



70 291

April 8, 1998

Mr. Barney Chan
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, #250
Alameda, CA 94502-6577

Re: **Corrective Action Plan**
Former Exxon Service Station
3055 35th Avenue
Oakland, California

Dear Mr. Chan:

On behalf of Golden Empire Properties, Cambria Environmental Technology (Cambria) is submitting this corrective action plan (CAP) for the site referenced above. The general objective of the CAP is to present a cost effective method of clean-up for the site. The proposed corrective action must adequately protect human health and the environment and restore or protect current or potential beneficial uses of water.

The goals for remediation of the site are to reduce hydrocarbon concentrations in soil and ground water to levels acceptable to the Alameda County Health Care Services Agency (ACHCSA); and/or demonstrate by risk evaluation, monitoring, or modeling that the leaching/migration potential of the remaining hydrocarbons in soil and ground water are not significant and therefore pose minimal risk to human health and the environment. Presented below are a site summary, a discussion of the distribution of hydrocarbons in soil and ground water, remedial objectives, an evaluation of remedial alternatives, and our proposed remedial approach for the site.

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SITE SUMMARY

ENVIRONMENTAL

Site Description

TECHNOLOGY, INC.

1144 65TH STREET,

SUITE B

OAKLAND,

CA 94608

PH: (510) 420-0700

FAX: (510) 420-9170

Site Location: The site is a former Exxon Service Station located at the northeast corner of 35th Avenue and School Street in Oakland, California (Figure 1). Currently, the site is a unpaved vacant lot situated within a mixed commercial and residential setting approximately 3 blocks west of the 580 Freeway. The topography in the area slopes generally westward towards the Oakland Inner Harbor and San Francisco Bay. The nearest surface water is Peralta Creek, located approximately 0.1 miles north (cross gradient) of the site.

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Adjacent Hydrocarbon Sources: An active British Petroleum (BP) service station is located on 35th Avenue one block east (upgradient) of the site. A former Texaco station is located across School Street immediately east (upgradient) of the site. Texaco's underground storage tanks were removed about 15 years ago. No soil samples were collected during the tank removal and no investigation has been conducted at the former Texaco site.

Site Lithology: The site lithology is highly variable and consists primarily of interbedded lenses of silty gravel, sands, silty sands, and sandy silts and clays to the maximum explored depth of 30 feet. The clayey soils are generally stiff and very plastic, and are highly expansive with increasing moisture contents. Local base rock backfill is present in the vicinity of the former underground storage tanks (USTs) and pump islands.

Ground Water Depth: During the past 3.5 years of quarterly ground water monitoring, the depth to ground water has ranged from approximately 8 to 20 ft below grade surface (bgs).

Ground Water Flow Direction: Ground water flows primarily towards the northwest, however a southwest ground water flow direction has been calculated from monitoring data collected during the fourth quarter of previous years.

Site Background

October 1990 Geotechnical Investigation: In October 1990, Geotechnical Engineering Inc. of Fremont, California, drilled two soil borings at the site for an pre-construction engineering analysis. No samples were collected for hydrocarbon analysis.

January 1991 Tank Removal: In January 1991, Pacific Excavators removed two 4,000-gallon USTs, two 6,000-gallon gasoline USTs, and one 500-gallon waste oil UST from the site. According to a September 24, 1992 report prepared by Consolidated Technologies of San Jose, California (CT), soil samples were collected during the tank removal, but were not analyzed or reported by Pacific Excavators (CT, 1992).

November 1991 Subsurface Investigation: In November 1991, CT drilled twelve soil borings to depths up to 35 ft bgs (Figure 2). Total petroleum hydrocarbons as gasoline (TPHg) concentrations were detected in soil samples collected from 11 of the 12 soil borings up to 2,100 parts per million (ppm). No total petroleum hydrocarbons as diesel (TPHd) or oil and grease (O&G) concentrations were detected in boring B-7, which is immediately down gradient of the former waste oil tank.

May 1994 Subsurface Investigation: Between May 5 and 9, 1994, Cambria drilled seven soil borings and installed three onsite monitoring wells (MW-1 through MW-3). TPHg concentrations were detected in six of the seven soil borings at concentrations up to 2,900 ppm. TPHg and benzene concentrations were detected in ground water at maximum concentrations of 130,000 and 22,000 parts per billion (ppb), respectively.

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Ground Water Monitoring: Quarterly ground water monitoring and sampling has been performed at the site since May 1994.

Remedial Testing: In July 1996, Cambria conducted a series of remedial tests involving soil vapor extraction (SVE), SVE combined with air sparging (AS), and SVE combined with aquifer pumping. Using an internal combustion engine, vacuums up to 150 inches of water were applied to each test well (MW-1 through MW-3) for a period ranging from 20 to 45 minutes. Very low air flow rates of 0.06, 0.36 and 0.40 cubic feet per minute were achieved from test wells MW-1, MW-2, and MW-3, respectively. TPHg soil vapor concentrations collected from each well at the end of the test ranged from less than 250 parts per million by volume (ppmv) in test wells MW-1 and MW-2, and greater than 10,000 ppmv in test well MW-3. No significant increases in air flow or soil vapor concentrations were observed when SVE was combined with AS. When SVE was combined with aquifer dewatering (0.5 gpm), the air flow rate from MW-2 increased significantly to 15 cfm, however, no corresponding increase in soil vapor concentrations was observed. **No vacuum radius of influence or ground water drawdown influence was observed in any well. The generally low air and ground water flow rates were indicative of low permeability soils.** Results of the remedial testing also indicated that SVE and/or AS with vacuums up to 150 inches of water, would not be effective in removing hydrocarbons from the subsurface soils. **However, dewatering combined with SVE could enhance remedial efforts.**

February 1997 Plume Definition: On February 26, 1997, Cambria installed one additional onsite monitoring well (MW-4) at the site. TPHg were detected in soil at a maximum concentration of 150 ppm at 15 ft bgs. TPHg and benzene concentrations were detected in ground water at concentrations of 47,000 and 11,000 parts per billion (ppb), respectively.

HYDROCARBON DISTRIBUTION IN SOIL AND GROUND WATER

Hydrocarbons in Soil: Gasoline-range hydrocarbons were detected in a majority of the onsite borings drilled during previous investigations. **The highest hydrocarbon concentrations were detected in the vicinity down gradient from the former underground gasoline storage tanks and the southernmost pump island (Figure 3, Table 1).** Vertically, the hydrocarbon-impacted soil is primarily located near the ground water table, within a zone from 15 to 20 ft bgs.

Hydrocarbons in Ground Water: Gasoline-range hydrocarbons are present in all four onsite monitoring wells, primarily in the vicinity down gradient from the former underground gasoline tanks and the southernmost pump island (Figures 5, Table 2). A hydrocarbon sheen has been observed in three of the four wells during sampling, and TPHg/BTEX concentrations detected in ground water are near the saturation concentrations of these compounds in ground water.

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REMEDIAL OBJECTIVES

Remediation objectives are typically based on one or more of the following criteria:

- Department of Toxic Substances Control (DTSC) maximum contaminant levels (MCLs) for drinking water,
- Risk-based cleanup levels established by risk assessments or risk-based corrective action (RBCA) guidelines,
- Current closure guidelines from the regulatory agencies, such as the RWQCB criteria for low-risk ground water cases, or
- Asymptotic levels have been achieved for chemical concentrations in ground water or soil vapor extracted by a remediation system.

The proposed remediation objectives in this CAP are a combination of the above criteria. Our objectives are to implement the most cost effective approach for remediating site ground water, protecting sensitive receptors and human health, and to comply with regulatory concerns. Due to the absence of any known water supply wells or surface waters in the vicinity of the site, hydrocarbon inhalation is the pathway with the most potential exposure to humans. Therefore, this CAP should control potential exposure to hydrocarbon vapors and provide enhanced remediation of residual hydrocarbons beneath the site.

Given the specific site conditions, the specific CAP objectives are to:

- Prevent liquid/dissolved-phase hydrocarbon migration from the site;
- Remediate soil and ground water to improve soil and ground water quality to the point where natural attenuation can remediate any residual hydrocarbons;
- Safeguard human health from subsurface hydrocarbon vapors; and
- Continue the ground water monitoring program to monitor water quality.

REMEDATION ALTERNATIVE EVALUATION

Cambria evaluated five alternatives to remediate ground water at the site. A description of each alternative is presented below. In accordance with Title 23 of the UST regulations, we propose to implement the most cost-effective alternative to remediate the hydrocarbon source area to the point where natural attenuation can remediate any residual hydrocarbons remaining at this site.

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Soil Excavation

Method Description and Comments: Removal of hydrocarbons contained in shallow clayey soils from the subsurface is best accomplished through soil excavation and treatment or disposal. This method is generally cost effective and technically feasible for sites that have shallow hydrocarbon-impacted soil (less than 17 ft bgs), no overhead obstructions or buildings, available space for soil stockpiling or staging, and do not require shoring or dewatering.

Cost Effectiveness: The estimated costs required to excavate, assuming an excavation depth of 20 ft bgs, a 100 ppm TPHg excavation cutoff, and a removal rate of \$60/cubic yard (includes excavation, loading, hauling, disposal at a Class II landfill, backfill, and compaction), would be approximately \$666,000. This estimated amount does not include the potential costs associated with ground water dewatering and disposal, or potential shoring along the property boundaries.

Recommendations: Due to the fact that a large portion of the hydrocarbons at the site are not located close to the surface and that dewatering and shoring activities would likely be required, excavation does not appear to be a cost effective remedial technique for source removal at this site.

Soil Vapor Extraction with Ground Water Pumping

This alternative involves applying a vacuum to extract hydrocarbon-bearing vapors from the vadose zone and capillary fringe area while using downhole pumps to separately extract hydrocarbon-impacted ground water and lower the ground water table. A positive displacement blower is typically used to create a vacuum up to 12 inches of mercury. Extracted vapor-phase hydrocarbons are typically treated by granular activated carbon, a catalytic or thermal oxidizer, or an internal combustion engine. Pneumatic or electric downhole pumps are typically used to extract ground water. Extracted liquids are typically treated by an air stripper and/or by granular activated carbon. SVE can improve ground water quality by removing source area hydrocarbons, by encouraging hydrocarbon diffusion from ground water, and by delivering oxygen to the subsurface. Oxygen usually stimulates naturally-occurring hydrocarbon biodegradation. Ground water pumping can lower the water table thereby exposing more well screen and allowing additional air flow from the subsurface. In general, this method is most effective for moderate to high permeability soils. Cambria's remedial testing indicated that although SVE was enhanced when accompanied with ground water pumping, air flow rates and the resulting hydrocarbon recovery rates were relatively low.

Cost-Effectiveness: A SVE/GW system would likely operate for about 12 to 18 months to reach low, asymptotic hydrocarbon concentrations in the system influent. Installing a SVE system would cost approximately \$130,000, including the costs to install as many as ten additional remediation wells. Operation and maintenance of the SVE system would likely cost approximately \$35,000 per year.

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Recommendation: Because SVE/GW testing yielded relatively low hydrocarbon removal rates and minimal radius of influence within the low permeable soils, this alternative does not appear to be an appropriate remedial technique for source removal at this site.

Dual Phase Vacuum Extraction

Dual Phase Vacuum Extraction (DPVE) is an insitu method that involves applying a high vacuum to an extraction tube inserted into a monitoring well to simultaneously remove liquid/dissolved-phase and vapor-phase hydrocarbons from the subsurface. The extracted liquids and vapors are separated at surface and treated similarly to a SVE system. Using a high vacuum liquid ring pump, the radius of influence is expanded allowing for increased removal rates of vapor-phase hydrocarbons from low permeability soils and/or from greater distances. Ground water removal using a high vacuum creates a larger ground water cone of depression allowing greater hydraulic plume control than typical ground water pumping systems. The use of an extraction tube also allows the selective removal of floating free product, if present. DPVE is most effective for low to moderate permeability soils, shallow ground water conditions, and sites with hydrocarbon-impacted soils trapped below groundwater.

Cost-Effectiveness: A DPVE system would likely operate for approximately 6 to 9 months to reach low, asymptotic hydrocarbon concentrations in the system influent. Installing a DPVE system would cost approximately \$100,000, including the costs to install as many as ten additional remediation wells. Initial system installation capital costs could be decreased through the rental of certain system components. Operation and maintenance of the DPVE system would likely cost about \$35,000 per year.

Recommendation: Because the hydrocarbons are within low permeable soils and are primarily located beneath the groundwater table, the high vacuum and dewatering capabilities of a DPVE system would be an effective remedial technique for source removal at this site.

Ground Water Oxygenation with Oxygen Releasing Compound (ORC)

This is a relatively new remedial technique being implemented at numerous sites. ORC™ releases dissolved oxygen (DO) into ground water to stimulate and accelerate naturally occurring aerobic hydrocarbon biodegradation. ORC™ is capable of elevating dissolved oxygen (DO) concentrations up to 40 mg/l, while DO concentrations from air injection techniques such as air sparging can typically only achieve up to about 10 mg/l. Unlike air injection techniques, ORC™ oxygenates ground water without the potential for causing hydrocarbon vapor migration. ORC™ is a solid magnesium peroxide compound that becomes activated by moisture thereby causing the release of oxygen into the ground water. ORC™ can be installed in existing ground water monitoring wells or installed as a slurry in borings drilled below the water table. ORC™ has been used to remediate low levels of hydrocarbons in ground water or to create a barrier to prevent the migration of a hydrocarbon plume. Biodegradation of hydrocarbons using ORC™ is dependent upon the amount and extent of the hydrocarbons, and the hydrogeologic and biological subsurface conditions.

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Cost-Effectiveness: When used for sites with low levels of dissolved-phase hydrocarbons of limited extent, ORC™ can be an easy and relatively inexpensive method of remediation, requiring no system operation or maintenance. Theoretical calculations indicate that approximately 30 pounds of ORC™ per pound of gasoline is typically required to remediate a site. With ORC™ costing approximately \$10 per pound, remediation of sites having a large hydrocarbon plume and/or elevated levels of hydrocarbons (large hydrocarbon mass) would likely be cost prohibitive. Due to variable subsurface conditions, the remedial effectiveness and time frame can not be accurately estimate without additional testing.

Recommendation: Because of the large mass of hydrocarbons below *and* above the ground water table, oxygenation using ORC™ does not appears to be a cost-effective and appropriate remedial technique for this site. This approach may be feasible after a majority of the hydrocarbon source from the vadose and smear zones has been removed.

Natural Attenuation

The natural attenuation alternative involves allowing hydrocarbons to biodegrade naturally and implementing a long-term ground water monitoring plan. The recent Lawrence Livermore National Laboratory report indicates that almost all subsurface hydrocarbons releases eventually stabilize and degrade on their own. In response to this report, the RWQCB focuses on source area removal, and no longer requests active remediation of dissolved hydrocarbons at most sites.

Hydrocarbon concentration trends are the primary indicators of natural attenuation rates. Secondary indicators such as DO, oxidation-reduction potential (ORP), alkalinity, nitrate, sulfate and ferrous iron are also used to evaluate the potential for natural attenuation. Natural attenuation at a given site can be due to aerobic and anaerobic hydrocarbon degradation. Most sites exhibit aerobic hydrocarbon degradation, and an inverse relationship is observed between hydrocarbon and DO concentrations. More specifically, DO concentrations are typically reduced in the hydrocarbon source area compared to near the plume boundary. For natural attenuation to occur by aerobic processes, a minimum of about 1 mg/l DO is required. Under anaerobic processes, sulfates, nitrates, and iron can act as electron receptors.

Cost-Effectiveness: Since this alternative allows hydrocarbons to degrade naturally and does not require active remediation, this is a very cost effective alternative. Sampling for intrinsic bioremediation parameters typically costs about \$100 per well when performed in conjunction with routine ground water monitoring. This sampling is frequently performed only once or twice at a site. Subsequently, only DO is monitored, which generally increases monitoring costs by about \$20/well. Since the site is currently being monitored on a quarterly basis for hydrocarbons, additional increases in monitoring costs would be about \$1,000 per year. The cost of additional ground water monitoring should be considered in the overall cost-effectiveness evaluation.

Recommendation: A natural bioattenuation protocol could be implemented once the DPVE has removed a majority of the hydrocarbon source.

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PROPOSED CORRECTIVE ACTION APPROACH

Based on the evaluation of the remedial alternatives above, Cambria proposes remediating the hydrocarbon impacted soil and ground water using DPVE. Remediation by this method has the following advantages: (1) ground water can be lowered to a specific depth facilitating the removal of hydrocarbons from the smear zone, (2) the high vacuum used in DPVE affects a larger area requiring less remediation wells, (3) DPVE typically has higher hydrocarbon removal rates resulting in faster site remediation and lower overall operating costs, and (5) installation of a DPVE system at this site is a simple, straightforward process. By using this remedial method, the site cleanup objectives will be satisfied in a quick and cost-effective manner. Cambria recommends implementing the following CAP as described below.

Additional Investigation

Based on a meeting with Mr. Barney Chan of the Alameda County Department of Environmental Health on December 18, 1997, it was agreed that additional assessment activities would be performed at the site. One soil boring will be drilled upgradient from the site to assess whether Texaco's former USTs may have released hydrocarbons that could be impacting the site. One or two additional groundwater monitoring wells will be installed down gradient of the site to define the down gradient extent of the hydrocarbon plume. See Figure 6 for location of the proposed soil boring and proposed ground water monitoring well(s). Soil samples will be collected at five foot intervals, and a grab ground water sample will be collected from each boring. The soil samples will be analyzed for TPHg and BTEX, and the grab groundwater samples will be analyzed for TPHg, BTEX, and MTBE. *add TPHd*

Remediation Using Dual Phase Vacuum Extraction

The remediation system will utilize three existing wells and seven new remediation wells. Above ground piping will run from each wellhead to a treatment compound, and a new electrical service will supply power to the compound. Vapor treatment will be performed by a thermal/catalytic oxidizer and possibly by vapor-phase granular activated carbon as influent concentrations become lower. Groundwater treatment will be performed by a low profile air stripper. See Figure 6 for the locations of the proposed remediation wells and Figure 7 for the proposed system design. The specific system design drawings and specifications will be part of the system installation bid package.

Permitting: Air discharge permits will be secured from the Bay Area Air Quality Control Board (BAAQMD) for the DPVE system. Building and electrical permits will be obtained from the City of Oakland to install and operate the system. Well installation permits will be obtained from the Alameda County Water District to install additional remediation wells and a discharge permit will be obtained from the East Bay Municipal Utility District to allow the discharge of treated ground water into the sanitary sewer.

Well Installation: Cambria will install seven new remediation wells in the locations shown on Figure 6. The wells will consist of 4-inch-diameter casing with a screened interval from 5 to 25 ft depth. A 1-inch-diameter

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extraction tube will be inserted into each remediation well and individually connected back to a manifold in the remediation equipment compound.

System Startup: An initial startup will be performed according to BAAQMD protocol. Upon receiving the startup results, a startup report will be issued to the BAAQMD.

System Operation and Maintenance (O&M): Following the first month of system startup, source testing, and trouble shooting, O&M visits will be performed every two weeks to optimize hydrocarbon removal rates and test the destruction efficiency of the system. When the hydrocarbon vapor concentrations begin to decrease, system cycling will be performed to optimize the hydrocarbon recovery. It is anticipated that system will operate for approximately 6 to 9 months before a low, asymptotic hydrocarbon recovery rate is reached.

Reporting: Remediation system performance will be reported concurrent with the quarterly ground water monitoring reports. System performance parameters reported will include vacuum, air and ground water flow rates, influent and effluent hydrocarbon concentrations in extracted vapor and ground water, and hydrocarbon removal rates.

System Shutdown: When the system's hydrocarbon recovery rate has reached a low, asymptotic level, Cambria will submit a request to shut down the DPVE system. After receiving approval to shutdown the system permanently, we will remove the remediation equipment and associated piping. We will restore the modified wellheads to their original condition and use them as monitoring wells.

Long Term Ground Water Remediation and Monitoring

ORCTM Installation: Upon completing DPVE activities, the feasibility and cost-effectiveness of installing an oxygen releasing compound (ORCTM) will be assessed. It is possible that the ORCTM could remediate hydrocarbons down gradient of the DPVE influence area. ORCTM placed in former source area wells could also enhance remediation of any residual dissolved hydrocarbons. If residual hydrocarbon concentrations are very low after DPVE, natural attenuation may be more appropriate than ORCTM use.

Quarterly Monitoring including DO Monitoring: Cambria will continue quarterly ground water sampling by collecting ground water samples from all wells. Ground water samples will be analyzed for TPHg, BTEX, and MTBE. Cambria will also monitor DO concentrations quarterly in the wells to evaluate the oxygenation by the DPVE system and the potential for biodegradation of hydrocarbons. If ORCTM is used to enhance remediation after the system has been shut down, DO monitoring will continue in any wells containing ORCTM to determine when the ORCTM have expired. Once the DO concentrations decrease to pre-ORCTM concentrations, new ORCTM may be installed in the wells. Wells containing elevated DO concentrations due to ORCTM will be sampled without purging to avoid removal of oxygen-rich ground water.

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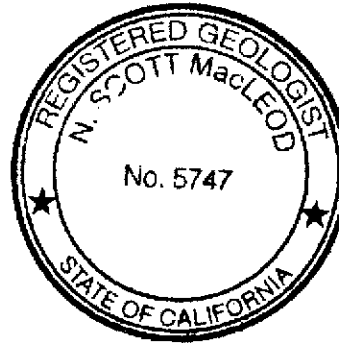
CLOSING

Please call us if you have any questions or comments.

Sincerely,
Cambria Environmental Technology, Inc.

Ron Schéele
Ron Schéele
Project Geologist

N. Scott MacLeod
N. Scott MacLeod, RG
Principal

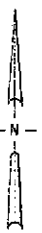
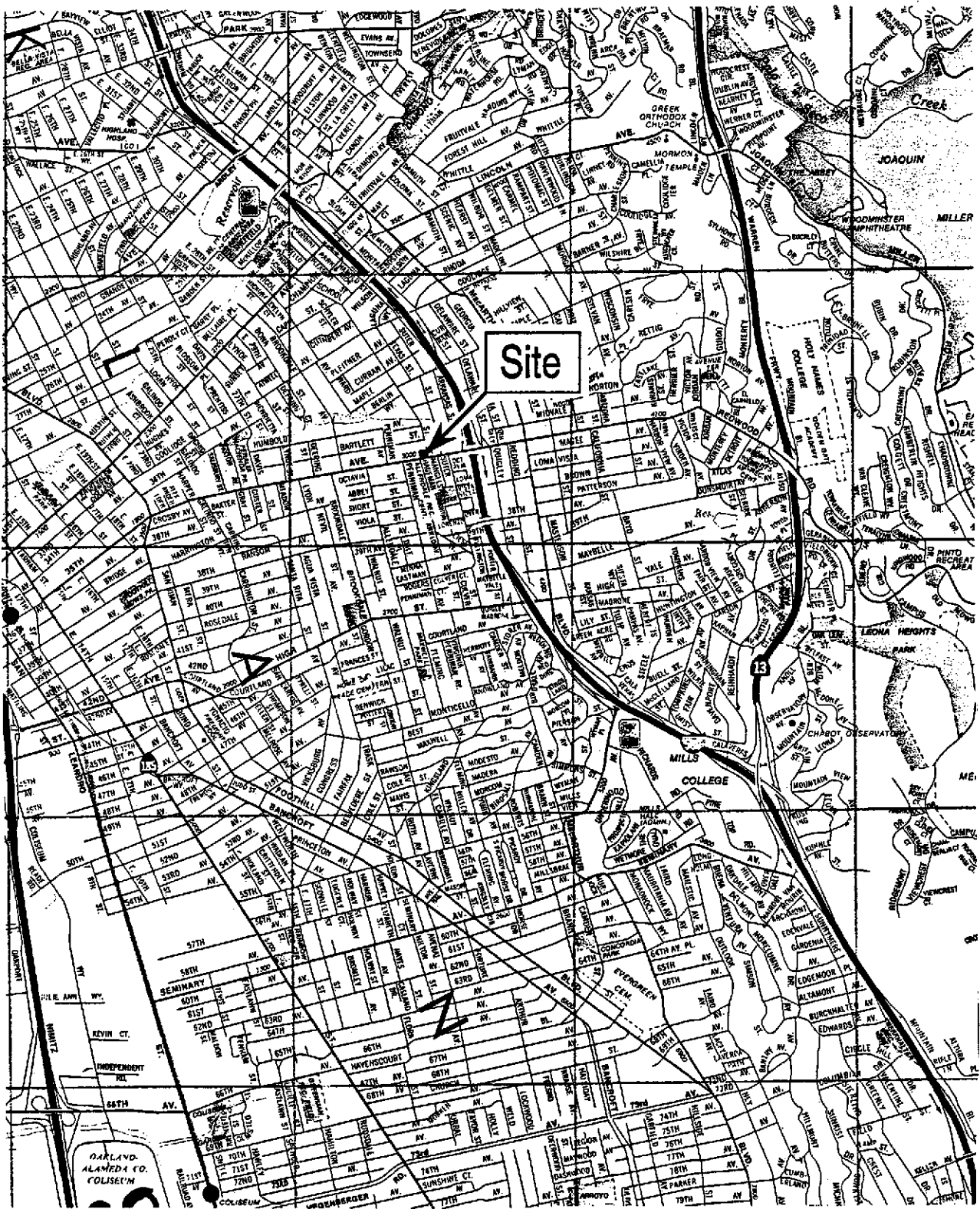


cc: Mr. Lynn Worthington, Golden Empire Properties, 5942 MacArthur Boulevard, Suite B,
Oakland, California 94605

Attachments

Figure 1: Site Location Map
Figure 2: Site Plan
Figure 3: Maximum Hydrocarbon Concentrations in Soil at 15 to 20 ft bgs
Figure 4: Ground Water Elevation Contour Map
Figure 5: Benzene Concentrations in Ground Water
Figure 6: Proposed Remediation Well Locations
Figure 7: Proposed Dual Phase Vacuum Extraction System Layout
Table 1: Soil Analytic Data
Table 2: Ground Water Elevation and Analytic Data

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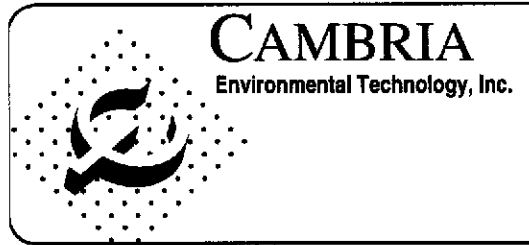
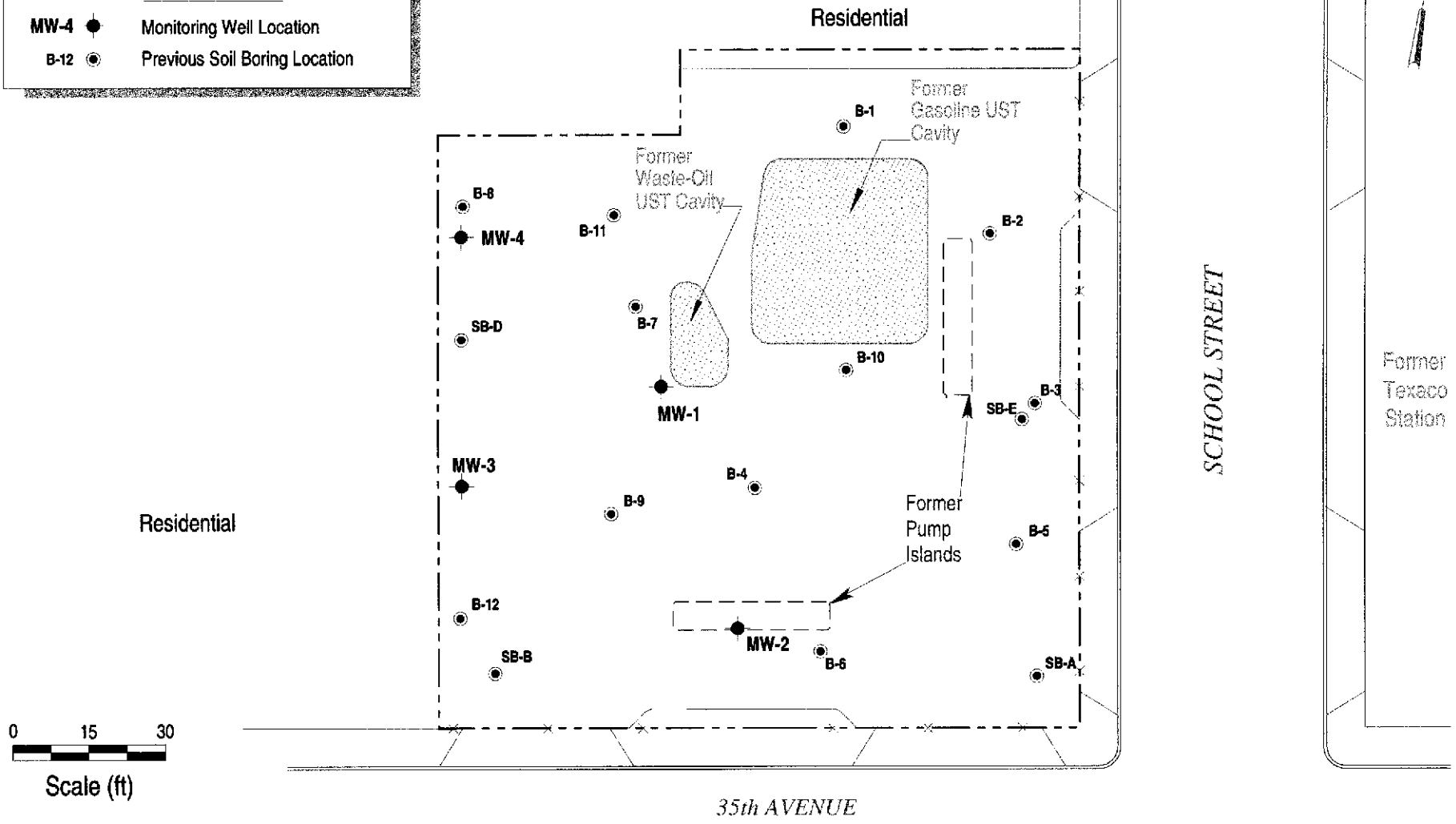
Site Map

FIGURE

1

EXPLANATION

- MW-4 ● Monitoring Well Location
- B-12 ○ Previous Soil Boring Location



Former Exxon Service Station
3055 35th Avenue
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Site Plan

FIGURE
2

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EXPLANATION

- MW-4 ● Ground Water Monitoring Well Location
- XX.X TPHg Concentrations in Parts Per Million (ppm)
- SB-1 ● Previous Soil Boring Location
- * Data Not Used For Contouring
- TPHg Concentration Contour, Dashed Where Inferred



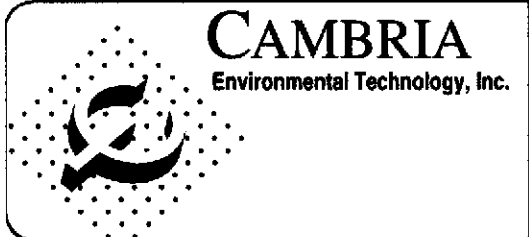
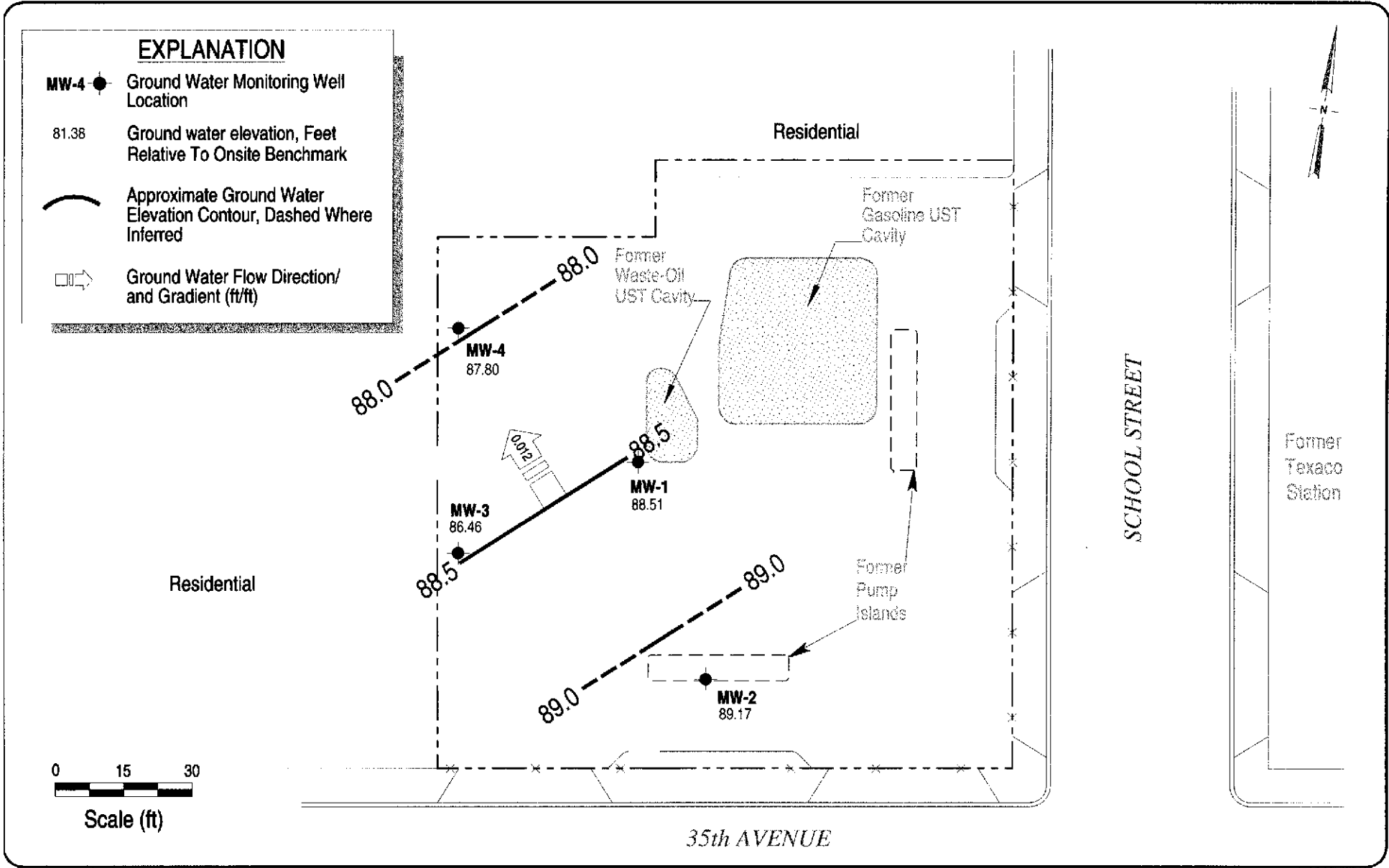
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Maximum TPHg Concentrations
in Soil at 15 to 20 ft bgs
March 18, 1998

FIGURE
3

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Oakland, California

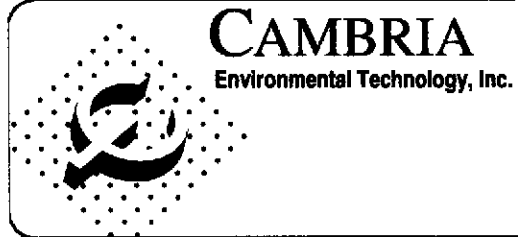
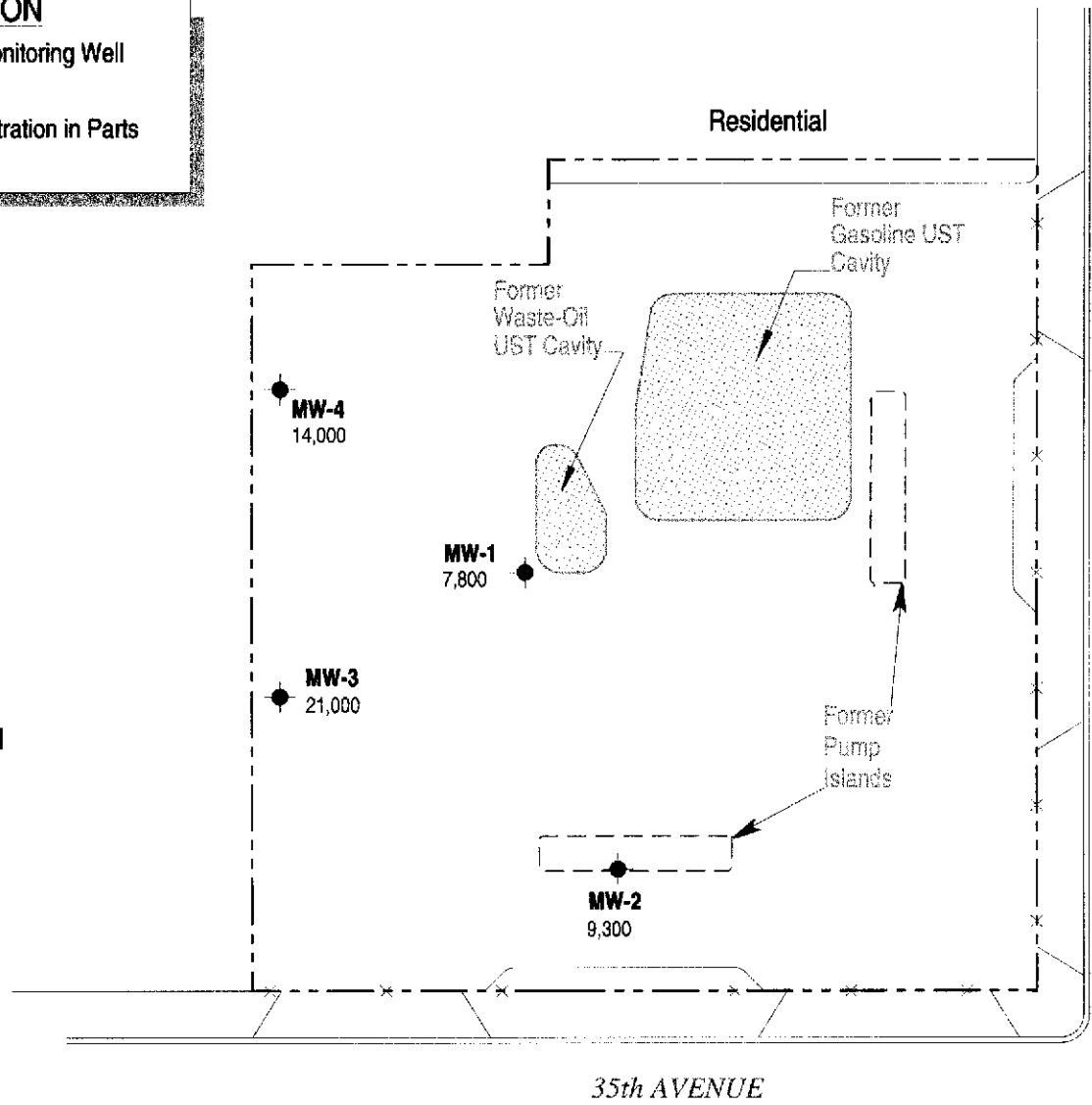
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Ground Water Elevation
Contours
March 18, 1998

FIGURE
4

EXPLANATION

- MW-4** ● Ground Water Monitoring Well Location
- X.XX** Benzene Concentration in Parts Per Billion (ppb)

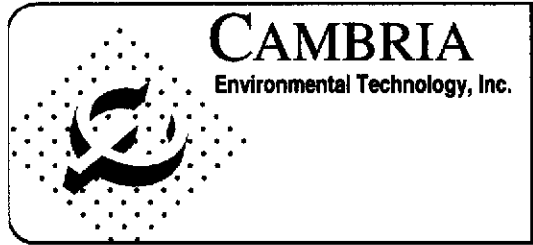
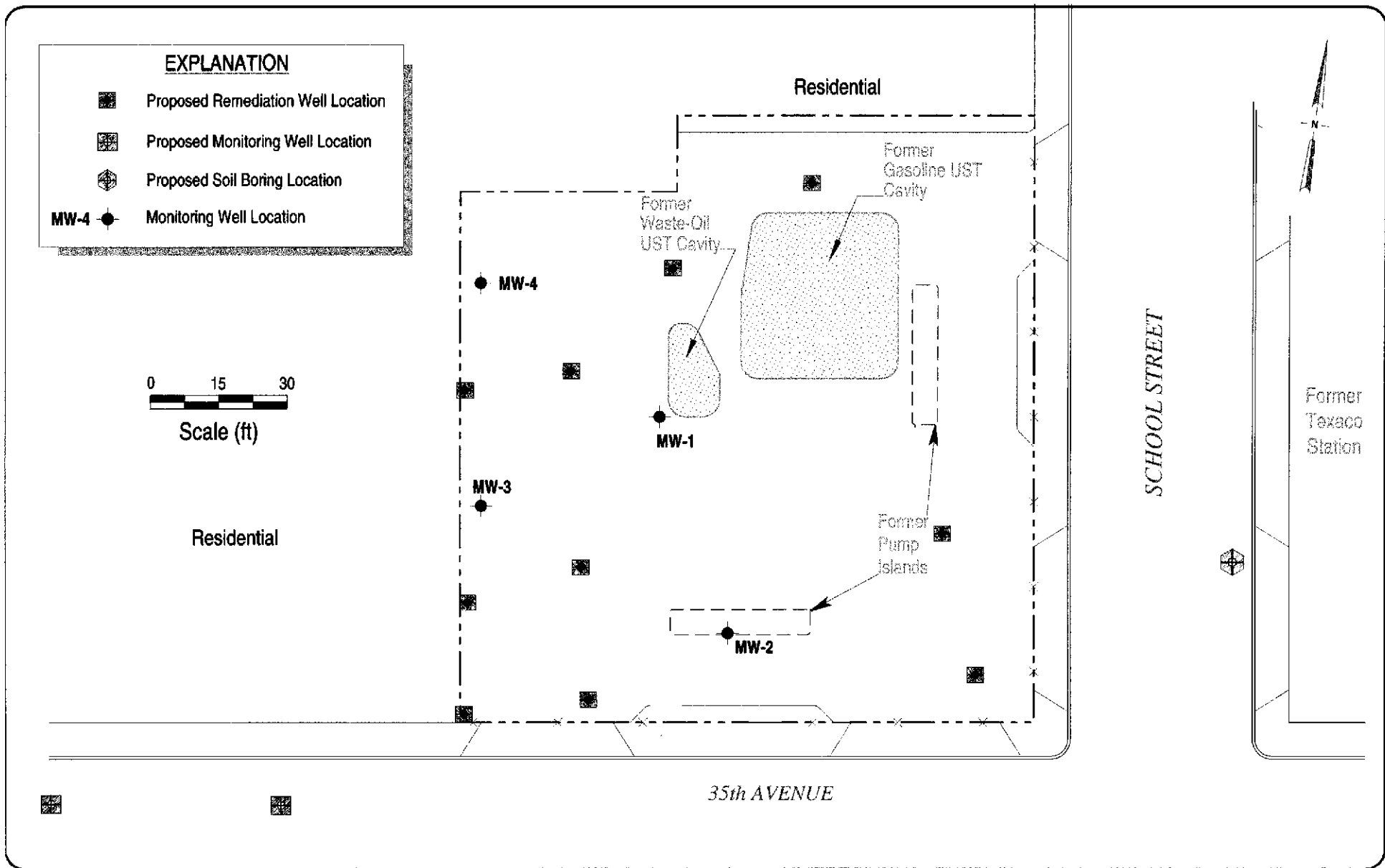


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Benzene Concentrations in
Ground Water (ppb)
March 18, 1998

FIGURE
5

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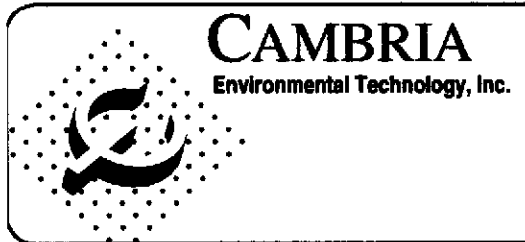
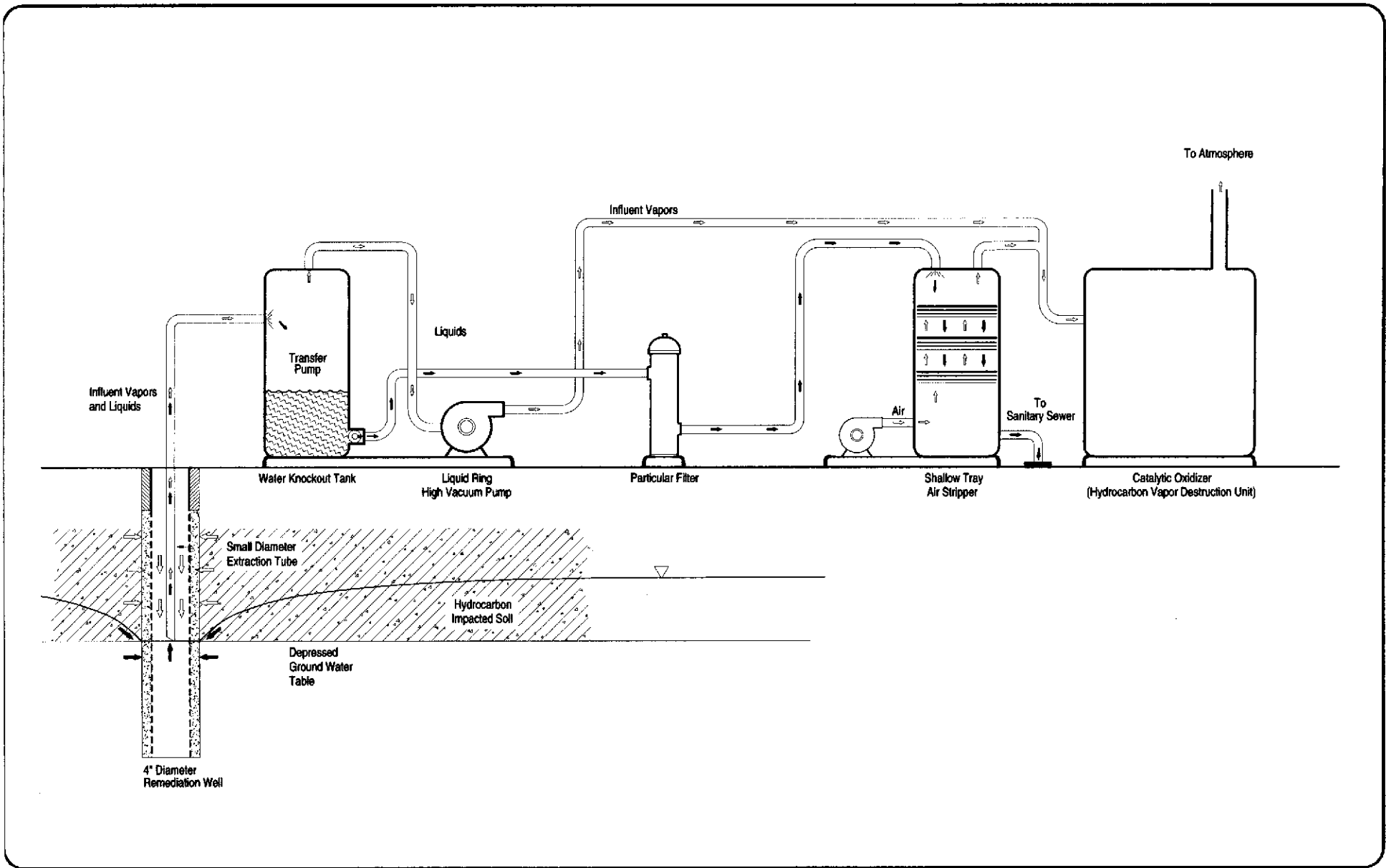


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H:\SB-2004\OAK-002\FIGURES\MAR98\REM-LOC8.DWG

Proposed Soil Boring and Well Locations

FIGURE
6



Former Exxon Service Station
3055 35th Avenue
Oakland, California

H:\SB-2004\OAKL-002\FIGURES\MAR88\LAYOUT.DWG

Proposed Dual Phase Vacuum Extraction
System Layout

FIGURE

7

Table 1. Soil Analytic Data - Former Exxon Service Station, 3055 35th Avenue, Oakland, California

Sample ID	Date Sampled	Sample Depth (ft)	GW Depth (ft)	Concentrations in ppm							Notes
				TPHg	TPHd	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	
MW-4-10	2/26/97	10	---	64	62	0.24	1.1	0.7	2.6	<0.2	a, b
MW-4-15	2/26/97	15	---	530	150	5.1	18	8.4	39	5.4	a, b
SB-A	5/5/94	11	14.5	3.4	4.2	<10	0.0072	0.0015	0.015	0.031	c
	5/5/94	16		1,600	620	<1,000	1.8	3.4	17	54	c
SB-B	5/6/94	11	15.0	170	52	<100	0.45	2.5	1.7	11	c
	5/6/94	16		940	120	<100	6.3	28	12	70	c
SB-C (MW-3)	5/6/94	11	13.9	25	6.7	<10	0.22	0.62	0.49	2.1	c
	5/6/94	16		490	280	<500	1.9	14	7.4	42	c
SB-D	5/6/94	11	19.5	<1	5.2	<10	<0.0025	<0.0025	<0.0025	<0.0025	
	5/6/94	16		<1	<1	<10	<0.0025	<0.0025	<0.0025	<0.0025	
SB-E	5/9/94	11	dry boring	220	56	<10	0.55	2.1	1.7	2.8	c
	5/9/94	16		3.8	1.4	<10	0.19	0.20	0.059	0.20	c
SB-F (MW-2)	5/9/94	11	13.3	370	57	<10	<0.25	<0.25	3.9	6.2	c
	5/9/94	15		2,900	450	<100	24	41	48	196	c
SB-G (MW-1)	5/9/94	11	14.5	20	18	<10	0.061	0.014	0.093	0.34	c
	5/9/94	15		390	52	<10	1.4	6.1	3.9	16	d
B1	11/5/91	20	---	1500	---	56	44	24	140	---	
B2	11/5/91	15	---	290	---	0.057	1.3	3.8	17	---	
B3	11/6/91	20	---	130	---	1.9	4.7	2.4	19	---	
B5	11/6/91	15	---	660	---	1.8	4.1	8.9	29	---	
B6	11/6/91	15	---	1200	---	6.6	21	18	98	---	
B7	11/6/91	15	---	2100	<1.0	28	100	38	290	---	

Table 1. Soil Analytic Data - Former Exxon Service Station, 3055 35th Avenue, Oakland, California

Sample ID	Date Sampled	Sample Depth (ft)	GW Depth (ft)	TPHg	TPHd	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Notes
				←————— Concentrations in ppm —————→							
B9	11/6/91	15	---	480	---	5.9	23	8.9	72	---	
B10	11/6/91	20	---	260	---	7.3	21	6.6	54	---	

Abbreviations:

ft = feet

GW = Ground water

TPHg = Total petroleum hydrocarbons as gasoline by modified EPA Method 8015

TPHd = Total petroleum hydrocarbons as diesel by modified EPA Method 8015

Benzene, ethylbenzene, toluene, and xylenes by EPA Method 8020

MTBE = Methyl Tertiary-Butyl Ether by EPA Method 8020

ppm = parts per million equivalent to milligrams per kilogram

Notes:

(a) Unmodified or weakly modified gasoline is significant (TPHg)

(b) Gasoline range compounds are significant (TPHd)

(c) The positive TPHd response appears to be a lighter hydrocarbon than diesel

(d) The positive TPHd result has an atypical chromatographic pattern

Table 1. Ground Water Elevation and Analytic Data - Former Exxon Service Station, 3055 35th Avenue, Oakland, California

Well ID (quarters sampled)	Date	GW	SPH	GW	TPH _g	TPH _d	TPH _{mo}	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	DO
		Depth (ft)	(ft)	Elev. (ft)	← Concentrations in parts per billion (µg/L) →								
MW-1 (all) TOC = 100.85	05/25/94	16.79	Sheen	84.06	120,000	25,000	<50,000	22,000	17,000	2,800	16,000	---	---
	07/19/94	20.77	---	80.08	---	---	---	---	---	---	---	---	---
	08/18/94	21.04	Sheen	79.81	925,000	---	---	16,500	6,200	1,000	9,400	---	---
	11/11/94	15.80	---	85.05	57,000	---	---	14,000	4,400	1,400	6,400	---	---
	02/27/95	15.53	---	85.32	45,000	---	---	2,900	2,500	760	4,100	---	---
	05/23/95	15.29	---	85.56	22,000	---	---	9,900	990	790	2,000	---	---
	08/22/95	20.90	---	79.95	23,000	---	---	6,900	340	1,200	1,900	---	---
	11/29/95	22.19	---	78.66	37,000	---	---	9,900	530	1,600	2,900	---	---
	02/21/96	11.69	---	89.16	33,000	4,300	---	10,000	480	1,000	1,800	3,300	---
	05/21/96	14.62	---	86.23	36,000	8,500	---	8,500	1,400	1,300	2,800	1,900	---
	08/22/96	22.30	---	78.55	41,000	6,200	---	8,600	1,300	1,500	2,900	<200	8.0
	11/27/96	17.24	Sheen	83.61	38,000	6,100	---	9,600	950	1,600	3,100	<400	5.6
	03/20/97	16.65	---	84.20	33,000	10,000	---	6,100	560	970	2,200	<400	8.5
	06/25/97	19.77	---	81.08	31,000	7,400 ^a	---	7,400	440	890	1,800	<400	3.7
	09/17/97	20.12	---	80.73	32,000 ^d	3,500 ^e	---	9,100	550	1,000	2,000	<1,000	2.1
12/22/97	12.95	---	87.90	26,000 ^d	5,800 ^e	---	7,900	370	920	1,500	<790	0.7	
03/18/98	12.34	Sheen	88.51	30,000 ^d	4,200 ^f	---	7,800	820	840	2,000	<1,100	1.3	
MW-2 (all) TOC = 100.00	05/25/94	15.65	---	84.35	61,000	6,900	<5,000	9,900	7,400	960	4,600	---	---
	07/19/94	19.81	---	80.19	---	---	---	---	---	---	---	---	---
	08/18/94	20.37	---	79.63	88,000	---	---	10,750	10,500	1,850	9,600	---	---
	11/11/94	15.52	---	84.48	54,000	---	---	5,900	6,700	1,300	7,500	---	---
	02/27/95	14.46	Sheen	85.54	44,000	---	---	5,100	5,300	930	6,400	---	---
	05/23/95	14.17	---	85.83	33,000	---	---	8,200	5,600	900	6,600	---	---
	08/22/95	19.80	---	80.20	38,000	---	---	6,400	5,000	1,100	5,600	---	---
	11/29/95	21.05	---	78.95	46,000	---	---	7,100	5,300	1,300	6,000	---	---
	02/21/96	10.53	---	89.47	59,000	---	---	8,000	6,000	1,800	8,900	4,500	---
	05/21/96	13.47	---	86.53	51,000	3,400	---	8,200	5,200	1,300	6,600	2,400	---
	08/22/96	19.12	---	80.88	37,000	5,700	---	5,100	3,500	960	4,500	<200	3.0
	11/27/96	16.61	Sheen	83.39	54,000	10,000	---	9,800	7,000	1,800	7,900	<2,000	3.1
	03/20/97	15.39	---	84.61	27,000	6,100	---	3,700	2,300	580	2,800	<400	8.1
	06/25/97	18.62	---	81.38	42,000	7,800 ^b	---	7,400	3,800	1,200	5,700	<200	0.9
	09/17/97	19.05	Sheen	80.95	41,000 ^d	8,900 ^b	---	5,200	3,400	1,300	5,900	<700	1.2
12/22/97	14.09	---	85.91	47,000 ^d	6,100 ^c	---	8,500	4,600	1,800	8,400	<1,200	1.2	
03/18/98	10.83	Sheen	89.17	58,000 ^d	7,000 ^f	---	9,300	6,100	1,800	8,200	<1,100	1.1	

Table 1. Ground Water Elevation and Analytic Data - Former Exxon Service Station, 3055 35th Avenue, Oakland, California

Well ID (quarters sampled)	Date	GW	SPH	GW	TPHg	TPHd	TPHmo	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	DO
		Depth (ft)	(ft)	Elev. (ft)	← Concentrations in parts per billion (µg/L) →								(mg/L)
MW-3	05/25/94	13.93	Sheen	82.94	56,000	14,000	<50,000	14,000	14,000	1,300	11,000	---	---
(all)	07/19/94	17.04	---	79.83	---	---	---	---	---	---	---	---	---
TOC = 96.87	08/18/94	17.75	---	79.12	116,000	---	---	28,300	26,000	2,400	15,000	---	---
	11/11/94	17.80	---	79.07	89,000	---	---	1,600	1,900	1,900	14,000	---	---
	02/27/95	11.86	Sheen	85.01	250,000	---	---	22,000	26,000	7,800	21,000	---	---
	05/23/95	11.60	Sheen	85.27	310,000	---	---	18,000	17,000	4,500	2,800	---	---
	08/22/95	17.10	---	79.77	74,000	---	---	14,000	13,000	1,900	11,000	---	---
	11/29/95	16.34	---	80.53	220,000	---	---	25,000	25,000	3,500	19,000	---	---
	02/21/96	7.92	---	88.95	60,000	---	---	10,000	7,800	1,500	8,800	3,400	---
	05/21/96	10.86	Sheen	86.01	69,000	13,000	---	17,000	9,400	1,700	9,400	2,600	---
	08/22/96	16.50	---	80.37	94,000	16,000	---	17,000	15,000	2,100	12,000	330	2.0
	11/27/96	13.47	Sheen	83.40	82,000	24,000	---	14,000	13,000	2,400	13,000	<1,000	2.4
	03/20/97	12.86	---	84.01	56,000	11,000	---	9,900	6,900	1,300	8,000	3,500	9.0
	06/25/97	15.98	---	80.89	49,000	7,700 ^b	---	9,700	7,100	1,300	7,000	220	5.8
	09/17/97	16.34	Sheen	80.53	78,000 ^d	15,000 ^e	---	11,000	9,900	1,800	10,000	<1,200	0.7
12/22/97	10.71	Sheen	86.16	49,000 ^d	14,000 ^e	---	7,300	5,300	1,400	7,500	<1,100	3.1	
03/18/98	8.41	Sheen	88.46	120,000 ^b	20,000 ^f	---	21,000	19,000	2,600	15,000	<1,600	1.6	
MW-4	03/20/97	13.75	---	83.59	47,000	3,100	---	11,000	4,500	1,100	5,200	3,400	8.4
(all)	06/25/97	16.15	---	81.19	61,000	5,800 ^b	---	16,000	6,100	1,500	5,900	780 ^e	1.4
TOC = 97.34	09/17/97	17.10	---	80.24	60,000 ^d	4,400 ^e	---	17,000	4,900	1,500	5,700	<1,500	1.5
	12/22/97	9.21	---	88.13	43,000 ^d	3,100 ^e	---	13,000	3,900	1,100	4,200	<960	3.7
	03/18/98	9.54	---	87.80	58,000 ^d	5,500 ^f	---	14,000	4,700	1,400	5,700	<1,200	0.8

Table 1. Ground Water Elevation and Analytic Data - Former Exxon Service Station, 3055 35th Avenue, Oakland, California

Well ID (quarters sampled)	Date	GW Depth (ft)	SPH (ft)	GW Elev. (ft)									
					←	Concentrations in parts per billion (µg/L)						→	

Abbreviations:

TOC = Top of casing elevation with respect to an onsite benchmark
 GW = Ground water
 SPH = Separate-phase hydrocarbons
 TPHg = Total petroleum hydrocarbons as gasoline by modified EPA Method 8015
 TPHd = Total petroleum hydrocarbons as diesel by modified EPA Method 8015
 TPHmo = Total petroleum hydrocarbons as motor oil by modified EPA Method 8015
 Benzene, Ethylbenzene, Toluene, and Xylenes by EPA Method 8020
 MTBE = Methyl Tertiary-Butyl Ether by EPA Method 8020
 DO = Dissolved oxygen
 µg/L = Micrograms per liter, which is equivalent to parts per billion in water
 mg/L = Milligrams per liter, which is equivalent to parts per million in water

Notes:

a = Result has an atypical pattern for diesel analysis
 b = Result appears to be a lighter hydrocarbon than diesel
 c = There is a >40% difference between primary and confirmation analysis
 d = Unmodified or weakly modified gasoline is significant
 e = Gasoline range compounds are significant
 f = Diesel range compounds are significant
 TOC Elevation of Well MW-4 surveyed relative to an arbitrary site datum by David Hop
 Licensed Surveyor on April 19, 1997