WP Not Approved See letter dated 3/7/97

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RISK BASED CORRECTIVE ACTION
TIER 1 EVALUATION
AND
TIER 2 WORKPLAN

Damele Property
4401 Market Street
Oakland, California

PREPARED FOR:
Mr. and Mrs. Damele
3750 Victor Street
Oakland, California

SUBMITTED TO:
Ms. Amy Leech
Alameda County Division of Environmental Health
1131 Harbor Bay Parkway
Alameda, California 94502

W. A. CRAIG, INC. PROJECT # 3522B
January 15, 1997

PROFESSIONAL CERTIFICATION

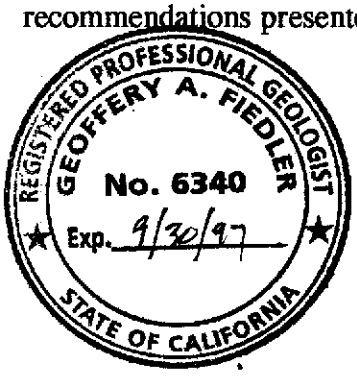
RISK BASED CORRECTIVE ACTION
TIER 1 EVALUATION
AND
TIER 2 WORKPLAN

Damele Property
4401 Market Street
Oakland, California

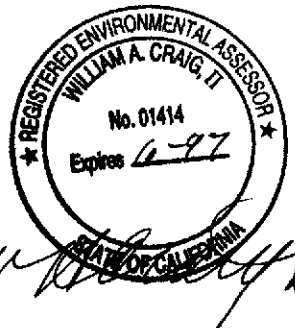
W.A. Craig, Inc.
Project No. 3365-4
January 15, 1997

This Workplan has been prepared by the staff of W. A. Craig, Inc., under the professional supervision of the persons whose seals and signatures appear hereon. No warranty, either expressed or implied, is made as to the professional advice presented herein. The analysis, conclusions and recommendations contained in this Workplan are based upon site conditions as they existed at the time of the investigation and they are subject to change.

The scope of work proposed in this Workplan is based solely upon visual observations of the site and vicinity, and interpretation of available information as described in this report. W.A. Craig, Inc., recognizes that the limited scope of services performed in execution of this investigation may not be appropriate to satisfy the needs, or requirements of other regulatory agencies, or of other users. Any use or reuse of this document or its findings, conclusions or recommendations presented herein is at the sole risk of said user.



Geoffery A. Fiedler, R.G.
Geologist



William A. Craig, II, R.E.A.
Principal

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FIGURES

1.0 INTRODUCTION

W.A. Craig, Inc. (WAC) is pleased to submit this Workplan for a Risk Based Corrective Action (RBCA), Soil and Groundwater Investigation for 4401 Market Avenue (site), in Oakland, California (**Figure 1**). This investigation is proposed in accordance with procedures outlined in the American Society for Testing Materials (ASTM) guidance document entitled "Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites" (Designation: E 1739-95). The scope of work presented herein has been developed in accordance with requests from the Alameda County Department of Environmental Health (ACDEH) letter dated December 4, 1996 and as further developed in our meeting with Amy Leech of the ACDEH on December 16, 1996.

Based on current site soil and groundwater data, we have performed a Risk-Based Corrective Action (RBCA) Tier 1 Evaluation and have prepared this Workplan for a Tier 2 Investigation. Four additional monitoring wells and one soil boring are proposed in this Workplan to further assess the extent of petroleum hydrocarbons in soil and groundwater at the site. Soil and groundwater samples will be collected to further characterize subsurface conditions and soil quality at the site and to evaluate potential remedial alternatives, including intrinsic bioremediation. This Workplan amends and supersedes WAC's Workplan dated November 21, 1996.

2.0 RBCA TIER 1 EVALUATION

2.1 Site History

The site is a former gasoline station located on the northwest corner of 44th and Market Streets in Oakland, California (**Figure 2**). It is our understanding that the site structure was constructed in 1943 and was used as a gasoline station until the 1970's. One 1000-gallon and three 500-gallon, single-wall steel, underground storage tanks (USTs), which previously contained gasoline, were removed from the site on June 22, 1990. When the USTs were removed, they were reported to be rusted, pitted and contain one or more holes, and the seam near the fill end of the 1000-gallon UST was split. Additionally, petroleum odors and staining of the surrounding soil were reported in the UST excavation.

Soil obviously impacted by petroleum hydrocarbons was excavated from the former UST location at the time of UST removal. The depth of the excavations ranged from 7.5 feet below ground surface (bgs) to 15 feet bgs, or approximately 2 feet below the bottoms of the USTs, as directed by Mr. Dennis Bryne of the ACDEH. Soil samples were collected from beneath the removed USTs and from the stockpiled soils.

Results?

Up to 870 milligrams per kilogram (mg/kg) total petroleum hydrocarbons as gasoline (TPH-g), 5 mg/kg benzene, 24 mg/kg toluene, 20 mg/kg ethylbenzene, and 110 mg/kg xylenes were detected in the six soil samples collected from the bottom of the UST excavation. The results of analytical testing of the composited soil samples from the stockpile, indicated a maximum of 130 mg/kg TPH-g. Because the excavation extended under the sidewalks, the ACDEH agreed that for safety considerations the stockpiled soil could by placed back in the excavation.

On September 6, 1990, WAC excavated two, approximately 5 feet deep, trenches in the approximate location shown on **Figure 3**. An unreported number of soil samples were collected from the trenches and placed in plastic bags. Petroleum hydrocarbon concentrations were measured in each bag with an organic vapor analyzer (OVA). OVA readings ranged from 30 parts per million (ppm) to 150 ppm. Soil samples for laboratory analysis were not collected. Trenching was not attempted below 5 feet bgs because of unstable soil conditions. The trenches were backfilled immediately following sample collection.

In October of 1994, WAC advanced seven soil borings at the site and converted three of them to groundwater monitoring wells (MW-1, MW-2 and MW-3). A slight odor of petroleum was reported during the drilling of four of the soil borings and floating product was reported in boring SB-2. Soil samples collected at approximately 15 feet bgs from soil borings SB-2, SB-4 and the boring for monitoring well MW-2 reported concentrations of TPH-g ranging from 19 mg/kg to 220 mg/kg. Groundwater was encountered in an apparently confined water bearing zone at about 23 to 25 feet bgs. Following installation of the monitoring wells, water levels in the monitoring wells were measured at approximately 11 to 12 feet bgs.

Groundwater samples have been collected on eight occasions between November 1994 and December 1996. Concentrations of TPH-g ranging from not detected to 540 micrograms per liter (μg/l) have been reported in samples collected from monitoring well MW-1. Concentrations of TPH-g, ranging from 4100 μg/l to 20,000 μg/l, have been reported in samples collected from monitoring well MW-2. TPH-g has not been reported in samples collected from monitoring well MW-3. Reported TPH-g concentrations in the groundwater samples have remained relatively stable during the monitoring period.

2.2 Source Characterization

Analysis of soil samples collected from the UST excavation reported up to 870 mg/kg TPH-g and 460 micrograms per kilogram (μg/kg) benzene. Samples from the soil borings reported up to 220 mg/kg TPH-g. TPH-g and benzene have been reported in groundwater samples collected from monitoring well MW-2 in each of eight quarterly sampling events. Floating product was reported in groundwater in soil boring SB-2 but was not sampled. The

greatest concentration of gasoline in soil appears to be along to southern border of the former UST excavation, in the vicinity of soil boring SB-2. The highest concentrations of TPH-g and benzene in soil samples collected from the soil borings are from a depth of approximately 15 feet bgs. → Below groundwater

Are the # + locations of borings sufficient? Why?

Analytical laboratory notes describe the gasoline in samples collected at 15 feet bgs in soil boring SB-2 and MW-2 as unmodified or weakly modified and as containing both heavy and light gasoline range components. Soil samples containing gasoline, collected from above and below 15 feet bgs in these borings, and soil samples collected from other borings were generally described as containing heavy range components or having heavy range components. These descriptions may indicate that the southern edge of the UST excavation contains the greatest accumulation and least altered concentrations of gasoline.

? — Benzene core. → no analytical for 5'

Figure 3 shows the approximate lateral extent of TPH-g contaminations in soil at 5, 10, 15 and 20 feet bgs. The distribution pattern suggests there may have been near surface discharges associated with the former pump island and deeper contamination associated with the USTs. The trace concentration of TPH-g reported at 20 feet bgs and the widespread distribution at 15 feet bgs suggest that gasoline may have been in contact with groundwater at that level.

Is water at 20' confined?

Figure 4 is a plot of TPH-g and benzene concentrations vs. time for monitoring wells MW-1 and MW-2 and **Figure 5** presents the same data on a log-normal plot. **Figure 6** is a best fit, linear regression analysis of the data, which suggests that TPH-g and benzene concentrations are decreasing with time.

2.3 Subsurface Conditions

The site is underlain by heterogeneous soil with discontinuous layers of gravelly, silty, and clayey sands, clayey and sandy silts, and silty and sandy clays, to the maximum depth explored. **Figure 7** is a stratigraphic cross-section based on soil boring lithology. Although the shallow water bearing zone has been described as confined, no confining layer (aquitard) has been clearly identified.

Groundwater was encountered in an apparently confined water bearing zone at about 23-25 feet bgs in the borings for the monitoring wells. Following well construction, water level in the wells rose to approximately 16 feet bgs. Water levels measured in the wells during the eight groundwater monitoring events ranged from 11.42 to 15.94 feet bgs. Groundwater flow directions are generally to the south, ranging from S35°W to S40°E.

On December 20, 1996, WAC performed Slug Tests on groundwater monitoring wells MW-1 and MW-2. The calculated Hydraulic Conductivities for MW-1 and MW-2 are 1.19 feet/day and 0.42 feet/day, respectively. **Based on an average groundwater gradient at the site of 0.02 ft/ft, the groundwater velocity is approximately ten feet per year.**

2.4 Receptor Characterization

Define in regard to risks to human health or environment

Potential receptors in the area comprise underground utility trenches, including gas, water, cable TV, sanitary sewers and storm sewers. The area is primarily residential. Although some of the houses in the vicinity appear to be as much as 100 years old, they probably have always been connected to a municipal water supply. According to the City of Oakland Public Works Department (PWD), the area was serviced by The Peoples Water Company as early as the 1880's. East Bay Municipal Utility District (EBMUD) records indicate that a 4-inch, cast iron water main was installed in Market Street in 1910. Neither the PWD nor EBMUD has records indicating that any municipal or private water wells exist in the area.

2.5 Calculation of Risk Based Screening Levels for Benzene

RBCA Tier 1, Risk Based Screening Levels (RBSLs) for benzene at the site were calculated for four exposure scenarios, based on the following assumptions. The site is primarily a residential area but it is unlikely that there is a nearby water well from which groundwater might be ingested. Therefore, a target excess individual lifetime cancer risk of one in ten thousand (1E-04) was used, as well as the more usual one in a million (1E-06). Additionally, because this is a residential neighborhood, RBSL calculations were performed using both 70 kg adult body weight and the more conservative 16 kg child body weight.

RBSLs were calculated using the following formula from ASTM Document E1739-95, for groundwater ingestion:

Why?

$$RBSLw = \frac{TR \times BW \times ATc \times 365}{SFo \times IRw \times EF \times ED}$$

RBSLw = Risk Based Screening Level (Potable Water, mg/L)
TR = target excess individual lifetime cancer risk (1E-04 to 1E-06)
BW = body weight (70 kg adult, 16 kg child)
ATc = averaging time for carcinogens (70 years)
SFo = oral cancer slope factor (0.029 kg-day/mg)
IRw = daily water ingestion rate (2 L/day)
EF = exposure frequency (350 days/year)
ED = exposure duration (30 years)

TABLE 1- RBSLs for BENZENE

	70 kg body weight	16 kg body weight
TR = 1E-04	290 μg/L	70 μg/L
TR = 1E-06	2.9 μg/L	0.7 μg/L

Comparison of the benzene concentrations in groundwater samples monitoring well MW-2 (330 μg/L to 1400 μg/L) with these RBSLs indicates that the RBSLs are exceeded, even for the least conservative estimate.

3.0 CONCLUSIONS AND RECOMMENDATIONS

Soil and groundwater at the site have been impacted by petroleum hydrocarbons. TPH-g has been reported at a concentration of 870 mg/kg in soil and 20,000 μg/l in groundwater. Benzene has been reported at 5 mg/kg in soil and 1400 μg/l in groundwater. **It is likely that there are near surface releases of petroleum hydrocarbons in the former pump island area and deeper releases in the former UST area.** The primary area of soil contamination appears to be along the southern side of the former UST excavation at approximately 15 feet bgs.

TPH-g concentrations in groundwater appear to be decreasing with time. However, TPH-g and benzene concentrations in soil and groundwater remain sufficiently high to warrant further investigation. Therefore, we recommend further investigation which will include the installation of four additional groundwater monitoring wells to assess the extent of petroleum hydrocarbons in soil and groundwater. Because TPH-g and benzene concentrations in groundwater appear to be stable or decreasing, a suite of analyses is proposed to evaluate if intrinsic bioremediation is a viable remedial alternative or if a more active remediation alternative will be required. The proposed scope of work is presented below.

4.0 RBCA TIER 2 WORKPLAN

4.1 Scope of Work

The scope of work proposed herein will be performed to obtain additional information on the site soil and groundwater quality. The proposed scope of work will include installation of four additional groundwater monitoring wells in order to fully delineate the extent of soil and groundwater contamination at the site. Two wells will be installed down-gradient from former UST locations and monitoring wells MW-1 and MW-2, on the south side of 44th Street. The other two wells will be installed on the east site of Market Street, down-gradient

of soil boring SB-4 and the former UST location. Upon completion of the proposed scope of work, the soil and groundwater quality data will be reviewed and WAC will recommend further investigative or remedial actions as necessary to achieve site closure. WAC's scope of services is based on our previous investigations of the site. The locations of the boreholes and wells proposed for this work are indicated on **Figure 2.**

The scope of work proposed for this investigation includes the following:

- Preparation of this Workplan for submittal to the ACHCSA;
- Obtaining appropriate permits and drilling four boreholes;
- Laboratory analysis of an estimated three soil samples per borehole;
- Constructing four groundwater monitoring wells;
- Developing and sampling the monitoring wells;
- Soil and groundwater samples will be analyzed for total petroleum hydrocarbons as gasoline (TPH-g) using EPA Method 8015 (modified), benzene, toluene, ethylbenzene and xylenes (BTEX) and methyl tertiary butyl ether (MTBE) using EPA Method 8020. Groundwater samples collected from the monitoring wells will be analyzed additionally for Heterotrophic Plate Count (Bacteria), Phosphorous, Potassium, Nitrates, Sulfates, Ammonia, Biological Oxygen Demand and Dissolved Oxygen. Soil samples collected from three selected soil borings will be analyzed for Heterotrophic Plate Count, Phosphorous, Potassium, Nitrates, Sulfates and Ammonia; and
- Preparation of a soil and groundwater quality investigation report.

4.2 Drilling and Soil Sampling

The exploratory soil borings and well installations will be permitted as required. WAC will obtain the services of a California Certified, C-57 licensed, drilling contractor for the drilling services. The soil borings will be drilled using a truck-mounted drill rig equipped with eight-inch outside-diameter hollow stem augers.

The boreholes will be logged in the field by a California Registered Geologist or by a WAC staff geologist under the direct supervision of a California Registered Geologist. Soil samples will be collected at a minimum of every five feet. A continuous log of the subsurface conditions will be prepared during drilling. Soils encountered during drilling will be logged in accordance with the Unified Soil Classification System. Soil samples obtained during drilling

will be collected using a two-inch, inside-diameter, Modified California Sampler. The sampler will be lined with three, six-inch long, brass liners and driven eighteen-inches into undisturbed soil using a 140 pound hammer. The drilling and sampling equipment will be decontaminated prior to use by steam cleaning or using a laboratory grade detergent solution with tap water or deionized water rinse.

Soil samples will be collected at five-foot intervals or when changes in lithology or impacted soil is observed or detected by photoionization detector (PID) screening or by visual or olfactory observations. Soil samples selected for analysis will be capped with Teflon-lined plastic caps, labeled, sealed in a plastic bag, and stored in a container with ice. Samples retained for chemical analysis will be delivered, under chain of custody control, to a state certified analytical laboratory.

The exploratory boreholes to be converted to monitoring wells will be extended 10 to 15 feet past the first encountered water. The boreholes will be terminated at a shallower depth if a minimum of five-feet of impermeable soil, such as clay, is penetrated. The boreholes will be drilled to groundwater or to a maximum depth of 50 feet, if groundwater is not encountered. If the water-bearing unit is found to be greater than 20 feet thick, drilling will be terminated 15 to 20 feet below the top of the aquifer. Borings not completed as monitoring wells will be drilled to the first encountered water and will be sealed by grouting to the ground surface.

All soil cuttings from the drilling operations will be stored on-site in 55-gallon, steel, DOT approved, drums.

4.3 Monitoring Well Construction

The groundwater monitoring wells will be constructed using two-inch, flush threaded, Schedule 40, PVC, well casing. The wells will be constructed through the hollow-stem augers, with materials placed from the bottom of the borehole to the ground surface. The screened interval of the well will be factory slotted and installed to approximately 10 to 15-feet below and five feet above, the first encountered groundwater. The screened section annulus will be packed with clean graded sand to a level approximately one foot above the screened interval. Approximately one foot of hydrated bentonite pellets will be placed above the sand as a sealing material. The well will be sealed from the bentonite seal to the ground surface using a Portland cement/bentonite grout mixture. No glues or other solvents will be used in the construction of the wells. The wells have not been designed to provide optimum flow but should provide hydraulic connection between the water-bearing zone and the well.

The wellhead will be protected from vandalism using a locking expansion-plug cap and will be housed within a traffic-rated box to protect the well from traffic and surface water runoff. The grout will be allowed to set for a period of 72 hours. During that period no development or other work should be performed on the well.

4.4 Well Development

The wells will be developed by intermittent surging, bailing and/or pumping. Field parameters, including color, odor, free phase liquid, turbidity, specific conductance (EC), temperature, and pH will be intermittently monitored during the development of the wells. Development will continue until field parameters stabilize and the water is relatively clear and free of silt and sand.

4.5 Groundwater Sample Collection

Water level measurements will be obtained from all of the site monitoring wells prior to development or sampling. The wells will be purged of a minimum of three well-casing volumes prior to sampling. The wells will be purged by pumping or by using a disposable polyethylene bailer. Should the well become completely evacuated during purging, samples will be collected after the well has recovered to 80 percent of its initial water level. Field parameters will be intermittently monitored during the purging of the well (as described in well development).

Groundwater samples will be decanted from the bailer into laboratory prepared containers. The samples will be immediately placed in refrigerated storage for delivery to the laboratory. The samples will be labeled in such a manner as to maintain client confidentiality. Samples will be delivered under chain of custody control to an analytical laboratory that is certified by the State of California to perform the requested analyses.

5.0 LABORATORY ANALYSES

Soil and groundwater samples will be analyzed for total petroleum hydrocarbons as gasoline (TPH-g) using EPA Method 8015 (modified), benzene, toluene, ethylbenzene and xylenes (BTEX) and methyl tertiary butyl ether (MTBE) using EPA Method 8020. Groundwater samples collected from the monitoring wells will be analyzed additionally for Heterotrophic Plate Count (Bacteria), Phosphorous, Potassium, Nitrates, Sulfates, Ammonia, Biological Oxygen Demand and Dissolved Oxygen. Soil samples collected from three selected soil borings will be analyzed for Heterotrophic Plate Count, Phosphorous, Potassium, Nitrates, Sulfates and Ammonia.

6.0 PURGE AND DECONTAMINATION WATER DISPOSAL

Purge water from the well development and sampling and decontamination rinsate from the drilling and sampling operations will be labeled and stored on-site in 55-gallon, steel, DOT approved, drums. The drums will be left on-site for subsequent disposal pending analytical results.

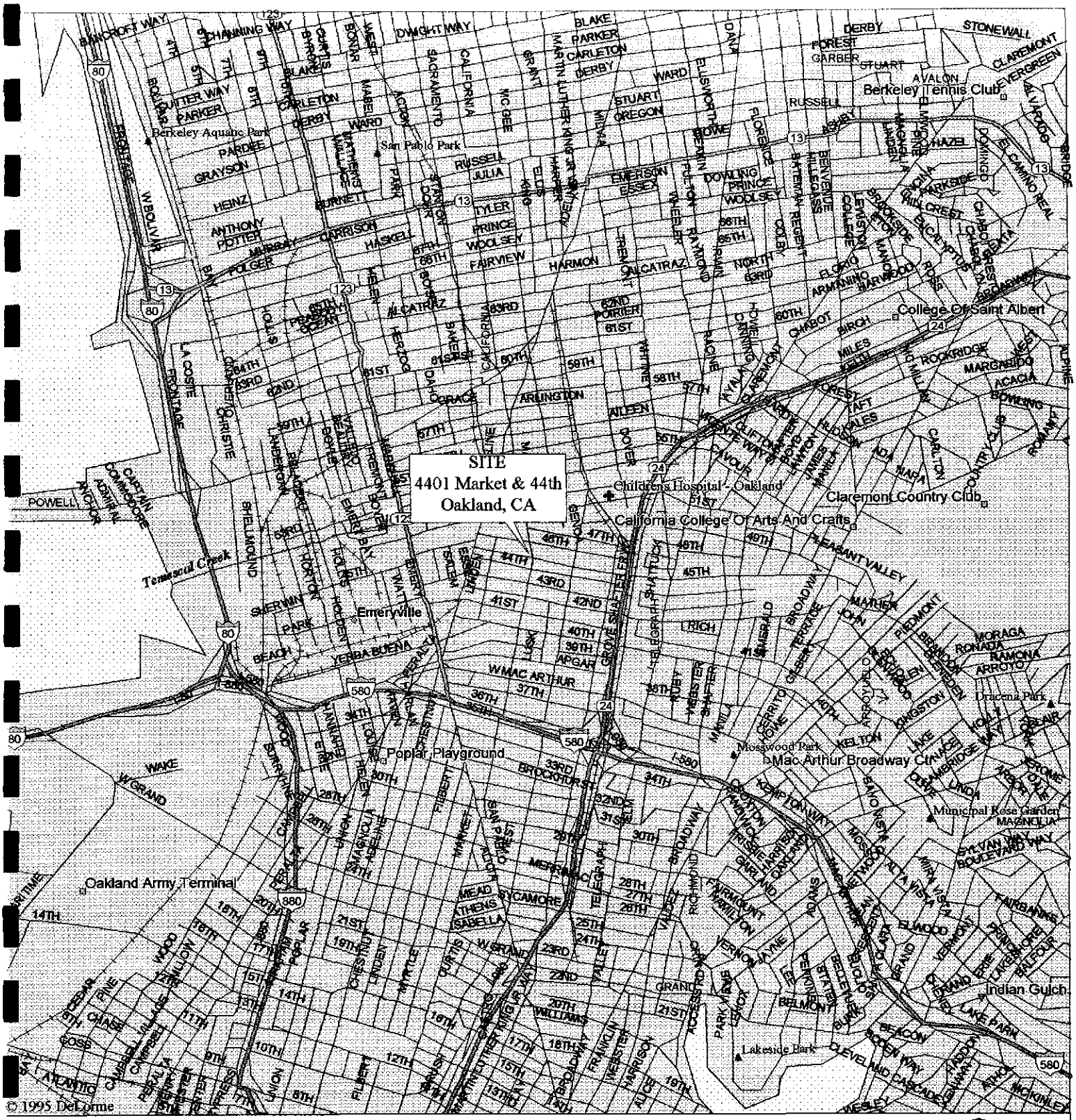
7.0 GROUNDWATER MONITORING

Following well installation and initial sampling of the monitoring wells, WAC will sample the wells on a minimum of three additional occasions at approximately three-month intervals. The scope of work conducted by WAC during this period will include the following:

- Measure static water levels in the seven monitoring wells;
- Purge and sample groundwater from the wells;
- Analyze groundwater samples for TPH-g, TPH-d, BTEX and MTBE. Additional analyses similar to the suite of analyses proposed following well installation may be proposed with modification based on our evaluation of the initial sampling results; and
- Prepare a Quarterly Monitoring Report for each sampling event.

8.0 REPORTS

Technical reports will be prepared and submitted to meet ACDEH and Regional Water Quality Control Board, San Francisco Bay Area requirements. Reports will include site history, figures identifying sample locations, drilling logs, summary of all work performed, analytical results and WAC's conclusions and recommendations.



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Scale 1:31,250 (at center)
2000 Feet

NORTH

Project No. 3609-2

July1996

SITE LOCATION MAP
Damele Property
4401 Market Street
Oakland, CA

Figure 1

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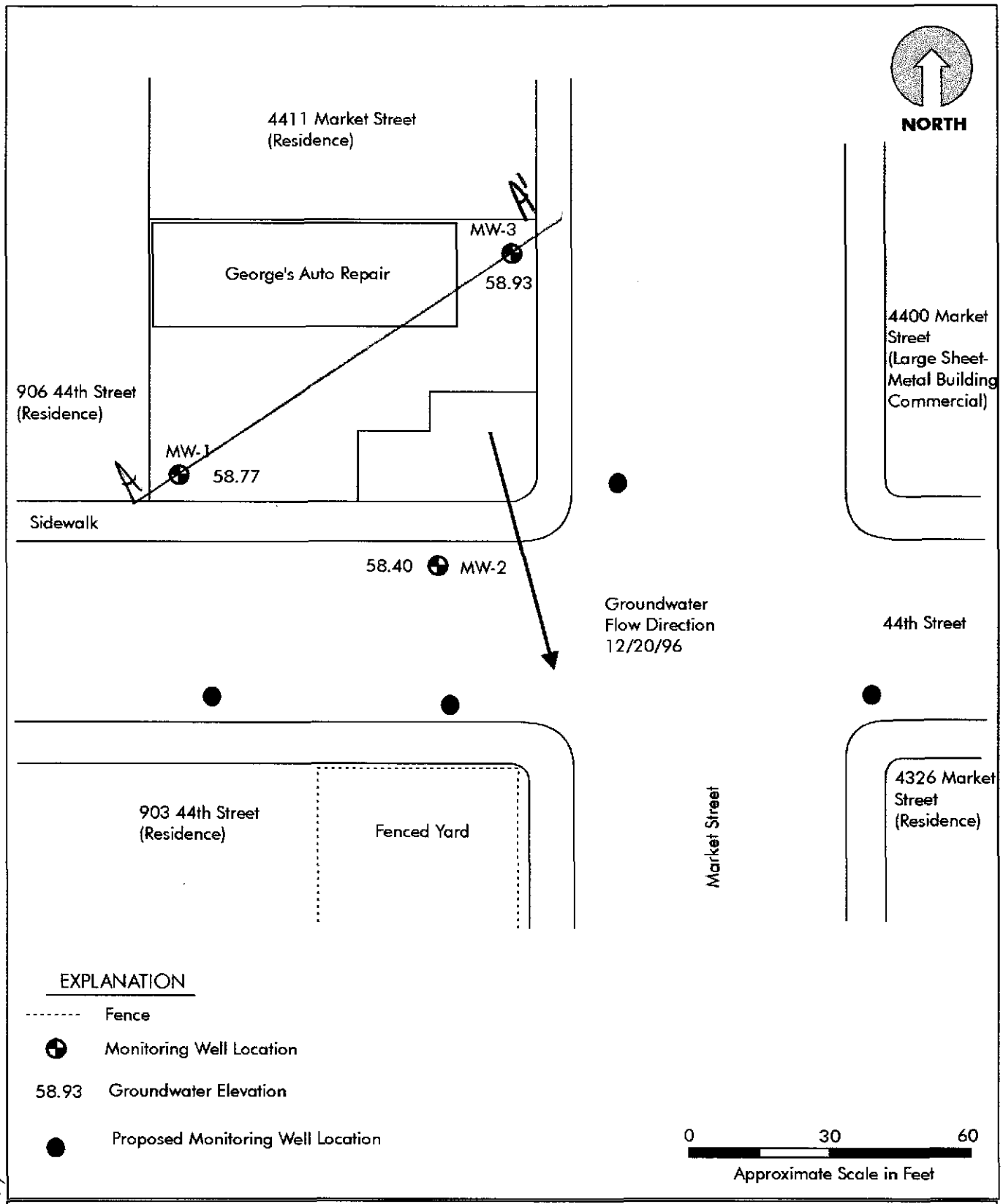

Project No. 3365-2

January 1997

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SITE PLAN
Damele Property
4401 Market Street
Oakland, CA

Figure 2

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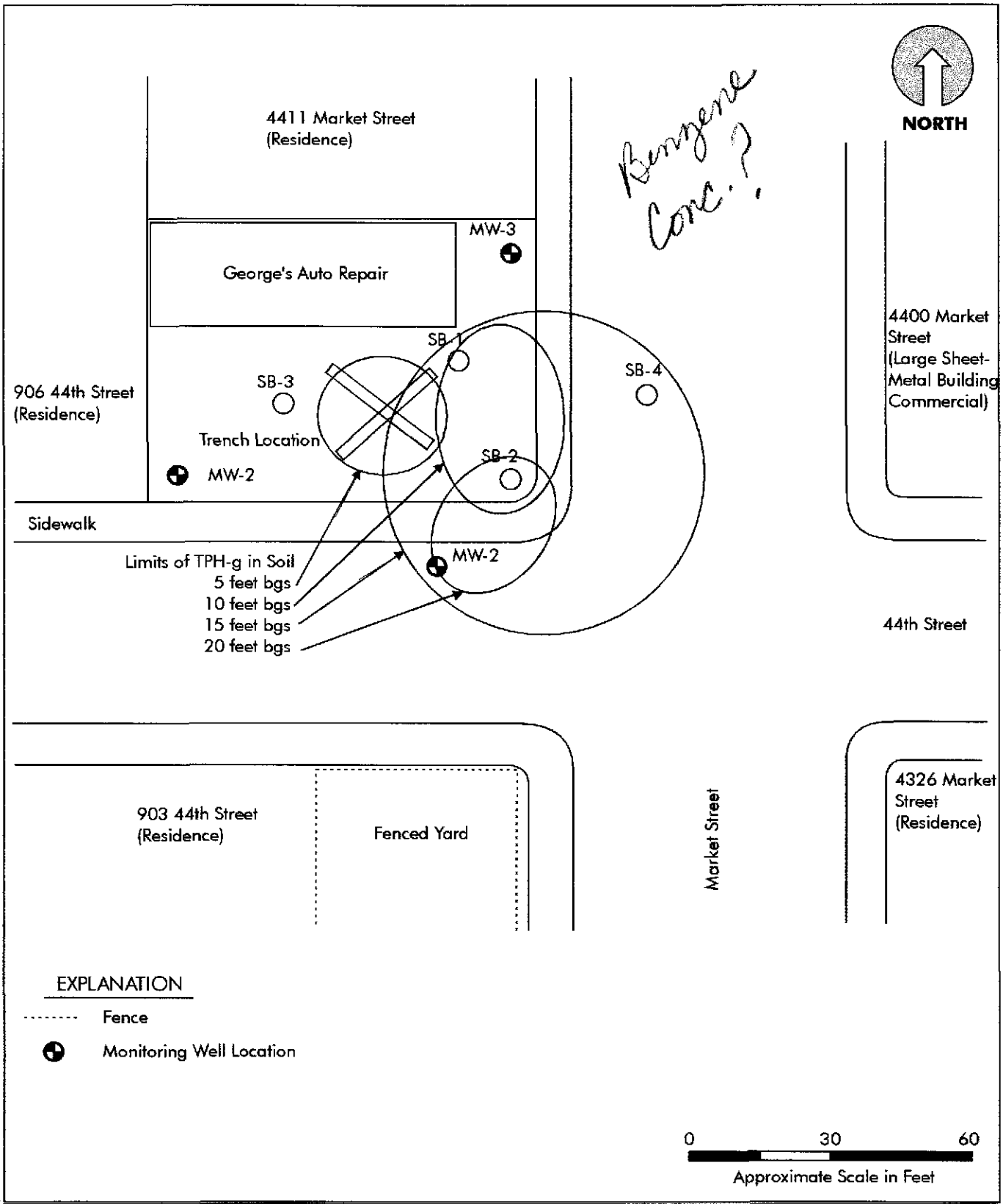

Project No. 3365-2

JANUARY 1997

LATERAL EXTENT OF TPHg IN SOIL

Damele Property
4401 Market Street
Oakland, CA

Figure 3

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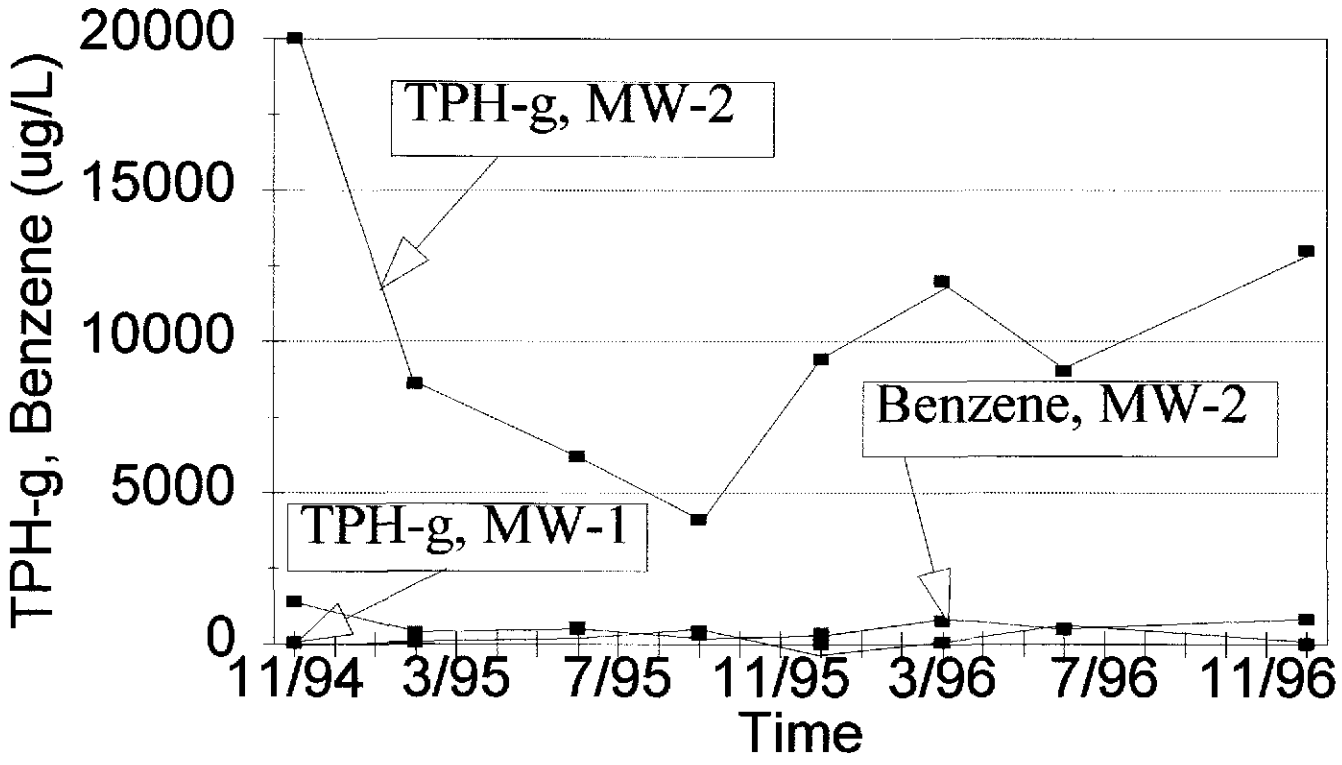
Damele Site

TPH-g, Benzene vs Time (MW-1,MW-2)



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January 1997

TPH-g & Benzene vs Time
4401 Market Street
Oakland, California

Figure 4

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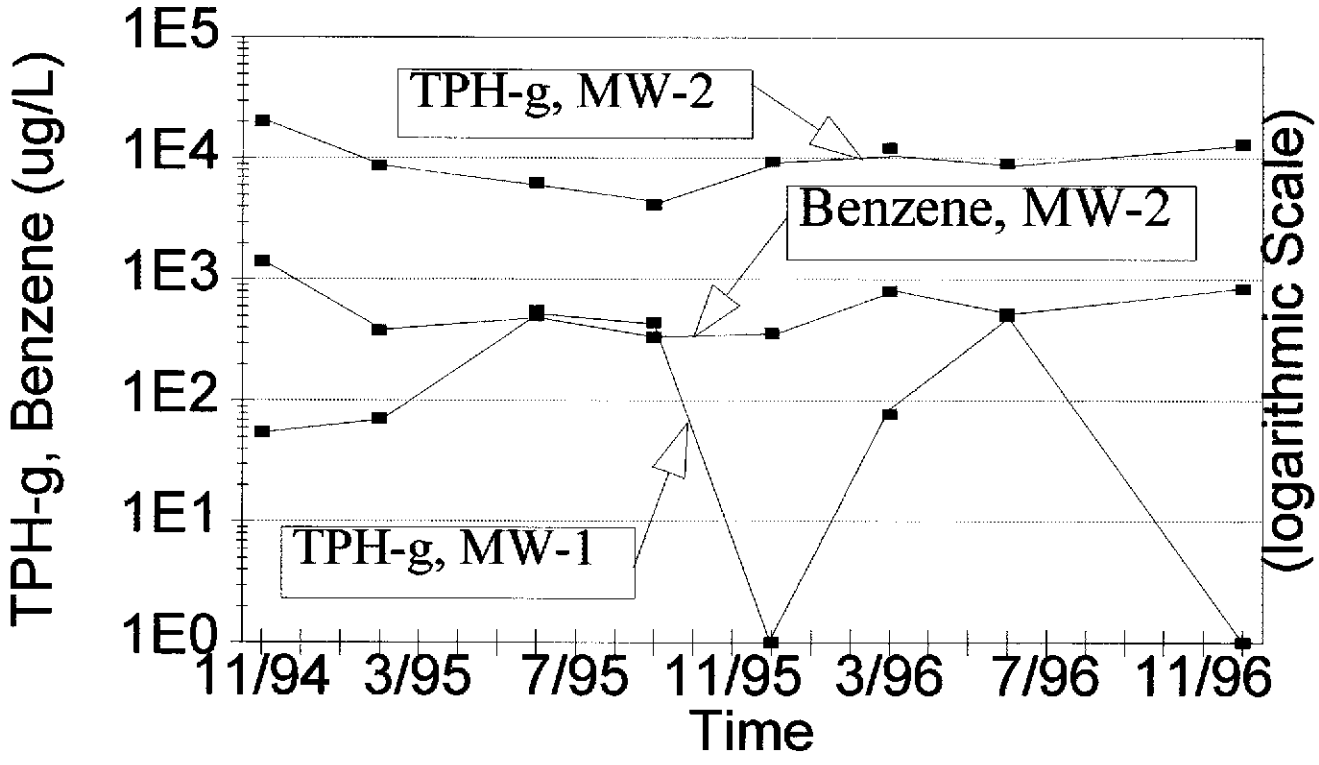
DAMELE SITE

TPH-g, Benzene in Groundwater



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Project No. 3365-4

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TPH-g & Benzene vs Time (Log-Normal)
Damele Site
4401 Market Street
Oakland, California

Figure 5

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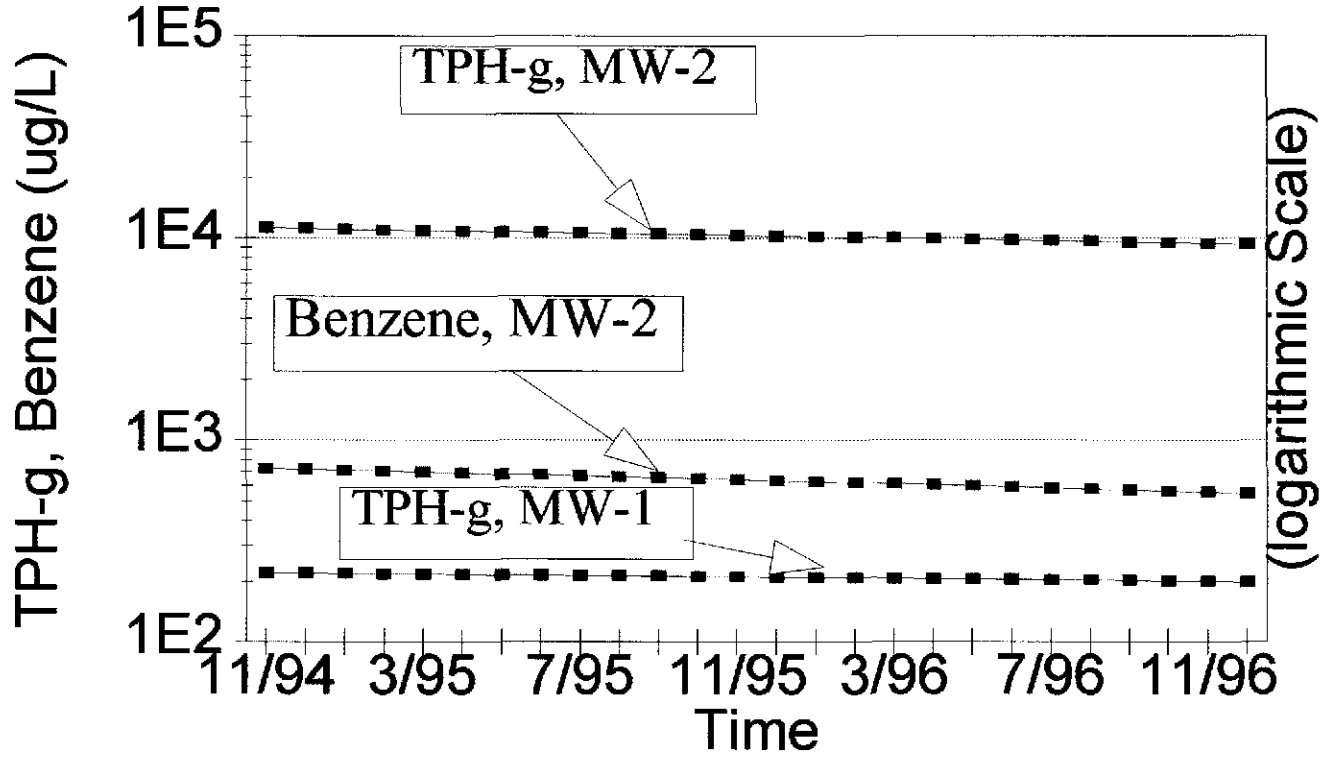
DAMELE SITE

TPH-g, Benzene in Groundwater



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January 1997

TPH-g & Benzene vs Time (linear regression)

4401 Market Street
Oakland, California

Figure 6

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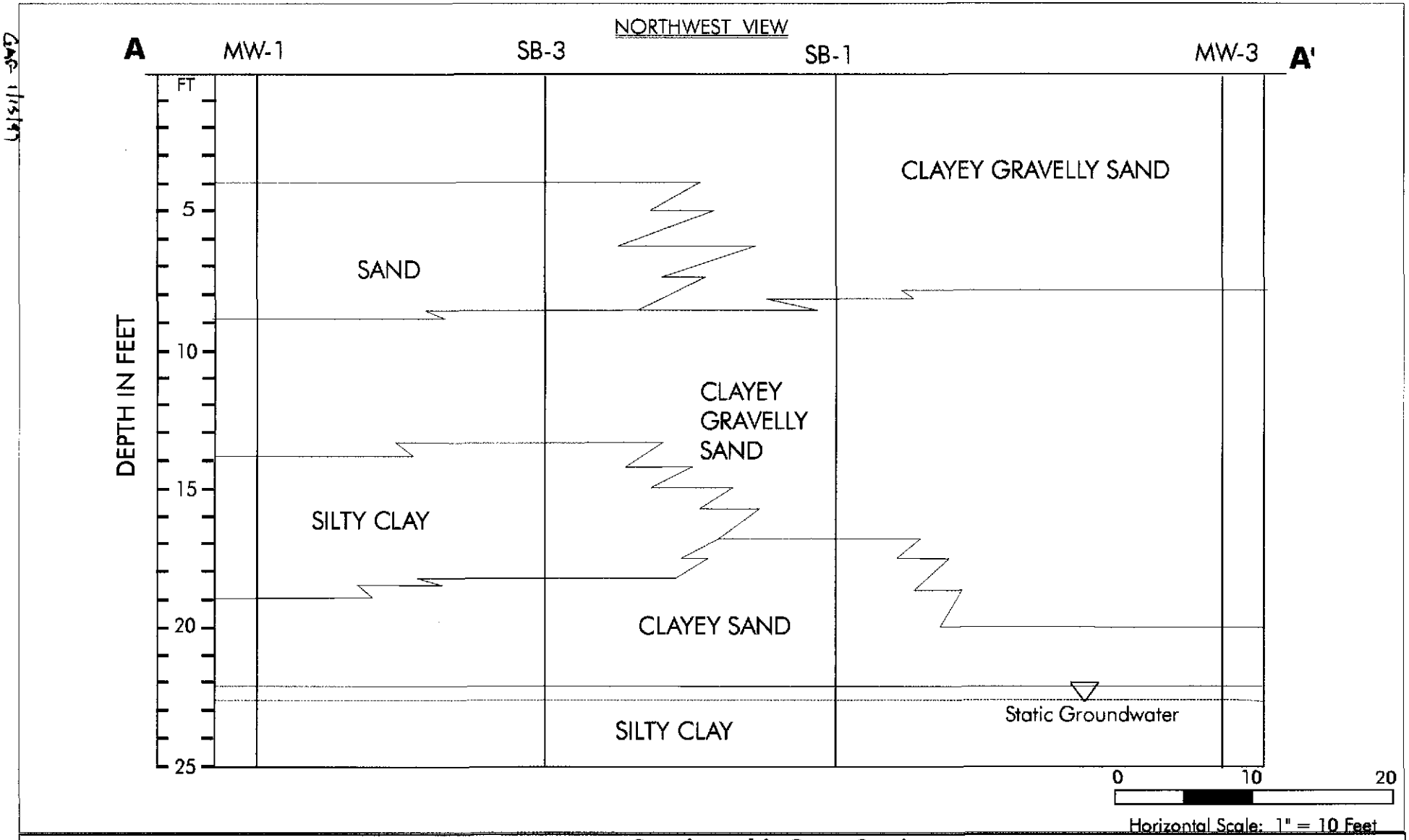

Project No. 3365

January 1997

Stratigraphic Cross Section

Damele Site
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Figure 7

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