BUTTNER PROPERTIES, INC.

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November 14, 2011

Alameda County Environmental Health Services
Local Oversight Program
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Attention: Ms. Barbara Jakub, Hazardous Materials Specialist

RE: Dave's Station
2250 Telegraph Avenue
Oakland, California

Dear Ms. Jakub:

The "Corrective Action Plan, 2250 Telegraph Avenue, Oakland, California dated November 21, 2011 " ("Report") was prepared by our consultant, Fugro West, Inc. ("Fugro"), who we believe to be experienced and qualified to advise us in a technical area that requires a high degree of professional expertise. Therefore we have relied upon Fugro's assistance, knowledge and expertise in their preparation of the Report. I am unaware of any material inaccuracy in the information in the Report or of any violation of government guidelines that are applicable to the Report. Accordingly, I am not aware of any reason to question the conclusions and recommendations contained in the Report.

This letter is submitted pursuant to the requirements of California Water Code Section 13267(b)(1).

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Sincerely,

Marianne Robison

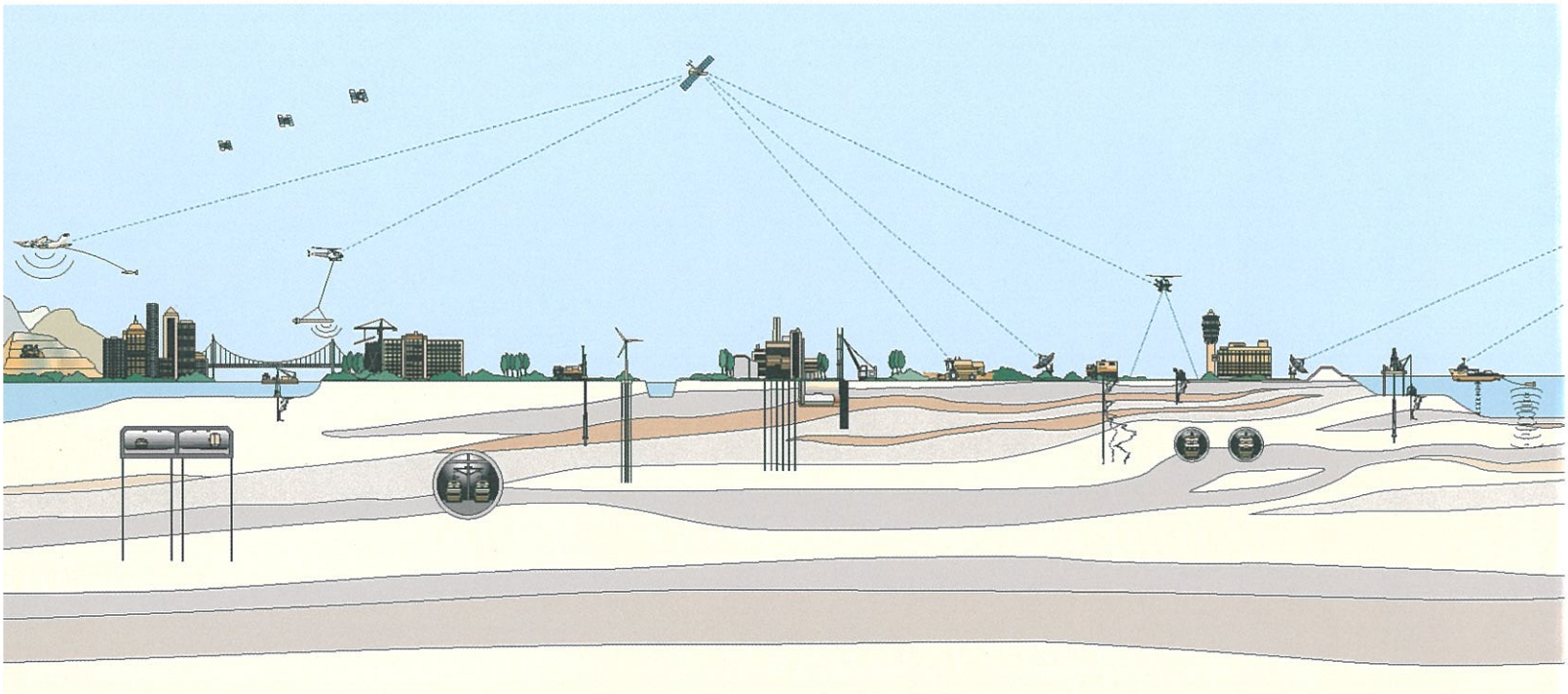
Marianne Robison
President

FUGRO CONSULTANTS, INC.

CORRECTIVE ACTION PLAN
2250 TELEGRAPH AVENUE
OAKLAND, CALIFORNIA

Prepared for:
ALAMEDA COUNTY ENVIRONMENTAL HEALTH

November 2011
Fugro Project No. 04.B0609004



FUGRO CONSULTANTS, INC.

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November 21, 2011
Project No. 04.B0609004

Ms. Barbara Jakub, Hazardous Materials Specialist
Alameda County Health Care Services Agency
1161 Harbor Bay Parkway, Suite 250
Alameda, CA 94502

Subject: Corrective Action Plan, Dave's Station, 2250 Telegraph Avenue, Oakland, California, RO#00000359, GeoTracker Global ID T0600100431

Dear Ms. Jakub:

Fugro Consultants, Inc. (Fugro) is pleased to present this Corrective Action Plan (CAP) for the property located at 2250 Telegraph Avenue in Oakland, California. The purpose of the CAP is to provide a framework for remediation at the Site, considering all pertinent regulatory guidance, site conditions, site remediation constraints, and the most likely future use of the Site. The CAP summarizes the results of studies conducted to date to characterize former releases from underground storage tanks and presents the results of a Human Health Risk Assessment. Various remedial alternatives are described and evaluated to select the most effective remedy for the Site. If you should have any questions regarding the information present in this report, please feel free to contact the undersigned at (510) 268-0461.

Sincerely:
FUGRO CONSULTANTS INC.

Karen A. Emery, P.G.
Senior Project Geologist
Professional Geologist 8788 (exp.10/12)

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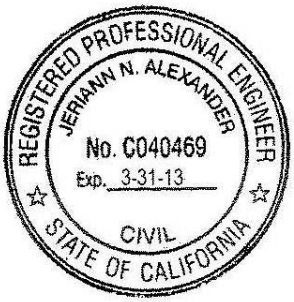

KAE/JNA:afp
Copies Submitted: (1 pdf) Addressee
(1 hardcopy and pdf) Ms. Marianne Robison, Buttner Properties
(1 pdf) Mr. Tim Robison

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1.0 INTRODUCTION

Fugro Consultants, Inc. (Fugro) has prepared this Corrective Action Plan (CAP) on behalf of the property owner, Buttner Properties, Inc. for the property located at 2250 Telegraph Avenue, in Oakland, California (Site). The purpose of this CAP is to provide a framework for remediation of petroleum hydrocarbon releases originating from onsite activities, considering all pertinent regulatory guidance, site conditions and constraints, and the most likely future use of the Site.

The CAP has been prepared in accordance with general guidance governing development of corrective action, remedial action, and removal action work plans provided by the State of California (applicable regulations found in California Code of Regulations [CCR] Title 23, Division 3, Chapter 16), Regional Water Quality Control Board (RWQCB), Environmental Protection Agency (EPA) and Department of Toxic Substances Control (DTSC).

2.0 SITE USE HISTORY

Historic information suggests that in the early 1950's Union Oil Company entered into a lease to operate a service station at the Site. In 1958, Buttner Properties, Inc. acquired the property and the existing service station management and operator was allowed to continue in their lease arrangement. In the late 1960's, research indicates that station improvements were reconfigured and underground storage tank (UST) and dispenser locations were likely affected.

At no time during property ownership did Buttner Properties, Inc. act as the operator of a service station at this Site. The Site is located at a major intersection and at some period in time all corners were occupied by service stations. In the late 1980's fuel dispensing ceased and the lease was changed to allow automobile servicing and repair activities.

In 1990, Subsurface Consultants, Inc. (an environmental consultancy firm acquired by Fugro in 2001) was retained by Buttner Properties, Inc. to observe UST removal activities. At that time the Site was occupied by a one-story former service station building that included two vehicle servicing bays and an office. Three USTs including two-10,000 gallon gasoline storage tanks and one-280 gallon waste oil tank were removed from the Site in August 1990 under the observation of Jeriann Alexander of Fugro while she was a project engineer with Subsurface Consultants, Inc. Impacts to soil and groundwater were observed immediately following UST removal.

Numerous Site characterization studies have been conducted to address the petroleum hydrocarbon impacts. Study findings are discussed throughout this CAP to provide a basis for evaluating corrective action. The results of major studies are described in Section 5 and include:

- Gasoline UST and Dispenser Island Removal and Investigation, 1990
- Waste Oil Tank Removal and Investigation, 1990
- Soil and Groundwater Investigations, 1996, 1997, and 2009,

- Soil-gas Investigation, 2009, and
- Monitoring Well Installation and Monitoring, 1994 to present.

3.0 SITE DESCRIPTION

The Site is located at 2250 Telegraph Avenue, situated at the northeast corner of Telegraph Avenue and West Grand Avenue, in Oakland, California (Plates 1 and 2). The Site and immediately adjacent properties are zoned for commercial development and use. The Site is currently occupied by a one-story former service station building that includes two vehicle servicing bays and an office. Exterior areas are paved and used mainly as a parking/storage area for vehicles. A chain link fence and two rolling gates located along Telegraph Avenue and West Grand Avenue encompass the entire Site. Four monitoring wells (MW-1 through MW-4) are located onsite, and four additional wells (MW-5 through MW-8) are located offsite, down and cross-gradient of the former UST improvements.

The Site is bounded on the west by Telegraph Avenue and to the south by West Grand Avenue. The adjacent property to the east, also owned by Buttner Properties, Inc. is occupied by a single story structure, and paved parking and use areas (460 West Grand Avenue). The 460 Grand Avenue site has been used as a nursery school since December 1988. The nursery school building is situated approximately 90 feet east of the former service station building, and cross- and downgradient of the former USTs which were removed in 1990. An outdoor play area comprising play structures situated over a paved surface exists between the 2250 West Grand Avenue building and the nursery school building.

The adjacent property to the north and upgradient of the former service station is used as a restaurant. A Chevron service station (2200 Telegraph Avenue) is located south of the Site, across West Grand Avenue; a Valero service station (2225 Telegraph Avenue) is located southwest of the Site; and a Taco Bell restaurant and parking area (2255 Telegraph Avenue) is located to the west, across Telegraph Avenue.

4.0 ENVIRONMENTAL SETTING

4.1 TOPOGRAPHY

The general terrain in the Site vicinity is flat with a gradual surface gradient to the southeast, toward Lake Merritt. Topography across the Site is relatively flat, with a ground surface elevation of approximately 20 feet mean sea level (MSL).

4.2 GENERAL GEOLOGIC SETTING

The geologic map titled: *Geologic Map of the Oakland Metropolitan Area, Alameda, Contra Costa, and San Francisco Counties, California* (U.S. Geological Survey, dated 2000) shows that the Site area is geologically mapped as Holocene and Pleistocene-aged Merritt Sands (Qms). These deposits tend to be fine-grained, very well sorted, well-drained alluvial deposits of western Alameda County. Locally, the Merritt Sand formation is overlain by

miscellaneous or artificial fill materials and alluvial deposits. The fill and alluvial deposits comprise interbedded deposits of clay, silt, and sandy soils which appear as discontinuous lenses and layers.

The Site is located in a seismically active region of California; however, it is not within an Alquist-Priolo Earthquake Fault Zone (CGS, 2007), a zone that delineates areas of known active faults, as defined by the State of California. The closest fault zone is associated with the Hayward fault system, a right lateral strike-slip fault, located approximately 3.2 miles northeast of the Site. The Site is also within the California Geological Survey Seismic Hazard Zone [formerly California Division of Mines and Geology (CDMG), 2003] for liquefaction.

4.3 SURFACE WATER

The nearest body of surface water is Lake Merritt, located approximately 0.4 miles southeast of the Site. Lake Merritt is a tidally influenced lake into which stormwater is allowed to drain from local upland areas. Other surface water bodies include the Oakland Inner Harbor Channel, located approximately 1.3 miles south of the Site and the San Francisco Bay, which is located approximately 2.1 miles to the northwest and 3.2 miles to the southwest.

4.4 SUBSURFACE CONDITIONS

Boring and sampling locations from all previous investigations are presented on Plates 3 and 4. A map showing the extent of impacts to soil and groundwater is presented on Plate 5. Generalized cross-sections showing the relationship between the UST source areas, and soil conditions encountered during the various Site studies are presented on Plates 6 and 7.

In general, the Site is underlain by a layer of fill consisting of clayey and sandy gravel varying in depth from about 2 to 5 feet. Artificial fill materials also exist in the former UST pit excavations to depths of 12 to 17 feet bgs. The fill materials are underlain by layers of silty clay to lean clay to the maximum depth explored of 20 feet bgs. As shown on the generalized geologic cross sections, a few pockets of silty sand were also encountered interlayered in the clayey soils (Borings B-3 through B-5 and B-10 through B-12).

Soil impacts predominately correlate with historic groundwater fluctuation across the Site. Residual soil impacted by UST source area releases is present between depths of 8 and 17 feet below ground surface (bgs) across the Site. Within the groundwater fluctuation zone, clay is the predominant soil type.

Groundwater at the Site has been monitored since 1994 and has fluctuated between depths of 8 to 13 feet bgs. Groundwater monitoring has shown that the groundwater flow direction is predominately toward the east-southeast. Monitoring activities suggest that the water-bearing stratum below the Site is a relatively low permeability formation, in that groundwater recharges very slowly in onsite wells and borings.

No free-floating hydrocarbon product has been observed by Fugro staff during any of the groundwater monitoring events and was not observed during drilling of any of the borings

located at the Site. However, based on the results of the numerous monitoring events, dissolved petroleum hydrocarbons and fuel constituents are present within the groundwater beneath the Site. The contaminant plume appears to be stable based on the lack of significant changes in concentrations over time, and appears limited in that it has not reached offsite monitoring wells MW-5, MW-6, or MW-7. Plume stability is also a reasonable finding given the existence of a consistently flat gradient and the presence of clayey soils within the groundwater fluctuation zone which impede plume movement.

5.0 OVERVIEW OF SITE CHARACTERIZATION STUDIES

Long-term use of the Site as a service station and automobile repair facility has resulted in impacts to both soil and groundwater. Numerous studies have been conducted since 1990 to characterize Site and contamination conditions. Major studies are summarized in this section.

5.1 FORMER GASOLINE UST AREA AND DISPENSER ISLANDS

Two fuel dispensing islands (each with two dispensers), and all related piping, were removed coincident with the UST removal project completed in August 1990. Upon removal of the USTs, Fugro staff did not observe visible deterioration of these gasoline USTs and no free floating product was observed in the excavation. However, a band of discolored soil was observed in the groundwater surface at the limits of the gasoline UST removal pit, and odors were detected in the soil from the UST pit and dispenser locations.

Analysis of thirteen (13) soil samples collected from the tank and dispenser island excavations and a grab groundwater sample from the UST pit indicated that elevated levels of total petroleum hydrocarbons within the gasoline range (TPHg) and Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) were present in soil and water confirming that releases had occurred. In late 1990 a remedial effort was undertaken to remove significantly impacted soils within accessible limits of the former UST pit and dispenser locations. During the October 1990 remedial activities, additional fill material was encountered along the western wall of the extended UST pit excavation. This additional fill material had a different consistency and color from the material removed in August.

Research conducted into the Site's history indicated that two USTs were previously located adjacent to the west side of the excavation area. Records further indicated that other USTs were removed from the Site in the 1960's, and as a result, the additional fill material likely represented backfill material from former UST removal activities. Analytical results indicated that the fill possessed elevated concentrations of petroleum hydrocarbons. As a result, the older fill material was also removed to its observable horizontal limits. Fourteen (14) additional soil samples were collected from the expanded excavation area, as well as from the former dispenser island locations. The final gasoline UST excavation area measured approximately 31 feet by 35 feet in plan view and extended to a depth of about 17 feet below the adjacent ground surface. During removal activities, groundwater was encountered at approximately 10.5 feet bgs, and a noticeable band of impacted soil coincident with the groundwater fluctuation zone was observed. The limits of excavation completed in 1990 are shown on Plate 3.

Review of the analytical results from the additional excavation indicated that neither TPHg nor BTEX were detected in any of the samples collected from the dispenser locations over-excavated in 1990. This indicated that excavation was successful in removing impacted soils from the circa-1990 dispenser island areas.

Analytical results of samples collected from the extended limits of the former UST excavation indicated that although soil remediation activities removed approximately 500 cubic yards of impacted soil, concentrations of petroleum hydrocarbons and their volatile constituents had been left in-place in soil at the limits of the excavation. The contamination appeared to exist in a thin layer coincident with the groundwater fluctuation zone, observed at the time to be situated between depths of about 9 and 11 feet bgs. Given the Site's active use and the location of the existing building, it was determined that it was not feasible to extend the excavation limits any further. The excavation areas were backfilled with engineered fill and the areas were capped with asphalt pavement.

Maximum contaminant concentrations in soil left in-place in the gasoline UST and dispenser source areas following remedial activities in 1990 are summarized below. The locations of samples obtained from the dispenser islands and gasoline UST excavation areas are presented in Plate 3. Historic chemical data is presented in Tables 1 and 2.

Former Gasoline UST and Dispenser Area
Maximum Soil Concentrations Left-In Place

Analyte	Gasoline UST Excavation Area	Dispenser Island Area
TPHg	310 mg/kg	<2.5 mg/kg
TPHd	100 mg/kg	<5.0 mg/kg
Benzene	820 µg/kg	<5.0 µg/kg
Toluene	59 µg/kg	<5.0 µg/kg
Ethylbenzene	1,300 µg/kg	<5.0 µg/kg
Xylene	1,600 µg/kg	<5.0 µg/kg

5.2 FORMER WASTE OIL UST AREA

The former waste oil UST was situated adjacent to the east side of the existing former station building. A remote fill for the tank was located within the former station building as a floor inlet. During tank removal activities in August 1990, Fugro staff observed numerous holes in the top of the waste oil UST and its bottom had been corroded through. A thin layer of oil was observed in the pit following tank removal activities.

To characterize this potential source area, six (6) soil samples from within the UST excavation were obtained. Two soil samples were obtained from the soil present within the tank pit and four samples were obtained from the material removed from the tank pit.

Results of the analyses indicated that elevated levels of TPHg, total petroleum hydrocarbons within the diesel range (TPHd), lead, and oil and grease were present in soil at elevated concentrations within the former tank excavation. The excavation area was backfilled with soil which had been removed with the waste-oil UST pending further remediation. The pit was first lined with plastic to demarcate impacted soil and the area was resurfaced.

In February 1994, interim remediation was conducted in an attempt to remove the significantly impacted soil within accessible limits in the area of the former UST. The final excavation measured approximately 10 feet by 15 feet in plan view and was extended to a depth of approximately 12 feet bgs. During removal activities, groundwater was encountered at approximately 11.5 feet bgs. A thin layer of residual soil possessing a green hue and a strong hydrocarbon odor was observed by Fugro staff between depths of 9 and 11 feet bgs, which coincides with the groundwater fluctuation zone observed onsite.

Nine (9) additional soil samples were collected from the UST area following soil remediation activities. Analytical results of samples collected from the limits of the former UST excavation indicated that although soil remediation removed approximately 70 cubic yards of soil, impacted soil still remains in-place and likely extends below the existing repair shop building.

Maximum contaminant concentrations in soil left in-place in the waste oil UST source area are summarized below. The locations of samples obtained from this excavation area are presented in Plate 3. Historic chemical data is presented in Tables 1 and 2.

Former Waste Oil UST Area
Maximum Soil Concentrations Left-In Place

Analyte	Waste Oil UST Pit
TPHg	240 mg/kg
TPHd	680 mg/kg
TPHmo	1,700 mg/kg
Oil & Grease	3,900 mg/kg
Lead	590 mg/kg
Benzene	580 µg/kg
Toluene	1,800 µg/kg
Ethylbenzene	2,500 µg/kg
Xylene	16,000 µg/kg
PNAs	varies

5.3 1994 GROUNDWATER MONITORING WELL INSTALLATION

In February 1994, four groundwater monitoring wells (MW-1 through MW-4) were installed onsite and a groundwater monitoring program was implemented. Soil samples were obtained from monitoring wells MW-1, MW-2, and MW-3 at a depth of 10 feet bgs, as these

locations were all situated within about 5 feet of the limits of the former gasoline UST excavation. The concentrations of contaminants of concern in the samples obtained from the well borings showed a marked decrease when compared to the sidewall samples from the UST excavations. Analytical results of soil samples obtained from the installation of wells MW-1 through MW-4 are presented in Table 2, water elevation and groundwater data are presented in Tables 7 and 8.

Soil samples were also obtained from monitoring well boring MW-4 installed immediately adjacent to the excavation for the former waste-oil UST. The concentrations of contaminants of concern in the sample from a depth of 10 feet bgs also showed a marked decrease when compared to the sidewall samples from the excavation. Initial groundwater monitoring data from wells MW-1, MW-2, and MW-3 indicated that the releases from the gasoline UST source area had impacted groundwater, and that the plume may have extended offsite. Similarly, groundwater monitoring data from well MW-4 indicated that releases from the waste oil UST source area had also impacted groundwater, and that the plume may extend offsite to the east. However, given that the source areas had been remediated to the extent practical, areas directly above the plumes were paved, the plumes appeared stabilized, and there was no plan to redevelop the Site, the potential risks posed to human health appeared limited and no further remedial action was deemed necessary.

5.4 1996 AND 1997 SITE CHARACTERIZATION INVESTIGATIONS

In a letter dated November 8, 1995, ACEH requested an investigation be performed to evaluate the extent of groundwater contamination downgradient of the Site. In May 1996, five temporary well points (TWPs) were installed and grab groundwater samples were obtained to assist in determining locations for two new offsite groundwater monitoring wells. The locations of the TWPs are shown on Plate 3. Results of the samples obtained from the TWPs were not judged to be comparable to samples obtained from monitoring wells due to their observed turbid nature. Grab groundwater sample data is presented in Table 4. The samples were collected from the first encountered water accumulated within temporary slotted casings which had been inserted into smaller diameter borings which did not have any filtering media. Review of the boring logs confirmed that the borings were extended to depths of about 19 feet bgs and soils encountered below a depth of 5.0 feet bgs comprised very fine grained silty and clayey materials with varying amounts of sand. Based on these results and observed gradient information from monitoring events, monitoring wells MW-5 and MW-6 were installed at offsite locations in June 1997, cross-gradient and downgradient from the former UST excavations (Plate 3). Monitoring well MW-5 was located in the eastbound parking lane of West Grand Avenue while well MW-6 was located in the westbound lane, close to the median. Wells MW-5 and MW-6 were completed to depths of 20 and 21.5 feet bgs, respectively. Analytical results of soil samples obtained from the installation of wells MW-5 and MW-6 are presented in Table 2; water elevation and groundwater data are presented in Tables 7 and 8.

No significant contaminants of concern were detected in soil or groundwater samples collected from well MW-5. Elevated concentrations of contaminants of concern were detected in the groundwater sample from well MW-6; however the fingerprint pattern was observed to be distinctively different from the pattern detected in groundwater samples from onsite wells. In

addition, MTBE is a contaminant of concern in well MW-6 and it is not an identified contaminant in onsite soils or water, which is reasonable given that fuel dispensing at the Site ceased prior to widespread use of MTBE. As such, Fugro concluded that the contamination observed in Well MW-6 was not related to releases from the Site.

5.5 2009 SITE CHARACTERIZATION INVESTIGATIONS

In 2008, ACEH requested that additional Site characterization be conducted to further define the lateral and vertical extent of contamination and to assess the potential volatilization pathway. In July 2009, Fugro completed an additional soil, groundwater, and soil-gas investigation at the Site. Fieldwork included the completion of twelve (12) direct push borings/temporary well points (B-1 through B-12) to depths ranging from 15 feet to 20 feet bgs, and the installation of seven (7) semi-permanent soil-gas probes/borings (SG-1 through SG-7) completed to a depth of 5.0 feet bgs. Soil, soil-gas and grab groundwater samples were collected and analyzed for contaminants of concern. The locations of the borings completed during the 2009 investigation are shown on Plate 4.

In general, the study confirmed that contaminated soil from former UST releases exists in both the vadose and groundwater zones, and that the limits of groundwater zone impacts have not been fully defined. However, the presence of the impacted soil and groundwater do not represent a significant risk to create an inhalation risk to current Site occupants based on recent soil-gas data. Analytical results of soil, grab groundwater, and soil-gas samples obtained during the 2009 investigation are presented in Tables 3 through 5.

Based on the results of the 2009 studies, and Fugro's review of the groundwater data collected to date, we recommended the installation of two new monitoring wells, wells MW-7 and MW-8, to better define the distal limits of the groundwater plume.

5.6 2011 GROUNDWATER MONITORING WELL INSTALLATION

In April and August 2011 groundwater monitoring wells MW-7 and MW-8 were installed offsite. Well MW-7 was advanced within the playground of the adjacent nursery school, downgradient of onsite well MW-4. Well MW-8 was advanced within the parking lane of West Grand Avenue, downgradient of the existing onsite well MW-3. Well locations are shown on Plate 4.

The concentrations of contaminants of concern detected in the soil samples obtained from the well borings showed low concentrations of TPHg and TPHd at concentrations well below residential and commercial land use ESLs. Elevated motor oil exceeding the residential land use Environmental Screening Level (ESL) of 370 mg/kg was only detected in Sample MW-7@1.5' (160 to 170 mg/kg) and in Sample MW-8@1.0' (390 mg/kg). The source of the elevated motor oil in the shallow soil is unknown but is most likely associated with historic paving activities.

Groundwater monitoring data from well MW-7 indicated that this well is situated outside of the groundwater plume. Data from well MW-8 indicated that releases from the gasoline UST

source area and possibly former dispenser islands have impacted groundwater in this area, and that the plume extends offsite to beneath West Grand Avenue.

5.7 GROUNDWATER MONITORING ACTIVITIES

Fugro has conducted groundwater monitoring at the Site since 1994. The data generated confirms that the Site is impacted by releases of both gasoline and waste oil products. The two points of release have resulted in a commingling of contaminant plumes as there is not sufficient separation between points of known releases and no identified boundary conditions exist to keep the plume areas separate.

As illustrated on the Rose Diagram on Plate 2, historic groundwater flow direction at the Site direction is predominately toward the east-southeast. Groundwater at the Site has fluctuated between depths of 8 to 13 feet bgs. Water elevations and groundwater monitoring data are presented in Tables 7 and 8.

6.0 EVALUATION OF IMPACTS

6.1 EXTENT OF SOIL IMPACTS

To preliminarily evaluate the lateral and vertical extent of soil impacts measured petroleum hydrocarbon concentrations at the Site were compared to 83 mg/kg, the residential land use ESL for TPHg and TPHd, and 370 mg/kg, the residential land use ESL for TPHmo. This comparison resulted in the identification of several areas of impacted soil as summarized below. The zone of suspected impacts is shown on Plates 5, 6 and 7.

Within the former gasoline UST area, the vertical extent of soil impacts are coincident with the groundwater fluctuation zone. No other shallow pockets of vadose zone impacted soils resulting from releases from gasoline UST improvements have been identified to date. Using data collected from well installations, previous UST remediation efforts, and borings, it appears that once contamination encountered the groundwater surface, the plume extended along the groundwater flow path.

Within the former waste oil UST area, soils are suspected to be impacted in the immediate area of previous UST system improvements located within and below the existing building. The improvements included a floor drain which has since been closed and conveyance piping leading over to the former waste oil UST. Sampling inside the structure has been limited due to the presence of a number of storage cabinets and improvements, and the presence of a long-standing viable automotive repair business. Based on the limited sampling inside the structure and the data from the waste oil UST removal, we believe that impacted soil extends from below the floor and east wall foundation wall to depths up to 17 feet bgs. Once at the groundwater surface the plume extends along the groundwater flow path. Based on the results of soil samples obtained within the groundwater fluctuation zone of well MW-7, located within the nursery school playground, soil impacts exceeding residential screening levels appear to be limited to just east of the Site boundary.

6.2 EXTENT OF GROUNDWATER IMPACTS

Groundwater below the Site has been impacted by releases of both gasoline and waste oil products. The zone of impact is shown on Plates 5, 6 and 7. Based on a review of all groundwater data collected to date, it appears that sufficient data exists to characterize the plume in the vicinity of both former UST pit areas. The two points of release have resulted in a commingling of contaminant plumes as there is not sufficient separation at the Site and no identified boundary conditions to keep the plume areas separate. The groundwater zone impacts appear to be limited as they do not appear to extend to the offsite wells (MW-5, MW-6, or MW-7) located to the southeast and east of the Site. Impacts have been identified in offsite well MW-8, situated immediately adjacent to the Site and downgradient of onsite well MW-3.

7.0 PREFERENTIAL PATHWAY SURVEY

Fugro prepared a preferential pathway survey for the Site in February 2004. Fugro updated the survey in November 2009 based on comments received from ACEH to include East Bay Municipal Utility District (EBMUD) water conveyance pipelines. In general, the updated research did not identify a preferential pathway or a known potable well which may be at risk of being impacted by the Site contaminant groundwater plume. All reported well locations in close proximity to the Site were visited by our staff to confirm their address and location. Land use in the area has not changed since the updated survey was completed in 2009 and as a result, our opinion of preferential pathways has not changed. We present a summary of the updated survey completed in 2009 below. Copies of documents, maps, and the registered well survey can be found in Fugro's Site Investigation Report and Summer 2009 Quarterly Groundwater Monitoring Report, dated November 20, 2009.

7.1 EVALUATION OF UNDERGROUND UTILITIES

City of Oakland maps show various utilities beneath Telegraph Avenue including a 16-inch diameter sanitary sewer main and a 12-inch storm drain conduit. Also shown are a 16-inch diameter storm drain conduit and a 16-inch sanitary sewer line located (between 7.2 and 6.0 feet above sea level) beneath Valley Street, with a single 10-inch lateral line connecting to the property block near the eastern block line. The approximate location and orientation of the utility lines are shown on Plate 2.

A shallow sanitary sewer line extends from the Site, toward Telegraph Avenue. A small storm drain catch basin exists along the West Grand Avenue curb line just beyond the southeast corner of the Site. This under-curb drain is not shown on the City maps we reviewed. The drain is apparently shallow and connected to a shallow-bedded pipeline, which conveys flow into the storm drain collector at Valley Street. This pipeline is also shown on the Plate 2.

In accordance with the request from ACEH for additional information with respect to the potential presence of water conveyance pipelines, which may act as preferential migration pathways, Fugro contacted EBMUD and reviewed historic groundwater depth information collected at the Site since 1994. Fugro previously met with EBMUD engineers and reviewed a number of blueprints and historic pipeline installation data, which suggested that all EBMUD

pipelines adjacent to the Site are situated above the groundwater table. Excluding discrete areas where short runs of pipelines were installed below City of Oakland infrastructures, EBMUD pipelines were generally embedded at depths ranging from approximately 3.5 to 9.5 feet below the existing grade on the north side of West Grand Avenue, and approximately 4.0 to 5.5 feet below the existing grade of Valley Street, situated 165 feet east of the Site. The as-built maps and field data notes, which provide pipeline details, do not indicate the type of trench bedding used. Many of the original pipelines were installed in the early 1920s to 1930's. Based on data collected for the onsite wells (MW-1 through MW-4) since 1994, the depth to groundwater has fluctuated between approximate depths of about 8 to 13 feet below the existing groundsurface, which suggests that the groundwater surface is predominately located below the elevation of the pipelines.

A continuing underground utility of interest is the Bay Area Rapid Transit (BART) tunnel, which may influence groundwater flow patterns in the area. The tunnel extends below the Chevron service station property located immediately south of the Site. The construction and operation of the tunnel should be viewed as a contributing influence on changing groundwater flows in the area.

Based on our review of all underground utilities in the Site vicinity, it is still our opinion that it is unlikely that preferential contaminant migration along utility lines is occurring. By the time that the contaminant plume reaches the property lines to the west, east and south, the depth of the plume varies from 8 to 17 feet. The closest pipeline to the Site is a shallow under-curb drain along West Grand Avenue and a sanitary sewer pipeline below Telegraph Avenue, approximately 30 feet away from the Site. The flow lines of these pipelines are situated above the plume surface. The closest storm drain line is situated more than 60 feet away from the Site in a cross gradient direction from the plume, and therefore judged not likely to intercept the plume.

7.2 REGISTERED WELL SURVEY

Fugro's 2009 registered well survey searched California Department of Water Resources (DWR) records for wells located within 0.25-mile of the Site. The search identified fifteen "well" properties listed within the surrounding area. Of the fifteen properties, approximately ten were upgradient/cross-gradient and five were downgradient of the Site. These 15 "well" properties account for a total of forty-two wells. According to information obtained in the well search, the nearest documented downgradient wells are located at the Old Oakland Tribune Garage at 23rd Street and Valdez Street, Kaiser Center Plaza at 300 Lakeside Drive, the Ordway Building at 1 Kaiser Plaza, and properties located at 327 21st Street and 21st Street and Broadway.

Fugro conducted a reconnaissance of the four downgradient properties in 2009, as well as the former Great Western Power Co. property located at 520 20th Street as requested by ACEH, to confirm location of the wells if possible. The Old Oakland Tribune Garage has been redeveloped into a covered and uncovered parking garage; the Great Western Power Co. has been redeveloped into an indoor rock climbing gym, and 327 21st Street and the property located at 21st Street and Broadway have both been redeveloped into parking lots. Kaiser

Center Plaza at 300 Lakeside Drive and the Ordway Building at 1 Kaiser Plaza are utilized as office buildings with an uncovered parking and a covered, multi-story parking garage. Fugro inquired about the presence of wells on each of these properties. Personnel at each location were unaware of any wells, and no wells were observed at any of the locations during our reconnaissance.

7.3 SURROUNDING PROPERTY SURVEY

The Site is located in a predominantly commercial section of Oakland, California. The property is bounded on the west and south by Telegraph Avenue and West Grand Avenue, respectively. The adjacent property to the east, which is also owned by Buttner Properties, is occupied by a nursery school (460 West Grand Avenue). The outdoor paved play area used by the school abuts the eastern fence line of the Site. The nursery school building is situated about 90 feet to the east and downgradient of the former waste oil tank location. The adjacent properties north and west of the Site are both restaurants (Off the Hook Seafood and Super Burritos at 2270 Telegraph Avenue and Taco Bell at 2255 Telegraph Avenue). A Chevron service station (2200 Telegraph Avenue) is located south of the Site, across West Grand Avenue, and a Valero service station (2225 Telegraph Avenue) is located southwest of the Site, Both the Chevron and Valero properties are currently under regulatory oversight of ACEH and the RWQCB.

8.0 RISK ASSESSMENT

Fugro subcontracted with SLR International Corporation (SLR) to assess potential human health risks based on the existing site conditions and data, as well as to assess potential risks to potential future receptors. The goal of the human health risk assessment (RA) was to identify the potential level of risk posed to current and future receptors at and adjacent to the Site from contaminants detected in soil, groundwater, and/or soil-gas. Fugro has conducted several studies of the impacts to soil, groundwater, and soil gas to assess impacts to the environment resulting from Site releases. These studies coupled with the results of the RA provide sufficient information to assess potential risks posed to human health and the environment resulting from previous UST releases.

Historical soil, groundwater, and soil-gas analytical data obtained by Fugro since 1990 and used in the preparation of the RA and CAP are summarized in Tables 1 through 8. A map showing the extent of impacts to soil and groundwater is presented on Plate 5. Generalized cross-sections showing the relationship between the UST source areas, and soil conditions encountered during the various Site studies are presented on Plates 6 and 7. SLR's Human Health Risk Assessment Report is presented in Appendix A.

8.1 CONCEPTUAL SITE MODEL

Fugro in consultation with SLR developed a conceptual site model (CSM) to identify potential human receptors and potentially complete exposure pathways to the soil and groundwater contamination. The CSM is an important preliminary step in the exposure assessment portion of a RA. The CSM schematically presents the relationship between

chemical sources and receptors at the Site, and identifies potentially complete and significant pathways through which receptors may be exposed to chemicals of potential concern (COPCs). This is accomplished by considering such important site characteristics as the source of chemical release, depth to the water table, distribution of chemical detections, chemical fate and transport, current and possible future land use at the Site and adjacent area, and groundwater use.

Based on a review of the Site conditions (the limited nature of the plume, relatively flat groundwater gradient, and the presence of clays in subsurface soils), potential Site receptors and exposure pathways identified as potentially complete and significant at the Site are presented in the CSM shown on Plate 8, and Figure 1 of the RA. The identified potentially complete and significant exposure pathways are summarized below. Detailed discussion of the development of the CSM for the RA is presented in Appendix A.

- Hypothetical current/future onsite commercial/industrial worker:
  - Inhalation of vapors from the subsurface in indoor air.
- Hypothetical current/future onsite construction/utility worker:
  - Incidental ingestion of and dermal contact with soil,
  - Inhalation of fugitive dusts, and
  - Incidental ingestion of and dermal contact with groundwater.
- Hypothetical future onsite resident receptor (adult and child):
  - Inhalation of vapors from the subsurface in indoor air,
  - Incidental ingestion of and dermal contact with soil, and
  - Domestic use of groundwater (ingestion, dermal contact, and inhalation of vapors).
- Hypothetical current/future offsite nursery school receptor (adult and child):
  - Inhalation of vapors from the subsurface in indoor air.

8.2 CONTAMINANTS OF POTENTIAL CONCERN

COPCs include those chemicals typically associated with service stations and automobile repair garages, and those that have been identified onsite. Site research suggests at least three UST locations were onsite; two associated with dispensing fuels and one associated with the waste oil tank. COPCs were identified based on comparison of maximum detected chemical concentrations in each medium with appropriate screening levels for that medium. The identification of COPCs in the RA constituted a conservative, risk-based screening evaluation, the objective of which was to identify the most toxic, persistent, and prevalent chemicals at the Site that are expected to contribute the majority of potential exposure. All chemicals detected in onsite soil, groundwater, and soil-gas and offsite groundwater were included in the screening process. Chemicals with maximum detected concentrations exceeding screening levels were identified as COPCs to be quantitatively evaluated in the RA for the corresponding receptors and exposure pathways.

Screening levels utilized in the COPC identification process included the following:

- Environmental Screening Levels (ESLs) from the California Regional Water Quality Control Board, San Francisco Bay Region for soil, soil gas, and groundwater;
- California Human Health Screening Levels (CHHSLs) from the CalEPA Office of Environmental Health Hazard Assessment (OEHHA) for soil and soil gas (not available for groundwater); and
- Regional Screening Levels (RSLs) from USEPA were used to identify receptor-specific soil COPCs where California-specific values were not available.

Based on the comparison of maximum detected concentrations with the relevant screening levels, the following chemicals were identified as COPCs for quantitative evaluation in the RA:

- **Soil.** Benzene, ethylbenzene, total xylenes, 1,2-dichloroethane, 2-methylnaphthalene, TPH in the gasoline and diesel ranges, and total oil and grease were identified as shallow soil (less than or equal to 10 feet bgs) COPCs for residential and commercial receptors. Naphthalene and two TPH mixtures (TPH as motor oil and hydraulic fluid) were also identified as residential COPCs in shallow soil. No shallow soil COPCs were identified for the construction worker exposure scenario.

  Of the twelve analytes identified as COPCs in shallow soil, only benzene, toluene, ethylbenzene, total xylenes, 2-methylnaphthalene, TPHg, and TPHd were detected in deep soil (greater than 10 feet bgs) at concentrations above residential and commercial screening levels. Similar to the shallow soil COPCs, no chemicals were detected in deep soil at concentrations above direct contact ESLs for the construction/trench worker scenario. This is the only scenario in which direct contact with deep soil may occur; the results of this screening evaluation therefore show that analyte concentrations in deep soil are below levels of concern for potential human health effects.

  Lead has also been identified as a COPC in shallow soil for both residential and commercial receptors at the Site. Standard toxicity values are not available for lead; however SLR evaluated lead by comparing concentrations in soil to the CHHSLs for a residential and commercial land use. Lead was detected in all four shallow (less than or equal to 10 feet bgs) soil samples, and all deep (greater than 10 feet bgs) soil samples, collected from the former gasoline UST and waste oil UST excavation areas. The maximum concentration of lead detected in shallow soil was 590 mg/kg at a depth of 6.0 feet bgs, which is almost an order of magnitude higher than the residential CHHSL of 80 mg/kg. Lead concentrations in the remaining shallow and deep soil samples were all well below the residential CHHSL of 80 mg/kg.

- **Groundwater.** Benzene and TPH in the gasoline, diesel, and motor oil ranges were identified as COPCs for the domestic use of groundwater scenario (relevant for onsite groundwater only). These were also conservatively retained as groundwater

COPCs for the construction worker scenario based on the lack of construction-specific screening levels for groundwater. No onsite or offsite groundwater COPCs were identified for vapor intrusion concerns.

- **Soil Gas.** TPHg was the only COPC identified in soil gas. Other chemicals were either not detected in soil gas, or detected at concentrations below the relevant soil gas screening levels.

8.3 SUMMARY OF RISK ASSESSMENT RESULTS

8.3.1 Human Health Risk Evaluation

Estimated non-cancer hazards (HIs) and total lifetime excess cancer risks (LECRs) were below the respective regulatory targets of 1 and 10^{-6}, respectively, for the construction worker receptor. Analyte concentrations in deep soil were also below levels of concern for human health based on the potentially complete exposure pathways identified in the CSM. Additionally, estimated HIs and LECRs across all other COPCs (with the exception of lead) in soil were below the regulatory targets for HI and LECR. As discussed earlier, standard toxicity values are not available for lead and therefore no HI or LECR estimates were calculated for this analyte. However, lead remains a COPC in shallow soil since total lead exceeded the CHHSL of 80 mg/kg for a residential land use near the former waste oil UST. No COPCs, other than TPHg, were identified in soil vapor. Since TPH indicator chemicals were either not detected or below screening levels in soil vapor, soil vapor data were not quantitatively evaluated in the RA.

For the hypothetical future resident receptor, HI and LECR estimates were above regulatory target levels due to the maximum detected concentration of benzene, the only COPC identified in groundwater. These estimates are based on the conservative assumption of domestic use of groundwater by hypothetical future residential receptors. As previously indicated, groundwater at the Site and vicinity is shallow, and water is currently provided to the City of Oakland from outside rivers and reservoirs by the East Bay Municipal Utility District (EBMUD), making future domestic use of groundwater highly unlikely. Risk and hazard estimates for the most realistic groundwater exposure scenario, direct contact by a construction/utility worker, were well below levels of concern. However, a groundwater threshold concentration for benzene was identified to provide a target concentration for any potential future remediation. The CalEPA maximum contaminant level (MCL) of 1.0 µg/L was identified as the groundwater threshold concentration for benzene. However, under current land use, benzene does not present a risk to human health since shallow groundwater is not used for domestic purposes.

TPH mixtures were not included for quantitative evaluation in the RA. The complex mixtures of TPH are comprised of thousands of chemicals, the most toxic of which are represented by specific compounds that were individually analyzed at the Site. Toxicity data are not typically available for TPH mixtures and these are therefore evaluated in risk assessments using indicator chemicals such as BTEX, polynuclear aromatic hydrocarbons (PAHs), and fuel oxygenates such as MTBE. Therefore, while data for TPH mixtures were included in the RA datasets and evaluated in the screening stage of the RA, only the detected constituents of these

mixtures were included in the quantitative human health risk evaluation performed by SLR, consistent with San Francisco Bay Regional Water Quality Control Board (RWQCB, 2008) and California Environmental Protection Agency (CalEPA, 1996) guidance.

8.3.2 Environmental Risk Evaluation

Sensitive receptors are not judged to be at risk from the presence of the contamination at this Site. However, the environment in the form of groundwater quality has been degraded. Although TPH mixtures are not included in the qualitative human health risk evaluation completed by SLR, they do exceed screening levels at the Site in both soil and groundwater, which results in these mixtures being considered an ongoing environmental impact to groundwater quality. Further, the presence of the elevated TPH mixtures in soil in the groundwater fluctuation zone contributes to the ongoing presence of impacted groundwater at the Site. As a result, Fugro considers the presence of TPH mixtures in soil, COPCs that require remediation to mitigate concerns regarding groundwater degradation.

9.0 CORRECTIVE ACTION PLAN DEVELOPMENT

The Corrective Action Plan (CAP) objectives which govern the development of the CAP presented herein are consistent with those specified in the applicable regulations (California Code of Regulations [CCR] Title 23, Division 3, Chapter 16), and are as follows:

- ***Investigate and analyze the potential effects of previously reported release of petroleum hydrocarbons in soil and groundwater at the site.***
- ***Propose a cost-effective plan to adequately protect human health and the environment.***
- ***Protect current and beneficial uses of water.***
- ***Propose a means to evaluate the effectiveness of the plan upon implementation.***

It is Fugro's professional opinion that contamination at the Site has been adequately characterized and further investigation of soil and groundwater is not warranted. Results of more than seventeen years of groundwater monitoring conducted at the Site have shown that the groundwater plume is localized and is not expanding. As a result, sufficient data exists upon which to develop several remedial alternatives, and ultimately select and implement the appropriate corrective action that will be protective of human health and environmental receptors.

9.1 TARGET CLEANUP GOALS

Groundwater at the site and vicinity is very shallow (8 to 13 feet bgs), and water is currently provided to the City of Oakland by EBMUD, making future domestic use of groundwater highly unlikely. Risk and hazard estimates for the most realistic groundwater exposure scenario, direct contact by a construction/utility worker, were also well below levels of

concern. However, given that contaminants are present in soil and groundwater, coupled with the property owner's ultimate goal of unrestricted reuse of the Site, the CalEPA maximum contaminant level (MCL) of 1.0 µg/L will be used as the Target Cleanup Goal (TCG) for benzene to provide a target concentration for future remediation.

The only COPC identified in shallow soil in the RA was lead. The maximum detected concentration of lead in soil was 590 mg/kg, well above the CHHSLs of 80 mg/kg for residential receptors. To satisfy the property owner's ultimate goal of unrestricted future reuse of the Site, the CHHSL of 80 mg/kg for lead has been identified as the proposed TCG for future corrective action activities.

TPH mixtures (TPHg, TPHd, and TPHmo) in soil also exceed residential land use ESLs in "hot spot" areas near the former waste oil and gasoline USTs. As a result, residential land use ESLs of 83 mg/kg for TPHg and TPHd and 370 mg/kg for TPHmo are proposed to provide target goals for future remediation of soil. The ESLs of 100 µg/L will be used as the TCG for TPH in gasoline, diesel, and motor oil ranges in groundwater, as that level has been determined to be protective of ongoing degradation of groundwater bodies.

Based on the regulatory criteria described above, TCGs for use in developing the CAP are summarized as follows:

Analyte	TCG in Soil	TCG in Groundwater
TPHg	83 mg/kg	100 µg/L
TPHd	83 mg/kg	100 µg/L
TPHmo	370 mg/kg	100 µg/L
Lead	80 mg/kg	Not Applicable
Benzene	Not Applicable	1.0 µg/L

9.2 REMEDIAL ALTERNATIVE EVALUATION

Based on historical patterns of remedy selection for sites where petroleum hydrocarbons are the primary COPCs, a "No Action" alternative and three "routinely utilized cleanup alternatives" have been evaluated for this CAP. The remedial alternatives evaluated to address impacted soil and groundwater at the Site include 1) No Action/Monitored Natural Attenuation, 2) Limited "Hotspot" Removal with ORC Placement, 3) Targeted Soil Removal with ORC Placement, and 4) Targeted Soil Removal with Aggressive Groundwater Treatment.

9.2.1 Alternative 1: No Action and Monitored Natural Attenuation

Alternative 1 comprises implementing no action other than the use of monitored natural attenuation (MNA). Natural attenuation involves the mitigation of COPCs through natural, non-destructive processes. With MNA, groundwater monitoring and sampling would be used to continuously evaluate concentrations of COPCs and document when cleanup levels have been

achieved. As shown on Plate 9, this alternative makes no attempt to address source removal or treatment of impacted soils or groundwater, only groundwater monitoring is involved.

Advantages of MNA are 1) contaminants are transformed naturally into safe by-products, 2) it is non-intrusive, allowing the continued use of the Site as a commercial property, and 3) costs are spread out over a long period of time. The significant disadvantage to MNA at this Site is the time frame for achieving cleanup goals is unknown. Based on a review of the groundwater monitoring data at the Site, groundwater concentrations over the last seventeen years have not significantly decreased in most onsite wells. This finding is attributed to the continuing presence of source material in the form of residual petroleum hydrocarbon mass in soil "hotspot" areas and within the groundwater fluctuation zone, resulting in ongoing contamination of groundwater. MNA will result in long-term monitoring costs and well rehabilitation costs to reduce concentrations at the Site to proposed TCGs.

The approximate costs to implement Alternative 1 would be $50,000 per year. This cost includes groundwater monitoring activities for the year, project management, and general well rehabilitation and maintenance.

The length of time to attain closure could be shortened if the property owner is willing to accept institutional controls on the Site. Institutional controls would include recording a deed restriction for the property. Any reuse of the Site would then need to acknowledge that contaminants have been left in place. Land use controls include restrictions on the type of use, regulatory agency notification of any change in use, and implementation of additional risk management strategies to minimize potential risks to human health and the environment. Costs developed for Alternative 1 do not include the costs associated with any tasks required to place institutional controls onto the property.

9.2.2 Alternative 2: "Hotspot" Removal with ORC Placement

Alternative 2 assumes that the commercial use of the Site will continue, which will limit the extent to which source removal can occur. Alternative 2 therefore assumes that the existing building will remain in place and any source removal will occur while keeping the structure intact.

Alternative 2 comprises the physical excavation and removal of various "hotspots" at the Site coupled with groundwater treatment through use of an oxygen releasing compound (ORC) placed into direct contact with groundwater. Soil samples obtained during various investigations conducted at the Site have identified five "hotspots" as shown on Plate 10. These five locations are areas where soil concentrations exceed proposed target cleanup goals (TCGs) and include the circa-1990 fuel dispenser islands and the known former gasoline and waste oil USTs areas, as well as a couple of other areas where concentrations in soil exceed cleanup goals. The soil source material in most of these areas is coincident with the groundwater fluctuation zone. Within the former waste oil UST area, impacted soil has been identified immediately adjacent to the former UST system improvements located within and below the existing building. Source material in this area is believed to extend from below the floor and east wall foundation wall to depths up to 17 feet bgs. As this remedial alternative does not include the destruction of the

existing building impacted source material would be removed from both inside and outside of the building, and may require the use of shoring systems to re-support the foundation.

Excavation activities would include using an excavator and/or other appropriate earth moving equipment to handle the soil. The excavation of the five hotspot areas will require the destruction of existing onsite monitoring wells MW-1, MW-3, and MW-4. Excavated soil will be stockpiled and covered with plastic sheeting pending completion of profiling, approval and offhaul to a licensed landfill facility. Visual observations will be used to direct excavation activities. Dust suppression using a water spray will be used as needed during all soil handling activities. Confirmation soil sampling and analysis would be conducted to verify that the TCGs are met.

Due to the shallow groundwater conditions at the Site, groundwater that recharges into the excavation areas will be periodically removed by pumping and will be placed into an onsite storage tank pending results to characterize the water for disposal. Based on the results, the water will then be transported to an accepting disposal facility.

All excavation areas would be backfilled with clean imported fill. Prior to backfill placement, oxygen-release compound (ORC) would be placed at the base of the pits with an adequate thickness to account for the groundwater fluctuation zone. ORC consists of a phosphate-intercalated magnesium peroxide that, when hydrated, produces a controlled release of oxygen to the subsurface environment which accelerates naturally occurring aerobic biodegradation of contaminants. This methodology has been found to be successful at achieving TCGs in many environments.

Advantages of implementing Alternative 2 at the Site are 1) source material would be removed, 2) impacted groundwater would be treated through both physical removal and through biodegradation, and 3) ORC supplies a controlled oxygen release for a period of up to 12 months on a single application. Disadvantages include 1) the possibility that due to the presence of clays in the subsurface, subsequent dosing of ORC or other remedial efforts to reduce groundwater concentrations may be required, and 2) the time for remediation is still unknown and would require continued long-term groundwater monitoring.

The approximate costs to implement the hotspot excavation and ORC Placement will range from $500,000 to $600,000. As part of this effort, three monitoring wells will need to be abandoned and replaced at a cost ranging from $45,000 to $60,000. Additional costs to monitor groundwater attenuation would be $70,000 per year. This cost includes groundwater monitoring activities for the year, project management, and general well rehabilitation and maintenance. As a result, the approximate Year 1 costs for Alternative 2 will range from $615,000 to $730,000.

9.2.3 Alternative 3: Targeted Soil Removal and ORC Placement

Alternative 3 is similar to Alternative 2 with the exception that Alternative 3 assumes that the existing Site improvements will be demolished prior to remediation. This would allow remedial activities to be conducted without restriction.

Once the structure has been removed, excavation activities would include the targeted removal of the five areas shown on Plate 11. With the building demolished, source removal can be more thorough. The excavation of the four areas will require the destruction of existing onsite monitoring wells MW-1, MW-3, and MW-4.

All excavation activities will be completed using an excavator and/or other appropriate earthmoving equipment to handle the soil. Similar to Alternative 2, excavated soil will be stockpiled and covered with plastic sheeting pending completion of profiling, approval and offhaul to a licensed landfill facility. Visual observations will be used to direct excavation activities. Dust suppression using a water spray will be used as needed during all soil handling activities. Confirmation soil sampling and analysis would be conducted to verify that the TCGs are met.

Due to the shallow groundwater conditions at the Site, groundwater that recharges into the excavation areas will be periodically removed by pumping and will be placed into an onsite storage tank pending results to characterize the water for disposal. Based on the results, the water will then be transported to an accepting disposal facility.

All excavation areas would be backfilled with clean imported fill. Prior to backfill placement, oxygen-release compound (ORC) would be placed at the base of the pits with an adequate thickness to account for the groundwater fluctuation zone. ORC consists of a phosphate-intercalated magnesium peroxide that, when hydrated, produces a controlled release of oxygen to the subsurface environment which accelerates naturally occurring aerobic biodegradation of contaminants. This methodology has been found to be successful at accelerating achieving TCGs in many environments.

Advantages to Alternative 3 are that 1) source removal is more complete compared to Alternative 2, 2) impacted groundwater would be treated through both physical removal and through biodegradation and 3) ORC supplies a controlled oxygen release for a period of up to 12 months on a single application. Disadvantages include 1) the possibility that due to the presence of clays in the subsurface soils, subsequent dosing of ORC or other remedial efforts to reduce groundwater concentrations may be required, and 2) the time for remediation is still unknown and would require continued long-term groundwater monitoring.

The approximate costs to implement the targeted soil excavation and ORC Placement will range from $550,000 to $650,000. As part of this effort, three monitoring wells will need to be abandoned and replaced at a cost ranging from $45,000 to $60,000. Additional costs to monitor groundwater attenuation would be $70,000 per year. This cost includes groundwater monitoring activities for the year, project management, and general well rehabilitation and maintenance. As a result, the approximate Year 1 costs for Alternative 3 will range from $665,000 to $780,000.

9.2.4 Alternative 4: Targeted Soil Removal with Aggressive Groundwater Treatment

Alternative 4 addresses soil and groundwater source remediation similar to Alternative 3, and addresses remnant groundwater contamination aggressively through the use of widespread

ORC injections across the Site as shown on Plate 12. Soil would be excavated from the two hotspot areas that contain the highest concentrations of COPCs at the Site. The excavation of the two hotspots would require the destruction of existing well MW-4. Following the completion of the excavation of the two hotspots, ORC will be injected into the groundwater fluctuation zone. The probes are installed in such a manner that they create "barriers" of ORC perpendicular to the direction of groundwater flow. This method requires fewer probe holes, is less disruptive to the site, and aids the spread of oxygen by spreading the ORC source material in a wider area across the Site.

Advantages of implementing Alternative 4 at the Site are 1) source removal is more complete compared to Alternative 2, 2) impacted groundwater would be treated faster than in Alternative 3, and 3) potential reduction in contaminants may occur in a shorter period of time over Alternative 3, thus reducing the time required to conduct groundwater monitoring. Disadvantages are similar to those identified for Alternative 3, however, the overall length of time to reach cleanup goals would most likely be less.

The approximate costs to implement the targeted soil excavation and ORC Injection at 100 point locations will range from $400,000 to $500,000. As part of this effort, one monitoring well will need to be abandoned and replaced at a cost ranging from $20,000 to $30,000. Additional costs to monitor groundwater attenuation would be $70,000 per year. This cost includes groundwater monitoring activities for the year, project management, and general well rehabilitation and maintenance. As a result, the approximate Year 1 costs for Alternative 4 will range from $490,000 to $600,000.

9.2.5 Comparison of Remedial Alternatives

A screening process has been conducted to evaluate the applicability of the alternatives compared to each other to make a final selection of the most effective remedy for the Site. The alternative screening criteria included the following;

- Effectiveness,
- Overall Protectiveness of Human Health and the Environment,
- Implementability, and
- Cost

The comparison of the four remedial alternatives is summarized below.

Alternative Evaluation Summary Table

	Alternative 1: No Action/MNA	Alternative 2: "Hotspot" Removal with ORC Placement	Alternative 3: Targeted Soil Removal and ORC Placement	Alternative 4: Targeted Soil Removal with Aggressive Groundwater Treatment
Short-term Effectiveness	Not Effective	Moderately effective	Highly effective to remove source material,	Highly Effective
Long-term Effectiveness	Not Effective	Source remains and will need to be remediated in the future, moderately effective but may require more aggressive groundwater treatment	Moderately effective but may require more aggressive groundwater treatment	Highly Effective
Overall Protectiveness	Not Protective	Moderately Protective	Protective	Protective
Administrative & Technical Implementability	Feasible	Feasible	Feasible	Feasible
Year 1 Cost	$50,000	$615,000 to $730,000	$665,000 to $780,000	$490,000 to $600,000
Estimated Years of Groundwater Monitoring	20 Years	2 Years	2 Years	2 Years
Total Estimated Cost	$1,000,000	$780,000 to $870,000	$805,000 to $920,000	$630,000 to $740,000

9.3 RECOMMENDED CORRECTIVE ACTION

Of the four remedial alternatives evaluated in Section 9.2, Alternative 4, Targeted Soil Removal with Aggressive Groundwater Treatment, appears to be the best available and most effective approach to remediate soil and groundwater at the Site. This option presents an approach that represents the least risk of having to implement another phase of remediation at the site. The selection of this alternative has been discussed with the property owner. The Work Plan detailing the proposed remedial alternative is presented below.

10.0 IMPLEMENTATION OF CORRECTIVE ACTION

10.1 CONTRACTOR SELECTION

A minimum of three written bids from licensed contractors will be obtained in accordance with UST Fund guidelines. From the bids, Buttner Properties, Inc. will select the licensed contractor to complete the selected remedial alternative at the Site.

10.2 LICENSES, TRAINING, AND PERMITS

Implementation of the selected Alternative will be performed with oversight from a California-professional geologist or professional civil engineer that will become the Consultant of Record for the project. All removal, transportation, and disposal will be performed in

accordance with all applicable federal, state, and local laws, regulations, ordinances, and notifications. All site preparation, excavation, soil handling, and relocation of the impacted soil will be completed by a contractor with a Class A – Hazardous Materials License. All personnel involved with implementing the field portions of the chosen alternative will have current Hazardous Waste Operations and Emergency Response (HAZWOPER) training and will be familiar with a Site-Specific Health and Safety Plan prepared by a Certified Industrial Hygienist (CIH). If required, a Grading Permit will be obtained through the City of Oakland.

Since the selected remedial alternative requires the destruction and reinstallation of well MW-4, necessary permits from Alameda County Public Works Agency (ACPWA) and encroachment permits from the City of Oakland to complete this portion of the work will be obtained.

10.3 HEALTH AND SAFETY PLAN (SSHSP)

All contractors will be responsible for operating in accordance with the most current requirements of Title 8, California Code of Regulations, Section 5192 (8 CCR 5192) and Title 29, Code of Federal Regulations, Section 1910.120 (29 CFR 1910.120), Standards for HAZWOPER. Onsite personnel are responsible for operating in accordance with all applicable regulations of the Occupational Safety and Health Administration (OSHA) outlined in 8 CCR General Industry and Construction Safety Orders and 29 CFR 1910 and 29 CFR 1926, Construction Industry Standards, as well as other applicable federal, state and local laws and regulations.

10.4 UTILITY CLEARANCE

To identify the location of underground utilities, the contractor shall contact USA a minimum of 48 hours prior to start of earthwork activities. A private utility locator will also be retained to locate and mark utilities at the Site.

10.5 SITE PREPARATION

The Site is secured by a chain link fence and two rolling gates. No additional perimeter fencing will be needed. Building demolition, if required will be performed prior to implementation of the Alternative and as such is not discussed in this section.

10.6 FIELD ACTIVITIES

Within six months following the approval of this CAP, Buttner Properties will begin the process of relocating the existing tenant and updating the case classification in the UST Fund project approval process. Once the tenant is relocated and UST Fund project approval is in place, Buttner Properties will obtain the required demolition permits through the City of Oakland and retain a contractor to demolish the existing structure. The Consultant of Record will assist Buttner properties in providing necessary notification to the ACEH when site work is to begin.

Following demolition of the existing structure, the selected remediation Contractor will begin excavation in the areas shown on Plate 12. Excavation at the former waste oil UST will

measure approximately 25 feet by 25 feet, to a depth of 17 feet bgs. Excavation adjacent to the former fuel dispenser island and in the area of soil-gas boring SG-7 will measure 15 feet by 15 feet, to a depth of 17 feet bgs.

Excavation will involve removing the subsurface soil using conventional earth moving construction equipment. Visual observations by the Consultant of Record will be used to direct excavation activities. Excavated soil will be stockpiled and covered with plastic sheeting pending completion of profiling, approval, and offhaul to a licensed landfill facility. After excavation is complete, confirmation sampling will be conducted by the Consultants of Record to verify that cleanup goals have been met.

Due to the shallow groundwater conditions at the Site, groundwater that recharges into the excavation areas will be periodically removed by the contractor by pumping. Removed water will be placed into an onsite storage tank pending results used to characterize the water for disposal. Based on the results, the water will then be transported to an accepting disposal facility.

Following the completion of the excavation of the two hotspots, approximately 30 pounds of ORC will be placed into each pit (for a total of 60 pounds) and then the excavation areas will be backfilled with clean imported fill. Backfill will be placed and compacted under engineered controls as documented by the Consultant of Record.

Groundwater monitoring well MW-4 will be re-installed at the Site at the location shown on Plate 12. The well will consist of a two-inch diameter, Schedule 40, PVC casing, 0.02-inch slotted PVC screen, and a locking well cap. Based on known groundwater fluctuation data, the well screen will be positioned between depths of 5 to 20 feet bgs, similar to the well screen installed for the existing well MW-4. The boring annulus between the well casing and the borehole wall will be filled with clean Monterey #3 sand from the bottom of the boring to six inches above the top of the screen section (4.5 to 20 feet bgs). Approximately one foot of hydrated bentonite pellets will be placed above the sand pack. Neat cement grout will be tremied from the top of the hydrated bentonite to the surface to provide the well seal. The wellhead will be secured with a water-tight, traffic-rated cover, installed flush with the existing pavement surface. After the well has been installed, the top of casing and the existing groundsurface will be surveyed to a local datum by a State-certified land surveyor.

After no less than 48-hours after installation, the well will be developed by purging between five and ten well volumes of water. During purging various parameters including temperature, conductivity, pH, and turbidity will be noted on well development logs. Well development will be completed using a peristaltic pump and/or disposable bailers.

After well installation and development, the aggressive groundwater treatment phase of the CAP will begin. This phase of work will involve injecting up to 9,000 pounds of ORC through about 100 injection points. Approximately 80 pounds of ORC will be injected at each injection point. Injection probes will be completed in rows and will be spaced approximately 10 feet from one another. Plate 12 illustrates the approximate probe locations.

ORC will be injected using direct push drilling equipment. At each injection probe ORC will conveyed through a nozzle with multiple ports and under higher pressure to enhance ORC delivery to the target zones. The direct push-drilling rig will advance a 1-inch diameter sampling rods to the groundwater fluctuation zone between 8 and 15 feet bgs. Prior to injection, the ORC will be heated onsite to decrease its viscosity. The ORC will then be pressure pumped through the injection rods to the target depths. Upon completion, probes will be grouted with neat cement and capped with asphalt or concrete to match the existing grade.

The effectiveness of the source removal and ORC injection based will be checked through ongoing groundwater monitoring. Status results will be presented in periodic groundwater monitoring reports.

10.7 DECONTAMINATION

All contractor equipment including, but not limited to earthwork equipment and transportation vehicles, shall be decontaminated prior to leaving the Site. Decontamination will be conducted within a pre-determined exterior contaminant reduction zone and will include brushing or high-pressure water washing. Soil and dust will be removed from all personnel prior to leaving the Site. Sanitation facilities will be isolated away from areas undergoing remediation. All sampling equipment will be decontaminated between uses.

10.8 DUST CONTROL

Standard dust control practices will be implemented during excavation and loading activities to minimize fugitive emissions in compliance with Bay Area Air Quality Management District (BAAQMD) regulations. The contractor will implement standard dust control practices to prevent the generation of dust. Standard dust control measures will include the use of water spray and using a controlled rate of work at the Site.

10.9 RUNOFF CONTROL

The contractor will use water spray for dust control purposes, and care will be taken to avoid overwatering the soil to prevent runoff from leaving the impacted area. Soil bins or stockpile areas will be appropriately protected from the elements.

10.10 TRANSPORATION ROUTE

The transportation route from the Site will be north along Telegraph Avenue, then west on 27th Avenue. Trucks will then merge onto Interstate 980. The reverse route will be followed for trucks arriving to the Site. This route is an established truck route to and from the Site. No schools and very few residential properties are located along this route.

10.11 SITE RESTORATION

As stated in Section 10.6, following excavation activities at the Site, the two excavation areas will be backfilled with clean imported soil compacted to 90 percent relative compaction. The two excavation areas will then be paved with asphalt to match the existing grade. ORC

injection points will be grouted to the surface and patched with asphalt or concrete to match existing grade once the groundwater treatment phase of the CAP is completed.

10.12 REPORTING

Following implementation of the selected remedial alternative, a Corrective Action Implementation Report (CAIR) will be completed by the Consultants of Record approximately 60 days after completion of all field services and forwarded to the ACEH for review and approval. The CAIR will include at a minimum the following:

- Description of field activities completed and justifications for deviations from the CAP (if any);
- Summary of implementation activities;
- Depth and volume of soil removed;
- Location of soil disposal;
- Description of groundwater treatment;
- Figures illustrating the locations of the confirmation samples;
- Tabulated analytical data for the confirmation sample locations;
- Description of site restoration activities;
- Conclusions and recommendations associated with the goals and objectives of the CAP.

Details regarding the new monitoring well installation activities, including well completion details, will also be presented in this report. In addition, a State of California Department of Water Resources (DWR) Form 188, Well Completion Report will be completed and filed in accordance with State and local jurisdiction requirements. A compact disc that includes the field notes, laboratory analytical reports, and copies of the disposal manifests will also be provided as part of the CAIR.

11.0 QUALITY CONTROL

The overall QA/QC objectives are to implement procedures for obtaining and evaluating data in an accurate, precise, and complete manner so that analytical data, sampling procedures, and field measurements are representative of field conditions. The following procedures focus on the validation of chemical data and field quality control samples, and sampling through the use of a combination of equipment blank and duplicate samples. Based on the data validation findings, it will be determined whether there are deficiencies in the data or field sampling, whether those deficiencies require corrective action, and whether the data is sufficient for the purposes of the project.

It is assumed that the analytical laboratory's established QC procedures for equipment calibration, sample preparation, and duplicate and spike QC samples are adequate and will

meet EPA Data Quality Indicators (DQI). As part of the laboratory selection process, the laboratory will be asked to confirm this assumption and/or identify alternative protocols where appropriate.

The following sections provide a list of field QA/QC objectives, and describes data validation procedures, corrective action, and quality assurance reporting.

11.1 FIELD QUALITY ASSURANCE/QUALITY CONTROL

The following describes the types of field QC samples that will be collected during the implementation of remedial activities at the Site.

11.1.1 Equipment Blanks (Equipment Decontamination Rinsates)

Equipment blanks will be used to assess the adequacy of practices of decontaminating sampling equipment and prevent cross-contamination between sampling locations and samples. Rinsate samples for this project will be collected daily only for sampling equipment used repetitively to collect environmental samples and not for dedicated or disposable sampling equipment. Rinsate water will be collected following the final decontamination rinse of sampling equipment (such as a spade, shovel, or mixing bowl) and then dispensed into an appropriate sample container. Specified sample containers and sample volumes are collected for each type of analysis to be conducted by the laboratory. The equipment decontamination rinsates will be handled and analyzed in the same manner as all environmental samples collected within the Study Area.

For this project, equipment blanks will be analyzed for TPHg and BTEX using EPA Methods 5030/8260.

11.1.2 Duplicates

Duplicates will be collected at selected locations to provide estimates of the total sampling and analytical precision. Typically, one duplicate sample is collected per day or is analyzed from each group of ten samples of a similar matrix type and concentration. The duplicates are handled and analyzed in the same manner as all environmental samples.

For this project, a duplicate soil sample will be obtained from the same location as the regular soil sample. The duplicate soil samples will be retained in 16-oz clean, sealable, glass jars or stainless steel tubes, capped with Teflon sheeting and plastic end-caps. Soil samples will be stored in a cooled ice-chest, delivered to Curtis and Tompkins Laboratories under chain-of-custody, and analyzed for some or all of the following:

- TPHg and BTEX using EPA Methods 5030/8260

11.2 ASSESSMENT OF COMPLETENESS, ACCURACY, PRECISION, COMPARABILITY, AND REPRESENTATIVENESS

Chemical data derived from remedial activities will be validated according to accuracy, precision, and completeness. The primary goal is to ensure that the data reported will be

representative of conditions at the Site and can be compared to certain environmental screening criteria. To meet this goal, a combination of qualitative evaluations and statistical procedures will be used to check the quality of the chemical data. However, the results of the statistical analyses will not be used to eliminate data from the database.

To assess the completeness of the data, the Consultant of Record will compare the laboratory report with the chain-of-custody to confirm that the laboratory reports are complete. The goal is that all data received from a chemical testing laboratory will be 100% complete.

To assess the accuracy of the data, all laboratory reports will be reviewed by the Consultant of Record to confirm compliance with the laboratory's own QC limits, particularly with respect to the laboratories matrix spike and surrogate spike results.

To assess the precision of the data, the Consultant of Record will review the relative percent difference (RPD) between duplicate laboratory and field samples on all of the laboratory reports. Typically a RPD of <20% for soil is considered acceptable.

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. The use of EPA Methods or standard Test Methods from a recognized source allows the data to be directly compared, facilitating evaluation of trends or changes in a site. Comparability also refers to the reporting of data in comparable units so direct comparisons are simplified.

Based on the quantitative assessment described above and other qualitative assessment of the findings, the Consultant of Record will judge whether the data appears to be representative of site conditions and, therefore, will be acceptable and comparable for the purposes of the project, particularly with respect to comparing data and analytical reporting limits to established environmental screening criteria.

11.3 DATA VALIDATION PROCEDURES

The procedures for evaluating field QA/QC data are presented below for duplicate and equipment blank samples.

11.3.1 Equipment Blanks

The evaluation procedure for equipment blanks is a qualitative review of the chemical analysis data reported by the laboratory. The procedure for assessing equipment blank samples will be as follows:

- Tabulate the data for the blank samples.
- Identify any blank samples with detected chemicals.
- If no chemicals are detected in any of the blank samples, enter the tabulated data into the report.

If any chemicals are found in blank samples, the compound(s), concentration(s), and the field data for that period of time will be assessed for potential problems with data interpretation at the laboratory. Data will not be removed from the database. Appropriate notations will be made in the final report submitted to the ACEH.

11.3.2 Duplicates

The procedure for assessing duplicate samples is as follows:

- Tabulate duplicate data and calculate the positive difference, average, and relative percent difference (RPD) as shown below for each duplicate pair:

$$RPD = \left| (X_1 - X_2) / (\overline{X})^* 100 \right|$$

Where: X_1 = concentration for sample 1 (regular sample)
X_2 = concentration for sample 2 (duplicate sample)
$\overline{X}$ = mean of sample 1 and sample 2

- Calculate the mean for the RPD for all duplicate pairs.
- Identify duplicates that exceed the precision goal for this project of an RPD of <20%.

Qualitatively evaluate the significance of the data that fall outside of the control limits or project goals. If data quality problems arise, the analytical laboratory will be notified and modifications to the field sampling may be implemented as a corrective measure. Data will not be removed from the database.

11.4 CORRECTIVE MEASURES

If any occasions arise that indicate a field or laboratory measurement error has occurred, one or more of the following corrective measures will take place. Corrective measures will be handled on a case-by-case basis.

11.4.1 Field Corrective Measures

The need for corrective measures will be identified as a result of field audits or by review of laboratory data by the Consultant of Record. If problems become apparent that are identified as originating in the field, immediate corrective measures will take place. If immediate corrective measures do not resolve the problem, appropriate personnel will be assigned to investigate and evaluate the cause of the problem. Once a corrective measure is implemented, the effectiveness of the action will be verified such that the end result is elimination of the problem.

11.4.2 Laboratory Corrective Measures

The need for corrective measures resulting from not meeting QC criteria (completeness, precision, and accuracy) and/or from QA audits will be initiated by the laboratory QA/QC

manager in consultation with the Consultant of Record. Corrective measures may include, but is not limited to:

- Re-analyzing the samples, if holding time criteria permit.
- Evaluating and amending analytical procedures.
- Accepting data with an acknowledged level of uncertainty.
- Re-sampling and analyzing.

In the event that the above corrective measures are deemed unacceptable, an alternative laboratory may be selected to perform necessary or appropriate verification analyses.

11.5 QUALITY ASSURANCE REPORTING

The results of the data validation process will be reported in the final report. The report will include an overall assessment of the performance of the field and laboratory programs based on the field audits, results of data validation, and on a summary of the RPD evaluations.

12.0 GROUNDWATER MONITORING

Continued groundwater monitoring activities will be conducted by the Consultant of Record at selected wells to evaluate when TCGs have been achieved. Groundwater samples obtained during monitoring activities at the Site will continue to be analyzed for the following:

- TPHg and BTEX using EPA Methods 5030/8260;
- TPHd and TPHmo using EPA Methods 8015m with silica gel cleanup;
- Lead scavengers (1,2,-dichloroethane and 1,2-dibromoethane) using EPA Method 8260; and
- Five fuel oxygenates (MTBE, TAME, ETBE, TBA, and DIPE) using EPA Method 8260.

Analytical results will be reported in future groundwater monitoring reports. A discussion of the ongoing effectiveness of the corrective action will also be discussed in each report. Based on the results, the need for additional corrective action will be evaluated.

13.0 SITE CLOSURE

Based on the effectiveness of the proposed remedy, site closure will be requested when concentrations in soil and groundwater are below the proposed cleanup levels described in Section 8.3 as approved by ACEH.

14.0 SCHEDULE

On behalf of Buttner Properties, we thank you in advance for your timely review and concurrence of the CAP described herein. With the regulatory oversight of ACEH, Buttner Properties envisions obtaining approval of the CAP described herein by early 2012. Accordingly, Buttner Properties is prepared to begin implementation of the proposed remedial process including the relocation of the tenant in the Spring to Summer of 2012.

15.0 LIMITATIONS

Fugro has prepared this report in a professional manner, using that degree of skill and care exercised for similar projects under similar conditions by reputable and competent environmental consultants. Fugro shall not be responsible for conditions or consequences arising from relevant facts that were concealed, withheld, or not fully disclosed at the time the report was prepared. Fugro also notes that the facts and conditions referenced in this report may change over time and the conclusions and recommendations set forth herein are applicable only to the facts and conditions as described at the time of this report. Fugro believes that conclusions stated wherein to be factual, but no guarantee is made or implied. This report has been prepared for the benefit of ACEH and Buttner Properties.

The information contained in this report, including all exhibits and attachments, may not be used by any party other than ACEH or Buttner Properties, without the express written consent of Fugro Consultants, Inc.

TABLES

Table 1
Summary of Chemical Concentrations in Soil - During Remediation Activities
2250 Telegraph Avenue
Oakland, California

		Petroleum Hydrocarbons					PCBs	Volatile Organic Compounds						Metals						Semi-Volatile Organic Compounds			
Sample Location and Depth in Feet	Sample Date	TPH, Gasoline Range	TPH, Kerosene Range	TPH, Diesel Range	TPH, Motor Oil Range	Total Oil Grease	Polychlorinated Biphenyls	Benzene	Toluene	Ethylbenzene	Xylenes	PCE	Chlorobenzene	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	2-Methylphenol	2-Methylnaphthalene	Di-N-Butyl Phthalate	Naphthalene
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Gasoline Tank and Dispenser Area																							
G3@ 10	8/29/1990	**120**	--	--	--	--	--	**820**	**560**	**2,300**	**4,000**	--	--	--	**--**	**--**	**9.07**	**--**	**--**	**--**	--	--	--
G4@ 10	8/29/1990	**18**	--	--	--	--	--	**89**	**11**	**150**	**520**	--	--	--	**--**	**--**	**19.2**	**--**	**--**	**--**	--	--	--
G5@ 10	8/29/1990	**270**	--	--	--	--	--	**2,300**	**220**	**3,400**	**410**	--	--	--	**--**	**--**	**5.43**	**--**	**--**	**--**	--	--	--
G6@ 15	8/29/1990	**8.3**	--	--	--	--	--	**320**	**6.3**	**170**	**220**	--	--	--	**--**	**--**	**4.93**	**--**	**--**	**--**	--	--	--
G7@ 11	8/29/1990	**6.3**	--	--	--	--	--	**270**	**34**	<5.0	**160**	--	--	--	**--**	**--**	**8.45**	**--**	**--**	**--**	--	--	--
G8@16	8/29/1990	<2.5	--	--	--	--	--	**19**	**5.6**	<5.0	<5.0	--	--	--	**--**	**--**	**6.65**	**--**	**--**	**--**	--	--	--
G9@ 10	8/29/1990	<2.5	--	--	--	--	--	<5.0	<5.0	<5.0	<5.0	--	--	--	**--**	**--**	**5.54**	**--**	**--**	**--**	--	--	--
G10@ 16	8/29/1990	**260**	--	--	--	--	--	**1,600**	**670**	**1,300**	**460**	--	--	--	**--**	**--**	**8.36**	**--**	**--**	**--**	--	--	--
G11@ 10	8/29/1990	<2.5	--	--	--	--	--	<5.0	<5.0	<5.0	<5.0	--	--	--	**--**	**--**	**6.01**	**--**	**--**	**--**	--	--	--
D1@ 0.5	8/29/1990	<2.5	--	--	--	--	--	<5.0	<5.0	<5.0	<5.0	--	--	--	**--**	**--**	**201**	**--**	**--**	**--**	--	--	--
D2@ 0.5	8/29/1990	**1,700**	--	--	--	--	--	**2,300**	**9,500**	**35,000**	**77,000**	--	--	--	**--**	**--**	**107**	**--**	**--**	**--**	--	--	--
D3@ 0.5	8/29/1990	**200**	--	--	--	--	--	**850**	**1,600**	**3,800**	**18,000**	--	--	--	**--**	**--**	**91.7**	**--**	**--**	**--**	--	--	--
D4@ 0.5	8/29/1990	<2.5	--	--	--	--	--	<5.0	<5.0	<5.0	**9.1**	--	--	--	**--**	**--**	**537**	**--**	**--**	**--**	--	--	--
Waste Oil Tank Area																							
WO-1	8/31/1990	**40**	--	**290**	**3,800**	**1,700**	<0.05	**1,800**	**880**	**800**	**1,200**	**39**	**40**	**0.431**	**23.4**	**38.4**	**151**	**32.5**	**167**	**0.9**	**2.4**	**0.5**	**1.3**
WO-2	8/31/1990	**740**	--	**640**	**5,100**	**3,600**	**--**	**12,000**	**15,000**	**10,000**	**18,000**	**470**	<10	**0.522**	**25.6**	**32.5**	**112**	**30.2**	**140**	**--**	--	--	--
WP1,2,3.4	8/31/1990	**130**	--	**1,000**	**4,800**	**3,200**	**--**	**11000**	**1,700**	**2,100**	**3,900**	**66**	<10	**0.482**	**26.0**	**23.3**	**85.9**	**27.5**	**70.6**	**--**	--	--	--
ESLs Residential Land Use[1]		100	100	100	370	370	0.22	120	9,300	2,300	11,000	370	1,500	1.7	750	230	200	150	600	NE	0.25	NE	1.3
ESLs Commercial/Industrial Land Use[1]		180	180	180	2,500	2,500	0.74	270	9,300	4,700	11,000	950	1,500	7.4	750	230	750	150	600	NE	0.25	NE	2.8

Notes

TPH = Total petroleum hydrocarbons
DCA = Dichloroethane
TCA = Trichloroethane
PCE = Tetrachloroethene
NE = No value established
mg/kg = milligrams per kilogram = parts per million
µg/kg = micrograms per kilogram = parts per billion
<1 = Chemical not present at a concentration greater than the laboratory detection limit shown or stated on test reports
- = Chemical not tested for

ESLs = San Francisco Bay Regional Water Quality Control Board, Screening for Environmental Concerns at Sites with Contaminated Soil and Grounwater, Interim Final November 2007, Revised May 2008
[1] = Table B Shallow Soil Screening Levels, Groundwater is not a Current or Potential Source of Drinking Water

Table 2
Summary of Chemical Concentrations in Soil - After Remediation Activities
2250 Telegraph Avenue
Oakland, California

		Petroleum Hydrocarbons					Volatile Organic Compounds								Metals	Semi-Volatile Organic Compounds											
Sample Location and Depth in Feet	Sample Date	TPH, Gasoline Range	TPH, Kerosene Range	TPH, Diesel Range	TPH, Motor Oil Range	Total Oil Grease	Benzene	Toluene	Ethylbenzene	Xylenes	1,1,1-TCA	1,2-DCA	PCE	Chlorobenzene	Lead	2-Methylnaphthalene	Anthracene	Bis-2-ethylhexyl Phthalate	Butylbenzylphthalate	Di-N-Butyl Phthalate	Fluoranthene	Fluorene	Naphthalene	Nitrobenzene	N-Nitrosodiphenylamine	Phenanthrene	Pyrene
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Gasoline Tank and Dispenser Area																											
G10@ 17	10/10/90	<2.5	--	<5	<50	--	**73**	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G12@ 10	10/5/90	**52**	--	**110**	<50	--	**110**	**45**	**480**	**140**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G13@ 10	10/8/90	**12**	--	<5	<50	--	**220**	**43**	**60**	**130**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G14@ 7.5	10/8/90	<2.5	--	<5	**100**	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G15@ 9.5	10/8/90	**310**	--	<5	<50	--	**820**	**59**	**1,300**	**1,600**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G16@11	10/8/90	**19**	--	<5	<50	--	**200**	**41**	**210**	**46**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G17@ 6	10/10/90	24.0	--	<5	<50	--	**38**	**20**	**12**	**18**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G18@ 8	10/17/90	<2.5	--	<5	<50	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G19@ 10	10/17/90	<2.5	--	<5	<50	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G20@ 17	10/17/90	<2.5	--	<5	<50	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G21@ 10	10/17/90	<2.5	--	<5	<50	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G22@ 10	10/17/90	<2.5	--	<5	**87**	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D2@ 4.5	10/8/90	<2.5	--	<5	<50	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D3@ 4.5	10/4/90	<2.5	--	<5	<50	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Waste Oil Tank Area																											
3@ 6	2/9/94	<1	<1	<1	**27**	<50	<5	<5	<5	<5	--	--	--	--	**8**	--	--	--	--	--	--	--	--	--	--	--	--
4@ 11	2/9/94	<1	<1	<1	**20**	**80**	<5	<5	<5	<5	--	--	--	--	**11**	--	--	--	--	--	--	--	--	--	--	--	--
5@ 6	2/9/94	**240**	<1	**560**	**1,700**	**3,900**	**300**	**1,800**	**2,500**	**16,000**	<5	**36**	**29**	**16**	**590**	**2.7**	**0.13**	<0.05	<0.05	<0.05	**0.14**	**0.12**	**1.8**	**0.39**	<0.05	**0.45**	**0.26**
6@ 11	2/9/94	**31**	<1	**250**	**640**	**1,700**	**580**	**670**	**550**	**2,700**	<5	<5	**8.0**	**8.4**	**45**	**3.7**	**0.18**	<0.05	<0.05	**1.6**	**0.15**	**0.14**	**2.5**	<0.05	**0.21**	**0.39**	**0.27**
7@ 6	2/9/94	<1	<1	<1	<10	<50	<5	<5	<5	**31**	<5	<5	<5	<5	**19**	<0.05	<0.05	**0.32**	**0.93**	**1.7**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
8@ 11.5	2/9/94	**100**	<1	**680**	**1,100**	**2,700**	**360**	**300**	**1,300**	**6,700**	--	--	--	--	**21**	--	--	--	--	--	--	--	--	--	--	--	--
9@ 6	2/9/94	<1	<1	<1	<10	<50	<5	<5	<5	<5	--	--	--	--	**8.6**	--	--	--	--	--	--	--	--	--	--	--	--
10@ 11.5	2/9/94	**6.5**	<1	**210**	**360**	**470**	**100**	**7.3**	**100**	**160**	--	--	--	--	**14**	--	--	--	--	--	--	--	--	--	--	--	--
11@ 13	2/9/94	**15**	<1	**210**	**450**	**780**	**430**	**45**	**350**	**960**	<5	<5	<5	**7.6**	**60**	**0.39**	<0.05	<0.05	<0.05	**2**	**0.05**	**0.08**	**0.34**	<0.05	<0.05	**0.2**	**0.1**
Well Boring Samples																											
MW1 @10	3/2/94	**260**	<1	<1	<10	--	<20	<20	**970**	**770**	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
MW2 @10	3/1/94	<1	<1	<1	<10	--	<90	<90	<5	<5	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
MW3 @10	3/1/94	**620**	<1	**5.6**	<10	--	<90	<90	**840**	**2,700**	**7.4**	<5	**11**	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
MW4 @10	3/2/94	**1.9**	<1	**8.9**	**22**	--	<20	<20	<5	<5	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
MW5 @4	6/23/97	<1	--	<1	--	--	<5	<5	<5	<5	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
MW5 @8	6/23/97	**3.1**	--	**5.1**	--	--	<5	<5	**5.7**	**17**	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
MW6 @6	6/23/97	<1	--	<1	--	--	<5	<5	<5	<5	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
MW6 @10	6/23/97	**4.4**	--	**6.5**	--	--	<5	<5	**26**	<5	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
ESLs Residential Land Use[1]		100	100	100	370	370	120	9,300	2,300	11,000	7,800	220	370	1,500	200	0.25	2.8	35	NE	NE	40	8.9	1.3	NE	NE	11	85
ESLs Commercial/Industrial Land Use[1]		180	180	180	2,500	2,500	270	9,300	4,700	11,000	7,800	480	950	1,500	750	0.25	2.8	120	NE	NE	40	8.9	2.8	NE	NE	11	85

Notes

TPH = Total petroleum hydrocarbons
DCA = Dichloroethane
TCA = Trichloroethane
PCE = Tetrachloroethene
NE = No value established
mg/kg = milligrams per kilogram = parts per million
µg/kg = micrograms per kilogram = parts per billion
<1 = Chemical not present at a concentration greater than the laboratory detection limit shown or stated on test reports
-- = Chemical not tested for

ESLs = San Francisco Bay Regional Water Quality Control Board, Screening for Environmental Concerns at Sites with Contaminated Soil and Grounwater, Interim Final November 2007, Revised May 2008
[1] = Table B Shallow Soil Screening Levels, Groundwater is not a Current or Potential Source of Drinking Water

Table 3
Summary of Chemical Concentrations in Soil - 2009 Investigation
2250 Telegraph Avenue
Oakland, California

Analyte	Units	Sample ID																			Regulatory Criteria	
		B-1@2	B-1@ 7.5	B-1@10	B-1@12	B-1@15	B-1@17	B-1@20	B-2@5	B-2@7.5	B-2@10	B-2@12	B-2@15	B-2@17	B-2@19.5	B-3@1	B-3@5	B-3@10	B-3@12	B-3@15	B-3@17	ESLs[1] Residential Land Use	ESLs[1] Commerical/Industrial Land Use
Date		7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009		
Sample Depth	feet	2.0	7.5	10	12	15	17	20	5.0	7.5	10	12	15	17	19.5	1.0	5.0	10	12	15	17		
Petroleum Hydrocarbons																							
TPHg	mg/kg	<0.98	<0.97	**170**	**320**	**1.1**	**2.0**[Y]	<1.0	<0.97	<1.0	<0.96	<1.0	**16**[Y]	**33**[Y]	<0.99	--	--	<1.0	<0.98	**8.7**[Y]	--	100	180
TPHd	mg/kg	**29**[Y]	**15**[Y]	--	**57**[Y]	--	--	--	<1.0	--	**1.9**[Y]	--	**17**[Y]	--	--	<5.0	**4.0**[Y]	**7.6**[Y]	**33**[Y]	**150**[Y]	**44**[Y]	100	180
TPHmo	mg/kg	**450**	**98**	--	<5.0	--	**--**	--	**5.9**	--	<5.0	--	<5.0	--	--	**33**	**10**	<5.0	**110**	**400**	**140**	370	2,500
TPHhy	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	370	2,500
Volatile Organic Compounds																							
Benzene	µg/kg	<4.7	<4.6	<500	<830	**10**	**34**	<4.6	<5.0	<4.7	<4.8	<4.7	<46	<50	<4.8	--	--	<4.9	<4.8	<4.8	--	120	270
Toluene	µg/kg	<4.7	<4.6	**1,300**	**4,000**	<4.9	<4.7	<4.6	<5.0	<4.7	<4.8	<4.7	<46	<50	<4.8	--	--	<4.9	<4.8	<4.8	--	9,300	9,300
Ethylbenzene	µg/kg	<4.7	<4.6	**6,900**	**12,000**	**22**	**23**	<4.6	<5.0	<4.7	<4.8	<4.7	<46	<50	<4.8	--	--	<4.9	<4.8	<4.8	--	2,300	4,700
Xylenes	µg/kg	<9.4	<9.2	**28,000**	**53,000**	**65**	<9.4	<9.2	<10	<9.4	<9.6	<9.4	<92	<100	<9.6	--	--	<9.8	<9.6	<9.6	--	11,000	11,000
MTBE	µg/kg	<4.7	<4.6	<500	<830	<4.9	<4.7	<4.6	<5.0	<4.7	<4.8	<4.7	<46	<50	<4.8	--	--	<4.9	<4.8	<4.8	--	8,400	8,400
TBA	µg/kg	<95	<92	<10,000	<17,000	<97	<95	<93	<100	<94	<96	<93	<930	<1,000	<96	--	--	<99	<95	<96	--	100,000	110,000
TAME	µg/kg	<4.7	<4.6	<500	<830	<4.9	<4.7	<4.6	<5.0	<4.7	<4.8	<4.7	<46	<50	<4.8	--	--	<4.9	<4.8	<4.8	--	NE	NE
DIPE	µg/kg	<4.7	<4.6	<500	<830	<4.9	<4.7	<4.6	<5.0	<4.7	<4.8	<4.7	<46	<50	<4.8	--	--	<4.9	<4.8	<4.8	--	NE	NE
ETBE	µg/kg	<4.7	<4.6	<500	<830	<4.9	<4.7	<4.6	<5.0	<4.7	<4.8	<4.7	<46	<50	<4.8	--	--	<4.9	<4.8	<4.8	--	NE	NE
1,2-DCA	µg/kg	<4.7	<4.6	<500	<830	<4.9	<4.7	<4.6	<5.0	<4.7	<4.8	<4.7	<46	<50	<4.8	--	--	<4.9	<4.8	<4.8	--	220	480
1,2-DBA	µg/kg	<4.7	<4.6	<500	<830	<4.9	<4.7	<4.6	<5.0	<4.7	<4.8	<4.7	<46	<50	<4.8	--	--	<4.9	<4.8	<4.8	--	19	44
Total Organic Carbon																							
	%	--	--	--	--	--	--	--	**0.53**	--	--	--	--	--	--	--	--	--	--	--	--	NE	NE

Notes:

TPHg = Total Petroleum Hydrocarbons as gasoline
TPHd = Total Petroleum Hydrocarbons as diesel
TPHmo = Total Petroleum Hydrocarbons as motor oil
TPHhy = Total Petroleum Hydrocarbons as hydraulicfluid
DCA = Dichloroethane
DBA = Dibromoethane
TCA = Trichloroethane
MTBE = tert-Butyl methyl ether
TBA = tert-Butyl alcohol
DIPE = Diisopropyl ether
ETBE = Ethyl tert butyl ether
TAME = Methyl tert amyl ether

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
Detected concentrations are shown in **Bold**
ND = Not detected at or above respective reporting limit
< = not detected at or above the listed laboratory reporting limit
NE = Not established
-- Not Analyzed

Y = Sample exhibits chromatographic pattern which does not resemble standard

ESLs = San Francisco Bay Regional Water Quality Control Board, Screening for Environmental Concerns at Sites with Contaminated Soil and Grounwater, Interim Final November 2007, Revised May 2008
[1] = Table B Shallow Soil Screening Levels, Groundwater is not a Current or Potential Source of Drinking Water

Table 3
Summary of Chemical Concentrations in Soil - 2009 Investigation
2250 Telegraph Avenue
Oakland, California

		Sample ID																	Regulatory Criteria	
Analyte	**Units**	**B-4a@5**	**B-4a@7.5**	**B-4a@10**	**B-4a@12**	**B-4a@15**	**B-4a@18**	**B-5@2**	**B-5@7.5**	**B-5@12**	**B-5@15**	**B-6@2**	**B-6@7.5**	**B-6@12**	**B-6@15**	**B-7@5**	**B-7@7.5**	**B-7@12**	**B-7@15**	**ESLs[2] Residential Land Use**	**ESLs[2] Commerical/Industrial Land Use**
Date		7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009		
Sample Depth	feet	5.0	7.5	10	12	15	18	2.0	7.5	12	15	2.0	7.5	12	15	5.0	7.5	12	15		
Petroleum Hydrocarbons																					
TPHg	mg/kg	--	--	--	**4.5**[Y]	<0.99	--	<0.96	<1.0	**8.8**[Y]	<0.96	<1.0	<0.99	<0.96	**11**[Y]	<0.97	<1.0	<1.0	<0.97	100	180
TPHd	mg/kg	**1.9**[Y]	**1.0**[Y]	**1.6**[Y]	**1,100**	**310**	**42**	**4.1**[Y]	<1.0	**1,100**	**2.8**[Y]	**55**[Y]	<0.99	**29**[Y]	**17**[Y]	**10**[Y]	**2.9**[Y]	**1.6**[Y]	<1.0	100	180
TPHmo	mg/kg	**10**	**9.8**	**13**	**850**	**120**	**23**	**32**	**6.9**	**520**	<5.0	**460**	<5.0	**39**	<5.0	**53**	**6.6**	<5.0	<5.0	370	2,500
TPHhy	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	370	2,500
Volatile Organic Compounds																					
Benzene	µg/kg	--	--	--	<47	<4.8	--	<4.8	<4.8	<5.0	<4.9	<4.9	<4.8	<4.8	**39**	<4.8	<4.8	<4.8	<4.9	120	270
Toluene	µg/kg	--	--	--	<47	<4.8	--	<4.8	<4.8	<5.0	<4.9	<4.9	<4.8	<4.8	<25	<4.8	<4.8	<4.8	<4.9	9,300	9,300
Ethylbenzene	µg/kg	--	--	--	<47	<4.8	--	<4.8	<4.8	<5.0	<4.9	<4.9	<4.8	<4.8	**80**	<4.8	<4.8	<4.8	<4.9	2,300	4,700
Xylenes	µg/kg	--	--	--	<94	<9.6	--	<9.6	<9.6	<10	<9.8	<9.8	<9.6	<9.6	<50	<9.6	<9.6	<9.6	<9.8	11,000	11,000
MTBE	µg/kg	--	--	--	<47	<4.8	--	<4.8	<4.8	<5.0	<4.9	<4.9	<4.8	<4.8	<25	<4.8	<4.8	<4.8	<4.9	8,400	8,400
TBA	µg/kg	--	--	--	<940	<97	--	<96	<96	<100	<99	<98	<97	<96	<500	<96	<96	<97	<98	100,000	110,000
TAME	µg/kg	--	--	--	<47	<4.8	--	<4.8	<4.8	<5.0	<4.9	<4.9	<4.8	<4.8	<25	<4.8	<4.8	<4.8	<4.9	NE	NE
DIPE	µg/kg	--	--	--	<47	<4.8	--	<4.8	<4.8	<5.0	<4.9	<4.9	<4.8	<4.8	<25	<4.8	<4.8	<4.8	<4.9	NE	NE
ETBE	µg/kg	--	--	--	<47	<4.8	--	<4.8	<4.8	<5.0	<4.9	<4.9	<4.8	<4.8	<25	<4.8	<4.8	<4.8	<4.9	NE	NE
1,2-DCA	µg/kg	--	--	--	<47	<4.8	--	<4.8	<4.8	<5.0	<4.9	<4.9	<4.8	<4.8	<25	<4.8	<4.8	<4.8	<4.9	220	480
1,2-DBA	µg/kg	--	--	--	<47	<4.8	--	<4.8	<4.8	<5.0	<4.9	<4.9	<4.8	<4.8	<25	<4.8	<4.8	<4.8	<4.9	19	44
Total Organic Carbon																					
	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	NE	NE

Notes:

TPHg = Total Petroleum Hydrocarbons as gasoline
TPHd = Total Petroleum Hydrocarbons as diesel
TPHmo = Total Petroleum Hydrocarbons as motor oil
TPHhy = Total Petroleum Hydrocarbons as hydraulic fluid
DCA = Dichloroethane
DBA = Dibromoethane
TCA = Trichloroethane
MTBE = tert-Butyl methyl ether
TBA = tert-Butyl alcohol
DIPE = Diisopropyl ether
ETBE = Ethyl tert butyl ether
TAME = Methyl tert amyl ether

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
Detected concentrations are shown in **Bold**
ND = Not detected at or above respective reporting limit
< = not detected at or above the listed laboratory reporting limit
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Y = Sample exhibits chromatographic pattern which does not resemble standard

ESLs = San Francisco Bay Regional Water Quality Control Board, Screening for Environmental Concerns at Sites with Contaminated Soil and Grounwater, Interim Final November 2007, Revised May 2008
[1] = Table B Shallow Soil Screening Levels, Groundwater is not a Current or Potential Source of Drinking Water

Table 3
Summary of Chemical Concentrations in Soil - 2009 Investigation
2250 Telegraph Avenue
Oakland, California

Analyte	Units	Sample ID																		Regulatory Criteria	
		B-8@7.5	B-8@15	B-8@20	B-9@5	B-9@10	B-9@15	B-9@20	B-10@2	B-10@5	B-10@10	B-10@15	B-11@2	B-11@7.5	B-11@12	B-12@5	B-12@7.5	B-12@12	B-12@15	B-13@8	ESLs[2] Residential Land Use	ESLs[2] Commerical/Industrial Land Use
Date		7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	7/27/2009	10/19/2009		
Sample Depth	feet	7.5	15	20	5.0	10	15	20	2.0	5.0	10	15	2.0	7.5	12	5.0	7.5	12	15	8.0		
Petroleum Hydrocarbons																						
TPHg	mg/kg	**13**[Y]	**8.0**	<0.98	**1.9**	**56**	**140**	<1.0	<1.0	<1.0	<0.97	<1.0	<0.99	<1.0	<1.0	<1.0	<1.0	**7.8**[Y]	<0.97	<0.99	100	180
TPHd	mg/kg	**9.3**[Y]	**1.3**[Y]	<1.0	**28**[Y]	**44**[Y]	**31**[Y]	<0.99	<1.0	**2.5**[Y]	**5.7**[Y]	**1.7**[Y]	**42**[Y]	<0.99	**1.4**[Y]	<1.0	**9.1**[Y]	**590**	<1.0	**73** [Y]	100	180
TPHmo	mg/kg	<5.0	<5.0	<5.0	**46**	**49**	**19**	<5.0	<5.0	**10**	**21**	<5.0	**440**	<5.0	**13**	<5.0	**88**	**270**	<5.0	**300** [Y]	370	2,500
TPHhy	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**390**	370	2,500
Volatile Organic Compounds																						
Benzene	µg/kg	**28**	**500**	**140**	<4.9	<250	<250	<4.8	<4.9	<4.7	<4.9	<4.7	<5.0	<4.8	<4.9	<4.9	<5.0	<250	<4.8	<5.0	120	270
Toluene	µg/kg	<26	**140**	<4.8	<4.9	<250	<250	<4.8	<4.9	<4.7	<4.9	<4.7	<5.0	<4.8	<4.9	<4.9	<5.0	<250	<4.8	<5.0	9,300	9,300
Ethylbenzene	µg/kg	**790**	**250**	**37**	<4.9	**3,300**	**2,800**	<4.8	<4.9	<4.7	<4.9	<4.7	<5.0	<4.8	<4.9	<4.9	<5.0	<250	<4.8	<5.0	2,300	4,700
Xylenes	µg/kg	**320**	**770**	**9.7**	<9.8	**9,900**	**8,600**	<9.6	<9.8	<9.4	<9.8	<9.4	<10	<9.6	<9.8	<9.8	<10	<500	<9.6	<10	11,000	11,000
MTBE	µg/kg	<26	<19	<4.8	<4.9	<250	<250	<4.8	<4.9	<4.7	<4.9	<4.7	<5.0	<4.8	<4.9	<4.9	<5.0	<250	<4.8	--	8,400	8,400
TBA	µg/kg	<520	<390	<97	<97	<5,000	<5,000	<96	<98	<94	<99	<95	<100	<95	<98	<97	<99	<5,000	<96	--	100,000	110,000
TAME	µg/kg	<26	<19	<4.8	<4.9	<250	<250	<4.8	<4.9	<4.7	<4.9	<4.7	<5.0	<4.8	<4.9	<4.9	<5.0	<250	<4.8	--	NE	NE
DIPE	µg/kg	<26	<19	<4.8	<4.9	<250	<250	<4.8	<4.9	<4.7	<4.9	<4.7	<5.0	<4.8	<4.9	<4.9	<5.0	<250	<4.8	--	NE	NE
ETBE	µg/kg	<26	<19	<4.8	<4.9	<250	<250	<4.8	<4.9	<4.7	<4.9	<4.7	<5.0	<4.8	<4.9	<4.9	<5.0	<250	<4.8	--	NE	NE
1,2-DCA	µg/kg	<26	<19	<4.8	<4.9	<250	<250	<4.8	<4.9	<4.7	<4.9	<4.7	<5.0	<4.8	<4.9	<4.9	<5.0	<250	<4.8	--	220	480
1,2-DBA	µg/kg	<26	<19	<4.8	<4.9	<250	<250	<4.8	<4.9	<4.7	<4.9	<4.7	<5.0	<4.8	<4.9	<4.9	<5.0	<250	<4.8	--	19	44
Total Organic Carbon																						
	%	**0.10**	--	--	--	--	--	--	--	**0.87**	--	--	--	**0.05**	--	--	--	--	--	--	NE	NE

Notes:

TPHg = Total Petroleum Hydrocarbons as gasoline
TPHd = Total Petroleum Hydrocarbons as diesel
TPHmo = Total Petroleum Hydrocarbons as motor oil
TPHhy = Total Petroleum Hydrocarbons as hydraulic fluid
DCA = Dichloroethane
DBA = Dibromoethane
TCA = Trichloroethane
MTBE = tert-Butyl methyl ether
TBA = tert-Butyl alcohol
DIPE = Diisopropyl ether
ETBE = Ethyl tert butyl ether
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Detected concentrations are shown in **Bold**
ND = Not detected at or above respective reporting limit
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Y = Sample exhibits chromatographic pattern which does not resemble standard

ESLs = San Francisco Bay Regional Water Quality Control Board, Screening for Environmental Concerns at Sites with Contaminated Soil and Grounwater, Interim Final November 2007, Revised May 2008
[1] = Table B Shallow Soil Screening Levels, Groundwater is not a Current or Potential Source of Drinking Water

Table 4
Summary of Chemical Concentrations in Grab Groundwater - 1996 to 2009 Investigations
2250 Telegraph Avenue
Oakland, California

		Sample ID																Regulatory Criteria		
Analyte	**Units**	**TW-1**	**TW-2**	**TW-3**	**TW-4**	**TW-5**	**B-1†**	**B-2**	**B-3**	**B-4a**	**B-5**	**B-6†**	**B-7**	**B-8**	**B-9**	**B-10**	**B-12**	**ESLs[1]**	**ESLs[2] Residential Land Use**	**ESLs[2] Commerical/Industrial Land Use**
Date		5/31/1996	5/30/1996	5/30/1996	5/31/1996	5/30/1996	7/30/2009	7/31/2009	7/28/2009	7/28/2009	7/28/2009	7/30/2009	7/28/2009	7/28/2009	7/28/2009	7/28/2009	7/28/2009			
Petroleum Hydrocarbons																				
TVHg	µg/L	**13,000**	**250**	<50	**11,000**	**70**	**41,000**	**1,300[Y]**	**360[Y]**	**10,000 [>LR,Y]**	**410[Y]**	**4,400[Y]**	**1,200[Y]**	**6,800[Y]**	**25,000[Y]**	**1,400[Y]**	**500[Y,b]**	210	NE	NE
TPHd	µg/L	**37,000**	<50	**83**	**1,900**	**180**	--	**530[Y]**	**7,600[Y]**	**240,000**	**3,400**	--	**910[Y]**	**290[Y]**	**1,600[Y]**	**59,000**	**27,000**	210	NE	NE
TPHmo	µg/L	--	--	--	--	--	--	<300	**25,000**	**110,000**	**1,500**	--	**400**	<300	<300	**33,000**	**13,000**	210	NE	NE
Volatile Organic Compounds																				
Benzene	µg/L	<50	<0.5	<0.5	**130**	<0.5	**630**	<0.50	**0.57**	<0.50	<0.50	**280**	**2.3**	**400**	**2,800**	<0.50	<2.5[b]	46	540	1,800
Toluene	µg/L	<50	<0.5	<0.5	**66**	<0.5	**780**	<0.50	**0.65**	**0.58**	<0.50	**4.1**	**1.3**	**73**	**50**	<0.50	<2.5[b]	130	380,000	530,000
Ethylbenzene	µg/L	<50	**13**	<0.5	**340**	<0.5	**910**	<0.50	<0.50	**0.75**	<0.50	**90**	**16**	**250**	**950**	<0.50	<2.5[b]	43	170,000	170,000
Xylenes	µg/L	**380**	**3.4**	<0.5	**260**	<0.5	**3,700**	<0.50	<0.50	**0.66**	<0.50	**14.71**	**2.46**	**760**	**2,850**	<0.50	<2.5[b]	100	160,000	160,000
MTBE	µg/L	--	--	--	--	--	<13	<0.50	**0.58**	**2.1**	<0.50	**1.6**	<0.50	<3.1	<17	**1.5**	<2.5[b]	1,800	24,000	80,000
TBA	µg/L	--	--	--	--	--	<250	**32**	<10	**12**	<10	**19**	**18**	<63	<330	<10	<50[b]	18,000	NE	NE
TAME	µg/L	--	--	--	--	--	<13	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.1	<17	<0.50	<2.5[b]	NE	NE	NE
DIPE	µg/L	--	--	--	--	--	<13	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.1	<17	<0.50	<2.5[b]	NE	NE	NE
ETBE	µg/L	--	--	--	--	--	<13	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.1	<17	<0.50	<2.5[b]	NE	NE	NE
1,2-DCA	µg/L	<1.0	<1.0	**20**	<1.0	<1.0	<13	<0.50	<0.50	**1.0**	<0.50	**0.83**	<0.50	**3.8**	<17	**1.1**	<2.5[b]	200	200	690
1,2-DBA	µg/L	--	--	--	--	--	<13	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.1	<17	<0.50	<2.5[b]	150	150	510
1,1,1-TCA	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	62	130,000	360,000
PCE	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	120	120	420
Chlorobenzene	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	25	13,000	37,000
Total Dissolved Solids																				
	mg/L	--	--	--	--	--	**880**	**770**	**880**	**1,200**	**520**	**730**	**990**	**720**	**770**	**970**	**460**	NE	NE	NE

Notes:

TVHg = Total Volatile Hydrocarbons as gasoline
TPHd = Total Petroleum Hydrocarbons as diesel
TPHmo = Total Petroleum Hydrocarbons as motor oil
DCA = Dichloroethane
DBA = Dibromoethane
MTBE = tert-Butyl methyl ether
TBA = tert-Butyl alcohol
DIPE = Diisopropyl ether
ETBE = Ethyl tert butyl ether
TAME = Methyl tert amyl ether
TCA = Trichloroethane
PCE = Tetrachloroethene

µg/L = micrograms per liter
Detected concentrations are shown in **Bold**
ND = Not detected at or above respective reporting limit
< = not detected at or above the listed laboratory reporting limit
NE = Not established
-- Not Analyzed
>LR = Response exceeds instrument's linear range
Y = Sample exhibits chromatographic pattern which does not resemble standard
b = Sample analyzed two minutes after hold time expired. No technical impact on sample data
† = Sample for TPHd and TPHmo analysis were obtained from B-1, however sample container broke on way to laboratory.
Sample for TPHd and TPHmo analysis were not obtained from B-6 due to inefficient groundwater recharge

ESLs = San Francisco Bay Regional Water Quality Control Board, Screening for Environmental Concerns at Sites with Contaminated Soil and Grounwater, Interim Final November 2007, Revised May 2008
[1] = Table F-1b Final Groundwater Screening Levels
[2] = Table E-1: Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns (volatile chemicals only)

Table 5
Summary of Chemical Concentrations in Soil-Gas - 2009 Investigation
2250 Telegraph Avenue
Oakland, California

		Sample ID												Regulatory Criteria	
Analyte	**Units**	**SG-1**	**SG-2**	**SG-3**	**SG-3 (Resample)**	**SG-4**	**SG-5**	**SG-6**	**SG-6**	**SG-6**	**SG-7**	**SG-7 (Duplicate)**	**Air Blank**	**ESLs[1] Lowest Residential Exposure**	**ESLs[1] Lowest Commerical/Industrial Exposure**
Sample Depth	feet	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	n/a		
Purge Volume		1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	7.0	1.0	1.0	--		
Date		7/31/2009	7/31/2009	7/31/2009	7/31/2009	7/31/2009	7/31/2009	7/31/2009	7/31/2009	7/31/2009	7/31/2009	7/31/2009	7/31/2009		
Petroleum Hydrocarbons															
TPHg	$\mu g/m^3$	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	**36,000**	**31,000**	<10,000	10,000	29,000
TPHd	$\mu g/m^3$	<50,000	<50,000	<50,000	<50,000	<50,000	<50,000	<50,000	<50,000	<50,000	<50,000	<50,000	<50,000	10,000	29,000
Volatile Organic Compounds															
Benzene	$\mu g/m^3$	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	84	280
Toluene	$\mu g/m^3$	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	63,000	180,000
Ethylbenzene	$\mu g/m^3$	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	980	3,300
m,p-Xylene	$\mu g/m^3$	**300**	<200	<200	<200	<200	**320**	**250**	<200	<200	**260**	**230**	<200	21,000	21,000
o-Xylene	$\mu g/m^3$	**130**	<100	<100	<100	<100	**140**	**120**	<100	<100	**100**	**100**	<100		
MTBE	$\mu g/m^3$	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	9,400	31,000
Dissolved Gases															
Methane	% Vol	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	NE	NE
Oxygen	% Vol	**16**	**9.6**	**20**	**19**	**11**	**13**	**8.7**	**3.2**	**9.7**	**16**	**6.8**	**21**	NE	NE
Carbon Dioxide	% Vol	**4.0**	**7.2**	**1.5**	**2.0**	**9.2**	**6.8**	**11**	**16**	**10**	**4.9**	**12**	<1.0	NE	NE
Leak Check Compound															
% of 1,1-Difluoroethane Detected	%	<0.04	<0.04	**0.14**	**0.07**	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		
1,1-Difluoroethane	$\mu g/m^3$	<10,000	<10,000	**37,000**	**19,000**	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	NE	NE

Notes:

TPHg = Total Petroleum Hydrocarbons as gasoline
TPHd = Total Petroleum Hydrocarbons as diesel
Detected concentrations are shown in **Bold**
NE = Not established
$\mu g/m^3$ = micrograms per cubic meter
-- = Not Applicable

< = not detected at or above the listed laboratory reporting limit
ESLs = San Francisco Bay Regional Water Quality Control Board, Screening for Environmental Concerns at Sites with Contaminated Soil and Grounwater, Interim Final November 2007, Revised May 2008
[1] = Table E-2 Sahllow Soil Gas Screening Levels for Evaluation of Potential Vapor Intrusion Concerns (volatile chemicals only)

Table 6
Summary of Chemical Concentrations in Soil - 2011 Well Installation
2250 Telegraph Avenue
Oakland, California

		Sample ID													Regulatory Screening Criteria	
Analyte	Units	MW-7 @ 1.5	MW-7 @ 1.5 RT	MW-7 @ 1.5 BOC	MW-7 @ 2	MW-7 @ 5	MW-7 @ 7	MW-7 @ 10	MW-7 @ 15	MW-8@1'	MW-8@3'	MW-8@10'	MW-8@12'	MW-8@14'	ESLs Residential Land Use*	ESLs Commercial Industrial Worker*
Sample Depth	ft	1.5'	1.5'	1.5'	2'	5'	7'	10'	15'	1.0'	3.0'	10'	12'	14'		
Sample Date		4/30/2011	4/30/2011	4/30/2011	4/30/2011	4/30/2011	4/30/2011	4/30/2011	4/30/2011	8/2/2011	8/2/2011	8/2/2011	8/2/2011	8/2/2011		
Hydrocarbons																
TPHg	mg/kg	<1.1	--	--	<1.1[b]	<1.0	<1.0	<0.94	<0.93	<0.99	<0.99	**10** [Y]	**3.3** [Y]	**8.1** [Y]	100	180
TPHd	mg/kg	**41**[Y]	**45**[Y**]	**36**[Y**]	**14**[Yb]	<1.0	**2.6**[Y]	**1.4**[Y]	**2.7**[Y]	**70** [Y]	<0.99	**18** [Y]	**11** [Y]	**2.7** [Y]	100	180
TPHmo	mg/kg	**240**	**170****	**160****	**66**[b]	<5.0	<5.0	<5.0	<5.0	**390**	**11** [Y]	<5.0	<5.0	<5.0	370	2,500
VOCs																
Benzene	µg/kg	<4.8	--	--	<5.0[b]	<4.6	<4.8	<4.7	<4.6	<4.9	<4.6	<4.9	<4.8	<4.9	120	270
Toluene	µg/kg	<4.8	--	--	<5.0[b]	<4.6	<4.8	<4.7	<4.6	<4.9	<4.6	<4.9	<4.8	<4.9	9,300	9,300
Ethylbenzene	µg/kg	<4.8	--	--	<5.0[b]	<4.6	<4.8	<4.7	<4.6	<4.9	<4.6	<4.9	<4.8	**25**	2,300	4,700
Total Xylenes	µg/kg	<9.6	--	--	<10.0[b]	<9.2	<9.6	<9.4	<9.2	<9.8	<9.2	<9.8	<9.6	**8.3**	11,000	11,000
MTBE	µg/kg	<4.8	--	--	<5.0[b]	<4.6	<4.8	<4.7	<4.6	<4.9	<4.6	<4.9	<4.8	<4.9	8,400	8,400
TBA	µg/kg	<95	--	--	<99[b]	<93	<97	<94	<92	<98	<92	<97	<97	<97	100,000	110,000
DIPE	µg/kg	<4.8	--	--	<5.0[b]	<4.6	<4.8	<4.7	<4.6	<4.9	<4.6	<4.9	<4.8	<4.9	NE	NE
ETBE	µg/kg	<4.8	--	--	<5.0[b]	<4.6	<4.8	<4.7	<4.6	<4.9	<4.6	<4.9	<4.8	<4.9	NE	NE
TAME	µg/kg	<4.8	--	--	<5.0[b]	<4.6	<4.8	<4.7	<4.6	<4.9	<4.6	<4.9	<4.8	<4.9	NE	NE
1,2-DCA	µg/kg	<4.8	--	--	<5.0[b]	<4.6	<4.8	<4.7	<4.6	<4.9	<4.6	<4.9	<4.8	<4.9	220	480
1,2-DBA	µg/kg	<4.8	--	--	<5.0[b]	<4.6	<4.8	<4.7	<4.6	<4.9	<4.6	<4.9	<4.8	<4.9	19	44

Notes:

TPHg = Total Petroleum Hydrocarbons as gasoline
TPHd = Total Petroleum Hydrocarbons as diesel
TPHmo = Total Petroleum Hydrocarbons as motor oil
VOCs = Volatile Organic Compounds
MTBE = Methyl tert-butyl ether
TBA = tert-butyl alcohol
DIPE = Isopropyl Ether
ETBE = Ethyl terbt-butyl ether
TAME = Methyl tert-amyl ehter
1, 2-DCA = 1, 2-Dichloroethane
1,2-DBA = 1, 2-Dibromoethane
mg/kg = Milograms per kilogram
µg/kg = micrograms per kilogram

Detected Concetrations shown in **Bold**
<25 = Not detected above laboratory detection limit
-- = Not Analyzed
[Y] = Sample exhibits chromatographic pattern which does not resemble standard
[b] = Sample was analyzed outside of hold time
ESL = Environmental Screening Levels, RWQCB Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater
-- Interim Final, November 2007, Revised May 2008
* = Table B - Groundwater is not a Current or Potential Source of Drinking Water
[**] = TPHd and mo with Silica Gel Cleanup
RT = Retested using Silica Gel Cleanup
BOC = Bottom of core
NE = Not Established

Table 7
Summary of Groundwater Elevation Data
2250 Telegraph Avenue
Oakland, California

Monitoring Well	Date	TOC Elevation (Feet MSL)	DTW (feet)	Elevation (Feet MSL)
MW-1	3/3/1994	20.55	10.39	10.16
	3/10/1994		10.54	10.01
	6/6/1994		11.36	9.19
	9/7/1994		11.92	8.63
	12/22/1994		10.83	9.72
	3/17/1995		9.73	10.82
	6/27/1995		10.51	10.04
	9/18/1995		11.12	9.43
	5/30/1996		10.49	10.06
	7/9/1997		11.79	8.76
	8/21/1998		11.00	9.55
	10/6/1998		11.84	8.71
	2/24/1999		9.74	10.81
	6/30/2000		11.28	9.27
	4/27/2001		10.56	9.99
	4/14/2005		10.12	10.43
	8/1/2005		10.56	9.99
	11/9/2005		12.53	8.02
	3/21/2006		9.71	10.84
	8/7/2006		11.40	9.15
	10/27/2006		11.39	9.16
	3/20/2007		10.94	9.61
	8/8/2007		11.21	9.34
	2/5/2008		9.52	11.03
	8/14/2008		11.00	9.55
	3/3/2009		9.69	10.86
	7/30/2009		11.10	9.45
	9/8/2009		11.77	8.78
	3/23/2010		10.15	10.40
	10/5/2010		10.98	9.57
	5/9/2011	21.03	10.17	10.86
	9/9/2011		11.11	9.92
MW-2	3/3/1994	20.03	10.37	9.66
	3/10/1994		10.53	9.50
	6/6/1994		11.15	8.88
	9/7/1994		11.72	8.31
	12/22/1994		11.27	8.76
	3/17/1995		9.85	10.18
	6/27/1995		10.70	9.33
	9/18/1995		11.67	8.36
	5/30/1996		11.56	8.47
	7/9/1997		11.52	8.51
	8/21/1998		11.91	8.12
	10/6/1998		11.57	8.46
	2/24/1999		9.91	10.12
	6/30/2000		11.16	8.87
	4/27/2001		11.32	8.71
	4/14/2005		11.00	9.03
	8/1/2005		11.67	8.36
	11/9/2005		11.54	8.49
	3/21/2006		11.02	9.01
	8/7/2006		11.84	8.19
	10/27/2006		11.92	8.11
	3/20/2007		12.52	7.51
	8/8/2007		12.82	7.21
	2/5/2008		10.39	9.64
	8/14/2008		9.10	10.93
	3/3/2009		12.31	7.72
	7/30/2009		11.41	8.62
	3/23/2010		Not Sampled	
	10/5/2010		12.32	7.71
	5/9/2011	20.53	10.53	10.00
	9/9/2011		10.96	9.57

Table 7
Summary of Groundwater Elevation Data
2250 Telegraph Avenue
Oakland, California

Monitoring Well	Date	TOC Elevation (Feet MSL)	DTW (feet)	Elevation (Feet MSL)
MW-3	3/3/1994	18.97	9.50	9.47
	3/10/1994		9.51	9.46
	6/6/1994		10.28	8.69
	9/7/1994		10.75	8.22
	12/22/1994		9.74	9.23
	3/17/1995		8.85	10.12
	6/27/1995		9.94	9.03
	9/18/1995		10.54	8.43
	5/30/1996		9.69	9.28
	7/9/1997		10.60	8.37
	8/21/1998		10.36	8.61
	10/6/1998		10.64	8.33
	2/24/1999		8.58	10.39
	6/30/2000		10.21	8.76
	4/27/2001		9.85	9.12
	4/14/2005		9.58	9.39
	8/1/2005		10.24	8.73
	11/9/2005		10.45	8.52
	3/21/2006		8.77	10.20
	8/7/2006		10.30	8.67
	10/27/2006		10.63	8.34
	3/20/2007		9.72	9.25
	8/8/2007		10.48	8.49
	2/5/2008		8.61	10.36
	8/14/2008		10.53	8.44
	3/2/2009		8.11	10.86
	7/30/2009		10.41	8.56
	9/8/2009		10.60	8.37
	3/23/2010		8.87	10.10
	10/5/2010		10.51	8.46
	5/9/2011	19.44	9.34	10.10
	9/9/2011		10.03	9.41
MW-4	3/3/1994	19.88	10.89	8.99
	3/10/1994		11.19	8.69
	6/6/1994		11.85	8.03
	9/7/1994		12.86	7.02
	12/22/1994		12.26	7.62
	3/17/1995		10.10	9.78
	6/27/1995		11.05	8.83
	9/18/1995		11.84	8.04
	5/30/1996		10.97	8.91
	7/9/1997		12.08	7.80
	8/21/1998		11.86	8.02
	10/6/1998		12.84	7.04
	2/24/1999		10.79	9.09
	6/30/2000		12.39	7.49
	4/27/2001		11.26	8.62
	4/14/2005		12.01	7.87
	8/1/2005		11.78	8.10
	11/9/2005		12.42	7.46
	3/21/2006		10.00	9.88
	8/7/2006		11.90	7.98
	10/27/2006		12.75	7.13
	3/20/2007		11.20	8.68
	8/8/2007		12.00	7.88
	2/5/2008		10.40	9.48
	8/14/2008		11.47	8.41
	3/2/2009		11.13	8.75
	7/30/2009		11.81	8.07
	9/8/2009		12.11	7.77
	3/23/2010		9.95	9.93
	10/5/2010		11.38	8.50
	5/9/2011	20.35	10.93	9.42
	9/9/2011		11.42	8.93

Table 7
Summary of Groundwater Elevation Data
2250 Telegraph Avenue
Oakland, California

Monitoring Well	Date	TOC Elevation (Feet MSL)	DTW (feet)	Elevation (Feet MSL)
MW-5	6/26/1997	16.02	8.44	7.58
	7/9/1997		8.48	7.54
	8/21/1998		8.32	7.70
	10/6/1998		8.51	7.51
	2/24/1999		6.86	9.16
	6/30/2000		7.63	8.39
	4/27/2001		7.60	8.42
	4/15/2005		7.20	8.82
	8/1/2005		8.16	7.86
	11/9/2005		7.92	8.10
	3/21/2006		6.58	9.44
	8/7/2006		8.27	7.75
	10/27/2006		8.48	7.54
	3/20/2007		7.67	8.35
	8/8/2007		8.43	7.59
	2/5/2008		6.76	9.26
	8/14/2008		8.31	7.71
	3/2/2009		6.20	9.82
	7/30/2009		8.13	7.89
	3/23/2010		Not Sampled	
	10/5/2010		8.18	7.84
	5/9/2011	16.49	7.44	9.05
	9/9/2011		7.85	8.64
MW-6	6/26/1997	18.36	10.89	7.47
	7/9/1997		10.98	7.38
	8/21/1998		11.00	7.36
	10/6/1998		10.79	7.57
	2/24/1999		9.32	9.04
	6/30/2000		10.37	7.99
	4/27/2001		10.10	8.26
	4/15/2005		9.55	8.81
	8/1/2005		10.54	7.82
	11/9/2005		No Access	
	3/21/2006		9.11	9.25
	8/7/2006		10.59	7.77
	10/27/2006		No Access	
	3/20/2007		10.10	8.26
	8/8/2007		10.85	7.51
	2/5/2008		9.27	9.09
	8/14/2008		10.71	7.65
	3/3/2009		8.60	9.76
	7/30/2009		No Access	
	3/23/2010		Not Sampled	
	10/5/2010		10.62	7.74
	5/9/2011	18.81	No Access	
	9/9/2011		No Access	
MW-7	5/9/2011	18.67	9.42	9.25
	9/9/2011		9.88	8.79
MW-8	8/4/2011	18.95	9.70	9.25
	9/9/2011		9.99	8.96

Notes:
TOC = Top of Casing
DTW = Depth to Water
MW-1 through MW-8: Elevation Reference: City of Oakland Benchmark, well monument at approximate centerline of Telegraph Avenue and 26th Street.
Benchmark Elevation = 27.54 feet (NGVD29)
*MW-1 through MW-6: Monitoring wells re-surveyed on May 7, 2011

Table 8
Summary of Chemical Concentrations - Groundwater Monitoring Wells
2250 Telegraph Avenue
Oakland, California

Well	Date	Groundwater Elevation (Feet MSL)	Petroleum Hydrocarbons				Volatile Organics														
			TVH as Gasoline µg/L	TEH as Kerosene µg/L	TEH as Diesel µg/L	TEH as Motor Oil µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Total Xylenes µg/L	MTBE -8020 µg/L	MTBE -8260 µg/L	TBA µg/L	DIPE µg/L	ETBE µg/L	TAME µg/L	1,1,1-TCA µg/L	1,2-DCA µg/L	1,2-DBA µg/L	PCE µg/L	Chlorobenzene µg/L
Soil Gas ESL*			NE	NE	NE	NE	540	380,000	170,000	160,000	24,000	24,000	310,000	NE	NE	NE	130,000	200	150	120	13,000
Groundwater ESL**			100	100	100	100	1.0	40	30	20	5.0	5.0	12	NE	NE	NE	62	0.5	0.05	5.0	25
MW-1	3/3/94	10.16	**300**	<50	<50	<500	**1.3**	<0.5	**2.7**	**3.1**	--	--	--	--	--	--	<0.5	**5.5**	--	<0.5	<0.5
	06/06/94	9.19	**430**	**180+**	<50	<500	**10**	**2.2**	**6.1**	**7.6**	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	09/07/94	8.63	**410**	<50	<50	<500	**6.4**	**0.8**	**2.6**	**3.8**	--	--	--	--	--	--	<0.5	**3.8**	--	<0.5	<0.5
	12/22/94	9.72	**130**	<50	<50	<500	**0.7**	<0.5	**0.6**	**0.8**	--	--	--	--	--	--	<0.5	**3.4**	--	<0.5	<0.5
	03/17/95	10.82	**1,600**	**170**	<50	<500	**29**	<0.5	**9.1**	**6.9**	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	06/27/95	10.04	**1,100**	<50	<50	<500	**14**	<0.5	**7.1**	**5.0**	--	--	--	--	--	--	<0.5	**3.3**	--	<0.5	<0.5
	09/18/95	9.43	**370**	--	**110+**	--	**4.4**	**0.6**	**2.0**	**1.4**	--	--	--	--	--	--	<0.5	**2.4**	--	<0.5	<0.5
	08/21/98	9.55	**170**	--	**62+**	--	<0.5	**0.76**	**0.79**	<0.5	<2.0	--	--	--	--	--	--	--	--	--	--
	02/24/99	10.81	**20**	--	**280+**	--	<0.5	<0.5	<0.5	<0.5	--	<2.0	--	--	--	--	--	--	--	--	--
	06/30/00	13.47	**240**	--	<50	--	**0.7**	**0.8**	<0.5	**0.74**	**4.0**	--	--	--	--	--	--	--	--	--	--
	04/27/01	9.99	**160**	--	<50	--	**3.3**	<0.5	**0.86**	<0.50	<2.0	--	--	--	--	--	--	--	--	--	--
	04/15/05	10.43	**520**	--	**99** [LY]	<300	**3.3**[C]	**1.8**	**<0.5**	**4.6**	--	<0.5	<10	<0.5	<0.5	<0.5	--	**0.6**	<0.5	--	--
	08/01/05	9.99	**480**	--	**62** [LY]	<300	<0.5	<0.5	<0.5	**2.3**	--	<0.5	**18**	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	11/09/05	8.02	**290**[Y]	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	**14**	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/21/06	10.84	**390**	--	**97**[LY]	<300	**1.0**	<0.5	**0.6**	<0.5	--	<0.5	**16**	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/07/06	9.15	**720**	--	**130**[LY]	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	**18**	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	10/27/06	9.16	**250**	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	**12**	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/20/07	9.61	**290**[Y]	--	**74**[LY]	<300	<0.5	<0.5	**0.58**	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/08/07	9.34	**300**[LY]	--	**95**[LY]	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	02/05/08	11.03	**100**[Y]	--	**62**[Y]	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/14/08	9.55	**71**[Y]	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/03/09	10.86	**73**[Y]	--	**93**[Y]	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	07/30/09	9.45	**160**[Y]	--	<50	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	09/08/09	8.78	**56**[Y]	--	--	--	<0.5	<0.5	<0.5	**0.56**[C]	--	<2.0	--	--	--	--	--	--	--	--	--
	03/24/10	10.40	**82**[Y]	--	**53**[Y]	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	10/06/10	9.57	**68**[Y]	--	**64**[Y]	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	05/07/11	10.38	NOT SAMPLED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-2	03/03/94	9.66	**110**	<50	<50	<500	<0.5	**1.7**	**0.58**	**2.7**	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	06/06/94	8.88	**100**	<50	<50	<500	**11**	<0.5	**0.7**	**1.1**	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	09/07/94	8.31	<50	<50	<50	<500	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	12/22/94	8.76	<50	<50	<50	<500	**0.8**	<0.5	<0.5	**0.8**	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	03/17/95	10.18	**180**	**100**	<50	<500	**31**	<0.5	**1.0**	**1.8**	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	06/27/95	9.33	**80**	<50	<50	<500	**6.0**	<0.5	<0.5	<0.5	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	09/18/95	8.36	<50	--	<50	--	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	08/21/98	8.12	<50	--	<50	--	<0.5	<0.5	<0.5	<0.5	<2.0	--	--	--	--	--	--	--	--	--	--
	02/24/99	10.12	<50	--	<50	--	<0.5	<0.5	<0.5	<0.5	--	<2.0	--	--	--	--	--	--	--	--	--
	06/30/00	14.24	<50	--	<50	--	<0.5	<0.5	<0.5	<0.5	**2.0**	--	--	--	--	--	--	--	--	--	--
	04/27/01	8.71	<50	--	<50	--	<0.5	<0.5	<0.5	<0.5	<2.0	--	--	--	--	--	--	--	--	--	--
	04/15/05	9.03	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/01/05	8.36	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	11/09/05	8.49	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/21/06	9.01	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/07/06	8.19	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	10/27/06	8.11	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/20/07	7.51	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/08/07	7.21	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	02/05/08	9.64	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/14/08	10.93	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/03/09	7.72	<50	--	<50	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	07/30/09	8.62	<50		<50	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/24/10	NOT SAMPLED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	10/05/10	7.71	NOT SAMPLED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/07/11	9.50	NOT SAMPLED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 8
Summary of Chemical Concentrations - Groundwater Monitoring Wells
2250 Telegraph Avenue
Oakland, California

Well	Date	Groundwater Elevation (Feet MSL)	Petroleum Hydrocarbons				Volatile Organics														
			TVH as Gasoline µg/L	TEH as Kerosene µg/L	TEH as Diesel µg/L	TEH as Motor Oil µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Total Xylenes µg/L	MTBE -8020 µg/L	MTBE -8260 µg/L	TBA µg/L	DIPE µg/L	ETBE µg/L	TAME µg/L	1,1,1-TCA µg/L	1,2-DCA µg/L	1,2-DBA µg/L	PCE µg/L	Chlorobenzene µg/L
Soil Gas ESL*			NE	NE	NE	NE	540	380,000	170,000	160,000	24,000	24,000	310,000	NE	NE	NE	130,000	200	150	120	13,000
Groundwater ESL**			100	100	100	100	1.0	40	30	20	5.0	5.0	12	NE	NE	NE	62	0.5	0.05	5.0	25
MW-3	03/03/94	9.47	**85**	<50	<50	<500	<0.5	**0.77**	<0.5	**3.7**	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	06/06/94	8.69	**100**	**110+**	<50	<500	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	**2.5**	**0.8**	--	**2.1**	<0.5
	09/07/94	8.22	**220**	<50	<50	<500	**11**	**1.8**	**2.6**	**3.5**	--	--	--	--	--	--	<0.5	<0.5	--	**0.6**	<0.5
	12/22/94	9.23	**130**	**95+**	<50	<500	**3.8**	**0.5**	**0.6**	**1.2**	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	03/17/95	10.12	**1,500**	**270**	<50	<500	**83**	**6.0**	**10**	**15**	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	06/27/95	9.03	**2,500**	<50	<50	<500	**330**	**8.9**	**8.1**	**20**	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	09/18/95	8.43	**1,500**	--	**770+**	--	**400**	**11**	**2.2**	**3.3**	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	08/21/98	8.61	**2,300**	--	**600+**	--	**410**	**9.3**	**36**	**25**	<10	--	--	--	--	--	--	--	--	--	--
	02/24/99	10.39	**55**	--	**110+**	--	<0.5	<0.5	<0.5	<0.5	--	<2.0	--	--	--	--	--	--	--	--	--
	06/30/00	10.83	**110**	--	**83+**	--	<0.5	<0.5	**0.51**	<0.5	<2.0	--	--	--	--	--	--	--	--	--	--
	04/27/01	8.67	<50	--	**690+**	--	<0.5	<0.5	<0.5	<0.5	<2.0	--	--	--	--	--	--	--	--	--	--
	04/14/05	9.12	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/01/05	9.39	**410**	--	**150** [HLY]	**750**	**17**	<0.5	**0.87c**	**1.4**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	11/09/05	8.73	**1,100** [Y]	--	**110** [LY]	<300	**150**	**3.4**	**6.1**	**3.8**	--	<0.5	**13**	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/21/06	10.20	**100**	--	**61** [Y]	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	**12**	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/07/06	8.67	**4,000** [Y]	--	**280** [LY]	<300	**630**	**9**	**31**	**12**	--	<0.5	**18**	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	10/27/06	8.34	**5,300**	--	**240** [LY]	<300	**950**	**13**	**17**	**11**	--	<10	<200	<10	<10	<10	--	<10	<10	--	--
	03/20/07	9.25	**1,000** [LY]	--	**180** [LY]	<300	**100**	**1.5**	**2.1**	**3.3**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/08/07	8.49	**2,100** [LY]	--	**130** [LY]	<300	**260**	**5.1**	**5.8**	**3.6**	--	<2.0	<40	<2.0	<2.0	<2.0	--	<2.0	<2.0	--	--
	02/05/08	10.36	**100**	--	**50** [Y]	<300	**7.6**	<0.5	<0.5	**0.5**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/14/08	8.44	**1,400**	--	**200** [Y]	<300	**510**	**8.2**	**22**	**7.2**	--	<3.6	<71	<3.6	<3.6	<3.6	--	<3.6	<3.6	--	--
	03/02/09	10.86	**170** [Y]	--	<50	<300	**16**	<0.5	<0.5	**2.4**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	07/30/09	8.56	**360**	--	**71** [Y]	<300	**14**	<0.5	**1.2**	<1.0	--	<0.5	**13**	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	09/08/09	8.37	**1200** [Y]	--	**--**	--	**280**	**2.4**	**9.2** [C]	**3.08** [C]	--	<2.0	--	--	--	--	--	--	--	--	--
	03/24/10	10.10	**300**	--	**130** [Y]	<300	**64**	**2.5**	**0.78**	**3.3**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	10/06/10	8.46	**450**	--	**76** [Y]	<300	**89**	**3.7**	**4.6**	**5.2**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	05/07/11	9.63	**600**	--	**130** [Y]	<300	**300**	**12**	**5.2**	**11.81**	--	<0.5	**12**	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
MW-4	03/03/94	8.99	**4,300**	<50	**240**	<500	**220**	**20**	**7.5**	**17**	--	--	--	--	--	--	<0.5	**5.9**	--	<0.5	**4.4**
	06/06/94	8.03	**4,400**	<50	**800+**	<500	**140**	<0.5	<0.5	<0.5	--	--	--	--	--	--	<0.5	<0.5	--	<0.5	<0.5
	09/07/94	7.02	**10,000**	**490+**	**280+**	<500	**84**	<0.5	**42**	**69**	--	--	--	--	--	--	<0.5	**4.4**	--	**0.5**	**4.3**
	12/22/94	7.62	**2,400**	**450+**	**54+**	<500	**11**	<0.5	**7.1**	**11**	--	--	--	--	--	--	<0.5	**3.6**	--	**3.6**	<0.5
	03/17/95	9.78	**2,200**	**380**	**160+**	<500	<0.5	<0.5	**7.9**	**10**	--	--	--	--	--	--	<0.5	**1.7**	--	<0.5	**4.5**
	06/27/95	8.83	**3,100**	<50	**82**	<500	<0.5	<0.5	**13**	**19**	--	--	--	--	--	--	<0.5	**2.3**	--	<0.5	**4.8**
	09/18/95	8.04	**3,000**	--	**1,231+**	--	**12**	<0.7	**6.9**	**8.3**	--	--	--	--	--	--	<0.5	**1.9**	--	<0.5	**4.0**
	08/21/98	8.02	**1,700**	--	**600+**	--	**8.2**	**12**	**13**	**5.2**	<2.0	-	--	--	--	--	--	--	--	--	--
	02/24/99	9.09	**2,700**	--	**2,100+**	--	**4.3**	**0.64**	<0.5	**0.54**	--	<2.0	--	--	--	--	--	--	--	--	--
	06/30/00	11.74	**6,700**	--	**3,200+**	--	**3.1**	**1.7**	**11**	**16.7**	**27**	--	--	--	--	--	--	--	--	--	--
	04/27/01	8.62	**1,900**	--	**710**	--	<0.5	<0.5	<0.5	<0.5	**14**	--	--	--	--	--	--	--	--	--	--
	04/14/05	7.87	**2,900**	--	**2,200** [HLY]	**2,500**	<0.5	<0.5	<0.5	**5.1**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/01/05	8.10	**2,000**	--	**2,100** [HLY]	**3400** [L]	<0.5	<0.5	<0.5	**5.8c**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	11/09/05	7.46	**2,000Y**	--	**1,900** [HLY]	**2,300** [L]	**1.2**	<0.5	<0.5	**0.8**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/21/06	9.88	**2,200**	--	**2,800** [HLY]	**4,000** [L]	**1.2**	<0.5	<0.5	**0.7**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/07/06	7.98	**2,500** [Y]	--	**4,700** [HLY]	**7,200** [L]	**0.6**	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	10/27/06	7.13	**2,200** [Y]	--	**2,500** [HLY]	**3,200** [L]	**0.5**	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/20/07	8.68	**2,700**	--	**2,900** [HLY]	**3,500** [L]	**0.77**	<0.5	<0.5	**0.67**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/08/07	7.88	**6,100** [LY]	--	**9,200** [HL]	**12,000** [HL]	**0.7**	<0.5	<0.5	**0.5**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	02/05/08	9.48	**2,100**	--	**2,100** [Y]	**2,200**	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/14/08	8.41	**1,900** [Y]	--	**370** [Y]	<300	**1.4**	**0.59**	<0.5	**0.85**	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/02/09	8.75	**1,300** [Y]	--	**880** [Y]	**850**	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	07/30/09	8.07	**1,400** [Y]	--	**1,100** [Y]	**1,300**	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	09/08/09	7.77	**580** [Y]	--	**--**	**--**	<0.5	<0.5	<0.5	**7.5** [C]	--	**2.4** [C]	--	--	--	--	--	--	--	--	--
	03/24/10	9.93	**510** [Y]	--	**670**	**980**	<0.5	<0.5	<0.5	<1.0	--	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	10/06/10	8.50	**560** [Y]	--	**130** [Y]	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	05/07/11	8.95	**260**	--	**1,200**	**1,500**	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--

November 2011
Project No. 04B.0609004

Table 8
Summary of Chemical Concentrations - Groundwater Monitoring Wells
2250 Telegraph Avenue
Oakland, California

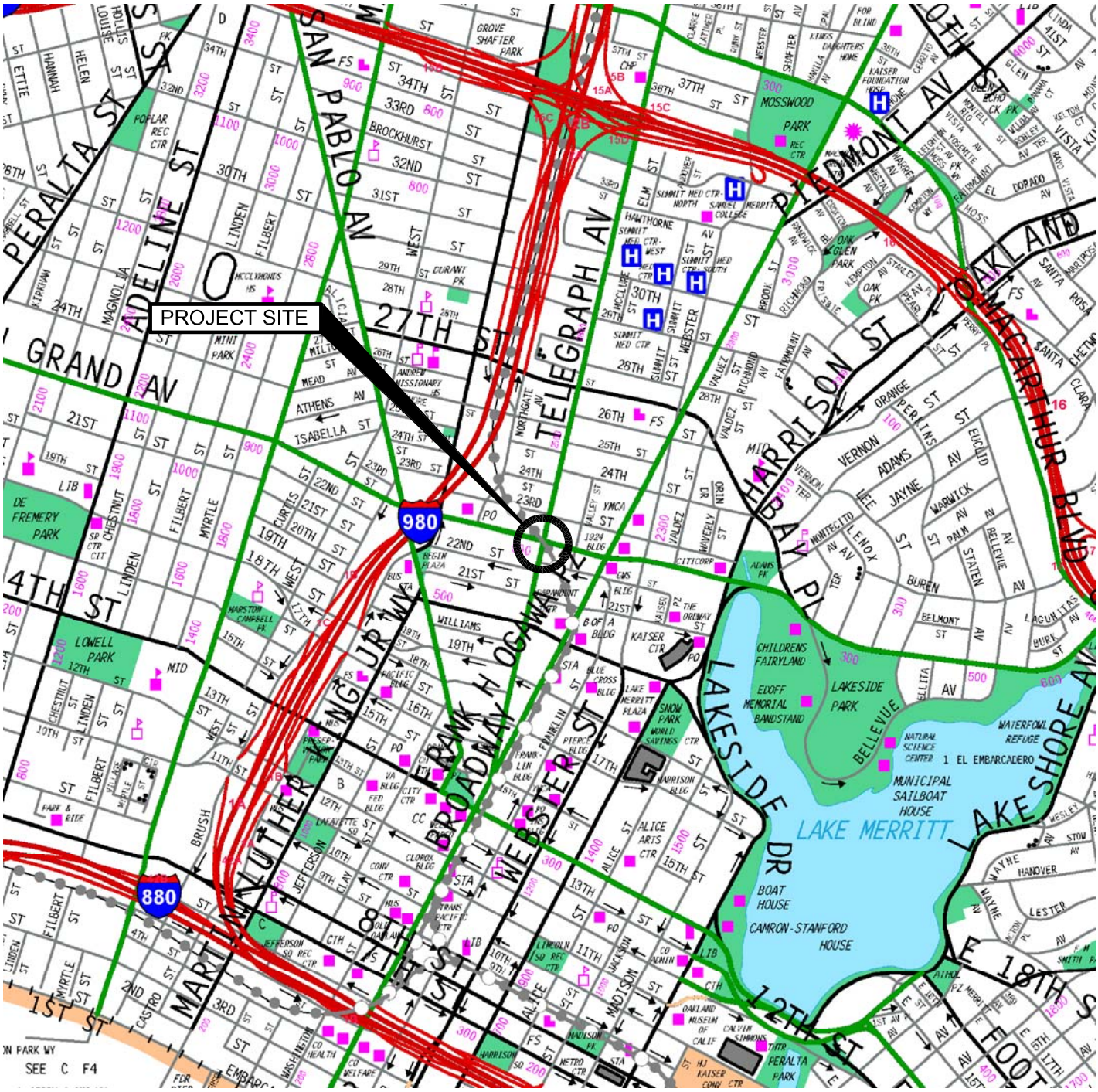
Well	Date	Groundwater Elevation (Feet MSL)	Petroleum Hydrocarbons				Volatile Organics														
			TVH as Gasoline µg/L	TEH as Kerosene µg/L	TEH as Diesel µg/L	TEH as Motor Oil µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Total Xylenes µg/L	MTBE -8020 µg/L	MTBE -8260 µg/L	TBA µg/L	DIPE µg/L	ETBE µg/L	TAME µg/L	1,1,1-TCA µg/L	1,2-DCA µg/L	1,2-DBA µg/L	PCE µg/L	Chlorobenzene µg/L
Soil Gas ESL*			**NE**	**NE**	**NE**	**NE**	**540**	**380,000**	**170,000**	**160,000**	**24,000**	**24,000**	**310,000**	**NE**	**NE**	**NE**	**130,000**	**200**	**150**	**120**	**13,000**
Groundwater ESL**			**100**	**100**	**100**	**100**	**1.0**	**40**	**30**	**20**	**5.0**	**5.0**	**12**	**NE**	**NE**	**NE**	**62**	**0.5**	**0.05**	**5.0**	**25**
MW-5	06/26/97	7.58	**120**	--	<50	--	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	<0.5	<0.5	--	**1.6**	<0.5
	08/21/98	7.70	<50	--	<50	--	<0.5	<0.5	<0.5	<0.5	<2.0	--	--	--	--	--	--	--	--	--	--
	02/24/99	9.16	<50	--	<50	--	<0.5	<0.5	<0.5	<0.5	--	<2.0	--	--	--	--	--	--	--	--	--
	06/30/00	8.39	<50	--	<50	--	<0.5	<0.5	<0.5	<0.5	**5.1**	--	--	--	--	--	--	--	--	--	--
	04/27/01	8.42	<50	--	<50	--	<0.5	<0.5	<0.5	<0.5	<2.0	--	--	--	--	--	--	--	--	--	--
	04/14/05	8.82	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/01/05	7.86	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	11/09/05	8.10	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/21/06	9.44	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/07/06	7.75	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	10/27/06	7.54	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/20/07	8.35	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/08/07	7.59	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	02/05/08	9.26	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/14/08	7.71	<50	--	<50	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/02/09	9.82	<50	--	<50	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	07/30/09	7.89	<50	--	<50	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/24/10	NOT SAMPLED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	10/05/10	7.84	<50	--	<50	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	05/07/11	8.58	NOT SAMPLED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-6	06/26/97	7.47	**1,500+**	--	**450+**	--	<0.5	<0.5	**11**	<0.5	-	-	--	--	--	--	<0.5	<0.5	--	<0.5	**1.7**
	08/21/98	7.36	**1,400**	--	**540+**	--	<0.5	**3.6**	**5.6**	**0.4**	**5.7**	**3.2**	--	--	--	--	--	--	--	--	--
	02/24/99	9.04	**1,600**	--	**600+**	--	<0.5	<0.5	**0.56**	<0.5	--	**2.3**	--	--	--	--	--	--	--	--	--
	06/30/00	8.04	**1,900**	--	**360+**	--	**0.56**	**3.0**	**5.4**	**3.5**	**30**	--	--	--	--	--	--	--	--	--	--
	04/27/01	8.26	**1,600**	--	**440**	--	<0.5	<0.5	<0.5	<0.5	**3.3**	--	--	--	--	--	--	--	--	--	--
	04/14/05	8.81	**2,100**	--	**890** [LY]	<300	<0.5	<0.5	<0.5	**5.9**	--	**0.7**	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/01/05	7.82	**2,100**	--	**670** [LY]	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	11/09/05	NO ACCESS	NA	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	03/21/06	9.25	**1,900**	--	**850** [LY]	<300	<0.5	<0.5	<0.5	<0.5	--	**0.5**	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/07/06	7.77	**2,200** [Y]	--	**940** [LY]	<300	<0.5	<0.5	<0.5	<0.5	--	**0.5**	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	10/27/06	NO ACCESS	NA	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	03/20/07	8.26	**2,000** [Y]	--	**670L** [Y]	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/08/07	7.51	**2,100** [HLY]	--	**680** [LY]	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	02/05/08	9.09	**1,400**	--	**560** [Y]	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	08/14/08	7.65	**1,100** [Y]	--	**390** [Y]	<300	<0.5	<0.5	<0.5	<0.5	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	03/03/09	9.76	**990** [Y]	--	**230** [Y]	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	07/30/09	NO ACCESS	NA	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	03/24/10	NOT SAMPLED	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	10/05/10	7.74	**910** [Y]	--	**420**	<300	<0.5	<0.5	<0.5	<1.0	--	<0.5	**14**	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
	05/07/11	NO ACCESS	NA	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-7	05/07/11	9.25	<50	--	<50	<300	<0.5	**2.4**	<0.5	<1.0	--	<0.5	<10	<0.5	<0.5	<0.5	--	<0.5	<0.5	--	--
MW-8	08/04/11	9.25	**1,700**	--	**260** [Y]	<300	**1.8**	**9.4**	**57**	**17.1**	--	<0.5	<10	<0.5	<0.5	<0.5	--	**3.0**	<0.5	--	--

Notes:

TVH = Total Volatile Hydrocarbons
TEH = Total Extractable Hydrocarbons
DCA = Dichloroethane
DBA = Dibromoethane
TCA = Trichloroethane
PCE = Tetrachloroethene
MTBE = tert-Butyl methyl ether
TBA = Tert butyl alcohol
DIPE = Diisopropyl Ether
ETBE = Ethyl tert butyl ether
TAME = Methyl tert amyl ether
-- = Chemical not tested for
NR = Hydrocarbon range not reported by laboratory
+ = Uncategorized hydrocarbons quantified in ranges specifiec

µg/L = micrograms per liter = parts per billion
<1 = Chemical not present at a concentration greater than the laboratory detection limit shown or stated on test reports
C = Presence Confirmed, but RPD between colums exceeds 40%
Y = Sample exhibits chromatographic pattern which does not resemble standarc
H = Heavier hydrocarbon contributed to the quantitation
L = Lighter hydrocarbon contributed to the quantitation
ESLs = San Francisco Bay Regional Water Quality Control Board, Screening for Environmental Concerns at Sites with Contaminated Soil and Grounwater, Interim Final November 2007, Revised May 200
* = Table E-1 Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns
** = Table F-1a Groundwater Screening Levels (groundwater is a current potential drinking water resource)
NA = Not Accessible During This Sampling Event
NE = Not Evaluated

PLATES



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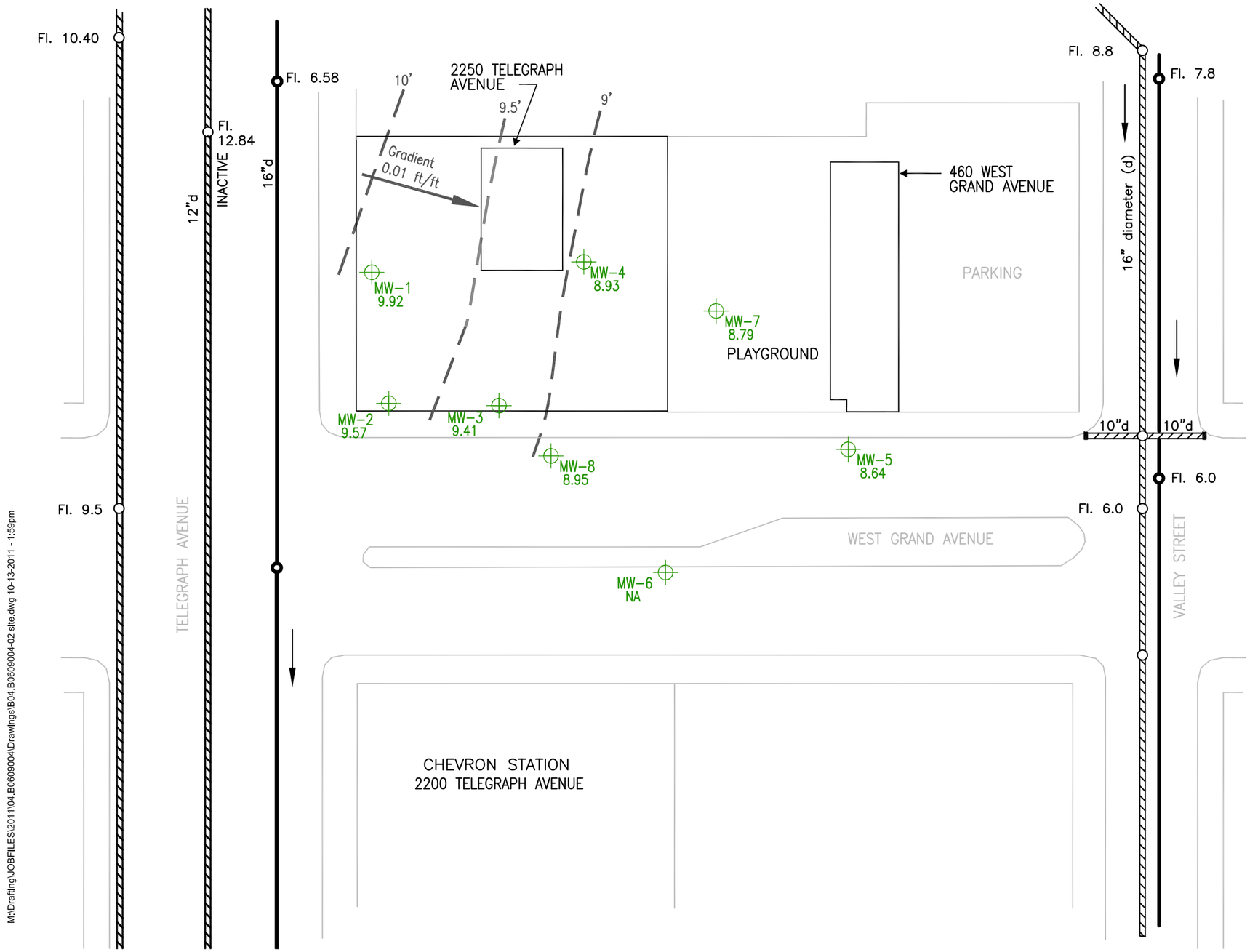
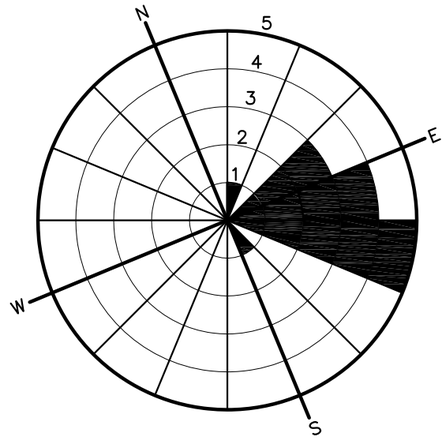
SOURCE: This Site Vicinity Map is based on The Thomas Guide Digital Edition 2003, Bay Area Metro, Alameda, Contra Costa, Marin, San Francisco, San Mateo, and Santa Clara Counties.

NORTH
0 1500 3000
FEET

VICINITY MAP
2250 Telegraph Avenue
Oakland, California

PLATE 1





ROSE DIAGRAM SHOWING
GROUNDWATER FLOW DIRECTION
(2004–2011)

LEGEND

STRUCTURE

MW–8 MONITORING WELL LOCATION

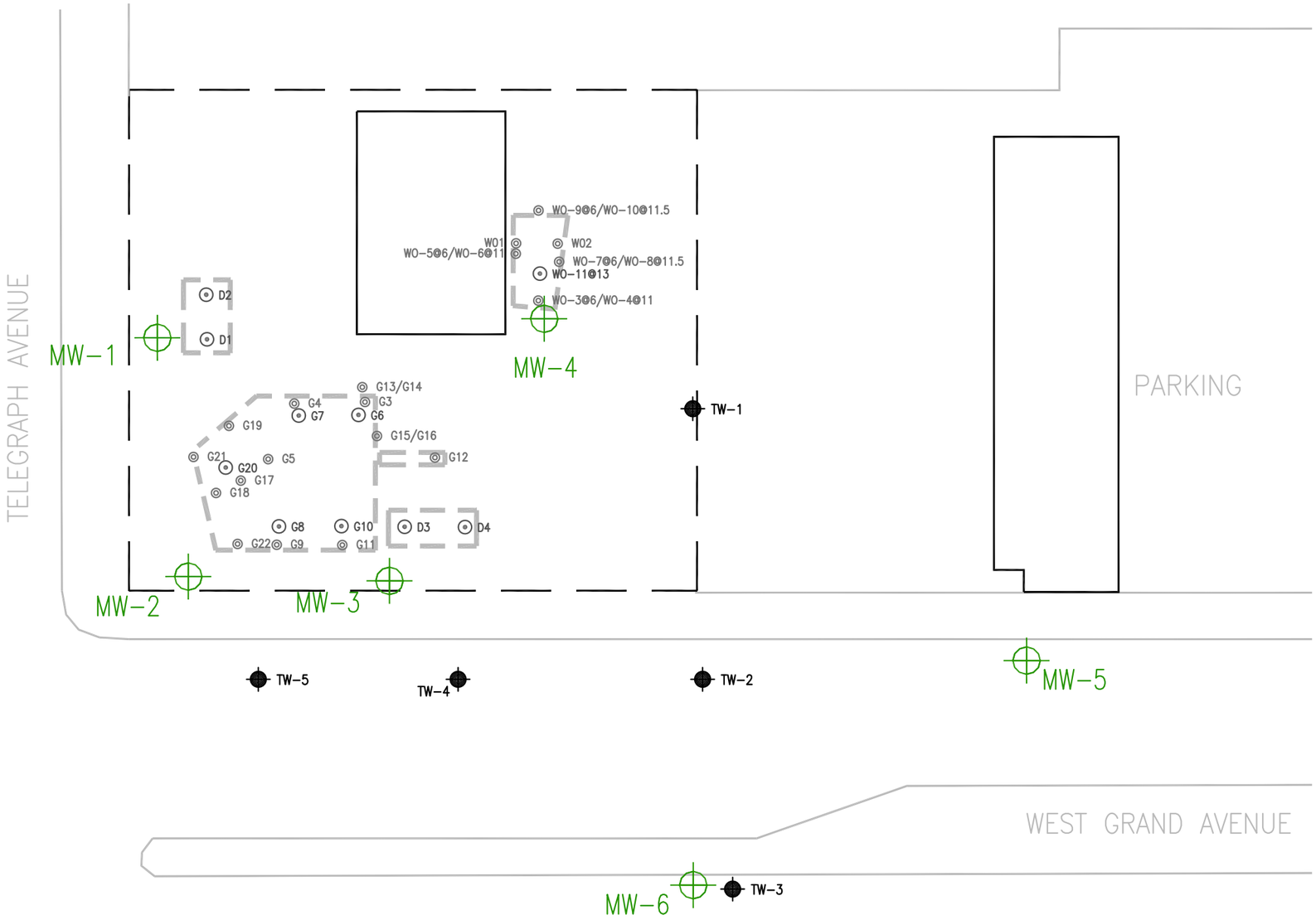
NORTH

0 40 80

FEET

SITE PLAN
2250 Telegraph Avenue
Oakland, California

PLATE 2



LEGEND

G5	APPROXIMATE LOCATION OF PREVIOUS SIDEWALL SAMPLE (1990)
G20	APPROXIMATE LOCATION OF PREVIOUS BOTTOM SAMPLE (1990)
TW-4	APPROXIMATE LOCATION OF TEMPORARY WELL POINT (1996)
	MONITORING WELL LOCATION
	LIMITS OF EXCAVATION

NORTH

0 25 50
FEET

SAMPLE LOCATIONS 1990-1997
2250 Telegraph Avenue
Oakland, California

PLATE 3

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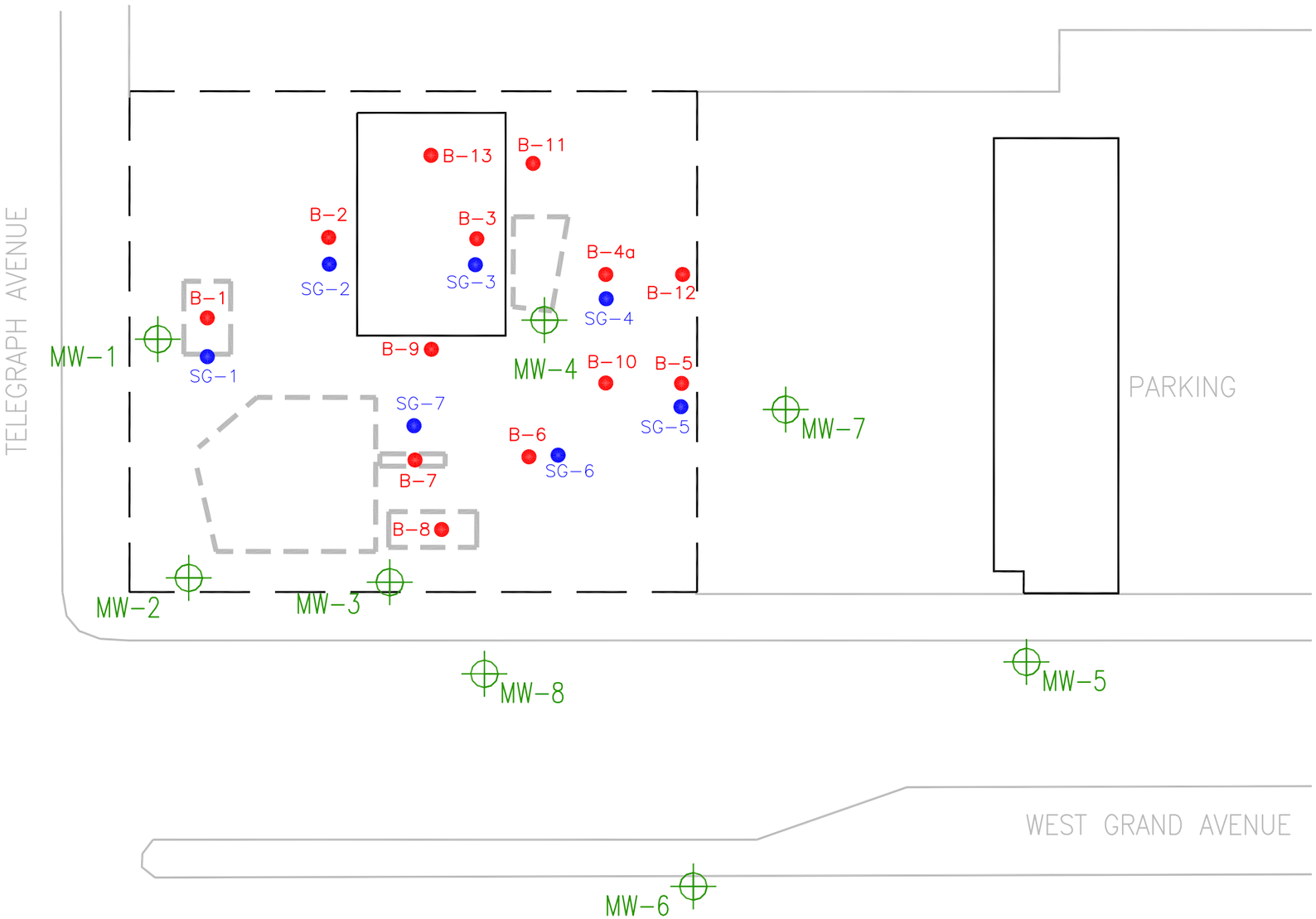

LEGEND

- B-1 APPROXIMATE LOCATION OF TEMPORARY WELL POINT - 2009
- STRUCTURE
- LIMITS OF EXCAVATION
- MONITORING WELL LOCATION
- SG-7 APPROXIMATE LOCATION OF TEMPORARY SOIL - GAS

NORTH

0 25 50

FEET

SAMPLE LOCATIONS 2009-2011
2250 Telegraph Avenue
Oakland, California

PLATE 4

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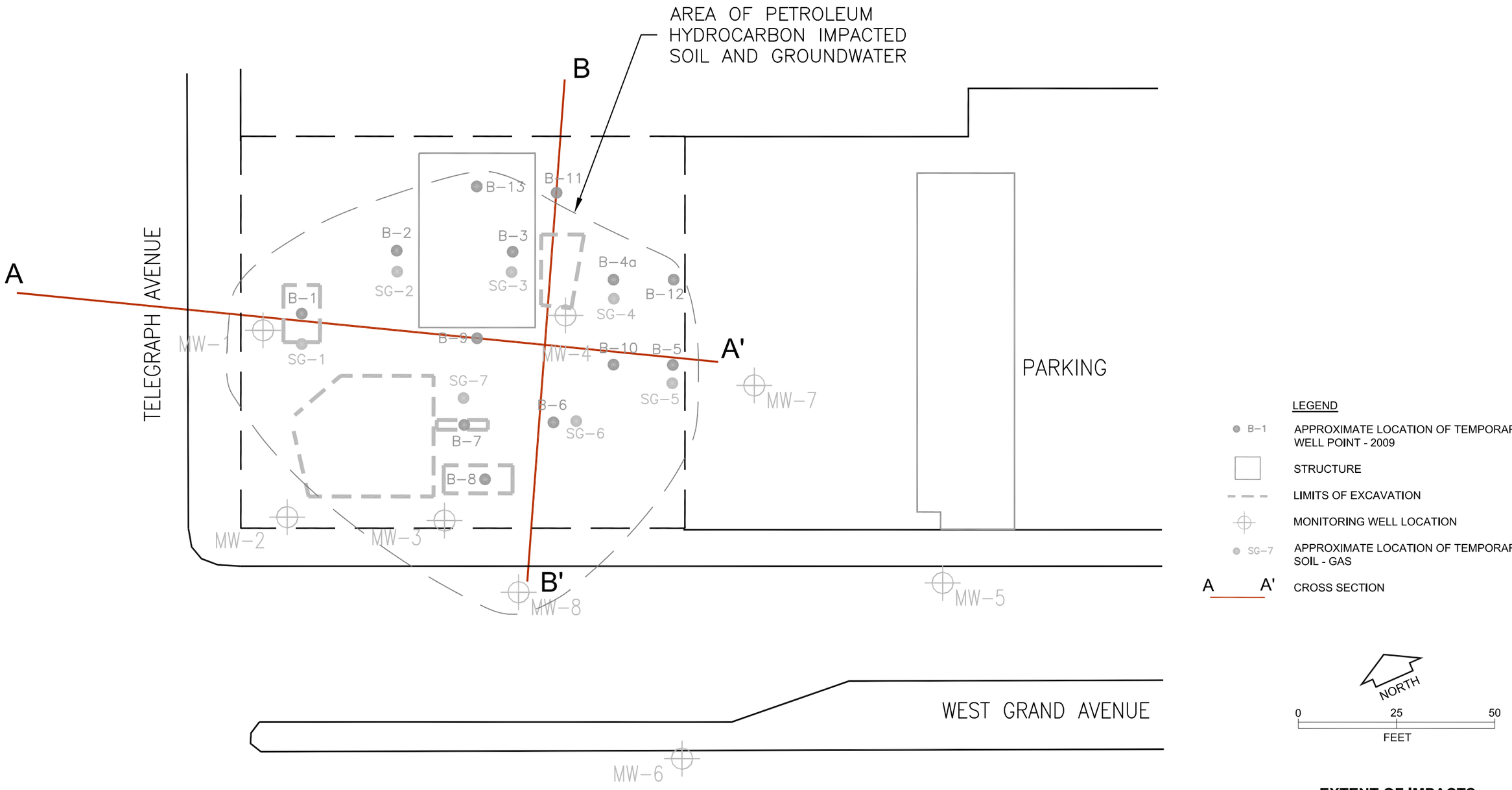

EXTENT OF IMPACTS
2250 Telegraph Avenue
Oakland, California

PLATE 5

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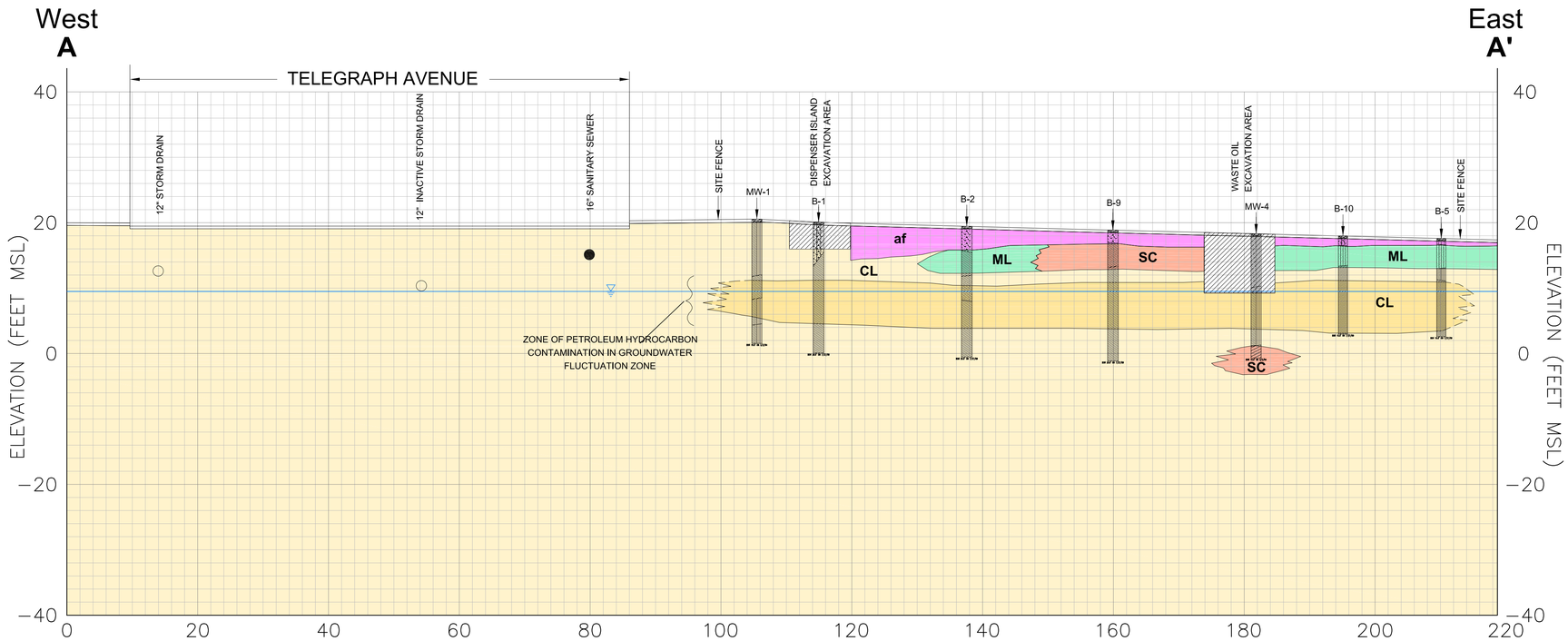

LEGEND

- af — Artificial fill
- CL — Lean Clay
- CL — Lean Clay in the Hydrocarbon Contamination Zone
- ML — Silt with sand
- SC — Clayey sand
- Geologic Contact, dashed where approximate
- Water Line

10
0
0
10

Horizontal and Vertical Scales in Feet

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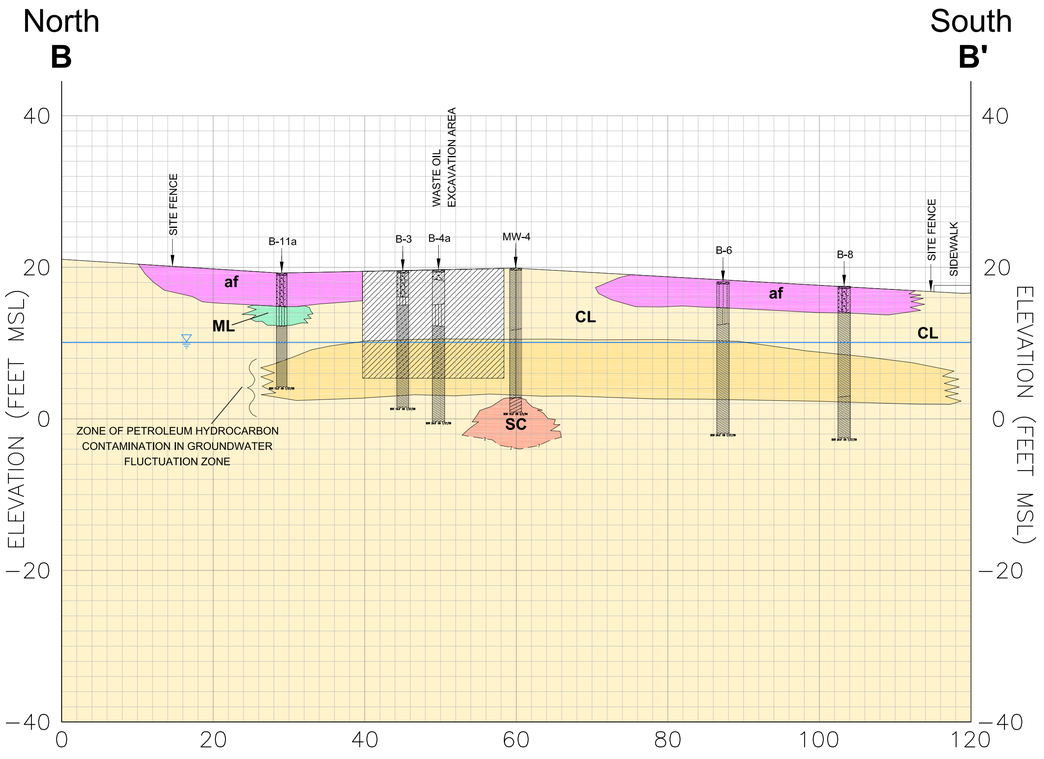
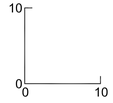
GENERALIZED CROSS SECTION A-A'
2250 Telegraph Avenue
Oakland, California

PLATE 6



LEGEND

- af — Artificial fill
- CL — Lean Clay
- CL — Lean Clay in the Hydrocarbon Contamination Zone
- ML — Silt with sand
- SC — Clayey sand
- Geologic Contact, dashed where approximate, queried where uncertain
- Water Line

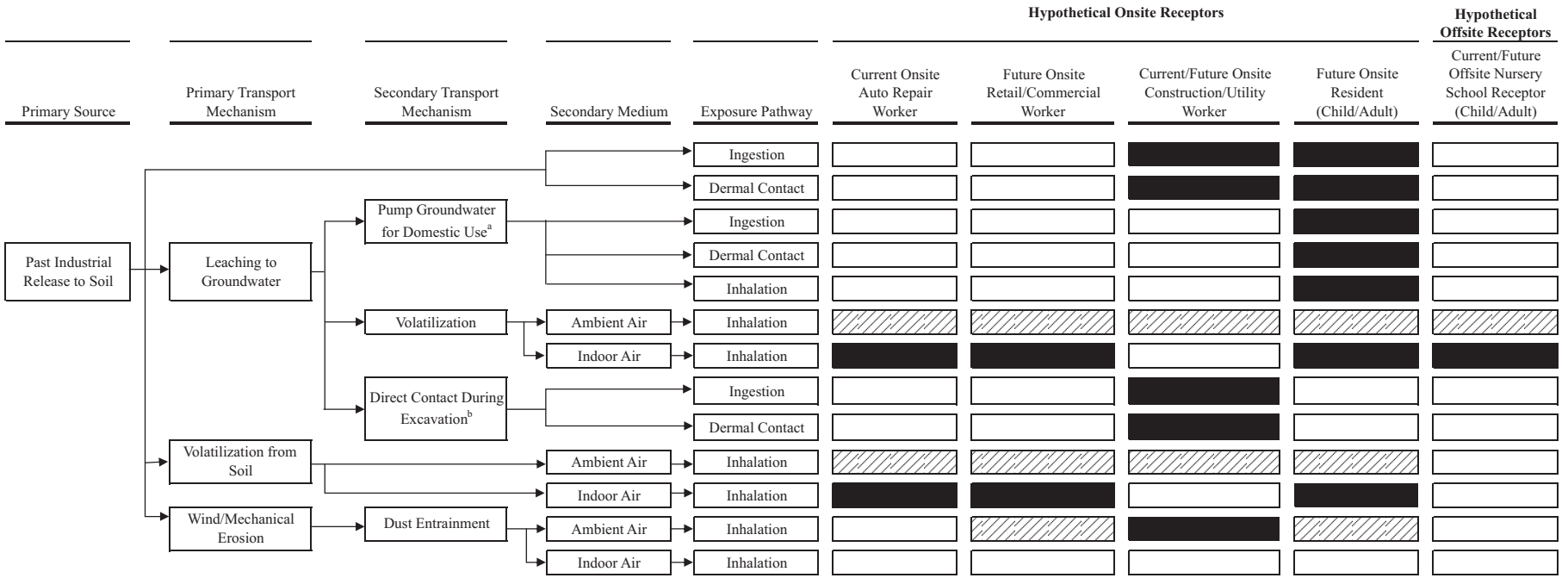


Horizontal and Vertical Scales in Feet

GENERALIZED CROSS SECTION B-B'
2250 Telegraph Avenue
Oakland, California

PLATE 7

M:\Drafting\JOBFILES\2011\04.B0609004\Drawings\A04.B0609004-06 CSM Diag.cdr, began 10-11-12



Receptor likely to be exposed via this route, so exposure pathway considered potentially complete and significant and quantitatively evaluated.

Receptor may be exposed via this route, so pathway is considered potentially complete. However, pathway likely insignificant. Qualitative evaluation only.

Pathway is incomplete; no further evaluation required.

[a] Based on results of a well survey and known local groundwater usage, it is unlikely that groundwater beneath the Site would be used for domestic purposes. However, due to the potential for future residential development, this pathway is conservatively considered potentially complete and significant.

[b] Depth to groundwater is approximately 10 feet below ground surface; therefore, direct contact during construction-related excavation is possible.

Note: Note: Developed in consultation with SLR International Corporation

September 2011
Project No. 04.B0609004

PLATE 8

CONCEPTUAL SITE MODEL DIAGRAM

Human Health Risk Assessment
2250 Telegraph Avenue
Oakland, California

LEGEND

- B-1 APPROXIMATE LOCATION OF TEMPORARY WELL POINT - 2009
- STRUCTURE
- LIMITS OF EXCAVATION
- MW-8 MONITORING WELL LOCATION
- SG-7 APPROXIMATE LOCATION OF TEMPORARY SOIL - GAS

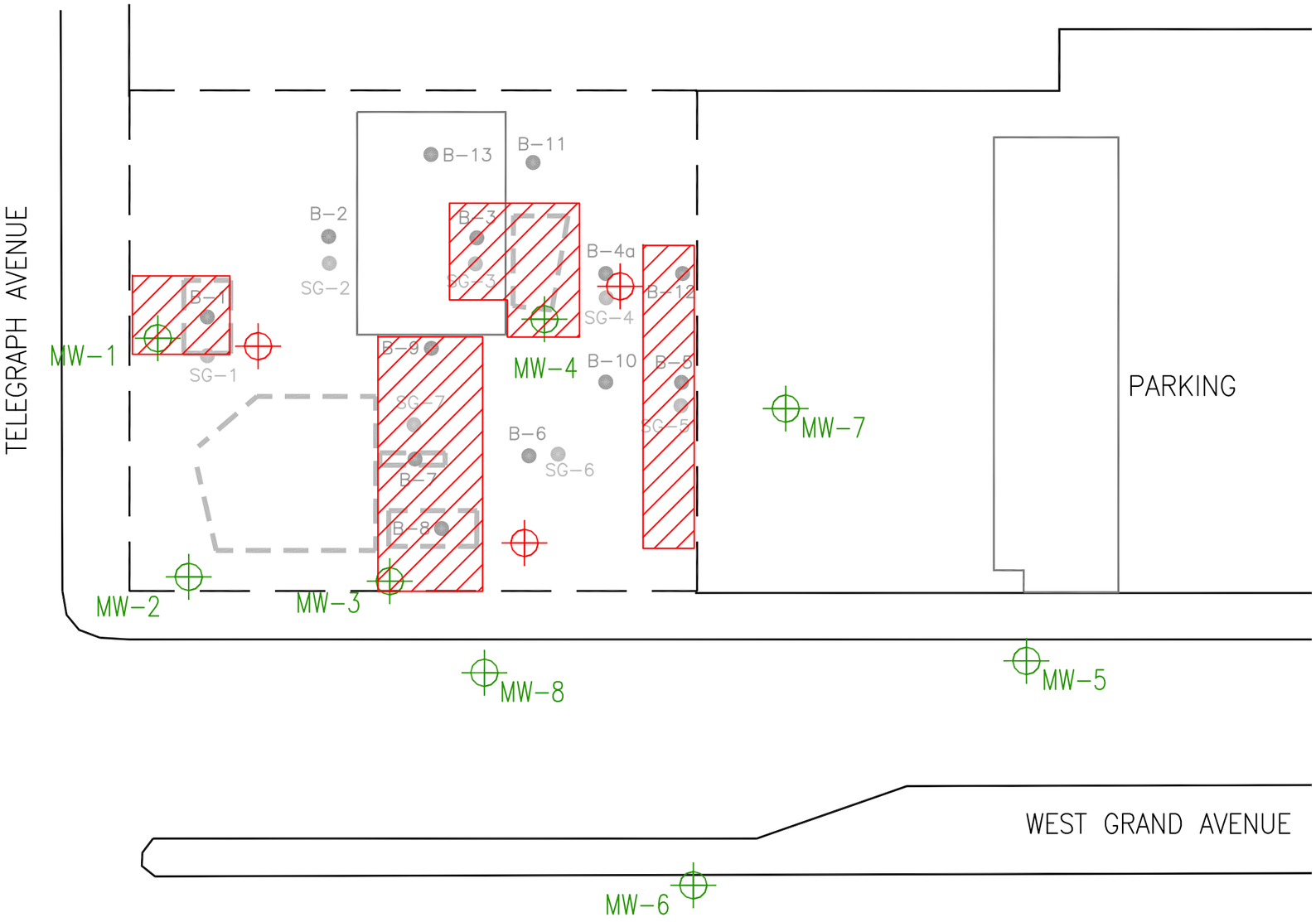
NORTH

0 25 50
FEET

REMEDIAL ALTERNATIVE 1: NO ACTION AND MONITORED NATURAL ATTENUATION
2250 Telegraph Avenue
Oakland, California

PLATE 9

M:\Drafting\JOBFILES\2011\04.B0609004\Drawings\B04.B0609004-09 RA1.DWG 11-15-11 11:00:19 AM began



LEGEND

- B-1 — APPROXIMATE LOCATION OF TEMPORARY WELL POINT - 2009
- SG-7 — APPROXIMATE LOCATION OF TEMPORARY SOIL - GAS
- STRUCTURE
- LIMITS OF EXCAVATION
- MW-8 — MONITORING WELL LOCATION
- SOURCE REMOVAL AREA WITH ORC PLACEMENT
- APPROXIMATE LOCATION OF NEW MONITORING WELL

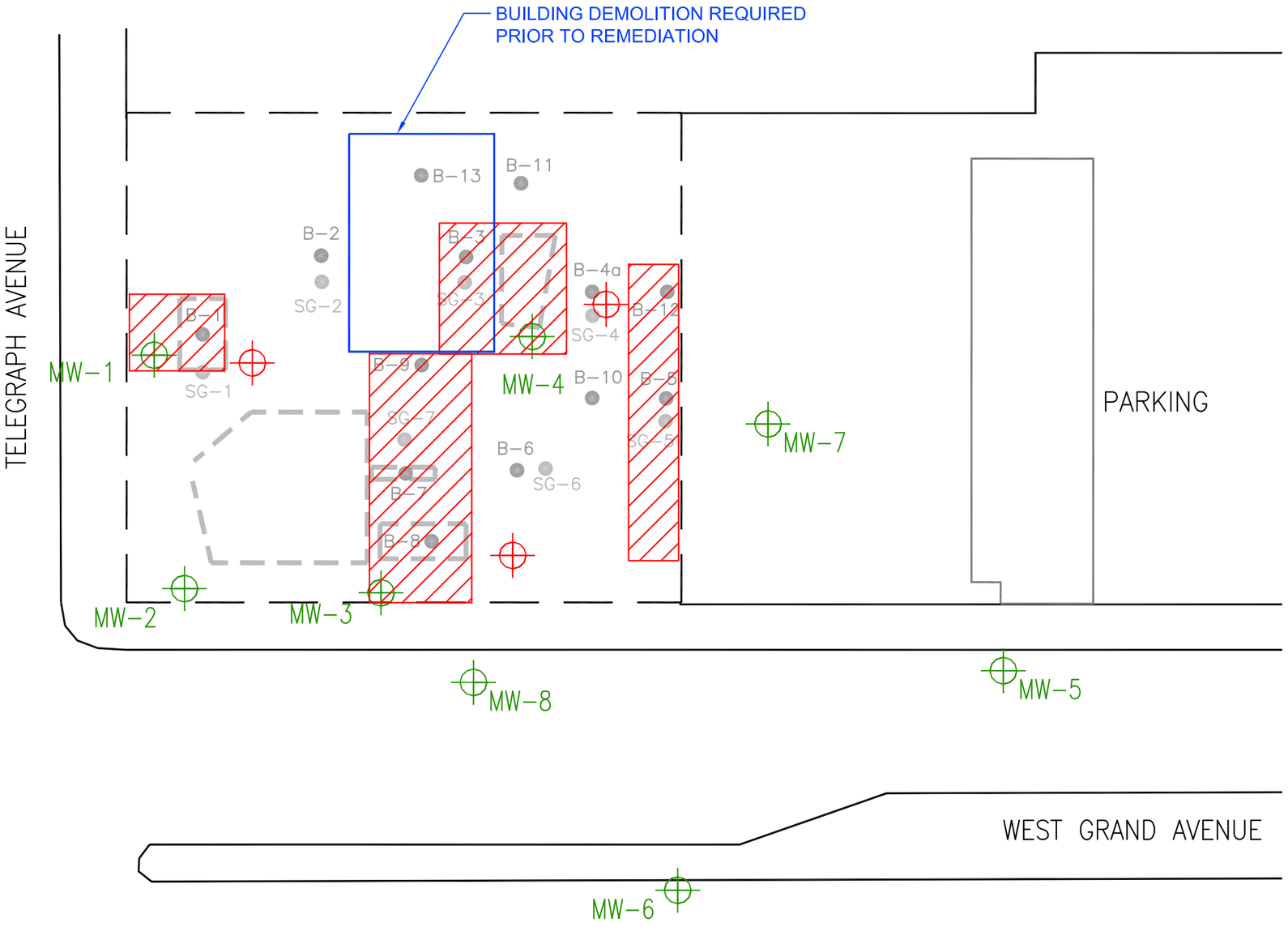
NORTH

0 25 50
FEET

REMEDIAL ALTERNATIVE 2: "HOTSPOT" REMOVAL WITH ORC PLACEMENT
2250 Telegraph Avenue
Oakland, California

PLATE 10

M: \Drafting \JOBFILES \2011 \04.B0609004 \Drawings \B04.B0609004-10 RA2.dwg 11-15-11 01:39:49 PM began



LEGEND

- B–1 — APPROXIMATE LOCATION OF TEMPORARY WELL POINT - 2009
- SG–7 — APPROXIMATE LOCATION OF TEMPORARY SOIL - GAS
- STRUCTURE
- LIMITS OF EXCAVATION
- MW–8 — MONITORING WELL LOCATION
- SOURCE REMOVAL AREA WITH ORC PLACEMENT
- APPROXIMATE LOCATION OF NEW MONITORING WELL

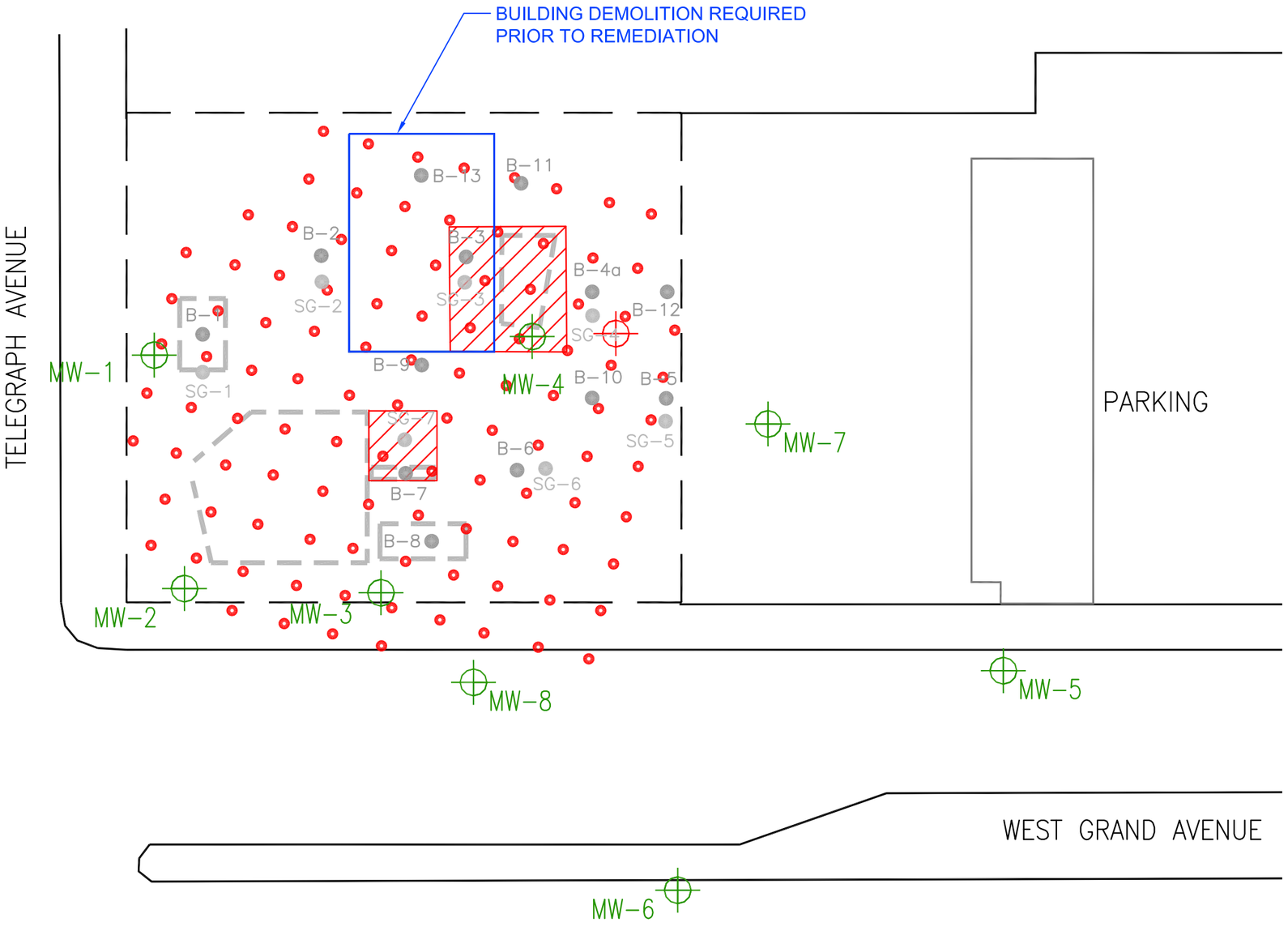
NORTH

0 25 50
FEET

REMEDIAL ALTERNATIVE 3: TARGETED SOIL REMOVAL AND ORC PLACEMENT
2250 Telegraph Avenue
Oakland, California

PLATE 11

M: \Drafting \JOBFILES \2011 \04.B0609004 \Drawings \B04.B0609004–11 RA3.dwg 11–15–11 01:43:36 PM began



LEGEND

- B-1 — APPROXIMATE LOCATION OF TEMPORARY WELL POINT - 2009
- STRUCTURE
- LIMITS OF EXCAVATION
- MW-8 — MONITORING WELL LOCATION
- SG-7 — APPROXIMATE LOCATION OF TEMPORARY SOIL - GAS
- SOURCE REMOVAL AREA
- ORC INJECTION POINT
- APPROXIMATE LOCATION OF NEW MONITORING WELL

NORTH

0 25 50
FEET

REMEDIAL ALTERNATIVE 4: TARGETED SOIL REMOVAL WITH AGGRESSIVE GROUNDWATER TREATMENT
2250 Telegraph Avenue
Oakland, California

PLATE 12

M:\Drafting\JOBFILES\2011\04.B0609004\Drawings\B04.B0609004-12 RA4.dwg 11-15-11 11:29:14 AM began

APPENDIX A
SLR INTERNATIONAL CORP., HUMAN HEALTH RISK ASSESSMENT, 2250 TELEGRAPH AVENUE, OAKLAND, CALIFORNIA, DATED NOVEMBER 10, 2011

HUMAN HEALTH RISK ASSESSMENT
2250 TELEGRAPH AVENUE
OAKLAND, CALIFORNIA

NOVEMBER 10, 2011

Prepared by:

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This document was prepared upon request of Fugro Consultants, Inc. and their client, Buttner Properties. No other party should rely on the information contained herein without prior written consent of SLR International Corp and Fugro Consultants, Inc, or Buttner Properties. The conclusions, recommendations, and interpretations in this report are based in part on information contained in other documents and sources, as cited in the text. Therefore, this report is also subject to the limitations of the cited documents and sources.

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1 INTRODUCTION

This report presents a risk assessment (RA) conducted to identify potential risk to current and future human receptors at and adjacent to the property located at 2250 Telegraph Avenue in Oakland, California, from contaminants detected in soil, groundwater, and soil gas. Historical chemical releases to the surface and subsurface have resulted from both current and previous site uses. The site was formerly occupied by a gasoline service station and is currently used commercially as an auto repair shop, and is located in an area zoned for commercial development and use (Fugro, 2009). Future potential site use plans include commercial and/or residential use. Although the site location is currently zoned for commercial use, this could change in the future to accommodate residential development, which would most likely be in the form of multi-family housing (such as apartments or condos). Surrounding properties include two restaurants and two service stations. A nursery school is also located adjacent to the eastern site boundary. A playground, which is fully paved and covered with a mat, constitutes the portion of the nursery school property that is directly adjacent to the site, and the school building is located to the east of the playground. Shallow and deep soil data, soil gas data, and both onsite and offsite groundwater data are available for the site and surrounding areas, and were included in the initial (i.e., screening) evaluation.

Petroleum hydrocarbons, benzene, toluene, ethylbenzene, and xylenes (BTEX), and other volatile organic compounds (VOCs) have been detected in soil as well as onsite and offsite groundwater. Semi-volatile organic compounds (SVOCs) and lead have also been detected in soil. Total petroleum hydrocarbons as gasoline (TPHg) and xylenes have been detected in soil gas.

2 DATA EVALUATION

Soil. Soil samples have been collected from onsite locations in 1990, 1994, and 2009, and from offsite locations in 1997 and 2011. Samples were initially collected in August of 1990 following removal of gasoline underground storage tanks (USTs), two fuel dispensing islands, and a waste oil UST. Thirteen samples were collected from the gasoline UST/dispenser island excavation areas at depths ranging from 0.5 to 16 feet below ground surface (bgs), and analyzed for TPHg, BTEX, and lead. Two samples were collected from the waste oil UST excavation, and four additional samples were collected from the material removed during that excavation. The waste oil area samples were analyzed for TPHg, TPH as diesel (TPHd), TPH as motor oil (TPHmo), and total oil and grease; BTEX; tetrachloroethene (PCE) and chlorobenzene; and cadmium, chromium, lead, zinc, nickel, and copper. One sample was also analyzed for 2-methylnaphthalene, 2-methylphenol, di-n-butyl phthalate, and naphthalene.

The August 1990 sampling results confirmed that contaminated soils remained in place following the initial excavations; additional excavation was therefore conducted in October 1990 (gasoline UST and dispenser island areas) and in February 1994 (waste oil UST area). Samples were collected from each location to characterize soils remaining in place following the additional excavation. Fourteen samples were collected from the gasoline UST/fuel island area, and analyzed for TPHg, TPHd, TPHmo, and BTEX. Nine samples were collected from the waste oil UST area, and were analyzed for TPHg, TPH as kerosene (TPHk), TPHd, TPHmo, total oil and grease, BTEX, 1,1,1-trichloroethane (1,1,1 TCA), 1,2-dichloroethane (1,2 DCA), PCE, chlorobenzene, lead, and SVOCs (2-methylnaphthalene, anthracene, bis[2-ethylhexyl]phthalate, butyl benzyl phthalate, di-n-butyl phthalate, fluoranthene, fluorene, naphthalene, nitrobenzene, n-nitrosodiphenylamine, phenanthrene, and pyrene).

Soil samples were also collected in 1994 and 1997 from monitoring well borings. Four samples were collected in 1994 from onsite well borings (MW-1 through MW-4) at a depth of 10 feet bgs, and four samples were collected in 1997 from offsite well borings (MW-5 and MW-6) at depths ranging from four to 10 feet bgs. The well boring samples were analyzed for TPHg, TPHk (onsite only), TPHd, TPHmo (onsite only), BTEX, 1,1,1 TCA, 1,2 DCA, PCE, and chlorobenzene.

An additional 57 soil samples were collected in 2009 from onsite soil borings at depths ranging from one to 20 feet bgs, as part of additional site characterization activities. The 2009 soil samples were analyzed for TPHg, TPHd, TPHmo, BTEX, five fuel oxygenates (methyl-tert-butyl ether [MTBE], tert-butyl alcohol [TBA], di-isopropyl ether [DIPE], ethyl tert-butyl ether [ETBE], and methyl tert amyl ether [TAME]), and two lead scavengers (1,2 DCA and 1,2-dibromoethane [1,2 DBA]). Not all samples were analyzed for all parameters. One sample was also analyzed for TPH as hydraulic fluids (TPHhy).

In 2011, two new monitoring wells (MW-7 and MW-8) were installed offsite. MW-7 was installed in the playground area of the adjacent nursery school east of the site, and MW-8 was installed in the eastbound parking lane of West Grand Avenue, south of the former dispenser island excavation area. Six samples (plus one bottom of casing sample) were collected from the boring for MW-7 at depths ranging from 1.5 to 15 feet bgs, and five samples were collected from the MW-8 boring at depths of 1 to 14 feet bgs. Samples were analyzed for the same parameters analyzed in the 2009 soil samples (except for TPHhy); the bottom of casing sample was analyzed only for TPHd and

TPHmo, and one sample collected from MW-7 at 1.5 feet bgs was also retested for these two parameters using the silica gel cleanup method.

Groundwater. Groundwater data have been collected from onsite wells (MW-1 through MW-4) since 1994. Sampling at offsite monitoring wells MW-5 and MW-6 commenced in 1997, and sampling at the two newest offsite monitoring wells (MW-7 and MW-8) began in 2011. Sampling frequency varies by well and by year; beginning in 2005, groundwater samples were generally collected at least twice per year from wells other than MW-7 and MW-8 (only one sample has been collected to date from each of these newest wells). No samples were collected from onsite wells in 1996 or 1997, or from any wells in 2002 through 2004. A total of 138 monitoring well samples have been collected at the site and vicinity, at depths ranging from 6.2 to 12.86 feet bgs. Locations of monitoring wells are shown on Plate 2 of Fugro (2009). Monitoring well samples were analyzed for TPHg, TPHk, TPHd, and TPHmo; BTEX; and select VOCs including TBA, DIPE, ETBE, TAME, 1,1,1 TCA, 1,2 DCA, 1,2 DBA, PCE, chlorobenzene, and MTBE. Not all samples were analyzed for all chemicals. Additional information and historical groundwater monitoring data through 2009 are provided in Fugro (2009).

Grab groundwater samples have also been collected at the site and adjacent areas. Five grab samples were collected in 1996 from temporary wells to assist in determining the locations for two new offsite monitoring wells (MW-5 and MW-6, which were installed in June of 1997). Eleven grab samples were collected in 2009 as part of additional site characterization to further define the extent of contamination. A total of 16 samples were collected and analyzed in 1996 and 2009. This includes a total of 12 onsite and four offsite sampling locations. Locations of grab samples are shown on Plate 2 of Fugro (2009). Grab groundwater samples were analyzed for the same suite of analytes as were monitoring well samples, and for total dissolved solids; not all samples were analyzed for all chemicals. Grab groundwater data are summarized on Table 5 of Fugro (2009).

Soil Gas. Nine soil gas samples were collected during the 2009 additional site characterization activities (plus one resample and one field duplicate, and an air blank sample). Two of these samples consisted of additional purge volumes from one location; these samples were collected to determine the most appropriate purge volume to use for the remaining sample collection. Based on the results from the purge volume test, a one-volume purge was used for the soil gas investigation. Soil gas samples were analyzed for TPHg, TPHd, BTEX, and MTBE, as well as dissolved gases and leak check compounds.

2.1 RISK ASSESSMENT DATA SET

A detailed evaluation of the available data was conducted to identify data applicable to the RA. The resulting data subset is termed the "RA data set." Not all data are applicable to risk assessment. Criteria used to identify suitable data were (1) sample locations, (2) sampling dates, (3) likely exposure areas, (4) sample depths, and (5) type of sample. The RA data sets are described below.

Sampling location/Exposure area. Data were subdivided for two exposure areas: (1) onsite and (2) offsite. These datasets were separately evaluated. Onsite data include samples collected from monitoring wells 1 through 4 (and associated borings for soil samples), as well as all soil and soil gas boring locations. Offsite data include samples collected from monitoring wells 5 through 8 (and associated borings for soil samples).

As discussed in Section 3 of this report, no potentially complete exposure pathways were identified for offsite soil. In addition, analyte concentrations in offsite soil were either non-detect, or lower than those detected in onsite soil. Offsite soil data were therefore not included in the soil RA dataset.

Sampling date. Many of the soil samples collected during the August 1990 investigations represent soil that was removed during the additional remediation activities conducted in October 1990 (gasoline UST and fuel dispenser island areas) and February 1994 (waste oil UST area). These samples were therefore not included in the soil RA dataset. Four soil samples collected during the August 1990 investigation of the gasoline UST area (G6@15, G7@11, G8@16, and G10@16) were identified as remaining in place following the additional remediation activities conducted in October 1990; these samples were therefore included in the RA dataset for soil. Alladditional onsite soil samples, collected beginning in October 1990, were also included in the RA soil dataset. Use of historical soil data in the RA is conservative and is likely associated with overestimates of risk, since natural attenuation and volatilization may have reduced historical concentrations of organic chemicals in soil.

Because of the dynamic nature of groundwater, monitoring well data obtained from the most recent four sampling events for each well were retained and included in the RA datasets. These data most accurately represent current subsurface conditions at and in the vicinity of the site. Not all monitoring wells were sampled during each monitoring event. Therefore, sample dates for the four most recent events vary by well. The last four sampling events were included in the RA dataset for each well to ensure that the most current conditions at each well location were reflected in the groundwater evaluation. In addition, offsite monitoring wells MW-7 and MW-8 were newly installed in 2011 and have therefore been sampled only once each. The sample results from the one sampling event for each of these wells were also included in the offsite groundwater RA dataset.

Soil gas data were collected in 2009. Although concentrations may have decreased with time since the 2009 sampling event, these samples represent the only available soil gas data for the site and were therefore included in the soil gas RA dataset.

Sample Depths. Generally, soil data are subdivided into two depth intervals for risk assessment; shallow (0 to 10 feet bgs) and deep (greater than 10 feet bgs). The shallow depth interval corresponds to the generally accepted excavation depth at California construction sites of 10 feet, and is associated with direct soil exposure pathways. The deeper depth interval corresponds only to the vapor inhalation pathway. Since groundwater and soil vapor data are available, and the vapor inhalation pathway is no longer evaluated using soil data, the deeper soil data were not quantitatively evaluated in the RA. However, it is possible in the event of future site redevelopment that excavation could extend to depths greater than 10 feet bgs. The deep soil dataset was, therefore, conservatively included in the soil screening evaluation to ensure that all chemicals detected in soil at any depth were evaluated, and is therefore presented in Table 1 (soil risk assessment dataset) along with data in the 0 to 10 feet bgs interval. Only soil data collected between 0 and 10 feet bgs were quantitatively addressed in this RA.

Sample Type. Grab groundwater samples are not generally suited for risk assessment as they are typically collected to aid in the placement of monitoring wells. Data from grab samples generally yield higher concentrations than would be anticipated from

groundwater wells due to the presence of soil particles from the borehole in the sample, and the lack of equilibrium conditions during sample collection. Soil particles containing adsorbed chemicals lead to higher concentrations of target analytes in the water sample. In addition, groundwater samples have been collected from onsite and offsite monitoring wells at the same or similar locations as the grab samples. Finally, grab groundwater data pre-date groundwater samples from established monitoring well locations. Therefore, grab sample data were not included in the RA dataset for groundwater.

A duplicate soil gas sample was collected from location SG-7. Field duplicate samples are collected for quality control purposes and are generally not included in RA datasets. To be conservative, for analytes detected in soil gas at location SG-7, either the detected result (if detected in only the primary or duplicate sample) or the higher detected result (if detected in both the primary and duplicate samples) was retained in the RA dataset. At this location, analyte concentrations were either the same in both samples, or higher in the primary sample. The duplicate soil gas sample collected from location SG-7 was therefore not included in the soil gas RA dataset.

Three different purge volume samples were collected from location SG-6 for the purpose of determining the most appropriate purge volume for sampling at the remaining locations. Based on this purge volume test, a one-volume purge was used for the soil gas investigation. Of the three samples collected from location SG-6, the one purge volume sample contained the only detected analyte concentrations (other than dissolved gases). For these reasons, the three and seven purge volume samples collected from this location were not included in the RA dataset for soil gas.

Finally, an ambient air blank sample was collected for quality control purposes, and all soil gas samples were analyzed for dissolved gases (methane, oxygen, and carbon dioxide) as well as leak check compounds. These types of quality control data are not relevant for use in risk assessment, and were therefore not included in the soil gas RA dataset.

Evaluation of TPH. TPH mixtures were not included for quantitative evaluation in the RA. These complex mixtures are comprised of thousands of chemicals, the most toxic of which are represented by specific compounds individually analyzed in the samples. Toxicity data are generally not available for TPH mixtures, and these are therefore evaluated in risk assessments using indicator chemicals such as BTEX, polycyclic aromatic hydrocarbons (PAHs), and oxygenates such as MTBE. Therefore, while data for TPH mixtures were included in the RA datasets and evaluated in the screening stage of the RA, only the detected constituents of these mixtures were included in the quantitative risk evaluation, consistent with San Francisco Bay Regional Water Quality Control Board (RWQCB, 2008) and California Environmental Protection Agency (CalEPA, 1996) guidance.

The RA datasets are provided for shallow and deep soil in Table 1, for onsite and offsite groundwater in Table 2, and for soil gas in Table 3.

2.2 ANALYTICAL RESULTS

The RA data sets are summarized below for soil, onsite groundwater monitoring wells, offsite groundwater monitoring wells, and onsite soil gas samples.

Shallow Soil Data. As shown in Table 1, a total of 46 shallow soil samples were collected from onsite locations between October 1990 and July 2009. All 46 samples were analyzed for TPHd and TPHmo, 43 samples were analyzed for TPHg and BTEX, 29 samples were analyzed for 1,2 DCA, and 1 to 8 samples were analyzed for the remaining target analytes.

TPH in the gasoline, diesel, and motor oil ranges and BTEX compounds were detected in 6 (benzene and toluene) to 25 (TPHmo) samples, at concentrations ranging from 0.012 milligrams per kilogram (mg/kg; ethylbenzene) to 1,700 mg/kg (TPHmo). TPHhy was detected in the one sample analyzed at a concentration of 390 mg/kg, and total oil and grease was detected in one of four samples at a concentration of 3,900 mg/kg; TPHk was not detected in any of the 8 samples analyzed. 1,1,1 TCA, 1,2 DCA, PCE, and chlorobenzene were each detected in one or two samples at concentrations ranging from 0.0074 mg/kg (1,1,1 TCA) to 0.036 mg/kg (1,2 DCA). The five fuel oxygenates were not detected in any samples. Lead was detected in all four samples analyzed; concentrations ranged from 8 mg/kg to 590 mg/kg. N-nitrosodiphenylamine was the only SVOC not detected in the two samples analyzed; other SVOCs were detected in one sample each at concentrations ranging from 0.12 mg/kg (fluorene) to 2.7 mg/kg (2-methylnaphthalene).

Deep Soil Data. As shown in Table 1, a total of 38 deep soil samples were collected from onsite locations between August 1990 and July 2009 from locations remaining in place following remedial activities. All 38 samples were analyzed for TPHg and BTEX, 30 samples were analyzed for TPHd and TPHmo, 28 samples were analyzed for 1,2 DCA, and other parameters were analyzed in 2 to 9 samples. TPHhy was not analyzed in deep soil samples.

TPH in the gasoline, diesel, and motor oil ranges and BTEX compounds were detected in 11 to 22 samples, at concentrations ranging from 0.0056 mg/kg (toluene) to 1,100 mg/kg (TPHd and TPHmo). Total oil and grease was detected in all 5 samples analyzed at concentrations ranging from 80 mg/kg to 2,700 mg/kg; TPHk was not detected in any of the 5 samples analyzed. PCE and chlorobenzene were detected in 1 to 2 samples, each at around 0.008 mg/kg. The five fuel oxygenates were not detected in any samples. Lead was detected in all 9 analyzed samples at concentrations of 4.93 mg/kg to 60 mg/kg. Anthracene and n-nitrosodiphenylamine were each detected in one of two samples (0.18 mg/kg and 0.21 mg/kg, respectively). Other detected SVOCs were detected in both analyzed samples, at concentrations ranging from 0.050 mg/kg (fluoranthene) to 3.7 mg/kg (2-methylnaphthalene). 1,1,1 TCA, 1,2 DCA, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, and nitrobenzene were not detected in deep soil samples.

Onsite Monitoring Well Data. As shown in Table 2, a total of 16 groundwater samples were collected from onsite groundwater monitoring wells during the last four monitoring events for each well, with dates ranging from February 2008 to May 2011.

TPH in the gasoline, diesel, and motor oil ranges was detected in two (TPHmo) to 12 (TPHg) samples at concentrations ranging from 53 micrograms per liter (µg/L; TPHd) to 1,500 µg/L (TPHmo). BTEX was detected in four (benzene, toluene, and ethylbenzene) to six (xylenes) samples at concentrations ranging from 0.56 µg/L (xylenes) to 300 µg/L (benzene). MTBE and TBA were detected in one sample each, at concentrations of 2.4 µg/L and 12 µg/L, respectively. Other target analytes were not detected in any of the 16

onsite monitoring well samples. No analytes were detected at MW-2. Maximum concentrations of BTEX and TPHg were all detected at MW-3.

Offsite Monitoring Well Data. As shown in Table 2, a total of 10 groundwater samples were collected from offsite groundwater monitoring wells during the four most recent monitoring events for each well (or the only event, for wells MW-7 and MW-8). Sampling dates for wells MW-5 and MW-6 range from February 2008 to October 2010; MW-7 and MW-8 were each sampled once in 2011, in May and August, respectively.

TPHg and TPHd were detected in five samples each, at concentrations ranging from 230 µg/L (TPHd) to 1,700 µg/L (TPHg). BTEX was detected in one (benzene, toluene, and xylenes) to two (ethylbenzene) samples at concentrations ranging from 1.8 µg/L (benzene) to 57 µg/L (ethylbenzene). TBA and 1,2 DCA were detected in one sample each, at concentrations of 14 µg/L and 3 µg/L, respectively. Other target analytes were not detected in any of the 10 offsite monitoring well samples. No analytes were detected at MW-5. Only TPHg, TPHd, and TBA were detected at MW-6, and only toluene was detected at MW-7. Maximum concentrations of all detected analytes other than TPHd and TBA were at MW-8.

Soil Gas Data. As shown in Table 3, a total of seven soil gas samples were included in the RA dataset for soil gas; samples were collected from onsite locations in July 2009.

Only TPHg and xylenes were detected in soil gas samples. TPHg was detected in one sample at a concentration of 36,000 micrograms per cubic meter (µg/m^3). Both xylene isomers (m,p- and o-xylenes) were detected in four samples, at concentrations ranging from 100 µg/m^3 (o-xylene) to 320 µg/m^3 (m,p-xylenes). The single detection of TPHg was at SG-7. Maximum concentrations of both xylene isomers were detected at SG-5.

2.3 STATISTICAL ANALYSIS

Tables 1 through 3 provide minimum and maximum detected concentrations, number of analyses and detections and frequency of detections, and average and standard deviation concentrations for analytes detected in soil, groundwater, and soil gas. Separate data summaries are provided for shallow and deep soil data, and for onsite and offsite groundwater data. Consistent with United States Environmental Protection Agency (USEPA, 1989) guidance, for generating summary statistics one-half the detection limit was used in lieu of nondetected values for analytes detected in more than one sample.

3 CONCEPTUAL SITE MODEL

In this section, potential human receptors and potentially complete exposure pathways are identified at the site and pertinent downgradient offsite area. A conceptual site model (CSM) was developed to facilitate the pathway analysis. The CSM is an important preliminary step in the exposure assessment portion of a RA (USEPA, 1989). The CSM provided in Figure 1 schematically presents the relationship between chemical sources and receptors at the site, and identifies potentially complete and significant pathways through which receptors may be exposed to chemicals of potential concern (COPCs). This is accomplished by considering such important site characteristics as the source of chemical release, depth to the water table, distribution of chemical detections, chemical fate and transport, current and possible future land use at the site and adjacent area, and groundwater use. The CSM was developed on the basis of the detailed site-specific land and groundwater uses provided in Fugro (2009) and summarized in Section 1 of this report.

Precise future land use plans for the site are unknown. For such cases, USEPA has provided recommendations in a memorandum titled Land Use in the CERCLA Remedy Selection Process (USEPA, 1995). USEPA recommended basing any required remediation (and hence RA) upon "reasonably anticipated future land use". They stated: "The baseline risk assessment generally needs only to consider the reasonably anticipated future land use". The most likely future use of the site property is commercial and/or residential. Residential use would most likely consist of multi-family homes such as apartments or condos, where pavement or landscaping would likely be present in undeveloped areas. Although considered unlikely, the development of single-family homes with yards could constitute a "reasonably anticipated future land use". Therefore, it was assumed for the RA that in the event of residential development at the site, such development would consist of single-family homes with yards. Evaluation of the residential land use scenario in the risk assessment should also be protective of other potential land uses that could occur at the site in the future.

"Receptor" is the term used in RAs for people who may be exposed to impacted media at or near an evaluated site. Receptors are not actual people. Rather, they represent groups of people associated with various assumed exposure scenarios and are, therefore, termed "hypothetical." Categories of receptors include: residential, commercial/industrial worker, visitor/trespasser, and construction/utility worker. When receptors are identified for a RA, these categories are considered in light of current and likely future use of the site and nearby area, and access to the site and impacted media.

Onsite Receptors. Because the site is currently used as an auto repair shop, commercial/industrial use was assumed to be the only current land use, as well as a likely future use. Therefore, a hypothetical current/future commercial/industrial worker receptor was identified. Future residential development of the site is also possible; therefore, resident receptors were assumed to be present onsite in the future. Assuming site redevelopment, hypothetical future onsite construction workers could also be present. In addition, construction/utility workers could be present for utility line or similar subsurface work either currently or in the future. Although people may visit or trespass at the site, such sporadic exposure would be substantially lower than exposure associated with an onsite commercial or residential scenario. Therefore, visitor receptors were not considered further. Moreover, an outdoor commercial scenario was not quantitatively evaluated at the site. Indoor commercial workers are more likely to be

present full-time and, therefore, to be more highly exposed to chemicals from site soil and groundwater through inhalation of VOCs, the primary exposure pathway for commercial workers at a fully paved site with subsurface impacts. In addition, evaluation of residential receptors should be protective of outdoor exposure pathways such as direct contact with soil.

Hypothetical current and future onsite receptors are summarized below:

- Current/future onsite commercial worker. This adult receptor is assumed to work indoors full-time at the site.

- Current/future onsite construction/utility worker. In the event of future redevelopment of the site, a construction worker would work at the site for a short period of time. Workers may also visit sporadically to maintain underground utility lines.

- Future onsite resident receptor (adult and child). This receptor was assumed to be an adult or child living at an onsite single-family dwelling in the future.

Offsite Receptors. As described in Fugro (2009), the site and surrounding properties are zoned for commercial development and use. Surrounding properties currently include two restaurants (to the north and west of the site), and two service stations (to the south and southwest of the site), as well as a nursery school to the east and immediately adjacent to the site. Groundwater flow is predominantly toward the east-southeast (Fugro, 2009). Therefore, nursery school workers and children were identified as the most likely and most sensitive receptors for potential offsite exposures, and a current/future offsite nursery school receptor was identified for the RA.

Exposure Pathways. Potentially complete and significant exposure pathways for the hypothetical receptors are identified in this section. An exposure pathway is a mechanism by which receptors are assumed to contact COPCs. USEPA (1989) describes a complete exposure pathway in terms of four components:

- A source and mechanism of chemical release (e.g., a UST system leak releasing benzene to the subsurface)

- A retention or transport medium (e.g., groundwater)

- A receptor at a point of potential exposure to a contaminated medium (e.g., commercial worker in an onsite building)

- An exposure route at the exposure point (e.g., inhalation of vapors).

If any of these four components are not present, then a potential exposure pathway is considered incomplete and is not evaluated further in a RA. If all four components are present, a pathway is considered complete. In addition to the distinction between complete and incomplete pathways, complete exposure pathways can be further delineated into those expected to be insignificant and those that may be significant. These two types of pathways are discussed below.

Complete but Insignificant Exposure Pathways. Exposure pathways in this category meet all four requirements to be considered complete. However, these pathways are

not expected to contribute significantly to the overall exposure for a receptor, due to the nature of the particular fate and transport mechanisms that comprise the pathway. For this reason, the potential health impacts associated with these types of pathways are evaluated qualitatively but not usually quantified in a RA.

Complete and Potentially Significant Exposure Pathways. A complete and potentially significant exposure pathway is comprised of fate and transport mechanisms that tend to result in more substantial exposures than complete but insignificant pathways. These pathways comprise the majority of exposure, and as such potential health effects associated with these pathways are typically quantified in a RA.

Soil Exposure Pathways. Direct access to site soil (i.e., ingestion, dermal contact, and inhalation of dust containing sorbed metals or SVOCs) is currently precluded by the presence of paving and buildings. Potential future residential development could consist of either multi-family dwellings or single-family homes with individual yards. In the event of future commercial or multi-family residential redevelopment, the site will likely continue to be fully paved or built out. Landscaped areas are generally small and constructed with imported fill at such new developments. Moreover, onsite commercial workers are unlikely to spend more than a small fraction of their working day outdoors, and are unlikely to engage in soil invasive activities such as construction or landscaping. Direct soil contact pathways were therefore identified as incomplete for the current/future commercial/industrial worker receptor. In the event of single-family residential development, the site will likely be fully covered with pavement, grass, or other landscaping. Although unlikely, direct soil contact through incidental ingestion and dermal contact could occur under a future residential scenario. These pathways were therefore identified as potentially complete and significant for future onsite resident receptors. Construction and utility workers engage in invasive activities such as digging. Direct soil contact pathways were therefore also identified as potentially complete and significant for the current/future construction/utility worker receptor.

USEPA (2002a) states that "site managers need only evaluate the fugitive dust pathway for a single contaminant, hexavalent chromium (Cr^{+6}) under the residential and commercial scenarios". As shown in Section 4.1 of this report, hexavalent chromium is not a COPC for this site; the dust inhalation pathway was therefore identified as potentially complete but insignificant for residential and commercial receptors. The dust inhalation pathway is more relevant under a construction scenario where excavation and use of heavy equipment may create excessive dust; this pathway was therefore identified as potentially complete and significant for the construction/utility worker receptor.

Volatile chemicals present in vadose soil at any depth may partition into the vapor phase, migrate upwards through the soil column, and enter either overlying structures or ambient air, where the receptors could inhale vapors. Therefore this is a potentially complete pathway for all hypothetical onsite receptors. Vapor concentrations in indoor air are expected to be higher than outdoor air concentrations, despite the retarding effect of the foundation. Therefore, the commercial worker and resident receptors (for the vapor inhalation pathway) were conservatively assumed to spend all their time indoors when present at the site. Outdoor vapor concentrations would be expected to be substantially lower than indoor air concentrations because of the instantaneous dispersion that occurs when vapors migrate from the soil surface. Vapor inhalation in outdoor air was not, therefore, considered a complete and potentially significant pathway

for any potential receptor. However, vapor inhalation in indoor air was considered complete for onsite commercial and residential receptors.

A playground constitutes the portion of the nursery school property that is directly adjacent to the site, and the nursery school building is located to the east of the playground. The playground area is fully paved and covered with a mat, thereby precluding direct access to offsite soil by nursery school receptors. In addition, soil impacts are expected to be limited to the onsite locations of former USTs and fuel dispenser islands; groundwater is likely the most significant medium for offsite exposure to COPCs. Contaminants present in offsite soil are not likely to be site-related. The limited available offsite soil data collected from offsite monitoring well borings (as presented in Fugro, 2009 and 2011) indicate that concentrations of COPCs are either lower than onsite concentrations, or below detection limits. Evaluation of residential exposures to onsite soils in the RA should therefore be protective of offsite exposures. Therefore, no potentially complete soil exposure pathways were identified for offsite receptors.

Receptors and potential soil pathways are summarized below and illustrated in the CSM diagram (Figure 1).

Groundwater Exposure Pathways. Groundwater at the site and vicinity is not currently pumped for domestic use (EBMUD, 2011). Domestic use of groundwater is also unlikely to occur in the future, particularly given the shallow depth to groundwater encountered at the site (ranging from approximately 6 to 13 feet bgs). However, due to the potential for future residential development of the site property, direct groundwater exposure pathways (i.e., ingestion, dermal contact, and inhalation during domestic use) were conservatively considered potentially complete and significant for the future onsite resident receptor.

VOCs dissolved in groundwater may partition into the vapor phase and migrate vertically to ambient or indoor air. Vapor inhalation in indoor air was therefore considered complete for onsite commercial and residential receptors, and for offsite nursery school receptors. As previously discussed, vapor inhalation in outdoor air is potentially complete but likely an insignificant pathway and was not quantitatively evaluated for any receptor.

As previously discussed, construction and utility workers engage in invasive activities such as digging. The generally accepted excavation depth at California construction sites is 10 feet bgs. Given that the water table has fluctuated historically between roughly 6 and 13 feet bgs, direct contact by a construction worker could occur during excavation activities. Incidental groundwater ingestion and dermal contact were therefore identified as potentially complete and significant exposure pathways for the current/future construction/utility worker receptor.

Receptors and potential groundwater pathways are summarized below and illustrated in the CSM diagram (Figure 1).

Soil Vapor Exposure Pathways. VOCs present in soil or groundwater may partition into the vapor phase and migrate vertically to ambient or indoor air. As described above for soil and groundwater, inhalation of vapors in outdoor air was not considered a complete and potentially significant pathway for any potential receptor, but the indoor air

inhalation pathway was considered complete for onsite commercial and residential receptors, and for offsite nursery school receptors.

Summary of Exposure Pathways for Quantitative Evaluation. Exposure pathways identified as potentially complete and significant for the hypothetical receptors are summarized below and in Figure 1.

- Hypothetical current/future onsite commercial/industrial worker
    - Inhalation of vapors from the subsurface in indoor air
- Hypothetical current/future onsite construction/utility worker
    - Incidental ingestion of and dermal contact with soil
    - Inhalation of fugitive dusts
    - Incidental ingestion of and dermal contact with groundwater
- Hypothetical future onsite resident receptor (adult and child)
    - Inhalation of vapors from the subsurface in indoor air
    - Incidental ingestion of and dermal contact with soil
    - Domestic use of groundwater (ingestion, dermal contact, and inhalation of vapors)
- Hypothetical current/future offsite nursery school receptor (adult and child)
    - Inhalation of vapors from the subsurface in indoor air

4 HUMAN HEALTH RISK ASSESSMENT

4.1 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN (COPCS)

Chemicals of potential concern (COPCs) were identified based on comparison of maximum detected chemical concentrations in each medium with appropriate screening levels for that medium. COPC identification constitutes a conservative, risk-based screening evaluation. The objective of this evaluation is to identify the most toxic, persistent, and prevalent chemicals at the site that are expected to contribute the majority of potential exposure, consistent with USEPA (1989) guidance. All chemicals detected in soil, soil gas, and groundwater were included in the screening process. Chemicals with maximum detected concentrations exceeding screening levels were identified as COPCs to be quantitatively evaluated in the RA for the corresponding receptors and exposure pathways.

Screening levels utilized in the COPC identification process include the following:

- Environmental Screening Levels (ESLs) from the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB, 2008) for soil, soil gas, and groundwater, and

- California Human Health Screening Levels (CHHSLs) from the CalEPA Office of Environmental Health Hazard Assessment (OEHHA; CalEPA, 2005 and 2009a) for soil and soil gas (not available for groundwater).

The RWQCB and OEHHA both provide receptor-specific (i.e., residential, commercial, etc.) screening values for soil and soil gas; COPCs for shallow soil and soil gas were therefore identified for each hypothetical receptor (residents, commercial workers, and construction workers). Although no complete exposure pathways were identified for deep soil, deep soil data were also compared to the corresponding ESLs and CHHSLs to ensure that chemicals detected in all media and at all depths were included in the screening evaluation. Although groundwater is not currently used as a drinking water source, soil ESLs for screening at sites where groundwater is a current or potential source of drinking water were conservatively used to identify COPCs in soil. Groundwater ESLs were used to identify COPCs for domestic use of groundwater (i.e., residential scenario). The RWQCB also provides receptor-specific groundwater ESLs to specifically address vapor intrusion concerns; these values were therefore used to identify groundwater COPCs (both onsite and offsite) for the residential and commercial vapor intrusion pathways. Regional Screening Levels (RSLs) from USEPA (2011a) were also used to identify receptor-specific soil COPCs where California-specific values were not available.

The identification of COPCs for the RA is presented in Tables 4 through 8.

Based on the comparison of maximum detected concentrations with the relevant screening levels, the following 12 chemicals were identified as COPCs for quantitative evaluation in the RA:

- **Soil.** Four VOCs (benzene, ethylbenzene, total xylenes, and 1,2 DCA), one SVOC (2-methylnaphthalene), one metal (lead), and TPH in the gasoline and

diesel ranges, as well as total oil and grease, were identified as shallow soil COPCs for residential and commercial receptors. Two TPH mixtures (TPHmo and TPHhy) and one SVOC (naphthalene) were also identified as residential COPCs in shallow soil. No soil COPCs were identified for the construction scenario.

The shallow soil COPC screening is presented in Table 4.

Of the 12 analytes identified as COPCs in shallow soil, only six (benzene, ethylbenzene, xylenes, 2-methylnaphthalene, TPHg, and TPHd) were detected in deep soil at concentrations above residential and commercial screening levels. As with shallow soil, no chemicals were detected in deep soil at concentrations above direct contact ESLs for the construction/trench worker scenario. This is the only scenario in which direct contact with deep soil may occur; the results of this screening evaluation therefore show that analyte concentrations in deep soil are below levels of concern for potential human health effects.

The toluene concentration in one deep soil sample was also above the deep soil ESLs for residential and commercial land use. These deep soil ESLs for toluene are based on groundwater protection; all other deep soil ESLs for toluene, including those for direct contact, are higher than the maximum detected concentration. Additionally, detected concentrations of toluene at all other deep soil sample locations are less than one-quarter of the groundwater protection-based ESLs, and shallow soil concentrations are also all below screening levels. Toluene was not detected in soil gas samples (Table 3) and is therefore not considered a concern for vapor intrusion. Toluene was also evaluated in groundwater, and detected concentrations were below all relevant screening levels (Tables 6 and 7). Therefore, and since there are no complete residential or commercial exposure pathways for deep soil, toluene was not evaluated as a COPC in the RA.

The deep soil screening results are presented in Table 5.

- **Groundwater.** One VOC (benzene) and TPH in the gasoline, diesel, and motor oil ranges were identified as COPCs for the domestic use of groundwater scenario (relevant for onsite groundwater only; Table 6). These were also conservatively retained as groundwater COPCs for the construction scenario based on the lack of construction-specific screening levels for groundwater. No onsite or offsite groundwater COPCs were identified for vapor intrusion concerns. Therefore, no COPCs were identified for offsite groundwater, for which only the vapor intrusion scenario is relevant.

  The COPC screening is presented in Tables 6 and 7 for onsite and offsite groundwater, respectively.

- **Soil Gas.** TPHg was the only COPC identified in soil gas. Other chemicals were either not detected in soil gas, or detected at concentrations below the relevant soil gas screening levels.

  The COPC screening for soil gas is presented in Table 8.

Based on the results of this conservative COPC screening evaluation, only the current/future onsite construction/utility worker receptor and the future onsite resident receptor were included in the quantitative risk evaluation, as described in Section 4.6.

4.2 TOXICITY EVALUATION

Potential toxic effects of chemicals are generally classified as carcinogenic (i.e., cancer-causing), or noncarcinogenic (i.e., noncancer health effects). These endpoints are separately quantified in RAs as cancer risks and noncancer health effects, respectively. Toxicity values numerically express the magnitude of potential toxic effects of chemicals. Reference doses (RfDs) and reference concentrations (RfCs) are used to quantify noncancer health effects, and cancer slope factors (SFs) and inhalation unit risks (IURs) are used to quantify cancer risks. Both cancer and noncancer endpoints may be evaluated for carcinogenic chemicals depending on the chemicals' toxic effects and availability of RfDs and/or RfCs.

Toxicity values for COPCs were obtained from the following sources, in the order provided below, for the RA:

- Toxicity Criteria Database (TCDB), an online database maintained by the OEHHA of CalEPA (CalEPA, 2011a) was used to obtain toxicity criteria as required for California sites. CalEPA cancer oral SFs and IURs, as well as noncancer chronic inhalation reference exposure levels (RELs), which are equivalent to USEPA inhalation RfCs, were obtained from this source where values have been published.

- Integrated Risk Information System (IRIS), an online database (USEPA, 2011b), was used to obtain SFs, IURs, RfDs, and RfCs not available through CalEPA (2011a). IRIS is updated monthly.

- Regional Screening Levels Tables, available online from USEPA (2011a), which contain toxicity values compiled from a variety of sources including federal and state agencies and are updated regularly, were used to obtain toxicity values not available through CalEPA (2011a) or IRIS (USEPA, 2011b).

- National Center for Environmental Assessment (NCEA) Provisional Peer-Reviewed Toxicity Values (PPRTVs), which are available upon request to the NCEA.

- Health Effects Assessment Summary Tables (HEAST; USEPA, 1997a) were consulted where values were not available from other sources.

Toxicity values are presented in Tables 9 and 10.

RfDs and RfCs are provided by USEPA for chronic and subchronic exposure, which correspond to 7 years or more, and less than 7 years exposure, respectively. Chronic RfDs (cRfDs) and RfCs (cRfCs) were used to evaluate residential receptors in the RA. Subchronic RfDs (sRfDs) and RfCs (sRfCs), where available, were used to evaluate construction worker receptors.

SFs and IURs correspond to lifetime exposure. CalEPA requires California SFs/IURs to be used where available. These are based on an independent review by OEHHA of the

toxicological literature, and are often more conservative (i.e., higher) than USEPA SFs and IURs. California SFs and IURs obtained from the TCDB (CalEPA, 2011a) were therefore used where available; USEPA SFs and IURs were used where CalEPA (2011a) values were not available.

4.3 EXPOSURE ASSUMPTIONS

Exposure assumptions are values used to quantify the assumed exposure to chemicals detected in soil, groundwater, and soil vapor for each receptor. Assumptions are either general and correspond to all the hypothetical receptors evaluated (e.g., averaging time), or receptor- and pathway-specific, such as body weight and exposure duration. Exposure assumptions were compiled for a conservative, reasonable maximum exposure (RME) scenario. The RME scenario is described by USEPA (1989) as the "highest exposure that can be reasonably anticipated to occur." Risk assessments are intended to be conservative to protect human health. RME scenarios are unlikely to occur in real life and describe only the smallest, most highly exposed portion of the population (i.e., 90^{th} to 95^{th} percentile and above). According to USEPA (1992), RME is not intended to be worst case, which would exceed upper percentile exposure. To this end, exposure assumptions should comprise both upper percentile and average values (USEPA, 1992). The exposure assumptions compiled for the receptors evaluated in the RA are considered adequately conservative to represent an RME evaluation, but not worst case. Parameters representing duration of exposure (i.e., exposure frequency and duration) are upper-bound. Pathway-specific media contact rates (e.g., water ingestion rates), reflect more of a "central tendency" or average scenario, but are recommended by USEPA (1997b) for use in RME scenarios.

Where applicable assumptions were not available in CalEPA guidance, RME values were obtained from USEPA sources, primarily the "Exposure Factors Handbook" (EFH; USEPA, 1997b), Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual (Part A; USEPA, 1989), RAGS Part B: Development of Risk-Based Preliminary Remediation Goals (USEPA, 1991a), and RAGS Part E: Supplemental Guidance for Dermal Risk Assessment (USEPA, 2004). Default exposure recommendations in the Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities ("Supplemental Guidance"; CalEPA, 1996) are based on standard USEPA (1991b) RME recommendations in the Standard Default Exposure Factors. CalEPA has not published updated exposure assumptions since 1996, although a number of recommendations in USEPA (1991b) have since been updated. As stated by CalEPA (1996), the Supplemental Guidance supplements USEPA guidance such as RAGS and the Standard Default Exposure Factors. Therefore, more recent USEPA sources, the EFH (USEPA, 1997b) and RAGS Part E (USEPA, 2004), were consulted for recently updated assumptions (e.g., dermal surface area). The EFH is a compilation of exposure assumptions that has been extensively revised on the basis of research conducted since the first version was published in 1990. It has been peer-reviewed, including by representatives of CalEPA, and represents final USEPA guidance.

The exposure assumptions used in the RA are provided in Table 11 along with supporting assumptions, methods, and literature sources.

4.4 CALCULATION OF EXPOSURE POINT CONCENTRATIONS (EPCS)

Chemical concentrations in the media to which receptors are assumed to be directly exposed at an assumed point of contact are referred to as exposure point concentrations (EPCs). For risk assessment purposes, USEPA (1989) recommends that EPCs be the lesser of the upper confidence level on the unknown mean (UCL) and maximum concentration. The UCL provides a conservative measure of the average concentration to which receptors are likely exposed as they move around a site over the assumed exposure duration. It was conservatively assumed that concentrations do not attenuate over time. Natural attenuation processes such as biodegradation and volatilization tend to decrease organic chemical concentrations in the subsurface over time.

USEPA's ProUCL software (version 4.1) was used to identify appropriate UCL concentrations for COPCs detected in at least five samples (USEPA, 2010a). This software analyzes the data distribution, and estimates and recommends mean and upper confidence limits (UCLs) on the mean using several approaches; the statistic that best fits the distribution is recommended by the software. One-half the detection limit for nondetected results was not used to calculate EPCs. Instead, the detection limit was directly used in the program, which now incorporates methods for assessing non-detect results in the statistical calculations. Output of the ProUCL statistical analysis is provided as Attachment A.

To be consistent with EPA guidance, the lesser of the maximum detected concentration and the UCL was used as the EPC for each COPC detected in at least five samples. The ProUCL *User's Guide* (EPA, 2010b) does not recommend selecting a UCL as the EPC for datasets with only a few detected values. Therefore, for chemicals with fewer than 5 detected values, the maximum concentration was selected as the EPC.

EPCs are summarized in Table 12.

Estimation of Concentrations of Chemicals in Indoor Air from Volatilization during Domestic Use. Volatile chemicals in groundwater may be inhaled by resident receptors during domestic use (i.e., showering). To estimate the benzene EPC for this exposure pathway, the groundwater EPC was multiplied by a volatilization factor of 0.5 liters per cubic meter (L/m^3), as recommended in the USEPA (1991a) RAGS (Part B) and shown in Table 12.

Estimation of Dermally Absorbed Dose from Groundwater. Chemicals in groundwater may be absorbed through the skin during domestic use (i.e., while showering) or during excavation work where shallow groundwater may be encountered. The dermally absorbed dose for benzene, the only non-complex mixture identified as a COPC in groundwater, was estimated for each potential receptor (child and adult residents, and construction workers) based on USEPA (2004; RAGS Part E). The methods provided in this guidance incorporate chemical-specific parameters such as permeability coefficients, lag times, and dermal absorption fractions, as well as site- and receptor-specific parameters such as event duration, to estimate the amount of chemical absorbed per exposure event in terms of milligrams of chemical per square centimeter of exposed skin. The EPCs provided in Table 12 were used to calculate the dermally absorbed dose per event for resident and construction worker receptors, as shown in Tables 13 and 14, respectively.

4.5 RISK ESTIMATION

Two steps were conducted to characterize risks: (1) dose estimation and (2) risk estimation. These steps are briefly described in the following sections.

4.5.1 Dose Estimation

To estimate exposure doses, exposure assumptions and EPCs were combined mathematically in dose equations specific to each exposure pathway. These equations are consistent with those provided in CalEPA and USEPA guidance (CalEPA, 1996; USEPA, 1989). The estimated dose is also referred to as the chronic daily intake (CDI) or subchronic daily intake (SDI). CDI and SDI correspond to exposures greater than 7 years or less than 7 years in duration, respectively (USEPA, 1989). CDIs were derived for resident receptors, and SDIs were derived for construction worker receptors, whose exposure duration is assumed to be less than 7 years.

Exposure doses were separately estimated for cancer effects (CDIc and SDIc) and noncancer effects (CDIn and SDIn), using the "averaging time" (AT) to differentiate the two endpoints. The averaging time is the time period over which the dose is averaged to yield a "daily intake" in units of milligrams of chemical per kilogram of body weight per day (mg/kg-day). For cancer effects, the carcinogenic averaging time (ATc) equals an assumed lifetime of 70 years. For noncancer effects, the noncarcinogenic averaging time (ATn) equals the receptor's exposure duration (Table 11).

The general equation to estimate an exposure dose is:

$$\text{Dose} = \frac{\text{EPC} * \text{ED} * \text{EF} * \text{IR}}{\text{BW} * \text{AT}}$$

Where:

Dose	=	CDI or SDI (mg/kg-day)
EPC	=	medium-specific exposure point concentration (i.e., soil, water)
ED	=	exposure duration (years)
EF	=	exposure frequency (days per year)
IR	=	intake rate (e.g. ingestion rate)
BW	=	body weight (kilograms)
AT	=	averaging time (days; ATn or ATc).

The exposure parameters used to estimate doses were described in Section 4.3 and compiled in Table 11. Pathway-specific dose equations are provided in the risk calculation tables (Tables 15 through 26).

4.5.2 Risk Estimation

Potential cancer and noncancer health effects were separately quantified in the RA as discussed in the following text.

Noncancer health effects were quantified to provide Hazard Quotients (HQs) and Hazard Indices (HIs) for each receptor. A HQ is a chemical-specific estimate of adverse noncancer health effects for a particular pathway and receptor. HQs are derived by comparing the noncancer exposure dose to the corresponding noncancer reference dose or reference concentration (i.e., ratio of dose to RfD or RfC). A HI is the sum of HQs for one pathway (across all COPCs) or the sum of HIs for all pathways (for a particular receptor). HQs and HIs were estimated as described below.

- HQ = CDIn /cRfD or SDIn/sRfD.
- An HQ was estimated for each COPC for a given pathway and receptor (e.g., ingestion of benzene in groundwater by a child resident receptor).
- HQs were summed across chemicals to provide a HI representing the total estimated noncancer hazard for each pathway (pathway-specific HI).
- Pathway-specific HIs were then summed across all pathways quantified for each receptor to provide a multipathway HI.
- The resulting HIs were compared to the agency-recommended target HI of one (1; CalEPA, 1996; USEPA, 1989). A HI less than or equal to 1 indicates that adverse noncancer health effects are not anticipated for the given receptor under the exposure conditions evaluated.

Cancer risks were estimated for each receptor as described below.

- Theoretical lifetime excess risk = CDIc * SF or SDIc * SF.
- A lifetime excess risk was estimated for each COPC for a given pathway and receptor (e.g., ingestion of benzene in groundwater by a child resident receptor).
- Chemical-specific risk estimates were summed to provide a pathway-specific total lifetime excess cancer risk (LECR) estimate for each pathway.
- Pathway-specific LECR estimates were then summed across all pathways quantified for each receptor to provide a multipathway total LECR estimate.
- Finally, child and adult risk estimates were added to provide a total resident receptor LECR estimate corresponding to a 30-year exposure duration (i.e., 6 years for the child plus 24 years for the adult). This same step was not performed for noncarcinogens because duration of exposure is not a variable in the equation (i.e., ATn is equal to ED, thus the terms cancel each other).

Cancer risks are termed “theoretical lifetime excess risks” to distinguish risk results from actual cancer cases such as those recorded for the general population by the Centers for Disease Control. Risk results are entirely theoretical and correspond to the hypothetical exposure scenarios evaluated in the RA. “Excess” means that risk results are additional to the “background” rate of cancer cases in the general population of about 40 percent (four in ten persons, according to the American Cancer Society).

USEPA characterizes theoretical LECRs below one in one million (10^{-6}) as not of concern and has stated that estimated risks between 10^{-6} and one in 10,000 (10^{-4}) are “safe and protective of public health” (Federal Register 56(20):3535, 1991). Remedial action is not generally required by USEPA for sites with a theoretical lifetime excess risk of less than 10^{-4} (USEPA, 1991c). CalEPA (1994) generally adopts the conservative target risk of 10^{-6}, the lower end of the USEPA target risk range, for residents. An excess cancer risk of one in 100,000 (10^{-5}) is frequently accepted by various agencies for occupational receptors. Moreover, the target risk for carcinogens evaluated under

State “Proposition 65” regulations is 10^{-5} (22 CCR 12703). However, consistent with CalEPA policy, a target cancer risk of 10^{-6} was utilized in the RA for all receptors.

Pathway-specific theoretical HIs and LECRs were calculated for the current/future construction/utility worker receptor in Tables 15 and 16, and for future onsite resident receptors in Tables 17 through 26.

4.5.3 Evaluation of Lead Exposure

Lead was identified as a COPC in shallow soil at the site. Standard toxicity values are not available for lead, and this metal is not typically evaluated using the standard risk assessment methods used to address other chemicals. Instead, lead is evaluated in relation to blood lead levels expected to result from exposure through various media (i.e., soil, water, air, and food). This evaluation is typically conducted through the use of models such as the USEPA’s Integrated Exposure Uptake Biokinetic (IEUBK) model and Adult Lead Model (ALM), as well as LeadSpread, which was developed by the CalEPA Department of Toxic Substances Control (DTSC; CalEPA, 2009b).

Evaluation of lead exposures is currently under internal CalEPA review, and the OEHHA has proposed revised CHHSLs for lead in the interim. The proposed CHHSLs were developed using the LeadSpread model; modeling was conducted to identify lead concentrations in soil that would lead to an incremental increase of up to 1 microgram per deciliter of blood (µg/dL) in people exposed to that soil (CalEPA, 2009a). The resulting values were 80 mg/kg for residential receptors, and 320 mg/kg for commercial receptors, as shown in Tables 4 and 5. Rather than conduct blood lead modeling based on lead concentrations in onsite soil, which would not provide useful information, lead was evaluated in this RA by comparing concentrations in soil to the proposed CHHSLs, as described below.

As shown in Table 1, lead was detected in all four shallow soil samples, and all five deep soil samples, collected from the former waste oil UST excavation area. Lead was also detected at the four deep soil sample locations within the former gasoline UST area that remained in place following the October 1990 remediation. The maximum concentration of lead detected in shallow soil was 590 mg/kg, which is almost an order of magnitude higher than the residential CHHSL of 80 mg/kg. This concentration was detected in a sample collected from location WO-5 on the west side of the former waste oil UST excavation, adjacent to the existing auto repair shop building, at a depth of 6 feet bgs (see Plate 3 of Fugro, 2009). The depth of this sample precludes direct contact under the current land use. Lead concentrations in the remaining shallow soil samples were much lower, ranging from 8 mg/kg to 19 mg/kg, and were all well below the residential CHSSL of 80 mg/kg (the more conservative of the revised CHHSL values). Lead concentrations in deep soil samples ranged from 11 mg/kg to 60 mg/kg in the former waste oil UST area, and from 4.93 mg/kg to 8.45 mg/kg in the former gasoline UST area, all of which were also below the proposed residential CHHSL value. Therefore, lead concentrations at locations other than WO-5 are not anticipated to result in an adverse blood lead level increase in children (i.e., up to 1 µg/dL). Based on comparison of the maximum lead concentration with those detected in other samples, a hot spot evaluation may be warranted. Since the maximum concentration was above the CHHSLs, a threshold concentration was identified for lead in soil, as described in Section 4.6.1.

4.6 RISK CHARACTERIZATION RESULTS

The RME risk characterization results are summarized below and in Table 27.

Hypothetical Current/Future Onsite Construction/Utility Worker Receptor:

- Theoretical HI: 0.04, which is below the target HI of 1. This indicates that adverse noncancer health effects are not anticipated for this receptor under the conservative exposure conditions evaluated.

- Theoretical LECR: $2x10^{-7}$, which is below both CalEPA's target risk of 10^{-6} and the lower end of USEPA's target risk range of 10^{-6} to 10^{-4}.

Hypothetical Future Onsite Child Resident Receptor:

- Theoretical HI: 8, which is above the target HI of 1. This HI estimate is primarily based on ingestion and inhalation (during domestic use) of benzene in groundwater, which was conservatively assumed to be used by future residents as a domestic water supply.

Hypothetical Future Onsite Adult Resident Receptor:

- Theoretical HI: 5, which is above the target HI of 1. Similar to the child resident receptor, this HI estimate is primarily based on ingestion and inhalation (during domestic use) of benzene in groundwater.

Total Theoretical LECR for Hypothetical Future Onsite Resident Receptor:

- The combined LECR for the adult and child future resident receptor is $2x10^{-3}$, which is above both the CalEPA target level of 10^{-6} and the upper end of USEPA's target risk range of 10^{-6} to 10^{-4}. This risk estimate is mainly due to inhalation (during domestic use) of benzene in groundwater, as well as ingestion and dermal contact, and results from the conservative assumption of future domestic use of groundwater in a residential setting.

4.6.1 Soil and Groundwater Threshold Concentrations

Estimated non-cancer hazards (HIs) and cancer risks (LECRs) were below the respective regulatory targets of 1 and 10^{-6} for the construction worker receptor. Additionally, estimated HIs and LECRs across all COPCs in soil were below the regulatory targets. No COPCs other than TPHg were identified in soil vapor. Since TPH indicator chemicals were either not detected or below screening levels in soil vapor, soil vapor data were not quantitatively evaluated in the RA.

For the hypothetical future resident receptor, HI and LECR estimates were above regulatory target levels due to the maximum detected concentration of benzene, the only COPC identified in groundwater. These estimates are based on the conservative assumption of domestic use of groundwater by hypothetical future residential receptors. Groundwater at the site and vicinity is very shallow (6 to 13 feet bgs), and water is currently provided to the City of Oakland from outside rivers and reservoirs by the EBMUD (EBMUD, 2011), making future domestic use of groundwater highly unlikely. Risk and hazard estimates for the most realistic groundwater exposure scenario, direct

contact by a construction/utility worker, were well below levels of concern. However, a groundwater threshold concentration for benzene was identified to provide a target concentration for any potential future remediation. The CalEPA maximum contaminant level (MCL) of 1 µg/L (CalEPA, 2011b) was identified as the groundwater threshold concentration for benzene. However, under current land use, benzene does not present a risk to human health since shallow groundwater is not used for domestic purposes.

HI and LECR estimates were not calculated for lead, as described in Section 4.5.3. The maximum detected concentration of lead in soil was, however, above the regulatory target values (CHHSLs of 80 mg/kg and 320 mg/kg for residential and commercial receptors, respectively). These values were therefore identified as residential and commercial land use-based threshold soil concentrations for any future corrective action activities.

Soil and groundwater threshold concentrations are summarized in Table 28.

4.6.2 Uncertainty Evaluation

Quantifying uncertainty is an essential element of the RA process. According to USEPA's Guidance on Risk Characterization for Risk Managers and Risk Assessors, the point estimates of risk that are generated in a deterministic RA such as that conducted herein "do not fully convey the range of information considered and used in developing the assessment" (USEPA, 1992). Feasible steps were taken to limit uncertainties in the RA. However, risk assessment is an inherently uncertain process due to its predictive nature and reliance on assumptions. In general, these uncertainties are driven by variability in:

- Chemical monitoring data and assumptions used in the statistical methods and calculations with which concentrations at receptor locations are estimated
- Receptor exposure assumptions
- The accuracy of toxicity values used to characterize risks and hazards.

Key uncertainties associated with each step of the HHRA are described below.

Data Collection and Evaluation. The techniques used for data sampling and analysis, and the methods used for identifying chemicals for evaluation in this assessment may result in a number of uncertainties. These uncertainties are itemized below in the form of assumptions:

- It was assumed that the nature and extent of chemical impacts at the site have been adequately characterized.
- It was assumed that sampling and analytical methods were based on agency-approved methods incorporating recommended quality assurance/control methods. Systematic or random errors in the chemical analyses may yield erroneous data.
- It was conservatively assumed in this RA that soil and soil vapor concentrations do not attenuate over time. Natural attenuation processes such as biodegradation and volatilization tend to decrease organic chemical

concentrations in the subsurface over time. This assumption may lead to an overestimate of risks and hazards, because the older data may not accurately represent current site conditions. Also, an infinite mass of material was assumed to be present in the subsurface. In reality, mass would likely be depleted before the end of the 30-year residential exposure period, further lowering exposure concentrations.

Overall, using upperbound estimates of the mean, or maximum detected concentrations, for the EPCs, compounded with the deterministic sampling strategy used at the site and other conservative assumptions regarding chemical concentrations, is likely to result in an overestimation of exposure and subsequent HIs and cancer risks.

Exposure Assessment. Key uncertainties associated with this component of the risk assessment are summarized below.

- Exposure Pathways. The exposure pathways quantified are expected to represent the primary drivers of exposure, based on the results of the chemical analyses and the expected fate and transport of these chemicals in the environment. Minor, secondary pathways may also exist but often cannot be identified or evaluated using the available data. The contribution of secondary pathways to the overall risk from the site is not likely to be significant.

- Exposure Assumptions. Exposure assumptions used in the risk assessment are reflective of trends (usually for the most sensitive individual within an entire population), and as such are subject to intrinsic variability. Their presence therefore introduces a level of uncertainty to the risk assessment. Assumptions used in the risk assessment were generally RME values obtained from CalEPA and USEPA guidance. Values used for resident exposure periods are very conservative. For example, it is highly unlikely that someone will, in the future, remain at one residence for 30 years and ingest all soil from the exact location of the highest lead concentration. According to USEPA (1997b), the median period people reside in one home is 9 years. Overall, the exposure assumptions used in the RA likely result in an overestimation of HIs and cancer risks for the pathways quantified.

- The assumption of future domestic use of groundwater is very conservative. Water is provided to the City of Oakland from outside sources, and shallow groundwater at depths up to only 13 feet bgs is unlikely to be used as a domestic water source in the future. The HI and LECR estimates that exceed regulatory targets are based on this assumption; estimates for the most realistic groundwater exposure pathways, which are based on direct contact by a construction/utility worker, are well below levels of concern.

- EPCs. Use of either upperbound estimates of the mean or maximum detected concentrations is adequately conservative. Moreover, receptors were assumed to be exposed to a single-point EPC for their entire exposure duration, since attenuation and degradation of soil and groundwater concentrations over time were not assumed to occur. These assumptions are associated with an overestimate of risks and hazards.

Toxicity Assessment. Toxicity information for many chemicals is often limited. Consequently, there are varying degrees of uncertainty associated with the toxicity values calculated by CalEPA and USEPA. Sources of uncertainty in the toxicity assessment include the following:

- BTEX compounds, MTBE, and PAHs were used as "indicator chemicals" for TPH, since quantitative risk assessment is not typically conducted for TPH mixtures. It was assumed that these chemicals adequately represent the most toxic components of the mixtures evaluated in the HHRA, and that the lack of elevated concentrations of the majority of these chemicals supports the conclusion that TPH mixtures in soil, groundwater, and soil gas do not pose a threat to human health.

Additional sources of uncertainty with respect to toxicity values include:

- Using dose-response information from effects observed at high doses in the laboratory to predict the adverse health effects that may occur following exposure to the low levels expected from human contact with the agent in the environment.

- Using dose-response information from short-term exposures in the laboratory to predict the effects of long-term exposures in the environment.

- Using dose-response information from animal studies to predict effects in humans.

- Using dose-response information from homogeneous animal or human populations to predict the effects likely to be observed in the general population consisting of individuals with a wide range of sensitivities.

Because "uncertainty factors" of 10 are typically used by USEPA and CalEPA for several of these variables, use of USEPA and CalEPA toxicity values likely results in an overestimation of hazard and risk.

Risk Characterization. A number of limitations are associated with the risk characterization approach for carcinogens and noncarcinogens. For instance, when estimating potential lifetime excess cancer risk, the cancer SF or IUR is often based on a 95^{th} UCL of the probability of a cancer response in the experimental subjects. It was further assumed that all cancer risks and noncancer hazards were additive regardless of the target organ or toxic mechanism of action.

Such factors likely result in an overestimation of the actual HIs and LECRs associated with subsurface residual chemical mass.

Summary of RA Uncertainties. The analysis of uncertainties and limitations associated with the risk assessment indicates that the data and exposure parameters used in the risk assessment likely overestimate actual hazards and risks to human health. Although, as outlined above, many factors can contribute to the potential for over- or under-

estimating risk, potential exposures were estimated using primarily conservative assumptions. Actual chemical exposures, if any, at the site and adjacent property are most likely less than those estimated herein.

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TABLES

Table 1
Soil Risk Assessment Dataset [a]
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Sample Location and Depth in Feet	Sample Date	Sample Depth (feet bgs)	Petroleum Hydrocarbons						Volatile Organic Compounds								Metals	Semi-Volatile Organic Compounds											
			TPH, Gasoline Range	TPH, Kerosene Range	TPH, Diesel Range	TPH, Motor Oil Range	TPH, Hydraulic Fluids	Total Oil Grease	Benzene	Toluene	Ethylbenzene	Xylenes	1,1,1-TCA	1,2-DCA	PCE	Chlorobenzene	Lead	2-Methylnaphthalene	Anthracene	Bis-2-ethylhexyl Phthalate	Butylbenzylphthalate	Di-N-Butyl Phthalate	Fluoranthene	Fluorene	Naphthalene	Nitrobenzene	N-Nitrosodiphenylamine	Phenanthrene	Pyrene
Shallow Soil			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Gasoline Tank and Dispenser Area																													
G12@ 10	10/5/90	10	**52**	--	**110**	<50	--	--	**110**	**45**	**480**	**140**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G13@ 10	10/8/90	10	**12**	--	<5	<50	--	--	**220**	**43**	**60**	**130**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G14@ 7.5	10/8/90	7.5	<2.5	--	<5	**100**	--	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G15@ 9.5	10/8/90	9.5	**310**	--	<5	<50	--	--	**820**	**59**	**1,300**	**1,600**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G17@ 6	10/10/90	6	**24.0**	--	<5	<50	--	--	**38**	**20**	**12**	**18**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G18@ 8	10/17/90	8	<2.5	--	<5	<50	--	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G19@ 10	10/17/90	10	<2.5	--	<5	<50	--	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G21@ 10	10/17/90	10	<2.5	--	<5	<50	--	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G22@ 10	10/17/90	10	<2.5	--	<5	**87**	--	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D2@ 4.5	10/8/90	4.5	<2.5	--	<5	<50	--	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D3@ 4.5	10/4/90	4.5	<2.5	--	<5	<50	--	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Waste Oil Tank Area																													
3@ 6	2/9/94	6	<1	<1	<1	**27**	--	<50	<5	<5	<5	<5	--	--	--	--	**8**	--	--	--	--	--	--	--	--	--	--	--	--
5@ 6	2/9/94	6	**240**	<1	**560**	**1,700**	--	**3,900**	**300**	**1,800**	**2,500**	**16,000**	<5	**36**	**29**	**16**	**590**	**2.7**	**0.13**	<0.05	<0.05	<0.05	**0.14**	**0.12**	**1.8**	**0.39**	<0.05	**0.45**	**0.26**
7@ 6	2/9/94	6	<1	<1	<1	<10	--	<50	<5	<5	<5	**31**	<5	<5	<5	<5	**19**	<0.05	<0.05	**0.32**	**0.93**	**1.7**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9@ 6	2/9/94	6	<1	<1	<1	<10	--	<50	<5	<5	<5	<5	--	--	--	--	**8.6**	--	--	--	--	--	--	--	--	--	--	--	--
Well Boring Samples																													
MW1 @10	3/2/94	10	**260**	<1	<1	<10	--	--	<20	<20	**970**	**770**	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
MW2 @10	3/1/94	10	<1	<1	<1	<10	--	--	<90	<90	<5	<5	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
MW3 @10	3/1/94	10	**620**	<1	**5.6**	<10	--	--	<90	<90	**840**	**2,700**	**7.4**	<5	**11**	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
MW4 @10	3/2/94	10	**1.9**	<1	**8.9**	**22**	--	--	<20	<20	<5	<5	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--
2009 Investigation																													
B-1@2	7/27/09	2.0	<0.98	--	**29**	**450**	--	--	<4.7	<4.7	<4.7	<9.4	--	<4.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-1@ 7.5	7/27/09	7.5	<0.97	--	**15**	**98**	--	--	<4.6	<4.6	<4.6	<9.2	--	<4.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-1@10	7/27/09	10	**170**	--	--	--	--	--	<500	**1,300**	**6,900**	**28,000**	--	<500	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-2@5	7/27/09	5.0	<0.97	--	<1.0	**5.9**	--	--	<5.0	<5.0	<5.0	<10	--	<5.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-2@7.5	7/27/09	7.5	<1.0	--	--	--	--	--	<4.7	<4.7	<4.7	<9.4	--	<4.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-2@10	7/27/09	10	<0.96	--	**1.9**	<5.0	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-3@1	7/27/09	1.0	--	--	<5.0	**33**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-3@5	7/27/09	5.0	--	--	**4.0**	**10**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-3@10	7/27/09	10	<1.0	--	**7.6**	<5.0	--	--	<4.9	<4.9	<4.9	<9.8	--	<4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-4a@5	7/27/09	5.0	--	--	**1.9**	**10**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-4a@7.5	7/27/09	7.5	--	--	**1**	**9.8**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-4a@10	7/27/09	10	--	--	**1.6**	**13**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-5@2	7/27/09	2.0	<0.96	--	**4.1**	**32**	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-5@7.5	7/27/09	7.5	<1.0	--	<1.0	**6.9**	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-6@2	7/27/09	2.0	<1.0	--	**55**	**460**	--	--	<4.9	<4.9	<4.9	<9.8	--	<4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-6@7.5	7/27/09	7.5	<0.99	--	<0.99	<5.0	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-7@5	7/27/09	5.0	<0.97	--	**10**	**53**	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-7@7.5	7/27/09	7.5	<1.0	--	**2.9**	**6.6**	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-8@7.5	7/27/09	7.5	**13**	--	**9.3**	<5.0	--	--	**28**	<26	**790**	**320**	--	<26	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-9@5	7/27/09	5.0	**1.9**	--	**28**	**46**	--	--	<4.9	<4.9	<4.9	<9.8	--	<4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-9@10	7/27/09	10	**56**	--	**44**	**49**	--	--	<250	<250	**3,300**	**9,900**	--	<250	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-10@2	7/27/09	2.0	<1.0	--	<1.0	<5.0	--	--	<4.9	<4.9	<4.9	<9.8	--	<4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-10@5	7/27/09	5.0	<1.0	--	**2.5**	**10**	--	--	<4.7	<4.7	<4.7	<9.4	--	<4.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-10@10	7/27/09	10	<0.97	--	**5.7**	**21**	--	--	<4.9	<4.9	<4.9	<9.8	--	<4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-11@2	7/27/09	2.0	<0.99	--	**42**	**440**	--	--	<5.0	<5.0	<5.0	<10	--	<5.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-11@7.5	7/27/09	7.5	<1.0	--	<0.99	<5.0	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-12@5	7/27/09	5.0	<1.0	--	<1.0	<5.0	--	--	<4.9	<4.9	<4.9	<9.8	--	<4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-12@7.5	7/27/09	7.5	<1.0	--	**9.1**	**88**	--	--	<5.0	<5.0	<5.0	<10	--	<5.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-13@8	10/19/09	8.0	<0.99	--	**73**	**300**	**390**	--	<5.0	<5.0	<5.0	<10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Deep Soil																													
Gasoline Tank and Dispenser Area																													
G6@ 15	8/29/90	15	**8.3**	--	--	--	--	--	**320**	**6.3**	**170**	**220**	--	--	--	--	**4.93**	--	--	--	--	--	--	--	--	--	--	--	--
G7@ 11	8/29/90	11	**6.3**	--	--	--	--	--	**270**	**34**	<5.0	**160**	--	--	--	--	**8.45**	--	--	--	--	--	--	--	--	--	--	--	--
G8@16	8/29/90	16	<2.5	--	--	--	--	--	**19**	**5.6**	<5.0	<5.0	--	--	--	--	**6.65**	--	--	--	--	--	--	--	--	--	--	--	--
G10@ 16	8/29/90	16	**260**	--	--	--	--	--	**1,600**	**670**	**1,300**	**460**	--	--	--	--	**8.36**	--	--	--	--	--	--	--	--	--	--	--	--
G10@ 17	10/10/90	17	<2.5	--	<5	<50	--	--	**73**	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G16@11	10/8/90	11	**19**	--	<5	<50	--	--	**200**	**41**	**210**	**46**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
G20@ 17	10/17/90	17	<2.5	--	<5	<50	--	--	<5	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Waste Oil Tank Area																													
4@ 11	2/9/94	11	<1	<1	<1	**20**	--	**80**	<5	<5	<5	<5	--	--	--	--	**11**	--	--	--	--	--	--	--	--	--	--	--	--
6@ 11	2/9/94	11	**31**	<1	**250**	**640**	--	**1,700**	**580**	**670**	**550**	**2,700**	<5	<5	**8.0**	**8.4**	**45**	**3.7**	**0.18**	<0.05	<0.05	**1.6**	**0.15**	**0.14**	**2.5**	<0.05	**0.21**	**0.39**	**0.27**
8@ 11.5	2/9/94	11.5	**100**	<1	**680**	**1,100**	--	**2,700**	**360**	**300**	**1,300**	**6,700**	--	--	--	--	**21**	--	--	--	--	--	--	--	--	--	--	--	--
10@ 11.5	2/9/94	11.5	**6.5**	<1	**210**	**360**	--	**470**	**100**	**7.3**	**100**	**160**	--	--	--	--	**14**	--	--	--	--	--	--	--	--	--	--	--	--
11@ 13	2/9/94	13	**15**	<1	**210**	**450**	--	**780**	**430**	**45**	**350**	**960**	<5	<5	<5	**7.6**	**60**	**0.39**	<0.05	<0.05	<0.05	**2**	**0.05**	**0.08**	**0.34**	<0.05	<0.05	**0.2**	**0.1**

Table 1
Soil Risk Assessment Dataset [a]
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Sample Location and Depth in Feet	Sample Date	Sample Depth (feet bgs)	Petroleum Hydrocarbons						Volatile Organic Compounds								Metals	Semi-Volatile Organic Compounds											
			TPH, Gasoline Range	TPH, Kerosene Range	TPH, Diesel Range	TPH, Motor Oil Range	TPH, Hydraulic Fluids	Total Oil Grease	Benzene	Toluene	Ethylbenzene	Xylenes	1,1,1-TCA	1,2-DCA	PCE	Chlorobenzene	Lead	2-Methylnaphthalene	Anthracene	Bis-2-ethylhexyl Phthalate	Butylbenzylphthalate	Di-N-Butyl Phthalate	Fluoranthene	Fluorene	Naphthalene	Nitrobenzene	N-Nitrosodiphenylamine	Phenanthrene	Pyrene
2009 Investigation																													
B-1@12	7/27/09	12	**320**	--	**57**	<5.0	--	--	<830	**4,000**	**12,000**	**53,000**	--	<830	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-1@15	7/27/09	15	**1.1**	--	--	--	--	--	**10**	<4.9	**22**	**65**	--	<4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-1@17	7/27/09	17	**2**	--	--	--	--	--	**34**	<4.7	**23**	<9.4	--	<4.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-1@20	7/27/09	20	<1.0	--	--	--	--	--	<4.6	<4.6	<4.6	<9.2	--	<4.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-2@12	7/27/09	12	<1.0	--	--	--	--	--	<4.7	<4.7	<4.7	<9.4	--	<4.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-2@15	7/27/09	15	**16**	--	**17**	<5.0	--	--	<46	<46	<46	<92	--	<46	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-2@17	7/27/09	17	**33**	--	--	--	--	--	<50	<50	<50	<100	--	<50	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-2@19.5	7/27/09	19.5	<0.99	--	--	--	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-3@12	7/27/09	12	<0.98	--	**33**	**110**	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-3@15	7/27/09	15	**8.7**	--	**150**	**400**	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-3@17	7/27/09	17	--	--	**44**	**140**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-4a@12	7/27/09	12	**4.5**	--	**1100**	**850**	--	--	<47	<47	<47	<94	--	<47	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-4a@15	7/27/09	15	<0.99	--	**310**	**120**	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-4a@18	7/27/09	18	--	--	**42**	**23**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-5@12	7/27/09	12	**8.8**	--	**1100**	**520**	--	--	<5.0	<5.0	<5.0	<10	--	<5.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-5@15	7/27/09	15	<0.96	--	**2.8**	<5.0	--	--	<4.9	<4.9	<4.9	<9.8	--	<4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-6@12	7/27/09	12	<0.96	--	**29**	**39**	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-6@15	7/27/09	15	**11**	--	**17**	<5.0	--	--	**39**	<25	**80**	<50	--	<25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-7@12	7/27/09	12	<1.0	--	**1.6**	<5.0	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-7@15	7/27/09	15	<0.97	--	<1.0	<5.0	--	--	<4.9	<4.9	<4.9	<9.8	--	<4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-8@15	7/27/09	15	**8**	--	**1.3**	<5.0	--	--	**500**	**140**	**250**	**770**	--	<19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-8@20	7/27/09	20	<0.98	--	<1.0	<5.0	--	--	**140**	<4.8	**37**	**9.7**	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-9@15	7/27/09	15	**140**	--	**31**	**19**	--	--	<250	<250	**2,800**	**8,600**	--	<250	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-9@20	7/27/09	20	<1.0	--	<0.99	<5.0	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-10@15	7/27/09	15	<1.0	--	**1.7**	<5.0	--	--	<4.7	<4.7	<4.7	<9.4	--	<4.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-11@12	7/27/09	12	<1.0	--	**1.4**	**13**	--	--	<4.9	<4.9	<4.9	<9.8	--	<4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-12@12	7/27/09	12	**7.8**	--	**590**	**270**	--	--	<250	<250	<250	<500	--	<250	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-12@15	7/27/09	15	<0.97	--	<1.0	<5.0	--	--	<4.8	<4.8	<4.8	<9.6	--	<4.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Shallow Soil Data Summary																													
Minimum			1.9	NA	1.0	5.9	390	3,900	28	20	12	18	7.4	36	11	16	8.0	2.7	0.13	0.32	0.93	1.7	0.14	0.12	1.8	0.39	NA	0.45	0.26
Maximum			620	NA	560	1,700	390	3,900	820	1,800	6,900	28,000	7.4	36	29	16	590	2.7	0.13	0.32	0.93	1.7	0.14	0.12	1.8	0.39	NA	0.45	0.26
Number Detected			12	0	24	25	1	1	6	6	10	11	1	1	2	1	4	1	1	1	1	1	1	1	1	1	0	1	1
Number Analyzed			43	8	46	46	1	4	43	43	43	43	6	29	6	6	4	2	2	2	2	2	2	2	2	2	2	2	2
Frequency of Detection			28%	0%	52%	54%	100%	25%	14%	14%	23%	26%	17%	3%	33%	17%	100%	50%	50%	50%	50%	50%	50%	50%	50%	50%	0%	50%	50%
Average [b]			41	NA	23	94	NA	NA	48	84	401	1,389	NA	NA	8.3	NA	156	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Standard Deviation [b]			116	NA	84	268	NA	NA	139	333	1,215	5,037	NA	NA	10.7	NA	289	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Deep Soil Data Summary																													
Minimum			1.1	NA	1.3	13	--	80	10	5.6	22	10	NA	NA	8.0	7.6	4.93	0.39	0.18	NA	NA	1.6	0.050	0.080	0.34	NA	0.21	0.20	0.10
Maximum			320	NA	1,100	1,100	--	2,700	1,600	4,000	12,000	53,000	NA	NA	8.0	8.4	60	3.7	0.18	NA	NA	2.0	0.15	0.14	2.5	NA	0.21	0.39	0.27
Number Detected			20	0	22	16	--	5	15	11	14	13	0	0	1	2	9	2	1	0	0	2	2	2	2	0	1	2	2
Number Analyzed			38	5	30	30	--	5	38	38	38	38	2	28	2	2	9	2	2	2	2	2	2	2	2	2	2	2	2
Frequency of Detection			53%	0%	73%	53%	--	100%	39%	29%	37%	34%	0%	0%	50%	100%	100%	100%	50%	0%	0%	100%	100%	100%	100%	0%	50%	100%	100%
Average [b]			27	NA	163	173	--	1,146	143	166	512	1,957	NA	NA	NA	8.0	20	2.0	NA	NA	NA	1.8	0.10	0.11	1.4	NA	NA	0.30	0.19
Standard Deviation [b]			69	NA	306	284	--	1,055	291	658	1,986	8,686	NA	NA	NA	0.57	19	2.3	NA	NA	NA	0.28	0.071	0.042	1.5	NA	NA	0.13	0.12

Abbreviations:
NA = not applicable
-- = chemical not analyzed
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
bgs = below ground surface
TCA = trichloroethane
DCA = dichloroethane
PCE = tetrachloroethene
TPH = total petroleum hydrocarbons
<# = Chemical not detected above laboratory detection limit shown

Footnotes:
[a] Only analytes detected in at least one sample are shown.
[b] For nondetected results, one-half of the laboratory detection limit was used to calculate average and standard deviation concentrations.

Table 2

Groundwater Risk Assessment Dataset [a]
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

			Petroleum Hydrocarbons			Volatile Organic Compounds						
Well	**Date**	**Groundwater Elevation (Feet > MSL)**	**TVH as Gasoline µg/L**	**TEH as Diesel µg/L**	**TEH as Motor Oil µg/L**	**Benzene µg/L**	**Toluene µg/L**	**Ethylbenzene µg/L**	**Total Xylenes µg/L**	**MTBE µg/L**	**TBA µg/L**	**1,2-DCA µg/L**
Onsite Wells												
MW-1	07/30/09	9.45	**160**	<50	<300	<0.5	<0.5	<0.5	<1.0	<0.5	<10	<0.5
	09/08/09	8.78	**56**	--	--	<0.5	<0.5	<0.5	**0.56**	<2.0	--	--
	03/24/10	10.40	**82**	**53**	<300	<0.5	<0.5	<0.5	<1.0	<0.5	<10	<0.5
	10/06/10	9.57	**68**	**64**	<300	<0.5	<0.5	<0.5	<1.0	<0.5	<10	<0.5
MW-2	02/05/08	9.64	<50	<50	<300	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5
	08/14/08	10.93	<50	<50	<300	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5
	03/03/09	7.72	<50	<50	<300	<0.5	<0.5	<0.5	<1.0	<0.5	<10	<0.5
	07/30/09	8.62	<50	<50	<300	<0.5	<0.5	<0.5	<1.0	<0.5	<10	<0.5
MW-3	09/08/09	8.37	**1,200**	--	--	**280**	**2.4**	**9.2**	**3.08**	<2.0	--	--
	03/24/10	10.10	**300**	**130**	<300	**64**	**2.5**	**0.78**	**3.3**	<0.5	<10	<0.5
	10/06/10	8.46	**450**	**76**	<300	**89**	**3.7**	**4.6**	**5.2**	<0.5	<10	<0.5
	05/07/11	9.63	**600**	**130**	<300	**300**	**12**	**5.2**	**11.81**	<0.5	**12**	<0.5
MW-4	09/08/09	7.77	**580**	--	--	<0.5	<0.5	<0.5	**7.5**	**2.4**	--	--
	03/24/10	9.93	**510**	**670**	**980**	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<0.5
	10/06/10	8.50	**560**	**130**	<300	<0.5	<0.5	<0.5	<1.0	<0.5	<10	<0.5
	05/07/11	8.95	**260**	**1,200**	**1,500**	<0.5	<0.5	<0.5	<1.0	<0.5	<10	<0.5
Offsite Wells												
MW-5	08/14/08	7.71	<50	<50	<300	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5
	03/02/09	9.82	<50	<50	<300	<0.5	<0.5	<0.5	<1.0	<0.5	<10	<0.5
	07/30/09	7.89	<50	<50	<300	<0.5	<0.5	<0.5	<1.0	<0.5	<10	<0.5
	10/05/10	7.84	<50	<50	<300	<0.5	<0.5	<0.5	<1.0	<0.5	<10	<0.5
MW-6	02/05/08	9.09	**1,400**	**560**	<300	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5
	08/14/08	7.65	**1,100**	**390**	<300	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5
	03/03/09	9.76	**990**	**230**	<300	<0.5	<0.5	<0.5	<1.0	<0.5	<10	<0.5
	10/05/10	7.74	**910**	**420**	<300	<0.5	<0.5	<0.5	<1.0	<0.5	**14**	<0.5
MW-7	05/07/11	9.25	<50	<50	<300	<0.5	**2.4**	<0.5	<1.0	<0.5	<10	<0.5
MW-8	08/04/11	9.25	**1,700**	**260**	<300	**1.8**	**9.4**	**57**	**17.1**	<0.5	<10	**3.0**

Table 2

Groundwater Risk Assessment Dataset [a]
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

			Petroleum Hydrocarbons			Volatile Organic Compounds						
Well	**Date**	**Groundwater Elevation (Feet > MSL)**	**TVH as Gasoline µg/L**	**TEH as Diesel µg/L**	**TEH as Motor Oil µg/L**	**Benzene µg/L**	**Toluene µg/L**	**Ethylbenzene µg/L**	**Total Xylenes µg/L**	**MTBE µg/L**	**TBA µg/L**	**1,2-DCA µg/L**
Onsite Data Summary												
Minimum			56	53	980	64	2.4	0.78	0.56	2.4	12	NA
Maximum			1,200	1,200	1,500	300	12	9.2	12	2.4	12	NA
Number Detected			12	8	2	4	4	4	6	1	1	0
Number Analyzed			16	13	13	16	16	16	16	16	13	13
Frequency of Detection			75%	62%	15%	25%	25%	25%	38%	6%	8%	0%
Average [b]			308	198	318	46	1.5	1.4	2.2	NA	NA	NA
Standard Deviation [b]			326	347	423	99	3.0	2.6	3.3	NA	NA	NA
Offsite Data Summary												
Minimum			910	230	NA	1.8	2.4	57	17.1	NA	14	3.0
Maximum			1700	560	NA	1.8	9.4	57	17.1	NA	14	3.0
Number Detected			5	5	0	1	2	1	1	0	1	1
Number Analyzed			10	10	10	10	10	10	10	10	10	10
Frequency of Detection			50%	50%	0%	10%	20%	10%	10%	0%	10%	10%
Average [b]			623	199	NA	NA	1.4	NA	NA	NA	NA	NA
Standard Deviation [b]			666	203	NA	NA	2.9	NA	NA	NA	NA	NA

Abbreviations:
TVH = Total Volatile Hydrocarbons
TEH = Total Extractable Hydrocarbons
µg/L = micrograms per liter
MTBE = methyl tert-butyl ether
TBA = tert-butyl alcohol
DCA = dichloroethane
NA = not applicable
-- = chemical not analyzed
> MSL = above mean sea level
<# = Chemical not detected above laboratory detection limit shown

Footnotes:
[a] Only analytes detected in at least one sample are shown.
[b] For nondetected results, one-half of the laboratory detection limit was used to calculate average and standard deviation concentrations.

Table 3
Soil Gas Risk Assessment Dataset
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Sample ID	Purge Volume	Date	Petroleum Hydrocarbons		Volatile Organic Compounds					
			TPHg	TPHd	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	MTBE
			µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
SG-1	1.0	7/31/09	<10,000	<50,000	<80	<200	<100	**300**	**130**	<10
SG-2	1.0	7/31/09	<10,000	<50,000	<80	<200	<100	<200	<100	<10
SG-3	1.0	7/31/09	<10,000	<50,000	<80	<200	<100	<200	<100	<10
SG-4	1.0	7/31/09	<10,000	<50,000	<80	<200	<100	<200	<100	<10
SG-5	1.0	7/31/09	<10,000	<50,000	<80	<200	<100	**320**	**140**	<10
SG-6	1.0	7/31/09	<10,000	<50,000	<80	<200	<100	**250**	**120**	<10
SG-7	1.0	7/31/09	**36,000**	<50,000	<80	<200	<100	**260**	**100**	<10
Data Summary										
Minimum			36,000	--	--	--	--	250	100	--
Maximum			36,000	--	--	--	--	320	140	--
Number Detected			1	--	--	--	--	4	4	--
Number Analyzed			7	--	--	--	--	7	7	--
Frequency of Detection			14%	--	--	--	--	57%	57%	--
Average [a]			NA	--	--	--	--	204	91	--
Standard Deviation [a]			NA	--	--	--	--	100	41	--

Abbreviations:
NA = not applicable
-- = analyte not detected
µg/m^3 = micrograms per cubic meter
TPH = total petroleum hydrocarbons
MTBE = methyl tert-butyl ether
<# = Chemical not detected above laboratory detection limit shown

Footnotes:
[a] For nondetected results, one-half of the laboratory detection limit was used to calculate average and standard deviation concentrations.

Table 4
Identification of Chemicals of Potential Concern (COPCs) in Shallow Soil
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Analyte [a]	Maximum Detected Concentration	ESLs			CHHSLs [d]		RSLs [e]	
		Residential [b]	Commercial [b]	Construction [c]	Residential	Commercial	Residential	Commercial
VOCs (µg/kg)								
Benzene	820	**44**	**44**	12,000	NA	NA	--	--
Toluene	1,800	2,900	2,900	650,000	NA	NA	--	--
Ethylbenzene	6,900	**2,300**	**3,300**	210,000	NA	NA	--	--
Xylenes	28,000	**2,300**	**2,300**	420,000	NA	NA	--	--
1,1,1-TCA	7.4	7,800	7,800	1,200,000	NA	NA	--	--
1,2-DCA	36	**4.5**	**4.5**	21,000	NA	NA	--	--
PCE	29	370	700	30,000	NA	NA	--	--
Chlorobenzene	16	1,500	1,500	680,000	NA	NA	--	--
SVOCs (mg/kg)								
2-Methylnaphthalene	2.7	**0.25**	**0.25**	1,400	NA	NA	--	--
Anthracene	0.13	2.8	2.8	100,000	NA	NA	--	--
Bis-2-ethylhexyl Phthalate	0.32	35	120	1,400	NA	NA	--	--
Butylbenzylphthalate	0.93	NA	NA	NA	NA	NA	260	910
Di-N-Butyl Phthalate	1.7	NA	NA	NA	NA	NA	6,100	62,000
Fluoranthene	0.14	40	40	14,000	NA	NA	--	--
Fluorene	0.12	8.9	8.9	12,000	NA	NA	--	--
Naphthalene	1.8	**1.3**	2.8	130	NA	NA	--	--
Nitrobenzene	0.39	NA	NA	NA	NA	NA	4.8	24
Phenanthrene	0.45	11	11	11,000	NA	NA	--	--
Pyrene	0.26	85	85	21,000	NA	NA	--	--
Metals (mg/kg)								
Lead	590	**200**	750	750	**80**	**320**	**150** [f]	800 [f]
Petroleum Hydrocarbons (mg/kg)								
TPH, Gasoline Range	620	**83**	**83**	4,200	NA	NA	--	--
TPH, Diesel Range	560	**83**	**83**	4,200	NA	NA	--	--
TPH, Motor Oil Range	1,700	**370**	2,500	12,000	NA	NA	--	--
TPH, Hydraulic Fluids	390	**370**	2,500	12,000	NA	NA	--	--
Total Oil Grease	3,900	**370**	**2,500**	12,000	NA	NA	--	--

Abbreviations:
NA = not available
-- = not applicable
ESL = environmental screening level
CHHSL = California human health screening level
RSL = regional screening level
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
TCA = trichloroethane
DCA = dichloroethane
PCE = tetrachloroethene
TPH = total petroleum hydrocarbons

Footnotes:

[a] Analytes identified as COPCs for any receptor are shown in bold font. Receptor-specific COPCs are identified by screening levels shown in bold font.

[b] Environmental screening levels (ESLs) from RWQCB (2008), Table A (Shallow Soils, Groundwater is Current or Potential Source of Drinking Water).

[c] ESLs from RWQCB (2008), Table K-3 (Direct Exposure Soil Screening Levels, Construction/Trench Worker Exposure Scenario).
Analytes with no construction-based screening levels available were not considered COPCs for the construction worker if concentrations were below other available screening levels.

[d] California Human Health Screening Levels (CHHSLs) from CalEPA (2005 and 2009a), Table 5 (from CalEPA, 2005; Soil-Screening Numbers [mg/kg soil] for Nonvolatile Chemicals Based on Total Exposure to Contaminated Soil: Inhalation, Ingestion and Dermal Absorption).

[e] Regional Screening Levels (RSLs) for Residential and Industrial Soil from USEPA (2011a). RSLs were only used if no ESL or CHHSL was available.

[f] The Human and Ecological Risk Division (HERD) of CalEPA's Department of Toxic Substances Control (DTSC) recommends using the 2004 USEPA residential soil Cal-modified Preliminary Remediation Goal (PRG) to evaluate residential exposures, and the 2004 USEPA industrial soil PRG for evaluation of lead exposures to evaluate industrial and adult exposures, pending completion of their internal review (CalEPA, 2009b). These values are therefore provided in this table for comparison purposes (PRGs are now RSLs).

References:

California Environmental Protection Agency (CalEPA). 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil. Office of Environmental Health Hazard Assessment (OEHHA). November 2004. January 2005 Revision.

CalEPA. 2009a. Revised California Human Health Screening Level for Lead (Review Draft). OEHHA. May 14.

CalEPA. 2009b. LeadSpread 7. BLOODPB7 1_09.xls. Excel-based model and User Guide. Department of Toxic Substances Control. January. Available at: http://www.dtsc.ca.gov/AssessingRisk/leadspread.cfm

California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region. 2008. Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater. Interim Final. November 2007 (Revised May 2008).

United States Environmental Protection Agency (USEPA). 2011a. Regional Screening Levels Table. June. Available at: http://www.epa.gov/region09/superfund/prg/

Table 5
Deep Soil Data Comparison with Screening Levels
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Analyte [a]	Maximum Detected Concentration	ESLs			CHHSLs [d]		RSLs [e]	
		Residential [b]	Commercial [b]	Construction [c]	Residential	Commercial	Residential	Commercial
VOCs (µg/kg)								
Benzene	1,600	**44**	**44**	12,000	NA	NA	--	--
Toluene	4,000	**2,900**	**2,900**	650,000	NA	NA	--	--
Ethylbenzene	12,000	**3,300**	**3,300**	210,000	NA	NA	--	--
Xylenes	53,000	**2,300**	**2,300**	420,000	NA	NA	--	--
PCE	8.0	700	700	30,000	NA	NA	--	--
Chlorobenzene	8.4	1,500	1,500	680,000	NA	NA	--	--
SVOCs (mg/kg)								
2-Methylnaphthalene	3.7	**0.25**	**0.25**	1,400	NA	NA	--	--
Anthracene	0.18	2.8	2.8	100,000	NA	NA	--	--
Di-N-Butyl Phthalate	2.0	NA	NA	NA	NA	NA	6,100	62,000
Fluoranthene	0.15	60	60	14,000	NA	NA	--	--
Fluorene	0.14	8.9	8.9	12,000	NA	NA	--	--
Naphthalene	2.5	3.4	3.4	130	NA	NA	--	--
n-Nitrosodiphenylamine	0.21	NA	NA	NA	NA	NA	99	350
Phenanthrene	0.39	11	11	11,000	NA	NA	--	--
Pyrene	0.27	85	85	21,000	NA	NA	--	--
Metals (mg/kg)								
Lead	60	750	750	750	80	320	150 [f]	800 [f]
Petroleum Hydrocarbons (mg/kg)								
TPH, Gasoline Range	320	**83**	**83**	4,200	NA	NA	--	--
TPH, Diesel Range	1,100	**83**	**83**	4,200	NA	NA	--	--
TPH, Motor Oil Range	1,100	5,000	5,000	12,000	NA	NA	--	--
Total Oil Grease	2,700	5,000	5,000	12,000	NA	NA	--	--

Abbreviations:
NA = not available
-- = not applicable
ESL = environmental screening level
CHHSL = California human health screening level
RSL = regional screening level
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
TCA = trichloroethane
DCA = dichloroethane
PCE = tetrachloroethene
TPH = total petroleum hydrocarbons

Footnotes:

[a] Analytes with concentrations above screening levels for any receptor are shown in bold font. Receptor-specific exceedances are identified by screening levels shown in bold font.

[b] Environmental screening levels (ESLs) from RWQCB (2008), Table C (Deep Soils, Groundwater is Current or Potential Source of Drinking Water).

[c] ESLs from RWQCB (2008), Table K-3 (Direct Exposure Soil Screening Levels, Construction/Trench Worker Exposure Scenario).

[d] California Human Health Screening Levels (CHHSLs) from CalEPA (2005 and 2009a), Table 5 (from CalEPA, 2005; Soil-Screening Numbers [mg/kg soil] for Nonvolatile Chemicals Based on Total Exposure to Contaminated Soil: Inhalation, Ingestion and Dermal Absorption).

[e] Regional Screening Levels (RSLs) for Residential and Industrial Soil from USEPA (2011a). RSLs were only used if no ESL or CHHSL was available.

[f] The Human and Ecological Risk Division (HERD) of CalEPA's Department of Toxic Substances Control (DTSC) recommends using the 2004 USEPA residential soil Cal-modified Preliminary Remediation Goal (PRG) to evaluate residential exposures, and the 2004 USEPA industrial soil PRG for evaluation of lead exposures to evaluate industrial and adult exposures, pending completion of their internal review (CalEPA, 2009b). These values are therefore provided in this table for comparison purposes (PRGs are now RSLs).

References:

California Environmental Protection Agency (CalEPA). 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil. Office of Environmental Health Hazard Assessment (OEHHA). November 2004. January 2005 Revision.

CalEPA. 2009a. Revised California Human Health Screening Level for Lead (Review Draft). OEHHA. May 14.

CalEPA. 2009b. LeadSpread 7. BLOODPB7 1_09.xls. Excel-based model and User Guide. Department of Toxic Substances Control. January. Available at: http://www.dtsc.ca.gov/AssessingRisk/leadspread.cfm

California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region. 2008. Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater. Interim Final. November 2007 (Revised May 2008).

United States Environmental Protection Agency (USEPA). 2011a. Regional Screening Levels Table. June. Available at: http://www.epa.gov/region09/superfund/prg/

Table 6
Identification of Chemicals of Potential Concern (COPCs) in Onsite Groundwater
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Analyte [a]	Maximum Detected Concentration [b] (µg/L)	ESLs (µg/L)		
		Groundwater [c]	Vapor Intrusion [d]	
			Residential	Commercial
VOCs				
Benzene	300	**1**	540	1,800
Toluene	12	40	380,000	530,000
Ethylbenzene	9.2	30	170,000	170,000
Xylenes	11.81	20	160,000	160,000
MtBE	2.4	5	24,000	80,000
TBA	12	12	Use soil gas [e]	Use soil gas [e]
Petroleum Hydrocarbons				
TPH, Gasoline Range	1,200	**100**	Use soil gas [e]	Use soil gas [e]
TPH, Diesel Range	1,200	**100**	Use soil gas [e]	Use soil gas [e]
TPH, Motor Oil Range	1,500	**100**	NA	NA

Abbreviations:
NA = not available
ESL = environmental screening level
µg/L = micrograms per liter
VOCs = volatile organic compounds
TBA = tert-butyl alcohol
MtBE = methyl tert-butyl ether
TPH = total petroleum hydrocarbons

Footnotes:
[a] Analytes identified as COPCs for any receptor and pathway are shown in bold font. Receptor- and pathway-specific COPCs are identified by screening levels shown in bold font.
[b] Maximum concentration detected in onsite monitoring wells (MW-1 through MW-4) in the last four monitoring events at each well.
[c] Environmental screening levels (ESLs) from RWQCB (2008), Table F-1a (Groundwater Screening Levels, groundwater is a current or potential drinking water resource). No construction-based screening levels are available for groundwater; the overall groundwater screening levels were therefore conservatively used to identify COPCs for the construction worker receptor.
[d] ESLs from RWQCB (2008), Table E-1 (Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns [volatile chemicals only]).
[e] Use of soil gas data is recommended by the RWQCB (2008) to evaluate potential vapor intrusion concerns for these analytes; therefore, other potential groundwater screening level sources were not consulted for these analytes.

References:
California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region. 2008. Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater. Interim Final. November 2007 (Revised May 2008).

Table 7
Identification of Chemicals of Potential Concern (COPCs) in Offsite Groundwater
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Analyte [a]	Maximum Detected Concentration [b] (µg/L)	ESLs [c] (µg/L)
VOCs		
Benzene	1.8	540
Toluene	9.4	380,000
Ethylbenzene	57	170,000
Xylenes	17.1	160,000
TBA	14	Use soil gas [d]
1,2-DCA	3	200
Petroleum Hydrocarbons		
TPH, Gasoline Range	1,700	Use soil gas [d]
TPH, Diesel Range	560	Use soil gas [d]
TPH, Motor Oil Range	NA	NA

Abbreviations:
NA = not available
ESL = environmental screening level
µg/L = micrograms per liter
VOCs = volatile organic compounds
TBA = tert-butyl alcohol
DCA = dichloroethane
TPH = total petroleum hydrocarbons

Footnotes:
[a] Analytes identified as COPCs and corresponding screening levels are shown in bold font.
[b] Maximum concentration detected in offsite monitoring wells (MW-5 through MW-8) in the last four monitoring events (as available) at each well.
[c] Environmental screening levels (ESLs) from RWQCB (2008), Table E-1 (Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns [volatile chemicals only]).
[d] Use of soil gas data is recommended by the RWQCB (2008) to evaluate potential vapor intrusion concerns for these analytes; therefore, other potential groundwater screening level sources were not consulted for these analytes.

References:
California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region. 2008.
Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater.
Interim Final. November 2007 (Revised May 2008).

Table 8
Identification of Chemicals of Potential Concern (COPCs) in Soil Gas
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Analyte [a]	Maximum Detected Concentration (µg/m^3)	ESLs [b] (µg/m^3)		CHHSLs [c] (µg/m^3)	
		Residential	Commercial	Residential	Commercial
VOCs					
m,p-Xylenes	320	21,000	58,000	320,000	890,000
o-Xylene	140			320,000	880,000
Petroleum Hydrocarbons					
TPH, Gasoline Range	36,000	**10,000**	**29,000**	NA	NA

Abbreviations:
NA = not available
µg/m^3 = micrograms per cubic meter
ESL = environmental screening level
CHHSL = California human health screening level
VOCs = volatile organic compounds
TPH = total petroleum hydrocarbons

Footnotes:
[a] Analytes identified as COPCs for any receptor are shown in bold font. Receptor-specific COPCs are identified by screening levels shown in bold font.
[b] Environmental screening levels (ESLs) from RWQCB (2008), shallow soil gas screening levels from Table E (Indoor Air and Soil Gas [Vapor Intrusion Concerns]).
ESLs were available for total xylenes only; these values were therefore used for both m,p- and o-xylene isomers.
[c] California Human Health Screening Levels (CHHSLs) from CalEPA (2005). Table 7 (Soil-Gas-Screening Numbers for Volatile Chemicals below Buildings Constructed without Engineered Fill below Sub-slab Gravel) values were conservatively used for soil gas screening.

References:
California Environmental Protection Agency (CalEPA). 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil. Office of Environmental Health Hazard Assessment (OEHHA). November 2004. January 2005 Revision.
California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region. 2008. Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater. Interim Final. November 2007 (Revised May 2008).

Table 9
Toxicity Values - Reference Doses and Inhalation Reference Concentrations
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical Of Potential Concern (COPC)	Chronic Oral Reference Dose (cRfDo) [a, b] (mg/kg-day)		Subchronic Oral Reference Dose (sRfDo) [b,c] (mg/kg-day)		Chronic Inhalation Reference Concentration (cRfCi) [a] (mg/m^3)		Subchronic Inhalation Reference Concentration (sRfCi) [c] (mg/m^3)	
	Value	Source	Sub-chronic UF	Value	Value	Source	Sub-chronic UF	Value
VOCs								
1,2-Dichloroethane	6.0E-03	USEPA, 2011a	--	--	7.0E-03	USEPA, 2011a	--	--
Ethylbenzene	1.0E-01	USEPA, 2011b	10	1.0E+00	2.0E+00	CalEPA, 2011a	--	--
Benzene	4.0E-03	USEPA, 2011b	3	1.2E-02	6.0E-02	CalEPA, 2011a	--	--
Xylenes	2.0E-01	USEPA, 2011b	--	--	1.0E-01	USEPA, 2011b	3	3.0E-01
SVOCs								
2-Methylnaphthalene	4.0E-03	USEPA, 2011b	--	--	--	--	--	--
Naphthalene	2.0E-02	USEPA, 2011b	10	2.0E-01	9.0E-03	CalEPA, 2011a	--	--

Abbreviations:
mg/kg-day: milligrams per kilogram body weight per day
mg/m^3: milligrams per cubic meter of air
UF: uncertainty factor
VOCs: volatile organic compounds
SVOCs: semi-volatile organic compounds
--: not available or not applicable

Footnotes:
[a] Toxicity values were obtained from the following sources of information in order of priority:
CalEPA 2011a, USEPA 2011b, USEPA 2011a, PPRTVs (from USEPA National Center for Environmental Assessment), and USEPA 1997a.
[b] In the absence of dermal toxicity values the oral reference doses were used to evaluate dermal exposure.
[c] Sub-chronic RfD and RfC values were derived by multiplying the chronic RfDs and RfCs by the uncertainty factor applied for sub-chronic to chronic extrapolation (from USEPA, 2011b), where applicable.

References:
CalEPA. 2011a. Office of Environmental Health Hazard Assessment (OEHHA). Toxicity Criteria Database. Online database. Accessed August.
http://oehha.ca.gov/risk/chemicaldb/index.asp
U.S. Environmental Protection Agency (USEPA). 1997a. Health Effects Assessment Summary Tables (HEAST) FY 1997 Update. Office of Solid Waste and Emergency Response. July.
USEPA. 2011a. Regional Screening Levels Table. June.
USEPA. 2011b. Integrated Risk Information System (IRIS). Online database. Accessed August.
http://www.epa.gov/iris/

Table 10
Toxicity Values - Slope Factors and Inhalation Unit Risks
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical Of Potential Concern (COPC)	Oral Slope Factor (SFo) [a,b] $(mg/kg\text{-}day)^{-1}$		Inhalation Unit Risk (IUR) [a] $(mg/m^3)^{-1}$		Carcinogenic Weight-of-Evidence [c]
	Value	Source	Value	Source	
VOCs					
1,2-Dichloroethane	4.7E-02	CalEPA, 2011a	2.1E-02	CalEPA, 2011a	B2
Ethylbenzene	1.1E-02	CalEPA, 2011a	2.5E-03	CalEPA, 2011a	--
Benzene	1.0E-01	CalEPA, 2011a	2.9E-02	CalEPA, 2011a	A
Xylenes	--	--	--	--	--
SVOCs					
2-Methylnaphthalene	--	--	--	--	--
Naphthalene	--	--	3.4E-02	CalEPA, 2011a	C

Abbreviations:
mg/kg-day: milligrams per kilogram body weight per day
mg/m^3: milligrams per cubic meter of air
VOCs: volatile organic compounds
SVOCs: semi-volatile organic compounds
--: not available or not applicable

Footnotes:
[a] Toxicity values were obtained from the following sources of information in order of priority:
CalEPA 2011a, USEPA 2011b, USEPA 2011a, PPRTVs (from USEPA National Center for Environmental Assessment), and USEPA 1997a.
[b] In the absence of dermal toxicity values the oral slope factors were used to evaluate dermal exposure.
[c] Cancer weight-of-evidence categories (from USEPA, 2011b) are as follows:
Group A: Human Carcinogen (sufficient evidence of carcinogenicity in humans).
Group B: Probable Human Carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans).
Group C: Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data).
Group D: Not Classifiable as to Human Carcinogenicity (inadequate or no evidence).
Group E: Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in adequate studies).

References:
CalEPA. 2011a. Office of Environmental Health Hazard Assessment (OEHHA). Toxicity Criteria Database. Online database. Accessed August. http://oehha.ca.gov/risk/chemicaldb/index.asp
U.S. Environmental Protection Agency (USEPA). 1997a. Health Effects Assessment Summary Tables (HEAST) FY 1997 Update. Office of Solid Waste and Emergency Response. July.
USEPA. 2011a. Regional Screening Levels Table. June.
USEPA. 2011b. Integrated Risk Information System (IRIS). Online database. Accessed August. http://www.epa.gov/iris/

Table 11
Exposure Assumptions
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Hypothetical Receptor/Parameter	Acronym	Value	Unit	Rationale	Reference
Curren/Future Onsite Construction/Utility Worker Receptor					
Averaging Time - Noncarcinogens	ATn	365	days	ATn = ED x 365 days ATc = Lifetime x 365 days.	CalEPA, 1996
Averaging Time - Carcinogens	ATc	25,550	days	ATc = Lifetime x 365 days.	CalEPA, 1996
Lifetime	--	70	years	Default value.	CalEPA, 1996
Body Weight	BW	70	kg	Default value.	USEPA, 1997b
Exposure Duration	ED	1	year	Based on best professional judgement in the absence of recommended value.	--
Exposure Frequency	EF	90	days/year	Based on best professional judgement in the absence of recommended value.	--
Exposure Time	ET	8	hours/day	Based on best professional judgement in the absence of recommended value.	--
Event Frequency	EV	1	event/day	Default value.	USEPA, 2004
Conversion Factor	CF	1E-06	kg/mg		--
Incidental Groundwater Ingestion Rate	IR_w	0.05	L/day	Recommended value for incidental ingestion of surface water while swimming (based on one hour event duration).	USEPA, 1989
Skin Surface Area	SA	4,849	cm^2	Corresponds to exposure of face, forearms, hands, and lower legs. Construction worker receptor was assumed to wear boots.	USEPA, 2004
Groundwater Exposure Event Duration	t_{event}	1	hour	Based on best professional judgement in the absence of recommended value.	--
Future Onsite Child Resident Receptor					
Averaging Time - Noncarcinogens	ATn	2,190	days	ATn = ED x 365 days ATc = Lifetime x 365 days.	CalEPA, 1996
Averaging Time - Carcinogens	ATc	25,550	days	ATc = Lifetime x 365 days.	CalEPA, 1996
Lifetime	--	70	years	Default value.	CalEPA, 1996
Body Weight	BW	15	kg	Default value.	CalEPA, 1996
Exposure Duration	ED	6	years	RME default assumption; added to adult resident ED results in a total RME ED for a resident receptor of 30 years.	CalEPA, 1996
Exposure Frequency	EF	350	day/year	Default RME recommendation.	CalEPA, 1996
Exposure Time - Indoor	ET	24	hours/day	Conservative assumption; healthy children older than a few months are very unlikely to stay indoors all day.	--
Event Frequency	EV	1	event/day	Default value.	USEPA, 2004
Conversion Factor	CF	1E-06	kg/mg		--
Soil Ingestion Rate	IR_s	100	mg/day	Recommended average value for site-specific risk assessments.	USEPA, 2002b
Inhalation Rate	InR	0.4	m^3/hour	CalEPA recommended average inhalation rate for a child, reflecting a total of 10 m^3/day, based on DTSC policy. The current USEPA (2002b) recommended value is 8.7 m^3/day.	--
Skin Surface Area (soil exposure)	SA_s	2,800	cm^2	Recommended for central tendency and reasonable maximum exposure.	USEPA, 2004
Soil Adherence Factor	AF	0.2	mg/cm^2-event	Recommended RME value for child based on the 95th percentile measured value for children playing at a day care center.	USEPA, 2004
Dermal Absorption Factor	DAF	Chemical-specific	--	Chemical-specific.	USEPA, 2004
	VOCs	0	--	Volatile organic compounds.	USEPA, 2004
	SVOCs	0.1	--	Semi-volatile organic compounds.	USEPA, 2004
Drinking water ingestion rate	IR_w	1	L/day	Recommended child value.	CalEPA, 1996
Skin Surface Area (total; bathing)	SA_{tot}	6,600	cm^2	Recommended for both central tendency exposure and RME.	USEPA, 2004
Bathing event duration	t_{event}	0.16	hours	Default recommendation.	USEPA, 2002b
Volatilization factor from water	k	0.5	L/m^3	Default recommendation.	USEPA, 1991a

Table 11
Exposure Assumptions
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Hypothetical Receptor/Parameter	Acronym	Value	Unit	Rationale	Reference
Future Onsite Adult Resident Receptor					
Averaging Time - Noncarcinogens	ATn	8,760	days	ATn = ED x 365 days ATc = Lifetime x 365 days.	CalEPA, 1996
Averaging Time - Carcinogens	ATc	25,550	days	ATc = Lifetime x 365 days.	CalEPA, 1996
Lifetime	--	70	years	Default value.	CalEPA, 1996
Body Weight	BW	70	kg	Default value.	USEPA, 1997b
Exposure Duration	ED	24	years	RME default assumption; added to child resident ED results in a total RME ED for a resident receptor of 30 years.	CalEPA, 1996
Exposure Frequency	EF	350	days/year	RME default assumption.	CalEPA, 1996
Exposure Time - Indoor	ET	24	hours/day	Conservative assumption. Unlikely to apply to the great majority of adults.	--
Event Frequency	EV	1	event/day	Default value.	USEPA, 2004
Conversion Factor	CF	1E-06	kg/mg		--
Soil Ingestion Rate	IR_s	50	mg/day	Recommended value for site-specific risk assessments.	USEPA, 1997b
Inhalation Rate	InR	1	m^3/hour	Recommended average rate for male adult 19-64 years and 65+ years; based on daily inhalation rate of 15.2 m^3/day. USEPA (1997b) does not recommend an upper-percentile inhalation rate.	USEPA, 1997b
Skin Surface Area (soil exposure)	SA_s	5,700	cm^2	Recommended for central tendency and reasonable maximum exposure.	USEPA, 2004
Soil Adherence Factor	AF	0.07	mg/cm^2-event	Recommended RME value.	USEPA, 2004
Dermal Absorption Factor	DAF	Chemical-specific	--	Chemical-specific.	USEPA, 2004
	VOCs	0	--	Volatile organic compounds.	USEPA, 2004
	SVOCs	0.1	--	Semi-volatile organic compounds.	USEPA, 2004
Drinking water ingestion rate	IR_w	2	L/day	Recommended adult value.	CalEPA, 1996
Skin Surface Area (total; bathing)	SA_{tot}	18,000	cm^2	Recommended for both central tendency and RME exposure	USEPA, 2004
Bathing event duration	t_{event}	0.25	hours	Recommended for central tendency exposure; consistent with CalEPA (1994).	USEPA, 2004
Volatilization factor from water	k	0.5	L/m^3	Default recommendation.	USEPA, 1991a

Abbreviations:
kg: kilograms; mg: milligrams; m^3: cubic meters; cm^2: centimeters squared; L: liters, --: not applicable, RME: reasonable maximum exposure, VOCs: volatile organic compounds, SVOCs: semi-volatile organic compounds

References:

California Environmental Protection Agency (CalEPA). 1994. Preliminary Endangerment Assessment Guidance Manual. Department of Toxic Substances Control. January.
CalEPA. 1996. Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities. Department of Toxic Substances Control.
U.S. Environmental Protection Agency (USEPA). 1989. Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual (Part A). Interim Final. EPA/540/1-89/002. December.
USEPA. 1991a. Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). Interim. EPA/540/R-92/003. December.
USEPA. 1997b. Exposure Factors Handbook, Volume I, II, and III. Office of Research and Development, National Center for Environmental Assessment, Washington D.C., EPA/600/P-95/002Fa. August.
USEPA. 2002b. Child-Specific Exposure Factors Handbook. Interim Report. EPA/600/P/00/002B. September.
USEPA. 2004. Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual. (Part E, Supplemental Guidance for Dermal Risk Assessment.) Final. EPA/540/R/99/005. July.

Table 12
Exposure Point Concentrations
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Direct Exposure Pathways		Indirect Exposure Pathways
	Soil EPC [a] (Cs) mg/kg	Onsite Groundwater EPC [a] (Cgw_on) mg/L	Vapors from Domestic Water Onsite [a,b] (Ci_dw_on) mg/m^3
VOCs [g]			
1,2-Dichloroethane	0.036	--	--
Ethylbenzene	0.73	--	--
Benzene	0.096	0.30	0.15
Xylenes (Total)	2.7	--	--
SVOCs			
2-Methylnaphthalene	2.7	--	--
Naphthalene	1.8	--	--

Abbreviations:
EPC: exposure point concentration
mg/kg: milligrams per kilogram
mg/L: milligrams per liter
mg/m^3: milligrams per cubic meter
VOCs: volatile organic compounds
SVOCs: semi-volatile organic compounds
--: not applicable; analyte is not a COPC for the exposure medium

Footnotes:
[a] Lesser of the maximum and upper confidence limit on the unknown mean recommended from ProUCL software (USEPA, 2010a). See Appendix A for ProUCL outputs. For COPCs with fewer than five detected values, the maximum concentration was selected as the EPC based on USEPA (2010b) guidance. Soil and groundwater concentrations were divided by 1,000 to convert to mg/kg and mg/L, respectively.
[b] Ci_dw = Cgw x k; where k (volatilization factor from water) is 0.5 L/m^3 per USEPA (1991a).

References:
U.S. Environmental Protection Agency (USEPA). 1991a. Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals), Interim. Publication 9285.7-01B. December.
USEPA. 2010a. ProUCL Version 4.1, A Statistical Software. National Exposure Research Lab, EPA, Las Vegas, Nevada. Available for download at: http://www.epa.gov/osp/hstl/tsc/software.htm
USEPA. 2010b. ProUCL Version 4.1. User Guide (Draft). EPA/600/R-07/041. May.

Table 13
Estimation of Dermally Absorbed Dose from Onsite Groundwater for Hypothetical Future Resident Receptors
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Groundwater EPC [a]		Chemical-Specific Parameters [b]					Resident Child		Resident Adult	
	(Cgw) (mg/L)	(Cgw) (mg/cm^3)	Permeability Coefficient (Kp) (cm/hr)	Lag Time per event (τ) (hrs/event)	Fraction Absorbed (FA) (unitless)	B (unitless)	Time to reach steady state (t*) (hr)	Event Duration [c] (t_{event}) (hrs/event)	Absorbed Dose per Event [d] ($Da_{event\_res\_c}$) (mg/cm^2-event)	Event Duration [c] (t_{event}) (hrs/event)	Absorbed Dose per Event [d] ($DA_{event\_res\_a}$) (mg/cm^2-event)
VOCs											
Benzene	0.30	3.0E-04	0.015	0.29	1.0	0.10	0.7	0.16	2.7E-06	0.25	3.3E-06

Abbreviations:
cm : centimeter; cm^2 : square centimeter; cm^3 : cubic centimeter; hr : hour; mg : milligram; L : liter; m^3 : cubic meter, VOCs: volatile organic compounds, EPC: exposure point concentration

Footnotes:
[a] Groundwater EPCs from Table 12. Cgw (mg/L) / 1000 = Cgw (mg/cm^3).
[b] Chemical properties for the water dermal pathway (Kp, τ, B, and FA) are from USEPA (2004), Exhibit B-3.
[c] t_{event} - bathing event duration (t_{event} for resident; from Table 11).
[d] DAevent = 2 x FA x Kp x Cgw (mg/cm^3) x sqrt (6 x τ x tevent/π); when tevent < t* for all organic chemicals.
DAevent = FA x Kp x Cgw (mg/cm3) x [(tevent/(1+B))+(2 x τ ((1+3B + 3B2)/(1+B)2))]; when tevent > t* for all organic chemicals.

References:
U.S. Environmental Protection Agency (USEPA). 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final. EPA/540/R/99/005. July.

Table 14
Estimation of Dermally Absorbed Dose from Onsite Groundwater for Hypothetical Current/Future Construction/Utility Worker Receptors
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Groundwater EPC [a]		Chemical-Specific Parameters [b]					Construction Worker	
	(Cgw) (mg/L)	(Cgw) (mg/cm^3)	Permeability Coefficient (Kp) (cm/hr)	Lag Time per event (τ) (hrs/event)	Fraction Absorbed (FA) (unitless)	B (unitless)	Time to reach steady state (t*) (hr)	Event Duration [c] (t_{event}) (hrs/event)	Absorbed Dose per Event [d] (DA_{event_cu}) (mg/cm^2-event)
VOCs									
Benzene	0.30	3.0E-04	0.015	0.29	1.0	0.10	0.70	1.00	7.0E-06

Abbreviations:
cm : centimeter; cm^2 : square centimeter; cm^3 : cubic centimeter; hr : hour; mg : milligram; L : liter; m^3 : cubic meter, VOCs: volatile organic compounds, EPC: exposure point concentration

Footnotes:
[a] Groundwater EPCs from Table 12. Cgw (mg/L) / 1000 = Cgw (mg/cm^3).
[b] Chemical properties for the water dermal pathway (Kp, τ, B, and FA) are from USEPA (2004), Exhibit B-3.
[c] t_{event} - excavation event duration (t_{event} for construction worker; from Table 11).
[d] DAevent = 2 x FA x Kp x Cgw (mg/cm^3) x sqrt (6 x τ x tevent/π); when tevent < t* for all organic chemicals.
DAevent = FA x Kp x Cgw (mg/cm3) x [(tevent/(1+B))+(2 x τ ((1+3B + 3B2)/(1+B)2))]; when tevent > t* for all organic chemicals.

References:
U.S. Environmental Protection Agency (USEPA). 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final. EPA/540/R/99/005. July.

Table 15
Risk Characterization for Incidental Ingestion of Groundwater During Excavation
Hypothetical Current/Future Onsite Construction/Utility Worker Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Subchronic Daily Intake [a] (SDIn) (mg/kg-day)	Oral Reference Dose (sRfDo) (mg/kg-day)	Hazard Quotient [b] (HQ) (unitless)	Subchronic Daily Intake [a] (SDIc) (mg/kg-day)	Oral Slope Factor (SFo) $(mg/kg\text{-}day)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
Benzene	5.3E-05	0.004	0.013	7.5E-07	0.10	7.5E-08
		Hazard Index (HI) [c]	0.01		**Total LECR [d]**	8E-08

Abbreviations:
mg/kg-day: milligrams per kilogram per day
--: not available or not applicable
VOC: volatile organic compound

Footnotes:
[a] SDI = (Cgw_on x EF x ED x IRw) / (BW x AT). SDIn is calculated using ATn and SDIc is calculated using ATc. Refer to Tables 11 and 12 for explanation of acronyms used in equation.
[b] Chemical-specific HQ = SDIn/sRfDo for each analyte; Chemical-specific LECR = SDIc x SFo for each analyte. Refer to Tables 9 and 10 for source of RfDs and SFs.
[c] Pathway-specific HI = sum of chemical-specific HQs.
[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 16
Risk Characterization for Dermal Contact with Groundwater During Excavation
Hypothetical Current/Future Onsite Construction/Utility Worker Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Subchronic Daily Intake [a] (SDIn) (mg/kg-day)	Oral Reference Dose (sRfDo) (mg/kg-day)	Hazard Quotient [b] (HQ) (unitless)	Subchronic Daily Intake [a] (SDIc) (mg/kg-day)	Oral Slope Factor (SFo) $(mg/kg\text{-}day)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
Benzene	1.2E-04	0.004	0.030	1.7E-06	0.10	1.7E-07
		Hazard Index (HI) [c]	0.03		**Total LECR [d]**	2E-07

Abbreviations:
mg/kg-day: milligrams per kilogram per day
--: not available or not applicable
VOC: volatile organic compound

Footnotes:

[a] SDI = $(DA_{event\_cu} \times EF \times ED \times EV \times SA) / (BW \times AT)$. SDIn is calculated using ATn and SDIc is calculated using ATc.
Refer to Tables 11 and 14 for explanation of acronyms used in equation.
DA_{event_cu} is calculated in Table 14.

[b] Chemical-specific HQ = SDIn/sRfDo for each analyte; Chemical-specific LECR = SDIc x SFo for each analyte.
Refer to Tables 9 and 10 for source of RfDs and SFs.

[c] Pathway-specific HI = sum of chemical-specific HQs.

[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 17
Risk Characterization for Incidental Ingestion of Soil
Hypothetical Future Onsite Child Resident Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Chronic Daily Intake [a] (CDIn) (mg/kg-day)	Oral Reference Dose (cRfDo) (mg/kg-day)	Hazard Quotient [b] (HQ) (unitless)	Chronic Daily Intake [a] (CDIc) (mg/kg-day)	Oral Slope Factor (SFo) $(mg/kg\text{-}day)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
1,2-Dichloroethane	2.3E-07	0.006	0.000038	2.0E-08	0.047	9.3E-10
Ethylbenzene	4.7E-06	0.10	0.000047	4.0E-07	0.011	4.4E-09
Benzene	6.1E-07	0.004	0.00015	5.3E-08	0.10	5.3E-09
Xylenes (Total)	1.8E-05	0.20	0.000088	1.5E-06	--	--
SVOCs						
2-Methylnaphthalene	1.7E-05	0.004	0.0043	1.5E-06	--	--
Naphthalene	1.2E-05	0.02	0.00058	9.9E-07	--	--
		Hazard Index (HI) [c]	0.005		**Total LECR [d]**	1E-08

Abbreviations:
mg/kg-day: milligrams per kilogram per day
--: not available or not applicable
VOC: volatile organic compound
SVOC: semi-volatile organic compound

Footnotes:

[a] CDI = (Cs x IRs x EF x ED x CF) / (BW x AT). CDIn is calculated using ATn and CDIc is calculated using ATc. Refer to Tables 11 and 12 for explanation of acronyms used in equation.

[b] Chemical-specific HQ = CDIn/cRfDo for each analyte; Chemical-specific LECR = CDIc x SFo for each analyte. Refer to Tables 9 and 10 for source of RfDs and SFs.

[c] Pathway-specific HI = sum of chemical-specific HQs.

[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 18
Risk Characterization for Dermal Contact with Soil
Hypothetical Future Onsite Child Resident Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Chronic Daily Intake [a] (CDIn) (mg/kg-day)	Oral Reference Dose (cRfDo) (mg/kg-day)	Hazard Quotient [b] (HQ) (unitless)	Chronic Daily Intake [a] (CDIc) (mg/kg-day)	Oral Slope Factor (SFo) $(mg/kg\text{-}day)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
1,2-Dichloroethane	0.0E+00	0.006	0	0.0E+00	0.047	0.0E+00
Ethylbenzene	0.0E+00	0.10	0	0.0E+00	0.011	0.0E+00
Benzene	0.0E+00	0.004	0	0.0E+00	0.10	0.0E+00
Xylenes (Total)	0.0E+00	0.20	0	0.0E+00	--	--
SVOCs						
2-Methylnaphthalene	9.7E-06	0.004	0.0024	8.3E-07	--	--
Naphthalene	6.4E-06	0.02	0.00032	5.5E-07	--	--
		Hazard Index (HI) [c]	0.003		**Total LECR [d]**	0E+00

Abbreviations:
mg/kg-day: milligrams per kilogram per day
--: not available or not applicable
VOC: volatile organic compound
SVOC: semi-volatile organic compound

Footnotes:
[a] CDI = (Cs x SA_s x DAF x AF x EF x ED x EV x CF) / (BW x AT). CDIn is calculated using ATn and CDIc is calculated using ATc. Refer to Tables 11 and 12 for explanation of acronyms used in equation.
[b] Chemical-specific HQ = CDIn/cRfDo for each analyte; Chemical-specific LECR = CDIc x SFo for each analyte. Refer to Tables 9 and 10 for source of RfDs and SFs.
[c] Pathway-specific HI = sum of chemical-specific HQs.
[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 19
Risk Characterization for Ingestion of Groundwater Used as a Domestic Water Supply
Hypothetical Future Onsite Child Resident Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Chronic Daily Intake [a] (CDIn) (mg/kg-day)	Oral Reference Dose (cRfDo) (mg/kg-day)	Hazard Quotient [b] (HQ) (unitless)	Chronic Daily Intake [a] (CDIc) (mg/kg-day)	Oral Slope Factor (SFo) $(mg/kg\text{-}day)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
Benzene	1.9E-02	0.004	4.8	1.6E-03	0.10	1.6E-04
		Hazard Index (HI) [c]	5		**Total LECR [d]**	2E-04

Abbreviations:
mg/kg-day: milligrams per kilogram per day
--: not available or not applicable
VOC: volatile organic compound

Footnotes:

[a] CDI = (Cgw_on x EF x ED x IRw) / (BW x AT). CDIn is calculated using ATn and CDIc is calculated using ATc. Refer to Tables 11 and 12 for explanation of acronyms used in equation.

[b] Chemical-specific HQ = CDIn/cRfDo for each analyte; Chemical-specific LECR = CDIc x SFo for each analyte. Refer to Tables 9 and 10 for source of RfDs and SFs.

[c] Pathway-specific HI = sum of chemical-specific HQs.

[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 20
Risk Characterization for Dermal Contact with Groundwater Used as a Domestic Water Supply
Hypothetical Future Onsite Child Resident Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Chronic Daily Intake [a] (CDIn) (mg/kg-day)	Oral Reference Dose (cRfDo) (mg/kg-day)	Hazard Quotient [b] (HQ) (unitless)	Chronic Daily Intake [a] (CDIc) (mg/kg-day)	Oral Slope Factor (SFo) $(mg/kg\text{-}day)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
Benzene	1.4E-03	0.004	0.35	1.2E-04	0.10	1.2E-05
		Hazard Index (HI) [c]	0.4		**Total LECR [d]**	1E-05

Abbreviations:
mg/kg-day: milligrams per kilogram per day
--: not available or not applicable
VOC: volatile organic compound

Footnotes:

[a] CDI = $(DA_{event\_res\_c} \times EF \times ED \times EV \times SA_{tot}) / (BW \times AT)$. CDIn is calculated using ATn and CDIc is calculated using ATc.
Refer to Tables 11 and 13 for explanation of acronyms used in equation.
$DA_{event\_res\_c}$ is calculated in Table 13.

[b] Chemical-specific HQ = CDIn/cRfDo for each analyte; Chemical-specific LECR = CDIc x SFo for each analyte.
Refer to Tables 9 and 10 for source of RfDs and SFs.

[c] Pathway-specific HI = sum of chemical-specific HQs.

[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 21
Risk Characterization for Inhalation of Vapors Indoors from Groundwater Used as a Domestic Water Supply
Hypothetical Future Onsite Child Resident Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Chronic Daily Intake [a] (CDIn) (mg/m^3)	Inhalation Reference Concentration (cRfCi) (mg/m^3)	Hazard Quotient [b] (HQ) (unitless)	Chronic Daily Intake [a] (CDIc) (mg/m^3)	Inhalation Unit Risk (IUR) $(mg/m^3)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
Benzene	1.4E-01	0.06	2.4	1.2E-02	0.029	3.6E-04
		Hazard Index (HI) [c]	2		**Total LECR [d]**	4E-04

Abbreviations:
mg/m^3: milligrams per cubic meter
--: not available or not applicable
VOC: volatile organic compound

Footnotes:
[a] CDI = (Ci_dw_on x EF x ED) / (AT). CDIn is calculated using ATn and CDIc is calculated using ATc. Refer to Tables 11 and 12 for explanation of acronyms used in equation.
[b] Chemical-specific HQ = CDIn/cRfCi for each analyte; Chemical-specific LECR = CDIc x IUR for each analyte. Refer to Tables 9 and 10 for source of RfCs and IURs.
[c] Pathway-specific HI = sum of chemical-specific HQs.
[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 22
Risk Characterization for Incidental Ingestion of Soil
Hypothetical Future Onsite Adult Resident Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Chronic Daily Intake [a] (CDIn) (mg/kg-day)	Oral Reference Dose (cRfDo) (mg/kg-day)	Hazard Quotient [b] (HQ) (unitless)	Chronic Daily Intake [a] (CDIc) (mg/kg-day)	Oral Slope Factor (SFo) $(mg/kg\text{-}day)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
1,2-Dichloroethane	2.5E-08	0.006	0.0000041	8.5E-09	0.047	4.0E-10
Ethylbenzene	5.0E-07	0.10	0.0000050	1.7E-07	0.011	1.9E-09
Benzene	6.6E-08	0.004	0.000016	2.3E-08	0.10	2.3E-09
Xylenes (Total)	1.9E-06	0.20	0.0000094	6.4E-07	--	--
SVOCs						
2-Methylnaphthalene	1.8E-06	0.004	0.00046	6.3E-07	--	--
Naphthalene	1.2E-06	0.02	0.000062	4.2E-07	--	--
		Hazard Index (HI) [c]	0.0006		**Total LECR [d]**	5E-09

Abbreviations:
mg/kg-day: milligrams per kilogram per day
--: not available or not applicable
VOC: volatile organic compound
SVOC: semi-volatile organic compound

Footnotes:

[a] CDI = (Cs x IRs x EF x ED x CF) / (BW x AT). CDIn is calculated using ATn and CDIc is calculated using ATc. Refer to Tables 11 and 12 for explanation of acronyms used in equation.

[b] Chemical-specific HQ = CDIn/cRfDo for each analyte; Chemical-specific LECR = CDIc x SFo for each analyte. Refer to Tables 9 and 10 for source of RfDs and SFs.

[c] Pathway-specific HI = sum of chemical-specific HQs.

[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 23
Risk Characterization for Dermal Contact with Soil
Hypothetical Future Onsite Adult Resident Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Chronic Daily Intake [a] (CDIn) (mg/kg-day)	Oral Reference Dose (cRfDo) (mg/kg-day)	Hazard Quotient [b] (HQ) (unitless)	Chronic Daily Intake [a] (CDIc) (mg/kg-day)	Oral Slope Factor (SFo) $(mg/kg\text{-}day)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
1,2-Dichloroethane	0.0E+00	0.006	0	0.0E+00	0.047	0.0E+00
Ethylbenzene	0.0E+00	0.10	0	0.0E+00	0.011	0.0E+00
Benzene	0.0E+00	0.004	0	0.0E+00	0.10	0.0E+00
Xylenes (Total)	0.0E+00	0.20	0	0.0E+00	--	--
SVOCs						
2-Methylnaphthalene	1.5E-06	0.004	0.00037	5.1E-07	--	--
Naphthalene	9.8E-07	0.02	0.000049	3.4E-07	--	--
		Hazard Index (HI) [c]	0.0004		**Total LECR [d]**	0E+00

Abbreviations:
mg/kg-day: milligrams per kilogram per day
--: not available or not applicable
VOC: volatile organic compound
SVOC: semi-volatile organic compound

Footnotes:
[a] CDI = (Cs x SA_s x DAF x AF x EF x ED x EV x CF) / (BW x AT). CDIn is calculated using ATn and CDIc is calculated using ATc. Refer to Tables 11 and 12 for explanation of acronyms used in equation.
[b] Chemical-specific HQ = CDIn/cRfDo for each analyte; Chemical-specific LECR = CDIc x SFo for each analyte. Refer to Tables 9 and 10 for source of RfDs and SFs.
[c] Pathway-specific HI = sum of chemical-specific HQs.
[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 24
Risk Characterization for Ingestion of Groundwater Used as a Domestic Water Supply
Hypothetical Future Onsite Adult Resident Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Chronic Daily Intake [a] (CDIn) (mg/kg-day)	Oral Reference Dose (cRfDo) (mg/kg-day)	Hazard Quotient [b] (HQ) (unitless)	Chronic Daily Intake [a] (CDIc) (mg/kg-day)	Oral Slope Factor (SFo) $(mg/kg\text{-}day)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
Benzene	8.2E-03	0.004	2.1	2.8E-03	0.10	2.8E-04
		Hazard Index (HI) [c]	2		**Total LECR [d]**	3E-04

Abbreviations:
mg/kg-day: milligrams per kilogram per day
--: not available or not applicable
VOC: volatile organic compound

Footnotes:
[a] CDI = (Cgw_on x EF x ED x IRw) / (BW x AT). CDIn is calculated using ATn and CDIc is calculated using ATc. Refer to Tables 11 and 12 for explanation of acronyms used in equation.
[b] Chemical-specific HQ = CDIn/cRfDo for each analyte; Chemical-specific LECR = CDIc x SFo for each analyte. Refer to Tables 9 and 10 for source of RfDs and SFs.
[c] Pathway-specific HI = sum of chemical-specific HQs.
[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 25
Risk Characterization for Dermal Contact with Groundwater Used as a Domestic Water Supply
Hypothetical Future Onsite Adult Resident Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Chronic Daily Intake [a] (CDIn) (mg/kg-day)	Oral Reference Dose (cRfDo) (mg/kg-day)	Hazard Quotient [b] (HQ) (unitless)	Chronic Daily Intake [a] (CDIc) (mg/kg-day)	Oral Slope Factor (SFo) $(mg/kg\text{-}day)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
Benzene	8.3E-04	0.004	0.21	2.8E-04	0.10	2.8E-05
		Hazard Index (HI) [c]	0.2		**Total LECR [d]**	3E-05

Abbreviations:
mg/kg-day: milligrams per kilogram per day
--: not available or not applicable
VOC: volatile organic compound

Footnotes:

[a] CDI = $(DA_{event\_res\_a} \times EF \times ED \times EV \times SA_{tot}) / (BW \times AT)$. CDIn is calculated using ATn and CDIc is calculated using ATc.
Refer to Tables 11 and 13 for explanation of acronyms used in equation.
$DA_{event\_res\_a}$ is calculated in Table 13.

[b] Chemical-specific HQ = CDIn/cRfDo for each analyte; Chemical-specific LECR = CDIc x SFo for each analyte.
Refer to Tables 9 and 10 for source of RfDs and SFs.

[c] Pathway-specific HI = sum of chemical-specific HQs.

[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 26
Risk Characterization for Inhalation of Vapors Indoors from Groundwater Used as a Domestic Water Supply
Hypothetical Future Onsite Adult Resident Receptor
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Chemical of Potential Concern (COPC)	Noncarcinogenic Effects			Carcinogenic Effects		
	Chronic Daily Intake [a] (CDIn) (mg/m^3)	Inhalation Reference Concentration (cRfCi) (mg/m^3)	Hazard Quotient [b] (HQ) (unitless)	Chronic Daily Intake [a] (CDIc) (mg/m^3)	Inhalation Unit Risk (IUR) $(mg/m^3)^{-1}$	Lifetime Excess Cancer Risk [b] (LECR) (unitless)
VOCs						
Benzene	1.4E-01	0.06	2.4	4.9E-02	0.029	1.4E-03
		Hazard Index (HI) [c]	2		**Total LECR [d]**	1E-03

Abbreviations:
mg/m^3: milligrams per cubic meter
--: not available or not applicable
VOC: volatile organic compound

Footnotes:
[a] CDI = (Ci_dw_on x EF x ED) / (AT). CDIn is calculated using ATn and CDIc is calculated using ATc. Refer to Tables 11 and 12 for explanation of acronyms used in equation.
[b] Chemical-specific HQ = CDIn/cRfCi for each analyte; Chemical-specific LECR = CDIc x IUR for each analyte. Refer to Tables 9 and 10 for source of RfCs and IURs.
[c] Pathway-specific HI = sum of chemical-specific HQs.
[d] Pathway-specific total LECR = sum of chemical-specific LECRs.

Table 27
Summary of Risk Characterization Results
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Exposure Pathway	Future Onsite Construction Worker		Future Onsite Child Resident		Future Onsite Adult Resident		Future Onsite Child/Adult Resident	
	HI	LECR	HI	LECR	HI	LECR	HI	LECR
Soil Pathways								
Incidental Ingestion	NA	NA	0.005	1 E-08	0.0006	5 E-09	--	2 E-08
Dermal Contact	NA	NA	0.003	0 E+00	0.0004	0 E+00	--	0 E+00
Groundwater Pathways								
Ingestion	0.01	8 E-08	5	2 E-04	2	3 E-04	--	4 E-04
Dermal Exposure	0.03	2 E-07	0.4	1 E-05	0.2	3 E-05	--	4 E-05
Inhalation	NA	NA	2	4 E-04	2	1 E-03	--	2 E-03
Multi-Pathways Totals [b]	**0.04**	**2 E-07**	**8**	**5 E-04**	**5**	**2 E-03**	**--**	**2 E-03**

Abbreviations:
--: not available or applicable
HI: pathway-specific hazard index
LECR: pathway-specific lifetime excess cancer risk
NA: not applicable; pathway is incomplete

Footnotes:
[a] Pathway specific estimates are summarized in Tables 15 through 26.
[b] Multi-pathway HI for each receptor is the sum of pathway-specific HIs.
Multi-pathway LECR is the sum of pathway-specific LECRs.

Table 28
Development of Soil and Groundwater Threshold Concentrations
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California

Exposure Scenario	Soil				Groundwater	
	Residential		Commercial		Domestic Use	
	Value (mg/kg)	Source	Value (mg/kg)	Source	Value (µg/L)	Source
Chemical						
Benzene	--	--	--	--	1.0	CalEPA MCL [b]
Lead	80	CHHSL [a]	320	CHHSL [a]	--	--

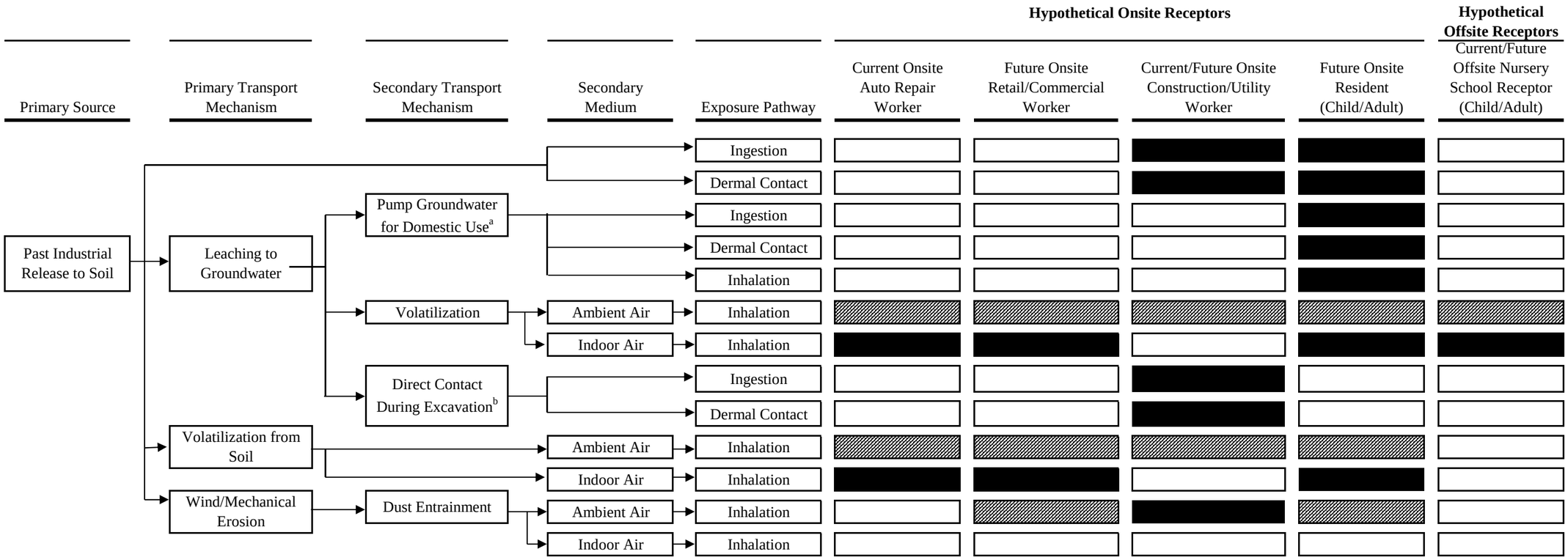
Abbreviations:
mg/kg: milligrams per kilogram
µg/L: micrograms per liter
CHHSL: California human health screening level
CalEPA: California Environmental Protection Agency
MCL: maximum contaminant level
--: not applicable

Footnotes:
[a] California human health screening levels from CalEPA (2009a).
[b] Maximum contaminant level for drinking water from CalEPA (2011b).

References:
CalEPA. 2009a. Revised California Human Health Screening Level for Lead (Review Draft). OEHHA. May 14.
CalEPA. 2011b. California Code of Regulations (CCR), Title 22, Division 4, Chapter 15, Article 5.5, Section 64444. Maximum Contaminant Levels – Organic Chemicals. Register 2011, No. 32. Current through August 12.

FIGURES

Figure 1
Conceptual Site Model Diagram
Human Health Risk Assessment
2250 Telegraph Avenue, Oakland, California



Receptor likely to be exposed via this route, so exposure pathway considered potentially complete and significant and quantitatively evaluated.

Receptor may be exposed via this route, so pathway is considered potentially complete. However, pathway likely insignificant. Qualitative evaluation only.

Pathway is incomplete; no further evaluation required.

[a] Based on results of a well survey and known local groundwater usage, it is unlikely that groundwater beneath the Site would be used for domestic purposes. However, due to the potential for future residential development, this pathway is conservatively considered potentially complete and significant.

[b] Depth to groundwater is approximately 10 feet below ground surface; therefore, direct contact during construction-related excavation is possible.

ATTACHMENT A
ProUCL OUTPUT

1				**General UCL Statistics for Data Sets with Non-Detects**								
2			**User Selected Options**									
3			From File	C:\SLR Project Files\Fugro - Telegraph Ave\RA data\EPCs\Shallow_Soil_data.wst								
4			Full Precision	OFF								
5			Confidence Coefficient	95%								
6			Number of Bootstrap Operations	2000								
7												
8												
9	**Result (benzene)**											
10												
11						**General Statistics**						
12						Number of Valid Data	43			Number of Detected Data	6	
13						Number of Distinct Detected Data	6			Number of Non-Detect Data	37	
14										Percent Non-Detects	86.05%	
15												
16						**Raw Statistics**				**Log-transformed Statistics**		
17						Minimum Detected	28			Minimum Detected	3.332	
18						Maximum Detected	820			Maximum Detected	6.709	
19						Mean of Detected	252.7			Mean of Detected	4.913	
20						SD of Detected	297.4			SD of Detected	1.285	
21						Minimum Non-Detect	4.6			Minimum Non-Detect	1.526	
22						Maximum Non-Detect	500			Maximum Non-Detect	6.215	
23												
24	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	42	
25	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	1	
26	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	97.67%	
27												
28	**Warning: There are only 6 Detected Values in this data**											
29	**Note: It should be noted that even though bootstrap may be performed on this data set**											
30	**the resulting calculations may not be reliable enough to draw conclusions**											
31												
32	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
33												
34												
35						**UCL Statistics**						
36						**Normal Distribution Test with Detected Values Only**				**Lognormal Distribution Test with Detected Values Only**		
37						Shapiro Wilk Test Statistic	0.794			Shapiro Wilk Test Statistic	0.958	
38						5% Shapiro Wilk Critical Value	0.788			5% Shapiro Wilk Critical Value	0.788	
39						**Data appear Normal at 5% Significance Level**				**Data appear Lognormal at 5% Significance Level**		
40												
41						**Assuming Normal Distribution**				**Assuming Lognormal Distribution**		
42						DL/2 Substitution Method				DL/2 Substitution Method		
43						Mean	48.3			Mean	1.855	
44						SD	138.6			SD	1.713	
45						95% DL/2 (t) UCL	83.86			95% H-Stat (DL/2) UCL	65.68	
46												
47						Maximum Likelihood Estimate(MLE) Method	N/A			Log ROS Method		
48						**MLE method failed to converge properly**				Mean in Log Scale	0.481	
49										SD in Log Scale	2.453	
50										Mean in Original Scale	37.31	
51										SD in Original Scale	135	
52										95% t UCL	71.94	

53											95% Percentile Bootstrap UCL	74.28
54											95% BCA Bootstrap UCL	99.09
55											95% H-UCL	168.8
56												
57	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
58					k star (bias corrected)	0.581	**Data appear Normal at 5% Significance Level**					
59					Theta Star	435.1						
60					nu star	6.968						
61												
62					A-D Test Statistic	0.247	**Nonparametric Statistics**					
63					5% A-D Critical Value	0.717					Kaplan-Meier (KM) Method	
64					K-S Test Statistic	0.717					Mean	59.85
65					5% K-S Critical Value	0.341					SD	128.1
66	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	21.45
67											95% KM (t) UCL	95.94
68	**Assuming Gamma Distribution**										95% KM (z) UCL	95.14
69					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	88.12
70					Minimum	0.000001					95% KM (bootstrap t) UCL	129
71					Maximum	820					95% KM (BCA) UCL	312.1
72					Mean	35.26					95% KM (Percentile Bootstrap) UCL	162.3
73					Median	0.000001					95% KM (Chebyshev) UCL	153.4
74					SD	135.5					97.5% KM (Chebyshev) UCL	193.8
75					k star	0.0698					99% KM (Chebyshev) UCL	273.3
76					Theta star	504.8						
77					Nu star	6.006	**Potential UCLs to Use**					
78					AppChi2	1.643					95% KM (t) UCL	95.94
79					95% Gamma Approximate UCL	128.9					95% KM (Percentile Bootstrap) UCL	162.3
80					95% Adjusted Gamma UCL	135.3						
81	**Note: DL/2 is not a recommended method.**											
82												
83	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
84	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
85	**For additional insight, the user may want to consult a statistician.**											
86												
87												
88	**Result (ethylbenzene)**											
89												
90	**General Statistics**											
91					Number of Valid Data	43					Number of Detected Data	10
92					Number of Distinct Detected Data	10					Number of Non-Detect Data	33
93											Percent Non-Detects	76.74%
94												
95	**Raw Statistics**						**Log-transformed Statistics**					
96					Minimum Detected	12					Minimum Detected	2.485
97					Maximum Detected	6900					Maximum Detected	8.839
98					Mean of Detected	1715					Mean of Detected	6.497
99					SD of Detected	2096					SD of Detected	1.9
100					Minimum Non-Detect	4.6					Minimum Non-Detect	1.526
101					Maximum Non-Detect	5					Maximum Non-Detect	1.609
102												
103	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	33
104	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	10

	A	B	C	D	E	F	G	H	I	J	K	L
105	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					76.74%
106												
107	**UCL Statistics**											
108	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
109	Shapiro Wilk Test Statistic					0.771	Shapiro Wilk Test Statistic					0.893
110	5% Shapiro Wilk Critical Value					0.842	5% Shapiro Wilk Critical Value					0.842
111	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
112												
113	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
114	DL/2 Substitution Method						DL/2 Substitution Method					
115	Mean					400.8	Mean					2.198
116	SD					1215	SD					2.551
117	95% DL/2 (t) UCL					712.5	95% H-Stat (DL/2) UCL					1356
118												
119	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
120	**MLE yields a negative mean**						Mean in Log Scale					1.355
121							SD in Log Scale					3.676
122							Mean in Original Scale					402.9
123							SD in Original Scale					1215
124							95% t UCL					714.4
125							95% Percentile Bootstrap UCL					734.5
126							95% BCA Bootstrap UCL					875.4
127							95% H-UCL					112225
128												
129	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
130	k star (bias corrected)					0.517	**Data appear Gamma Distributed at 5% Significance Level**					
131	Theta Star					3316						
132	nu star					10.34						
133												
134	A-D Test Statistic					0.235	**Nonparametric Statistics**					
135	5% A-D Critical Value					0.765	Kaplan-Meier (KM) Method					
136	K-S Test Statistic					0.765	Mean					408.1
137	5% K-S Critical Value					0.278	SD					1199
138	**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean					192.7
139							95% KM (t) UCL					732.2
140	**Assuming Gamma Distribution**						95% KM (z) UCL					725
141	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					691.6
142	Minimum					0.000001	95% KM (bootstrap t) UCL					1086
143	Maximum					6900	95% KM (BCA) UCL					1193
144	Mean					398.9	95% KM (Percentile Bootstrap) UCL					972.9
145	Median					0.000001	95% KM (Chebyshev) UCL					1248
146	SD					1216	97.5% KM (Chebyshev) UCL					1611
147	k star					0.0688	99% KM (Chebyshev) UCL					2325
148	Theta star					5797						
149	Nu star					5.917	**Potential UCLs to Use**					
150	AppChi2					1.598	95% KM (t) UCL					732.2
151	95% Gamma Approximate UCL					1477						
152	95% Adjusted Gamma UCL					1551						
153	**Note: DL/2 is not a recommended method.**											
154												
155	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
156	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											

	A	B	C	D	E	F	G	H	I	J	K	L
157	**For additional insight, the user may want to consult a statistician.**											
158												
159												
160	**Result (xylenes)**											
161												
162	**General Statistics**											
163	Number of Valid Data					43	Number of Detected Data					11
164	Number of Distinct Detected Data					11	Number of Non-Detect Data					32
165							Percent Non-Detects					74.42%
166												
167	**Raw Statistics**						**Log-transformed Statistics**					
168	Minimum Detected					18	Minimum Detected					2.89
169	Maximum Detected					28000	Maximum Detected					10.24
170	Mean of Detected					5419	Mean of Detected					6.632
171	SD of Detected					9086	SD of Detected					2.49
172	Minimum Non-Detect					5	Minimum Non-Detect					1.609
173	Maximum Non-Detect					10	Maximum Non-Detect					2.303
174												
175	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					32
176	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					11
177	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					74.42%
178												
179	**UCL Statistics**											
180	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
181	Shapiro Wilk Test Statistic					0.676	Shapiro Wilk Test Statistic					0.956
182	5% Shapiro Wilk Critical Value					0.85	5% Shapiro Wilk Critical Value					0.85
183	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
184												
185	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
186	DL/2 Substitution Method						DL/2 Substitution Method					
187	Mean					1389	Mean					2.701
188	SD					5037	SD					2.644
189	95% DL/2 (t) UCL					2681	95% H-Stat (DL/2) UCL					3220
190												
191	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
192	**MLE yields a negative mean**						Mean in Log Scale					-0.366
193							SD in Log Scale					5.134
194							Mean in Original Scale					1387
195							SD in Original Scale					5038
196							95% t UCL					2679
197							95% Percentile Bootstrap UCL					2741
198							95% BCA Bootstrap UCL					3437
199							95% H-UCL					309100000
200												
201	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
202	k star (bias corrected)					0.31	**Data appear Gamma Distributed at 5% Significance Level**					
203	Theta Star					17472						
204	nu star					6.823						
205												
206	A-D Test Statistic					0.394	**Nonparametric Statistics**					
207	5% A-D Critical Value					0.812	Kaplan-Meier (KM) Method					
208	K-S Test Statistic					0.812	Mean					1400

	A	B	C	D	E	F	G	H	I	J	K	L
209					5% K-S Critical Value	0.274					SD	4975
210	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	795.7
211											95% KM (t) UCL	2738
212	**Assuming Gamma Distribution**										95% KM (z) UCL	2709
213					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	2682
214					Minimum	0.000001					95% KM (bootstrap t) UCL	5161
215					Maximum	28000					95% KM (BCA) UCL	2990
216					Mean	1386					95% KM (Percentile Bootstrap) UCL	2818
217					Median	0.000001					95% KM (Chebyshev) UCL	4868
218					SD	5038					97.5% KM (Chebyshev) UCL	6369
219					k star	0.0665					99% KM (Chebyshev) UCL	9317
220					Theta star	20838						
221					Nu star	5.721			**Potential UCLs to Use**			
222					AppChi2	1.499					95% KM (t) UCL	2738
223					95% Gamma Approximate UCL	5291						
224					95% Adjusted Gamma UCL	5562						
225	**Note: DL/2 is not a recommended method.**											
226												
227	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
228	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
229	**For additional insight, the user may want to consult a statistician.**											
230												