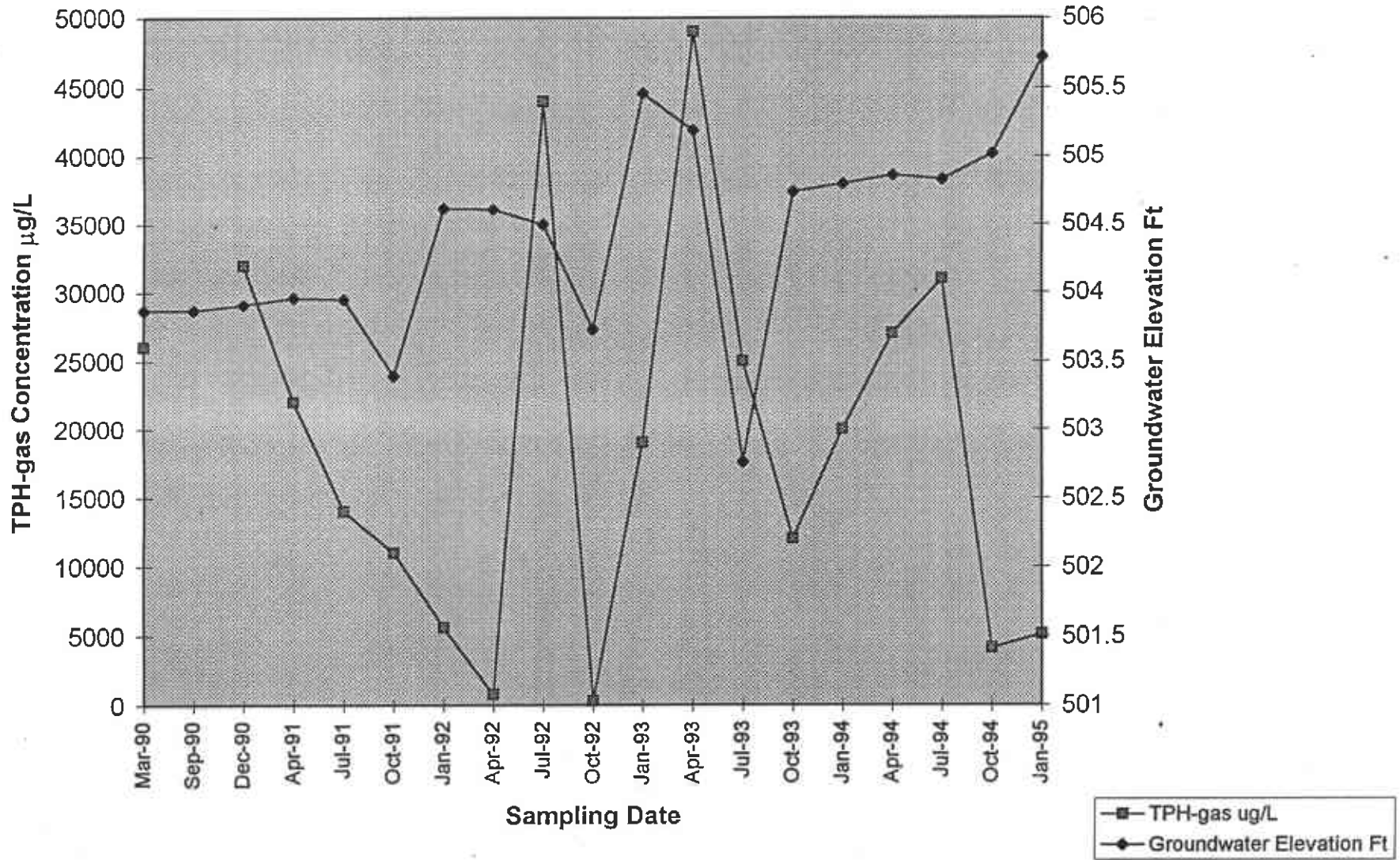


Figure 9: Summary Plot of Groundwater Elevation vs. Benzene Concentration at Site 6034, Well MW-4

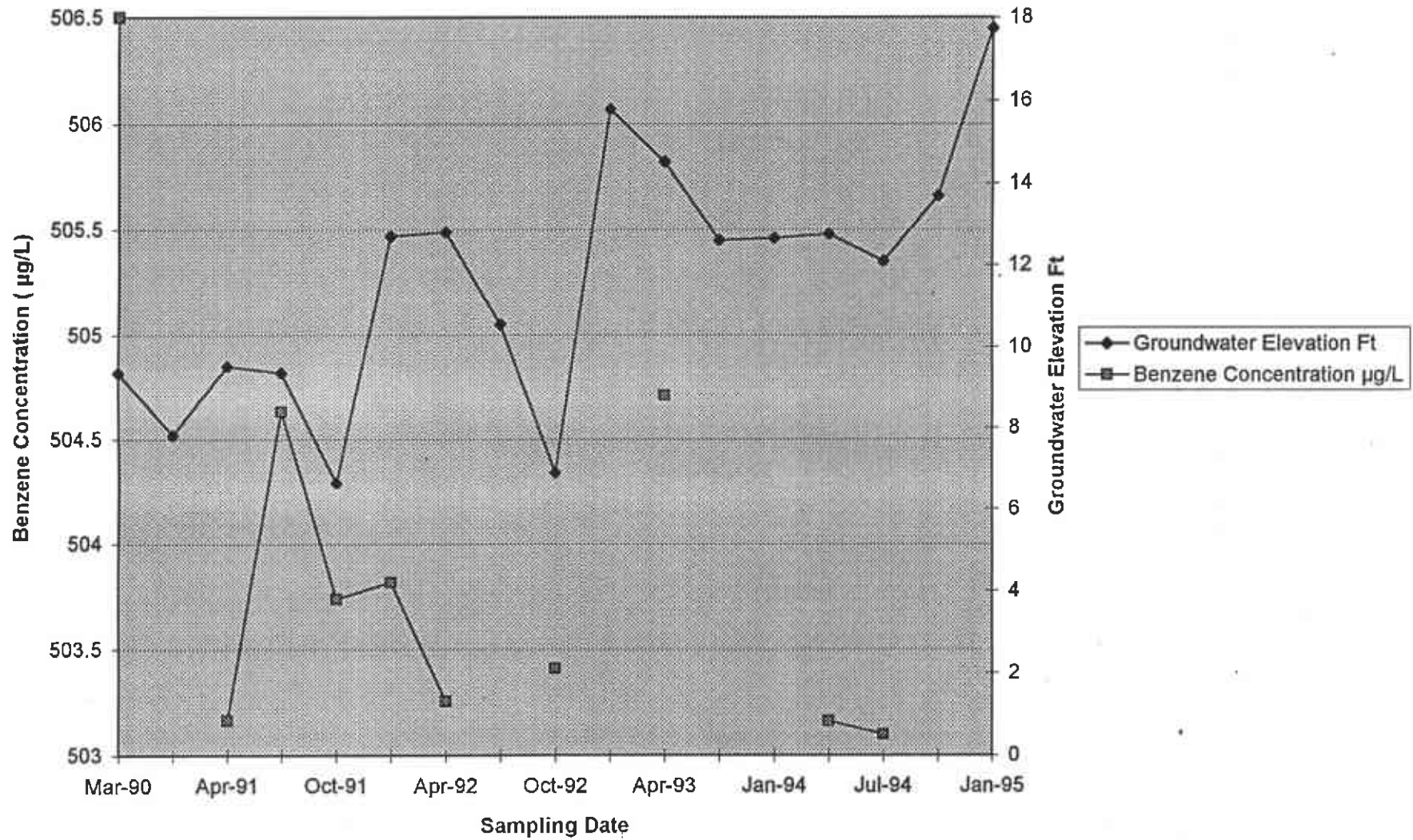
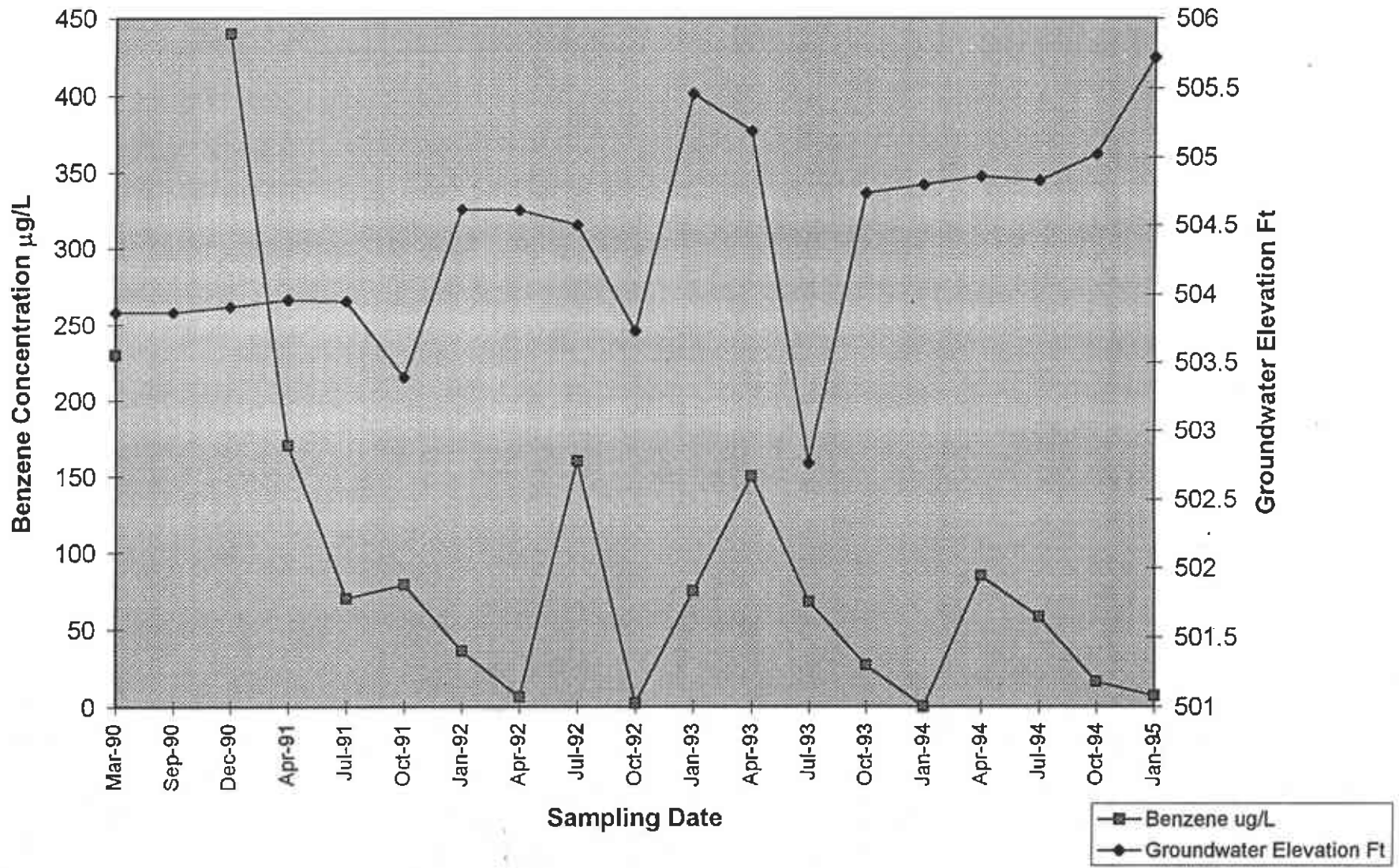
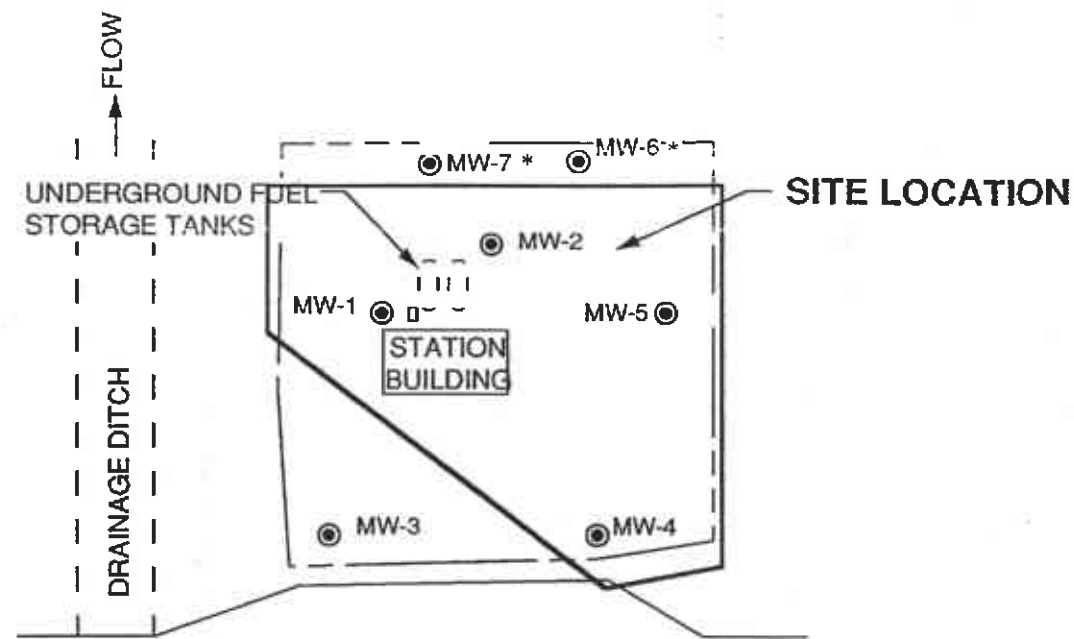
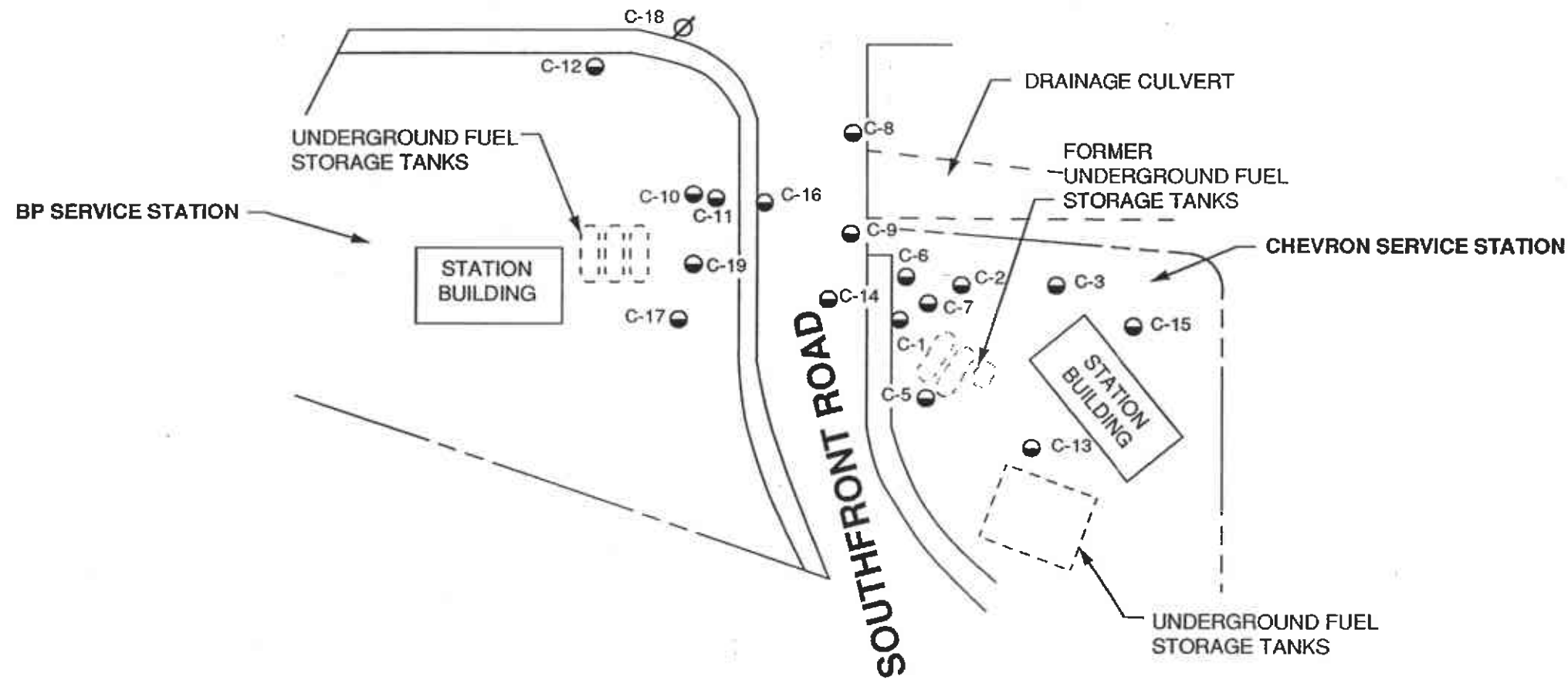


Figure 10: Summary Plot of Groundwater Elevations vs. Benzene Concentrations at Site 6034, MW-2





FIRST STREET

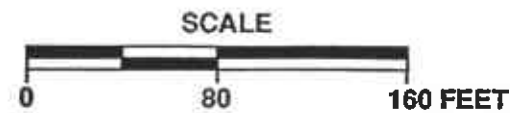


LEGEND

- MW-1 ● GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION (UNOCAL)
- C-2 ● GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION (CHEVRON)
- C-18 ∅ ABANDONED GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION (CHEVRON)
- NON-ATTAINMENT AREA ZONE
- * CONTAINMENT MONITORING WELL LOCATIONS



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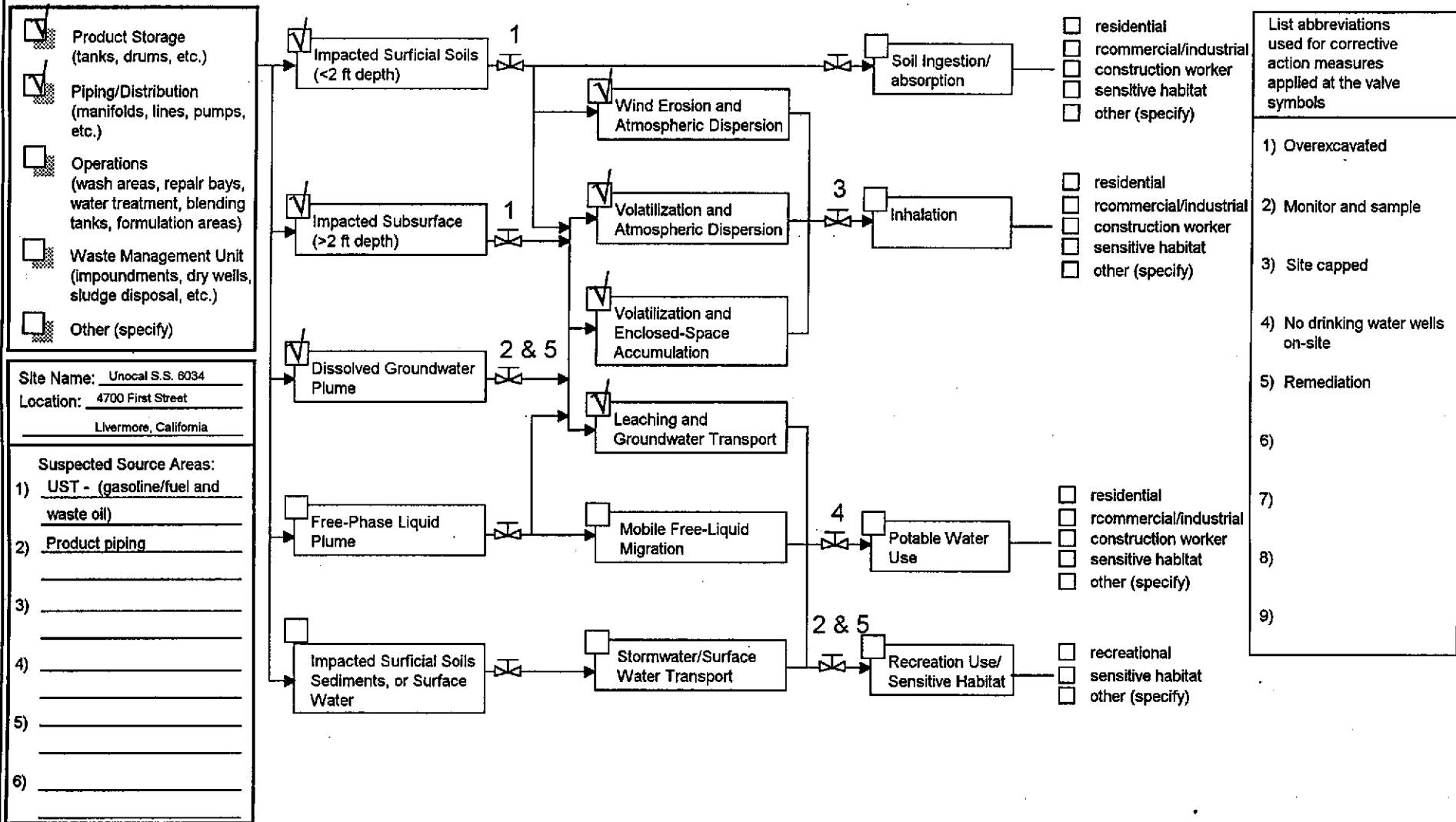


UNOCAL SERVICE STATION 6034
4700 First Street at Southfront Road
Livermore, California

NON-ATTAINMENT AREA AND CONTAINMENT MONITORING LOCATIONS

FIGURE:
11
PROJECT:
310-105.3A

Primary Sources	Secondary Sources	Transport Mechanisms	Exposure Pathways	Receptor Characterization	Corrective Action Options
-----------------	-------------------	----------------------	-------------------	---------------------------	---------------------------



Step 1: Characterize Site Sources and Exposure Pathways • complete Tier 1 worksheets • check applicable boxes for sources, release mechanisms, and actual or imminent exposure pathways ✓	Step 2: Identify Receptors, Compare Site Conditions with Tier 1 Levels • identify receptors • check applicable boxes for potential receptors and RBSL value(s) exceeded ✓	Step 3: Identify Potential Corrective Measures • complete Tier 1 Summary Report • fill in exposure pathway shut-off valves, <input checked="" type="checkbox"/> record the abbreviation for the corrective measure above the valve, and record the abbreviation on the right-hand-side table.
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UNOCAL SERVICE STATION 6034
 4700 First Street at Southfront Road
 Livermore, California

RISK ASSESSMENT: EXPOSURE PATHWAY ANALYSIS

FIGURE: 12
PROJECT: 310-105.3A

13101053A/EVALFLOW.VSD

6. REFERENCES

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- Kaprealian Engineering, Inc. *Soil Sampling Report.* August 15, 1989.
- Kaprealian Engineering Inc. *Preliminary Groundwater Investigation.* December 18, 1989.
- Kaprealian Engineering Inc. *Quarterly Report.* July 24, 1990.
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- Kaprealian Engineering Inc. *Quarterly Report.* May 4, 1992.
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- Kaprealian Engineering Inc. *Quarterly Summary Report.* Third Quarter 1992.
- Kaprealian Engineering Inc. *Status Report on Environmental Project SS# 6034 Livermore, CA.* November 18, 1992.
- Kaprealian Engineering Inc. *Quarterly Report.* December 1, 1993.
- MPDS, Inc. *Quarterly Data Report.* August 16, 1994.

**APPENDIX A
HISTORICAL GROUNDWATER DATA**

TABLE 3

**SUMMARY OF LABORATORY ANALYSES
WATER
UNOCAL MONITORING WELLS**

<u>Date</u>	<u>Well #</u>	<u>TPH as Gasoline</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethyl- benzene</u>	<u>Xylenes</u>
1/18/95	MW1	SAMPLED ANNUALLY				
	MW2	5,100	6.8	7.3	100	1,500
	MW3	SAMPLED SEMI-ANNUALLY				
	MW4	790	1.5	3.3	1.2	2.6
	MW5	ND	ND	ND	ND	ND
	MW6	WELL WAS OBSTRUCTED BY ROOTS				
	MW7	ND	ND	ND	ND	ND
10/19/94	MW1	SAMPLED ANNUALLY				
	MW2	4,100	16	3.5	8.6	1,100
	MW3	ND	ND	0.61	ND	0.51
	MW4	750	ND	3.6	4.2	3.4
	MW5	ND	ND	0.71	ND	0.57
	MW6	WELL WAS OBSTRUCTED BY ROOTS				
	MW7	ND	ND	0.87	ND	0.61
7/21/94	MW1	SAMPLED ANNUALLY				
	MW2	31,000	58	29	940	6,200
	MW3	SAMPLED SEMI-ANNUALLY				
	MW4	320	0.51	1.4	1.0	1.6
	MW5	ND	ND	ND	ND	ND
	MW6	ND	ND	ND	ND	ND
	MW7	ND	ND	ND	ND	ND
4/21/94	MW1*	ND	ND	ND	ND	ND
	MW2	27,000	85	65	880	5,300
	MW3	ND	ND	ND	ND	ND
	MW4	380	0.83	1.2	1.2	1.7
	MW5	ND	ND	ND	ND	ND
	MW6	ND	ND	ND	ND	ND
	MW7	ND	ND	ND	ND	ND

TABLE 3 (Continued)

SUMMARY OF LABORATORY ANALYSES
WATER
UNOCAL MONITORING WELLS

<u>Date</u>	<u>Well #</u>	<u>TPH as Gasoline</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethyl-benzene</u>	<u>Xylenes</u>
1/20/94	MW2	20,000	ND	ND	270	3,300
	MW3	SAMPLED SEMI-ANNUALLY				
	MW4	1,200	ND	2.6	4.7	7.4
	MW5	ND	ND	ND	ND	ND
	MW6	ND	ND	ND	ND	ND
	MW7	ND	ND	ND	ND	ND
	10/20/93	MW2	12,000	27	10	100
MW3		ND	ND	ND	ND	ND
MW4		640	ND	2.5	2.3	1.9
MW5		110	0.80	ND	ND	ND
MW6		ND	ND	ND	ND	ND
MW7		ND	ND	ND	ND	ND
7/20/93		MW2	25,000	68	94	1,000
	MW3	ND	ND	ND	ND	ND
	MW4	NOT SAMPLED - SAMPLING ACCESS DENIED				
	MW5▲	89	1.1	0.51	ND	1.8
	MW6	WELL WAS OBSTRUCTED				
	MW7	ND	ND	ND	ND	ND
	4/22/93	MW2	49,000	150	1,000	3,000
MW3		ND	ND	ND	ND	ND
MW4		1,100	8.8	1.0	7.2	6.0
MW5▲		94	1.2	ND	ND	1.3
MW6		WELL WAS OBSTRUCTED				
MW7		ND	ND	ND	ND	ND
1/14/93		MW2	19,000	75	430	900
	MW3	ND	ND	ND	ND	ND
	MW4	920	ND	6.3	12	3.9
	MW5▲	91	ND	0.53	1.2	11
	MW6	WELL WAS OBSTRUCTED				
	MW7	ND	ND	ND	ND	ND

TABLE 3 (Continued)

SUMMARY OF LABORATORY ANALYSES
WATER
UNOCAL MONITORING WELLS

Date	Well #	TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Xylenes	
10/16/92	MW2	290	2.3	ND	5.1	15	
	MW3	ND	ND	ND	ND	ND	
	MW4	300	2.1	ND	4.8	13	
	MW5▲	180	7.8	1.1	17	6.4	
	MW6	WELL WAS OBSTRUCTED					
	MW7	ND	ND	ND	ND	ND	
	7/07/92	MW2	44,000	160	1,100	1,000	17,000
MW3		ND	ND	ND	ND	ND	
MW4		340	ND	2.2	2.4	2.4	
MW5▲		76	0.48	1.1	0.32	1.3	
MW6		ND	ND	ND	ND	ND	
MW7		ND	ND	ND	ND	ND	
4/06/92		MW2	760	6.3	2.1	ND	130
	MW3	ND	ND	ND	ND	ND	
	MW4	660	1.3	3.8	2.9	4.1	
	MW5	240◆	ND	ND	0.35	ND	
	MW6	ND	ND	ND	ND	ND	
	MW7	ND	ND	ND	ND	ND	
	1/14/92	MW2	5,600	36	120	450	2,600
MW3		ND	ND	ND	ND	ND	
MW4		1,500	4.2	7.1	18	9.2	
MW5		99	1.0	1.2	ND	0.32	
MW6		ND	ND	ND	ND	ND	
MW7		ND	ND	ND	ND	ND	
10/14/91		MW2	11,000	79	130	660	4,700
	MW3	ND	ND	ND	ND	ND	
	MW4	880	3.8	2.2	8.6	5.8	
	MW5	660	55	4.4	50	66	
	MW6	ND	ND	ND	ND	ND	
	MW7	ND	ND	ND	ND	ND	

TABLE 3 (Continued)

SUMMARY OF LABORATORY ANALYSES
WATER
UNOCAL MONITORING WELLS

<u>Date</u>	<u>Well #</u>	<u>TPH as Gasoline</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethyl-benzene</u>	<u>Xylenes</u>
7/10/91	MW1*	ND	ND	ND	ND	ND
	MW2	14,000	70	160	570	5,400
	MW3	ND	ND	ND	ND	ND
	MW4	830	8.4	19	7.7	7.2
	MW5	220	5.1	8.7	9.1	9.7
	MW6	ND	ND	ND	ND	ND
	MW7	ND	ND	ND	ND	ND
4/10/91	MW1*	ND	ND	ND	ND	ND
	MW2	22,000	170	190	490	6,200
	MW3	ND	ND	ND	ND	ND
	MW4	950	0.84	4.3	9.6	5.0
	MW5	630	35	14	47	30
	MW6	ND	ND	ND	ND	ND
	MW7	ND	ND	ND	ND	ND
12/24/90	MW1*	ND	ND	ND	ND	0.40
	MW2	32,000	440	340	460	13,000
	MW3	ND	ND	ND	ND	ND
	MW4	1,400	ND	8.7	15	10
9/07/90	MW1*	ND	ND	1.2	ND	ND
	MW2	ND	ND	1.5	ND	ND
	MW3	1,100	11	ND	6.6	16
	MW4	15,000	100	140	210	4,600
6/05/90	MW1*	ND	ND	ND	ND	ND
	MW2	31,000	250	460	950	9,200
	MW3	ND	ND	ND	ND	ND
	MW4	1,400	1.2	4.7	24	12
3/08/90	MW1**	ND	ND	ND	ND	ND
	MW2	26,000	230	410	1,300	2,100
	MW3	ND	ND	ND	ND	ND
	MW4	1,200	18	8.4	37	28

TABLE 3 (Continued)

SUMMARY OF LABORATORY ANALYSES
WATER
UNOCAL MONITORING WELLS

<u>Date</u>	<u>Well #</u>	<u>TPH as Gasoline</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethyl-benzene</u>	<u>Xylenes</u>
11/18/89	MW1***	ND	ND	ND	ND	ND
	MW2	53,000	540	500	130	22,000
	MW3	ND	0.35	ND	ND	ND
	MW4	990	9.8	10	7.1	4.7

- ◆ Sequoia Analytical Laboratory reported that the hydrocarbons detected did not appear to be gasoline.
- * Total Oil & Grease (TOG) and all EPA method 8010 constituents were non-detectable.
- ** TOG was detected at 4.7 milligrams per liter (mg/L). All EPA method 8010 compounds were non-detectable.
- *** TOG was detected at 3.1 mg/L. All EPA method 8010 compounds were non-detectable, except for trichloroethene at 0.55 µg/L.
- ▲ Methyl tert butyl ether was detected at a concentration of 2.2 µg/L on July 20, 1993, 0.82 µg/L on April 22, 1993, 1.2 µg/L on January 14, 1994, 2.0 µg/L on October 16, 1992, and 1.5 µg/L on July 7, 1992.

ND = Non-detectable.

-- Indicates analysis was not performed.

Results are in micrograms per liter (µg/L), unless otherwise indicated.

Note: Laboratory analyses data prior to January 20, 1994, were provided by Kaprealian Engineering, Inc.