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Alameda County
Environmental Health

Site Conceptual Model Report and Data Gap Work Plan

Foothill Mini Mart
6600 Foothill Boulevard
Oakland, CA 94605

Fuel Leak Case No. RO0000175
GeoTracker Global ID: T0600102286

Submitted by:

Mr. Ravi Sekhon

Prepared for:

Mr. Ravi Sekhon

Prepared by:

Environmental Risk Specialties Corporation
1600 Riviera Avenue, Suite 310
Walnut Creek, CA 94596

October 2008

ers

Mr. Paresh C. Khatri
Hazardous Material Specialist

Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

RE: Sekhon Gas Station

6600 Foothill Boulevard
Oakland, California, 94605
Fuel Leak Case No. RO0000175
GeoTracker Global ID: T0600102286
UST Cleanup Fund Claim No. 14095

Dear Mr. Khatri:

As the responsible party of the above-referenced project location, I have reviewed the *Site Conceptual Model Report and Data Gap Work Plan*, prepared by Environmental Risk Specialties Corporation (ERS), of Walnut Creek, California. I declare, under penalty of perjury, that the information and/or recommendations contained in this document or report are true and correct to the best of my knowledge.

Sincerely,

Mr. Ravi Sekhon

Date: 10-20-2008

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EXECUTIVE SUMMARY

In response to the July 24, 2008 letter issued by Alameda County Environmental Health (ACEH), Environmental Risk Specialties Corporation (ERS) has prepared a *Site Conceptual Model Report and Data Gap Work Plan*. A preliminary Site Conceptual Model (SCM) has been developed based on the available data obtained from the following site characterization investigations, in addition to quarterly groundwater monitoring results:

- June 2001 initial groundwater investigation (AARS, 2001);
- June 2002 additional site investigation (AARS, 2002b); and
- August 2005 site characterization (AARS, 2005).

The preliminary SCM is described in Section 8. The developed SCM has been used to assist in the identification of the potential site and plume data gaps. The preliminary SCM also will assist in site/groundwater plume characterization before upcoming site cleanup and closure activities. The preliminary SCM will be upgraded after the results of data gap investigation proposed in this document are available.

The following categories of data gaps have been identified based on the preliminary SCM:

- Local lithology and hydrogeology
- Contaminated soil and contaminant plume
- Potential of natural attenuation

Based on the identified data gaps (see Sections 9 and 10), an investigation work plan has been included in this document. The work plan recommends soil boring/sampling and groundwater sampling, as well as a shallow water-bearing zone pumping test. A total of ten monitoring wells, including four well pairs and two single wells, have been proposed (see Table 5). The soil sampling and new monitoring well locations are shown in Figure 21. The scope of work and associated schedule for the data gap investigation is included in Sections 11 and 12.

1. INTRODUCTION

At the request of Mr. Ravi Sekhon, the Claimant of the UST Cleanup Fund for the Sekhon Gas Station site, and in response to the July 24, 2008 letter issued by the Alameda County Environmental Health (ACEH), Environmental Risk Specialties Corporation (ERS) has prepared a *Site Conceptual Model Report and Data Gap Work Plan* to satisfy the regulatory requirements set forth for the site. The developed Site Conceptual Model (SCM) is used to assist in the identification of the site/plume data gaps and to assist in site/groundwater plume characterization before site cleanup and closure activities.

1.1 Purpose of the Report and Work Plan

Based on the previous site investigation and characterization results, a preliminary Site Conceptual Model (SCM) has been developed. The developed SCM has been used to assist in the identification of the site/groundwater plume data gaps. The preliminary SCM will be updated after the data gaps are filled. The updated SCM will be used to assist in the design of site cleanup measures.

This document contains two portions: a report for the development of a preliminary SCM and a work plan for the data gap investigation. The purpose of this document is to summarize the previous site investigation/characterization results, and to develop a preliminary SCM. This document also includes a work plan describing the scope of work/activities and the schedule for the investigation for filling the data gaps associated with the site lithology and site contamination.

1.2 Structure of the Document

This site cleanup report contains the following sections:

- Section 1 – Introduction
- Section 2 – Site description and History
- Section 3 – Environmental Setting
- Section 4 – Geology and Hydrogeology
- Section 5 – Previous Site Investigations
- Section 6 – Preferential Pathway Study
- Section 7 – Contamination Extent and Plume Movement
- Section 8 – Preliminary Site Conceptual Model

- Section 9 – Data Gaps
- Section 10 – Data Gap Investigation Work Plan
- Section 11 – Scope of Work
- Section 12 – Schedule of Proposed Activities
- Section 13 – References
- Section 14 – Document Distribution List

2. SITE DESCRIPTION AND HISTORY

2.1 Site Location and Description

The subject site is located at 6600 Foothill Boulevard, Oakland, California, on the northeastern corner of Havenscourt Boulevard and Foothill Boulevard (Figure 1). Ground surface elevation of the site is approximately 60 feet above mean sea level (msl). Regional topography of the site slopes gently toward the south-southwest direction. The site is located in an area with mixed commercial and residential uses. It is currently occupied by a retail gasoline station (Golden Gasoline) that includes a convenience store and two gasoline dispenser islands. Each dispenser island has two dispensers.

The property is bounded by an empty commercial building to the east, Foothill Boulevard to the south, Havenscourt Boulevard to the west and Evergreen Cemetery to the north. Across Foothill Boulevard, south of the site, is an empty lot formerly used as a gas station at the southeast corner of Havenscourt Boulevard and Foothill Boulevard. East of the empty lot is a two-story residential building with a store. The site plan is shown in Figure 2.

The site is located in the foothills of the Oakland Hills to the north. San Francisco Bay is located approximately two miles to the west of the property, and San Leandro Bay is approximately two miles southwest of the property. The Frick Jr. High School, Luther Burbank School, and Markham School are located within 2,000 feet of the property.

2.2 Site and Underground Storage Tank History

The site has been a retail gas station since 1959 and was formerly operated as Shell, ARCO, and BEACON gasoline stations. The underground storage tank (UST) system of the former gas stations consisted of one 8,000-gallon, single wall, steel UST, two 10,000-gallon, single wall, fiberglass USTs, two dispenser islands, and two dispensers on each dispenser island. Mr. Ravi Sekhon purchased the property from the BEACON gas station in 1998.

As part of the UST system upgrade, a suspected leakage of the 8,000-gallon steel UST was noticed in November 1998. Consequently, the steel UST and associated dispensers were removed on December 16, 1998, and the leakage was reported in January 1999. Mr. Steve Crawford of the City of Oakland Fire Department was on site during the tank removal to observe site conditions and to direct sample collections. At Mr. Crawford’s direction, two soil samples were collected, individually; from the eastern and western sidewalls of the UST pit and three soil samples were collected from beneath the dispenser islands. Since the pipe trench between the dispensers and UST pit was less than 20 feet, Mr. Crawford did not require that pipe trench samples be collected. Copies of the sampling results for samples collected from beneath the dispenser islands and from the UST pit sidewall were forwarded to the ACEH on January 11, 1999. In addition, on December 31, 1998, staff of Edd Clark & Associates collected one grab groundwater sample. A copy of these sample results was also forwarded to the ACEH (AARS, 2003b). Review of all laboratory reports shows that, with the exception of 25 ppb of toluene in the east dispenser island soil sample, the only detected compound in the soil has been methyl tertiary butyl ether (MTBE). The water sample from the pit shows that compounds of Total Petroleum Hydrocarbons as gasoline (TPH-g), benzene, toluene, ethylbenzene, and xylenes (BTEX), and MTBE were detected in the groundwater.

Following the removal of the 8,000-gallon steel UST on December 16, 1998, P&D Environmental (P&D) of Oakland, California, was retained by Mr. Sekhon to provide consulting services. During P&D's site visit on January 9, 1999, approximately 6 inches of groundwater was observed at the bottom of the UST pit, from which a steel UST had just been removed. The measured depth to groundwater was 8.0 feet below ground surface (bgs). Sheen was observed on the water in the UST pit. However, no petroleum hydrocarbon odors were detected in any of the soil at the site. Based on a January 11, 1999 telephone conversation between Mr. Crawford of the City of Oakland Fire Department and the staff of P&D, Mr. Crawford indicated that there was nothing remarkable about the site, and no evidence of contamination other than MTBE, which was reported in the laboratory reports.

Based on the above observations and the sampling results, P&D recommended that the UST pit be backfilled, the upgrade of the remaining UST system be completed, and that a groundwater investigation be performed to determine the extent and origin of petroleum hydrocarbons in groundwater. Thus, prior to backfilling, groundwater was pumped from the UST pit and stored in above ground storage tanks pending carbon filtration and discharge to the storm drain with an approved San Francisco Bay Regional Water Quality Control Board temporary groundwater discharge permit. In addition, the stockpile soil generated during UST removal was characterized, profiled and removed from the site to the BFI Vasco Road Landfill in Livermore, California (P&D Environmental, 1999). Additionally, to complete the UST system upgrade, two fiberglass USTs were kept at the site, new dispensers with dispenser pans and sensors, double walled piping, overfill and overspill protection, a sump with a sensor for each UST, and an automatic tank gauging system were installed, and pit backfilled in January and February 1999.

2.3 Site Investigation History

Mr. Sekhon retained Advanced Assessment And Remediation Services (AARS) of Concord, California, to conduct subsequent groundwater investigation. AARS conducted a preliminary site assessment in June 2001, supervised the installation of monitoring wells MW-1, MW-2, and MW-3 on June 4, 2001, and conducted quarterly sampling on June 13, 2001 (AARS, 2001) and March 21, 2002 (AARS, 2002a). The results of the preliminary site investigation, as well as the June 2001 and March 2002 quarterly monitoring and sampling, confirmed the presence of elevated petroleum hydrocarbons and MTBE in monitoring well MW-2 near the backfilled UST pit. AARS conducted an additional site investigation by installing three monitoring wells MW-4, MW-5, and MW-6 and two soil borings. These monitoring wells were installed on June 26, 2002, and an additional groundwater sampling was performed on July 9, 2002 (AARS, 2002b).

After that, ARRS only conducted six quarterly monitoring and sampling events. The above wells were not monitored regularly every quarter between 2001 and 2005. Wells MW-1 through MW-3 were gauged only twice each year between 2002 and 2005, and wells MW-4 through MW-6 were gauged and sampled twice each year between 2003 and 2005. AARS conducted a final monitoring event on November 30, 2005 (AARS, 2006). The analytical results (ARRS, 2006) indicated an elevated concentration of petroleum hydrocarbons in MW-4 and the farthest downgradient monitoring well MW-6, as well as elevated MTBE concentrations in monitoring wells MW-1, MW-2, and MW-6. Results of those monitoring events suggested that off-site migration of petroleum hydrocarbons and MTBE might have occurred. ACEH, thus, requested additional site characterization to define the lateral and vertical extent of the groundwater impact in ACEH's March 28, 2008 letter.

Mr. Ravi Sekhon retained ERS on July 9, 2008, to manage this site cleanup and closure project. At the request of ACEH's July 24, 2008 letter, ERS conducted a preferential pathway study and submitted a study report (ERS, September 2008a). ERS also resumed quarterly groundwater monitoring for the subject site beginning with the third quarter 2008 (3Q08) on August 8, 2008. A 3Q08 groundwater monitoring report has been submitted (ERS, 2008b).

3. ENVIRONMENTAL SETTING

3.1 Climate

The climate in the Oakland area is considered Mediterranean with moist, mild winters and hot, dry summers (DWR, 2008). Average rainfall in the Oakland area is about 24 inches per year. Lowland areas, including the East Bay Plain Basin, receive an average annual rainfall of about 15 to 25 inches. The winter temperatures range from 35°F to 65°F, summer temperatures range from 50°F to 90°F. Roughly 90% of the rainfall occurs between November and April. Urban areas, such as the subject site area, exhibit reduced evapotraspiration due to low vegetative cover. Dense fog typically covers low-lying areas in the morning and burns off by the afternoon.

3.2 Topography

From the subject site area the Coast Range rises to a maximum altitude of 1500 feet above msl approximately 3.5 miles to the north of the site. The local Coast Range elevation ranges from 400 to 1000 feet within 2.5 miles of the site to the east and northeast. The site lies at the base of the Coast Range Geomorphic province where the site area topography is relatively flat with a gentle slope towards the Bay. The site altitude is approximately 60 feet above msl with the local topography dipping slightly to the southwest. The gradual slope continues to the San Leandro Bay, which is located approximately two miles to the southwest.

3.3 Surface Water

The watershed for the East Bay Plain is over 100 square miles along the western edge of the Coast Range Mountains. Surface water in the area includes Lion Creek, located approximately 0.6 miles to the east of the site, and flowing southwest into a tidal slough that drains into San Francisco Bay approximately two miles to the west of the site. Peralta Creek runs southeast approximately two miles southwest of the site. Under the update to the City of Oakland's Storm Water Management and Discharge Control in 1997, the City of Oakland launched a creek restoration project for Peralta Creek in 2003. The creek ordinance has provided stronger safeguard ordinances for local creeks.

3.4 Land Use

Land use in the subject site area is predominantly residential and commercial. The area is developed urban with most surface area covered with asphalt, concrete and buildings. A large unpaved cemetery is located approximately 300 feet north of the subject site, a park about 600 feet to the northwest, and a school roughly 750 feet to the west.

The property at 6548 Foothill Boulevard, west of the subject site across Havenscourt Boulevard, remained a gas station at least until 1970. It was subsequently converted into an auto repair shop in 1986. The property at 6601 Foothill Boulevard, south of the subject site across Foothill Boulevard, was also a gas station at least until 1950. It became vacant in 1958. These potential off-site sources for petroleum contamination are either cross gradient or down gradient from the subject site, and appear not to contribute hydrocarbon contaminants to the subject site. However, they may influence the effectiveness and/or cost of cleanup of the subject site if these two properties were contaminated by the former gas stations.

The nearest UST Cleanup Fund site (1 Eastmont Mall Nor) located 1,600 feet southeast/down gradient of the subject site, is not considered contributory to hydrocarbon contaminants to the groundwater plume of the subject site. The concerned hydrocarbons include waste oil, motor oil, and hydraulic/lubricant oil. This site also does not influence the migration of the groundwater plume from the subject site, because no cleanup activities have occurred at this site.

3.5 Water Use

In the Bay Area more than 50 % of the water is used for residential purposes. In the site area water is used for residential and commercial purposes. In the greater Bay area groundwater accounts for roughly 5% of the average water supply. The East Bay Plain Basin is not considered one of the more heavily used basins for groundwater supplies in the Bay Area (DWR, 2008). Prior to the 1930s, groundwater in the area was used for water supply. However, seepage and saltwater intrusion began to affect groundwater quality in the 1920's. The Mokelumne Aqueduct began importing water to East Bay residents starting in 1929, and many of the local groundwater wells were abandoned thereafter. In 1996, the Regional Water Quality Control Board reported that Oakland did not have plans to develop local groundwater resources due to potential saltwater intrusion, contamination, and poor or limited quality (RWQCB, 1999). Local drinking water is supplied by the East Bay Municipal Utilities District (EBMUD) via the Mokulumne aqueduct, which transports water from the Mokulmne River. There are no active EBMUD water supply wells within ¼ mile from the subject site.

There are two wells within 3,000 feet of the subject site. Irrigation well (2S/3W-10G1) is located in the northeastern direction, which is up gradient of the subject site, with the pumping interval from 127 to 437 feet bgs. Industrial well 2S/3W-10Q1 is located approximately 2,800 feet from the subject site in the cross-gradient direction, with a pumping interval of 90 to 393 feet bgs.

All the identified monitoring wells and test wells are installed within the shallow zone (less than 45 feet bgs) and are located at a distance farther than ¼ mile from the subject site, except for shallow test/monitoring wells 2S/3W-10L2 through 10L5 and 10L7 through L9 located at 6455 Foothill Boulevard, approximately 330 feet from the subject site. Those shallow test/monitoring wells are not used for any water supply purposes.

4. GEOLOGY AND HYDROGEOLOGY

The regional and local geology and hydrogeology described in this section will be used to assist the development of the SCM.

4.1 Regional Geology

The region of the site lies in a mixture of Holocene and Pleistocene alluvial fan deposits at the base of the Coast Range Physiographic/Geomorphic Province of California. The province is defined by a series of northwest-southwest trending valleys and ridges that are part of the Franciscan Assemblage. The ridges adjacent to the site area are part of the Joaquin Miller and Knoxville Formations composed of Cretaceous and Jurassic basalts, gabbros and keratophyres (Graymer, 2000). Quaternary alluvial deposits slope gradually to the west, towards the San Francisco Bay, with artificial fill closer to the Bay. The regional geologic map near Oakland and Alameda County is included in Appendix B.

The site is located approximately 2,000 feet southwest of the Hayward fault zone, a northwest-southeast trending fault that extends the entire length of the east bay. San Francisco Bay formed as a depression in the Franciscan bedrock caused by the east-west extension of the Hayward and San Andreas faults. The surficial deposits are Quaternary alluvial deposits of irregularly stratified and poorly sorted unconsolidated deposits of mud, silt, sand and gravel.

4.2 Regional Hydrogeology

The site is located in the East Bay Plain Ground Water Basin. The basin is approximately two to seven miles wide by 25 miles long, and trends between northwest and southeast. The basin is bounded to the north by San Pablo Bay, to the east by a contact with the Franciscan bedrock, and to the south by the Nile Cone Ground Water Basin. Two subbasins within the East Bay Plain Basin are known as the San Francisco and San Pablo Basins. The site is located in the San Francisco subbasin, which extends from the Dumbarton Bridge northward to the southern Richmond shoreline. The general groundwater flow direction is from east to west, approximately following the surface topography.

4.3 Local Lithology and Soil

The subject site and its vicinity are located in the foothills of the Oakland Hills, and at the eastern edge of an alluvial plain on the east side of San Francisco Bay. The uppermost lithologic member is the San Antonio Formation with sediments deposited in a complex and ever-changing depositional environment ranging from alluvial fans to flood plains, to lakes, to swamps, and to beaches. The underlying unconsolidated sediments comprise three distinct Holocene and Pleistocene formations (the Santa Clara, Alameda, and Temescal Formations) ranging from 300 feet to 700 feet in thickness. These formations are composed mostly of bay mud, silts clays, and some gravels, and are underlain by westward sloping Franciscan bedrock. The Temescal Formation, consisting of silts, clays and some gravels, underlies the site.

The subject site and its vicinity are underlain by broad and relatively flat coarse- to fine-grained alluvial fan deposits. The alluvial deposits consist largely of inter-fingered lenses of clayey gravel, sandy and silty clays, and sand to silty clay mixtures. Individual units are discontinuous and have low correlation with distance. These sediments were deposited in estuarine, river and flood plain environments. The grain size decreases at the distal edge of the alluvial fan, where the fluvial deposits are described as sand with increasing silt and clay to sandy or silty clay (EBMUD, 2005).

The local subsurface lithology is composed of fine-grained materials consisting of gravel-sand-clay mixtures, stiff clay, poorly sorted clay and silty clay to the depth of 30 feet bgs. Predominant soil types at the site are clays and silty clays with a stringer of clayey gravels and gravelly sand. Most of the clays and silty clays are very stiff with high plasticity. The site area is mainly industrial and residential, and the topsoil is generally covered by asphalt, concrete, and buildings.

4.4 Local Hydrogeology

Groundwater under and near the subject site is often shallow ranging from 4.37 feet bgs (MW-4) to 10.62 feet bgs (MW-1) during the available monitoring events performed between June 2001 and August 2008. Depth to groundwater also varies with rainfall and seasons. The measured local groundwater depths, directions, and gradients are summarized in Table 1. The average on-site groundwater depths determined from wells MW-1 through MW-3 are consistently greater than the average groundwater depths determined from off-site wells MW-4 through MW-6. The survey data indicates that the off-site ground surface elevation at and near the properties of 6601, 6619, and 6620 Foothill Boulevard is approximately 1.4 feet lower than the ground elevation of the subject site (ERS, 2008a) As a result, the corrected average off-site groundwater depth is deeper than the average on-site groundwater depth in July 2002, and July and November 2003, when the local groundwater direction was in the southeastern direction, based on the groundwater elevation contours. Except for the above events, the local groundwater direction was reversed and ranged between the southwestern and northwestern direction. Since February 2004, the general local groundwater flow is primarily in the southwestern direction toward the San Francisco Bay.

5. PREVIOUS SITE INVESTIGATIONS

To assess the nature and extent of groundwater contamination, P&D prepared and submitted a work plan for a preliminary site investigation. After the work plan was approved by ACEH, Mr. Sekhon retained AARS to supervise the drilling of three soil borings to a maximum depth of 25 feet bgs by Exploration Geoservices of San Jose, California, on June 4, 2001. After being sampled and screened at five-foot intervals, these soil borings were converted into monitoring wells MW-1 through MW-3. One sample from each borehole was delivered for laboratory analysis based on: the groundwater depth, smell of odors, and Photon Ionization Detector (PID) reading. Collected soil samples and groundwater samples from wells MW-1 through MW-3 were analyzed for TPH-g by EPA Method 8015M, and analyzed for BTEX and MTBE by EPA Method 8020. Elevated TPH-g, benzene, and MTBE concentrations were found in soil (870, 4.3, and 0.29 mg/Kg, respectively) and groundwater (5,800, 94,000, and 160 μg/L, respectively) samples collected from MW-2. EPA Method 8260 confirmed the above data. The investigation results are presented in the *Groundwater Quality Investigation* report (AARS, 2001).

Another work plan was approved by ACEH (AARS, 2002c). For this additional site investigation, AARS supervised drilling and sampling of five borings, SB-1, SB-2, MW-4, MW-5, and MW-6, to a maximum depth of 20 feet bgs by Exploration Geoservices, on June 26 and 27, 2002. Soil samples from these five borings were collected in the same manner as the 2001 preliminary investigation. Three borings were converted into monitoring wells MW-4 through MW-6 after soil sampling. As in 2001, soil and groundwater samples were analyzed for TPH-g, BTEX, and MTBE using the same EPA methods. The 2002 additional investigation revealed that elevated MTBE concentrations of 37,600, 28,300, 18,600, and 11,300 μg/L were found in wells MW-2, MW-4, MW-5, and MW-6, respectively. Elevated MTBE concentrations of 593, 4,290, and 1,160 mg/Kg were found in soil samples collected from borings MW-4, MW-5, and MW-6, respectively, at a depth of 10 feet bgs. The 2002 additional investigation (AARS, 2002b) suggests that both TPH-g and MTBE have migrated to the southeast of the subject property following the groundwater flow. Prior to soil sampling and well installation, a horizontal conduit study and well search was also performed. No significant horizontal and vertical conduits were identified.

A work plan was approved by ACEH (AARS, 2003b) for another site investigation performed in August 2005 (AARS, 2005). AARS supervised drilling of 12 soil borings, SB-3 through SB-14 by Gregg Drilling and Testing, Inc. of Martinez, California, on August 10 and 11, 2005. Soil borings SB-3 and SB-4 were drilled to 20 feet bgs; soil borings SB-5, SB-6 and SB-10 through SB-14 were drilled to 17 feet bgs. Soil boring SB-7 was drilled to 30 feet bgs, and SB-8 and SB-9 were drilled to 28 feet bgs. Soil samples were collected from the above borings at five-foot intervals and analyzed for TPH-g, BTEX, and MTBE. Multiple soil samples were collected from borings SB-7, SB-8, and SB-9 based on the change of lithology or PID reading. Temporary well casings were installed in all soil borings for groundwater collection. Since borings SB-9, SB-13, and SB-14 were dry, groundwater samples were not collected (see Table 2). Groundwater was collected from other locations within the screened interval of 10 to 20 feet bgs. Collected soil and groundwater samples were analyzed for TPH-g by EPA Method 8015M, and for BTEX and MTBE by EPA Method 8021B.

The 2005 site characterization revealed the following conditions:

- Highly clayey soil exists nearby the UST pit. Thus, the migration of dissolved hydrocarbons in groundwater is limited.

- The hydrocarbon plume is primarily confined to the vicinity of the removed tank pit area and has migrated to the southeast following the direction of groundwater flow.

- Groundwater samples collected from MW-2, MW-4, MW-6, SB-7, and SB-8 detected TPH-g concentrations between 91 and 9,300 μg/L (SB-8), and benzene concentrations between non-detect to 470 μg/L.

- Although MTBE was detected in all monitoring wells and soil borings, with concentrations ranging from 13 (SB-11) to 23,000 μg/L (SB-7), elevated MTBE concentrations were detected in monitoring wells MW-1, MW-2, MW-4, and MW-6, and soil borings SB-7 and SB-8.

- Significant levels of MTBE were detected in soil borings SB-7, SB-8, and SB-9 near the UST pit. TPH-g concentration containing strongly aged gasoline or diesel range compounds between 1.7 and 200 mg/Kg was detected in these soil borings.

- Due to the high mobility of MTBE, the delineated MTBE plume boundary is much broader than the hydrocarbon plume.

- Only a low TPH-g concentration of 4.7 mg/Kg containing strongly aged gasoline or diesel range compounds was detected at SB-4. No TPH-g, BTEX, and MTBE were detected in all other soil borings located on the properties of 6601 and 6619 Foothill Boulevard. In accordance with a personal communication with Mr. Billy Jue, property owner, elevated TPH-g concentration of 13,000 μg/L, detected in groundwater from location of SB-5 located on the property of 6619 Foothill Boulevard, with none-typical gasoline pattern, was likely associated with past railroad activities of General Motors Automotive Plant.

6. PREFERENTIAL PATHWAY STUDY

In response to ACEH's March 28 and July 24, 2008 letters, ERS conducted a preferential pathway study in July through August, 2008, and submitted a *Preferential Pathway Evaluation Report* (ERS, 2008a) to assist in groundwater plume characterization and the development of a Site Conceptual Model, as well as to satisfy the regulatory requirements set forth for the site before site cleanup and closure activities. The results/findings of the preferential pathway study are summarized below:

6.1 Utility Survey

ERS has contacted the following potential utility providers obtained from the Underground Service Alert (USA):

- City of Oakland
- Alameda County
- East Bay Municipal Utility District
- PG&E
- AT&T
- MCI WorldCom
- Pacific Bell Hayward
- Comcast-Oakland
- Time Warner

A log detailing the contacts and summarizing the results/data is included in Appendix B of the *Preferential Pathway Evaluation Report* (ERS, 2008a). The findings of the utility survey are summarized below:

(1) According to the drawings obtained from the City of Oakland, depths of a 15-inch storm drain and an 8-inch sanitary sewer located south of the subject site, along Foothill Boulevard, range from 4.7 to 8.5 feet bgs and from 4.5 to 4.9 feet bgs, respectively. Existing on-site monitoring wells MW-2, MW-3, and MW-4 are near the northern sidewalk of Foothill Boulevard. According to the historical groundwater monitoring data from June 2001 through August 2008 (AARS, 2006; ERS, 2008), groundwater depths for wells MW-2, MW-3, and MW-4 are 6.68 to 10.69 feet bgs, 8.71 to 9.98 feet bgs, and 4.62 to 8.39 feet bgs, respectively (Note: these depths have been converted from top of well casing elevation to ground elevation). The calculated slope of the 15-inch storm drain under Foothill Boulevard south of the subject site is 0.008 feet per foot in an easterly direction. The above data indicates that gravel and/or pipe within the storm drain trench could have intercepted local groundwater and accelerated the lateral migration of the groundwater plume, especially in the area near well MW-4 east of the subject property. Since the depth of the sanitary sewer is above 5 feet bgs, it constitutes a less likely preferential pathway for the migration of the groundwater plume in a horizontal direction.

(2) Sanitary sewers under the properties of 6601 and 6619 Foothill Boulevard are deeper than 5 feet from the ground surface (5.0 to 6.3 feet bgs). Historical groundwater depths for wells MW-5 and MW-6 are between 6.39 and 8.76 feet bgs and 5.34 and 8.23 feet bgs, respectively (AARS, 2006; ERS, 2008). These sanitary sewers could also provide a preferential pathway and influence the lateral migration of the groundwater plume, should the contaminated groundwater reach this area.

(3) Depth of the sanitary sewer within the 5-foot wide easement north of the subject property is approximately 2.7 feet bgs and all other utilities in the vicinity of the subject site, including gas pipes and power cables, if installed underground (3.25 feet and 4.25 feet bgs), telephone lines, and TV cables (1.75 feet and 2.75 feet bgs), are less than 5 feet bgs. Thus, it is unlikely those utility conduits constitute a preferential pathway for plume migration.

(4) There is a 48-inch water aqueduct and an 8-inch water main installed under Havenscourt Boulevard (west of the subject site), and one 8-inch pipe and one 16/6-inch pile installed under Foothill Boulevard (southeast/south of the subject site). The bottom of the 48-inch aqueduct is between 10.8 to 13.3 feet bgs, and the bottoms of the 8-inch and 16/6-inch pipe are approximately 5-feet bgs near the subject site. Since local groundwater flow is between a southeast and southwest direction, the 8-inch and 16/6-inch water pipes under Foothill Boulevard can become conduits of lesser resistance for the groundwater plume and expedite its lateral migration when the groundwater elevation is higher than 5 feet bgs. If the bottom of the groundwater plume is deeper than 11 feet bgs and the plume also reaches Havenscourt Boulevard southeast of the subject site, the 48-inch water aqueduct may also become a major preferential pathway for the off-site migration of the groundwater plume.

(5) The bottom of the UST tank pit is 8.5 feet bgs. The historical groundwater elevation data obtained from well MW-2 (6.68 to 10.69 feet bgs) suggests that residual contaminants near the bottom of the tank pit, after the removal of a leaky steel tank, can dissolve into the groundwater if the groundwater elevation is higher than 8.5 feet bgs.

6.2 Well Survey

ERS searched the well records maintained by the State of California, Department of Water Resources (DWR) and the County of Alameda, Public Works Agency, Water Resources Section (ACWRS). A total of 16 wells were identified by searching the DWR records and 14 wells were found by ACWRS. The finding of the well survey are summarized below:

(1) An irrigation well (2S/3W-10G1) is located in the northeastern direction, which is up gradient of the subject site. Although the pumping rate and pumping scheme of this well are not clear, considering the distance (approximately 1,200 feet from the subject site) and the pumping interval (127 to 437 feet bgs), the capture zone of this well likely does not cover the groundwater plume of the subject site. The hydraulic effect on the vertical migration of the groundwater plume from the subject site is not likely to be significant.

(2) Similarly, industrial well 2S/3W-10Q1 is located at approximately 2,800 feet from the subject site in the cross-gradient direction, with a pumping interval of 90 to 393 feet bgs. Since shallow soil near the subject site is predominantly clay, both the industrial and irrigation wells within ¼ or ½ mile from the subject site should not have significant hydraulic influence on the vertical migration of the groundwater plume. Their effect on the groundwater plume is insignificant compared with local horizontal groundwater gradient and lithology.

(3) No active EBMUD water supply wells exist within ¼ mile from the subject site.

(4) All the identified monitoring wells and test wells are installed within the shallow zone (less than 45 feet bgs) and are located at a distance farther than ¼ mile from the subject site, except for shallow test/monitoring wells 2S/3W-10L2 through 10L5 and 10L7 through L9 located at 6455 Foothill Boulevard, approximately 330 feet from the subject site. Those shallow test/monitoring wells do not affect vertical migration of the groundwater plume from the subject site.

6.3 Background Study

ERS performed a background study for the subject site and the properties in its vicinity through a review of historical Sanborn® Fire Insurance Maps; Historical Topographic Maps; the City Directory Abstract; and historical aerial photographs provided by Environmental Data Resources, Inc. (EDR) of Milford, Connecticut. Based on the background study, land use of the subject site and the properties in its vicinity is summarized below:

(1) The property at 6548 Foothill Boulevard, west of the subject site across Havenscourt Boulevard, remained a gas station at least until 1970. It was subsequently converted into an auto repair shop in 1986. The property at 6601 Foothill Boulevard, south of the subject site across Foothill Boulevard, was also a gas station at least until 1950. It became vacant in 1958. These potential off-site sources for petroleum contamination are either cross gradient or down gradient from the subject site, and appear not to contribute hydrocarbon contaminants to the subject site.

(2) The nearest UST Cleanup Fund site (1 Eastmont Mall Nor) located 1,600 feet southeast/down gradient of the subject site, is not considered contributory to hydrocarbon contaminants to the groundwater plume of the subject site. The concerned hydrocarbons include waste oil, motor oil, and hydraulic/lubricant oil. This site also does not influence the migration of the groundwater plume from the subject site, because no cleanup activities have occurred at this site.

6.4 Conclusions of the Preferential Pathway Study

- The subsurface utilities including gas, telephone, and TV cable in the vicinity of the subject site do not appear to be preferential pathways for the groundwater plume.

- Sanitary sewers under Havenscourt Boulevard and Foothill Boulevard and the sewer within the 5-foot wide easement north of the subject site are not the preferential pathways for lateral plume migration. However, sewers under the properties at 6601 and 6619 Foothill Boulevard may become a migration pathway for the off-site plume if local groundwater elevation is higher than 5 to 6 feet bgs.

- Since the slope of the 15-inch storm drain under Foothill Boulevard south of the subject site is toward the east, the depth of the storm drain becomes deeper east of well MW-3. As a result, the 15-inch storm drain has a greater possibility of behaving like a preferential pathway when the groundwater elevation is near or higher than 5 feet bgs, especially in the area east of well MW-2.

- The 8-inch and 16/6-inch EBMUD water pipes installed under Foothill Boulevard, however, can become a preferential pathway for lateral migration of the plume if local groundwater elevation is higher than 5 feet bgs.

- The 48-inch EBMUD water aqueduct and the 15-inch storm drain installed under Foothill Boulevard can be a major migration pathway if the bottom of the off-site groundwater plume is deeper than 11 feet and the plume reaches Havenscourt Boulevard south of Foothill Boulevard.

- No active EBMUD water supply wells exist within ¼ mile from the subject site. Based on the lithology and/or soil characteristics near the subject site, both the identified industrial and irrigation wells within ¼ or ½ mile from the subject site should not have significant hydraulic influence on the vertical migration of the groundwater plume.

- Residual contaminants near the bottom of the UST tank pit, after the removal of a leaky steel tank, can dissolve into the groundwater if the groundwater elevation is higher than 8.5 feet bgs.

- Former gas stations at 6548 and 6610 Foothill Boulevard hydraulically do not contribute hydrocarbon contaminants to the groundwater plume of the subject site. However, they may influence the effectiveness and/or cost of cleanup of the subject site if these two properties were contaminated by the former gas stations.

- There are no apparent vertical conduits and pumping activities in the vicinity that may affect the vertical and/or lateral migration of the groundwater plume from the subject site.

7. CONTAMINATION EXTENT AND PLUME MOVEMENT

7.1 Source of Contamination

The site has been a retail gas station since 1959. The UST system of the former gas stations consisted of one 8,000-gallon, single wall, steel UST, two 10,000-gallon, single wall, fiberglass USTs, two dispenser islands, and two dispensers on each dispenser island. All the USTs stored only gasoline. As part of the UST system upgrade, a suspected leakage of the 8,000-gallon single wall steel UST was noticed in November 1998. Based on the field observation of the open tank pit and the tank closure sampling data, residual contaminants near the bottom of the UST tank pit, after the removal of a leaky steel tank, can dissolve into the groundwater if the groundwater elevation is higher than 8.5 feet bgs. Thus, release of gasoline from the former 8,000-gallon steel UST is the subsurface source of petroleum hydrocarbon contamination of the subject site.

7.2 Contaminants of Concern

Cumulative groundwater sampling data of all the sampling events between June 2001 and August 2008 (Table 2) show that elevated concentrations of dissolved hydrocarbons, including TPH-g and/or benzene, as well as oxygenates, including MTBE and/or Tertiary Butyl Alcohol (TBA), have been detected from on-site monitoring wells MW-1 and MW-2, and off-site monitoring wells MW-4, MW-5, and MW-6. Thus, TPH-g, benzene, MTBE, and TBA are the contaminants of concern for the subject site.

7.3 Contaminant Migration and Distribution

Local groundwater flow has been found in the southeastern, southwestern, and northwestern direction from June 2001 through August 2008. The determined magnitude of horizontal hydraulic gradient ranged from 0.05 to 0.008 ft/ft.

Migration or transport of dissolved hydrocarbon compounds in groundwater is a complex process influenced by a number of factors such as the seepage velocity of the groundwater flow, thickness and spatial orientation of the sediments and sand/clay lenses, anisotropy of the hydraulic conductivity of the sediments, diffusion/dispersivity of compounds within the sediments, partition of the dissolved compounds with sediment particles, as well as the presence of low resistance media or utility pipe lines/trenches in subsurface. The distribution of dissolved hydrocarbon compounds in the subsurface, or the lateral and vertical extent of contamination, is determined by the process of contaminant migration/transport and the existence of contaminant source(s). Site characterization or data gap investigations and groundwater monitoring assist in the collection of data used to evaluate the influence of the above environmental factors and to determine the lateral and vertical distribution of contaminants in soil and groundwater.

7.3.1 Soil Contamination

7.3.1.1 Subsurface Stratigraphy

A total of 20 boring logs (see Appendix A), including well logs for wells MW-1 through MW-6 and soil logs for borings SB-1 through SB-14, drilled to a maximum depth of 30 feet bgs (boring SB-7), are available from the 2001, 2002, and 2005 investigations. Based on the available boring logs, 8 underground cross-sections (A-A' though H-H') have been developed to delineate the characteristics of subsurface stratigraphy and lithology. Locations of the above cross-sections are shown in Figure 3. The developed cross-sections A-A through H-H' are presented in Figures 4 through 11.

As discussed in Section 4.3, predominant soil types at the site are clays and silty clays with a stringer of clayey gravels and gravelly sand. Most of the clays and silty clays are very stiff with high plasticity. Results of the soil borings show that local subsurface lithology is composed of fine-grained materials consisting of gravel-sand-clay mixtures, stiff clay, poorly sorted clay and silty clay. Inter-fingered lenses of clayey gravel, poorly- and well-graded sand/gravel, sandy and gravely clays, and sand to silty clay exist to the depth of 30 feet bgs.

Although individual sand/gravel lenses with limited extent and thickness are discontinuous, cross-sections A-A', E-E', and G-G' clearly indicate that a layer of sediment constituted by permeable materials with variable thickness exists within a depth interval between ground surface and 15 feet bgs (see Figures 4, 8, and 10). This permeable layer may facilitate the migration of the contaminant plume. In addition to the permeable layer shown in cross-section G-G', off-site migration of the groundwater plume may take place through the inter-fingered or interconnected permeable materials above or below 15 ft bgs. The potential pathways for off-site migration have been identified in cross-sections C-C', D-D', F-F', and H-H' (see Figures 6, 7, 9, and 11). As a result, although the predominant soil types at the subject site are clays and silty clays, the presence of inter-fingered or interconnected permeable materials may become a "conduit" of lesser hydraulic resistance for the migration of dissolved contaminants, in addition to the 15-inch storm drain, the 8/16-inch drinking water pipes, and the 48-inch EBMUD water aqueduct described in Section 6.1. Overall, although permeable layers or pathways of less hydraulic resistance exist, clays and silty clays are dominant at depths between 15 and 30 feet bgs.

7.3.1.2 Lateral and Vertical Extent of Soil Contamination

As mentioned previously, release of gasoline from the removed 8,000-gallon steel UST is the only significant source of subsurface contamination for the subject site. Dissolved petroleum hydrocarbons and added oxygenate, MTBE, move along with the groundwater and also adsorb on soil particles. Thus, migration of dissolved constituents in groundwater not only contaminates soil but also affects the concentration level and distribution of contaminants in the soil matrix. The level of soil contamination is primarily related to the following parameters:

solubility of contaminant compounds in the water, organic carbon content and adsorption capacity of soil particles, and water quality. For example, solubility of pure MTBE, benzene, and TPH-g in the water are 50,000 mg/L, 1,780 mg/L, and 45 mg/L, respectively. Since MTBE has an extremely high solubility in water, consequently, it has much lesser affinity with soil and does not readily sorb to soil particles compared with benzene and TPH-g. Due to its high solubility and, consequently, high mobility, MTBE moves almost at the same speed with the groundwater, in which MTBE dissolves. As a result, the movement of the groundwater plume and the partition of contaminants between water and solids will influence the concentration level and distribution of MTBE, benzene, and TPH-g in the soil.

In order to reveal the lateral extent of soil contamination resulting from plume migration, the maximum TPH-g, benzene, and MTBE concentrations for samples collected within the depth intervals of 8 – 15 feet bgs or 6 – 29 feet bgs during the 2001, 2002, and 2005 investigations (AARS, 2001; 2002b; 2005) have been plotted. The soil concentration data of 2001, 2002, and 2005 are combined and plotted together because soil concentrations normally do not change rapidly over time. The interpreted lateral range of soil contamination by TPH-g, benzene, and MTBE are presented in Figures 12 through 14. Similarly, the approximate vertical range and elevation of the TPH-g and MTBE impacted soil are also presented together with the stratigraphy shown in Figures 4 through 7 and 9 through 11. Based on cross-sections A-A’, B-B’, and C-C’, the approximate range of soil contamination within the source is within the depth interval of 7 to 25 feet bgs.

As shown in Figures 12 through 14, the shape and orientation of the footprints of TPH-g, benzene, and MTBE soil contamination are similar. It appears that the UST pit is the source of on-site and off-site soil contamination. Based on the TPH-g and benzene footprints, the area of the impacted soil near the gasoline release source is approximately 70 feet by 50 feet located on the southeastern corner of the property downgradient from the UST pit. Due to the relatively high mobility of MTBE, the MTBE impacted area shown in Figure 14 is much broader than the area impacted by TPH-g and benzene shown in Figures 12 and 13. As a result, the off-site MTBE concentration is approximately one order of magnitude higher than the soil concentration of MW-2, and the average off-site MTBE soil concentration of 1.33 mg/Kg is close to the average on-site soil concentration of 1.97 mg/Kg. Conversely, the off-site TPH-g and benzene concentrations are approximately one to two orders of magnitude less than the maximum on-site concentrations detected in soil of MW-2. The above data or results suggest that:

- Comparatively higher TPH-g and benzene soil concentrations were identified near the UST pit;
- MTBE has migrated farther away from the source compared with TPH-g and benzene; and
- MTBE impacted area in the soil is broader than the TPH-g and benzene impacted area.

Apparently the above situation is caused by the high mobility of MTBE in groundwater, as opposed to the lower mobility of TPH-g and benzene. In addition to the factor of mobility, the off-site migration of TPH-g, benzene, and MTBE are also facilitated by the presence of permeable layers identified in subsurface cross-sections discussed in Section 7.3.1.1 and the dominant, prevailing southeastern and southwestern groundwater flow direction for the subject site.

It should be noted that the average off-site MTBE soil concentration of 1.33 mg/Kg is significantly greater than the associated Environmental Screening Level (ESL) of 0.023 mg/Kg listed in the November 2007 Interim Final promulgated by California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB) for soil above 10 feet bgs if the groundwater is a potential drinking water resource. If the local groundwater is not a drinking water resource, the associated ESL is 8.4 mg/Kg.

7.3.2 Groundwater Contamination

As discussed in Section 7.3.1, concentration level and extent of soil contamination downgradient from the source is closely related to the concentration level and range of the groundwater plume. To demonstrate the migration/movement of the contaminant plume, and to assist in the delineation of soil contamination presented in Section 7.3.1, groundwater concentrations of TPH-g, benzene, and MTBE obtained from the 2005 site characterization and the Third Quarter 2008 (3Q08) groundwater monitoring event are plotted and presented in Figures 15 through 17. Since soil borings SB-1 and SB-2 were sampled in June 2002, unlike the soil impacted area presented in Figures 12 through 14, the June 2002 groundwater sample data is not included in Figures 15 through 17.

Cumulative groundwater analytical data available from July 2002 through August 2008 (see Table 2) shows that TPH-g has migrated across Foothill Boulevard. Although Figure 15 shows that the center of the THP-g plume has not significantly moved between August 2005 and August 2008, the plume boundary has significantly expanded along the west and southwest direction since August 2005. This observation is consistent with local groundwater flow direction and the low solubility (45 µg/L)/low mobility of TPH-g. As opposed to the migration of the TPH-g plume, the range of the MTBE and benzene plumes have significantly reduced as shown in Figures 16 and 17, and the associated concentration levels within the plume have greatly diminished. Again, this situation is likely influenced by the high solubility of MTBE (50,000 mg/L) and benzene (1,780 mg/L). It should be noted that in addition to the solubility/mobility that influences the contaminant transport discussed in Section 7.3.1.2, benzene is also more volatile than TPH-g and MTBE. For example, the Henry's Law Constant of benzene (0.00556 atm-m^3/mole @ 25°C) is over one order of magnitude greater than MTBE's Henry's Law Constant (0.000391 atm-m^3/mole). Thus, the 3Q08 sampling results indicate that benzene was not detected in all on-site and off-site wells, except for the off-site well MW-6. Consequently, the benzene plume obviously has greatly diminished and migrated away from the subject site as shown in Figure 16. Similar to benzene, the size and concentration level of the

MTBE plume also have significantly reduced since August 2005. This finding is clearly reflected by the decline of MTBE concentrations in all of the on-site and off-site monitoring wells sampled during the 3Q08 monitoring event as shown in Figure 17. The diminishing of the MTBE plume is primarily caused by the high solubility or the dilution of MTBE in groundwater, instead of the volatility. The approximate vertical range and elevation of the TPH-g and MTBE plumes are also presented together with the stratigraphy shown in Figures 4 through 7 and 9 through 11.

Little TBA concentration data is available from the historical quarterly monitoring events and previous site investigations. Thus, the TBA data is not contoured. However, comparing the concentrations of MTBE and TBA obtained from the historical record, the TBA concentration has been less than or close to the MTBE concentration between June 2001 and May 2004 when the TBA data is available, except for the February and May 2004 data for wells MW-3 and/or MW-5. However, the August 2008 data indicates that the TBA concentration has been greatly increased, and the TBA concentration is greater than the MTBE concentration shown in wells MW-2 through MW-6. This finding is exceptionally notable in wells MW-2 and MW-4, in which the sampled TBA concentrations are 17,000 and 1,800 μg/L, respectively. This situation suggests that MTBE not only has been dispersed by groundwater flow, it is very likely that MTBE has been naturally biodegraded.

The migration and natural attenuation of TPH-g, benzene, and MTBE are demonstrated by the change of their concentrations over time as shown in Figures 18 through 20. Figure 18 indicates that the TPH-g concentrations in on-site wells MW-1 through MW-3 have greatly diminished. However, the TPH-g concentrations in off-site wells MW-4 through MW-6 are quite stable. The time trend for benzene and MTBE is completely different compared with the time trend of TPH-g. Both the benzene and MTBE concentrations have shown a clear diminishing trend over time in both on-site and off-site wells (Figures 19 and 20).

In addition to Figures 18 through 20, the groundwater sampling data between June 2001 and August 2008, summarized in Table 2, has been used to further evaluate the effect of natural attenuation on TPH-g, benzene, and MTBE concentrations. A scoring system has been employed to quantify the performance of natural depletion. A positive number "+1" is added if the concerned concentration is deceased from the previous sampling event, and a negative number "-1" is added if the concerned concentration is increased from the previous sampling event. The performance evaluation of natural contaminant depletion is presented in Table 4. A positive score suggests the increasing trend of concentration reduction. A negative score suggests the opposite.

The above discussion and the performance of natural attenuation suggest that:

- The centers of the THP-g and MTBE plumes have not significantly moved between August 2005 and August 2008. However, the TPH-g plume boundary has greatly increased, and the MTBE plume boundary has been reduced within the same period. In addition, the concentration level of the TPH-g plume has slightly increased and the concentration level of the MTBE plume, conversely, has greatly diminished.

- The TPH-g and MTBE plumes have migrated off-site, primarily across Foothill Boulevard.

- The reduction of TPH-g concentration through natural attenuation is not as prominent compared with MTBE and benzene, which is reflected by the expansion of the TPH-g plume shown in Figure 15. Conversely, a significant concentration reduction trend is shown for MTBE and/or benzene, especially in wells MW-2 (5 for MTBE, 2 for benzene), MW-4 (score 7 for MTBE), and MW-5 (score 7 for MTBE, 2 for benzene). The effect is shown in Figures 16 and 17.

- More specifically, TPH-g shows an increasing trend in wells MW-1 and MW-5. MTBE's increasing trend is shown in wells MW-1 and MW-3. Additionally, The MTBE concentration is not well reducing in off-site well MW-6 compared with wells MW-2, MW-4, and MW-5. The above findings cannot be easily identified in Figures 18 and 20 without the evaluation performed in Table 4.

- Based on the increase of TBA in groundwater and the concentration reduction trends, natural attenuation, especially dispersion and biodegradation, likely is significant across the subject site.

8. PRELIMINARY SITE CONCEPTUAL MODEL

A preliminary/initial site conceptual model has been developed based on the following data collected from previous site characterization/investigations and available information sources:

- Site location and description
- Underground storage tank release and removal history
- Environmental setting of the site
- Regional geology and hydrogeology
- Local geology and hydrogeology
- Preferential pathways
- Release from potential off-site sources
- Contaminants of concern
- Potential on-site source areas
- Soil contamination
- Groundwater contamination

All the above data and information have been presented and discussed in Sections 2 through 7.

The major characteristics of the preliminary SCM are summarized below, following the order of the model characteristics listed above:

- ❑ The site is located in an area with mixed commercial and residential uses. It is bounded by an empty commercial building to the east (6620 Foothill Boulevard), Foothill Boulevard to the south, Havenscourt Boulevard to the west and Evergreen Cemetery to the north. The property at 6601 Foothill Boulevard, south of the subject site across Foothill Boulevard, was a gas station at least until 1950. It became vacant in 1958. The property at 6548 Foothill Boulevard, west of the subject site across Havenscourt Boulevard, remained a gas station at least until 1970. It was subsequently converted into an auto repair shop in 1986. These potential off-site sources for petroleum contamination are either cross gradient or down gradient from the subject site, and appear not to contribute hydrocarbon contaminants to the subject site.

- The site has been a retail gas station since 1959. The UST system of the former gas stations operated by Shell, ARCO, and BEACON consisted of one 8,000-gallon, single wall, steel UST, two 10,000-gallon, single wall, fiberglass USTs, and two dispenser islands. Mr. Ravi Sekhon purchased the property from the BEACON gas station in 1998. As part of the UST system upgrade, a suspected leakage of the 8,000-gallon steel UST was noticed in November 1998. The steel UST and associated dispensers were removed on December 16, 1998, and the leakage was reported in January 1999. To complete the UST system upgrade, two fiberglass USTs were kept at the site, new dispensers with dispenser pans and sensors, double walled piping, overfill and overspill protection, a sump with a sensor for each UST, and an automatic tank gauging system were installed. The pit was backfilled in January and February 1999.

- The climate in the Oakland area is considered Mediterranean with moist, mild winters and hot, dry summers. Average rainfall in the Oakland area is about 24 inches per year. The winter temperatures range from 35°F to 65°F, summer temperatures range from 50°F to 90°F. Roughly 90% of the rainfall occurs between November and April.

- Ground surface elevation of the site is approximately 60 feet above mean sea level (msl). Regional topography of the site slopes gently toward the south-southwest direction. From the subject site area the Coast Range rises to a maximum altitude of 1500 feet above msl approximately 3.5 miles to the north of the site. The local Coast Range elevation ranges from 400 to 1000 feet within 2.5 miles of the site to the east and northeast. The site lies at the base of the Coast Range Geomorphic province where the site area topography is relatively flat with a gentle slope towards the Bay.

- The watershed for the East Bay Plain is over 100 square miles along the western edge of the Coast Range Mountains. Surface water in the area includes Lion Creek, located approximately 0.6 miles to the east of the site, and flowing southwest into a tidal slough that drains into San Francisco Bay approximately two miles to the west of the site. Peralta Creek runs southeast approximately two miles southwest of the site.

- Land use in the subject site area is predominantly residential and commercial. The area is developed urban with most surface area covered with asphalt, concrete and buildings. A large unpaved cemetery is located approximately 300 feet north of the subject site, a park about 600 feet to the northwest, and a school roughly 750 feet to the west.

- Prior to the 1930s, groundwater in the area was used for water supply. Beginning in 1929, local drinking water is supplied by the EBMUD via the Mokelumne aqueduct. There are two wells within 3,000 feet of the subject site. Irrigation well (2S/3W-10G1) is located in the northeastern direction, which is up gradient of the subject site, with the pumping interval from 127 to 437 feet bgs. Industrial well 2S/3W-10Q1 is located at approximately 2,800 feet from the subject site in the cross-gradient direction, with a pumping interval of 90 to 393 feet bgs. There are no active EBMUD water supply wells within ¼ mile from the subject site. All the identified monitoring wells and test wells are installed within the shallow zone, and are not used for any water supply purposes.

- The region of the site lies in a mixture of Holocene and Pleistocene alluvial fan deposits at the base of the Coast Range Physiographic/Geomorphic Province of California. The site is located approximately 2,000 feet southwest of the Hayward fault zone. The surficial deposits are Quaternary alluvial deposits of irregularly stratified and poorly sorted unconsolidated deposits of mud, silt, sand and gravel. Quaternary alluvial deposits slope gradually to the west, towards the San Francisco Bay, with artificial fill closer to the Bay.

- The site is located in the East Bay Plain Ground Water Basin approximately two to seven miles wide by 25 miles long, and trends between northwest and southeast. The basin is bounded to the north by San Pablo Bay, to the east by a contact with the Franciscan bedrock, and to the south by the Nile Cone Ground Water Basin. The site is located in the San Francisco sub-basin of the East Bay Plain Ground Water Basin. The general regional groundwater flow direction is from east to west following the surface topography.

- The subject site and its vicinity are underlain by a broad and relatively flat coarse- to fine-grained alluvial fan deposits, and are located in the foothills of the Oakland Hills, and at the eastern edge of an alluvial plain on the east side of San Francisco Bay. The alluvial fan deposits consist largely of inter-fingered lenses of clayey gravel, sandy and silty clays, and sand to silty clay mixtures. The uppermost lithologic member is the San Antonio Formation with sediments deposited in a complex and ever-changing depositional environment ranging from alluvial fans to flood plains, to lakes, to swamps, and to beaches. The local subsurface lithology is composed of fine-grained materials consisting of gravel-sand-clay mixtures, stiff clay, poorly sorted clay and silty clay to a depth of 30 feet bgs. Predominant soil types are clays and silty clays with a stringer of clayey gravels and gravelly sand. Most of the clays and silty clays are stiff with high plasticity. Clays and silty clays are dominant at depths between 15 and 30 feet bgs.

- Groundwater under and near the subject site is often shallow ranging from 4.37 feet bgs to 10.62 feet bgs. Except for the available monitoring events for June 2001, March and July 2002, July and November 2003, when the local groundwater direction was toward the southeast, the local groundwater direction ranged between the southwestern and northwestern direction since February 2004. The general local groundwater flow is primarily in the southwestern direction toward the San Francisco Bay.

- The 15-inch storm drain has a possibility of becoming a preferential pathway when the groundwater elevation is near or higher than 5 feet bgs, especially in the area east of well MW-2. Sewers under the properties at 6601 and 6619 Foothill Boulevard may also become a migration pathway for the off-site plume if local groundwater elevation is higher than 5 to 6 feet bgs.

- The 8-inch and 16/6-inch EBMUD water pipes installed under Foothill Boulevard can become a preferential pathway for lateral migration of the plume if local groundwater elevation is higher than 5 feet bgs.

- The 48-inch EBMUD water aqueduct and the 15-inch storm drain installed under Foothill Boulevard can be a major migration pathway if the bottom of the off-site groundwater plume is deeper than 11 feet and the plume reaches Havenscourt Boulevard south of Foothill Boulevard.

- Sanitary sewers under Havenscourt Boulevard and Foothill Boulevard and the sewer within the 5-foot wide easement north of the subject site are not preferential pathways for lateral plume migration. The subsurface utilities including gas, telephone, and TV cable in the vicinity of the subject site also do not appear to be preferential pathways for the groundwater plume.

- Both the identified industrial and irrigation wells within ¼ or ½ mile from the subject site should not have significant hydraulic influence on the vertical migration of the groundwater plume. There are no other vertical conduits and pumping activities in the vicinity that may affect the vertical and/or lateral migration of the groundwater plume from the subject site.

- The property at 6548 Foothill Boulevard, west of the subject site across Havenscourt Boulevard, was operated as a gas station at least until 1970. It was subsequently converted into an auto repair shop in 1986. The property at 6601 Foothill Boulevard, south of the subject site across Foothill Boulevard, was also a gas station at least until 1950. It became vacant in 1958. These two potential off-site sources for petroleum contamination are either cross gradient or down gradient from the subject site, and appear not to directly contribute hydrocarbon contaminants to the subject site if these two properties were contaminated by their former gas stations.

- Cumulative groundwater sampling data collected between June 2001 and August 2008 indicate that TPH-g, benzene, MTBE, and TBA are the contaminants of concern for the subject site.

- Suspected leakage of the 8,000-gallon, single wall, steel UST removed in December 1998 is the on-site source for petroleum hydrocarbon contamination. Residual contaminants near the bottom of the UST tank pit can dissolve into the groundwater if the groundwater elevation is higher than 8.5 feet bgs. Based on the delineated footprints of TPH-g and benzene soil contamination, the area of the impacted soil near the gasoline release source is approximately 70 feet by 50 feet located on the southeastern corner of the property downgradient from the UST pit. The approximate depth of soil contamination is in the depth interval of 7 to 25 feet bgs.

- In addition to the 15-inch storm drain, the 8/16-inch drinking water pipes, and the 48-inch EBMUD water aqueduct, the presence of inter-fingered/interconnected permeable materials may also become a “conduit” of lesser hydraulic resistance that facilitates the migration of dissolved contaminants. The low-resistance pathway has been clearly identified and is shown in cross-sections A-A’, E-E’, and G-G’ within a depth interval between ground surface and 15 feet bgs. In addition to the low-resistance pathway shown in cross-section G-G’, off-site migration of the groundwater plume may take place through the inter-fingered/ interconnected permeable materials above or below 15 ft bgs. The potential pathways for off-site migration are identified and shown in cross-sections C-C’, D-D’, F-F’, and H-H’.

- The shape and orientation of the lateral footprints of TPH-g, benzene, and MTBE soil contamination are likely influenced by the permeable layers/hydraulic ”conduits” shown in cross-sections A-A’, C-C’, D-D’, F-F’, G-G’, and H-H’, as well as the screen interval of wells MW-5 and MW-6, in addition to the potential preferential pathways of the 15-inch storm drain, the 8/16-inch drinking water pipes, and the 48-inch EBMUD water aqueduct.

- Due to the relatively high mobility of MTBE in groundwater compared with the lower mobility of TPH-g and benzene, the MTBE impacted area is much broader than the TPH-g and benzene impacted area. As a result, comparatively higher TPH-g and benzene soil concentrations were identified near the UST pit.

- Due to the presence of permeable layers identified in cross-sections G-G’, C-C’, D-D’, F-F’, and H-H’, and the dominant southeastern and southwestern groundwater flow direction prevailing under and near the subject site, MTBE has migrated farther away from the source compared with TPH-g and benzene.

- Although the centers of the THP-g and MTBE plumes have not moved significantly between August 2005 and August 2008, the TPH-g plume boundary has significantly expanded, and, conversely, the MTME plume boundary has significantly shrunken. In addition, the concentration level of the TPH-g plume has slightly increased and the concentration level of the MTBE plume, conversely, has greatly diminished. The lateral range of TPH-g and MTBE plumes delineated in 2008 are similar.

- TPH-g, MTBE, and benzene have migrated across Foothill Boulevard, as noted by the elevated TPH-g, MTBE, and benzene concentrations in wells MW-5 and/or MW-6. The benzene plume, however, has diminished to an insignificant level.

- Although the bottoms of the TPH-g and MTBE plumes have not been clearly defined, according to the interpreted plume range and depth shown in Figures 4 through 7 and 9 through 11, the center of mass of the TPH-g and MTBE plumes likely does not exceed 20 feet bgs.

- Change of MTBE and TBA concentrations over time suggests that MTBE not only has been dispersed by groundwater flow, it is very likely that MTBE has been naturally biodegraded.

9. DATA GAPS

The subsurface lithology, soil/groundwater contamination, and preferential pathway for plume migration have been investigated by AARS (2001, 2002b, 2005) and ERS (2008a). The available site characterization results are summarized in a preliminary SCM presented in Section 8. Since the objectives of site characterization are to determine the lateral and vertical extent of soil and groundwater contamination and to collect sufficient data to assist in the site cleanup measures, the preliminary SCM has been employed to identify the site and the groundwater plume data gaps.

Based on the preliminary SCM presented in Section 8, data gaps have been identified in the following areas:

- Local Lithology and Hydrogeology – soil characteristics and groundwater flow in the deeper water-bearing zone below 30 feet bgs, lithology under the properties at 6601, 6619/6625, and 6620 Foothill Boulevard; and permeability of the shallow water-bearing zone

- Contaminated Soil and Plume – contaminant concentration level/plume boundary north, east, southwest, and south of the subject site; bottom of the plume in the off-site area

- Potential of Monitored Natural Attenuation (MNA) – water quality parameters and the presence of petroleum hydrocarbons and MTBE degrader

An investigation work plan for the above data gaps is included in Sections 10, 11, and 12.

10. DATA GAP INVESTIGATION WORK PLAN

The data gap investigation will focus on the collection and assembly of the following categories of data:

Local Lithology and Hydrogeology

To determine the soil characteristics and groundwater flow in the deeper water-bearing zone, and to characterize the lithology under the properties at 6601, 6619, and 6620 Foothill Boulevard, two shallow monitoring wells and four well pairs used to monitor the shallow and deeper water-bearing zones will be installed. All the proposed well locations are shown in Figure 21. The rationale and well construction data of the proposed new wells are included in Table 5. Bore holes for monitoring wells will be continuously logged from the ground surface to the bottom of the well. In addition, in order to evaluate the permeability of the shallow water-bearing zone, a 72-hour pumping test will be conducted by pumping monitoring well MW-2 after all the proposed new wells are installed and developed. Groundwater elevation in the shallow and deep water-bearing zone will be observed from monitoring wells MW-1, MW-3, MW-4, MW-5, MW-6, and a number of new shallow and deep wells during the 72-hour pumping.

Contaminated Soil and Plume

Contaminant concentration level and plume boundary in the northern, eastern, southwestern, and southern direction, as well as the bottom of the plume in the off-site area, will be monitored using the proposed new wells included in Table 5. Those new wells will be included in the current quarterly groundwater monitoring program.

Potential of Monitored Natural Attenuation (MNA)

The following water quality parameters will be measured in the field or analyzed in the fixed laboratories to evaluate the existence and potential of natural biodegration:

- Dissolved oxygen (DO)
- Oxidation and reduction potential (ORP)
- pH and conductivity
- Alkalinity
- Total organic carbon (TOC) and Total inorganic carbon (TIC)
- Total dissolved solids (TDS)
- Nitrate
- Total iron and ferric ions (Fe^{+3})

- Sulfate
- Orthophosphate and ammonia nitrogen
- Biological oxygen demand (BOD_5)
- Chemical oxygen demand (COD)
- Soil oxygen demand (SOD)

The above water quality parameters will be measured and/or sampled from existing/proposed wells MW-1, MW-2, MW-4, MW-5, MW-6, MW-7, MW-8A, MW-9A, MW-11A, and MW-12A. Total heterotrophic plate count and the concentrations of the petroleum hydrocarbons and MTBE degraders in soil sampled from the boreholes of MW-9A, MW-11A, and MW-12A will be estimated as well. The collected soil samples will be cultivated and microbial mass will be counted in the biological laboratory. The above parameters will constitute a line of evidence for the existence or potential of natural biodegradation of petroleum hydrocarbons and MTBE in the subsurface under and in the vicinity of the subject site.

The data collected from the data gap investigation will be used to update the preliminary SCM presented in this document and to assist in the design of cost-effective site cleanup measures.

11. SCOPE OF WORK

Specifically, the data gap investigation includes the following tasks:

Task 1 – Permit Application

Off-site access permit will be obtained from the property owners of 6601 Foothill Boulevard for wells MW-8A and MW-8B, of 6619/6625 Foothill Boulevard for wells MW-9A and MW-9B, of 6620 Foothill Boulevard for wells MW-12A and MW-12B, and from the owner of 6615 Brann Street for wells MW-11A and MW-11B. An encroachment permit will be obtained from the City of Oakland Public Works Department for well MW-7.

Groundwater pumped from the 72-hour pumping test at well MW-2 will be temporarily stored in above ground storage tanks and treated by carbon filtration. The laboratory analysis data of the treated water will be submitted to the oversight regulatory agency prior to discharge to the storm drain or the sanitary sewer. The temporary groundwater discharge permit will be obtained from the San Francisco Bay Regional Water Quality Control Board (storm drain) or the City of Oakland Public Works Department (sanitary sewer).

Task 2 – Soil Boring and Sampling

Prior to soil boring/well installation, each well location will be marked and cleared by Underground Service Alert (USA). Further clearance will be performed by hand augering to 5 feet bgs. A Hollow Stem Auger rig and/or limited access rig will be used to drill the boreholes for soil sampling.

Continuous soil coring will be conducted at every 5-foot interval. Both soil cores and soil samples will be collected continuously during drilling using a 2-foot California-modified split-spoon sampler within every 5-ft interval. Blow counts will be recorded by driving the sampler 18 to 24 inches past the lead auger by falling a 140-pound hammer a minimum of 30 inches. Boring logs will be generated in accordance with the Unified Soil Classification System (USCS). Soil cores will be screened using a photon ionization detector (PID). Soil samples will be collected at the intervals where lithologic changes are observed and where an elevated PID reading is recorded, as well as in the interval where capillary fringe is encountered. Selected soil samples in the liners will be collected using EPA Method 5035. A minimum of one soil sample from each boring will be analyzed. All the soil samples will be labeled, packed in a chilled cooler, and documented with a Chain-of-Custody prior to delivering to a California certified laboratory for chemical analysis. The sampling collection and handling method is included in Appendix C.

Soil cuttings will be contained in 55-gallon D.O.T.-approved drums on site. Waste soil is sampled to chemically profile it for disposal, and hauled by a licensed waste hauler to an appropriate landfill. All waste stored on site is properly labeled at the time of production.

Task 3 – Well Installation, Well Development, Well Survey, and Groundwater Sampling

A 10-foot or 15-foot long well screen with 0.01-inch slot sizes attached to the bottom of a 2-inch or a 1.5-inch diameter Schedule 40 PVC blank casing will be installed within the 8-inch borehole. Graded sand filter pack will be filled within the annular space and extended one to two feet above the screen. A minimum two-foot seal of bentonite is placed above the sand pack. Neat cement or a cement/bentonite grout mixture seals the remaining annular space to the surface. A watertight locking cap and protective traffic-rated vault box is installed on top of each wellhead. The proposed depth of boreholes and screen intervals are included in Table 5.

All newly installed monitoring wells will be developed to remove fine-grained sediments from the well and to stabilize the filter pack and the disturbed aquifer materials prior to quarterly groundwater sampling. Development takes place at least 48 hours after setting the seal on the well, unless otherwise directed by the oversight agency. Well development will be conducted by surging with a surge block and removing water from the well with a pump until the well is free of sediment, or until at least 10 well casing volumes of groundwater have been removed. All development equipment is cleaned prior to use and between wells with a non-phosphate cleaning solution, then rinsed in potable water. All data collected during development are recorded on the Well Development Data Sheet and, if necessary, the Purging Data Sheet.

Both the wellhead elevation and well coordinates for all new wells will be surveyed according to the GeoTracker standard by a registered surveyor prior to be included in the quarterly groundwater monitoring program. Groundwater will be sampled following the Standard Operating Procedures for Groundwater Monitoring and Sampling included in Appendix D.

Task 4 – Soil and Groundwater Sample Analysis

All collected soil and groundwater samples were analyzed by Kiff Analytical - a California-certified analytical laboratory located in Davis, California - for total petroleum hydrocarbons as gasoline (TPH-g) using EPA Method 8015M; benzene, toluene, ethylbenzene, total xylenes (BTEX), and methyl tertiary butyl ether (MTBE) using EPA Method 8260B.

Task 5 – Pumping Test

The purpose of the pumping test is to evaluate the response of groundwater in the shallow and deep water-bearing zones by creating a stress in the shallow groundwater. The data of observed groundwater response in different directions and elevations will be analyzed and interpreted to estimate the following critical characteristics that influence the migration and natural attenuation of the groundwater plume, in addition to the potential of MNA:

- Permeability and heterogeneity of the shallow water-bearing zone media;

- Existence of low hydraulic resistance “conduits” delineated in subsurface cross-sections A-A’ through H-H’; and

- Hydraulic connection between the shallow and deep water-bearing zones.

A 72-hour pumping test is proposed for this purpose. All the details including required equipment, use of observation wells, flow control, groundwater observation method including data observation frequency and schedule, anticipated data quality, data analysis methods, and handling of pumped and treated water will be presented in a separate work plan. A step-test will be needed to identify the sustainable pumping rate for the test, especially since the soil under the subject site is generally clayey and silty.

Task 6 – Health and Safety Plan (completed)

As required by the Occupational Health and Safety Administration (OSHA) 29 CFR 1910.120, Hazardous Waste Operation and Emergency Responses, a site Health and Safety Plan (H&SP) has been prepared for use while conducting proposed field drilling, sampling, well installation, and testing activities. The H&SP has been read and approved by the ERS Project Manager and a Quality Assurance Reviewer. It will be read and approved by the On-site Safety Officer of all subcontractors working at the subject property. The site-specific H&SP is included in Appendix E.

Task 7 - Reporting

A technical report will be submitted to Mr. Ravi Sekhon and ACEH within eight weeks following receipt of all analytical data. Boring logs will be generated. Chemical data for the groundwater and soil samples will be evaluated and interpreted relative to the purpose and objectives of this Data Gap Investigation Work Plan. Analytical data will be summarized, tabulated and, as appropriate, presented graphically to assess the lateral and vertical extent of off-site soil and groundwater contamination and the nature and potential of MNA. The report will generate findings regarding the assessment of soil and groundwater, as well as propose recommendations and conclusions for future remediation activities and/or additional investigation, if needed. An updated SCM also will be included in the same technical report.

12. SCHEDULE OF PROPOSED ACTIVITIES

Prior to the approval of this data gap investigation work plan, the schedule for the completion of Tasks 1 through 5 and Task 7 is proposed below:

Tasks	Scope of Work	Time Duration
N/A	Approval of the data gap investigation work plan and the pumping test work plan	30 - 60 days
1	Permit application(including obtaining off-site access permits from property owners)	20 days
2	Soil boring and sampling	5 days
3	Well installation, well development, well survey, and groundwater sampling	10 days
4	Soil and groundwater samples analysis	7 days
5	Pumping test (including work plan preparation and data analysis)	12 days
7	Reporting	20 days
Total Duration	**(Not include regulatory approval of the work plans)**	**74 days**

This schedule will be revised pending the time of receiving the off-site access permits from the property owners and the other permits required from the regulatory agencies. All fieldwork will be coordinated with ACEH and inspectors of the permits before it starts.

13. REFERENCES

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14. DOCUMENT DISTRIBUTION LIST

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TABLES

Table 1. Local Groundwater Depths, Directions and Gradients

Date	Groundwater Depth (feet bgs)						Average On-site Groundwater Depth (feet bgs)	Average Off-site Groundwater Depth (feet bgs)	Difference of On-Site and Off-Site Depths (feet)	Local Groundwater Direction	Local Groundwater Gradient (ft/ft)
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6					
6/13/2001	9.36	10.44	9.69	NA	NA	NA	9.83	no off-site well	NA	SE	0.05
3/21/2002	7.96	8.18	8.80	NA	NA	NA	8.31	no off-site well	NA	SE	0.024
7/9/2002	8.51	8.35	9.33	8.14	8.16	7.45	8.73	7.92	0.81	SE	0.014
7/11/2003	8.66	7.58	9.35	6.73	7.94	7.98	8.53	7.55	0.98	SE	0.012
11/13/2003	8.10	8.01	8.85	6.54	7.41	7.47	8.32	7.14	1.18	SE	0.012
2/19/2004	8.24	6.43	8.46	4.37	6.14	5.09	7.71	5.20	2.51	NW - SW	0.008
5/21/2004	8.51	6.83	9.09	5.79	7.42	6.38	8.14	6.53	1.61	NW - SW	0.019
8/11/2005	8.34	7.31	8.87	6.65	7.67	6.68	8.17	7.00	1.17	SW	0.008
11/30/2005	9.86	7.98	9.73	6.05	8.51	7.43	9.19	7.33	1.86	NW - SW	0.018
8/8/2008	10.62	7.19	9.64	5.91	7.59	6.23	9.15	6.58	2.57	NWN - SW	0.017-0.031

TABLE 2

Cumulative Groundwater Elevation and Analytical Data

6600 Foothill Blvd, Oakland, California

Monitoring Wells	Total Depth Drilled (ft bgs)	Date Sampled	Top of Casing Elevation (ft, above msl)	Depth to Water (ft, below TOC)	Water Elevation (ft, above msl)(1)	Groundwater Flow Direction	GW Gradient (ft/ft)	TPH-g (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Xylenes (ug/L)	MTBE (ug/L)	TBA (ug/L)	ETBE, DIPE, TAME, METH, ETH (ug/L)	1,2-DCA (ug/L)	1,2-EDB (ug/L)
Analysis Methods								EPA 8015M	EPA 8021B/EPA 8260B(2)					EPA 8260B			
Maximum Contaminant Level^								NA	5	1,000	700	10,000	5	12 (Ca.)	NA	5	0.05
MW-1	25	6/13/2001	100.00*	9.36	90.64	SE	0.05	ND	ND	ND	ND	ND	130	NA	--	--	--
		3/21/2002	100.00*	7.96	92.04	SE	0.024	95	ND	ND	ND	ND	72.5	NA	--	--	--
		7/9/2002	100.00*	8.51	91.49	SE	0.014	ND	ND	ND	ND	ND	208	NA	--	--	--
		7/11/2003	160.25	8.66	151.59	SE	0.012	ND	0.7	ND	ND	1.2	636	NA	--	--	--
		11/13/2003	160.25	8.10	152.15	SE	0.012	ND<5000#	ND	ND	ND	ND	72,000	22,000	--	--	--
		2/19/2004	160.25	8.24	152.01	NW - SW	0.008	1,350	460	ND	ND	ND	82,000	8,630	--	--	--
		5/21/2004	160.25	8.51	151.74	NW - SW	0.019	ND	ND<50	ND<50	ND<50	ND<100	12,000	ND<1000	--	--	--
		8/11/2005	160.25	8.34	151.91	SW	0.008	ND	ND	ND	ND	ND	4,900	NA	--	--	--
		11/30/2005	160.25	9.86	150.39	NW - SW	0.018	ND<250	ND<2.5	ND<2.5	ND<2.5	ND<2.5	8,400	NA	--	--	--
		8/8/2008	60.02	10.62	49.40	NWN - SW	0.017-0.031	390	<1.5	<1.5	<1.5	<1.5	720	7.4J	<1.5, Meth<300, Eth<15	<1.5	<1.5
MW-2	25	6/13/2001	98.71*	10.44	88.27	SE	0.05	5,800	160	210	290	980	94,000	980	--	--	--
		3/21/2002	98.71*	8.18	90.53	SE	0.024	452	3.4	ND	1.6	2.1	79,100	NA	--	--	--
		7/9/2002	98.71*	8.35	90.36	SE	0.014	497	61.6	ND	ND	1.6	37,600	NA	--	--	--
		7/11/2003	158.97	7.58	151.39	SE	0.012	553	48.9	ND	ND	ND	38,200	NA	--	--	--
		11/13/2003	158.97	8.01	150.96	SE	0.012	ND<2500#	NS	ND	ND	ND	47,000	11,000	--	--	--
		2/19/2004	158.97	6.43	152.54	NW - SW	0.008	4,390	410	265	160	490	26,700	3,930	--	--	--
		5/21/2004	158.97	6.83	152.14	NW - SW	0.019	1,150	254	ND<200	ND<200	ND<400	24,600	ND<4000	--	--	--
		8/11/2005	158.97	7.31	151.66	SW	0.008	91	ND	1.1	ND	ND	6,500	NA	--	--	--
		11/30/2005	158.97	7.98	150.99	NW - SW	0.018	69	ND	1.4	ND	ND	2,300	NA	--	--	--
		8/8/2008	58.74	7.19	51.55	NWN - SW	0.017-0.031	300	<9.0	<9.0	<9.0	<9.0	9.8	17,000	<9.0, Meth<900, Eth<90	<9.0	<9.0
MW-3	25	6/13/2001	99.9*	9.69	90.21	SE	0.05	300	1	ND	0.07	2	450	NA	--	--	--
		3/21/2002	99.9*	8.80	91.10	SE	0.024	274	1.1	ND	1	2.5	7,520	NA	--	--	--
		7/9/2002	99.9*	9.33	90.57	SE	0.014	ND	ND	ND	ND	ND	40.8	NA	--	--	--
		7/11/2003	160.17	9.35	150.82	SE	0.012	ND	ND	ND	ND	ND	24.3	NA	--	--	--
		11/13/2003	160.17	8.85	151.32	SE	0.012	ND	ND	ND	ND	ND	37	27	--	--	--
		2/19/2004	160.17	8.46	151.71	NW - SW	0.008	83	ND	ND	ND	ND	42.7	508	--	--	--
		5/21/2004	160.17	9.09	151.08	NW - SW	0.019	ND	ND	ND	ND	ND	54	1100	--	--	--
		8/11/2005	160.17	8.87	151.30	SW	0.008	ND	ND	ND	ND	ND	27	NA	--	--	--
		11/30/2005	160.17	9.73	150.44	NW - SW	0.018	ND	ND	ND	ND	ND	28	NA	--	--	--
		8/8/2008	59.94	9.64	50.30	NWN - SW	0.017-0.031	99	<0.50	<0.50	<0.50	<0.50	4.5	130	<0.50, Meth<80, Eth<5.0	<0.50	<0.50

TABLE 2

Cumulative Groundwater Elevation and Analytical Data

6600 Foothill Blvd, Oakland, California

Monitoring Wells	Total Depth Drilled (ft bgs)	Date Sampled	Top of Casing Elevation (ft, above msl)	Depth to Water (ft, below TOC)	Water Elevation (ft, above msl)[1]	Groundwater Flow Direction	GW Gradient (ft/ft)	TPH-g (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Xylenes (ug/L)	MTBE (ug/L)	TBA (ug/L)	ETBE, DIPE, TAME, METH, ETH (ug/L)	1,2-DCA (ug/L)	1,2-EDB (ug/L)
Analysis Methods								EPA 8015M	EPA 8021B/EPA 8260B[2]					EPA 8260B			
Maximum Contaminant Level^								NA	5	1,000	700	10,000	5	12 (Ca.)	NA	5	0.05
MW-4	20	7/9/2002	98.19*	8.14	90.05	SE	0.014	9,680	43	17	369	1990	28,300	NA	--	--	--
		7/11/2003	158.42	6.73	151.69	SE	0.012	3,170	16.5	6.4	71.7	240	16,600	NA	--	--	--
		11/13/2003	158.42	6.54	151.88	SE	0.012	ND<1000#	49	ND	340	900	16,000	4,500	--	--	--
		2/19/2004	158.42	4.37	154.05	NW - SW	0.008	7,230	107	7	497	1063	14,300	1,400	--	--	--
		5/21/2004	158.42	5.79	152.63	NW - SW	0.019	9,340	194	ND	309	860	7,380	ND<2000	--	--	--
		8/11/2005	158.42	6.65	151.77	SW	0.008	3,000	15	24	87	190	1,200	NA	--	--	--
		11/30/2005	158.42	6.05	152.37	NW - SW	0.018	4,300	18	28	84	130	340	NA	--	--	--
		8/8/2008	58.19	5.91	52.28	NWN - SW	0.017-0.031	3,600	0.53	0.61	5.6	1.5	24	1,800	<0.50, Meth<80, Eth<5.0	<0.50	<0.50
MW-5	20	7/9/2002	97.81*	8.16	89.65	SE	0.014	275	30.2	ND	ND	3	18,600	NA	--	--	--
		7/11/2003	158.03	7.94	150.09	SE	0.012	890	10	0.6	ND	7.1	5,090	NA	--	--	--
		11/13/2003	158.03	7.41	150.62	SE	0.012	ND<1000#	ND	ND	ND	ND	3,400	3,100	--	--	--
		2/19/2004	158.03	6.14	151.89	NW - SW	0.008	1,310	ND	0.7	ND	2.2	438	1,330	--	--	--
		5/21/2004	158.03	7.42	150.61	NW - SW	0.019	1,960	9.7	0.7	ND	ND	214	436	--	--	--
		8/11/2005	158.03	7.67	150.36	SW	0.008	410**	ND	3.3	ND	ND	100	NA	--	--	--
		11/30/2005	158.03	8.51	149.52	NW - SW	0.018	240**	ND	1.8	ND	1.4	82	NA	--	--	--
		8/8/2008	57.80	7.59	50.21	NWN - SW	0.017-0.031	1,900	<0.50	<0.50	<0.50	4.0	8.6	510	<0.50, Meth<50, Eth<5.0	<0.50	<0.50
MW-6	20	7/9/2002	97*	7.45	89.55	SE	0.014	12,000	432	22	637	1740	11,300	NA	--	--	--
		7/11/2003	157.24	7.98	149.26	SE	0.012	2,970	534	6.3	70.1	278	18,000	NA	--	--	--
		11/13/2003	157.24	7.47	149.77	SE	0.012	ND<2500#	300	ND	ND	52	18,000	ND	--	--	--
		2/19/2004	157.24	5.09	152.15	NW - SW	0.008	5,340	184	5	65	127	5,310	4,260	--	--	--
		5/21/2004	157.24	6.38	150.86	NW - SW	0.019	6,110	340	12.7	205	308.8	3,900	4,060	--	--	--
		8/11/2005	157.24	6.68	150.56	SW	0.008	6,100	470	48	23	30	3,200	NA	--	--	--
		11/30/2005	157.24	7.43	149.81	NW - SW	0.018	3,700	310	30	16	12	3,400	NA	--	--	--
		8/8/2008	57.01	6.23	50.78	NWN - SW	0.017-0.031	6,500	63	2.0	42	98	230	810	<0.50, TAME<0.66, Meth<200, Eth<8.0	<0.50	<0.50

TABLE 2

Cumulative Groundwater Elevation and Analytical Data

6600 Foothill Blvd, Oakland, California

Monitoring Wells	Total Depth Drilled (ft bgs)	Date Sampled	Top of Casing Elevation (ft, above msl)	Depth to Water (ft, below TOC)	Water Elevation (ft, above msl)[1]	Groundwater Flow Direction	GW Gradient (ft/ft)	TPH-g (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Xylenes (ug/L)	MTBE (ug/L)	TBA (ug/L)	ETBE, DIPE, TAME, METH, ETH (ug/L)	1,2-DCA (ug/L)	1,2-EDB (ug/L)
Analysis Methods								**EPA 8015M**	**EPA 8021B/EPA 8260B[2]**					**EPA 8260B**			
Maximum Contaminant Level^								NA	5	1,000	700	10,000	5	12 (Ca.)	NA	5	0.05
SB-1/GW	20	6/27/2002	--	--	--	--		554	1	0.8	11.6	76.2	74.1	NA	--	--	--
SB-2/GW	20	6/27/2002	--	--	--	--		3000	95.6	10.2	394	831	485*	NA	--	--	--
SB-3/GW	20	8/11/2005	--	--	--	--		ND	ND	ND	ND	ND	32	NA	--	--	--
SB-4/GW	20	8/11/2005	--	--	--	--		160**	ND	ND	ND	ND	180	NA	--	--	--
SB-5/GW	17	8/10/2005	--	--	--	--		13000**	ND<5.0	260	ND<5.0	ND<5.0	ND<50	NA	--	--	--
SB-6/GW	17	8/10/2005	--	--	--	--		ND	ND	ND	ND	ND	ND	NA	--	--	--
SB-7/GW	30	8/11/2005	--	--	--	--		2900	19	ND<10	160	ND	23000	NA	--	--	--
SB-8/GW	28	8/11/2005	--	--	--	--		9300	230	10	460	1500	11000	NA	--	--	--
SB-10/GW	17	8/10/2005	--	--	--	--		ND	ND	ND	ND	ND	16	NA	--	--	--
SB-11/GW	17	8/10/2005	--	--	--	--		ND	ND	ND	ND	ND	13	NA	--	--	--
SB-12/GW	17	8/10/2005	--	--	--	--		ND	ND	ND	ND	ND	ND	NA	--	--	--

Notes:

TPH-g	total petroleum hydrocarbons as gasoline
MTBE	Methyl Tertiary Butyl Ether
TBA	Tertiary Butyl Alcohol
ETBE	Ethyl-tetra-butyl ether
DIPE	Diisopropyl ether
TAME	Tertiary-amyl methyl ether
METH	Methanol
ETH	Ethanol
1,2-DCA	1,2-Dichloroethane
1,2-EDB	1,2-Dibromoethane
SB	Soil Boring
GW	Grab Ground Water

ND = "non-detect" or below the Method Reporting Limits

NA = Not Available

^ US EPA Drinking Water Standard

* The top of casing (TOC) elevations originally surveyed on June 13, 2001 used MW-1 as the common datum with an assumed elevation of 100.00 feet above mean sea level (MSL). All other TOC elevations were surveyed relative to MW-1. All the wells were again surveyed per GeoTracker standard on July 11, 2003, by PLS Surveys, Inc., a California licensed surveyor. All elevations are reported with respect to feet above mean sea leval (MSL).

+ Confirmed by GC/MS method 8260B

** Laboratory reported does not match gasoline pattern

See Laboratory explanations (dated November 26 & December 8, 2003)

[1] The TOC elevations reported in all previous groundwater monitoring reports are incorrect. The datum elevation adopted previously was revised on August 4, 2008 using City of Oakland datum (NAD83). The revised TOC elevations are converted to mean sea level elevation and used to calculate all the groundwater elevations.

[2] EPA 8260B adopted since 8/8/2008

ug/L - microgram per litter (part per billion)

Table 3

WELL CONSTRUCTION DATA

6600 Foothill Boulevard
Oakland, California

Well I.D.	Date installed	Casing diameter (inches)	Borehole diameter (inches)	Total depth (feet)	Screened Interval (feet bgs)	Sand Interval (feet bgs)	Bentonite Seal (feet bgs)	Cement (feet bgs)	Slot Size (inches)	Sand Size
MW-1	6/4/2001	2	8	25	10 - 25	8 - 25	6 - 8	0 - 6	0.01	Lonestar #2
MW-2	6/4/2001	2	8	25	10 - 25	8 - 25	6 - 8	0 - 6	0.01	Lonestar #2
MW-3	6/4/2001	2	8	25	10 - 25	8 - 25	6 - 8	0 - 6	0.01	Lonestar #2
MW-4	6/26/2002	2	8	20	7.5 - 20	6 - 20	5 - 6	0 - 5	0.01	Lonestar #2
MW-5	6/26/2002	2	8	20	7.5 - 20	6 - 20	5 - 6	0 - 5	0.01	Lonestar #2
MW-6	6/26/2002	2	8	20	7.5 - 20	6 - 20	5 - 6	0 - 5	0.01	Lonestar #2

TABLE 4. Evaluation of Contaminant Depletion Trend

Monitoring Wells	Date Sampled	TPH-g (ug/L)	Benzene (ug/L)	MTBE (ug/L)	Total Score
MW-1	6/13/2001	ND	ND	130	
	3/21/2002	95	ND	72.5	
	7/9/2002	ND	ND	208	
	7/11/2003	ND	0.7	636	
	11/13/2003	ND<5000#	ND	72,000	
	2/19/2004	1,350	460	82,000	
	5/21/2004	ND	ND<50	12,000	
	8/11/2005	ND	ND	4,900	
	11/30/2005	ND<250	ND<2.5	8,400	
	8/8/2008	390	<1.5	720	
sub-score		-1	0	-1	-2
MW-2	6/13/2001	5,800	160	94,000	
	3/21/2002	452	3.4	79,100	
	7/9/2002	497	61.6	37,600	
	7/11/2003	553	48.9	38,200	
	11/13/2003	ND<2500#	NS	47,000	
	2/19/2004	4,390	410	26,700	
	5/21/2004	1,150	254	24,600	
	8/11/2005	91	ND	6,500	
	11/30/2005	69	ND	2,300	
	8/8/2008	300	<9.0	9.8	
sub-score		1	2	5	8
MW-3	6/13/2001	300	1	450	
	3/21/2002	274	1.1	7,520	
	7/9/2002	ND	ND	40.8	
	7/11/2003	ND	ND	24.3	
	11/13/2003	ND	ND	37	
	2/19/2004	83	ND	42.7	
	5/21/2004	ND	ND	54	
	8/11/2005	ND	ND	27	
	11/30/2005	ND	ND	28	
	8/8/2008	99	<0.50	4.5	
sub-score		1	0	-1	0

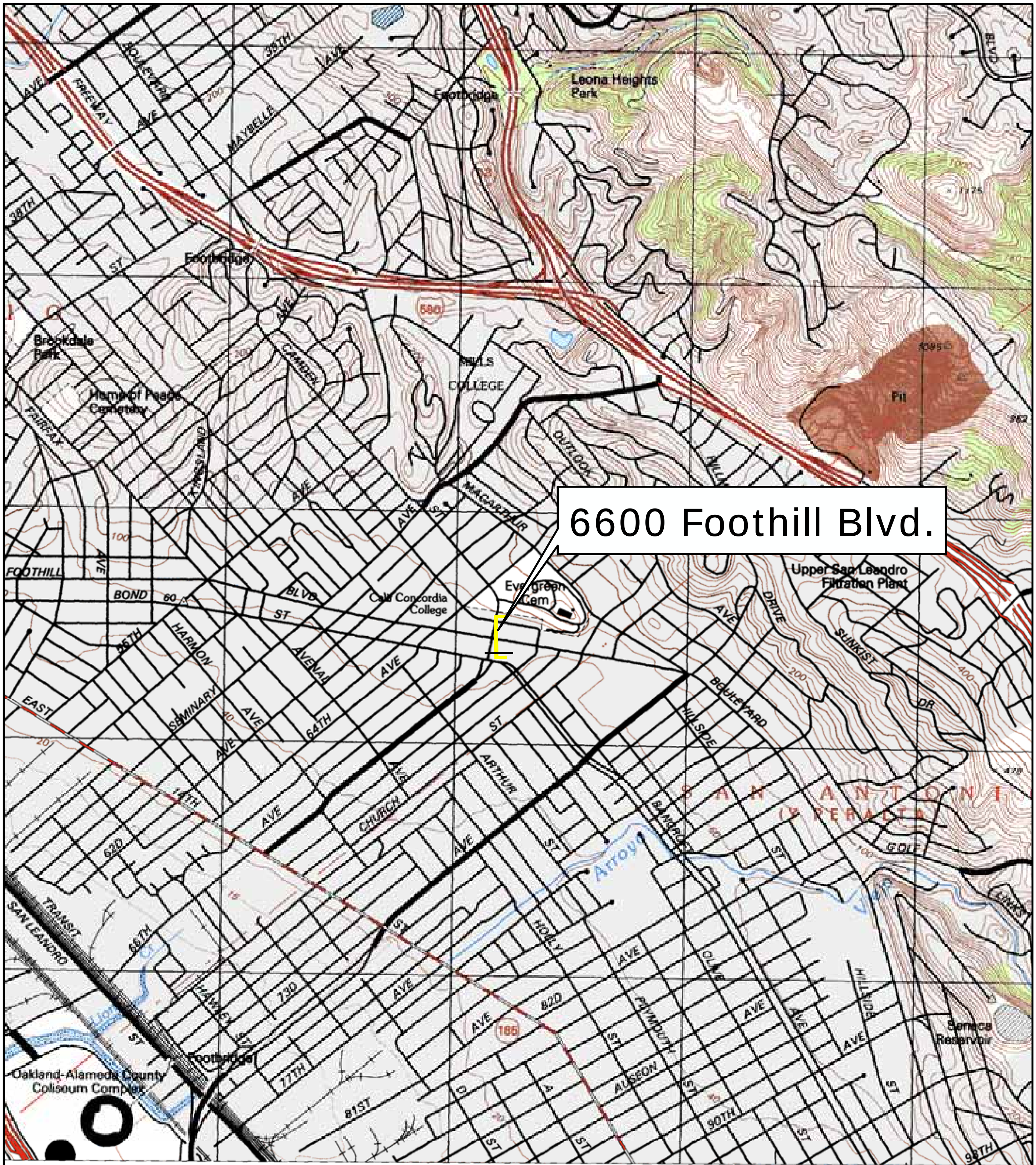
TABLE 4. Evaluation of Contaminant Depletion Trend

Monitoring Wells	Date Sampled	TPH-g (ug/L)	Benzene (ug/L)	MTBE (ug/L)	Total Score
MW-4	7/9/2002	9,680	43	28,300	
	7/11/2003	3,170	16.5	16,600	
	11/13/2003	ND<1000#	49	16,000	
	2/19/2004	7,230	107	14,300	
	5/21/2004	9,340	194	7,380	
	8/11/2005	3,000	15	1,200	
	11/30/2005	4,300	18	340	
	8/8/2008	3,600	0.53	24	
sub-score		1	-1	7	7
MW-5	7/9/2002	275	30.2	18,600	
	7/11/2003	890	10	5,090	
	11/13/2003	ND<1000#	ND	3,400	
	2/19/2004	1,310	ND	438	
	5/21/2004	1,960	9.7	214	
	8/11/2005	410**	ND	100	
	11/30/2005	240**	ND	82	
	8/8/2008	1,900	<0.50	8.6	
sub-score		-1	2	7	8
MW-6	7/9/2002	12,000	432	11,300	
	7/11/2003	2,970	534	18,000	
	11/13/2003	ND<2500#	300	18,000	
	2/19/2004	5,340	184	5,310	
	5/21/2004	6,110	340	3,900	
	8/11/2005	6,100	470	3,200	
	11/30/2005	3,700	310	3,400	
	8/8/2008	6,500	63	230	
sub-score		1	1	2	4

Table 5. Well Construction Data and Rationale for the Proposed New Wells

Well ID	Well Type	Well Depth (feet bgs)	Screen Interval (feet bgs)	Rationale
MW-7	Shallow well	20	10 - 20	• Monitor plume migration and lateral extent in the southwestern direction • Delineate flow direction
MW-8A, MW-8B	Shallow and deep well	25 (A), 50 (B)	10 – 25 (A) 40 - 50 (B)	• Monitor plume migration and boundary under 6601 Foothill Blvd in shallow and deep zone • Delineate flow direction • Delineate lithology in shallow and deep zone
MW-9A, MW-9B	Shallow and deep well	25 (A), 50 (B)	10 – 25 (A) 40 - 50 (B)	• Monitor plume migration and boundary under 6619/6625 Foothill Blvd in shallow and deep zone in the southern direction • Delineate flow direction • Delineate lithology in shallow and deep zone
MW-10	Shallow well	20	10 - 20	• Monitor plume migration and lateral extent in the northern direction • Delineate flow direction
MW-11A, MW-11B	Shallow and deep well (1.5-inch well casing)	25 (A), 50 (B)	10 – 25 (A) 40 - 50 (B)	• Monitor plume migration and boundary in shallow and deep zone in the northern direction • Delineate flow direction • Delineate lithology in shallow and deep zone
MW-12A, MW-12B	Shallow and deep well	25 (A), 50 (B)	10 – 25 (A) 40 - 50 (B)	• Monitor plume migration and boundary under 6620 Foothill Blvd in shallow and deep zone in the eastern direction • Delineate flow direction • Delineate lithology in shallow and deep zone

FIGURES



0 1,000 2,000 Feet

1 inch equals 2,000 feet

Vicinity Map

6600 Foothill Blvd, Oakland, CA

Figure 1

Environmental Risk Services Corporation

LEGEND

MW-3 Monitoring Well

SB-8 Soil Boring (2002 & 2005)

Approximate Property Boundary

* = location approximate

Site Plan

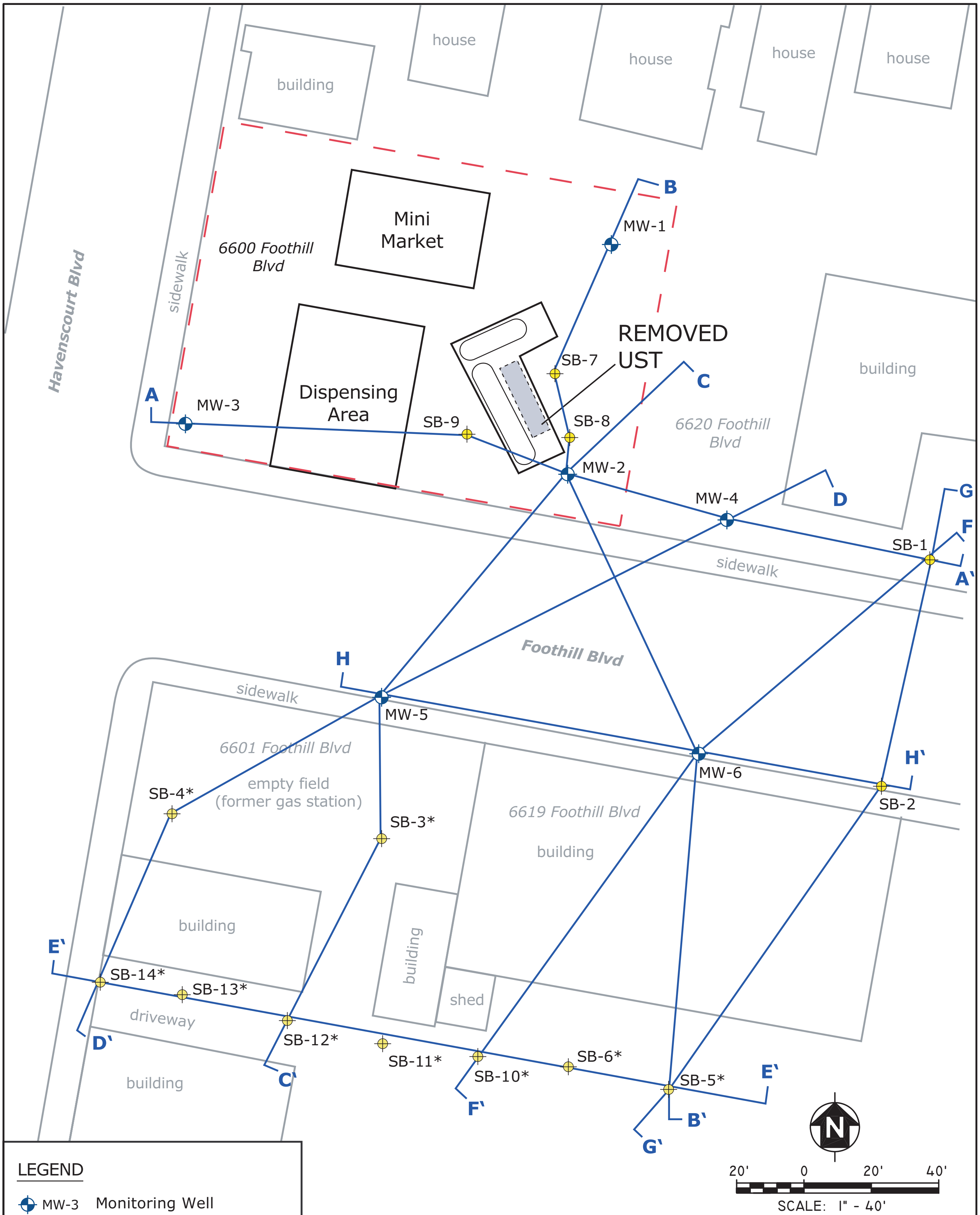
6600 Foothill Blvd, Oakland, CA 94605

Figure

2

ers

Environmental Risk Services Corporation



LEGEND

MW-3 Monitoring Well

SB-8 Soil Boring (2002 & 2005)

Approximate Property Boundary

* = location approximate

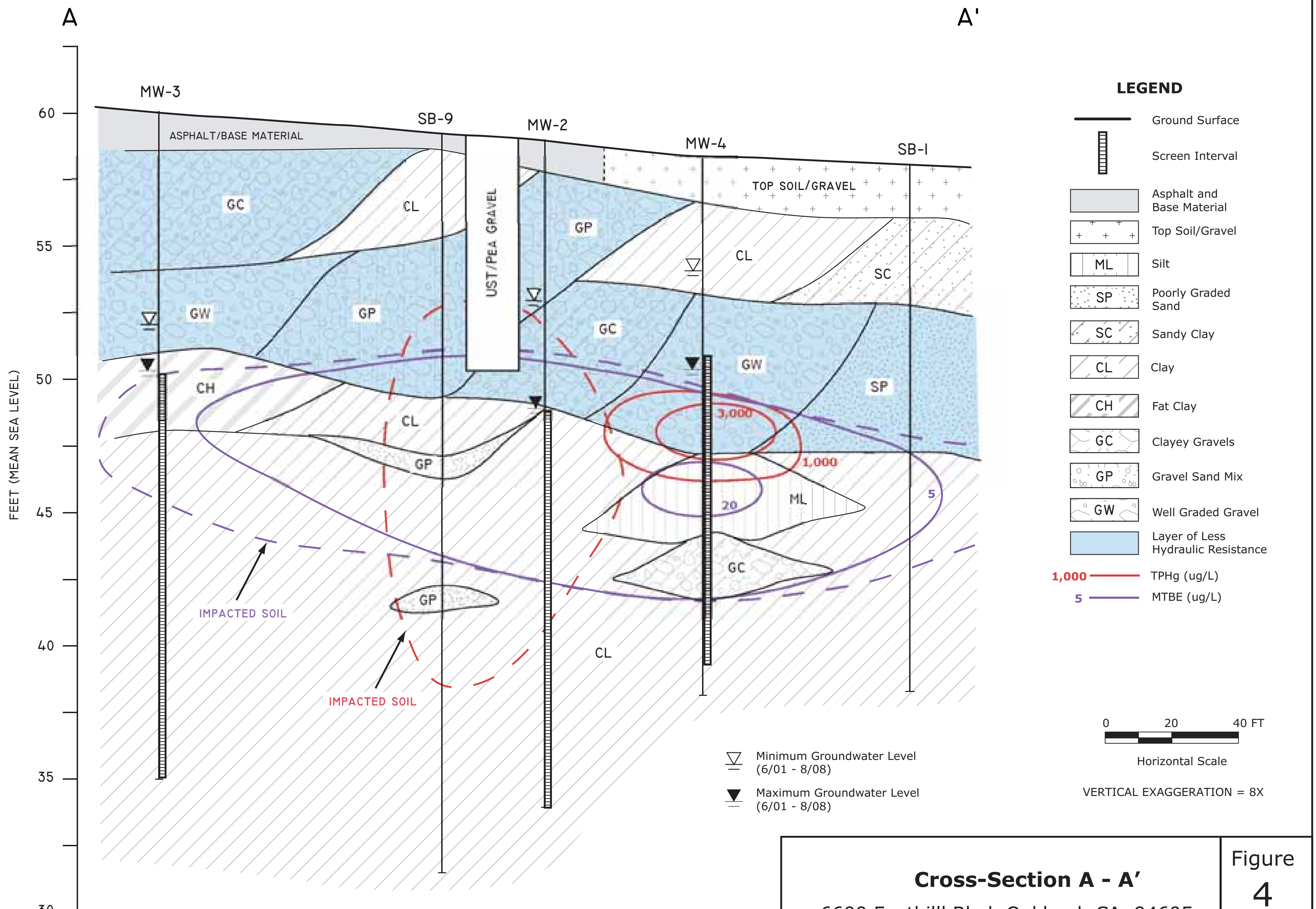
Cross Section Locations

6600 Foothill Blvd, Oakland, CA 94605

Figure 3

ers

Environmental Risk Services Corporation



Note: Soil boring elevations are projected.

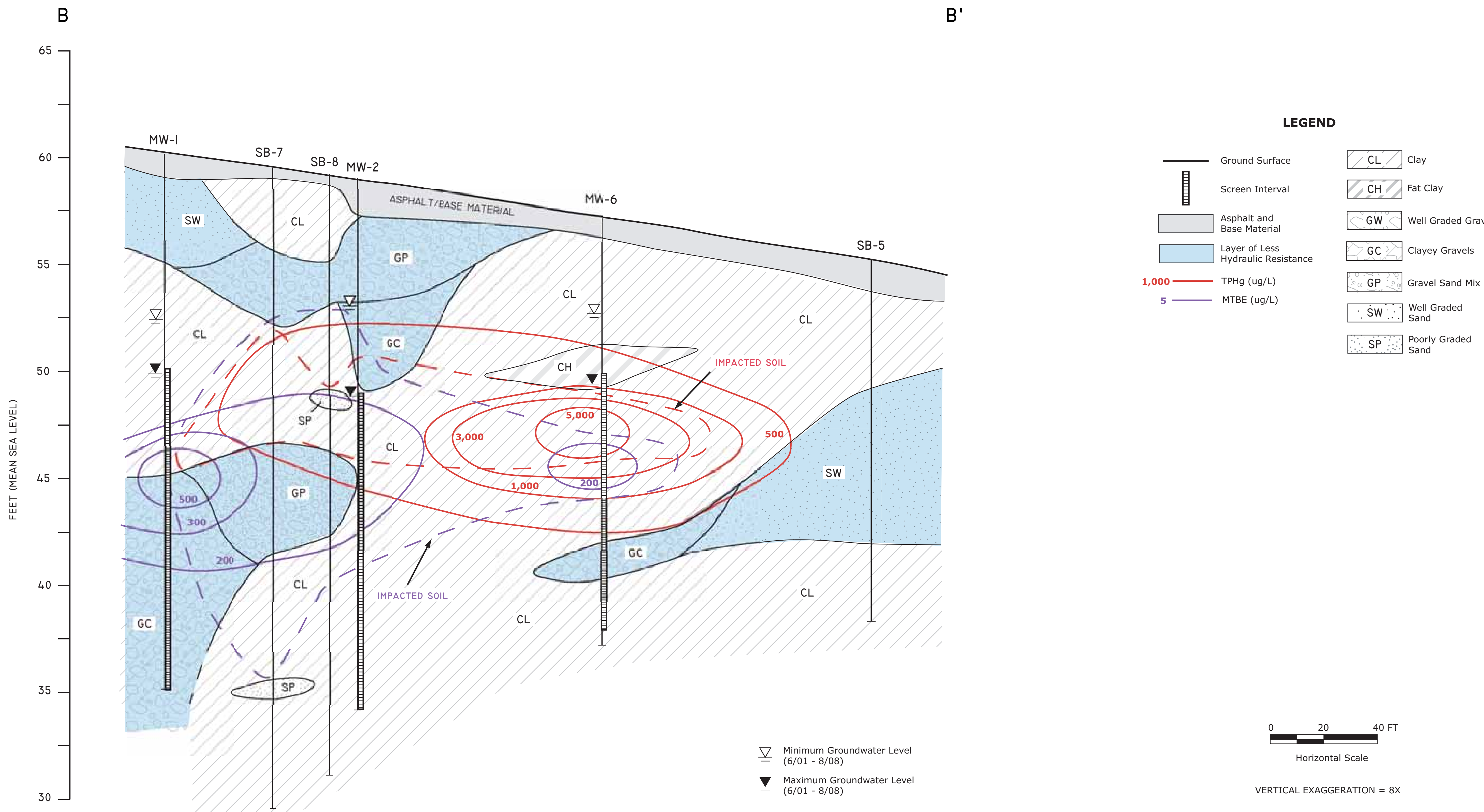
Cross-Section A - A'

6600 Foothilll Blvd, Oakland, CA 94605

Figure 4

ers

Environmental Risk Services Corporation



Note: Soil boring elevations are projected.

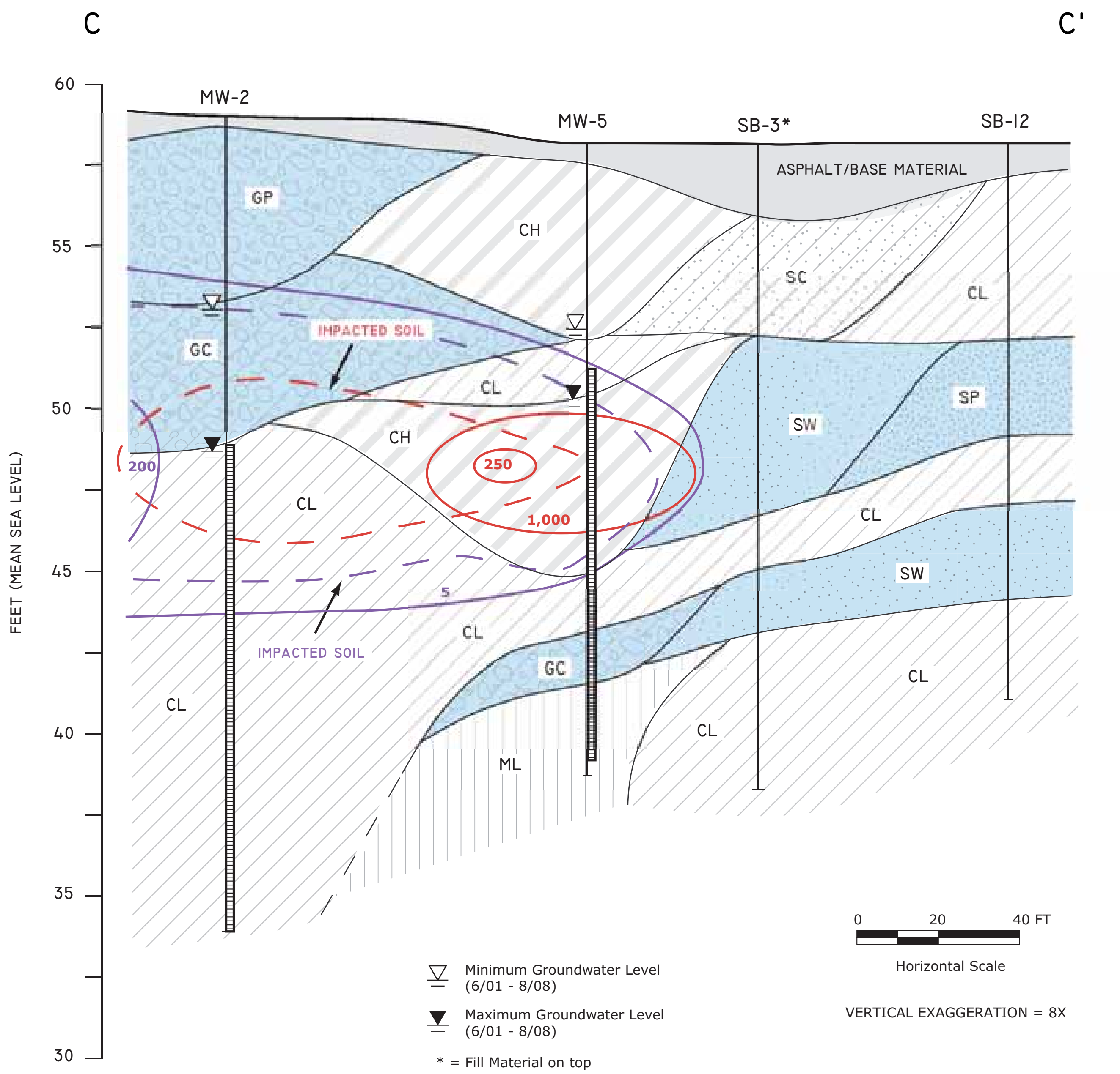
Cross-Section B - B'

6600 Foothilll Blvd, Oakland, CA 94605

Figure 5

ers

Environmental Risk Services Corporation



LEGEND

	Ground Surface	SW	Well Graded Sand
	Screen Interval	SP	Poorly Graded Sand
	Asphalt and Base Material	SC	Sandy Clay
	Layer of Less Hydraulic Resistance	GP	Gravel Sand Mix
ML	Silt	GW	Well Graded Gravel
CL	Clay	GC	Clayey Gravels
CH	Fat Clay	1,000	TPHg (ug/L)
		5	MTBE (ug/L)

Note: Soil boring elevations are projected

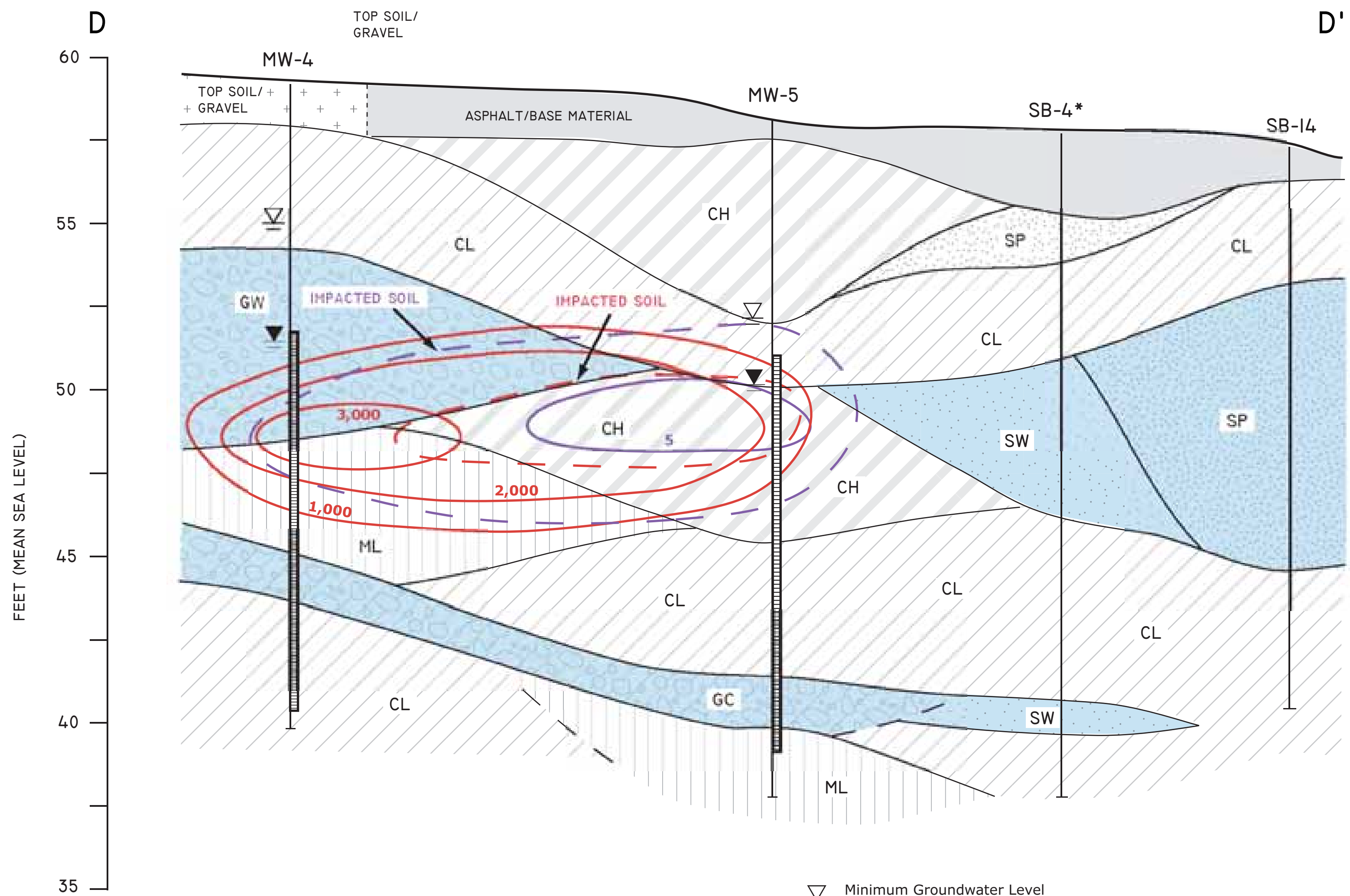
Cross-Section C - C'

6600 Foothilll Blvd, Oakland, CA 94605

Figure 6

ers

Environmental Risk Services Corporation



LEGEND

	Ground Surface	1,000	TPHg (ug/L)	GC	Clayey Gravels
	Screen Interval	5	MTBE (ug/L)	ML	Silt
	Asphalt and Base Material	CL	Clay	SW	Well Graded Sand
	Layer of Less Hydraulic Resistance	CH	Fat Clay	SP	Poorly Graded Sand
		GW	Well Graded Gravel		

Minimum Groundwater Level (6/01 - 8/08)

Maximum Groundwater Level (6/01 - 8/08)

* = Fill Material on top

0 20 40 FT

Horizontal Scale

VERTICAL EXAGGERATION = 8X

Note: Soil boring elevations are projected.

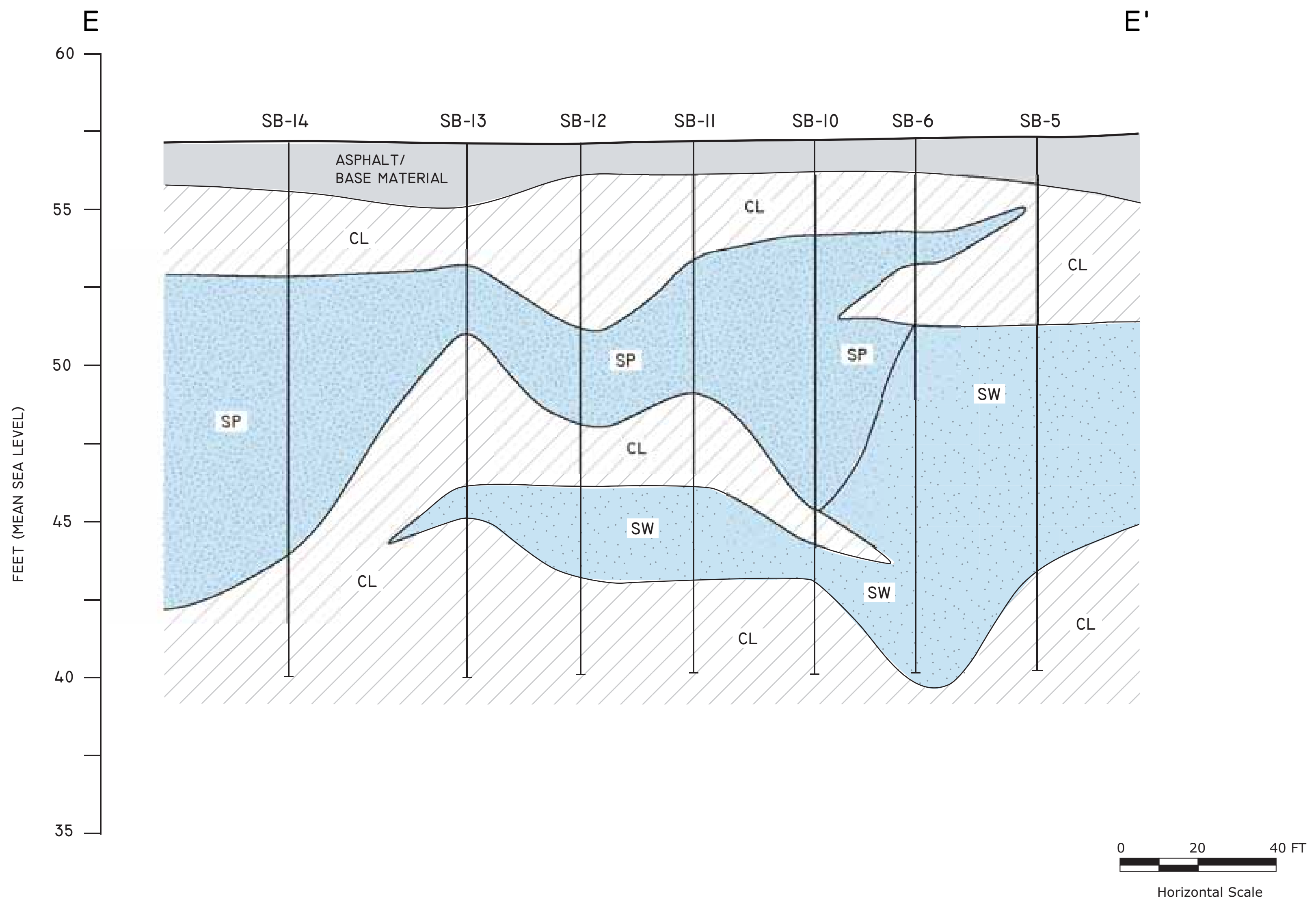
Cross-Section D - D'

6600 Foothilll Blvd, Oakland, CA 94605

Figure 7

ers

Environmental Risk Services Corporation



LEGEND

	Ground Surface	CL	Clay		Layer of Less Hydraulic Resistance
	Screen Interval	SW	Well Graded Sand		
	Asphalt and Base Material	SP	Poorly Graded Sand		

Note: Soil boring elevations are projected.

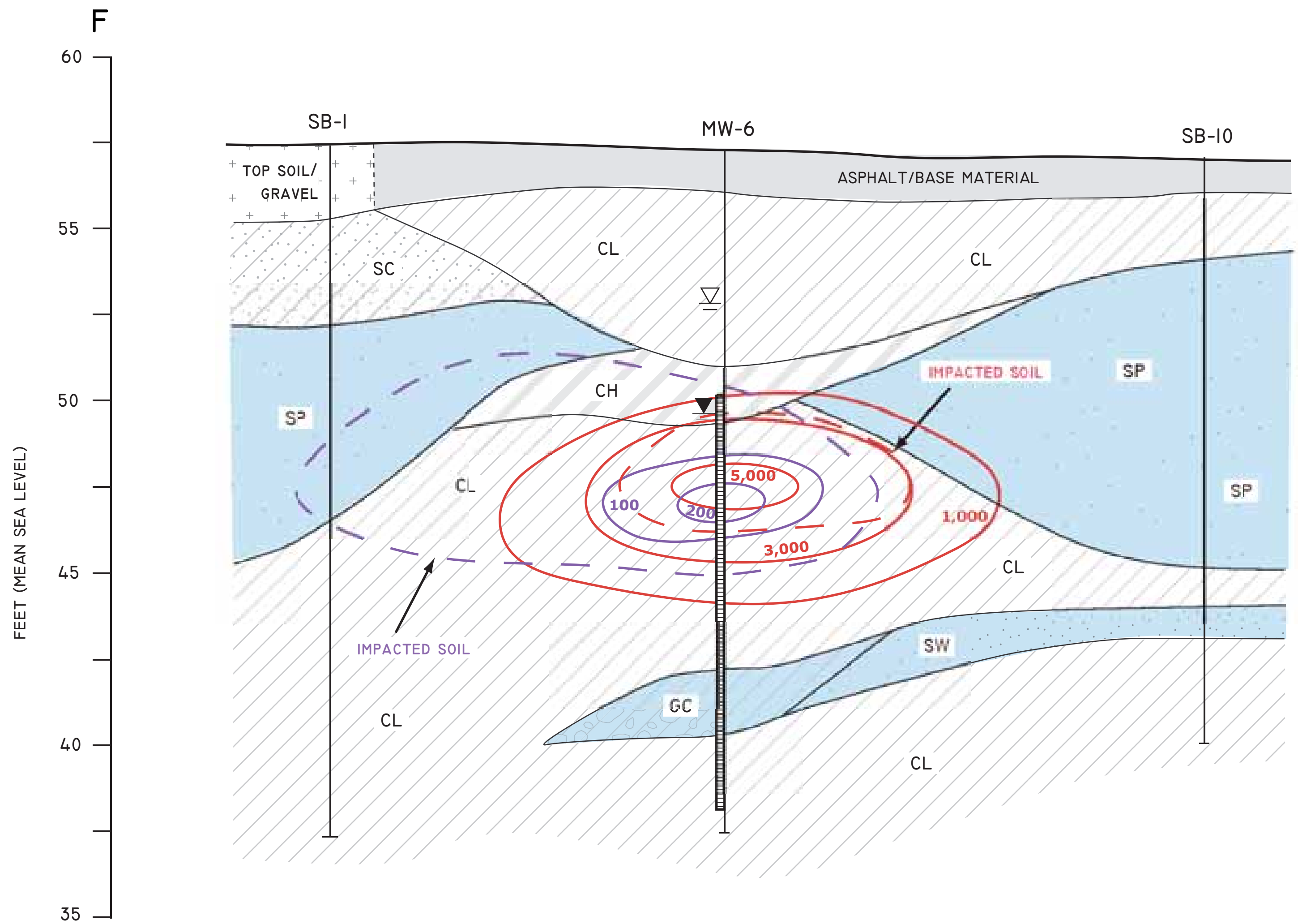
Cross-Section E - E'

6600 Foothilll Blvd, Oakland, CA 94605

Figure 8

ers

Environmental Risk Services Corporation



Minimum Groundwater Level (6/01 - 8/08)

Maximum Groundwater Level (6/01 - 8/08)

0 20 40 FT

Horizontal Scale

VERTICAL EXAGGERATION = 8X

LEGEND

- Ground Surface
- Screen Interval
- Asphalt and Base Material
- Layer of Less Hydraulic Resistance
- 1,000 — TPHg (ug/L)
- 5 — MTBE (ug/L)
- CL — Clay
- CH — Fat Clay
- SC — Sandy Clay
- GC — Clayey Gravels
- SW — Well Graded Sand
- SP — Poorly Graded Sand

Note: Soil boring elevations are projected.

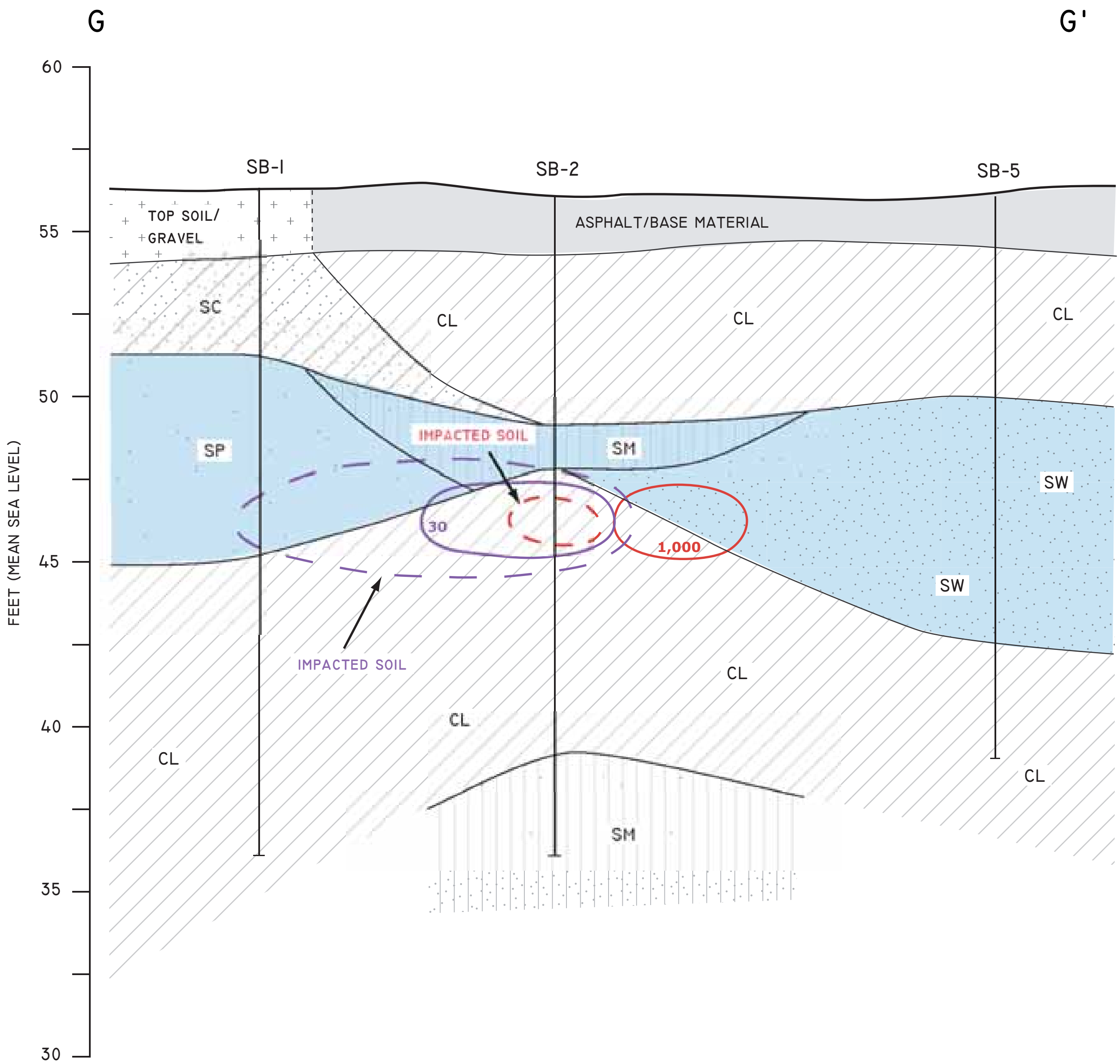
Cross-Section F - F’

6600 Foothilll Blvd, Oakland, CA 94605

Figure 9

ers

Environmental Risk Services Corporation



LEGEND

Ground Surface

Screen Interval

Asphalt and Base Material

Layer of Less Hydraulic Resistance

ML Silt

CL Clay

1,000 TPHg (ug/L)

5 MTBE (ug/L)

CH Fat Clay

SW Well Graded Sand

SP Poorly Graded Sand

SC Sandy Clay

SM Silty Sand

Note: Soil boring elevations are projected

0 20 40 FT

Horizontal Scale

VERTICAL EXAGGERATION = 8X

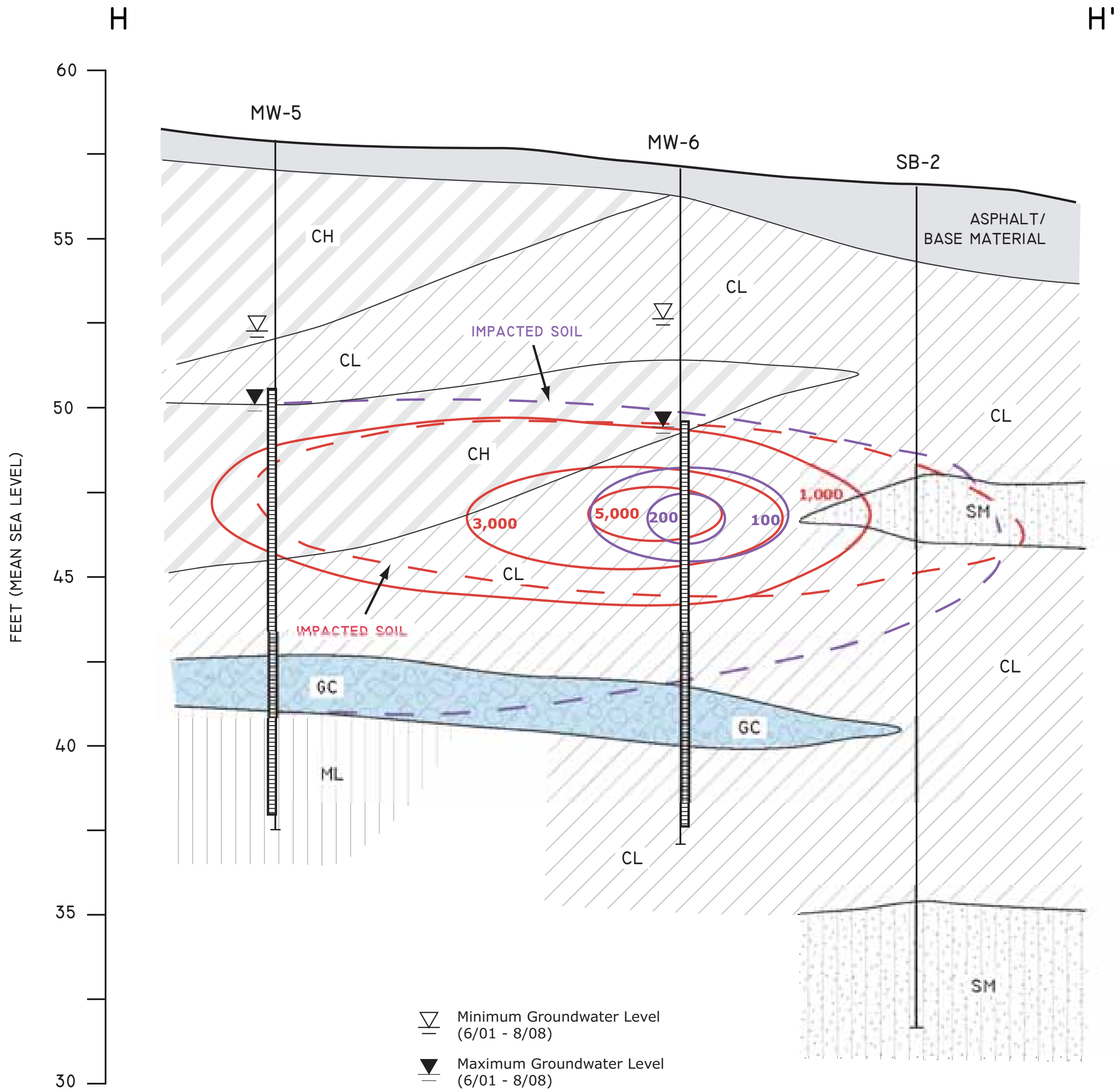
Cross-Section G - G'

6600 Foothilll Blvd, Oakland, CA 94605

Figure 10

ers

Environmental Risk Services Corporation



LEGEND

Ground Surface		1,000	TPHg (ug/L)
Screen Interval		5	MTBE (ug/L)
Asphalt and Base Material		CH	Fat Clay
Layer of Less Hydraulic Resistance		SM	Silty Sand
ML	Silt	GC	Clayey Gravels
CL	Clay		

Note: Soil boring elevations are projected

0 20 40 FT

Horizontal Scale

VERTICAL EXAGGERATION = 8X

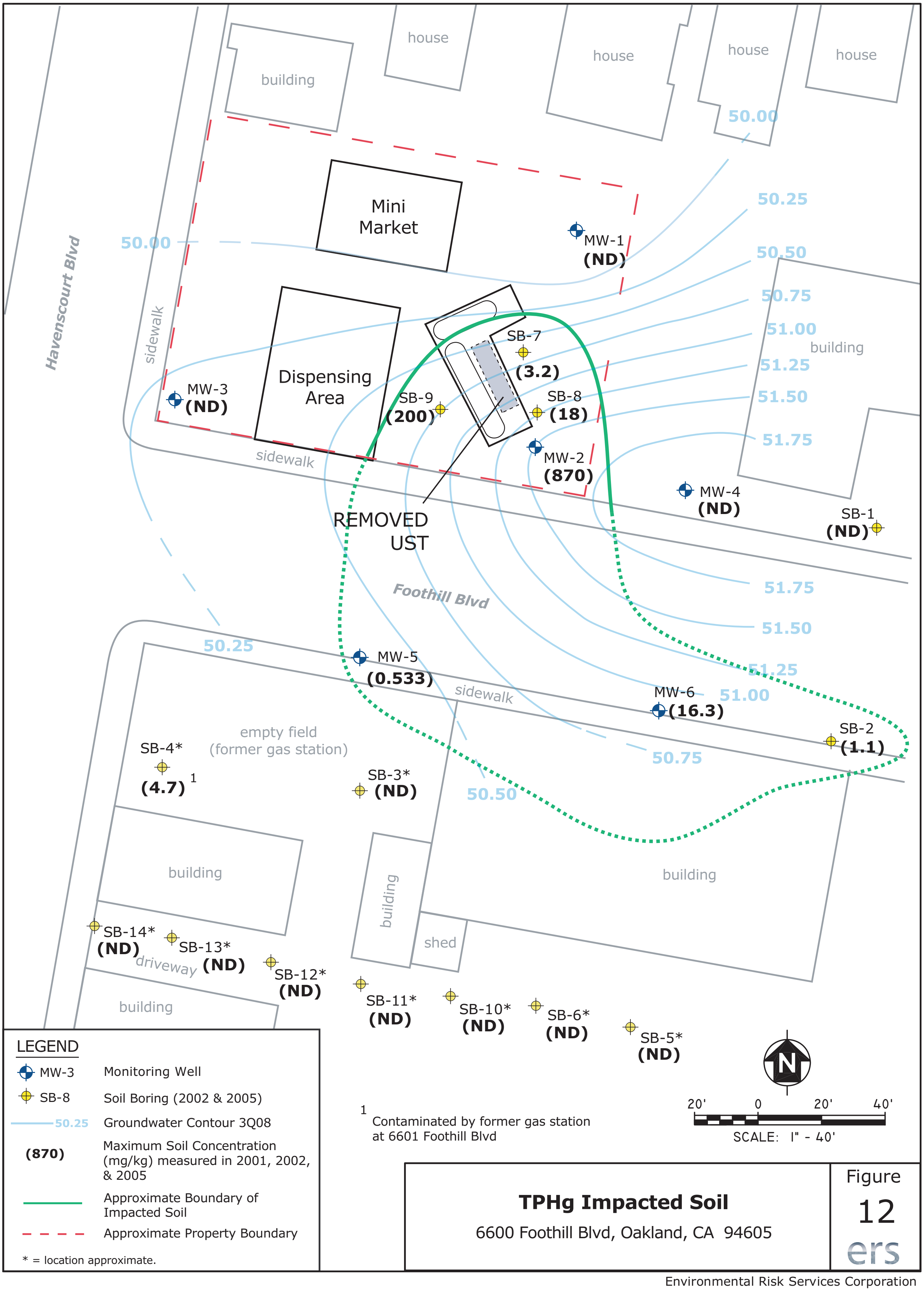
Cross-Section H - H'

6600 Foothilll Blvd, Oakland, CA 94605

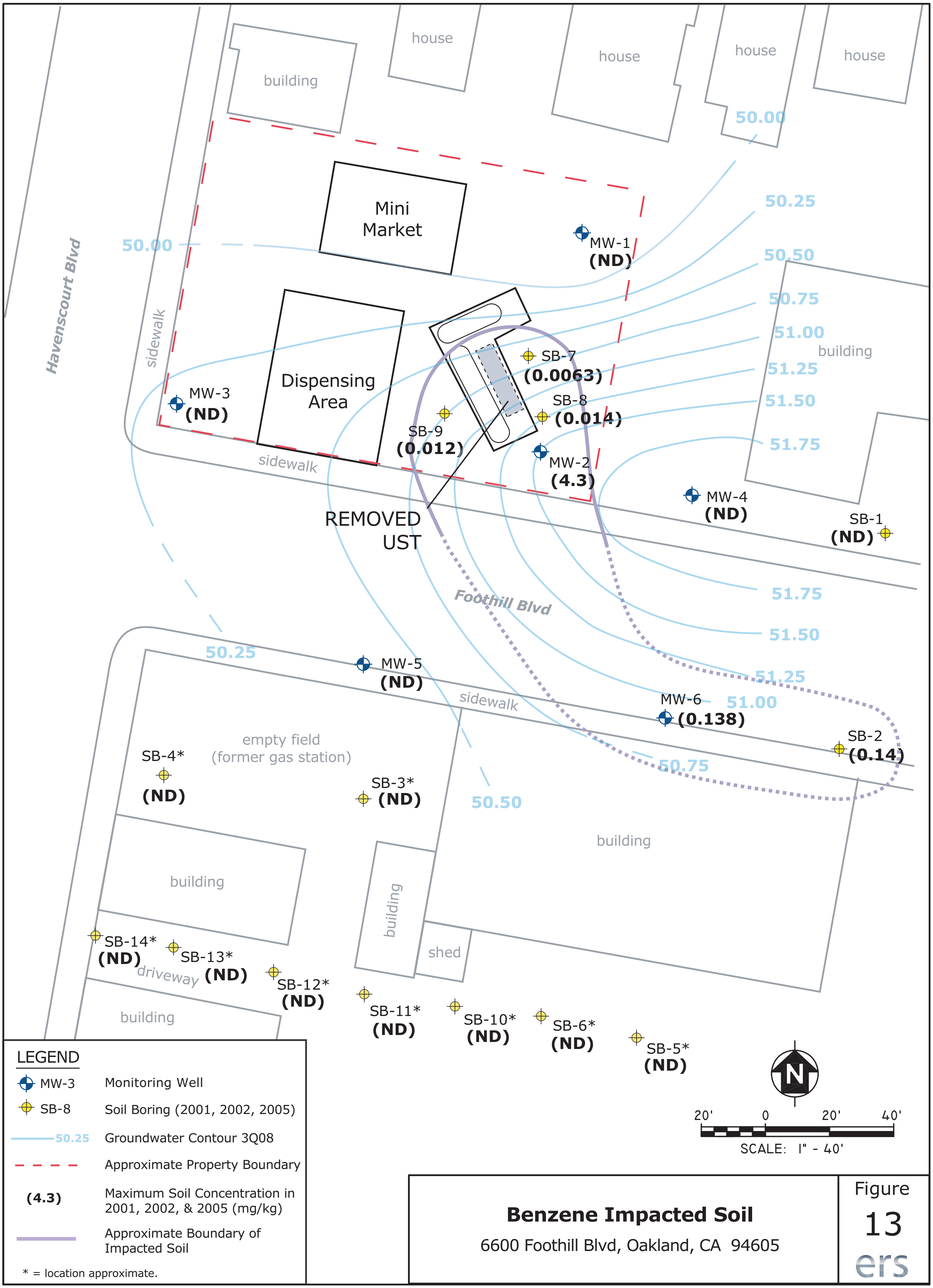
Figure 11

ers

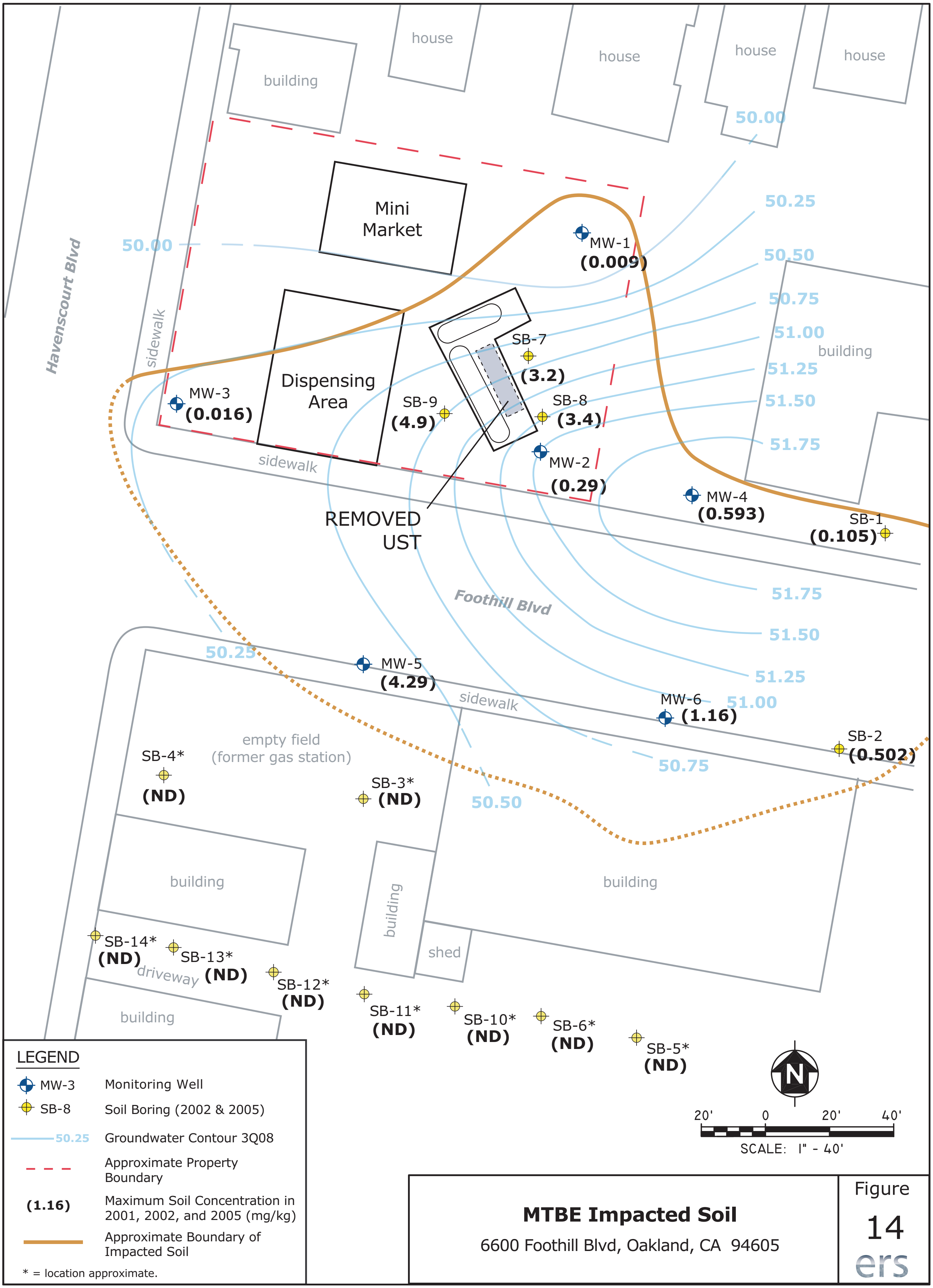
Environmental Risk Services Corporation



house
building
house
house
house
50.00
Mini
Market
MW-1
(ND)
50.25
50.50
50.75
51.00
building
51.25
51.50
51.75
Havenscourt Blvd
sidewalk
50.00
Dispensing
Area
SB-7
(3.2)
MW-3
(ND)
SB-9
(200)
SB-8
(18)
MW-2
(870)
sidewalk
MW-4
(ND)
SB-1
(ND)
REMOVED
UST
Foothill Blvd
51.75
51.50
50.25
MW-5
(0.533)
51.25
sidewalk
MW-6
(16.3)
51.00
SB-2
(1.1)
empty field
(former gas station)
SB-4*
(4.7) 1
SB-3*
(ND)
50.75
50.50
building
building
building
shed
SB-14*
(ND)
SB-13*
(ND)
driveway
SB-12*
(ND)
building
SB-11*
(ND)
SB-10*
(ND)
SB-6*
(ND)
SB-5*
(ND)
N
LEGEND
MW-3 Monitoring Well
SB-8 Soil Boring (2002 & 2005)
50.25 Groundwater Contour 3Q08
(870) Maximum Soil Concentration (mg/kg) measured in 2001, 2002, & 2005
Approximate Boundary of Impacted Soil
Approximate Property Boundary
* = location approximate.
1 Contaminated by former gas station at 6601 Foothill Blvd
20' 0 20' 40'
SCALE: 1" - 40'
TPHg Impacted Soil
6600 Foothill Blvd, Oakland, CA 94605
Figure
12
ers
Environmental Risk Services Corporation



Environmental Risk Services Corporation



MTBE Impacted Soil

6600 Foothill Blvd, Oakland, CA 94605

Figure 14

ers

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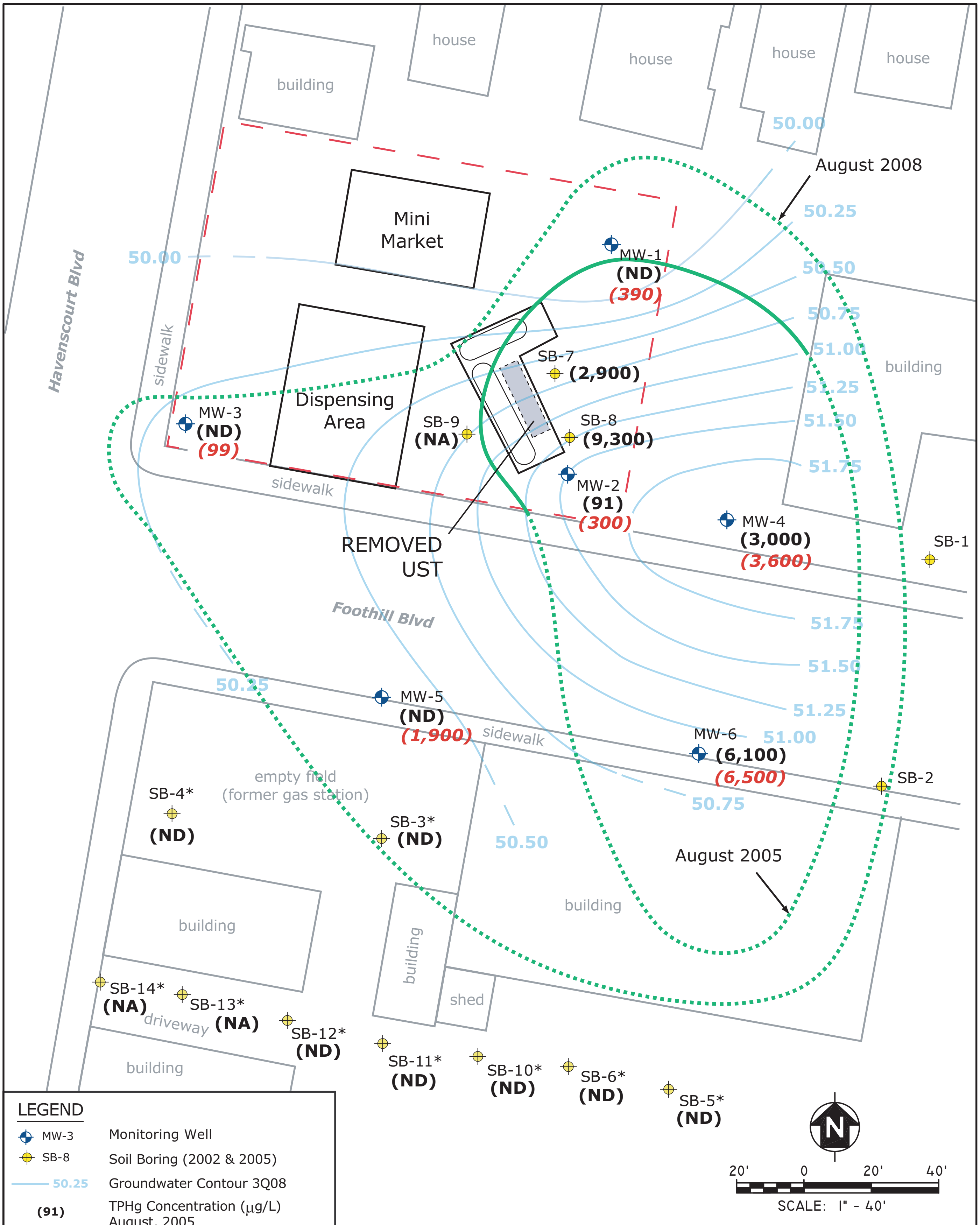

TPHg Impacted Groundwater

6600 Foothill Blvd, Oakland, CA 94605

Figure 15

ers

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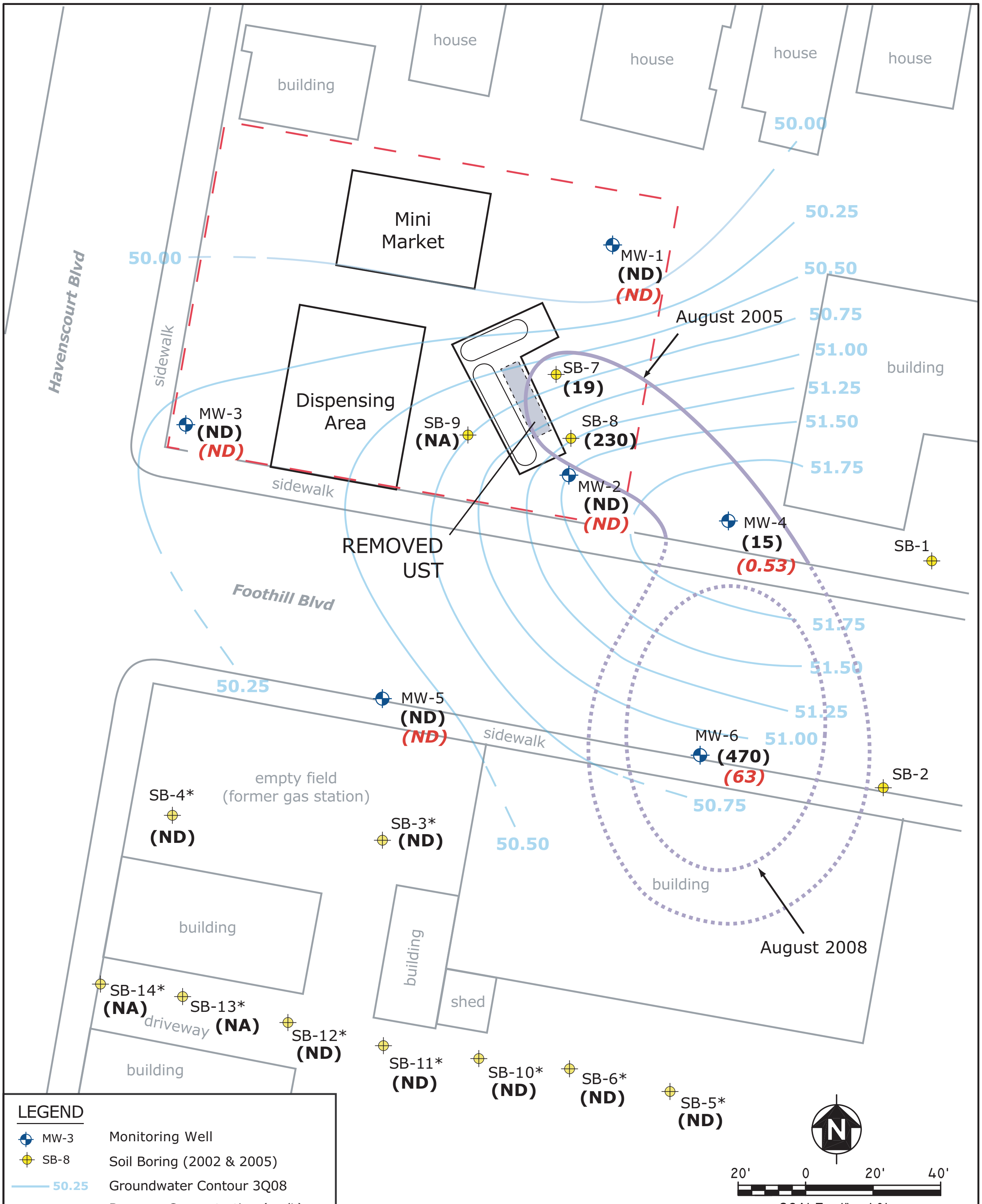

LEGEND

MW-3	Monitoring Well
SB-8	Soil Boring (2002 & 2005)
50.25	Groundwater Contour 3Q08
(15)	Benzene Concentration (µg/L) August, 2005
(0.53)	Benzene Concentration (µg/L) August, 2008
	Approximate Boundary of Impacted Groundwater
	Approximate Property Boundary

* = location approximate.

Benzene Impacted Groundwater

6600 Foothill Blvd, Oakland, CA 94605

Figure 16

ers

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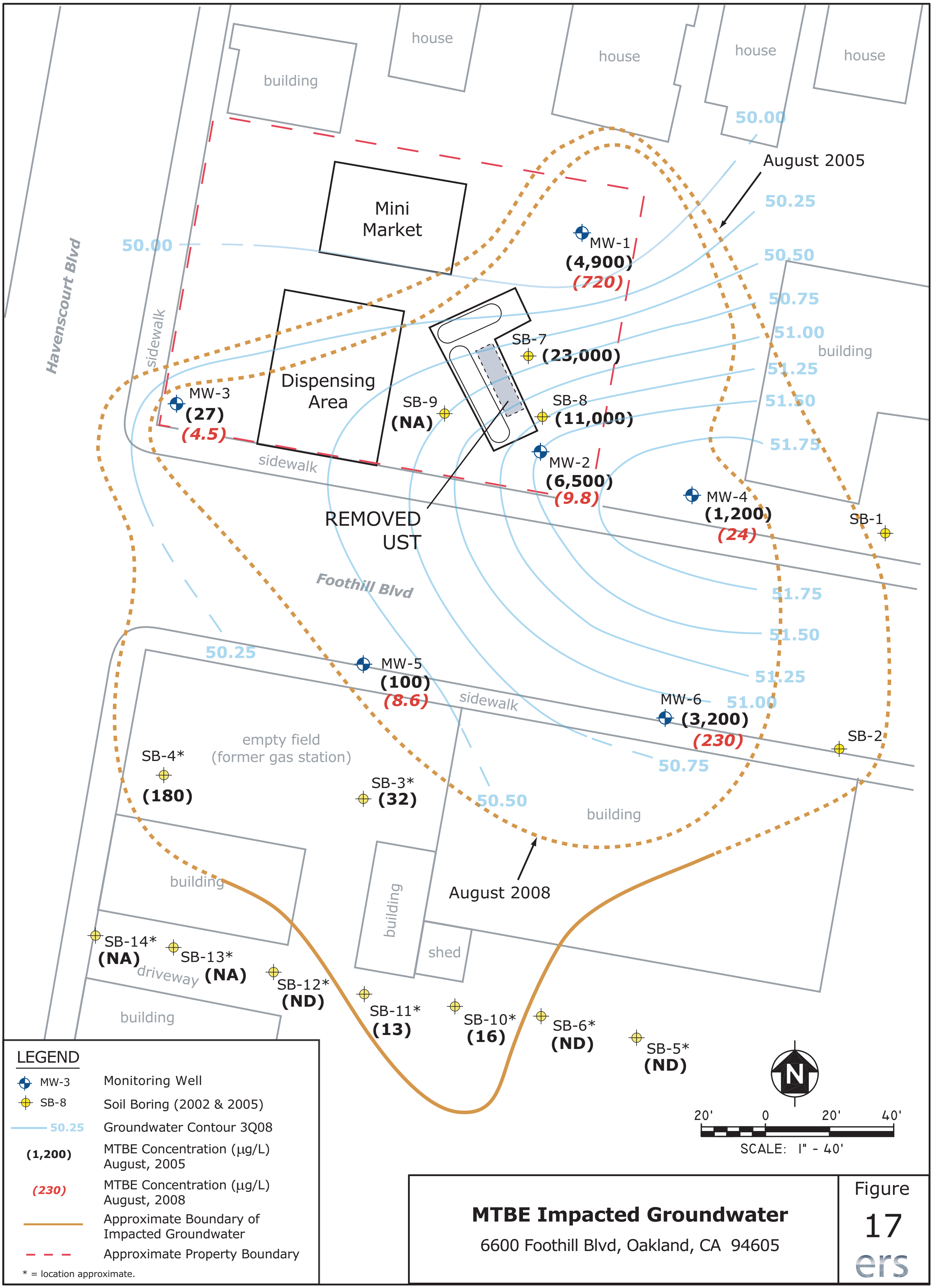
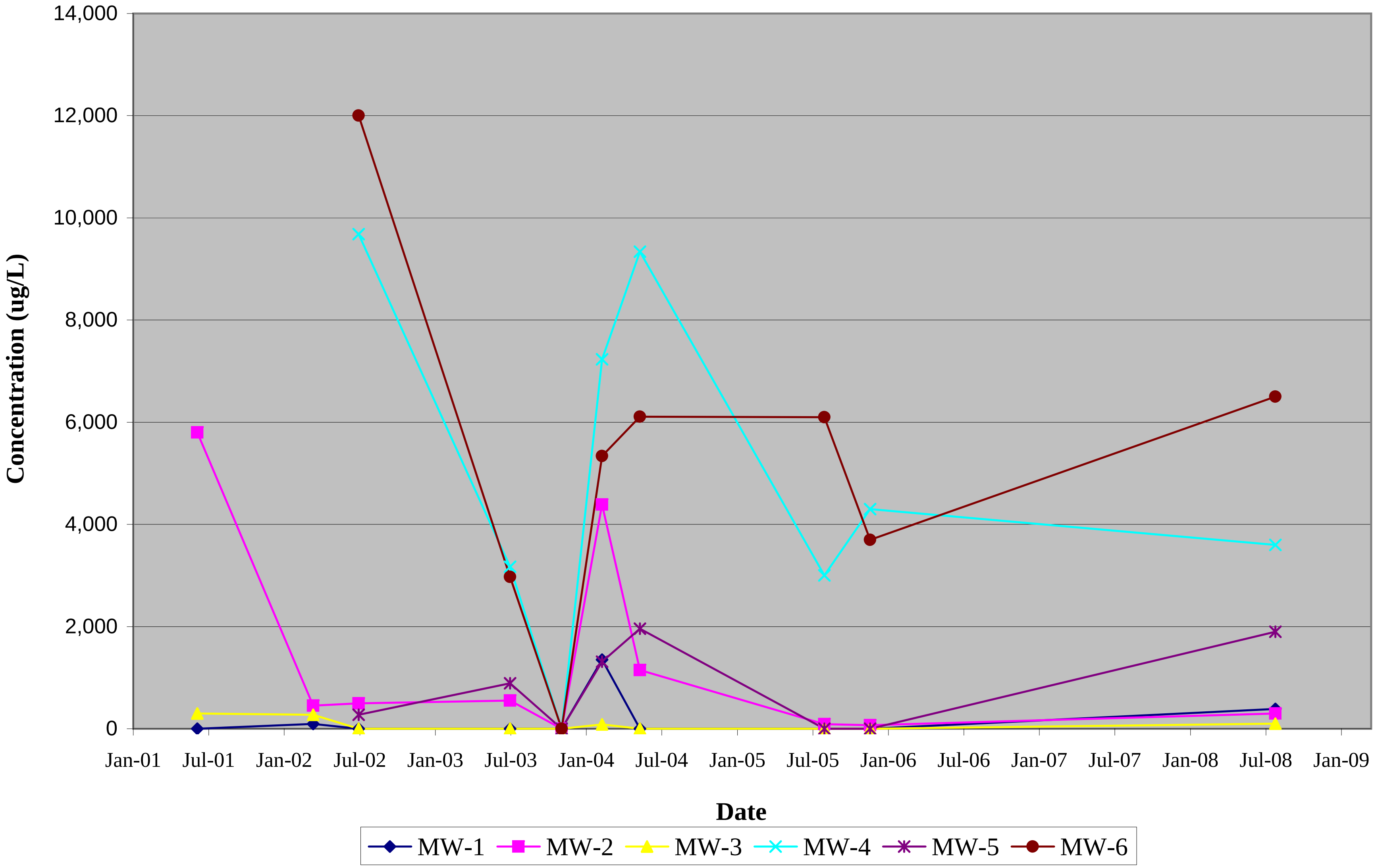


Environmental Risk Services Corporation

Figure 18
Change of TPH-g Concentration Over Time



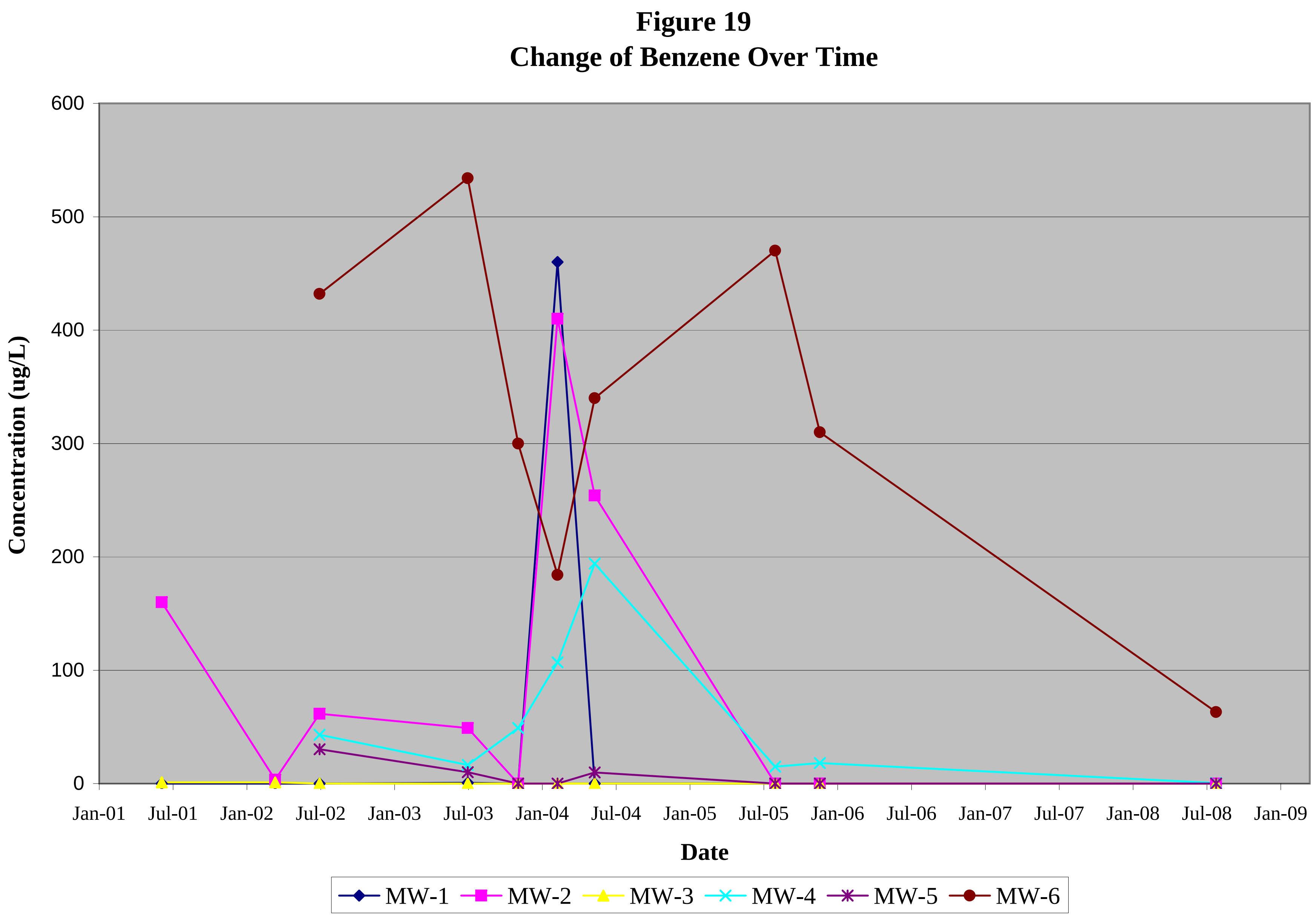
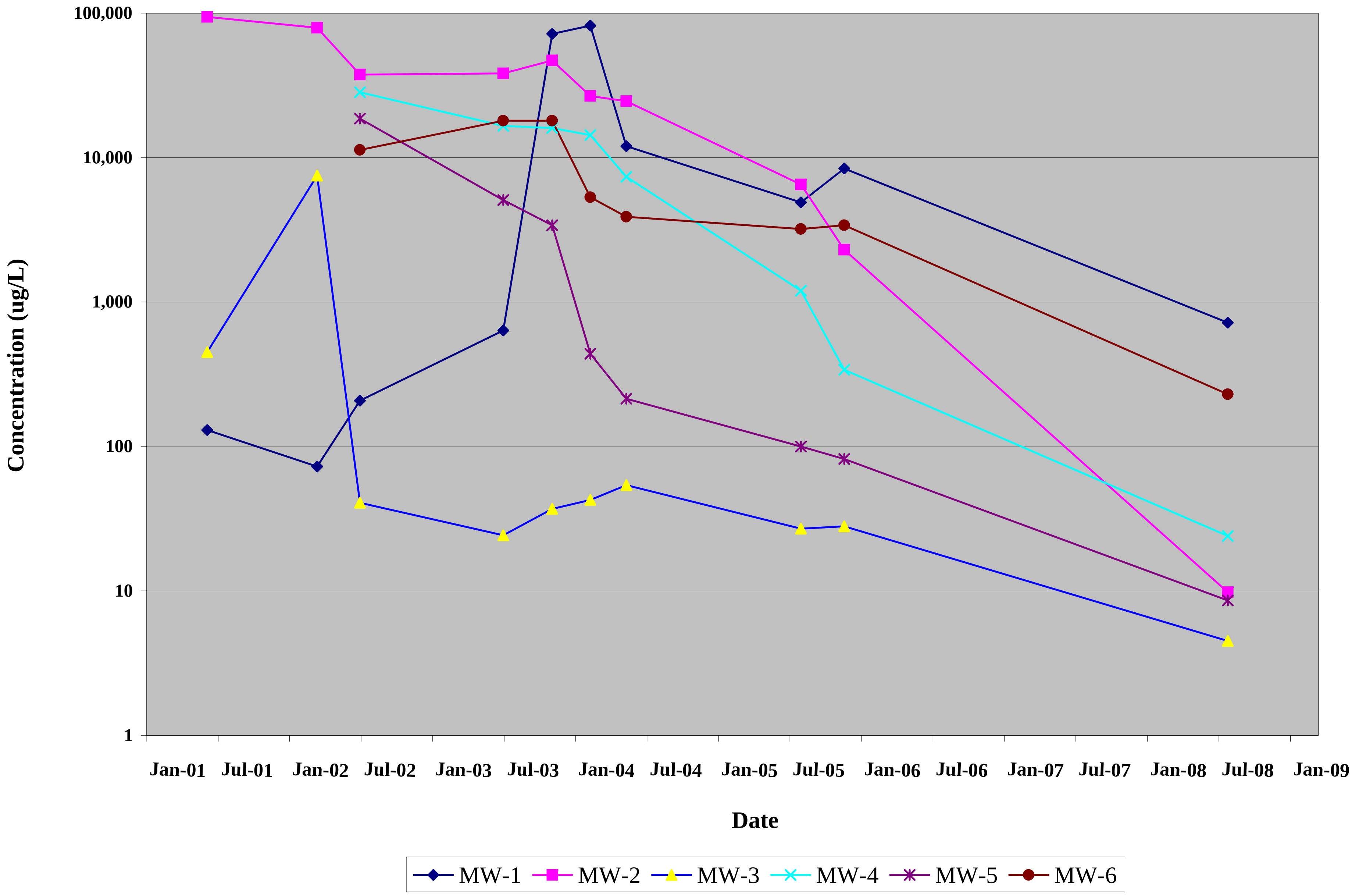
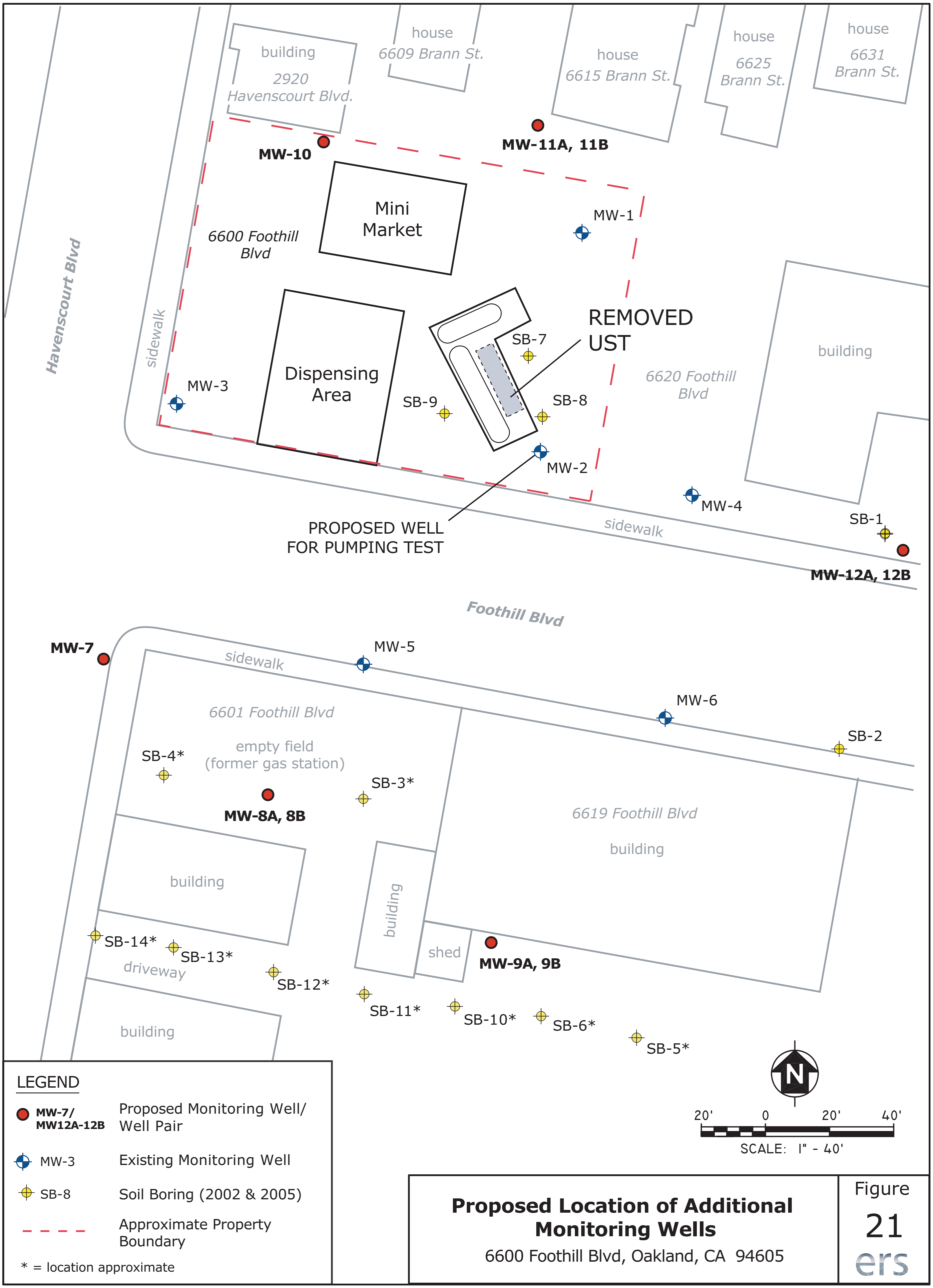


Figure 19
Change of Benzene Over Time
Concentration (ug/L)
600
500
400
300
200
100
0
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Jan-05
Jul-05
Jan-06
Jul-06
Jan-07
Jul-07
Jan-08
Jul-08
Jan-09
Date
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6

Figure 20
Change of MTBE Concentration Over Time





Proposed Location of Additional Monitoring Wells

6600 Foothill Blvd, Oakland, CA 94605

Figure 21

ers

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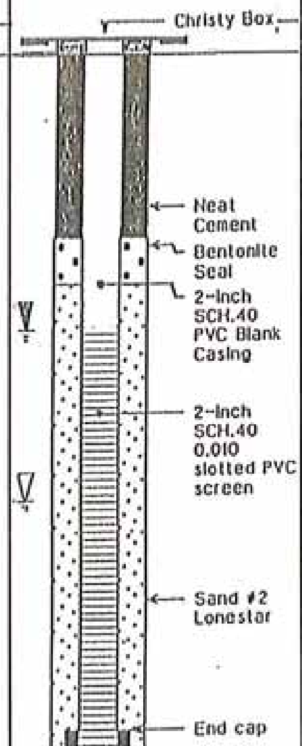
APPENDIX A

LOG OF EXPLORATORY BORING NO. MW-1

Project: Sekhon Gas Station	Drill Method: HSA	Logged By: T. Guha
Drilling Co.: Exploration Geoservices	Driller: David Yeager	Sampler: Split Spoon
Start Date: 6/4/01	Drill Rig: B-61	Hole Dia.: 8 inch
End Date: 6/4/01		

LITHOLOGIC DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	DRIVEN in	RECOVERY-in	OVA (ppm)
3" ASPHALT & 6" BASE MATERIAL			0				
GRAVELLY SAND: brownish gray, angular gravels, damp	SW		-5-				0
SILTY CLAY: brown, moist, stiff	CL		-10-				0
				☒	6 6 6	6 6 6	0
CLAYEY GRAVEL: brown, angular gravels with sand clay mixture, very moist, no odor @ 16 feet, wet	GC		-15- -20-				
BORE HOLE TERMINATED @ 25 feet			-25- -30-				

WELL CONSTRUCTION DETAIL



ADVANCED ASSESSMENT & REMEDIATION SERVICES 2380 Salvio Street, Suite202 Concord, CA 94520	*Note:*	Project No. 00015 Page 1 of 1

LOG OF EXPLORATORY BORING NO. MW-2

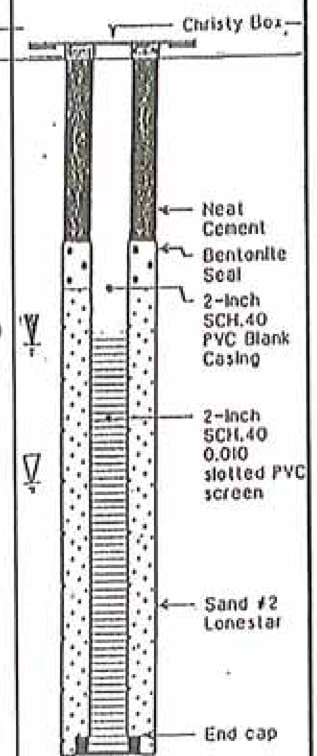
Project: Sekhon Gas Station
Drilling Co.: Exploration Geoservices
Start Date: 6/4/01
End Date: 6/4/01

Drill Method: HSA
Driller: David Yeager
Drill Rig: B-61

Logged By: T. Guha
Sampler: Split Spoon
Hole Dia.: 8 inch

LITHOLOGIC DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		DRIVEN in	RECOVERY-in	OVA (ppm)
3" ASPHALT & 8" BASE MATERIAL			0					
SANDY GRAVEL: gray, angular gravels, damp	GP		-5-					200
CLAYEY GRAVEL: greenish gray, angular gravels with clay mixture, moist, strong gasoline odor	GC		-10-	☒		6 6 6	6 6 6	1200
SILTY CLAY: brown, very moist, very stiff	CL							20
wet			-15-					
with minor gravels			-20-					
			-25-					
BORE HOLE TERMINATED @ 25 feet			-30-					

WELL CONSTRUCTION DETAIL



Note: Problem drilling at 2 feet; probe the hole, may be a pipe. Move 1 feet north and drill.

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Project No. 00015

LOG OF EXPLORATORY BORING NO. MW-3

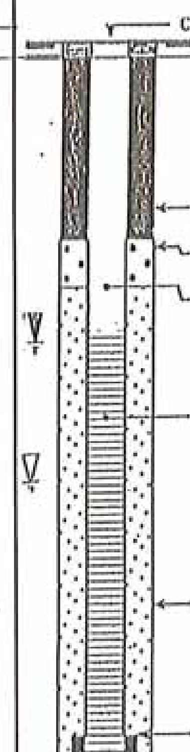
Project: Sekhon Gas Station
Drilling Co.: Exploration Geoservices
Start Date: 6/4/01
End Date: 6/4/01

Drill Method: HSA
Driller: David Yeager
Drill Rig: B-61

Logged By: T. Guha
Sampler: Split Spoon
Hole Dia.: 8 inch

LITHOLOGIC DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		DRIVEN in	RECOVERY-in	OVA (ppm)
3" ASPHALT & 8" BASE MATERIAL			0					
CLAYEY GRAVEL: drak gray, angular gravels, damp, loose	GC		-5-					0
GRAVEL: brown, angular gravels with very little fines, slightly moist, loose	GW					6 6 6	6 6 6	10
CLAY: brown, very moist, very stiff	CH		-10-	⊠				
GRAVELEY CLAY: greenish gray, angular gravels, very moist, very stiff wet color changes to light brown	CL		-15- -20-					0
BORE HOLE TERMINATED @ 25 feet			-25- -30-					

WELL CONSTRUCTION DETAIL



Note: .

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Project No. 00015
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LOG OF EXPLORATORY BORING NO. MW-4

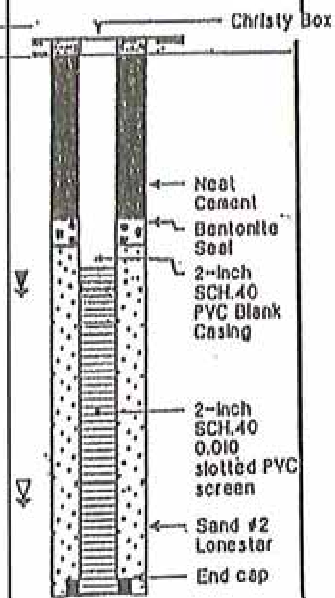
Project: Sekhon Gas Station
Drilling Co.: Exploration Geoservices
Start Date: 6/26/02
End Date: 6/26/02

Drill Method: HSA
Driller: Loren
Drill Rig: B-53

Logged By: T. Guha
Sampler: Split Spoon
Hole Dia.: 8 inch

LITHOLOGIC DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		DRIVEN in	RECOVERY-in	OVA (ppm)
Top soil & gravel mix 1 8"			0					
SILTY CLAY: drak gray, moist, stiff	CL							
GRAVEL: brown, with some sands, slightly moist, loose	GW		-5-					20
			-10-	■				
SILT: reddish brown, very moist, stiff	ML							650
CLAYEYGRAVEL: brown, sand, gravel ~~& clay mix, loose, wet~~	GC		-15-					10
SILTY CLAY: yellowish brown, wet, stiff	CL							
BORE HOLE TERMINATED @ 20 feet			-20-					0
			-25-					
			-30-					

WELL CONSTRUCTION DETAIL



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Note: .

Project No. 00015
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LOG OF EXPLORATORY BORING NO. MW-5

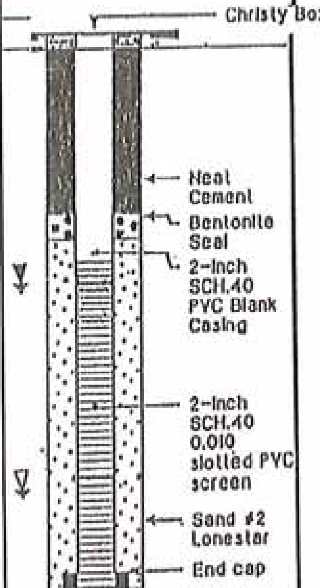
Project: Sekhon Gas Station
Drilling Co.: Exploration Geoservices
Start Date: 6/26/02
End Date: 6/26/02

Drill Method: HSA
Driller: Loren
Drill Rig: B-53

Logged By: T. Guha
Sampler: Split Spoon
Hole Dia.: 8 inch

LITHOLOGIC DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		DRIVEN in	RECOVERY-in	OVA (ppm)
3" ASPHALT & 8" BASE MATERIAL			0					
CLAY: drak gray, moist, stiff	CH		-5-					20
CLAY: brown, with rounded gravels & sand, moist	CL							
CLAY: brown, moist, very stiff	CH		-10-	■				800
SILTY CLAY: brown, very moist, stiff	CL		-15-					10
CLAYEY GRAVEL: brown, sand, gravel & clay mixture, loose, wet	GC							
SILT: brown, wet, stiff	ML		-20-					
BORE HOLE TERMINATED @ 20 feet			-25-					
			-30-					

WELL CONSTRUCTION DETAIL



Note: .

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Project No. 00015
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LOG OF EXPLORATORY BORING NO. MW-6

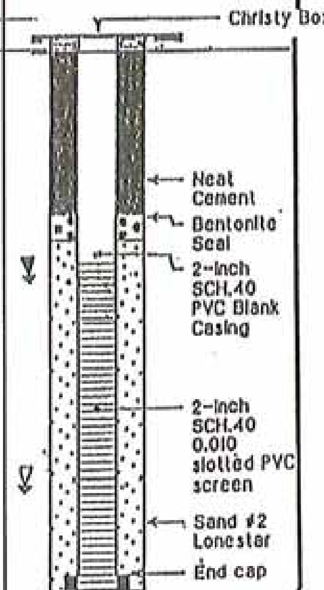
Project: Sekhon Gas Station
Drilling Co.: Exploration Geoservices
Start Date: 6/26/02
End Date: 6/26/02

Drill Method: HSA
Driller: Loren
Drill Rig: B-53

Logged By: T. Guha
Sampler: Split Spoon
Hole Dia.: 8 inch

LITHOLOGIC DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		DRIVEN in	RECOVERY-in	OVA (ppm)
3" ASPHALT & 8" BASE MATERIAL			0					
CLAY: drak gray, with angular gravels, moist, stiff	CL		-5-					50
CLAY: light brown, moist, stiff	CH							
SILTY CLAY:lt. brown, very moist, stiff	CL		-10-	■				1100
			-15-					10
CLAYEY GRAVEL: brown, sand, gravel & clay mixture, loose, wet	GC							
SILTY CLAY:yellowish brown, wet, very stiff	CL		-20-					
BORE HOLE TERMINATED @ 20 feet								
			-25-					
			-30-					

WELL CONSTRUCTION DETAIL



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Note: .

Project No. 00015

LOG OF EXPLORATORY BORING NO. SB-1

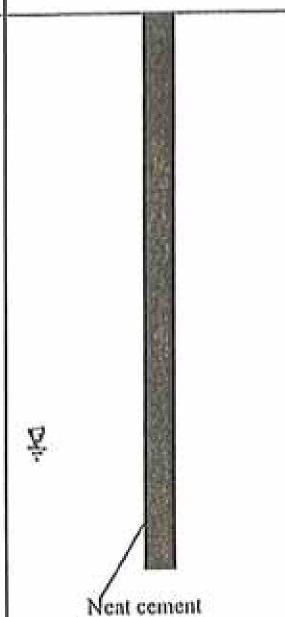
Project: Sekhon Gas Station
Drilling Co.: Exploration Geoservices
Start Date: 6/27/02
End Date: 6/27/02

Drill Method: HSA
Driller: Loren
Drill Rig: B-53

Logged By: T. Guha
Sampler: Split Spoon
Hole Dia.: 8 inch

LITHOLOGIC DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		DRIVEN in	RECOVERY-in	OVA (ppm)
Top soil gravel mixture 24"			0					
CLAYEY SAND: drak gray, sand, silt & clay mixture, dry, loose	SC		-5-					10
GRAVELLY SAND: brown, dry, loose	SP							
Same with more silt and clay, slightly moist, loose			-10-	■				150
SILTY CLAY: brown, moist, stiff	CL							
very moist, stiff								
wet			-15-					0
			-20-					0
BORE HOLE TERMINATED @ 20 feet								
			-25-					
			-30-					

WELL CONSTRUCTION DETAIL



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Note: .

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LOG OF EXPLORATORY BORING NO. SB-2

Project: Sekhon Gas Station
Drilling Co.: Exploration Geoservices
Start Date: 6/27/02
End Date: 6/27/02

Drill Method: HSA
Driller: Loren
Drill Rig: B-53

Logged By: T. Guha
Sampler: Split Spoon
Hole Dia.: 8 inch

LITHOLOGIC DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE		DRIVEN in	RECOVERY-in	OVA (ppm)	WELL CONSTRUCTION DETAIL
3" ASPHALT & 21" BASE MATERIAL			0						
SILTY CLAY: drak gray, moist, soft	CL								
color changes to brown, with some small gravels			-5-					10	
SILTY SAND: greenish gray, moist, soft	SM								
SILTY CLAY: greenish gray, moist, stiff	CL		-10-					550	
color changes to yellowish brown, very moist, stiff									
wet			-15-					10	
SILTY SAND: yellowish brown, wet, soft	SM								
			-20-					0	Neat cement
BORE HOLE TERMINATED @ 20 feet									
			-25-						
			-30-						

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Note: .

Project No. 00015

LOG OF EXPLORATORY BORING NO. SB-3

PROJECT: SEKHON GAS STATION
DRILLING CO.: GREGG DRILLING & TSTG.
DRILLER: VINCENT POKRYWKA
DRILL METHOD: DIRECT PUSH

LOGGED BY: T. GUHA
SAMPLER: MACROCORE
HOLE DIAMETER: 2 INCH
DRILL RIG: GEOPROBE M 5 T

START DATE: 8/10/05
END DATE: 8/11/05
INITIAL GW DEPTH : ? FEET

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
FILL: Gravel, sand and clay mix			0–3				Neat Cement
SAND: gray, with some clay, moist, loose	SC		3–6			0	
GRAVELLY SAND: gray, dry, loose	SW		6–12	■ (11)		0	
CLAY: brown, very moist, very stiff	CL		12–13				
GRAVELLY SAND: grayish brown, dry, loose	SW		13–15			0	
CLAY: brown, with some gravel & sand, moist, stiff	CL		15–18				
CLAY: brown, very moist, very stiff	CL		18–20			0	
Borehole terminated at 20 feet			20–30				

ADVANCED ASSESSMENT AND
REMEDIATION SERVICES
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Notes:
During drilling did not encounter wet zone, bottom of the hole was very moist, left hole open for 24 hours, 2 feet of water in the hole, groundwater sample collected.

Project No.
SEKHON
GAS STATION

LOG OF EXPLORATORY BORING NO. SB-4

PROJECT: SEKHON GAS STATION
DRILLING CO.: GREGG DRILLING & TSTG.
DRILLER: VINCENT POKRYWKA
DRILL METHOD: DIRECT PUSH

LOGGED BY: T. GUHA
SAMPLER: MACROCORE
HOLE DIAMETER: 2 INCH
DRILL RIG: GEOPROBE M 5 T

START DATE: 8/10/05
END DATE: 8/11/05
INITIAL GW DEPTH : ? FEET

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
FILL: Gravel, sand and clay mix			0–3				Neat Cement
SAND: gray, with gravels and clay, moist, loose	SP		3–4				
CLAY: dark gray, minor sand, moist, very stiff	CL		4–7			0	
GRAVELLY SAND: yellowish brown, dry, loose	SW		7–12	11		0	
CLAY: greenish gray, very moist, very stiff	CL		12–17			0	
GRAVELLY SAND: brown, moist, loose	SW		17–18				
CLAY: greenish gray, very moist, very stiff	CL		18–20			0	
Borehole terminated at 20 feet			20–30				

ADVANCED ASSESSMENT AND REMEDIATION SERVICES
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Notes:
During drilling did not encounter wet zone, bottom of the hole was very moist, left hole open for 24 hours, 2 feet of water in the hole, groundwater sample collected on 8/11/05.

Project No.
SEKHON GAS STATION

LOG OF EXPLORATORY BORING NO. SB-5

PROJECT: SEKHON GAS STATION
DRILLING CO.: GREGG DRILLING & TSTG.
DRILLER: VINCENT POKRYWKA
DRILL METHOD: DIRECT PUSH

LOGGED BY: T. GUHA
SAMPLER: MACROCORE
HOLE DIAMETER: 2 INCH
DRILL RIG: GEOPROBE M 5 T

START DATE: 8/10/05
END DATE: 8/10/05
INITIAL GW DEPTH :12.5 FEET

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
ASPHALT 2 in. FILL: Gravel, sand and clay mix			0–2				
CLAY: dark gray, moist, very stiff	CL		2–6.5			0 (at 5)	
GRAVELLY SAND : yellowish brown, dry, loose	SW		6.5–14			720 (at 10)	
color changes to light green, moist, strong odor						950 (at 11)	
wet				■ (at 12)			
CLAY: dark gray, moist, very stiff	CL		14–17			0 (at 15); 0 (at 17)	Neat Cement
Borehole terminated at 17 feet			17–30				

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2380 Salvio Street, Suite 202
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Notes:
During drilling groundwater encounter at 12 1/2 feet. A grab groundwater sample was collected.

Project No.
SEKHON GAS STATION

LOG OF EXPLORATORY BORING NO. SB-6

PROJECT: SEKHON GAS STATION
DRILLING CO.: GREGG DRILLING & TSTG.
DRILLER: VINCENT POKRYWKA
DRILL METHOD: DIRECT PUSH

LOGGED BY: T. GUHA
SAMPLER: MACROCORE
HOLE DIAMETER: 2 INCH
DRILL RIG: GEOPROBE M 5 T

START DATE: 8/10/05
END DATE: 8/10/05
INITIAL GW DEPTH :12 FEET

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
			0				
ASPHALT 4 in. FILL: Gravel, sand and clay mix			1				
CLAY: dark gray, moist, very stiff	CL		2				
			3				
SAND: light gray, with gravels, damp, loose	SP		4				
CLAY: dark gray, moist, very stiff	CL		5			0	
			6				
GRAVELLY SAND : yellowish brown, dry, loose	SW		7				
			8				
			9				
			10			0	
			11				
wet			12	■			
color changes to gray wet			13				
			14				
			15			0	
			16			0	Neat Cement
			17			0	
Borehole terminated at 17 feet			18				
			19				
			20				
			21				
			22				
			23				
			24				
			25				
			26				
			27				
			28				
			29				
			30				

ADVANCED ASSESSMENT AND REMEDIATION SERVICES
2380 Salvio Street, Suite 202
Concord, CA 94520

Notes:
During drilling groundwater encounter at 12 feet. A grab groundwater sample was collected.

Project No.
SEKHON GAS STATION

LOG OF EXPLORATORY BORING NO. SB-7

PROJECT: SEKHON GAS STATION
DRILLING CO.: GREGG DRILLING & TSTG.
DRILLER: JESSE PATTISON
DRILL METHOD: DIRECT PUSH

LOGGED BY: T. GUHA
SAMPLER: MACROCORE
HOLE DIAMETER: 2 INCH
DRILL RIG: GEOPROBE M 57

START DATE: 8/11/05
END DATE: 8/11/05
INITIAL GW DEPTH : ? FEET

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
			0				
ASPHALT: (4 IN.)							
CLAY: dark gray, moist, very stiff	CL		1–4				
SANDY GRAVEL: yellowish brown, damp, loose	GP		5			5	
			8	■		150	
CLAY: greenish gray, moist, very stiff, strong odor	CL		9				
			10			250	
			13	■		550	
SANDY GRAVEL: brown, moist, loose, stng odor	GP		14				
			15			350	
color changes to light brown, strong odor			17	■		250	
CLAY: brown, moist, very stiff	CL		18–19				
			20			0	
greenish color layer			22				
			24	■		0	
SAND: brown, very little fines, moist, loose	SP		24–25				
CLAY: brown, moist, very stiff	CL		26				
			27				Neat Cement
			29	■		0	
Borehole terminated at 30 feet			30				

ADVANCED ASSESSMENT AND
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Notes: hit concrete at 2 1/2 feet, move one foot east, encounter pea gravel, move one foot east, hand auger to 4 feet, screen set at 13 feet for 2 hours, no water, drilled to 30 feet; wet zone was not encountered; hole was left open for 5 hours; there was just enough water to fill 3 VOAs

Project No.
SEKHON
GAS STATION

LOG OF EXPLORATORY BORING NO. SB-8

PROJECT: SEKHON GAS STATION
DRILLING CO.: GREGG DRILLING & TSTG.
DRILLER: JESSE PATTISON
DRILL METHOD: DIRECT PUSH

LOGGED BY: T. GUHA
SAMPLER: MACROCORE
HOLE DIAMETER: 2 INCH
DRILL RIG: GEOPROBE M 57

START DATE: 8/11/05
END DATE: 8/11/05
INITIAL GW DEPTH : ? FEET

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
			0				
ASPHALT: (4 IN.)			1				
CLAY: dark gray, moist, very stiff color changes to dark brown	CL		2–4				
SANDY GRAVEL: yellowish brown, dry, loose color changes to grayish green	GP		4–6	■ (6)		5	
CLAY: brown, moist, very stiff	CL		6–10	■ (10)		650	
SAND: brown, very little fines, moist, loose, odor	SP		10–11				
SILTY CLAY: brown, moist, stiff, odor	CL		11–13				
SANDY GRAVEL: brown, moist, loose, odor	GP		13–17	■ (14)		850	
CLAY: brown, moist, very stiff greenish color layer	CL		17–28	■ (19)		0	
			25			0	
			27	■ (27)		0	Neat Cement
Borehole terminated at 28 feet			28–30				

ADVANCED ASSESSMENT AND REMEDIATION SERVICES
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Concord, CA 94520

Notes:
Hit concrete at 2 1/2 feet move one foot east, hand auger to 4 feet; during drilling did not encounter wet zone, hole was open for 2 hours; there was just enough water for 3 VOAs.

Project No.
SEKHON GAS STATION

LOG OF EXPLORATORY BORING NO. SB-9

PROJECT: SEKHON GAS STATION
DRILLING CO.: GREGG DRILLING & TSTG.
DRILLER: JESSE PATTISON
DRILL METHOD: DIRECT PUSH

LOGGED BY: T. GUHA
SAMPLER: MACROCORE
HOLE DIAMETER: 2 INCH
DRILL RIG: GEOPROBE M 57

START DATE: 8/11/05
END DATE: 8/11/05
INITIAL GW DEPTH : ? FEET

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
			0				
ASPHALT: (4 IN.)			1				
CLAY: dark gray, moist, very stiff	CL		2				
color changes to dark brown			3				
SANDY GRAVEL: brown, dry, loose	GP		5				
color changes to grayish green, strong gas odor			6	■		450	
CLAY: brown, moist, very stiff	CL		10	■		5	
SANDY GRAVEL: brown, moist, loose, strong odor	GP		12	■		550	
CLAY: brown, moist, very stiff	CL		14				
SANDY GRAVEL: brown, moist, loose, odor	GP		17	■		50	
CLAY: gray, moist, very stiff	CL		19				
a thin sand layer greenish color			21	■		50	
			27	■		0	Neat Cement
Borehole terminated at 28 feet			29				
			30				

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Notes:
hand auger to 4 feet ; during drilling did not encounter wet zone, hole was open for 3 hours, the hole was dry, no groundwater sample.

Project No.
SEKHON GAS STATION

LOG OF EXPLORATORY BORING NO. SB-10

PROJECT: SEKHON GAS STATION
DRILLING CO.: GREGG DRILLING & TSTG.
DRILLER: VINCENT POKRYWKA
DRILL METHOD: DIRECT PUSH

LOGGED BY: T. GUHA
SAMPLER: MACROCORE
HOLE DIAMETER: 2 INCH
DRILL RIG: GEOPROBE M 5 T

START DATE: 8/10/05
END DATE: 8/10/05
INITIAL GW DEPTH :11.5 FEET

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
ASPHALT 2 in. FILL: Gravel, sand and clay mix			0–1				Neat Cement
CLAY: dark gray, moist, very stiff	CL		1–3				
SAND: light gray, with gravels, dry, loose	SP		3–12			0 (5)	
color changes light brown, moist, loose							
			10			0	
			11	■			
wet							
CLAY: brown, wet, very stiff	CL		12–13.5				
GRAVELLY SAND : brown, loose, wet	SW		13.5–14				
CLAY: brown, very stiff, wet	CL		14–17			0 (15), 0 (17)	
Borehole terminated at 17 feet							

Depth scale: 0–30

Neat Cement

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Notes:
During drilling groundwater encounter at 11 1/2 feet. A grab groundwater sample was collected.

Project No.
SEKHON GAS STATION

LOG OF EXPLORATORY BORING NO. SB-11

PROJECT: SEKHON GAS STATION
DRILLING CO.: GREGG DRILLING & TSTG.
DRILLER: VINCENT POKRYWKA
DRILL METHOD: DIRECT PUSH

LOGGED BY: T. GUHA
SAMPLER: MACROCORE
HOLE DIAMETER: 2 INCH
DRILL RIG: GEOPROBE M 5 T

START DATE: 8/10/05
END DATE: 8/10/05
INITIAL GW DEPTH : 11 FEET

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
ASPHALT 2 in. FILL: Gravel, sand and clay mix			0–1				
CLAY: dark gray, moist, very stiff	CL		1–3.5				
SAND: light gray, with gravels, dry, loose No recovery 5 to 8'	SP		3.5–8			0	
CLAY: brown, very moist, very stiff	CL		8–11			0	
GRAVELLY SAND : brown, loose, wet	SW		11–14	■ (12)			
CLAY: brown, very stiff, wet	CL		14–17			0 0	Neat Cement
Borehole terminated at 17 feet							

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Notes:
During drilling groundwater encounter at 12 feet. A grab groundwater sample was collected.

Project No.
SEKHON GAS STATION

LOG OF EXPLORATORY BORING NO. SB-12

PROJECT: SEKHON GAS STATION
DRILLING CO.: GREGG DRILLING & TSTG.
DRILLER: VINCENT POKRYWKA
DRILL METHOD: DIRECT PUSH

LOGGED BY: T. GUHA
SAMPLER: MACROCORE
HOLE DIAMETER: 2 INCH
DRILL RIG: GEOPROBE M 5 T

START DATE: 8/10/05
END DATE: 8/10/05
INITIAL GW DEPTH : 11 FEET

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
			0				
ASPHALT 2 in. FILL: Gravel, sand and clay mix			1				
CLAY: dark gray, moist, very stiff	CL		2–4				
color changes to light gray			5			0	
SAND: light gray, with gravels, dry, loose	SP		6–9				
CLAY: yellowish brown, very moist, very stiff	CL		10			0	
GRAVELLY SAND : brown, loose, wet	SW		11–13	■			
CLAY: brown, very stiff, wet	CL		14–15			0	
			16				Neat Cement
			17			0	
Borehole terminated at 17 feet			18–30				

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Concord, CA 94520

Notes:
During drilling groundwater encounter at 11 feet. A grab groundwater sample was collected.

Project No.
SEKHON
GAS STATION

LOG OF EXPLORATORY BORING NO. SB-13

PROJECT: SEKHON GAS STATION	LOGGED BY: T. GUHA	START DATE: 8/10/05
DRILLING CO.: GREGG DRILLING & TSTG.	SAMPLER: MACROCORE	END DATE: 8/11/05
DRILLER: VINCENT POKRYWKA	HOLE DIAMETER: 2 INCH	INITIAL GW DEPTH : ? FEET
DRILL METHOD: DIRECT PUSH	DRILL RIG: GEOPROBE M 5 T	

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
ASPHALT 2 in. FILL: Gravel, sand and clay mix			0–2				Neat Cement
CLAY: dark gray, moist, very stiff	CL		2–4				
SAND: light gray, with gravels, dry, loose	SP		4–6			0	
CLAY: brown, with gravel and sand very moist, stiff	CL		6–11			0	
GRAVELLY SAND : brown, dry, loose	SW		11–12	■			
CLAY: brown, very moist, very stiff	CL		12–17			0 0	
Borehole terminated at 17 feet			17–30				

ADVANCED ASSESSMENT AND REMEDIATION SERVICES
2380 Salvio Street, Suite 202
Concord, CA 94520

Notes:
During drilling did not encounter wet zone; at 12 feet soil very moist, left hole open for 24 hours; hole was dry

Project No.
SEKHON GAS STATION

LOG OF EXPLORATORY BORING NO. SB-14

PROJECT: SEKHON GAS STATION
DRILLING CO.: GREGG DRILLING & TSTG.
DRILLER: VINCENT POKRYWKA
DRILL METHOD: DIRECT PUSH

LOGGED BY: T. GUHA
SAMPLER: MACROCORE
HOLE DIAMETER: 2 INCH
DRILL RIG: GEOPROBE M 5 T

START DATE: 8/10/05
END DATE: 8/11/05
INITIAL GW DEPTH : ? FEET

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH (Feet)	SAMPLE	BLOWS?FT	PID (ppm)	BORING CLOSURE
			0				
ASPHALT 2 in. FILL: Gravel, sand and clay mix			1				
CLAY: dark gray, minor sand, moist, stiff	CL		2				
			3				
			4				
SAND: gray, with gravels and clay, dry, loose	SP		5			0	
			6				
			7				
color changes to brown			8				
			9				
			10			0	
			11	■			
very moist			12				
			13				
CLAY: greenish gray, very moist, very stiff	CL		14				
			15			0	
			16				Neat Cement
			17			0	
Borehole terminated at 17 feet			18				
			19				
			20				
			21				
			22				
			23				
			24				
			25				
			26				
			27				
			28				
			29				
			30				

ADVANCED ASSESSMENT AND
REMEDIATION SERVICES
2380 Salvio Street, Suite 202
Concord, CA 94520

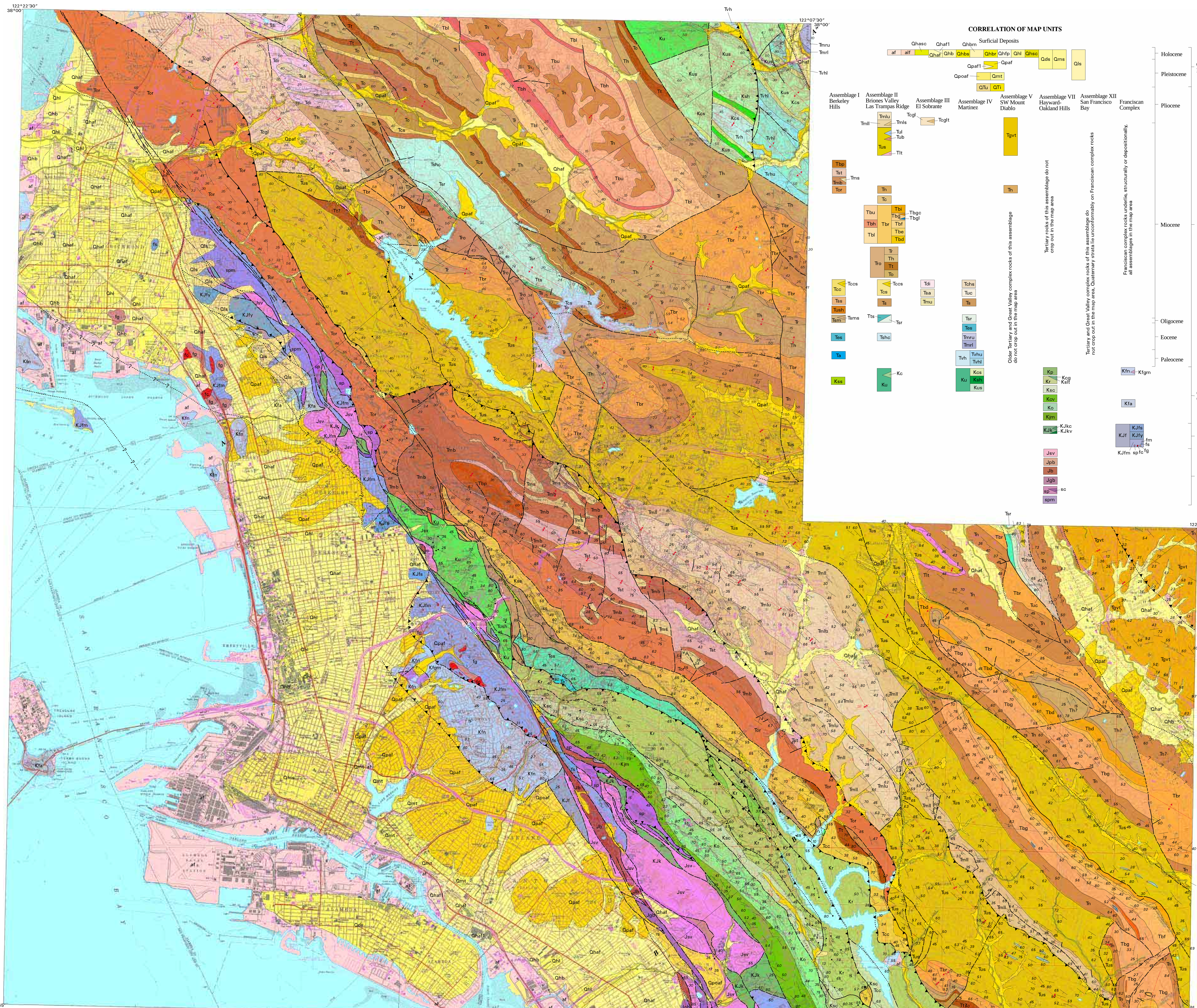
Notes:
During drilling did not encounter wet zone; at 12 feet was very moist, left hole open for 24 hours; hole was dry

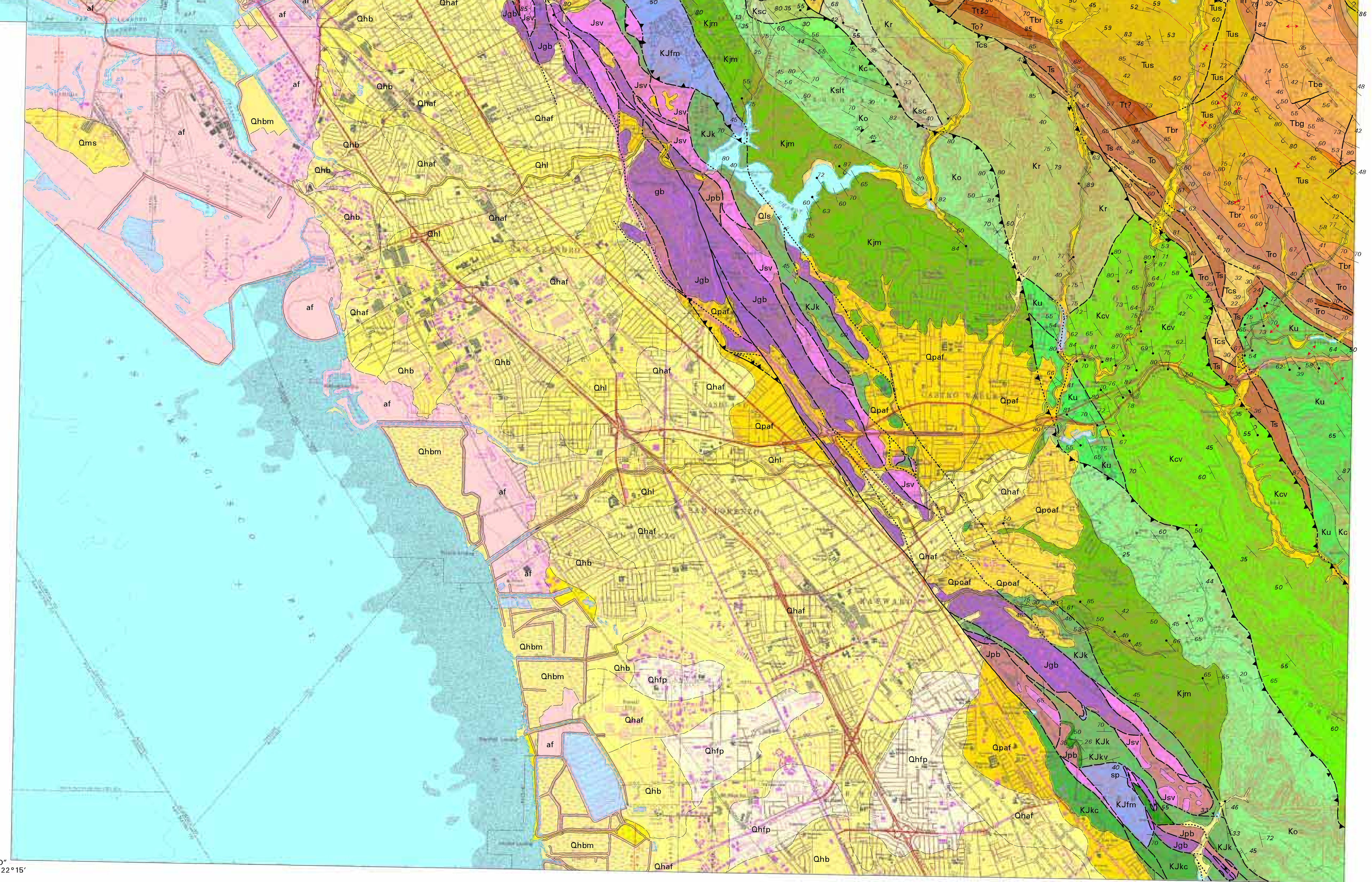
Project No.
SEKHON
GAS STATION

APPENDIX B

USGS
science for a changing world
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MF- 2342, Version 1.0
Pamphlet accompanies map





LIST OF MAP UNITS

Surficial Deposits

- af — Artificial fill (Historic)
- alf — Artificial levee fill (Historic)
- Qhasc — Artificial stream channels (Historic)
- Qhaf1 — Younger alluvial fan deposits (Holocene)
- Qhaf — Alluvial fan and fluvial deposits (Holocene)
- Qhb — Basin deposits (Holocene)
- Qhbs — Basin deposits, salt affected (Holocene)
- Qhbm — Bay mud (Holocene)
- Qhbr — Beach ridge deposits (Holocene)
- Qhfp — Floodplain deposits (Holocene)
- Qhl — Natural levee deposits (Holocene)
- Qhsc — Stream channel deposits (Holocene)
- Qds — Dune sand (Holocene and Pleistocene)
- Qms — Merrit sand (Holocene and Pleistocene)
- Qls — Landslide deposits (Holocene and/or Pleistocene)
- Qpaf — Alluvial fan and fluvial deposits (Pleistocene)
- Qpaf1 — Alluvial terrace deposits (Pleistocene)
- Qmt — Marine terrace deposits (Pleistocene)
- Qpoaf — Older alluvial fan deposits (Pleistocene)
- QTi — Irvington Gravels of Savage (1951) (Pleistocene and Pliocene (?))
- QTu — Undifferentiated continental gravels (Pleistocene and/or Pliocene)

Assemblage I

- Tbp — Bald Peak Basalt (late Miocene)
- Tst — Siesta Formation (late Miocene)
- Tmb — Moraga Formation (late Miocene)
- Tms — Interflow sedimentary rocks
- Tor — Orinda Formation (late Miocene)
- Tcc — Claremont chert (late to middle Miocene)
- Tccs — Interbedded sandstone
- Tss — Unamed sandstone (Miocene (?))
- Tush — Unnamed gray mudstone (early Miocene)
- Tsm — Unnamed glauconitic mudstone (Miocene and Oligocene (?))
- Tsms — Interbedded sandstone
- Tes — Unnamed mudstone (Eocene)
- Ta — Unnamed glauconitic sandstone (Paleocene)

Great Valley Complex

- Kss — Unnamed lithic sandstone (Cretaceous)

Assemblage II

Mullholland Formation of Ham (1952) (Pliocene and late Miocene)

- Tmlu — Upper member
- Tmll — Lower member
- Tmls — Sandstone marker beds
- Tus — Unnamed sedimentary and volcanic rocks (late Miocene)
- Tub — Interbedded basalt
- Tul — Interbedded limestone
- Tlt — Lafayette Tuff (late Miocene)
- Tn — Neroly Sandstone (late Miocene)
- Tc — Cierbo Sandstone (late Miocene)
- Tbr — Briones Formation (late and middle Miocene)

In southern part of the assemblage, locally divided into:

- Tbi — I member of Wagner (1978)
- Tbg — G member of Wagner (1978)
- Tbgc — Conglomerate
- Tbgl — Limestone
- Tbf — F member of Wagner (1978)
- Tbe — E member of Wagner (1978)
- Tbd — D member of Wagner (1978)

In northern part of the assemblage, locally divided into:

- Tbu — Upper sandstone and shale member
- Tbh — Hercules shale member
- Tbl — Lower sandstone and siltstone member
- Tro — Rodeo Shale, Hambre Sandstone, Tice Shale, and Oursan Sandstone, undivided (middle Miocene)
- Tr — Rodeo Shale (middle Miocene)
- Th — Hambre Sandstone (middle Miocene)
- Tt — Tice Shale (middle Miocene)
- To — Oursan Sandstone (middle Miocene)
- Tcs — Claremont Shale (middle Miocene)
- Tccs — Sandstone interbeds
- Ts — Sobrante Sandstone (middle Miocene)
- Tts — Tuffaceous sandstone (Miocene and/or Oligocene)
- Tsr — San Ramon Sandstone (Miocene and/or Oligocene)
- Tshc — Shale and claystone (Eocene)

Great Valley Complex

- Ku — Unnamed sedimentary rocks (Late Cretaceous, Turonian and Cenomanian)
- Kc — Conglomerate

Assemblage III

- Tcgl — Conglomerate, sandstone, and siltstone (Pliocene and Miocene)
- Tcglt — Rhyolite tuff and tuff breccia
- Tdi — Diatomite (Miocene)
- Tsa — Sandstone (Miocene)
- Tmu — Mudstone, shale, siltstone (Miocene)

Assemblage IV

- Tchs — Unnamed shale (Miocene)
- Tuc — Unnamed conglomerate (Miocene)
- Ts — Sobrante Sandstone (Miocene)
- Tsr — San Ramon Sandstone (Miocene and/or Oligocene)
- Tes — Escobar Sandstone of Weaver (1953) (Eocene)

Muir Sandstone of Weaver (1953), (Eocene)

- Tmru — Upper member
- Tmrl — Lower member
- Tvh — Vine Hill Sandstone of Weaver (1953) (Paleocene)
- Tvhu — Upper member
- Tvhl — Lower member

Great Valley Complex

- Ku — Undivided Great Valley complex rocks (Cretaceous)
- Kcs — Gray massive quartz arenite
- Ksh — Siltstone and shale
- Kus — Sandstone, siltstone, and shale

Assemblage V

- Tgvt — Green Valley and Tassajara Formations of Conduit (1938), undivided (Pliocene and Miocene)
- Tn — Neroly Sandstone (Miocene)

Assemblage VII

Great Valley Complex

- Kp — Pinehurst Shale (Late Cretaceous, Campanian)
- Kr — Redwood Canyon Formation (Late Cretaceous, Campanian)
- Ksc — Shephard Creek Formation (Late Cretaceous, Campanian)
- Kcv — Unnamed sandstone, conglomerate, and shale of the Castro Valley area (Late Cretaceous, Turonian and younger (?))
- Ko — Oakland Conglomerate (Late Cretaceous, Turonian and/or Cenomanian)
- Kcg — Conglomerate
- Kslt — Siltstone
- Kjm — Joaquin Miller Formation (Late Cretaceous, Cenomanian)
- KJk — Knoxville Formation (Early Cretaceous and Late Jurassic)
- KJkc — Conglomerate
- KJkv — Volcanoclastic breccia
- Jsv — Keratophyre and quartz keratophyre (Late Jurassic)

Coast Range ophiolite (Jurassic)

- Jpb — Pillow basalt, basalt breccia, and minor diabase
- Jb — Massive basalt and diabase
- Jgb — Gabbro
- sp — Serpentinite
- sc — Silica-carbonate rock
- spm — Serpentinite matrix mélange

Franciscan Complex

- KJf — Undivided Franciscan complex rocks (Cretaceous and Jurassic)
- Kfn — Sandstone of the Novato Quarry terrane of Blake and others (1984) (Late Cretaceous)
- Kfgm — Fine-grained quartz diorite (Late Cretaceous (?))
- Kfa — Sandstone of the Alcatraz terrane of Blake and others (1984)(Cretaceous)
- KJfy — Metasandstone of the Yolla Bolly terrane of Blake and others (1984) (Cretaceous(?) and Late Jurassic)
- KJfs — Franciscan complex sandstone, undivided (Late Cretaceous to Late Jurassic)
- KJfm — Franciscan complex, mélange (Cretaceous Late Jurassic), includes mapped locally:
- fs — Graywacke and meta-graywacke blocks
- fc — Serpentinite blocks
- sp — Chert blocks
- fg — Greenstone blocks
- fm — Schist blocks

Contact-- Depositional or intrusive contact, dashed where approximately located, dotted where concealed

Fault-- Dashed where approximately located, small dashes where inferred, dotted where concealed, queried where location is uncertain.

Reverse or thrust fault-- Dashed where approximately located, dotted where concealed

Normal fault-- Dashed where approximately located, dotted where concealed

Anticline-- Shows fold axis, dashed where approximately located, dotted where concealed

Syncline

35 Strike and dip of bedding

48 Strike and dip of bedding, top indicator observed

60 Strike and dip of bedding, approximate

83 Overturned bedding

79 Overturned bedding, top indicator observed

Horizontal bedding

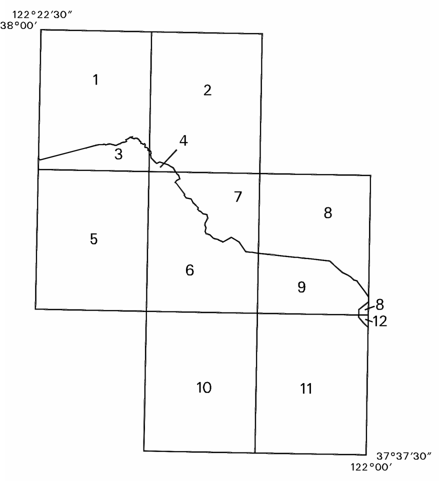
Vertical bedding

Vertical bedding, top indicator observed

35 Strike and dip of foliation

Vertical foliation

35 Strike and dip of joints



INDEX MAP SHOWING SOURCES OF DATA

EXPLANATION

Quaternary surficial deposits modified from Helley and Graymer (1997a,b)

1. Extensive new mapping by author, modifying Graymer and others (1994), Wagner (1978), Dibblee (1980d), and Sheehan (1956). Some data from Blake and others (1974).

2. New mapping by author, modifying Graymer and others (1994), Wagner (1978), Pease (1954), and Dibblee (1980a). See also Doumani (1957).

3. New mapping by author, modifying Graymer and others (1996), Dibblee (1980d), and Blake and others (1974).

4. New mapping by author, modifying Graymer and others (1996), Wagner (1978), Dibblee (1980a), and Pease (1954).

5. New mapping by author in the small area of bedrock exposure. Yerba Buena Island from Blake and others, 1999. See also Radbruch (1957).

6. Some new mapping by author modifying Graymer and others (1996), Radbruch (1969), and Radbruch and Case (1967).

7. New mapping by author modifying Graymer and others (1994), Radbruch (1969), Wagner (1978), and Radbruch and Case (1967).

8. New mapping by author modifying Graymer and others (1994), Wagner (1978), Ham (1952), Dibblee (1980c), Aarons (1958), and Sonneman and Switzer (unpublished maps, 1961-62).

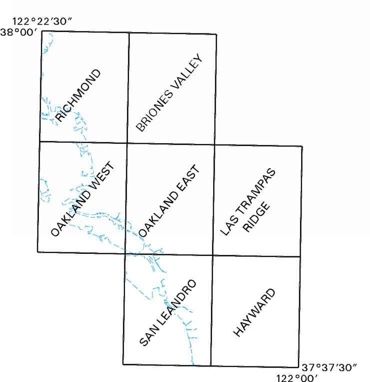
9. Some new mapping by author modifying Graymer and others (1996), Wagner (1978), Ham (1952), Dibblee (1980c), Aarons (1958), and Sonneman and Switzer (unpublished maps, 1961-62).

10. New mapping by author modifying Graymer and others (1996).

11. New mapping by author modifying Graymer and others (1996), Dibblee (1980b), Robinson (1956), and Wagner (1978).

12. Modified from Graymer and others (1994) and Wagner (1978).

See the pamphlet (oakmf.pdf, oakmf.ps, oakgeo.txt, oakgeo.pdf, or oakgeo.ps) for complete references.



INDEX MAP OF QUADRANGLES

Base derived from U.S. Geological Survey Digital Raster Graphic (DRG) files of Richmond (1980), Briones Valley (1968), Oakland West (1980), Oakland East (1980), Las Trampas Ridge (1980), San Leandro (1980), and Hayward (1980) 7.5 minute topographic quadrangles. DRG files available on the USGS Mapping Division San Francisco Bay area web-site: http://bard.wr.usgs.gov

Stateplane projection, California coordinate system, zone 3

MAP LOCATION

SCALE 1:50000

1 .5 0 1 2 3 4 5 MILE

1 .5 0 1 2 3 4 5 KILOMETER

0 1 2 3 4 5 6 7 8 9 10 11 THOUSAND FEET

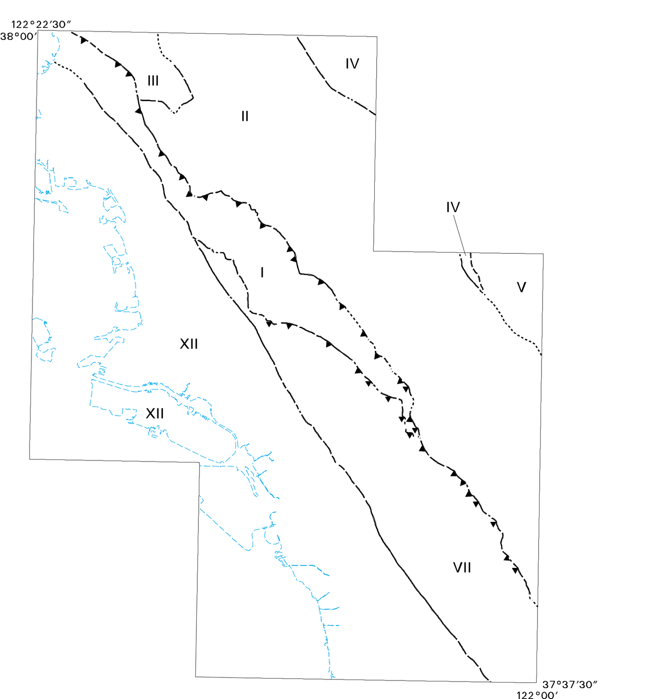
CONTOUR INTERVAL 50 METERS

TRUE NORTH
MAGNETIC NORTH
16.5°
APPROXIMATE MEAN DECLINATION, 1980

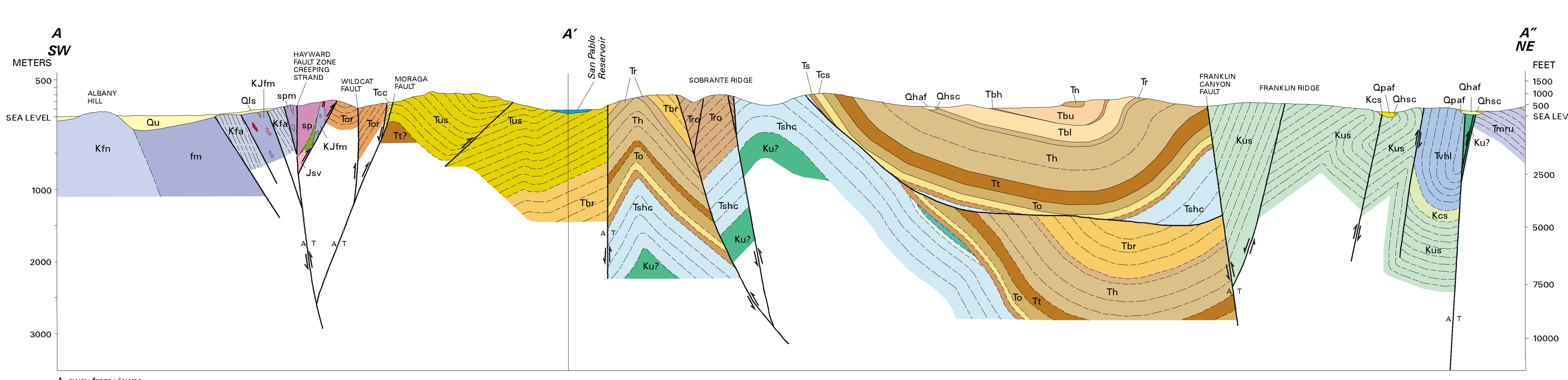
Digital Cartography by R.W. Graymer and R.E. Stamski, 1999-2000

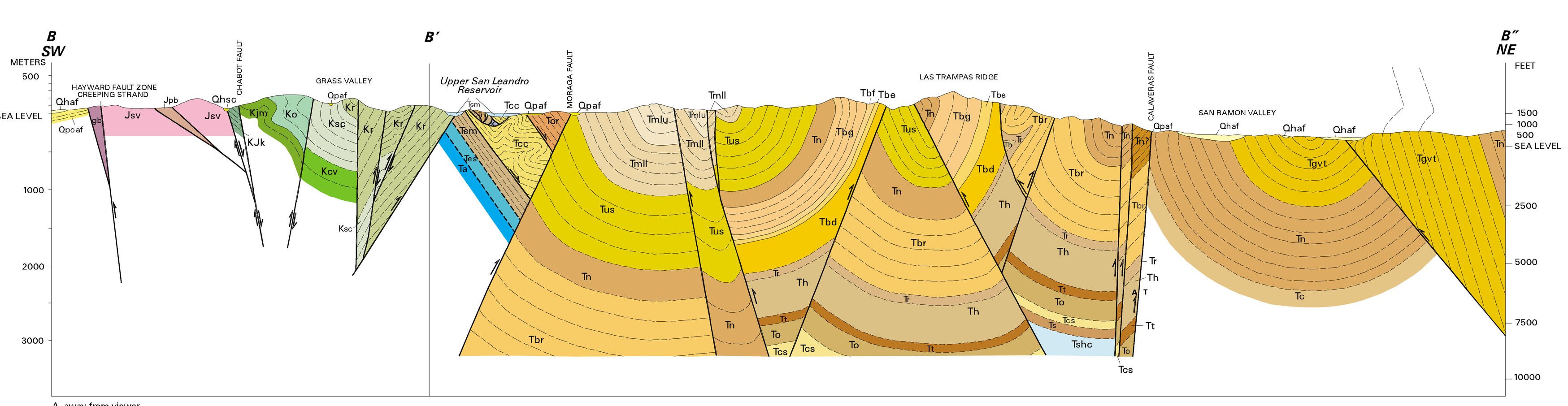
Edited by Jan Zigler

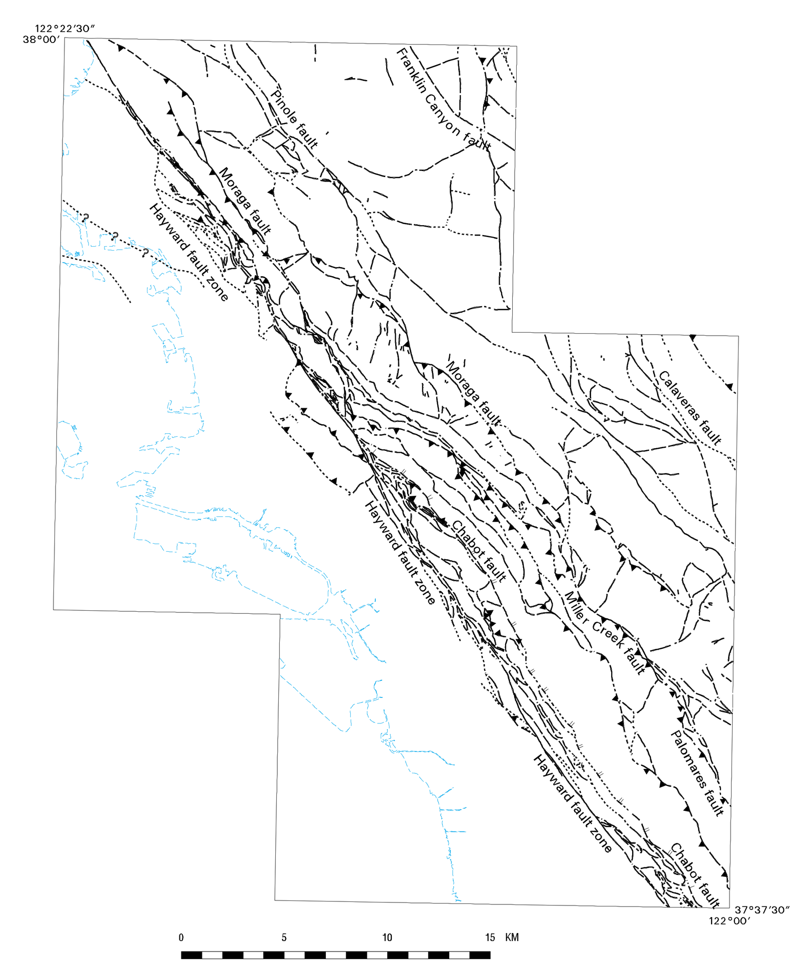
Manuscript approved for publication, June 21, 2000



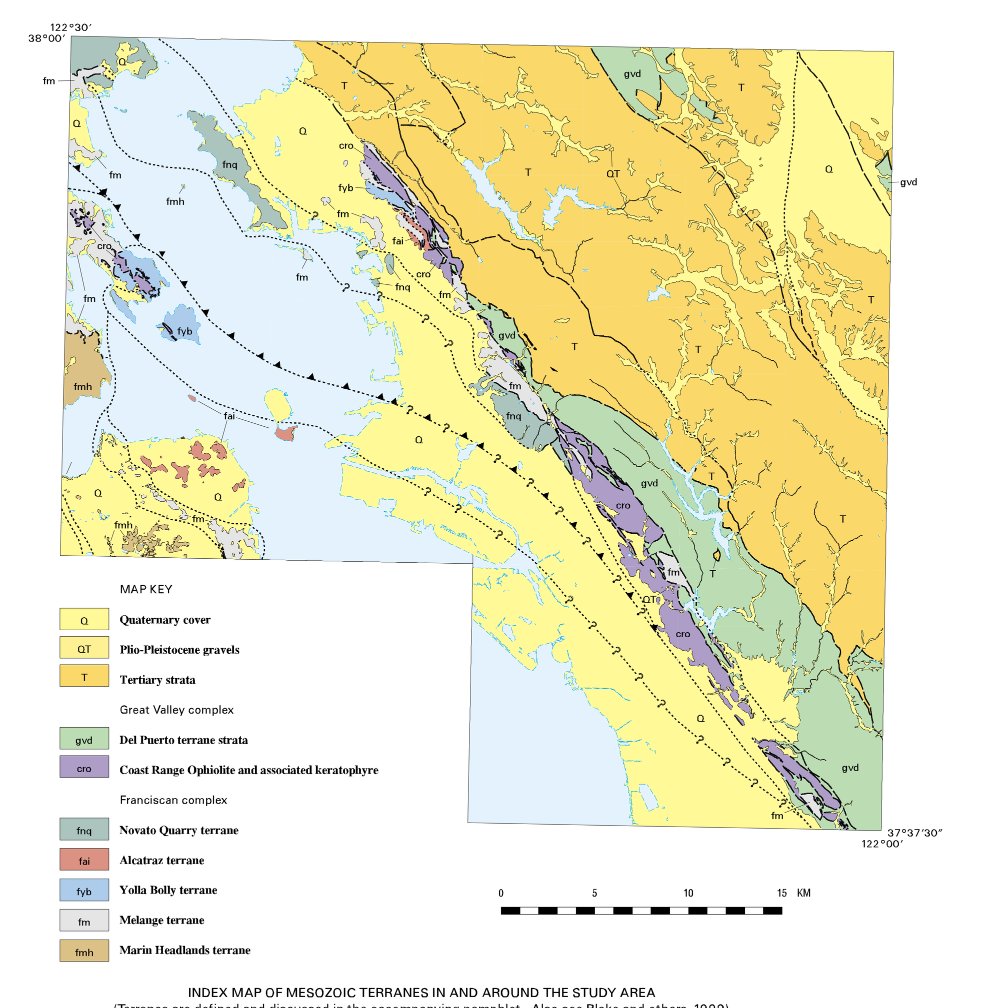
INDEX MAP OF ASSEMBLAGES
(Assemblages are defined and discussed in the accompanying pamphlet)







INDEX MAP OF FAULTS AND FAULT NAMES



INDEX MAP OF MESOZOIC TERRANES IN AND AROUND THE STUDY AREA
(Terranes are defined and discussed in the accompanying pamphlet. Also see Blake and others, 1999)

Digital data and cartography prepared using Arc/Info 7.1.2 running under Solaris 2.6 on a UNIX workstation.

This map was printed on an electronic plotter directly from digital files. Dimensional calibration may vary between electronic plotters and between X and Y directions on the same plotter, and paper may change size due to atmospheric conditions; therefore, scale and proportions may not be true on plots of this map.

For sale by U.S. Geological Survey, Map Distribution, Box 25286, Federal Center, Denver, CO 80225, 1-888-ASK-USGS

This publication also includes a digital geologic map (GIS) database. The data files, as well as digital versions of the map sheet and pamphlet, are available on the World Wide Web at: http://geopubs.wr.usgs.gov/map-mf/mf2342

GEOLOGIC MAP AND MAP DATABASE OF THE OAKLAND METROPOLITAN AREA, ALAMEDA, CONTRA COSTA, AND SAN FRANCISCO COUNTIES, CALIFORNIA

By
R.W. Graymer

2000

APPENDIX C

EPA Method 5035SC™ Soil Sampler
(Standard Operating Procedures)

1. Introduction

EPA Method 5035 is a closed-system purge-and-trap process for the analysis of volatile organic compounds (VOCs) in solid materials (e.g., soils, sediments, and solid waste). Although this method is designed for use on samples containing low levels of VOCs, procedures are also available for collecting and preparing solid samples containing high concentrations of VOCs and for oily wastes. Method 5035 may be used in conjunction with any appropriate determinative gas chromatographic procedure, including, but not limited to, Methods 8015, 8021, and 8260.

2. Sample Collection

The soil sample is collected using the 5035SC™ Sampler by removing the pre-cleaned plastic cap. The plunger is shipped in the forward position. Holding the wingtips on either side of the sampler body, the 5035SC™ Sampler is pushed into the soil to be sampled. Approximately 4.5 to 5.5 grams of dry to semi-dry soils will pack tightly into the body of the 5035SC™ Sampler, pushing the plunger back to its rear position. The patented plunger stop of the 5035SC™ Sampler sleeve prevents the plunger from exiting the body of the sampler. The filled soil sampler is then removed from the soil volume/interval and the airtight plastic cap is pushed over the open end of the sampler. The 5035SC™ Sampler is placed into a hermetically sealed reclosable polyethylene-shipping bag. Once the 5035SC™ Sampler is placed in the sampler-shipping bag and is tagged with the waterproof label, it is ready to be placed into the cooler with the dry ice to be kept at <-7° C. Chain-of-custody procedures are used to accompany the samples to the laboratory. All sampling activities are to be performed using sanitary, industrial grade, chemically resistant gloves.

3. Screening and Handling of Soil Samples

In order to provide valuable soil analysis data, lithologic variations and heterogeneity, both vertically and laterally, must be well characterized and understood so that representative soil samples are collected. Soil samples should be screened in the field with a meter that measures organic vapors, such as a photoionization detector (PID). Field screening gives a rough estimate of VOC concentration and other factors such as visual staining, soil discoloration and professional judgment should be used to pick the samples for EPA Method 5035.

After collecting the 4.5 to 5.5 grams of soil samples in the pre-cleaned 5035SC ™ Sampler, the sampler is sealed with an airtight inert plastic cap. The 5035SC ™ Sampler is then placed into a hermetically-sealed reclosable polyethylene shipping bag, with a waterproof label with date, time, sampler's name, sample number, site location, compounds of interest, chemical preservation techniques (if any), and laboratory equipment specifications or laboratory methods.

The 5035SC Samplers are then placed in a cooler with dry ice to ensure freezing of the 5035SC ™ Samplers. There must be adequate dry ice to cool the samples to <-7° C and that the temperature is maintained in the cooler during transport to the laboratory. The samples are labeled and shipped under chain-of-custody procedures to the state-approved laboratory for the requested analysis. The 5035SC ™ Samplers should not be frozen below –20° C.

A temperature blank (see Section 5) should be included with the samples so that the laboratory can verify the temperature upon receipt, and the arrival temperature of the samples should be noted on the chain-of-custody forms. Because the entire sampling device is to be submitted to the laboratory, a visual inspection of the seals is required to be noted on the chain-of-custody by the receiving person at the laboratory to verify that the 5035SC ™ Sampler is intact and sample volatilization has not occurred.

4. Holding Time

The 5035SC ™ Samplers preserved with dry ice the samples can be held at <-7° C for up to seven days prior to analysis from the sample collection date, providing the laboratory places the samples in a refrigerated environment or uses a chemical preservation method. Samples that are preserved with wet ice have a laboratory holding time of 48 hours.

5. Temperature Blank

Many laboratories expect three 5035SC ™ Samplers for each soil sampling point. For example, if a soil boring has 2 samples, one at 5 feet and one at 10 feet below ground surface, three 5035SC ™ Samplers are needed for each soil sampling point. A total of six 5035SC ™ Samplers is required for the two sampling points. On the receiving end, an infrared thermometer should be used to measure the temperature blank when the samples arrive at the laboratory.

APPENDIX D

GROUNDWATER MONITORING AND SAMPLING - STANDARD OPERATING PROCEDURES (SOP)

1. **Purposes**

This document focuses on the equipment, field procedures, and level of accuracy and quality control measures required for the groundwater monitoring and sampling program. Development of this SOP is to guide the ERS field staff to perform the groundwater monitoring and sampling jobs properly, to maintain consistency of field procedures, and to facilitate the assurance of the quality and reliability of data obtained from all groundwater monitoring events.

2. **Equipment**

Groundwater monitoring and sampling need the following equipment and supplies:

- Job description, site maps, chain-of-custody, field data forms and activity logs, indelible ink pen, watch, cell phone
- Hardhead, boots, safety vest/suit, and gloves
- Traffic control cones and tapes
- Water level indicator (sounder)
- Purging pump or bailers
- Water quality meter(s)
- Decon water, soap, and Liquinox® solution
- Sampling pump or bailers
- Laboratory-supplied sample bottles/containers
- Ice chest(s) with ice
- Waste storage drums and buckets
- Tools for opening well caps, string, tubing, and duck or Teflon tapes
- Multi-phase sounder, if needed.
- Health & Safety Plan

3. **Procedures**

Groundwater monitoring and sampling job include the following procedures, and should be performed in the designated order:

1. Job Preparation
2. Equipment Decontamination
3. Gauging of Groundwater Depth
4. Purging of Wells
5. Well Sampling
6. Handling of Groundwater Samples
7. Closing of Monitoring Event

Job Preparation

The following work should be conducted prior to arriving the site:

- Contact project manager
- Review job description, site direction, site maps, list of chemicals to be analyzed, H&SP
- Prepare chain-of-custody and sample labels
- Contact analytical lab for sample pickup
- Contact site manager 24 hours before sampling
- Calibrate water quality instruments daily
- Check equipment, supplies, and vehicle before departure

Equipment Decontamination

After checking in with the site manager, a decontamination area and traffic control cones should be setup prior to well gauging and sampling. Any non-dedicated downhole gauging, purging or sampling equipment should be decontaminated prior to use. Downhole equipment is scrubbed in a Liquinox® solution wash. Wash solution is also pumped through purging pumps and rinsed with potable water. The same equipment should be rinsed again with potable water or de-ionized water if the latter is required.

Gauging of Groundwater Depth

If local groundwater is under confined or semi-confined conditions, caps for all monitoring wells should be opened to allow atmospheric pressure to equalize for about 15 minutes prior to gauging. Depth to bottom for each well should be measured during the first monitoring event at the site. It is typically measured once every year or more frequently, if needed. The static water level is measured to the nearest 0.01 feet with an electronic water indicator. If historical analytical data for monitoring wells are not available, which can be used to establish an order of increasing contamination, the water level indicator should be decontaminated between wells. If floating product or separate-phase hydrocarbons (SPH) are suspected or observed within wells, a clear and open-ended bailer will be used to collect the product or SPH. The thickness is measured to the nearest 0.01 feet in the bailer. SPH may also be measured with an electronic interface probe. Any monitoring well containing a measurable thickness of SPH before or during purging will not be purged and sampled. Unless otherwise determined by the data conditions and specified by the project manager, wells containing hydrocarbon sheen are still sampled. Well conditions, water level and floating product thickness are recoded on appropriate data form.

Purging of Wells

Prior to groundwater sampling, each monitoring well is purged using either a bailer or a submersible pump. Water quality parameters of the purged water including pH, temperature and conductivity are measured during purging activities in order to determine if the water collected from the well is representative of the aquifer. If required, parameters such as dissolved oxygen, total dissolved solids, and turbidity etc. are also measured. Samples are considered representative if data reaches stability. Stability is defined as a change of pH in less than 0.25 pH units, change of conductivity less than 10% in μS, and change of temperature less than 1.0 degree centigrade or 1.8 degrees Fahrenheit. Selected quality parameters are measured in a discreet sample decanted from the bailer. Parameters are measured at least four times during purging: one before purging, and one each after purging each one casing volume. Purging continues until three well casing volumes of groundwater have been removed or until the well completely dewaters. Wells that dewater or demonstrate a slow recharge rate may still be sampled after less than three casing volumes have been removed. Well purging information is recorded on appropriate data form. Purge and rinsate water is sealed, labeled, and stored on site in D.O.T.-approved 55-gallon drums. These drums are either picked up by a disposal facility pending chemical profiling data provided to the facility or directly transported to the appropriate facility for disposal.

If groundwater recharges slowly during purging, groundwater samples are collected when the well has recovered to at least 80% of its static water level. If recharge rate is extremely slow, the well is allowed to recharge for at least two hours, if practicable, or until sufficient volume of water has accumulated in the well for sampling. A well should be sampled within 24 hours of purging. All purging equipment should be thoroughly decontaminated between each well.

Well Sampling

Groundwater samples are collected immediately after purging using polyethylene bailers, either disposable or dedicated to the well, or a low-rate peristaltic sampling pump. Samples being analyzed for volatile compounds are collected first. During sample collection for volatile organic analysis, the amount of air passing through the sample should be minimized. Sample bottles are filled slowly by running the collected water down the side of the bottle until there is a convex meniscus over the mouth of the bottle. The lid is carefully screwed onto the bottle such that no air bubbles are present within the bottle. If a bubble is present, the cap is removed and additional water is added to the sample container. After resealing the sample container, if bubbles still are present inside the bottle, the sample container should be discarded and the procedure is repeated with a new container.

Handling of Groundwater Samples

Collected samples are placed in appropriate laboratory-supplied containers, labeled, documented on a chain of custody form, and placed on ice in a chilled cooler for transport to a state-certified analytical laboratory. Analytical detection limits should match or surpass standards required by relevant local or regional guidelines.

Closing of Monitoring Event

The following work should be performed prior to leaving the site:

- Decon the equipment
- Cover/lock all wells
- Seal the drums that store purged water, and place them in a secure area
- Remove the cones/tapes and clean the ground
- Checkout with the site manager and call the project manager in the office

4. Quality Assurance (QC) Measures

To prevent contamination of the samples in the field, the following measures should be taken:

- Put on a clean pair of latex gloves prior to sampling each well;
- Gauge, purge and sample wells in the determined order of increasing degree of contamination based on historical analytical results; and
- Based on the site conditions, regulatory requirements, or clients' request, include trip blanks and equipment blanks to QC the sample handling and transportation procedures, and include duplicate samples to QC the lab procedures.

Trip blanks are prepared by the laboratory. They are transported to the site in the same manner along with other laboratory-supplied sample bottles/containers. The trip blank are not opened in the field, and are returned to the laboratory with the collected groundwater samples.

Equipment blanks are obtained in the field to determine if the field sampling equipment has been effectively decontaminated. The sampling equipment used to collect the groundwater samples is rinsed with distilled water, which is then decanted into laboratory-supplied containers. The equipment blanks are transported to the laboratory in the same manner along with other collected groundwater samples, and are analyzed for the same chemical constituents as the groundwater samples collected at the site.

Duplicates are collected at the same time with other groundwater samples. They are analyzed for the same chemical constituents in order to verify the repeatability of laboratory procedures. Number of duplicates is determined based on the number of monitoring wells and the size of the monitoring program. The duplicates are assigned identification numbers that are not associated with the well identification.

APPENDIX E

HEALTH AND SAFETY PLAN

Former Sekhon Gas Station

6600 Foothill Blvd

Oakland, CA 94605

Case # RO000175

Prepared for:

Ravi Sekhon

Prepared by:

Environmental Risk Services, Corporation
Walnut Creek, California

October 2008

Table of Contents

LIST OF FIGURES

APPENDICES

1. ORGANIZATIONAL STRUCTURE

This section describes lines of authority, responsibility and communication as they pertain to health and safety functions of the site. The purpose of this section is to identify the personnel who impact the development and implementation of the site health and safety plan and to describe their roles and responsibilities. This section also identifies other contractors and subcontractors involved in work operations and establishes the lines of communication among them for safety and health matters.

The content of this site Health and Safety Plan (HASP) is consistent with OSHA requirements in 29 CFR 1910.120(b)(2) and provides the following site-specific information:

- The general supervisor who has the responsibility and authority to direct all hazardous waste operations
- The site safety and health officer who has the responsibility and authority to develop and implement this HASP and verify compliance
- Other personnel needed for hazardous waste operations and emergency response and their general functions and responsibilities
- The lines of authority, responsibility and communication for safety and health functions

1.1 ROLES AND RESPONSIBILITIES

All Personnel and visitors on this site must comply with the requirements of this HASP. The specific responsibilities and authority of management, safety and health, other personnel on this site are detailed in the following paragraphs.

1.1.1 Project Manager

The Project Manager (PM) for this site is Jim Ho. The PM has responsibility and authority to direct all work operations. The PM coordinates safety and health functions with the Site Safety and Health Officer (SSHO), has the authority to oversee and monitor the performance of the SSHO, and bears ultimate responsibility for the proper implementation of this HASP. The specific duties of the PM are:

Preparing and coordinating the site work plan; providing site supervisor(s) with work assignments and overseeing their performance; coordinating safety and health efforts with the SSHO; ensuring effective emergency response through coordination with the Emergency Response Coordinator (ERC); serving as primary site liaison with public agencies and officials and site contractors.

The qualified alternate Project Manager (PM) is Tyson Fulmer

1.1.2 Site Workers

Site workers are responsible for complying with this HASP, using the proper PPE, reporting unsafe acts and conditions and following the work and safety and health instructions of the PM, Site Safety and Health Officer (SSHO), and Site Supervisor.

1.2 IDENTIFICATION OF OTHER SITE CONTRACTORS

The other contractor and subcontractors on this site who could be affected by the tasks and operations associated with this work plan and HASP are listed in Table 1-2 below.

Table 1-1 Other Site Contractors and Subcontractors

Company	Function
Undermined	Drilling Services

1.3 STATE/FEDERAL AGENCY REPRESENTATIVES AND THEIR ROLES AND RESPONSIBILITIES

The Lead Agency Representative for this site is Paresh Kahtri, representing the Alameda County Environmental Health (ACEH). Serving either in the capacity as On-Scene Coordinator (OSC), Remedial Project Manager (RPM), or Site Inspection Officer (SIO), the Representative is responsible for overall project administration and contractor oversight. As part of that oversight function, EPA will ensure that project plans meet OSHA requirements at a minimum, and that the health and safety of all site personnel is a primary concern. As an OSC or RPM, EPA serves in the capacity of site supervisor.

Table 1-2 Contact Information

Name	Title	Organization	Phone Number
Jim Ho	Project Manager	ERS Corp	(925) 938-1600 ext108
Tyson Fulmer	Alternate PM	ERS Corp	(925) 938-1600 ext104
Paresh Kahtri	Haz Mat Specialist	ACEH	(510) 777-2478

2. JOB HAZARD ANALYSIS

(In compliance with 29 CFR 1910.120(b)(4)(ii)(A), and 1910.120(i))

- Site description
- Hazardous substance information

The organization responsible for ongoing hazard analysis at the site is ERS Corp.

2.1 SITE DESCRIPTION/HISTORY

The Site is located at 6600 Foothill Boulevard, Oakland, California, on the northeastern corner of Havenscourt Boulevard and Foothill Boulevard (Figure 1). Ground surface elevation of the site is approximately 60 feet above msl. Regional topography of the site slopes gently toward the south-southwest direction. The site is located in an area with mixed commercial and residential uses. It is currently occupied by a retail gasoline station (Golden Gasoline) that includes a convenience store and two gasoline dispenser islands. Each dispenser island has two dispensers.

The property is bounded by an empty commercial building to the east, Foothill Boulevard to the south, Havenscourt Boulevard to the west and Evergreen Cemetery to the north. Across the street of Foothill Boulevard is an empty former gas station lot at the corner of Havenscourt Boulevard and Foothill Boulevard (Figure 2). Adjacent to the empty lot is a two-story residential building with store.

The site has been a retail gas station since 1959 and was formerly operated as Shell, ARCO, and BEACON gasoline stations. The underground storage tank (UST) system of the former gas stations consisted of one 8,000-gallon single wall steel UST, two 10,000-gallon single wall fiberglass USTs, two dispenser islands, and two dispensers on each dispenser island. Mr. Ravi Sekhon purchased the property from the BEACON gas station in 1998.

2.1 CONSTITUENTS OF POTENTIAL CONCERN (COPC)

The COPCs at 6600 Foothill Blvd include TPHg, MTBE, BTEX (Benzene, toluene, ethyl and xylene). None of these constituents however, have been measured above PRG or NIOSH REL exposure limits in the soil.

3. EMPLOYEE NOTIFICATION OF HAZARDS AND OVERALL SITE INFORMATION PROGRAM

The information in the JHAs and the attached data sheets is made available to all employees who could be affected by it prior to the time they begin their work activities. Modifications to JHAs and the accompanying data sheets are communicated during routine briefings.

Consistent with paragraph (i) of HAZWOPPER, we also inform other contractors and subcontractors about the nature and level of hazardous substances at this site, and the likely degree of exposure to workers who participate in site operations.

The party responsible for providing site information, this HASP and any modifications to the HASP to other contractors and subcontractors working on this site is ERS Corp.

3.1 Site Specific JHAs

<table>
<tr><th colspan="9">Table 3.1: Site Specific Job Hazard Analysis</th></tr>
<tr><td>Phase</td><td colspan="2">Task</td><td colspan="5">Location</td><td>Date</td></tr>
<tr><td>1</td><td colspan="2">Drilling and Well Construction</td><td colspan="5">Sampling Boundaries</td><td>1/2008</td></tr>
<tr><td colspan="4">Organization Certifying JHA</td><td colspan="5">Signature</td></tr>
<tr><td colspan="4">ERS Corp</td><td colspan="5"></td></tr>
<tr><td colspan="9">Chemical Hazards</td></tr>
<tr><td colspan="2">Chemical Name</td><td colspan="3">Source</td><td colspan="2">Concentration</td><td colspan="2">Exposure Limit</td></tr>
<tr><td colspan="2">TPHg
Benzene</td><td colspan="3">Former storage tanks</td><td colspan="2">21-35ppm
0.88-1.3ppm</td><td colspan="2">TWA:500ppm,
TWA:2.5ppm</td></tr>
<tr><td colspan="9">Biological Hazards</td></tr>
<tr><td colspan="2">Name of Biological Hazard</td><td colspan="4">Source</td><td colspan="3">Exposure Potential</td></tr>
<tr><td colspan="2">None</td><td colspan="4">None</td><td colspan="3">Unlikely</td></tr>
<tr><td colspan="9">Physical Hazards</td></tr>
<tr><td colspan="2">Name of Physical Hazard</td><td colspan="3">Source</td><td colspan="2">Exposure Level/ Potential</td><td colspan="2">Exposure Limit</td></tr>
<tr><td colspan="2">Noise, Heavy machinery</td><td colspan="3">Drilling Rig</td><td colspan="2">Likely</td><td colspan="2">NA</td></tr>
<tr><td colspan="9">Control Measures Used</td></tr>
<tr><td colspan="9">Engineering Controls:</td></tr>
<tr><td colspan="9">Work Practices:
Skin and Eye Protection:
Workers at the site will wear protective clothing and latex protective gloves while on site. Clothing should be changed on a daily basis and rinsed before reuse. Steel-toed boots with steel shank are recommended for working at site.
Ingestion Protection:
Workers should refrain from eating, drinking and smoking on site. Any food or drink that is consumed during work hours should be stored at a location off site and covered from exposure. Workers should thoroughly wash hands with soap and water before the consumption of any food. With any symptoms of ingestion related exposure, listed in the NIOSH information, worker should leave site and seek medical attention.
Operational Hazards:
Workers on site will be required to wear ear protection during heavy equipment operations. Workers are instructed to stay beyond the borders of heavy equipment operations area when in use. All employees will use hardhats at all times.
A PID will be used to measure concentrations on site, when levels above the exposure limits are recorded, site personnel will be evacuated</td></tr>
<tr><td colspan="4">Level of PPE: D</td><td colspan="5">Respirator Cartridge/Canister: N/A</td></tr>
</table>

4. SITE CONTROL

(in compliance with 29CFR 1910.120(b)(4)(ii)(F) and 29CFR 1910.120(d))

This site control program is designed to reduce the spread of hazardous substances from contaminated areas to clean area, to identify and isolate contaminated areas of the site, to facilitate emergency evacuation and medical care, to prevent unauthorized entry to the site and to deter vandalism and theft.

The site control program includes the elements specified in 29 CFR 1910.120(d) and provides the following site-specific information:

- A site map including site perimeter and work zones
- Site security
- Site access procedures
- Site work zones including standard operating procedures
- Use of the buddy system both internal (on-site) and external communications

Tyson Fulmer is responsible for evaluating site conditions and for verifying that the site control program functions effectively. The site control program is updated regularly to reflect the current site conditions, work operations and procedures.

4.1 SITE MAP

A map of this site, showing site boundaries, well and boring locations, and the location of the former tanks, is provided in Figure 2.

4.2 SITE ACCESS

The site is currently an active fueling station and access to this site is not restricted. However, during active investigation or remediation efforts on site personnel are expected to comply with the requirements of this HASP if they are operating in the site work zone. Visitors who want to enter the work zone must have the required training and medical evaluation and receive a site specific briefing about protecting themselves from site hazards, recognizing site zone demarcations and following emergency evacuation procedures. PPE for visitors will be provided by ERS corp.

4.3 SITE SECURITY

Security at the site is maintained during both working hours and non-working hours to prevent unauthorized entry; removal of contaminated material from the exclusion zone; exposure of unauthorized, unprotected people to site hazards and increased hazards due to vandalism and theft.

Tyson Fulmer is responsible for establishing and maintaining site security during work hours. This site takes the following measures for security during working hours:

ERS is responsible for establishing and maintaining site security during non-working hours.

4.4 SITE WORK ZONES

The biological, chemical and physical hazards associated with 6600 Foothill Blvd are not serious enough to establish zone divisions and decontamination facilities. Non-workers are instructed to stay outside of the boundaries of 6600 Foothill Blvd. Workers are instructed to decon within the site boundaries so as not to track the contaminants outside off site.

4.5 BUDDY SYSTEM

The site conditions are not serious enough to establish a buddy system among workers or any other personnel.

4.6 HAND SIGNALS

There will be times during the earth moving process that the excessive noise will require the use of hand signals. Any communication between the operator and the project manager or any other personnel will be established before the commencement of any heavy equipment operations.

4.7 EMERGENCY MEDICAL ASSISTANCE

The nearest emergency medical facility selected to support this site is

Organization:	Highland Hospital
Contact:	Emergency Medical Services
Address and Location:	1411 E 31st St
	Oakland, CA 94602
Telephone:	(510) 437-8497

A map to this facility is located in this document (Figure 3)

5. MEDICAL SURVEILLANCE

(in compliance with 29CFR 1910.120(f) and other substance-specific medical surveillance requirements found in 29CFR 1910.1001-1052)

The medical surveillance section of the HASP describes how worker health status is monitored at this site. Medical surveillance is used when there is the potential for worker exposure to hazardous substance at levels above OSHA permissible exposure limits or other published limits. The purpose of a medical surveillance program is to medically monitor worker health to ensure that personnel are not adversely affected by sire hazards. The provisions for medical surveillance at this site are based on the site characterization and job hazard analysis found in chapter 3 of this HASP and are consistent with OSHA requirements in 29 CFR 1910.120(f) and the following substance-specific requirements: TPH gasoline, Benzene, Toluene, Ethylene, Xylenes, and MTBE.

The medical surveillance program is consistent with 29CFR 1910.120(f) and addresses the following information:

- Provisions of the site medical surveillance program
- Communication between the site, physician, and workers
- Medical recordkeeping procedures

The person responsible for ensuring the implementation of this program is Tyson Fulmer

6. PERSONAL PROTECTIVE EQUIPMENT

(in compliance with 29CFR 1910.120(b)(4)(ii) and 29CFR 1910.120(g))

This chapter of the HASP describes how personal protective equipment (PPE) is used to protect against employee exposures to hazardous substances and hazardous conditions on this site. Exposure to hazards from the decontamination process is also considered . The following topics are addressed in this chapter.

- PPE selection criteria
- Training in use of PPE
- Respiratory protection

ERS Corp is in charge of the PPE program for this site

6.1 PPE SELECTION CRITERIA:

Site safety and health hazards are eliminated or reduced to the greatest possible extent through engineering controls and work practices. Where hazards are still present, a combination of engineering controls, work practices, and PPE are used to protect employees.

Based on the current and foreseeable conditions present at 6600 Foothill Blvd, ERS Corp has determined the level of PPE.

6.2 TRAINING IN USE OF PPE

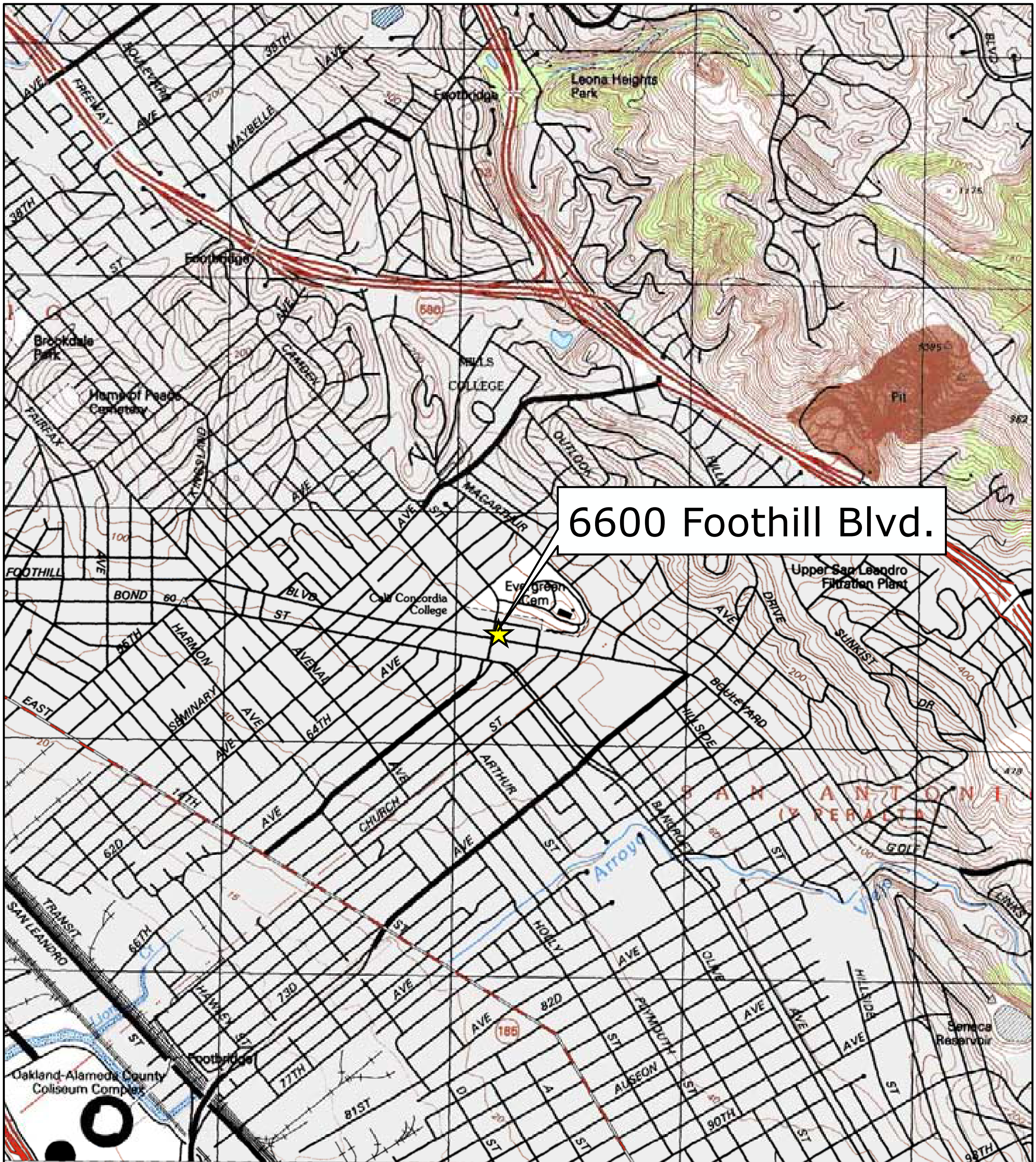
ERS Corp will notify on site personnel of the PPE standards and how to fulfill them.

6.3 RESPIRATORY PROTECTION

The site conditions are not critical enough to require any respiratory protection

Table 6-1 Site Specific PPE Ensembles

Level D		
Equipment	Material	Model
Coveralls/ Standard Work Clothes	Durable cotton	
Boots/ Shoes, Chemical resistant steel toe w/ shank	Leather	Redwings, CATs, etc..
Safety Glasses	Shatterproof poly carbon	Uvex, etc..
Hardhat	Durable plastic	
Gloves	Nitrile	

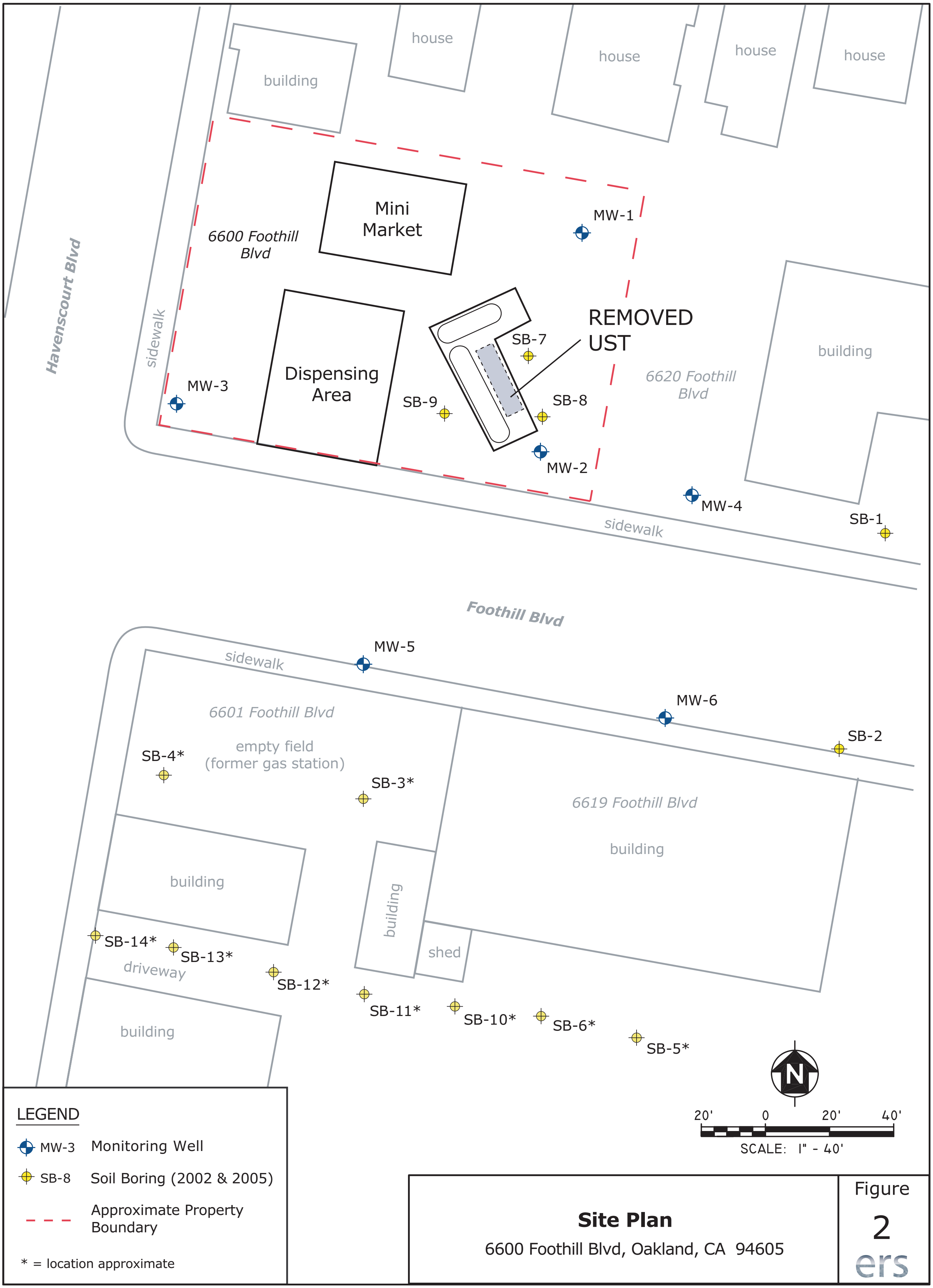


Vicinity Map

6600 Foothill Blvd, Oakland, CA

Figure 1

Environmental Risk Services Corporation



Site Plan

6600 Foothill Blvd, Oakland, CA 94605

Figure 2

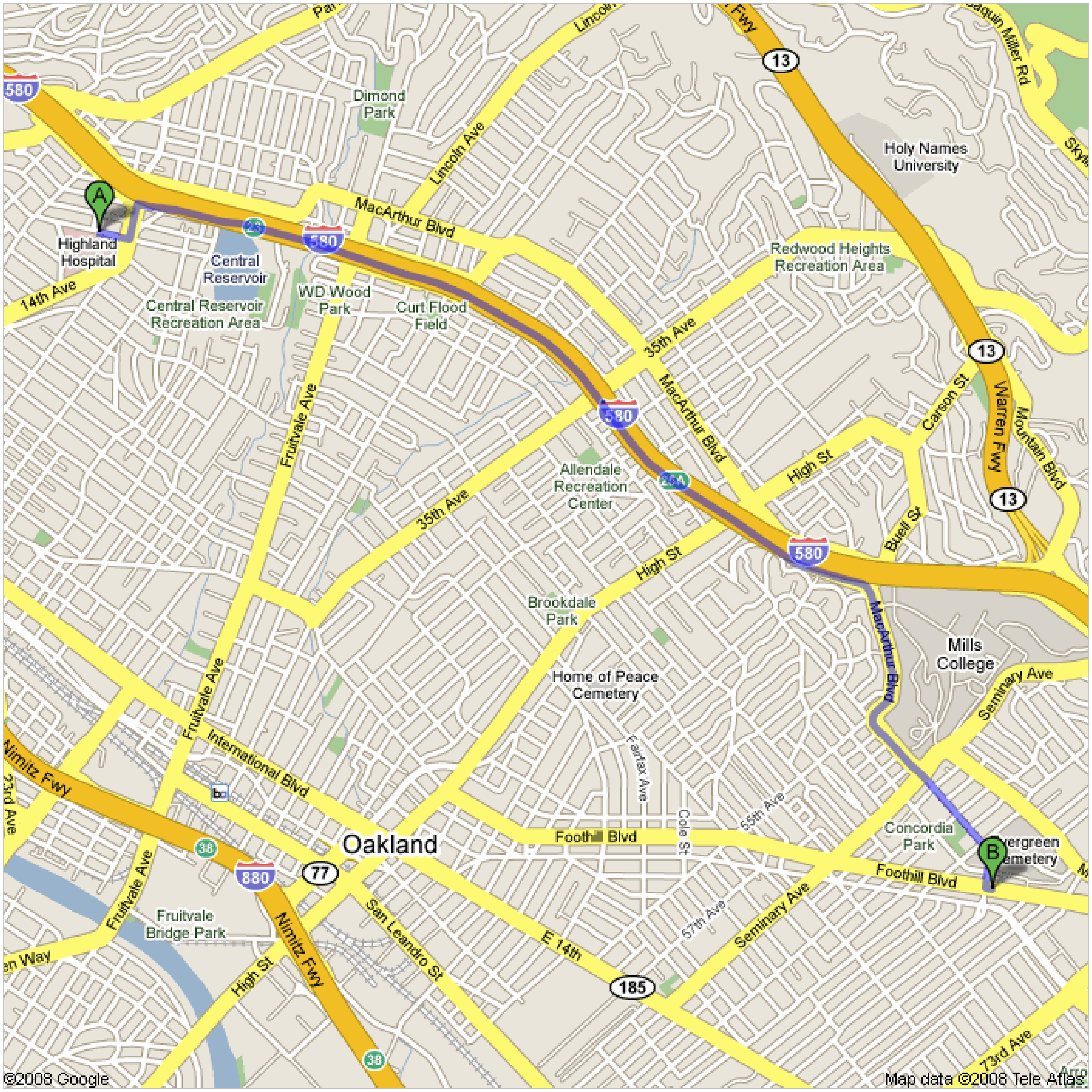
ers

Environmental Risk Services Corporation

Google Maps

Directions to 6600 Foothill Blvd, Oakland, CA 94605

3.9 mi – about **9 mins**



Highland Hospital
1411 E 31st St
Oakland, CA 94602

1.	Head **east** on **E 31st St** toward **14th Ave**	go 466 ft total 466 ft
2.	Turn **left** at **Beaumont Ave** About 1 min	go 0.1 mi total 0.2 mi
3.	Turn **right** to merge onto **I-580 E** toward **Hayward** About 3 mins	go 2.1 mi total 2.3 mi
4.	Take the **MacArthur Blvd** exit	go 0.4 mi total 2.7 mi
5.	Turn **right** at **MacArthur Blvd** About 2 mins	go 0.7 mi total 3.4 mi
6.	Continue on **Camden St** About 2 mins	go 0.4 mi total 3.8 mi
7.	Continue on **Havenscourt Blvd**	go 253 ft total 3.9 mi
8.	Turn **left** at **Foothill Blvd** Destination will be on the left	go 125 ft total 3.9 mi

6600 Foothill Blvd
Oakland, CA 94605

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

NIOSH Pocket Guide to Chemical Hazards

Gasoline	**CAS** 8006-61-9
	RTECS LX3300000
Synonyms & Trade Names Motor fuel, Motor spirits, Natural gasoline, Petrol [Note: A complex mixture of volatile hydrocarbons (paraffins, cycloparaffins & aromatics).]	**DOT ID & Guide** 1203 128

Exposure Limits	NIOSH REL: Ca See Appendix A
	OSHA PEL†: none
IDLH Ca [N.D.] See: IDLH INDEX	**Conversion** 1 ppm 2.95 mg/m^3 (approx)

Physical Description
Clear liquid with a characteristic odor.

MW: 72 (approx)	BP: 102°F	FRZ: ?	Sol: Insoluble
VP: 38-300 mmHg	IP: ?		Sp.Gr(60°F): 0.72-0.76
Fl.P: -45°F	UEL: 7.6%	LEL: 1.4%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Strong oxidizers such as peroxides, nitric acid & perchlorates

Measurement Methods
OSHA PV2028
See: NMAM or OSHA Methods

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation Provide: Eyewash, Quick drench	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Important additional information about respirator selection
Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid); possible liver, kidney damage; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys

Cancer Site [in animals: liver & kidney cancer]

See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

Benzene	**CAS** 71-43-2
C_6H_6	**RTECS** CY1400000
Synonyms & Trade Names Benzol, Phenyl hydride	**DOT ID & Guide** 1114 130

Exposure Limits	NIOSH REL: Ca TWA 0.1 ppm ST 1 ppm See Appendix A
	OSHA PEL: [1910.1028] TWA 1 ppm ST 5 ppm See Appendix F

IDLH Ca [500 ppm] See: 71432	**Conversion** 1 ppm = 3.19 mg/m^3

Physical Description
Colorless to light-yellow liquid with an aromatic odor. [Note: A solid below 42°F.]

MW: 78.1	BP: 176°F	FRZ: 42°F	Sol: 0.07%
VP: 75 mmHg	IP: 9.24 eV		Sp.Gr: 0.88
Fl.P: 12°F	UEL: 7.8%	LEL: 1.2%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Strong oxidizers, many fluorides & perchlorates, nitric acid

Measurement Methods
NIOSH 1500, 1501, 3700, 3800; OSHA 12, 1005
See: NMAM or OSHA Methods

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation Provide: Eyewash, Quick drench	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Important additional information about respirator selection
Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, blood, central nervous system, bone marrow

Cancer Site [leukemia]

See also: INTRODUCTION See ICSC CARD: 0015 See MEDICAL TESTS: 0022

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NIOSH Pocket Guide to Chemical Hazards

Toluene	**CAS** 108-88-3
$C_6H_5CH_3$	**RTECS** XS5250000
Synonyms & Trade Names Methyl benzene, Methyl benzol, Phenyl methane, Toluol	**DOT ID & Guide** 1294 130

Exposure Limits	NIOSH REL: TWA 100 ppm (375 mg/m^3) ST 150 ppm (560 mg/m^3)
	OSHA PEL†: TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)
IDLH 500 ppm See: 108883	**Conversion** 1 ppm = 3.77 mg/m^3

Physical Description
Colorless liquid with a sweet, pungent, benzene-like odor.

MW: 92.1	BP: 232°F	FRZ: -139°F	Sol(74°F): 0.07%
VP: 21 mmHg	IP: 8.82 eV		Sp.Gr: 0.87
Fl.P: 40°F	UEL: 7.1%	LEL: 1.1%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Strong oxidizers

Measurement Methods
NIOSH 1500, 1501, 3800, 4000; OSHA 111
See: NMAM or OSHA Methods

Personal Protection & Sanitation
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Important additional information about respirator selection
Respirator Recommendations NIOSH
Up to 500 ppm: (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*/(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/(APF = 10) Any supplied-air respirator*/(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION See ICSC CARD: 0078 See MEDICAL TESTS: 0232

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International Chemical Safety Cards

ETHYLENE

ICSC: 0475

National Institute for Occupational Safety and Health

Ethene
C_2H_4 / CH_2=CH_2
Molecular mass: 28.0
(cylinder)

ICSC # 0475
CAS # 74-85-1
RTECS # KU5340000
UN # 1962
EC # 601-010-00-3
March 25, 1996 Peer reviewed

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Extremely flammable.	NO open flames, NO sparks, and NO smoking.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out; in other cases extinguish with water spray.
EXPLOSION	Gas/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding). Use non-sparking handtools.	In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE			
•INHALATION	Drowsiness. Unconsciousness.	Ventilation.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
•SKIN			
•EYES			
•INGESTION			

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Ventilation. Remove all ignition sources and turn off gas at source if possible. Personal protection: chemical protection suit including self-contained breathing apparatus.	Fireproof. Separated from strong oxidants.	F+ symbol R: 12-67 S: 2-9-16-33-46 UN Hazard Class: 2.1

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0475

International Chemical Safety Cards

ETHYLENE

ICSC: 0475

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS COMPRESSED GAS , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The gas is lighter than air. As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
The substance may polymerize to form aromatic compounds under the influence of temperatures above 600°C. Reacts with strong oxidants causing fire and explosion hazard.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 200 ppm as TWA A4 (not classifiable as a human carcinogen); (ACGIH 2005).
MAK:
Carcinogen category: 3B;
(DFG 2005).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation.

INHALATION RISK:
On loss of containment this gas can cause suffocation by lowering the oxygen content of the air in confined areas.

EFFECTS OF SHORT-TERM EXPOSURE:
Exposure could cause lowering of consciousness.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:

PHYSICAL PROPERTIES

Boiling point: -104°C
Melting point: -169.2°C
Solubility in water:
none
Vapour pressure, kPa at 15°C: 8100

Relative vapour density (air = 1): 0.98
Flash point: Flammable Gas
Auto-ignition temperature: 490°C
Explosive limits, vol% in air: 2.7-36.0

ENVIRONMENTAL DATA

NOTES

High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. Check oxygen content before entering area.

Transport Emergency Card: TEC (R)-20S1962
NFPA Code: H1; F4; R2;

ADDITIONAL INFORMATION

ICSC: 0475 ETHYLENE

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NIOSH Pocket Guide to Chemical Hazards

p-Xylene	**CAS** 106-42-3
$C_6H_4(CH_3)_2$	**RTECS** ZE2625000
Synonyms & Trade Names 1,4-Dimethylbenzene; para-Xylene; p-Xylol	**DOT ID & Guide** 1307 130

Exposure Limits	NIOSH REL: TWA 100 ppm (435 mg/m^3) ST 150 ppm (655 mg/m^3)
	OSHA PEL†: TWA 100 ppm (435 mg/m^3)
IDLH 900 ppm See: 95476	**Conversion** 1 ppm = 4.41 mg/m^3

Physical Description
Colorless liquid with an aromatic odor. [Note: A solid below 56°F.]

MW: 106.2	BP: 281°F	FRZ: 56°F	Sol: 0.02%
VP: 9 mmHg	IP: 8.44 eV		Sp.Gr: 0.86
Fl.P: 81°F	UEL: 7.0%	LEL: 1.1%	

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities
Strong oxidizers, strong acids

Measurement Methods
NIOSH 1501, 3800; OSHA 1002
See: NMAM or OSHA Methods

Personal Protection & Sanitation
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Important additional information about respirator selection
Respirator Recommendations NIOSH/OSHA
Up to 900 ppm: (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*/(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*/(APF = 10) Any supplied-air respirator*/(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

See also: INTRODUCTION See ICSC CARD: 0086 See MEDICAL TESTS: 0243

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International Chemical Safety Cards

METHYL TERT-BUTYL ETHER

ICSC: 1164

National Institute for Occupational Safety and Health

tert-Butyl methyl ether
MTBE
Methyl-1,1-dimethylethyl ether
2-Methoxy-2-methyl propane
$(CH_3)_3COCH_3$ / $C_5H_{12}O$
Molecular mass: 88.2

ICSC # 1164
CAS # 1634-04-4
RTECS # KN5250000
UN # 2398
EC # 603-181-00-X
April 11, 2000 Peer reviewed

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking. NO contact with oxidants.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
•INHALATION	Drowsiness. Dizziness. Headache. Weakness. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
•SKIN	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES	Redness.	Safety goggles or face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal pain. Nausea. Vomiting. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Remove all ignition sources. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Personal protection: filter respirator for organic gases and vapours.	Fireproof. Separated from strong oxidants, strong acids.	F symbol Xi symbol R: 11-38 S: 2-9-16-24 UN Hazard Class: 3 UN Packing Group: II

SEE IMPORTANT INFORMATION ON BACK

ICSC: 1164

International Chemical Safety Cards

METHYL TERT-BUTYL ETHER

ICSC: 1164

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The vapour is heavier than air and may travel along the ground; distant ignition possible.

CHEMICAL DANGERS:
Reacts violently with strong oxidants causing fire hazard. The substance decomposes on contact with acids.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 50 ppm as TWA; A3; (ACGIH 2004).
MAK: 50 ppm, 180 mg/m³;
Peak limitation category: I(1.5); Carcinogen category: 3B;
Pregnancy risk group: C;
(DFG 2004).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation and by ingestion.

INHALATION RISK:
A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the skin. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. Exposure far above the OEL could cause lowering of consciousness.

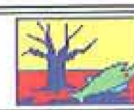
EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:

PHYSICAL PROPERTIES

Boiling point: 55°C
Melting point: -109°C
Relative density (water = 1): 0.7
Solubility in water, g/100 ml at 20°C: 4.2
Vapour pressure, kPa at 20°C: 27
Relative vapour density (air = 1): 3.0
Relative density of the vapour/air-mixture at 20°C (air = 1): 1.5
Flash point:
-28°C c.c.
Auto-ignition temperature: 375°C
Explosive limits, vol% in air: 1.6-15.1
Octanol/water partition coefficient as log Pow: 1.06

ENVIRONMENTAL DATA

It is strongly advised not to let the chemical enter into the environment because it persists in the environment.



NOTES

Much less likely to form peroxides than other ethers. Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

Transport Emergency Card: TEC (R)-30GF1-I+II

ADDITIONAL INFORMATION

ICSC: 1164 **METHYL TERT-BUTYL ETHER**

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I have read and understand the risks associated with this site according to the Site Health and Safety Plan. I will make an effort to comply with the recommendations laid out in this plan to assure my safety and the safety of others.

Name (print)	**Organization**	**Signature**

CERTIFICATION

This document was prepared under the supervision of a State of California Professional Engineer at Environmental Risk Specialties Corporation (ERS). All statements, conclusions, and recommendations are based solely upon published results from previous consultants, field observations by ERS, and laboratory analysis performed by a California DHS-certified laboratory related to the work performed by ERS.

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Sincerely,

ENVIRONMENTAL RISK SPECIALTIES CORPORATION

LICENSED PROFESSIONAL ENGINEER
JIMMY N. HO
062.059381
Exp. 9/30/09
STATE OF ILLINOIS

Jim Ho, PE #C68639