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Alameda County
Environmental Health

July 23, 2008

VIA ALAMEDA COUNTY FTP SITE

Mr. Paresh Khatri
Alameda County Health Care Services Agency
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: **Revised Site Conceptual Model and Corrective Action Plan**
Former Exxon Station
5175 Broadway Street
Oakland, California
ACEH Fuel Leak Case No. RO0000139

Dear Mr. Khatri:

On behalf of Rockridge Heights, LLC, Pangea Environmental Services, Inc. has prepared this *Revised Site Conceptual Model and Corrective Action Plan* for the subject site. This report addresses comments provided in your June 10, 2008 letter by updating the Site Conceptual Model provided our *Addendum to Preliminary Results of Site Characterization:Proposed Additional Activities* dated November 8, 2006 and by revising the feasibility study and interim corrective action plan provided in *Pangea's Feasibility Test Report and Interim Remedial Action Plan (IRAP)* dated July 20, 2007.

As you recall from our July 10, 2008 meeting, the property owner is under contract to sell the site and requires agency approval (or an acceptable 'regulatory comfort letter') by mid August to complete the transaction. Pangea offers to meet with you to help explain site conditions and discuss the proposed corrective action. If you have any questions or comments, please call me at (510) 435-8664 or email briddell@pangeaenv.com.

Sincerely,
Pangea Environmental Services, Inc.

Bob Clark-Riddell, P.E.
Principal Engineer

Attachment: *Revised Site Conceptual Model and Corrective Action Plan*

cc: Rockridge Heights, LLC, C/O Gary Feiner, 34 Schooner Hill, Oakland, California 94618
RWQCB – SF Bay Region, Cherie McCaulou, 1515 Clay Street, Oakland, California 94612
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SWRCB Geotracker (Electronic copy)

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REVISED CONCEPTUAL MODEL AND CORRECTIVE ACTION PLAN

Former Exxon Station
5175 Broadway
Oakland, California

July 23, 2008

Prepared for:

Rockridge Heights, LLC
C/O Gary Feiner
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Oakland, California 94618

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REVISED SITE CONCEPTUAL MODEL AND CORRECTIVE ACTION PLAN

Former Exxon Station
5175 Broadway
Oakland, California

July 23, 2008

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1.0 INTRODUCTION

1.1 Background

On behalf of Rockridge Heights, LLC, Pangea Environmental Services, Inc. (Pangea) prepared this *Revised Site Conceptual Model and Corrective Action Plan* (report) for the subject site. The subject property is located at 5175 Broadway Street, at the southwest corner of the intersection of Broadway and Coronado Avenue in Oakland, California in Alameda County (Figure 1). The property has been vacant since 1979 and was formerly occupied by an Exxon Service Station used for fuel sales and automobile repair. This report contains the following:

- An updated Site Conceptual Model (SCM) for the site, incorporating additional soil sampling results and other elements required by the June 10, 2008 letter from the Alameda County Environmental Health (ACEH). This SCM updates the existing SCM which was presented in Pangea's *Addendum to Preliminary Results of Site Characterization: Proposed Additional Activities* dated November 8, 2006;

- A Revised Feasibility Study which identifies two cost-effective remedial alternatives and updates the feasibility study presented in Pangea's *Feasibility Test Report and Interim Remedial Action Plan (IRAP)* dated July 20, 2007;

- A Corrective Action Plan (CAP) that expands on the interim remedial action plan presented in Pangea's *Feasibility Test Report and Interim Remedial Action Plan (IRAP)* dated July 20, 2007, and includes a discussion of cleanup levels and goals for the site; and

- A proposed remedial approach (excavation and biosparging) compatible with the mixed use development with subgrade parking approved by the City of Oakland Planning Department, and an *alternate* remedial approach for insitu remediation (DPE/AS) if future site development does not include a subgrade parking garage (due to recent financial difficulties associated with the housing market, the current property owner is under contract to sell the subject site, and the prospective purchaser may implement the approved mixed use redevelopment plans or pursue other site development).

1.2 Summary of Previous Environmental Investigations

Environmental compliance work commenced when three 8,000-gallon steel single-walled USTs, associated piping, and a 500-gallon steel single-walled waste oil tank were removed in January 1990. Tank Protect

Engineering, Inc. (TPE) conducted the tank removal and observed holes in all four tanks. Groundwater was reportedly observed to stabilize in the UST excavation between 10.5 and 11 feet bgs. Approximately 700 tons of contaminated soil was excavated during tank removal and was subsequently remediated and reused for onsite backfill by TPE. In April 1990, TPE installed and sampled monitoring wells MW-1, MW-2 and MW-3. In June 1991, Soil Tech Engineering (STE), subsequently renamed Environmental Soil Tech Consultants (ESTC), installed monitoring wells STMW-4 and STMW-5. Groundwater monitoring was conducted on the site intermittently until October 2002. A risk assessment study entitled *Conducting Human Health Risk Assessment* was conducted by SOMA in 2004, although the risk assessment methods and exposure pathways used were not considered appropriate by ACEH. Golden Gate Tank Removal (GGTR) performed additional assessment in January and February 2006, including collection of soil and/or groundwater samples from ten onsite soil borings.

In June 2006, the property was purchased by Rockridge Heights, LLC. Pangea commenced quarterly groundwater monitoring at the site in July 2006. Additional assessment was performed by Pangea in January through September 2007, including the destruction of four monitoring wells, installation of fifteen new wells and five exploratory borings to help define the vertical and lateral extent of groundwater contamination, and collection of soil gas and subslab gas samples to assess potential hazards to nearby human receptors. In April 2007, Pangea conducted a dual phase extraction/air sparging test (DPE/AS) to evaluate potentially applicable remedial alternatives for remediating residual site contaminants. Details of the additional assessment are included in Pangea's *Site Investigation Report* dated July 17, 2007, *Soil gas Sampling and Well Installation Report* dated October 23, 2007, and *Additional Soil Gas Sampling Report* dated July 14, 2008. The DPE/AS testing findings are reported in Pangea's *Feasibility Test Report and Interim Remedial Action Plan* (IRAP) dated July 20, 2007.

2.0 SITE CONCEPTUAL MODEL

2.1 Site Conceptual Model Overview

The site and adjacent areas have been subject to past releases of petroleum hydrocarbons that have impacted shallow soil and groundwater and may pose a potential threat to workers and residents at and adjacent to the site. The releases are associated with operation of the site as a gasoline station until 1979. The top of the saturated zone is typically at approximately 10 to 15 feet bgs and groundwater is found within fractured bedrock underlying the site at shallow depth, and in places within clay, silt, sand and gravel that constitutes native soil and fill overlying the bedrock.

A site conceptual model (SCM) is a representation of site conditions that is used to summarize important site issues and provide a guide for future assessment and/or remediation. A site map showing the locations of all sampling points, wells and geologic cross sections is included as Figure 2. Historical soil and groundwater analytical data and groundwater elevation data used to develop the SCM were derived from reports prepared both by prior consultants and by Pangea, are summarized in Tables 1 through 3. Well construction details are summarized on Table 4. Boring logs, well construction diagrams and surveyor's reports for wells and borings drilled at and adjacent to the site are provided in Appendix A.

Figures 3 through 17 illustrate the overall lateral and vertical extent of soil, groundwater and soil gas contamination, and the concentration trends for groundwater contamination. Specifically, Figures 3 and 4 illustrate the distribution of TPHg and benzene, respectively, in shallow soil. Figure 5 shows the groundwater elevation and groundwater sampling results from the most recent (1st quarter 2008) quarterly monitoring event, supplemented by grab groundwater sampling conducted in 2006 and 2007. Figures 6 and 7 show contour maps of the lateral distribution of TPHg and benzene, respectively, in shallow groundwater. Figure 8 is a map showing groundwater elevation and hydrocarbon concentrations in deep groundwater, based on recent monitoring data. Figures 9 and 10 show the lateral distribution of TPHg and benzene in deep groundwater. Concentration trends in representative wells for TPHg and benzene are shown on Figures 11 and 12, respectively. Soil gas results are shown on Figure 13. Figure 14 summarizes the shallow impact in site soil and groundwater. Geologic cross sections showing the vertical distribution of onsite groundwater, soil and soil gas contamination are shown on Figures 15 through 17.

Figures 18 through 22 provide illustrations of the proposed corrective action in conjunction with approved mixed use development. Figures 23 and 24 provide illustrations of alternative corrective action proposed for any future redevelopment without a subgrade parking garage. The primary impact area is also illustrated on Figures 22 and 23.

The following sections describe the SCM, including discussions of the geology and hydrogeology, source of contamination, distribution of groundwater contamination, and potential receptors.

2.2 Site Location and Description

The site is located at the southwest corner of the intersection of Broadway and Coronado Avenue, approximately 0.6 miles south-southeast of Highway 24 and approximately 2.3 miles east of Interstate 80 and the San Francisco Bay. The property is relatively flat lying, with a slight slope to the south-southwest, and lies at an elevation of approximately 160 feet above mean sea level. Topographic relief in the area surrounding the site also slopes generally towards the south-southwest. The western site boundary is the top of an approximately 10 foot high retaining wall that separates the site from an adjacent apartment complex.

The property has been vacant since 1979 and was formerly occupied by an Exxon Service Station used for fuel sales and automobile repair. The site is approximately 13,200 square feet in area with about 10% of the area occupied by a vacant station/garage structure. The majority of the ground surface is paved with concrete and/or asphalt. Land use to the west and northwest is residential, including apartment buildings and single family homes. Properties to the northeast, east and south of the site are commercial. The site and adjacent properties are shown on Figure 2.

2.3 Geology and Hydrogeology

Regional Geology and Hydrogeology

The site lies at the foot of the Oakland Hills on a low ridge composed of Cretaceous sandstone, siltstone, and serpentinite of the Franciscan Complex, as mapped by Graymer (2000). The bedrock is onlapped several hundred feet to the west and southwest of the site by Pleistocene and younger alluvial and fluvial deposits derived from westward flowing streams draining the hills to the east. The Hayward Fault, a major active regional fault of the San Andreas fault system, lies 1.5 miles northeast of the site.

The site lies immediately east of the East Bay Plain groundwater basin. Most of the East Bay Plain is underlain by deep Tertiary depositional basins whose current depocenters are the San Francisco Bay (the San Francisco Basin) and San Pablo Bay (San Pablo Basin) (Figuers, 1998). The site lies on bedrock forming the eastern boundary of the San Francisco Basin. Groundwater in the San Francisco Basin is designated beneficial for municipal and domestic water supply and industrial process, service water, and agricultural water supply.

Local Hydrogeology

Most of the site is underlain at relatively shallow depths by impermeable bedrock composed of fractured Cretaceous sandstone, serpentinite and siltstone of the Franciscan Complex. The bedrock is overlain by variable thicknesses (from 2 to 20+ feet) of native soil and artificial fill, consisting of unconsolidated clay, silt, sand and gravel. Figure 3 is a geologic cross section showing the distribution of these units in the subsurface. The location of the geologic cross section is shown on Figure 2. Prior investigations indicate that the water table intersects the contact between the unconsolidated units and bedrock units, so in some areas shallow groundwater is present in both the unconsolidated units and the bedrock, and in other areas groundwater is present only within the bedrock. The only newly installed well where shallow groundwater was encountered during drilling was well MW-6A, drilled through the backfill of the former UST excavation, where it was encountered at approximately 8 ft bgs and was measured at a depth of 7.17 ft on March 26, 2007. This observation, and similar observations made during prior drilling of shallow wells at the site, indicates that groundwater is present under unconfined conditions within the shallow soil/fill units, and possibly present under unconfined conditions within the shallowest portion of the underlying bedrock.

All of the other newly installed wells (MW-2C, MW-3A, MW-3C, MW-4A, MW-5A, MW-5B, MW-5C, MW-7B, MW-7C, MW-8A, MW-8C, MW-9A, MW-9C and MW-10A) were installed into relatively impermeable clay or bedrock that did not yield evidence of the presence of groundwater during well installation, or were not logged because they were installed within the borings of existing monitoring wells. In general, past investigations have reported that the clay or bedrock sections do not yield appreciable volumes of groundwater, with the exception of thin zones within the bedrock. During drilling of the onsite monitoring wells for which the entire saturated zone is in bedrock (MW-1, MW-2 [now reconstructed as MW-2C] and MW-3 [now reconstructed as MW-3C]), prior consultants reported that bedrock yielded no water, with the exception of thin, discrete, slightly productive water-bearing zones encountered between 20 and 22 feet bgs in MW-1 and MW-2. Water levels rose substantially in these deep wells shortly after completion, and appear to define a southward to southwestward sloping piezometric surface. These observations indicate that the bedrock is relatively impermeable, and that the thin water-bearing zones within the bedrock are permeable layers or fracture zones (i.e.,fracture porosity) of unknown continuity and orientation. Field observations of nearby bedrock outcrops east of the site on the opposite side of Broadway corroborate this interpretation. These thin zones are under *confined* or *semi-confined* conditions on the scale of the well borings, but may be *unconfined* at the scale of the site.

Groundwater Flow

Shallow Groundwater: Based on depth-to-water data collected March 15, 2008, elevation data and the inferred flow directions for shallow A-zone groundwater are shown on Figure 5. As shown on Figure 5, groundwater in A-zone groundwater appears to have mounded in the former UST excavation, and the apparent gradient radiates outwards towards the east, south and west, although regional groundwater flow is generally towards the south and southwest. This observation suggests that the unpaved former UST excavation has acted as a collector for rainwater during the rainy season, and that the asphalt pavement covering the remainder of the site serves to reduce infiltration elsewhere and likely directs rainwater to the unpaved UST excavation area. The March 2008 inferred flow direction in A-zone groundwater is generally consistent with previous quarterly monitoring events.

Deep Groundwater: Elevation data for both B-zone and C-zone groundwater and the inferred flow direction for C-zone groundwater are shown on Figure 8. The horizontal component of flow for the C-zone groundwater is westwards to southwestwards. The elevation of the piezometric surface for deep C-zone wells is lower than elevations for A-zone wells, indicating that a downward gradient is present.

Surface Water

The site lies approximately midway between the southward flowing Broadway and Rockridge branches of Glen Echo Creek, which discharges to Lake Merritt and eventually San Francisco Bay (Sowers, 2000). The Rockridge Branch lies approximately 800 feet west of the site and the Broadway Branch is approximately 800 feet southeast of the site. Both creek branches flow through culverts along much of their lengths. The confluence of the two branches is approximately 2,000 feet south-southwest of the site.

2.4 Source of Contamination

Three 8,000-gallon steel single-walled fuel USTs, associated piping, and a 500-gallon steel single-walled waste oil tank were all observed to have *holes* at the time of their removal in January 1990. Soil samples collected adjacent to and/or below the three fuel USTs contained up to 970 mg/kg total petroleum hydrocarbons as gasoline (TPHg) (Figure 6). No benzene or toluene was detected and only very low concentrations of ethylbenzene and xylenes were present in four of the samples. Samples collected beneath the fuel product piping near the dispenser islands did not contain detectable TPHg, benzene, toluene, ethylbenzene, or xylenes (BTEX). A single sample collected beneath the waste oil tank contained no detectable TPHg, TPHd, BTEX, oil and grease, or halogenated volatile organic compounds.

In February 1990, shortly after removal of the tanks, 700 tons of contaminated soil was excavated from the fuel-UST area shown on Figure 2. It is not known whether confirmation sampling was conducted at this time. This soil was stockpiled for approximately 9 months and, following sampling of the stockpiles and approval by ACEH in a letter dated November 9, 1990, was reused to backfill the tank excavations in November 1990. The records of this sampling are unavailable.

No further releases are known to have occurred at the site since 1990. Separate-phase hydrocarbons (SPH) was observed in 2007 during monitoring of recently abandoned well STMW-4 and during dual-phase-extraction feasibility testing of well MW-3C, indicating that SPH is still present and in contact with groundwater beneath the site.

The leaking fuel USTs and associated contaminated soil were the original source of contamination at the site. SPH and associated residual soil contamination appear to be the primary continuing sources of groundwater contamination.

2.5 Residual Soil Contamination

The primary soil contaminants of concern at the site consist of gasoline-range hydrocarbons and benzene. Residual soil contamination detected in soil samples collected from recently drilled onsite soil borings and monitoring wells, and from previously excavated samples collected during the 1990 tank removal, is illustrated in Figures 3 and 4. Contaminant concentrations are compared to San Francisco Bay Regional Water Quality Control Board (RWQCB) Environmental Screening Levels (ESLs) for shallow or deep soil at a residential or commercial land use permitted site with groundwater that is a potential source of drinking water. Although land use at the site and adjacent buildings along Broadway is currently commercial, adjacent crossgradient properties and some downgradient properties are residential, so cleanup to residential ESLs would apply to contaminants that might migrate westwards from the site.

Historical soil analytical results and ESLs are summarized on Table 1. TPHg concentrations were less than ESLs for all soil samples except for those collected at a depth of 9 feet in borings B-3, B-4 and B-9, at 8 to 14 feet in the boring for well MW-1, and in previously excavated samples in the former UST excavation. TPHg contamination primarily is present in the northwest and northeast portions of the site, and concentrations in the borings ranged from 140 to 190 mg/kg, and had been up to 970 mg/kg in the tank pit area prior to soil removal, exceeding the ESL of 83 mg/kg. While residual soil concentrations beneath the former tank pit are not known, geotechnical boring B-6 found "strong hydrocarbon odor in wet clayey sand with greenish-blue color at 11 to 13 ft depth" according to the July 17, 2007 geotechnical report prepared by others (Appendix B).

Benzene concentrations 1.7 mg/kg, 0.65 mg/kg, and 0.31 mg/kg, were detected in soil from respective locations MW-1, B-3 and MW-8C, and exceeded the ESL of 0.044 mg/kg. Soil analytical results detected low concentrations of petroleum hydrocarbons in select soil samples.

Based on the soil results, residual vadose zone soil contamination appears to be restricted primarily to the northeast and northwest portions of the site, primarily at depths close to the water table elevation, suggesting that a zone of capillary fringe soil contamination at concentrations slightly exceeding ESLs is probably present, as depicted on Figures 15 through 17. Soil sampling efforts within the deeper site subsurface have been limited by the inability to collect adequate 'soil' samples from the rock formation. Given the presence of SPH, elevated hydrocarbon impact in groundwater, and limited plume attenuation over 18 years after UST removal (and source area soil excavation), a significant hydrocarbon source is apparently present in the capillary fringe/upper saturated zone. This primary impact area is also illustrated on Figures 22 and 23.

2.6 Hydrocarbon Distribution in Groundwater

The primary groundwater contaminants at the site are gasoline-range hydrocarbons and benzene. Both TPHg and benzene concentrations substantially exceed RWQCB Tier 1 Final ESLs for groundwater that is a potential source of drinking water. Secondary contaminants that also exceed ESLs are toluene, ethylbenzene, xylenes, and 1,2-dichloroethane (EDC). In particular, TPHg concentrations throughout the site exceed the ceiling ESL of 100 µg/L, and benzene concentrations exceed the ESL of 540 µg/L for indoor air impacts.

Free Product (SPH): A thin layer (up to 0.06 ft) of SPH has been observed in well STMW-4 during three quarters of monitoring. The SPH was generally discovered after initiating well purging but not during initial well gauging. SPH was also detected in newly installed deep well MW-3C after initiating well purging during the second quarter of 2007. One possible explanation of the discovery of SPH in these wells is that well purging induces SPH trapped within the fractured bedrock to enter the well casing. Another possible explanation for SPH in well MW-3C is that dual-phase extraction testing in that well in April 2007 induced downward migration of SPH into the well via bedrock fractures. No SPH have been detected in any other site wells, including well MW-4A, which was subsequently installed (though with a shallower screened interval) in the drilled out borehole of STMW-4.

Contaminant Distribution in Shallow Groundwater: As shown on Figures 6 and 7, *shallow* (A-zone) unconfined groundwater contains petroleum hydrocarbons at elevated concentrations in the following two primary areas near the former UST excavation: 1) a northern area in the vicinity of well MW-4A (the location where free product has previously been observed), and 2) a southwestern area in the vicinity of wells MW-3A and MW-8A and which extends to the southern site boundary in the vicinity of wells MW-7B and MW-7C. This distribution of hydrocarbons in shallow A-zone groundwater is tentatively interpreted to be due to the mounding of groundwater within the uncapped former UST excavation during the rainy season, likely encouraging plume migration radially away from the excavation area into areas that are protected from infiltration by paved surfaces. The lack of elevated hydrocarbon concentrations in well MW-5A and boring B19, both located downgradient from the former UST excavation, is unexpected, and may be due to the presence of a thick, relatively impermeable clay section observed in boring logs of shallow soil in that area that impedes migration of contaminated groundwater in shallow soil in that area (Figure 9). It should also be noted that the northernmost extent of the northeasternmost area has not been completely defined, since boring B-4 contained elevated hydrocarbon concentrations. The southward offsite extent of the southernmost area appears *not* to extend a significant distant offsite since wells MW-9A and MW-9C did not contain significant concentrations of TPHg or benzene. This conclusion is tentative since downgradient borings drilled on the other side of Broadway were unable to reach groundwater due to refusal during drilling.

Contaminant Distribution in Deeper Groundwater: As shown on Figures 6 and 9, the distribution of *deep* groundwater containing elevated concentrations of petroleum hydrocarbons differs significantly from the distribution of hydrocarbons in shallow groundwater. High levels of contamination within deeper (B- and C-zone) groundwater only appear to be present in the central and southern, downgradient portion of the site, based on elevated hydrocarbon concentrations detected in wells MW-3C, MW-7B and MW-7C. The lateral extent of the deeper contamination appears to be well defined, except in the downgradient, offsite direction. It should also be noted that because permeable zones within the bedrock are thin, discrete permeable layers and fractures, the impacted groundwater within the bedrock shown on the cross sections (Figures 15, 16 and 17) is likely to be *less extensive* than depicted on the cross sections, and to be present only within narrow permeable preferential pathways within the shown impacted areas.

Vertical Distribution of Contaminants: Evaluation of concentration data from shallow/deep well clusters suggests that the *shallow groundwater is more impacted than the deeper groundwater* for much of the site.

- In the impacted area *north* of the UST source area, benzene concentrations are higher in shallow A-zone well MW-4A (Figure 7) than in deeper well MW-1 (Figure 10) screened in the B- and C-zones.

- In the *western* downgradient area between the source area and the adjacent offsite residence (MW-8A/8B well pair), hydrocarbons are significantly higher in shallow well MW-8A, in comparison to those measured in deeper well MW-8C, screened in bedrock.

- In the *southeastern* corner of the site (MW-5A/5B/5C well cluster) downgradient of the source area, negligible contaminants were detected in A-zone well MW-5A, slightly greater but still negligible concentrations were detected in well MW-5B, and no hydrocarbons were detected in deep well MW-5C.

- In the source area and *central* portion of the site (MW-3A/3C well cluster), benzene concentrations are higher in shallow A-zone well MW-3A than in deep well MW-3C. Benzene concentrations in wells MW-3A and MW-3C are higher than in abandoned well MW-3, which had a maximum benzene concentration of 770 μg/L within the past 15 years (MW-3 was screened across the A-, B- and C-zones). This data suggests that contaminants have migrated downward through bedrock fractures in this area so that deeper groundwater has been impacted in this area. However, since well MW-3 was reportedly installed dry due to low permeability and lack of water encountered during drilling, it is unlikely that significant contaminant mass is present at this location.

- The *deeper* groundwater zone within the fractured bedrock apparently has limited contaminant mass due to limited permeability and low water yield during well purging (wells MW-5B, MW-7B, MW-7C, and MW-8C all dewatered after purging 1 or 2 well volumes). These wells also produced little water during well development and DPE testing (reported separately).

Groundwater Contaminant Concentration Trends: Review of the historical groundwater concentration data (Figures 11 and 12) indicates that although substantial concentration fluctuations have occurred in site wells since monitoring began in 1989, no consistent concentration trends have been observed, and concentration data collected in 2007 are generally of similar magnitude to earliest concentration data very low and that natural attenuation mechanisms have not been effective in reducing contaminant concentrations. This observation suggests that groundwater velocities at the site are very low and that natural attenuation mechanisms have not been effective in reducing contaminant concentrations.

MTBE Not a Concern: MTBE was *not* detected in sampled groundwater and it is not a compound of concern at this site.

2.7 Hydrocarbon Soil Gas Distribution

Soil gas/subslab gas sampling events were conducted in September 2007 and June 2008 at and adjacent to the site to assess the potential for vapor intrusion hazards at the adjacent properties south and west of the site. The sampling locations, shown on Figure 13, included seven shallow soil gas locations (SG-1 through SG-7) and two subslab gas locations (SS-1 and SS-2). Sample depth intervals and soil gas analytical results are summarized on Table 3. Detailed descriptions of these sampling events are provided in Pangea's *Soil Gas Sampling and Well Installation Report*, dated October 23, 2007 and *Additional Soil Gas Sampling Report*, dated July 14, 2008. All gas samples were collected in Summa canisters and were analyzed by Total Organics Method 3 (TO-3) for total petroleum hydrocarbons as gasoline (TPHg) and by Total Organics Method 15 (TO-15) for benzene, toluene, ethylbenzene, xylene(s) (BTEX) and isopropanol. The sampling apparatus for each sample was placed within a shroud sealed to the ground surface in which an isopropanol leak tracer atmosphere was maintained and sampling was conducted in accordance with the Department of Toxic Substances Control/Cal – EPA, *Vapor Intrusion Guidance Document – Final Interim,* December 15, 2004 (DTSC Guidance), and the DTSC and California Regional Water Quality Control Board, Los Angeles Region joint guidance document entitled, *Advisory – Active Soil Gas Investigations*, dated January 28, 2003 (Advisory).

Isopropanol was detected in four of the eleven samples so the Summa canister samples collected from within the leak tracer shrouds for these samples were also analyzed for isopropanol. The results from these samples indicated a maximum calculated apparent ambient air leak of 0.7%, which is considered negligible , therefore, the soil gas results all appear representative of subsurface conditions.

Contaminant concentrations detected in the soil gas probes were compared to the shallow soil gas Environmental Screening Levels (ESLs) established by the San Francisco Regional Water Quality Control Board (RWQCB). The subslab sample results were compared to the ESL for indoor air multiplied by 100 (multiplying the indoor air ESL by 100 is to compensate for subslab air having to travel through the concrete slab to reach potential receptors) in accordance with DTSC Guidance.

As shown on Figure 13 and in Table 3, the soil gas and subslab gas sampling results show that vapor concentrations significantly exceed applicable ESLs indicating that potential vapor intrusion hazards may be present in the vicinity of the adjacent apartment building to the west of the site at 5230 Coronado Avenue. Pangea notes on Figure 15 that the lower level of that building has a concrete floor and is used for storage, not occupancy; therefore, this building use will mitigate potential hazards to upstairs occupants. Benzene concentrations in *subslab* soil gas samples at and adjacent to the commercial property to the south slightly exceed conservative RWQCB ESLs in the first round of sampling, and both samples were non-detect during the second round of sampling, indicating only a slight possibility of vapor intrusion impacts at that location. Elevated soil vapor concentrations observed in site wells during DPE testing in April 2007, also shown on Figure 13, indicate that significant residual impact is present in the capillary fringe and saturated soil (Note that these vapor concentrations are not fully comparable to soil gas concentrations obtained from shallower gas probes with limited purging methods).

2.8 Feasibility Testing

Feasibility testing was conducted to help determine if the site could be remediated with in situ techniques before, during or after site redevelopment. The testing has facilitated the evaluation of the following in situ remedial techniques: dual phase extraction (DPE), soil vapor extraction (SVE), groundwater extraction, and air sparging/biosparging. The results of the feasibility testing are described in detail in Pangea's *Feasibility Test Report and Interim Remedial Action Plan*, dated July 20, 2007, and summarized briefly below.

In April 2007, Pangea performed DPE pilot testing from selected site wells to evaluate whether DPE and related in situ remedial technologies effectively remove residual hydrocarbons from beneath the site. DPE is a technology that simultaneously extracts soil vapor and groundwater under high vacuum in the same process stream. DPE testing can also evaluate soil vapor extraction and groundwater extraction techniques. DPE was evaluated as a possible remedial alternative because previous assessments demonstrated that petroleum hydrocarbons are present at depths below the water table and soil vapor extraction without water table depression would not be sufficient to remove these hydrocarbons. While performing DPE testing, Pangea also performed limited air sparge (AS) testing on select site wells.

Specific goals of the DPE pilot test were to determine:

- Groundwater extraction rates under vacuum and the extraction rate necessary for dewatering hydrocarbon-impacted soils below the water table;
- Soil vapor extraction vacuum and flow rates;
- The estimated radius of influence for the applied vacuum;
- Vapor-phase hydrocarbon concentrations and trends in extracted vapor; and
- Contaminant mass removal rates.

Specific goals of the AS pilot test were to determine:

- If air injection improves contaminant removal rates during DPE;
- Air delivery pressure required to induce air flow in the water-bearing zone; and
- The effective radius of influence of air sparging.

Testing was conducted using a 25-horsepower liquid-ring vacuum pump to extract soil vapor and groundwater from selected site monitoring wells. For AS testing, a 2-horsepower reciprocating air compressor was used to provide compressed air. An adjustable flow regulator and flow meter were used to regulate air flow and pressure from the compressor to the injection wells. DPE testing was performed for a total of 85 hours on selected site wells. Short-term testing (tests of less than 4 hours in duration) on individual wells was performed from wells MW-3A, MW-4A, MW-7B, MW-7C, MW-8A and MW-8C. Long-term testing was performed from well MW-3C for approximately 28 hours, and simultaneously from wells MW-3C, MW-4A, MW-7B and MW-8A for approximately 24 hours. Applied vacuum rates ranged from 19 to 27 inches of mercury ("Hg). Soil vapor extraction flow rates ranged from 14 cubic feet per minute (cfm) to 77 cfm.

Groundwater Extraction Rates: Groundwater extraction rates observed during testing were below 0.5 gallons per minute (gpm) from all wells. Since much of the extracted water was located within the well borehole at the start of testing, the groundwater extraction rates at the end of the test were significantly lower. Given the total water extraction of 899 gallons, the average groundwater extraction over the 85 hour test duration was approximately 0.15 gpm (which included simultaneous extraction from multiple wells).

Vapor-Phase Hydrocarbon Removal Rates: Based on laboratory analytical data and extraction flow rates, vapor-phase hydrocarbon mass removal rates in individual wells ranged from approximately 3.5 to 7 pounds per day (ppd) for tested A-zone wells, and from approximately 0.3 to 2.5 ppd for C-zone wells. A temporary removal rate of 51.2 ppd was observed during initial combined extraction from wells MW-3C, MW-4A, MW-7B and MW-8A. This removal rate is based on the laboratory analysis from the beginning of test when the corresponding FID reading was >10,000 ppm. Since the FID readings reduced significantly during the test (reduced to 1,787 ppm after 2.7 hours of testing started), the removal rate likely reduced to a corresponding rate of approximately <9 pounds per day. When air sparging commenced the following day, the hydrocarbon concentrations (as measured by FID) increased from 1,907 ppm to a maximum of 2,687 during the hour-long combined DPE/AS test. This suggests that air sparging improved contaminant removal rates by approximately 40%.

Vacuum Radius of Influence: During DPE testing, Pangea collected vacuum radius of influence measurements from selected observation wells in the vicinity of the extraction wells. Radius of influence measurements were collected during DPE testing from wells MW-3A, MW-3C, MW-4A, MW-5A, MW-6A, MW-7B, MW-8A and MW-8C. Vacuum influence measurements above background readings were measured in only two wells during the DPE testing: in MW-1 during extraction from MW-4A, and in MW-8C during extraction from MW-3C. For these wells, the vacuum influence was measured in C-zone wells with the well screens totally submerged beneath several feet of water. The observed vacuum is likely indicative water level drawdown in the observation wells rather than vacuum influence in the contaminant smear zone or vadose zone soil. While the vadose-zone A-zone wells are not nearby to facilitate better evaluation of vacuum influence, other DPE data can be used to evaluate DPE effectiveness. In addition, the presence of the backfill within the former excavation cavity in the center of the site could also encourage short-circuiting during vapor extraction.

Water Table Drawdown during DPE Testing: Pangea also collected water levels from selected observation wells in the vicinity of the extraction wells. During extraction from MW-3A, the water level in MW-3C (located approximately 13 ft away) dropped 0.11 ft after 3.75 hours of testing, while the water level in well MW-5A (located approximately 54 ft away) rose 0.09 ft during the same time period. The water level decrease in MW-3C seems reasonable, while the increase in well MW-5A may be an aberration. During long-term extraction testing from MW-3C, the water level in well MW-5C (located approximately 60 ft away) dropped 0.71 ft after approximately 24 hours of continuous extraction. This data indicates that limited dewatering via DPE is possible at the site, and that, if DPE were implemented, the extraction well network necessary would need to be closely spaced to ensure adequate dewatering to expose impacted soil to vapor extraction via DPE.

Air Sparging Injection and Influence Testing: Short-term air sparge testing was performed on selected site wells on April 25, 2007 to determine the effective radius of influence of air sparging and the air delivery pressures required to induce air flow in the water-bearing zone. Pangea initially performed air sparge testing without DPE on deep C-zone wells MW-7C and MW-8C for approximately 1.5 hours each. A delivery pressure of 40 pounds per square inch (psi) in well MW-7C yielded a pressure rate of >1 psi in nearby well MW-7B (Well MW-7B has a 3-foot screened interval installed from 15.5 to 18.5 ft bgs, and approximately 1.5 feet above the screened interval of MW-7C, which is installed from 20 to 25 ft bgs). During air injection in well MW-8C, also screened from 20 to 25 ft bgs, no air pressure influence was observed in site observation wells MW-1, MW-3C, MW-6A or MW-8A, located 5 to 71 feet away. In conclusion, AS results indicated that a relatively high air pressure is required to induce very little air flow rate. This observation is consistent with the limited average groundwater extraction rate of 0.15 gpm or less after initial well dewatering. This result is not surprising given that the prevalence of fractured bedrock/mudstone in the sparged C-zone wells.

Air Sparging Effect on Contaminant Removal Rates: To evaluate whether air injection improved contaminant removal rates during DPE, Pangea performed air sparging during DPE. The first test involved air sparging in well MW-3C for 1.5 hours during DPE on nearby well MW-3A on April 25, 2007. Based on flame-ionization detector (FID) measurements of extracted vapor within MW-3A, hydrocarbon concentrations increased from 294 parts per million by volume (ppmv) before sparging to 1,775 ppmv approximately 30 minutes after sparging commenced. This represents an increase of 500%. While leakage of the pre-sparge laboratory bag sample prevented confirmation of the concentration increase using analytical results, prior MW-3A removal rates without sparging (0.5 ppd) were about 5 times lower than removal rates during sparging (2.5 ppd). Following the DPE/sparging test on MW-3C and the prior air injection testing on wells MW-7C and MW-8C, Pangea commenced DPE in wells MW-3C, MW-4A, MW-7B and MW-8A. The resultant contaminant removal rates upon DPE start up were 51 ppd, which represents an approximate 250% increase over prior observed removal rates of an assumed maximum of approximately 20 ppd (the combined maximum removal rate from each DPE well individually). Note that this increased removal rate is not during active air sparging, and that the removal rate likely reduced to a corresponding rate of approximately <9 pounds per day. (based on FID readings reducing from >10,000 ppmv to 1,787 ppmv after 2.7 hours of testing). The significant decrease in removal rate is likely due to the stoppage of air sparging, and due to capture of subsurface vapor injected into the subsurface (including DPE well MW-3C) previously during sparging. When air sparging testing resumed, the hydrocarbon concentrations (as measured by FID) increased from 1,907 ppm to a maximum of 2,687 during the hour-long combined DPE/AS test (a contaminant removal rate increase of approximately 40%). Pangea concludes that air sparging improves contaminant removal achieved by DPE, but limited pressure influence data suggests that a dense network of DPE extraction wells are merited to help ensure vapor capture.

2.9 Conduit Study

To evaluate the potential for contaminant migration via preferential pathways, GGTR surveyed subsurface utilities in the vicinity of the site and compared utility depths to groundwater depth in site monitoring wells. This survey was reported in the GGTR *Workplan for Additional Site Characterization* dated September 12, 2005, which concluded that it is unlikely that utilities serve as preferential pathways for migration of contaminated groundwater. Conduits identified by GGTR are shown in Figure 2.

2.10 Current Receptors

A risk assessment study conducted by SOMA (*Conducting Human Health Risk Assessment*, dated February 17, 2004) concluded that the *primary human health risk was inhalation by residential receptors of benzene* volatilized from site groundwater, and that concentrations measured in site monitoring wells were below thresholds of concern for those receptors, with the exception of well STMW-4. In an October 6, 2004 letter, the ACEH requested modifications to the risk assessment method used by SOMA and consideration of soil exposure pathways not considered by SOMA in future risk assessment work. ACEH also indicated that further risk assessment efforts should be postponed until additional site characterization work was completed. In addition, the recent grab groundwater sampling data collected by GGTR indicated that chemicals of concern may be present at the downgradient edge of the site at concentrations exceeding those found in site monitoring wells. It should also be noted that the high levels of petroleum hydrocarbons (230,000 ug/L TPHg, 13,000 ug/L benzene) detected in the GGTR grab groundwater sample (B-11) collected at the downgradient edge of the site significantly exceeded those concentrations previously detected onsite; these results increase the possibility that vapor intrusion hazards may be present for the residential pathway discussed by SOMA, or potentially for workers in commercial buildings, since the California Regional Water Quality Control Board (CRWQCB) Environmental Screening Levels (ESL) for the commercial or industrial land use vapor intrusion pathway is 540 µg/L for benzene in groundwater.

Land use at the site and adjacent buildings along Broadway is currently commercial, so, in the absence of an approved risk assessment, commercial ESLs are applicable for assessing sampling data immediately downgradient (south) of the site. However, with residential properties located west of the site in the down/crossgradient direction, residential ESLs would apply to contaminants that might migrate west from the site. The Final ESLs for TPHg and benzene, the primary site contaminants, are the same for commercial and residential land use for shallow and deep soil where groundwater is a potential source of drinking water.

2.11 Planned Site Development and Potential Future Receptors

Rockridge Heights, LLC, has received approval from the City of Oakland Planning Department to redevelop the former service station site into a mixed commercial and residential building with subgrade parking. The approved development would involve excavating the entire site to approximately 11 feet depth to install a parking subgrade parking garage. The redevelopment schedule will follow the excavation phase of the CAP discussed below, and the CAP proposes engineering controls (e.g., subslab ventilation) to mitigate the potential impact to human health.

The proposed corrective action plan would be conducted in conjunction with planned site redevelopment to help control corrective action costs. For example, the site development will include a subsurface garage to approximately 11 feet depth, avoiding the need for import and compaction of clean backfill material for 11 ft and shallower. In addition, the planned garage excavation to approximately 11 feet depth across the site (upon completion of contaminated soil excavation) would facilitate the cost-effective installation of a subgrade vapor and/or water collection system, and will minimize the length of any additional wells required for site remediation or monitoring beneath the site.

The commercial space is intended to be occupied by low-intensity food service (like a coffee shop) and other residential-oriented retail services. We anticipate that the 3,000 square foot space would ultimately be divided into two, or at most three, separate commercial units that front onto Broadway. The second half of the first floor is proposed as residential units; as are the second, third and fourth floors. The residential units would all be condominiums, anticipated to sell in 2009-2010.

The approved development would include commercial and residential receptors similar to those currently present at adjacent properties. Risk pathways for those receptors would be the same as current receptors, except that development would afford the opportunity to install mitigation measures (e.g, subslab venting system and/or vapor barrier). The subgrade parking structure may also include a water-proof barrier to prevent water (and vapor) from entering the subgrade garage; the other water control technique could include a dewatering system with permitted discharge of groundwater. Therefore, the subgrade excavation and mitigation measures would reduce the overall risks to the receptors, and also allow installation of active subslab remediation systems. The excavation and subslab remediation system should eventually reduce contaminant concentrations at site boundaries, and thereby reduce (through diffusion and oxygenation) adjacent offsite concentrations and hazards.

2.12 Prospective Property Sale and Possible Alternate Site Development

Due to recent financial difficulties associated with the housing market, the Rockridge Heights, LLC is under contract to sell the subject site. The prospective purchaser may implement the approved mixed use redevelopment plans, or pursue other site development. Alternate site development may include commercial site use and/or no subgrade parking structure. Pangea offers an alternate site remediation approach in the event of alternate redevelopment without a subgrade structure.

2.13 Site Conceptual Model Summary

The information given above is the basis for the following conceptual model describing the distribution and fate of contaminants for the site.

- The primary source of contamination was apparently leaks associated with the USTs and/or product piping at the site. The USTs and piping were removed in 1990 and 700 tons of contaminated and/or overburden soil was excavated, remediated onsite and replaced. Residual hydrocarbons represent an ongoing source of contamination.

- Recent efforts have well characterized the extent of hydrocarbons in soil, groundwater and soil gas. The southern, downgradient extent of contamination has been delineated by offsite wells MW-9A, MW-9C and MW-10A. Additional efforts to delineate offsite groundwater were hampered by drilling refusal due to the presence of bedrock.

- The primary chemical of concern (COC) at the site is *benzene*, which could potentially represent a vapor intrusion hazard to offsite receptors and future onsite receptors. Secondary COCs are TPHg, toluene, ethylbenzene, xylenes, and 1,2 dichloroethane, which all exceed Final ESLs for residential and/or commercial sites where groundwater is a potential drinking water source. The primary impact concern is hydrocarbon concentrations exceeding ESLs for soil, groundwater, and soil gas, as well as separate-phase hydrocarbons (SPH) present near abandoned well STMW-4 and existing well MW-3C. The maximum SPH thickness measured in well STMW-4 was 0.06 ft in October 2006, while a 0.02 ft thickness of SPH was observed in well MW-3C following DPE testing in April 2007. It is possible that short-term DPE testing induced downward migration of SPH and dissolved hydrocarbons, although deeper groundwater concentratons have generally returned to pre-test levels.

- Vadose zone soil (approximately 0 to <9 ft bgs) is relatively uncontaminated and is unlikely to represent a significant threat to human health. Several soil samples slightly exceeded ESLs, but these samples were from 9 ft bgs and likely represent the top of the capillary fringe. However, elevated soil gas concentrations are present onsite and west of the site. Saturated soil impact is likely greatest within the range of the historical capillary fringe, although additional impact is also likely present with bedrock fractures.

- Groundwater is apparently present under unconfined conditions within the surficial soil and fill, and under semi-confined or unconfined conditions within bedrock fractures. Shallow groundwater may flow radially from the former UST area. Groundwater flows generally westwards to southwards primarily through clay, silt, sand and gravel near the water table, and through fractures in relatively impermeable bedrock below approximately 10 to 15 feet bgs. In parts of the site, the top of bedrock is above the water table, so groundwater in those locations flows only within the bedrock. The observed removal rate during DPE testing was approximately 0.15 gpm.

- Approved site development would result in onsite receptors and risk pathways essentially the same as existing receptors on adjacent properties. However, implementation of the approved development would help facilitate cost-effective remediation and the installation of engineered mitigation measures that would lower the risks for both onsite and offsite receptors.

3.0 CLEANUP LEVELS AND GOALS

With residual free product (SPH), elevated contaminant concentrations in soil, groundwater and soil gas that exceed RWQCB ESLs, and currently ineffective natural attenuation onsite, the *overall* remedial objective is to perform active remediation to provide sufficient source removal to achieve site cleanup levels and facilitate ultimate achievement of final site cleanup goals. The *short-term* remedial objective for this site is to achieve site cleanup *levels* and satisfy regulatory criteria to allow site development and subsequent building occupancy. The *long-term* objective is to provide sufficient source removal to justify regulatory case closure and achieve cleanup *goals* (water quality objectives) within a reasonable time.

For discussion purposes, the cleanup *level* is considered the contaminant concentration at which active remediation efforts are discontinued, while the cleanup *goal* is the ultimate contaminant concentration achieved after post-remediation monitoring and/or after natural attenuation further remediates residual contaminants within a reasonable time in the future. Using an example of benzene in groundwater, the proposed active remediation cleanup *level* is 540 ug/L (the RWQCB ESL protective of indoor air for residential receptors), while the tentative cleanup *goal* is 1 ug/L (the ESL protective of drinking water beneficial use). With this example, site cleanup would discontinue when benzene concentrations in groundwater are reduced to <540 ug/L, but case closure would be granted when monitoring indicates that benzene concentrations should reach 1 ug/L within a reasonable time. In summary, this example uses a final ESL where groundwater is *not* a current or potential source of drinking water as the cleanup *level,* but retains the final ESL for drinking water protection as the cleanup *goal*.

The proposed cleanup *levels* and cleanup *goals* for this site, along with recent maximum contaminant concentrations and the basis for the proposed cleanup levels andgoal are presented on Table 5. For soil gas and groundwater, the proposed cleanup *level* is the ESL for indoor air protection assuming residential site use due to elevated hydrocarbon beneath the subgrade residences immediately west of the site. The cleanup *level* for soil and the cleanup *goal* for soil and groundwater is the final ESL for sites where groundwater *is* a potential drinking water resource (these ESLs for soil and groundwater are identical for residential and commercial site use under drinking water resource sites). The only deviation to the above discussion is the proposed cleanup *level* for TPHg/TPHd in groundwater, for which Pangea defers to the soil gas ESL for protection of indoor air (consistent with RWQCB guidance) and for which Pangea proposes a TPH cleanup level of 1,000 ug/L. Using a TPH cleanup level of 10 times the final ESL of 100 ug/L means that TPH concentrations would only need to attenuate/decrease one order of magnitude to reach the cleanup goal. To confirm that soil gas concentrations have decreased to below established levels/goals, Pangea proposes the collection of final confirmation soil gas samples at least one week after shutdown of any active remediation.

Pangea offers the following contingent cleanup *levels/goals* in the event that site remediation achieves soil gas cleanup *levels* but hydrocarbon concentrations in groundwater (or in the system influent) reach asymptotic levels above the cleanup level. Under this scenario Pangea will request case closure by virtue of achieving *low-risk closure criteria for groundwater cases* consistent with RWQCB guidance. The low-risk closure criteria requires source removal, adequate site characterization, plume stability, and no significant risk to human health or the environment posed by residual contaminants. Furthermore, since the current cleanup goals for soil and groundwater are based on ESLs protective of potential drinking water use, it may be appropriate at that time to further evaluate groundwater yield to determine if non-drinking water ESLs could be applicable to this site (e.g., the de-designation of site groundwater as a potential drinking water source).

4.0 REVISED FEASIBILITY STUDY

Pangea offers this evaluation of the appropriateness and cost effectiveness of several remedial alternatives for site remediation. Our evaluation of remedial alternatives is based on our review of subsurface conditions and recent dual-phase extraction (DPE) feasibility testing described above.

Consistent with California UST Cleanup Fund guidelines, Pangea recommends implementation of the most cost-effective remedial alternative to achieve site cleanup levels and goals. As detailed below, the most cost-effective cleanup involves site excavation and biosparging in conjunction with the approved mixed use site development. The second most cost-effective approach is insitu remediation using dual phase extraction and air sparging (DPE/AS). Again, due to financial difficulties in the housing market, the current site owner is under contract to sell the site, and the prospective purchaser may implement the approved mixed use redevelopment plans or may pursue other site development. If the future development does *not* include extensive subgrade excavation (with its associated remediation cost savings), the most cost-effective alternative is the insitu DPE/AS approach.

4.1 Evaluation of No Action Alternative

The “no action” alternative is presented here as a baseline for the alternatives discussed below. However, this alternative is considered to be unrealistic and unacceptable because, as noted in the SCM described above, free product is present at the site and petroleum hydrocarbon concentrations in onsite groundwater, offsite soil gas, and offsite subslab vapor samples all exceeded applicable ESLs. It is reasonably certain that soil gas samples collected within the contaminated onsite areas would indicate even greater vapor intrusion hazards than is currently indicated for the soil gas samples from offsite/site periphery. These findings clearly indicate a continuing threat to water quality goals and human receptors. Active remediation is merited to reduce the threats to human health on the subject property and adjacent properties.

4.2 Evaluation of Monitored Natural Attenuation

As described in the SCM above, free product is still present beneath the site and petroleum hydrocarbon concentrations in groundwater have remained relatively constant over more than a decade, indicating that natural attenuation mechanisms have not been effective and are unlikely to become effective under current site conditions. In any case, monitored natural attenuation (MNA) is not considered by the regulatory agencies to be acceptable unless significant source removal has been accomplished. Without the removal of residual free product and soil contamination (primarily capillary fringe and saturated soil) that is impacting groundwater, MNA is not a viable alternative.

4.3 Evaluation of Soil Vapor Extraction

Soil vapor extraction (SVE) is a common approach for remediating unsaturated soil. This approach uses an aboveground vacuum pump to extract vapor-phase hydrocarbons from the site subsurface. SVE can also remediate hydrocarbons adsorbed to unsaturated soil that could pose a risk to groundwater quality. At sites with a fairly permeable capillary fringe and saturated zones, SVE can improve groundwater quality and can remove floating, separate-phase hydrocarbons. When saturated zone remediation is required, SVE is commonly combined with other technologies such as air sparging or groundwater extraction. Extracted vapors are typically treated aboveground with oxidizers or activated carbon.

Site Specific Evaluation: Based on the high vacuum required to induce low soil vapor flow rates (and lack of consistent vacuum influence) observed during DPE testing, SVE alone would not be feasible without dewatering provided by submersible pumps (e.g., groundwater extraction) or by a large aboveground vacuum pump (e.g., dual phase extraction). This is a common result for sites with low permeability soil types as encountered beneath the site. Also, the fact that significant hydrocarbon impact is present below the water table and therefore not available for removal via SVE, this technology is not an appropriate remedial alternative for the site.

4.4 Evaluation of Groundwater Extraction

Groundwater extraction (GWE) is a common approach for remediating hydrocarbon impacts to groundwater, especially where MTBE removal or hydraulic control is required. GWE relies on submersible groundwater pumps to extract subsurface groundwater for aboveground treatment and disposal, which can be costly. GWE was used extensively in the 1980's and early 1990's before being displaced by more cost-effective in situ treatment methods, such as soil vapor extraction (SVE), air sparging (AS), dual phase extraction (DPE), oxidation, and enhanced biodegradation. GWE is often implemented to facilitate remediation and hydraulic control of MTBE, given MTBE's high solubility and low adsorption rates. GWE is also conducted in conjunction with SVE (sometimes called dual-phase extraction [DPE] or two-phase extraction [TPE]) to help dewater the hydrocarbon smear zone and expose hydrocarbons for vapor extraction. This approach typically requires a network of extraction and discharge piping and equipment to extract, treat and dispose of the extracted water and vapor.

Site Specific Evaluation: Pangea does not recommend GWE alone as a remedial option at this site for the following reasons: (1) MTBE is not a primary constituent of concern at this site, so GWE is not necessary for plume control of MTBE impacts, and (2) groundwater production rates observed in site wells during DPE testing were extremely low, so hydrocarbon mass removal rates via GWE would be correspondingly low. If GWE were to be implemented at the site, a closely-spaced extraction well network with appropriately screened well casings would be required to target hydrocarbon-impacted areas beneath the site. Even with an extensive extraction well network, it is unlikely that GWE alone would be more than marginally effective at remediating the site because of the presence of fractures in the subsurface bedrock and the suspected higher permeability materials in the former excavation area that allow for preferential air flow from areas with little or no hydrocarbon impact. Very importantly, GWE has the potential to induce downward migration of SPH and dissolved hydocarbons, which was apparently observed to occur as a result of groundwater extraction during DPE testing. Given the required dense well spacing and limited groundwater yield, DPE (using a large aboveground vacuum pump) would be more cost effective to expose saturated materials for vapor extraction than using submersible pumps in multiple wells.

In conclusion, Pangea recommends considering GWE as a contingency to expose vapor collection piping proposed beneath the planned subgrade garage. The development may include a GWE as part of a dewatering system to prevent groundwater intrusion into the garage. Any dewatering system would include permitted discharge of treated groundwater.

4.5 Evaluation of Air Sparging and Biosparging

Air sparging (AS) is a common technique for cost-effectively remediating petroleum hydrocarbons from saturated soil and groundwater. AS involves the injection of compressed air into the saturated zone to ‘strip’ hydrocarbons from saturated soil and groundwater for capture by SVE or DPE. AS also oxygenates groundwater, and thereby stimulates hydrocarbon degradation. AS is generally more cost effective than groundwater extraction because no large extraction and treatment equipment is required with AS, and system operation and maintenance costs are low. AS wells are typically constructed with well screens starting approximately 10 feet or more below the water table, and well screen intervals are carefully selected to allow capture of hydrocarbon vapors created by sparging. Low-flow AS (known a biosparging) can be performed to stimulate hydrocarbon biodegradation for additional cost-effective remediation.

Biosparging, also known as low-flow air sparging, is a technique used to stimulate degradation of residual contaminants that slowly diffuses out of fine-grained materials at a given site. Biosparging can cost effectively remediate petroleum hydrocarbons from saturated soil and groundwater, and can even help remediate vadose zone soil (a process called bioventing). Biosparging involves the injection of compressed air at low flow rates (generally 1 to 2 cubic feet per minute per injection point) into the saturated zone to oxygenate groundwater and thereby stimulate contaminant biodegradation by microbes present in the subsurface. The low air flow rate is designed to oxygenate groundwater within the well and/or surrounding formation while minimizing the potential for causing any significant migration of contaminants in the vapor phase.

Biosparging wells are typically constructed with well screens starting approximately 5 to 10 feet below the water table, with a screened interval of 1 to 2 feet in length. The submerged well screen allows the injection of air directly into the formation for a greater influence area. Biosparging can be conducted into groundwater monitoring wells screened at shallower depths, but this approach provides a more limited influence area and primarily oxygenates the well water and relies on the diffusion of dissolved oxygen from the well into the surrounding soil. Biosparging in existing monitoring wells is also more dependent upon the groundwater velocity at a site.

Biosparging is very cost effective since the remedial approach only involves procurement of a small to medium-sized air compressor to inject air into the subsurface, and use of existing or new wells screened into the water table at appropriate depths. This approach is most cost effective if existing wells are appropriately screened and subsurface piping installation is minimal.

Site Specific Evaluation Air sparging test results suggest that air injection could likely influence the deeper fractured bedrock at the site. If the site is developed with the approved mixed use building and a subgrade parking garage, biosparging could also be performed to oxygenate groundwater within the permeable excavation backfill material following removal of the primary source material via site excavation. Therefore, further consideration of biosparging is recommended. In addition, if future development does not include significant excavation for a subgrade structure, Pangea recommends further consideration of air sparging to augment site remediation.

4.6 Evaluation of Excavation (with Biosparging)

Excavation is a proven and effective technique for remediating shallow petroleum hydrocarbons. Excavation is most appropriate for low permeability soil, where insitu remedial techniques are generally ineffective. Excavation is also a cost effective option for undeveloped sites such as this, where the excavation area is accessible and not beneath site facilities. Excavation can remove unsaturated soil, capillary fringe soil, and saturated soil. Excavated soil is usually transported offsite for disposal, but soil can be treated and reused at the site in accordance with regulatory guidelines and with regulatory approval.

Site Specific Evaluation: As a vacant lot with relatively shallow impacted soil of low permeability, excavation is an appropriate alternative to consider. Especially since insitu techniques such as DPE have somewhat limited effectiveness based on site test results. And with the planned site development, the cost to implement excavation can be reduced as follows: 1) no import material or soil reuse/compaction would be required for the upper 10 feet of the site due to the planned parking garage, 2) planned shoring will make more impacted soil more readily accessible, and 3) the demolition of the existing vacant structure will help expose the impacted area under the building for excavation, and 4) it will facilitate cost-effective installation of subgrade water/vapor collection systems and vapor barriers. Since the excavation extent will likely not fully target the secondary impact in deeper bedrock/soil, biosparging can augment site excavation for site remediation. Therefore, Pangea recommends further consideration of excavation with biosparging. A cost evaluation for this approach with or without subgrade development is presented below.

Cost Evaluation for Excavation with Approved Subgrade Development: To target primary impact areas (and portions of secondary impact), Pangea evaluated the excavation of 6,450 tons of soil down to a depth of approximately l5 ft. The extent of the evaluated excavation is shown for the northeastern and south-central portions of the site in plan view on Figure 18 and in cross-sectional view on Figures 15, 16 and 17. The excavation would remove heavily impacted source material, potentially to the point where residual hydrocarbons can attenuate naturally. To target residual contaminants in deeper soil and groundwater and in offsite groundwater beyond the anticipated extent of the excavation, Pangea recommends biosparging. The excavated subgrade parking garage and proposed biosparging approach is shown in plan view on Figure 18 and in cross-sectional view on Figures 19, 20 and 21. A summary of the shallow impacts to be targeted by excavation is shown on Figure 14. A conceptual model of the excavation and biosparging approach is shown on Figure 22. Details of the biosparge treatment cell are discussed in the corrective action plan section.

For cost evaluation purposes under the site redevelopment scenario with a subgrade parking garage, Pangea divided the subsurface into the following different zones as shown on Figure 22: overburden soil/bedrock (0-9 ft), impacted soil/bedrock (9-15 ft). The impacted zone is subdivided into the 9-11 ft zone requiring excavation for offhaul of impacted soil but *not* requiring backfilling due to the planned garage, and into the 11-15 ft zone that *will* require backfilling and compaction after the excavation of impacted material. Pangea assumed that approximately ½ of the overburden soil/bedrock for 0-9 ft depth with minimal hydrocarbon impact would be eligible for reuse at the site. The shallow fractured bedrock could be used as permeable material within the biosparge treatment cell.

For comparison with other alternatives, Pangea offers the following scenario and cost estimate in Table A.

Table A – Excavation + Biosparging Cost Estimate – With Subgrade Development

Scenario – Excavation to approximately 15 feet depth to target hydrocarbon-impacted soils above the bedrock in the northeastern and south-central portions of the site. Estimated removal of 4,300 cubic yards (6,450 tons) of material. Cost assumes ½ of the overburden rock/soil could be reused, with offsite disposal for remainder. After excavation and during site redevelopment activities, a biosparging system will be installed beneath the parking garage to remediate residual hydrocarbons in soil and groundwater.	
Estimated Excavation Duration	4-8 weeks
Estimated Biosparge Duration	2 years
Estimated Effectiveness	High
Estimated Time until Closure	3 years
Excavation Oversight/Reporting by Pangea	$25,000
Demolition of Existing Structure (cost paid by developer)	$0 (Development benefit)
Shoring Costs (Assume conducted in conjunction with development and paid by developer)	$0 (Development benefit)
Sample Analyses	$10,000
Excavation Contractor Cost: Excavation equipment, soil loading and labor: 10 days @ $5,000/day	$25,000 (0-9’ overburden) $25,000 (9-15’ impact)
Overburden Impacted Soil Offhaul (0-9 ft): Assume ½ (1,935 tons) of total 3,870 tons is reusable. Assume $35/ton for TPHg <50 mg/kg impact.	$ 68,000
Deeper Impacted Soil Offhaul (11-15 ft): Assume 2,580 tons disposed at $45/ton for TPHg >50 mg/kg impact.	$116,000
Backfill Import and Compaction Labor (0-11 ft): None for subgrade parking structure	$0 (Development benefit)
Backfill Import (11-15 ft): Assume ½ (860 tons) of 1,720 tons is reused from overburden. $50/ton.	$43,000
Backfill Compaction Labor (11-15 ft)	$15,000
Installation of a biosparging system in permeable backfill beneath parking garage slab and four contingent sparge wells	$50,000

in deeper bedrock	
Operation and Maintenance of biosparging system for 2 years @ $1,000/month.	$24,000
Quarterly GW Monitoring ($6,000/qtr)	$72,000 (3 years)
Total	**$473,000**

Cost Evaluation for Excavation <u>without</u> Subgrade Development: This alternative is identical to the above excavation alternative, but without the cost savings associated with the subgrade parking garage. With this excavation scenario there are additional costs for backfill material, soil stockpiling and analytical results to evaluate reuse potential, and backfill/compaction labor. Also includes one extra year of groundwater monitoring for the delay associated with planning for a different development plan. For comparison with other alternatives, Pangea offers the following scenario and cost estimate in Table B.

Table B – Excavation + Biosparging Cost Estimate – *Without* Subgrade Development

Scenario – Excavation to approximately 15 feet depth to target hydrocarbon-impacted soils above the bedrock in the northeastern and south-central portions of the site. Estimated removal of 4,300 cubic yards (6,450 tons) of material. Cost assumes ½ of the overburden rock/soil could be reused, with offsite disposal for remainder. After excavation and during site redevelopment activities, a biosparging system will be installed in the bottom of the excavation prior to backfilling to the surface.

Estimated Excavation Duration	4-8 weeks
Estimated Biosparge Duration	2 years
Estimated Effectiveness	High
Estimated Time until Closure	4 years
Excavation Oversight/Reporting by Pangea	$25,000
Demolition of Existing Structure (cost paid by developer)	$0 (Development benefit)
Shoring Costs	$0 (Assumes none required)
Sample Analyses	$15,000
Excavation Contractor Cost: Excavation equipment, soil loading and labor: 10 days @ $5,000/day	$25,000 (0-9' overburden) $25,000 (9-15' impact)
Overburden Impacted Soil Offhaul (0-9 ft): Assume ½ (1,935 tons) of total 3,870 tons is reusable. Assume $35/ton for TPHg <50 mg/kg impact.	$ 68,000
Deeper Impacted Soil Offhaul (11-15 ft): Assume 2,580 tons disposed at $45/ton for TPHg >50 mg/kg impact.	$116,000
Stockpile/Handle for Reuse (0-9 ft): 5 days @ $5,000/day	$25,000

Backfill Import (0-11 ft): Assume 2,365 tons, ½ at $50/ton for Class II baserock, and ½ at $20/ton for loamy sand fill	$83,000
Backfill Compaction Labor (0-11 ft): 10 days @ $5,000/day	$50,000
Backfill Import (11-15 ft): Assume ½ (860 tons) of 1,720 tons is reused from overburden. $50/ton.	$43,000
Backfill Compaction Labor (11-15 ft)	$15,000
Installation of a biosparging system in permeable backfill beneath parking garage slab and four contingent sparge wells in deeper bedrock	$50,000
Operation and Maintenance of biosparging system for 2 years @ $1,000/month.	$24,000
Quarterly GW Monitoring ($6,000/qtr)	$96,000 (4 years)
Total	**$660,000**

4.7 Evaluation of DPE and Air Sparging

DPE is a common technique for remediating sites impacted with elevated concentrations of petroleum hydrocarbons and separate-phase hydrocarbons (SPH). This approach targets unsaturated soil, the capillary fringe, and shallow saturated soil. DPE involves the simultaneous extraction of soil vapor and liquid (groundwater/SPH mixture) from site wells using a large above-ground extraction blower. For applications requiring significant groundwater extraction flow rates, submersible groundwater pumps can be used to help dewater the hydrocarbon smear zone and expose hydrocarbons to vapor extraction. DPE requires a network of extraction and discharge piping to extract, treat and dispose of the extracted soil vapor and groundwater. Long-term DPE applications typically require permanently-installed high-amperage electrical service, as well as natural gas or propane for supplemental fuel for vapor treatment via thermal or catalytic oxidizers. Extracted groundwater requires temporary storage and/or treatment prior to discharge to the sanitary sewer or storm drain. For small scale and short-term operations, portable generators and temporary water storage tanks are used. Air sparging or ozone sparging can also be used in conjunction with this technique to accelerate site remediation, to target deeper saturated zone impact, or remediate compounds more responsive to oxidation/biodegradation than extraction. While DPE is most appropriate for sites with moderate permeability, DPE can be used within higher and lower permeability soil with decreased efficiency.

Regarding the cost effectiveness of this approach, DPE is typically an expensive alternative due to the large equipment and energy requirements, and labor-intensive operation and maintenance. The benefit of this expensive approach can be fairly rapid and thorough site remediation, thereby reducing ongoing monitoring requirements and controlling lifecycle costs.

Site Specific Evaluation: Feasibility testing conducted at this site indicates DPE would be marginally effective at remediating the soils beneath the site because of the low permeability overlying clay and bedrock and the generally low observed vapor-phase hydrocarbon mass removal rates (removal rates in individual wells ranges from 0.3 to 7 ppd). However, air sparging within deeper site wells apparently increased contaminant removal rates during DPE by 40% to 500% (see feasibility testing description above in section 2.8). The resultant contaminant removal rates for DPE after sparging were as high 51 ppd, although removal rates apparently decreased within 2.7 hours to approximately <9 pounds per day. Pangea concludes that air sparging improves contaminant removal achieved by DPE, but limited pressure influence data suggests that a dense network of DPE extraction wells is merited to help ensure vapor capture. Therefore, Pangea recommends further consideration of DPE and AS for the subject site.

Cost Evaluation: Based on DPE/AS test results, a closely-spaced extraction well network with appropriately screened well casings would be required to target hydrocarbon-impacted areas beneath the site and capture vapors created by AS. Note that longer-term DPE would likely be required due to anticipated marginal remediation effectiveness within fractures in the subsurface bedrock, and due to the relatively higher permeability of materials in the former excavation area that allow for preferential air flow from areas with little or no hydrocarbon impact. The lack of consistent vacuum influence during DPE testing indicates that preferential air flow during DPE could be occurring. Therefore, deeper DPE wells would be appropriate in the former UST excavation area to target deeper impact (identified in geotechnical boring B-6) and to minimize extraction short-circuiting within the excavation fill material. Due to observed contaminant removal rates, activated carbon may be a cost-effective method for treating extracted vapors.

To allow comparison with other alternatives, Pangea offers the following scenario and cost estimate in Table C. The remediation scenario includes DPE from 13 wells based on a conservative radius of influence of 15 feet per well. The scenario also includes 6 AS wells, and keeps existing site wells for groundwater monitoring and evaluation of remedial effectiveness.

Table C – DPE/AS Approach & Cost Estimate

Scenario – DPE/AS from a network of 13 DPE wells and 6 AS wells. Assumes 2 years of system operation due to bedrock fractures and clayey soil. Assumes groundwater monitoring for 1 year before and 1 year after system operation to achieve closure.

Estimated DPE Duration	2 years
Estimated Effectiveness	Moderate
Estimated Time until Closure	4 years
Design, Permitting, and Utilities	$35,000
Well Installation (13 DPE + 6 AS wells)	$45,000
Equipment Procurement	$90,000

Utility Installation (Elec and Nat Gas)	$30,000
System Installation and Startup	$120,000
O&M Labor/Reporting ($1,800/mo)	$43,200 (2 years)
O&M Utilities/Fees ($2,700/mo)	$64,800 (2 years)
Quarterly GW Monitoring ($6,000/qtr)	$96,000 (4 years)
Total	$524,000

4.8 Feasibility Study Conclusions and Selected Alternative(s)

To facilitate comparison of the above remediation alternatives, Pangea summarized the advantages, disadvantages, estimated costs, and contingency costs on Table 6. Table 6 also evaluates each approach's estimated effectiveness within the unsaturated and saturated zone, estimated duration until closure, and overall cost effectiveness.

Consistent with California UST Cleanup Fund guidelines, Pangea recommends implementation of the most cost-effective remedial alternative to achieve site cleanup levels and goals. As detailed above, the most cost-effective cleanup involves site excavation and biosparging in conjunction with the approved mixed use site development. The second most cost-effective approach is insitu remediation using dual phase extraction and air sparging (DPE/AS). Again, due to financial difficulties in the housing market, the current site owner is under contract to sell the site, and the prospective purchaser may implement the approved mixed use redevelopment plans or may pursue other site development. If the future development does *not* include extensive subgrade excavation (with its associated remediation cost savings), the most cost-effective alternative is the insitu DPE/AS approach.

During the July 10, 2008 meeting with the ACEH, case worker Paresh Khatri requested that the SCM/CAP present data to justify selection of the proposed remedial alternative. Pangea acknowledges that there is limited saturated soil analytical data to help justify site excavation. However, the limited availability of saturated zone data is primarily due to the extensive presence of bedrock, preventing soil sample collection and analysis. Nonetheless, data from other impacted media confirm the need for saturated-zone remediation. To address Mr. Khatri's concern, Pangea compiled the following information to substantiate the appropriateness and cost-effectiveness of the excavation and biosparging for the approved mixed use development:

- <u>Liquid-Phase Data</u>: Free product is present near STMW-4 in the shallow "smear zone" that encompasses the depth interval between the water table highstand and lowstand, and was present in MW-3C after DPE testing (Figures 14, 22 and 23).

- Soil Gas Data: Elevated soil gas impact is found across the site and extending offsite, and additional soil gas data (Figure 13 and Table 3) was collected as detailed with Pangea's *Additional Soil Gas Sampling Report* dated July 14, 2008.

- Adsorbed Phase: Elevated soil concentrations were detected from 9 to 14 ft depth in several soil borings and beneath the former site USTs during their removal (Figures 3 and 4). Furthermore, strong hydrocarbon odor and soil staining observed at 11 to 13 ft depth during completion of geotechnical boring B-6 in July 2007 suggests that significant impact confirmed by analytical results from the excavation floor (e.g., 930 mg/kg and 970 mg/kg at 10 ft depth) are present below the former UST area in the encountered wet clayey sand (Figure 3 and Appendix B) (Pangea is not aware of additional confirmation samples from deeper excavation beneath the former USTs).

- Dissolved Phase Data: Isoconcentration maps for shallow groundwater impact are presented in Figures 6 and 7, and for deeper groundwater impact are presented in Figures 9 and 10. Isoconcentration contours in cross-sectional view are presented on Figures 15, 16 and 17, which also illustrate the anticipated excavation extent to target the shallow impact. In addition, as shown on the cleanup level table (Table 5), if shallow impacted groundwater is removed during excavation, the benzene impact in deep groundwater at hot spot MW-3C is only three times the ESL protective of indoor air. Pangea anticipates that excavation will improve the deeper groundwater conditions, which may therefore obviate the need for biosparging to further remediate deeper groundwater to cleanup levels.

- Sensitive Receptor Data: As required by the ACEH, Pangea obtained additional soil gas and subslab gas data regarding nearby residential and commercial potential receptors. Pangea also provided additional information about the subgrade development at the adjacent residences west of the site (Figures 15 and 19).

- Prior Remediation Data: Groundwater monitoring data indicates that excavation significantly improved shallow groundwater quality in source area well MW-6A. Therefore, the proposed shallow excavation should also improve sign similar results.

- Conceptual Models: Illustrated conceptual models were also prepared to communicate the presented data (Figures 14, 22 and 23).

- Feasibility Test Data: Post-test groundwater data suggests that DPE testing from deeper wells (e.g, MW-3C, MW-7B and MW-7C) induced downward migration of contaminants. Hydrocarbon concentrations in groundwater significantly increased in these wells following DPE, and then decreased. Most importantly, a SPH thickness of 0.02 ft was observed in the bailer from MW-3C.

In addition, feasibility testing provided vacuum influence data to evaluate insitu remedial effectiveness, design an extraction well network, and estimate system operation duration.

- Cost Data: The feasibility test also provided cost data to substantial cleanup approach selection.

Finally, Mr. David Charter of the California UST Cleanup Fund indicated that the Fund could review the SCM/CAP and would attempt to provide informal cost pre-approval or written comments regarding eligible cost determination within a few weeks for this time-sensitive project. Mr. Charter indicated that the Fund often favors site excavation due to its short timeline, the certainty of source removal, and the avoidance of confirmatory soil borings. He suggested that the Fund would reimburse, as a minimum, all costs for transportation and disposal of impacted material, and would pay for all other reasonable excavation-related costs (e.g., excavation, soil handling, analyses, backfill material, compaction, and reporting) as they have for several other projects. While describing the appropriateness of excavation for a given site, Mr. Charter expressed a general concern about the significant cost and uncertainty associated with active remediation systems such as DPE/AS. From our meeting, Pangea understands that the ACEH has had similar discussions with Fund personnel. Pangea will forward the Fund’s written approval or comments to you upon receipt, which may assist with ACEH review and approval of this CAP.

Pangea considers the recommended excavation and biosparging approach in conjunction with the approved mixed use development to be a very pragmatic and cost-effective remedial alternative, especially considering the unique site conditions. The “free” (to the remediation project) excavation costs resulting from the proposed subgrade parking project substantially reduces the cost of excavating the relatively small additional soil volume needed to remove soil contamination and contaminated groundwater within the capillary fringe zone. Such excavation would also likely remove the free product that has been observed within this zone. This method is considered to be significantly more reliable than in situ methods.

5.0 CORRECTIVE ACTION PLAN

Based on the current and approved plan for mixed use redevelopment of the site, the proposed corrective action plan (CAP) is site excavation with biosparging, as detailed below. In the event that the future site owner develops the site without a significant subgrade structure (which would not provide associated excavation cost savings), Pangea has included an alternate remedial plan to expedite and simplify any such future corrective action. Pangea's alternate CAP involves the implementation of insitu DPE/AS. The alternate CAP is also provided to assist with due diligence efforts by the prospective purchaser to facilitate comments from the ACEH and the Fund, thereby aiding the property transaction. The conceptual model for each approach is presented on Figures 22 and 23. Each of these alternatives is the most cost-effective remedial alternative for the respective development scenario based on our cost evaluation.

5.1 Proposed Corrective Action – Site Excavation & Biosparging

Based on our evaluation presented above, Pangea proposes soil excavation followed by the installation and operation of a biosparging system is the most cost-effective technique to conduct interim remedial action at this site. Figure 18 presents in plan view the proposed extent of excavation for targeting the primary extent of contaminants. The proposed excavation extent in cross-sectional view is shown on Figures 19, 20, and 21. To target residual contaminants in deeper soil and groundwater and in offsite groundwater beyond the anticipated extent of the excavation, Pangea proposes biosparging. Figure 20 shows the planned biosparging system and associated wells. Figure 22 shows a conceptual model of the excavation and biosparging approach.

The planned excavation will be completed to approximately 15 feet bgs to target hydrocarbon-impacted soils above the bedrock in the northeastern and south-central portions of the site. If hydrocarbon-impacted soils are encountered deeper than 15 ft bgs and are accessible for excavation, the excavation will be deepened slightly to remove the impacted material. The anticipated maximum final extent of the excavation is shown on the above referenced figures, although this may be modified based on new analytical data, field observations, and direction from representatives of the ACEH and the Fund. For example, the excavation may be expanded laterally to target impacted identified by geotechnical B-6 if sidewall soil samples for the nearby excavation northeast and south of this location contain hydrocarbon concentrations above cleanup levels.

The estimated remedial excavation volume for the northeastern portion of the site is approximately 1,600 cubic yards (2,400 tons), and for the south-central portion, approximately 2,700 cubic yards (4,050 tons), yielding an excavation total of 6,450 tons of overburden and/or impacted soil. Soil disposal and potential reuse of overburden soil is described below. Groundwater pumping and/or storage may be required if a significant volume of groundwater is encountered during excavation activities. If a significant volume of groundwater is encountered during excavation activities, Pangea will arrange to have groundwater that collects in the excavation cavity pumped out and disposed of properly.

During site redevelopment activities described in the previous *Planned Site Redevelopment* section, and after excavation activities are completed, Pangea will coordinate the installation of a biosparging system. The conceptual biosparging design involves the installation several horizontally-oriented ‘wells’ or slotted piping installed in the permeable backfill material beneath the subsurface parking garage. Low flow sparging within these slotted pipes will oxygenate and remediate residual dissolved hydrocarbons. Vapor collection piping would be installed at the top of the permeable backfill beneath the parking garage floor. Groundwater monitoring and potential extraction wells (and associated piping) will be installed to allow dewatering of each biosparge cell (if necessary to capture vapors created by more aggressive sparging). A thick plastic vapor barrier system would be incorporated beneath the floor to avert migration of vapors in to the garage. Final biosparging system design will be modified based on field observations, final building design, and discussions with the project civil engineer. Biosparge design drawings and an implementation schedule will be submitted to the ACEH prior to system installation activities. If aqueous-phase hydrocarbon concentrations remain elevated after excavation activities are completed, Pangea may elect to install several vertically-oriented biosparge wells into native material and perform aggressive sparging at higher flow rates (3-4 cfm per well) before the building is occupied to reduce residual hydrocarbon concentrations in groundwater. To address this potential contingency, Pangea will sample groundwater within the excavation or within any remaining deeper wells.

In summary, the contingent remedial activities include: (1) biosparging within deeper vertical wells, (2) vapor extraction above the horizontal biosparge/air sparge wells to capture sparge vapors, and (3) groundwater extraction within the biosparge cell to expose vapor extraction piping. A final contingency would be expanded site remediation west of the site if soil gas conditions do not significantly improve beneath the residences at 5230 Coronado Avenue. Contingency costs were considered within the feasibility study as shown on Table 6.

Pangea will oversee the following tasks to facilitate excavation:

Task 1 – Well Destruction: For cost control purposes, Pangea proposes to destroy shallow wells MW-3A, MW-4A, and MW-8A with excavation equipment since they are screened within the anticipated excavation limit and.depth. In addition, Pangea will attempt to retain deeper wells (MW-3C, MW-7B, MW-7C, and MW-8C) by excavating around (and cutting) the solid riser piping to retain the deeper well seal and screen interval. (This is recommended because the rocky site conditions make well installation difficult and expensive). If required, Pangea will destroy these wells in advance of excavation in accordance with ACEH requirements. Replacement monitoring wells will be installed as described below.

Task 2 – Permitting: The excavation contractor will obtain permits from local agencies to allow excavation.

Task 3 – Disposal Profiling: Pangea will submit existing soil data to landfill(s) to obtain pre-approval for direct loading and offhauling of soil for disposal at appropriate landfill(s). Pangea anticipates having some relatively 'clean' soil (<50 mg/kg TPHg), and some deeper soil significantly impacted by petroleum hydrocarbons (>50 mg/kg, but <1,000 mg/kg). Disposal efforts should not be affected by lead. To verify the presence or absence of lead in subsurface soils, pre-excavation soil samples will be collected where necessary and analyzed for lead for confirmation.

Task 4 – Excavation Preparation/Development Shoring: The excavation contractor shall mark the site for underground service alert (USA), and shall use an underground line locator to clear the planned excavation area. The excavation contractor will mobilize excavation equipment and personnel to perform the excavation. Pangea will meet with ACEH representatives as necessary to prepare for excavation. If the development schedule and fund permits, shoring of the planned development area will be conducted in advance of remedial excavation to optimize contaminant removal and provide additional safety.

Task 5 – Soil Excavation: The contractor shall excavate soil in the northeastern and south-central portions of the site to meet project objectives. These areas will be excavated to a depth of approximately 15 feet bgs, although shallower or deeper excavation may be conducted based on soil/groundwater analytical data, field observations, or direction from the ACEH and the Fund. Shoring will be provided as required for safety purposes or engineering requirements. The estimated maximum excavation volume is 4,300 cubic yards (6,450 tons). The contractor will make every effort to segregate any clean fill for reuse below the parking garage in the biosparge treatment cell (the overburden bedrock fragments may serve as good quality fill). Soil/rock stockpiling and sampling will be conducted to facilitate soil/rock reuse as required by the ACEH.

Pangea will collect soil samples from excavation sidewalls and floor when accessible as directed by the ACEH. Soil samples will be analyzed for TPHg/BTEX/MTBE by EPA Method 8015M/8020. Samples with TPHg concentrations exceeding the 83 mg/kg ESL will also be analyzed for TPHd by EPA Method 8015M. Pangea will collect composite or discrete soil samples for any stockpiles to facilitate soil disposal and/or reuse.

Task 6 – Soil Transportation and Disposal: To the extent possible, soil will be loaded directly onto trucks for transportation and offsite disposal during initial excavation activities. If necessary, soil may be segregated and stockpiled for future disposal or reuse. The contractor will provide alternate disposal rates for soil with <50 mg/kg TPHg and >50 mg/kg TPHg, and as otherwise provided by appropriately licensed landfills.

Task 7 – Backfilling: The subgarage excavation cavity and biosparge cells will be filled with drain rock, pea gravel, or self-compacting material that meets engineering requirements for site redevelopment activities. A compaction of 95% will be provided for any non-self-compacting material.

Additional Excavation Tasks (As Needed): The following tasks will be only be conducted as needed:

- Temporary fence installation and rental;
- Shoring;
- Removal and replacement of any underground utilities;
- Pumping, storage and treatment of any encountered groundwater; and
- Special traffic control.

Task 8 – Biosparging System Installation: Upon completion of excavation activities, biosparging system installation activities will take place, and will be coordinated with site construction activities and scheduling. The details of the biosparge system are described above.

Task 9 – Well Installation/Replacement: In accordance with ACEH requirements, Pangea will coordinate the installation of contingency biosparge wells and replacement groundwater monitoring wells (as necessary). Replacement monitoring wells shall be installed within 10 feet downgradient of and/or adjacent to the excavation limits after completion of the overexcavation work to evaluate the remedial action and onsite groundwater impact. Replacement monitoring wells can be placed within the subgrade parking structure if required for additional groundwater monitoring, although groundwater dewatering wells and vertical sparge wells could also provide groundwater monitoring data. In addition, grab groundwater sampling may be appropriate to assess deeper groundwater conditions before installing wells (due to rocky conditions this sampling would be conducted with a large hollow-stem auger rig). Pangea will install wells in accordance with our standard procedures (Appendix C).

Task 10 – Soil Gas Probe Installation and Monitoring: To evaluate soil gas concentrations in shallow soil during and after future sparging or other remediation, Pangea will install soil gas probes down to approximately 5 ft depth at onsite and offsite locations shown on Figure 18 and 19. Note that probes SG-4 through SG-7 were already installed on 5230 Coronado Avenue and are available for future soil gas sampling. As a minimum, Pangea plans to sample soil gas from these vapor monitoring probes approximately one month after completion of excavation activities. Soil gas sampling will also be conducted within probes/vents installed outside the planned parking garage as shown on Figure 19.

Task 11 – Excavation Completion Report: Upon completing the excavation portion of the CAP, Pangea will prepare an Excavation Completion Report. The report will describe the excavation activities and results, and will present tabulated analytical results. The report will include site photographs and provide waste manifests for disposed soil. The report will also describe installation of the monitoring/remediation wells, biosparge cells, and any contingent remediation piping and equipment. Interim excavation reports will also be prepared to help determine if additional excavation is required by the ACEH and if the Fund deems the additional excavation as cost-effective and reasonable.

Task 12 – System Operation & Maintenance (O&M), Monitoring, and Reporting: Upon completion of the biosparge system (and any contingent remediation system), Pangea will commence equipment testing and system startup. The remediation system will be started and operated in accordance with manufacturer recommendations and any BAAQMD air permit requirements or EBMUD groundwater discharge requirements. Pangea will monitor the air injection pressure and flow rate for the biosparge conduits/wells. If vapor extraction is performed, Pangea will measure the applied vacuum, vapor extraction flow rates, hydrocarbon concentrations in extracted vapor for the system influent; vapor samples will be periodically collected from each vapor extraction well and analyzed using a PID or organic vapor analyzer, and vapor samples will also be periodically collected for laboratory analysis. If groundwater extraction is performed to expose vapor piping for vapor capture, Pangea will record extracted groundwater volumes and sample the system influent, effluent, and any carbon treatment locations.

Pangea plans to conduct operation and maintenance at least weekly during the first month of operation. We will perform routine system maintenance, record meter readings, and collect samples to comply with permit conditions and evaluate system performance. We will manage discharge of any groundwater extracted by the system.

Pangea plans to perform quarterly groundwater monitoring during active remediation to evaluate system performance in a timely manner. The groundwater monitoring will be performed on all onsite and offsite monitoring wells. Periodic groundwater monitoring may also be performed on deeper sparge wells, if merited. Remediation system operation and monitoring data will be incorporated into the quarterly groundwater monitoring reports.

5.2 Alternate Approach (Insitu DPE/AS) for Development without Subgrade Excavation

In the event that development plans change, the above approach of excavation and biosparging would likely not be considered the most cost-effective remedial approach (the estimated costs and advantages of DPE/AS are presented on Table 6). Therefore, Pangea presents this alternate approach of insitu DPE/AS. A conceptual model and proposed well network for DPE/AS are shown on Figures 23 and 24, respectively. The estimated conservative radius of influence of 15 ft per DPE well is shown on Figure 24, which illustrates that Pangea's proposed approach extensively targets the primary extent of site contaminants in both soil and groundwater. It is anticipated that DPE/AS implementation would achieve the proposed cleanup levels, though probably over a somewhat longer timeframe than excavation and biosparging.

DPE will provide groundwater extraction to expose impacted soil/fractured rock to vapor extraction, capture contaminant vapors created by air sparing, and remove free product and aqueous-phase contaminants. DPE also provides enhanced groundwater extraction rates compared to GWE using submersible pumps. Air sparging will volatilize hydrocarbons from the saturated zone for capture by vacuum extraction, and will also provide dissolved oxygen to stimulate the biodegradation of petroleum contaminants. Additional rationale for this approach is presented in the feasibility study evaluation above.

The proposed DPE/AS approach involves the following:

- The DPE equipment will include a liquid-ring vacuum pump capable of providing approximately 29" of mercury and approximately 300 cubic feet per minute (cfm) of air flow. Drop tube 'stingers' will be used to facilitate extraction from each well by the large aboveground vacuum pump. Due to contaminant removal rates of up to 51 pounds per day during DPE testing, Pangea plans to treat initial extracted vapor with a catalytic oxidizer. Once contaminant concentrations sufficiently decrease, Pangea anticipates switching to more cost-effective vapor treatment using activated carbon.

- DPE will be conducted from thirteen (13) wells. All wells will be 2" diameter to minimize drilling costs in the bedrock subsurface. The DPE well screen intervals will allow extraction from shallower zones. DPE is not proposed from deeper zones to minimize the potential to induce downward migration of SPH and dissolved hydrocarbons, which was apparently performed during brief DPE testing at the site.

- AS will be conducted from approximately six (6) new wells (AS-1 through AS-6). (As noted on Figure 24, Pangea plans to sample deeper groundwater near the geotechnical boring B-6 where strong odor and soil staining was observed beneath the former UST excavation; deep well MW-6B may be installed and also as AS-6). The AS wells will be screened from approximately 20 to 24 ft bgs, but could be slightly shallower depending on site conditions. An appropriate air compressor will be selected to conduct sparging at flow rates of approximately 2-5 cubic feet per minute (cfm) during aggressive air sparing, and approximately 1 cfm if offsite vapor monitoring suggests lower flow rates are appropriate.

- Vapor monitoring can be performed as required from existing and proposed soil gas probes shown on Figures 18 and 19. Groundwater monitoring from existing wells to evaluate remedial effectiveness. Pangea also proposes groundwater monitoring of AS wells after installation and after rebound testing for post-remediation monitoring. System performance data will be evaluated to help optimize remedial effectiveness.

The scope of work to implement this alternate CAP approach of insitu DPE/AS is described below.

Task 1 – Pre-Field Activities for Remediation Well Installation: Prior to initiating test well installation, Pangea will conduct the following tasks:

- Obtain the necessary well installation permits;
- Pre-mark the well locations with white paint, notify Underground Service Alert (USA) of the drilling and sampling activities at least 72 hours before work begins, and conduct private line locating as merited;
- Prepare a site-specific health and safety plan to educate personnel and minimize their exposure to potential hazards related to site activities; and
- Coordinate with drilling subcontractor, analytical laboratory subcontractor and other involved parties.

Task 2 – Remediation Well Installation: Pangea will coordinate installation of the 13 DPE wells (DPE-1 through DPE-13) and six new air sparge wells (AS-1 through AS-6). Pangea will install the wells using a hollow-stem auger rig at the locations shown in Figure 24. DPE wells will be constructed using 2-inch diameter Schedule 40 polyvinyl chloride (PVC) casing, 0.02-inch slotted PVC screen and #3 sand (similar to deeper site wells), with a bentonite seal and grout to the surface. The DPE wells will be screened from approximately 10 to 15 ft bgs, although select wells may be screened deeper near and within the former UST excavation area (Figure 23).

The AS wells will be constructed using 1-inch diameter Schedule 80 polyvinyl chloride (PVC) casing, 0.02-inch slotted PVC screen and #3 sand with a bentonite seal and grout to the surface. The AS wells will be screened from approximately 20 to 24 feet bgs. The proposed AS screen depth is approximately 10 ft below the seasonal high groundwater elevation. All new wells will be protected by traffic-rated well vaults. Pangea will install wells in accordance with our standard procedures (Appendix C).

Pangea does not plan to conduct soil sampling during well installation, but does plan to conduct groundwater monitoring from all new remediation wells to provide additional lateral and vertical plume delineation prior to remediation. After a minimum of 72 hours after well installation, Pangea will develop the new wells using surge-block agitation. For the DPE wells, Pangea will coordinate purging of approximately 10 well casing volumes or until the well water clears (whichever occurs first). To control costs, Pangea will perform limited well development on the AS wells. If the AS wells do not allow sufficient air injection flow rates at reasonable pressures, Pangea will conduct more thorough well development to improve well performance. To provide additional cost savings, Pangea will sample the remediation wells immediately after development, rather than remobilizing to the site approximately 48 hours later to purge additional groundwater and then sample.

Task 3 - System Design: Upon CAP approval, Pangea will design the system and prepare construction drawings. The proposed well layout for the DPE/AS system is shown on Figure 24. The drawings will include system layout, trenching, piping, wellhead, equipment compound, and equipment anchoring details. Electrical single line and process and instrumentation diagrams will also be included. The DPE and AS remediation piping to each well will be plumbed underground and manifolded near the treatment equipment, and will include valves, meters, gauges and/or sampling ports to facilitate flow control flow and parameter measurement for individual wells. The DPE and AS equipment are specified below. The treatment equipment compound design and location will include noise reduction, to the extent practical at the design phase (additional noise abatement will be performed during startup and operation as merited).

Task 4 – System Permitting: Pangea will conduct discharge permitting for the final DPE/AS system. Pangea will conduct air discharge permitting with the Bay Area Air Quality Management District (BAAQMD) as necessary. Limited permitting with BAAQMD will be required if we rent a blower/oxidizer with a BAAQMD various location permit. The BAAQMD permit application will include provisions to switch to activated carbon treatment, if deemed cost effective. A groundwater discharge permit will be obtained from the East Bay Municipal Utility District (EBMUD), the local sanitary sewer agency. Pangea anticipates that the remediation installation contractor will obtain permits from the City of Oakland Building Department as required.

Task 5 – Equipment Procurement: Pangea will coordinate procurement of remediation equipment for the proposed remediation. For initial DPE operation, Pangea plans to rent a blower/oxidizer system, preferrably with a BAAQMD various location permit. The equipment will likely include a 20-hp liquid-ring blower capable of providing up to 29” of mercury vacuum and 300 cubic feet per minute (cfm) air flow. A blower/carbon system may be used as deemed cost effective. An appropriate air compressor will be selected to conduct sparging at flow rates of approximately 2-5 cubic feet per minute (cfm) during air sparging, with the capability of lower flow of approximately 1 cfm if merited for lower flow air sparging. The remediation equipment may include valves and/or solenoids, meters, gauges, and sampling ports to facilitate flow control flow and parameter measurement for individual wells.

Task 6 – Remediation System Installation, Startup, Operation and Maintenance: Upon completion of well installation, Pangea will observe installation of the remediation system by a licensed contractor. The installation contractor will be retained to install the system in accordance with building and use permit conditions. Electrical service will be provided to the equipment compound as required. An electrical ground will be provided for the remediation equipment. Supplemental propane or natural gas may also be provided for oxidizer use. The remediation piping will be installed underground. All underground piping will be buried at least 18 inches below grade with magnetic warning tape within each trench. Long-radius elbow piping will be used to ease pulling of conduits and reduce pressure loss during extraction and injection. The underground piping will be tested prior to completion of installation activities. All conveyance piping will be pneumatically tested at 10 psi for one hour, or in accordance with additional specifications or manufacturer requirements. The piping manifold will include valves, gauges and sampling ports to control and measure flow within each well. Pangea will connect to the local sanitary sewer for permitted discharge of extracted groundwater. An autodialer may be installed to alert Pangea technicians in the event of system shutdown.

Upon completion of system installation and groundwater sampling of new wells, Pangea will commence equipment testing and system startup. The remediation system will be started and operated in accordance with BAAQMD air permit requirements, sanitary sewer requirements, and manufacturer recommendations. Pangea will monitor the applied vacuum, vapor extraction flow rates, hydrocarbon concentrations in extracted vapor for individual wells and the system influent. Pangea will monitor the air injection pressures and flow rates for each air sparge well. Vapor samples will be periodically collected from each vapor extraction well and analyzed using a PID or organic vapor analyzer. Vapor samples will also be periodically collected for laboratory analysis.

To help ensure capture of hydrocarbon vapors created by sparging, Pangea will first conduct DPE without AS to establish initial vapor-phase concentrations in the subsurface. Pangea will then commence AS within a few AS wells located within the center of the extraction network. After hydrocarbon concentrations in extracted vapor decrease to near initial pre-AS levels, Pangea will commence sparging in additional wells. Pangea will also keep the AS rate well below the vapor extraction rate. Vacuum/pressure influence will be monitored in site monitoring wells.

Pangea plans to conduct operation and maintenance at least weekly during the first three months of operation. We will perform routine system maintenance, record meter readings, and collect vapor samples to comply with permit conditions and evaluate system performance. We will manage discharge of any groundwater extracted by the system.

Pangea plans to perform quarterly groundwater monitoring during DPE operation to evaluate system performance in a timely manner. The groundwater monitoring will be performed on all onsite and offsite monitoring wells. Periodic groundwater monitoring may also be performed on air sparge wells, if merited. Remediation system operation and monitoring data will be incorporated into the quarterly groundwater monitoring reports.

Task 7 – Geotracker Information and Surveying: Upon completion of wellhead modification, Pangea will retain a licensed surveyor to survey the modified elevations of the remediation wells to facilitate uploading to the state Geotracker database.

Task 8 – Report Preparation: Upon completion of well installation, Pangea will prepare a well installation report. Pangea will prepare a system startup report for EBMUD and the BAAQMD in accordance with permit requirements. System installation, design and performance information will be incorporated into quarterly groundwater monitoring reports. The report will describe the remedial activities, present tabulated data, and offer conclusions and recommendations for future site remediation. All reports and associated files will be uploaded to the GeoTracker database.

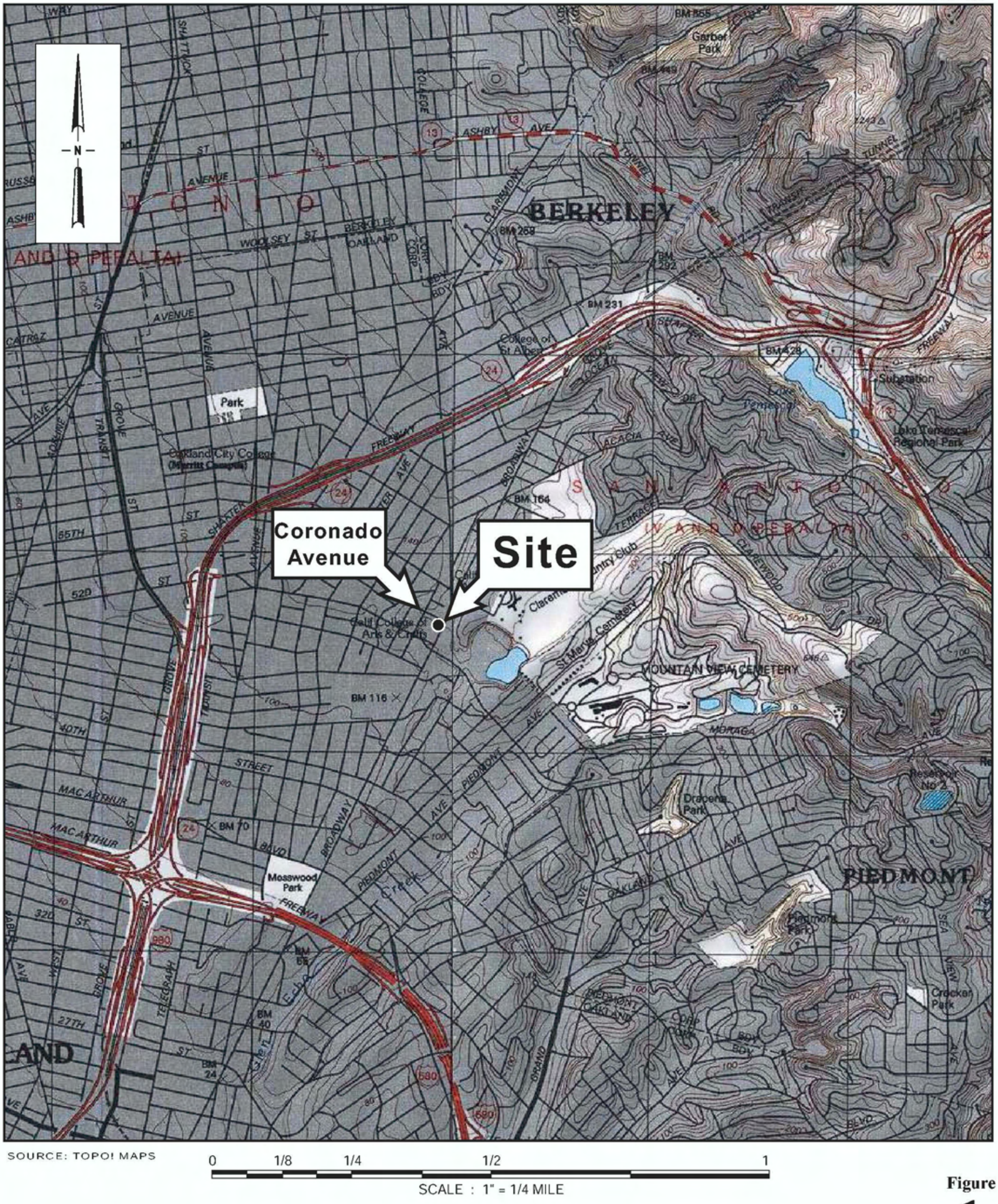
6.0 REFERENCES

Figuers, S., 1998, Groundwater study and water supply history of the East Bay Plain, Alameda and Contra Costa Counties, California: Norfleet Consultants, June 15.

Graymer, R.W., 2000, Geologic map and map database of the Oakland metropolitan area, Alameda, Contra Costa and San Francisco Counties, California, U.S. Geological Survey Miscellaneous Field Studies Map MF-2342, 1:50,000 scale. (http://geopubs.wr.usgs.gov/map-mf/mf2342/mf2342f.pdf).

Sowers, J. M., 2000, Guide to San Francisco Bay Area Creeks: Ettie St. Pump Station Watershed Map, the Oakland Museum of California. (http://www.museumca.org/creeks/oakmap.html).

7/16/2007



SOURCE: TOPO! MAPS

SCALE : 1" = 1/4 MILE

Figure
1

Site Location Map

Former Exxon Station
5175 Broadway
Oakland, California

PANGEA

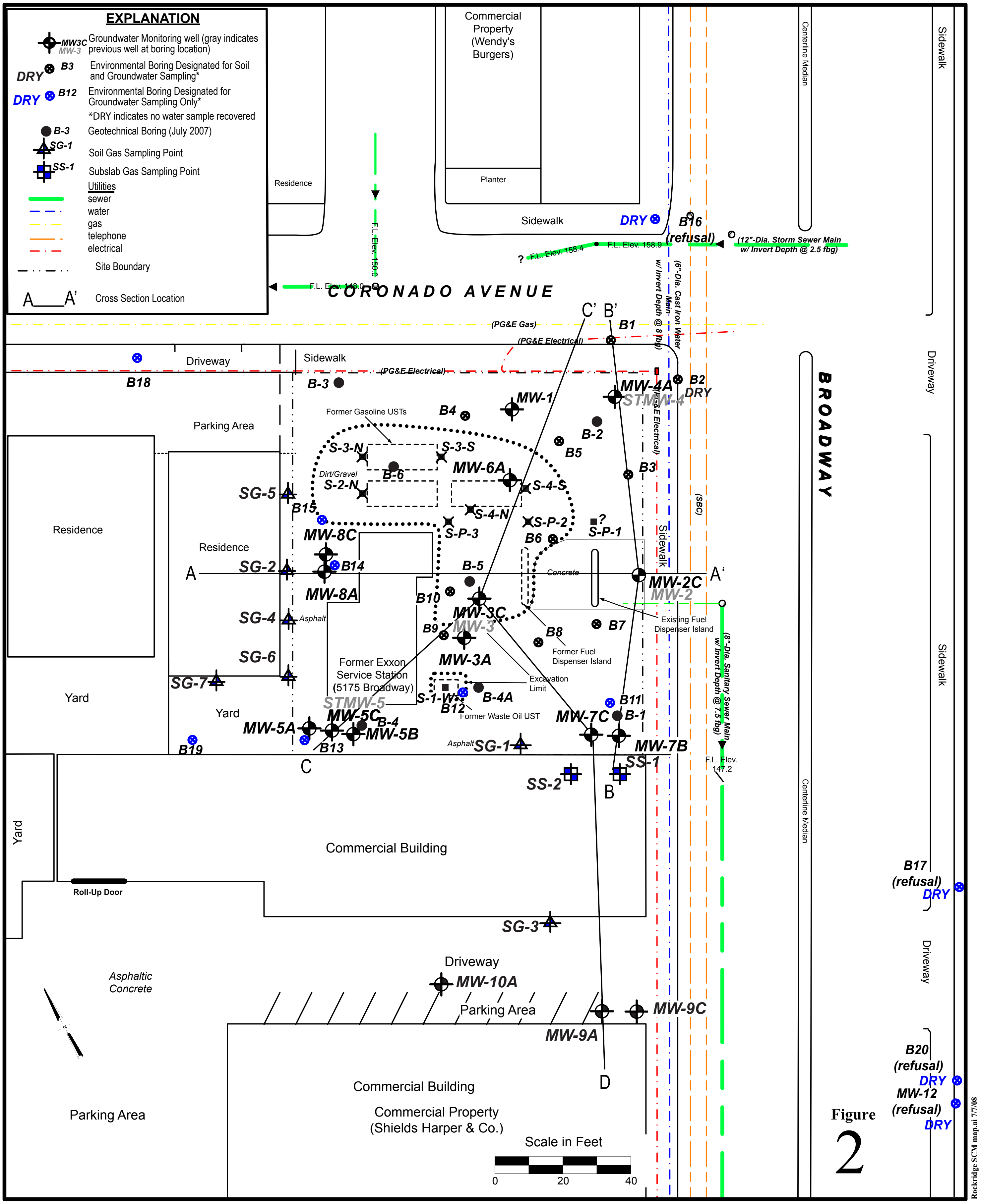


Figure
2

Former Exxon Station
5175 Broadway
Oakland, California

Site Map Showing Sampling, Utility and Cross Section Locations

PANGEA

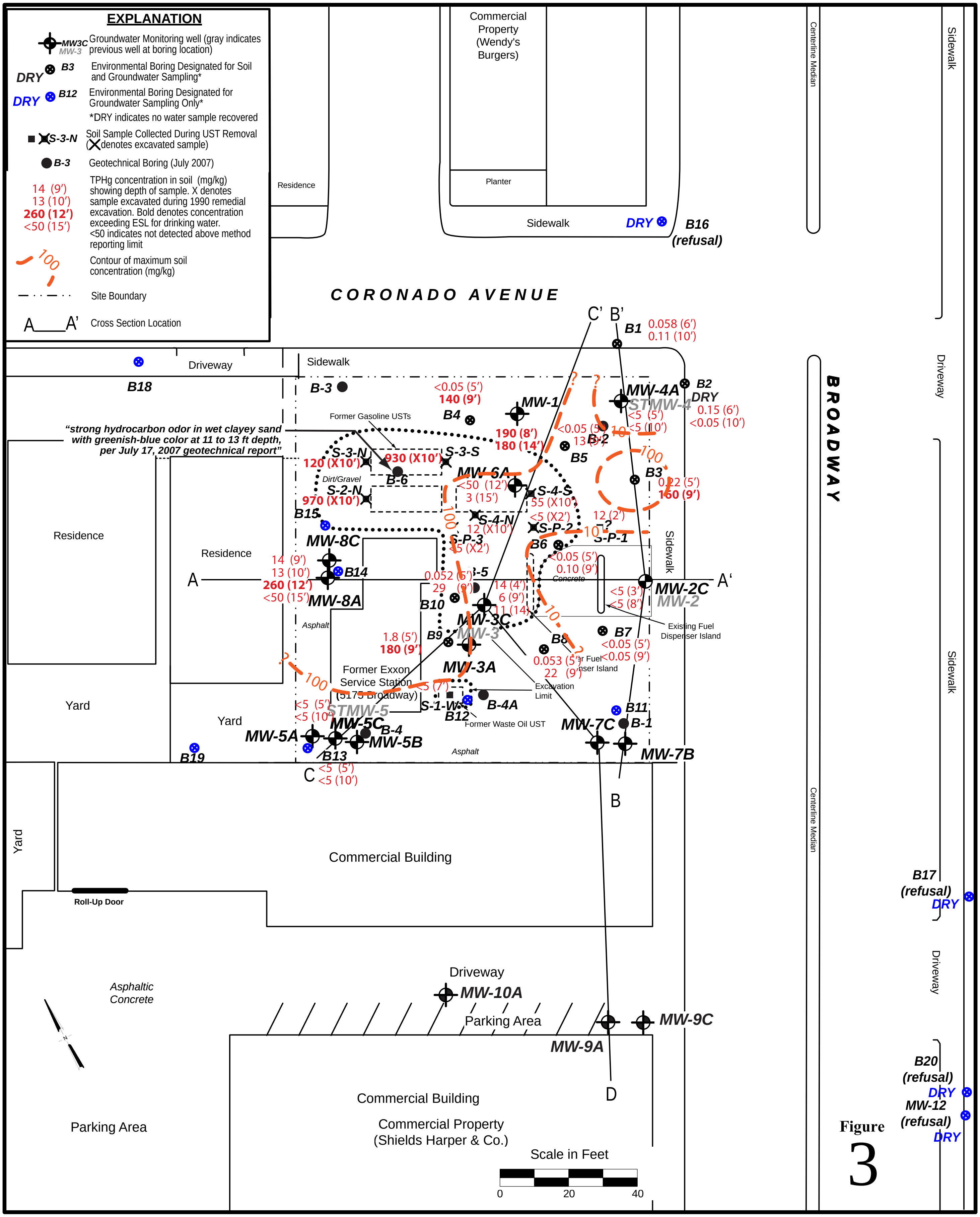


Figure
3

Rockridge SCM map.ai 7/7/08

Former Exxon Station
5175 Broadway
Oakland, California

Distribution of TPHg in Soil

PANGEA

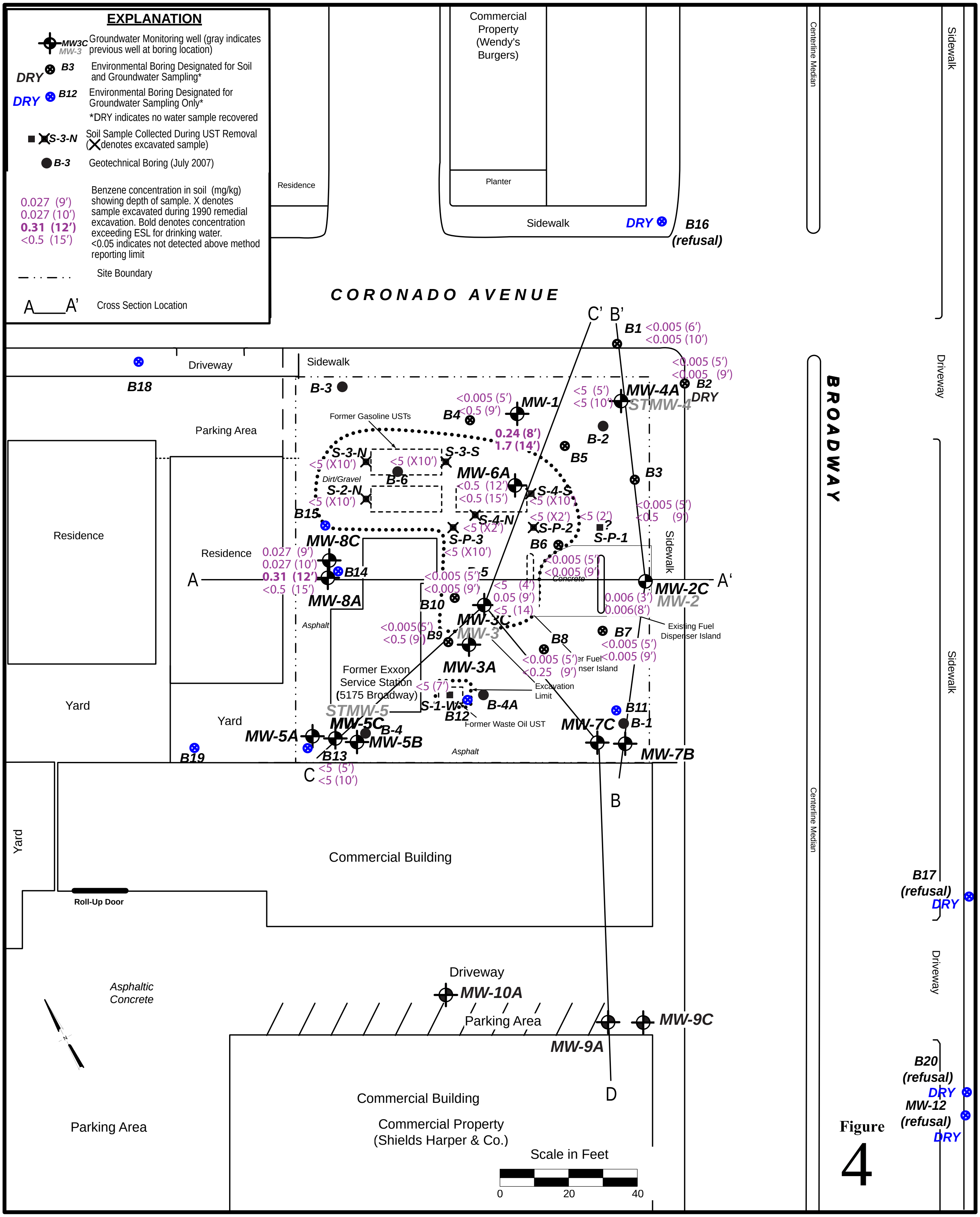


Figure
4

Former Exxon Station
5175 Broadway
Oakland, California

Distribution of Benzene in Soil

PANGEA

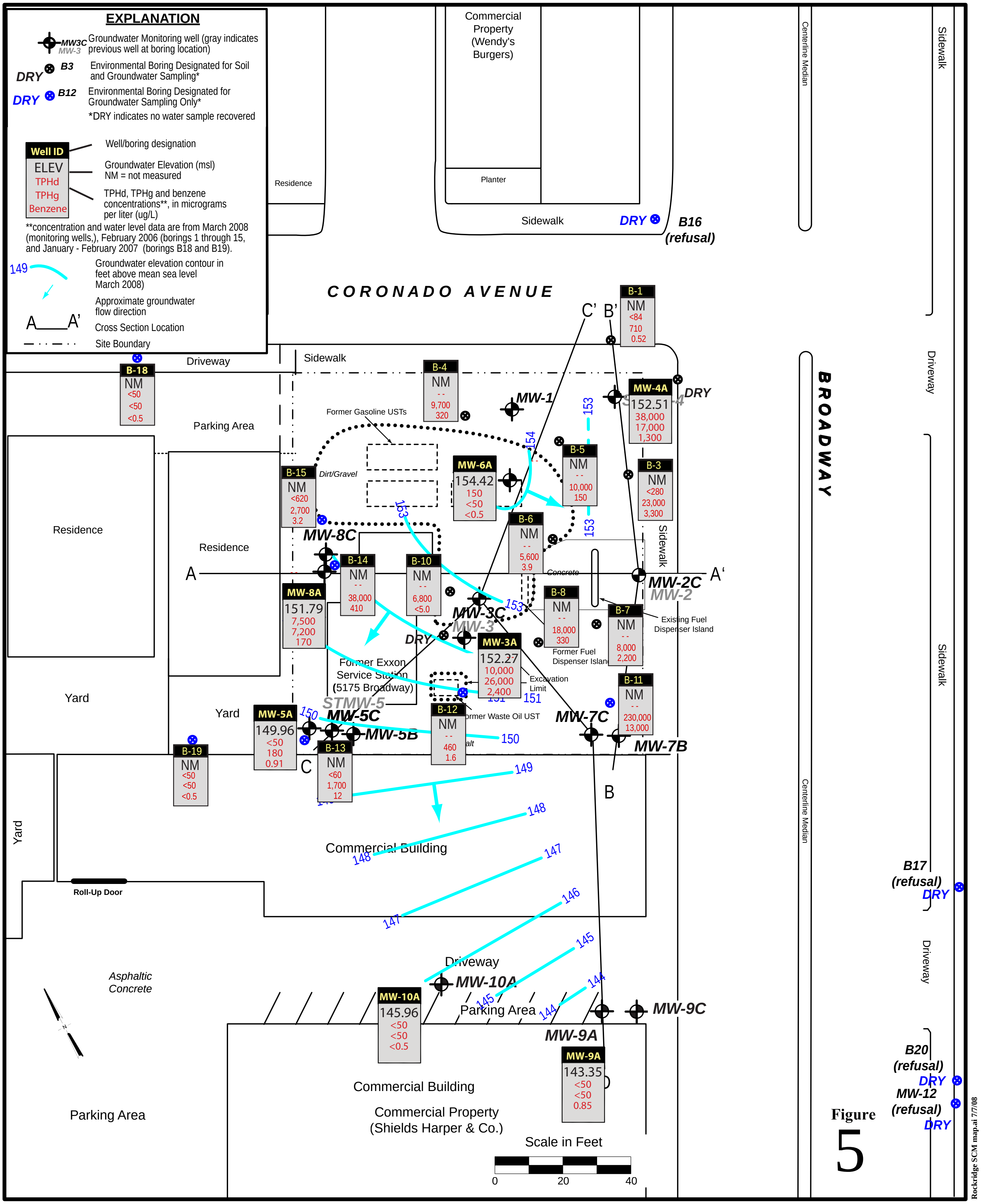


Figure 5

Former Exxon Station
5175 Broadway
Oakland, California

Groundwater Elevation and Hydrocarbon Concentration Map (Shallow)

PANGEA

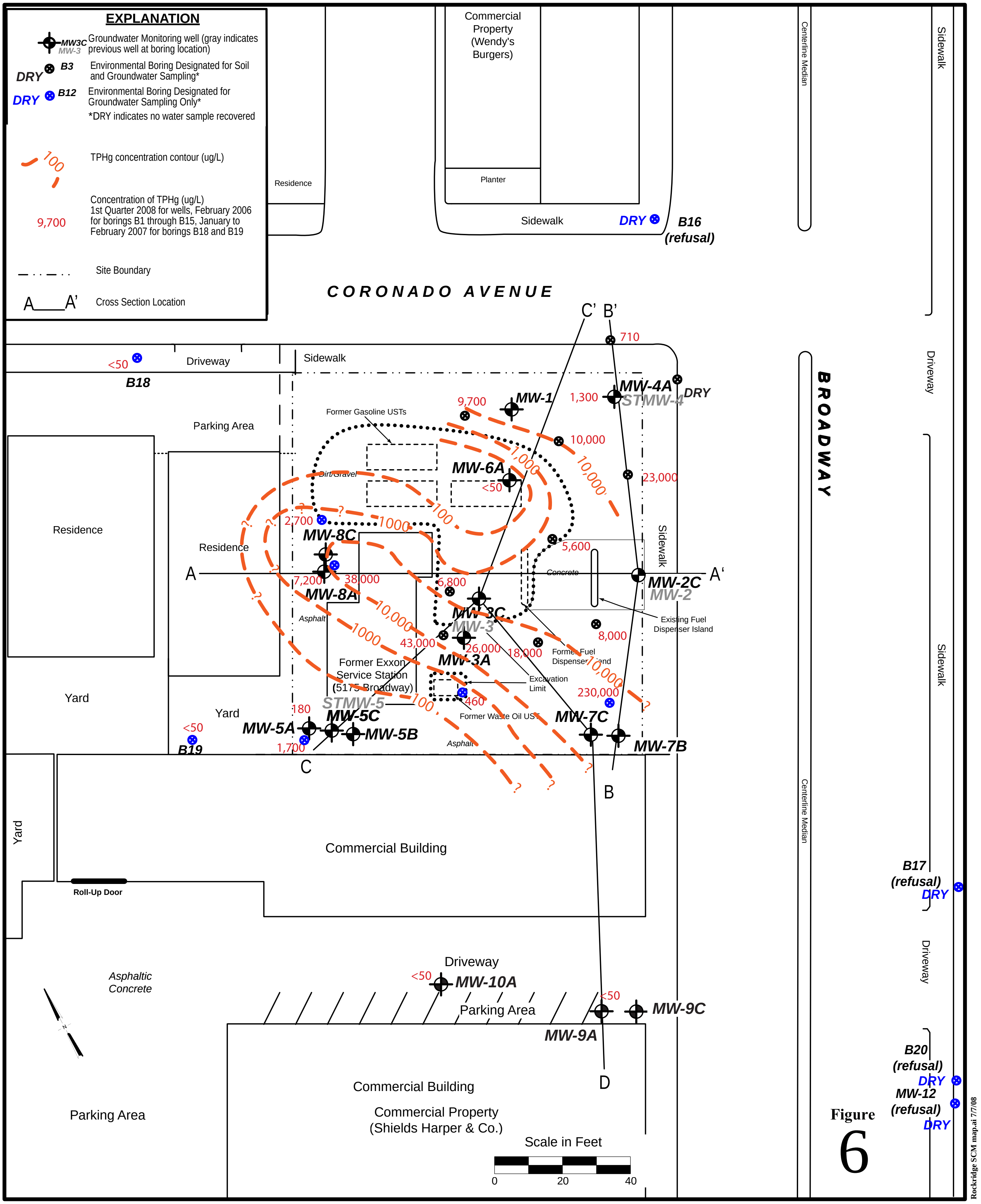
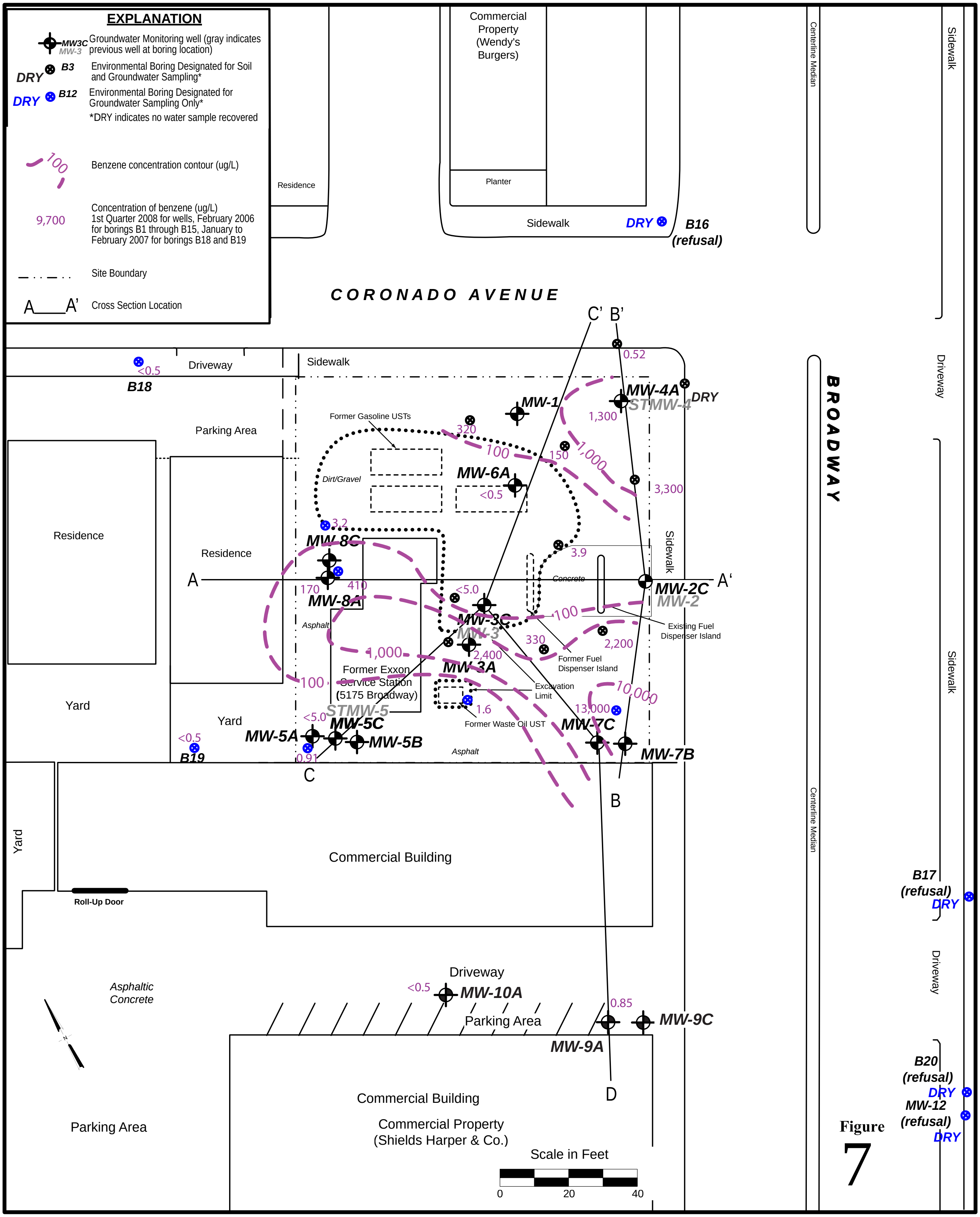


Figure
6

Former Exxon Station
5175 Broadway
Oakland, California

Distribution of TPHg in Shallow Groundwater

PANGEA



Former Exxon Station
5175 Broadway
Oakland, California

Contour Map of Benzene Concentrations in Shallow Groundwater

PANGEA

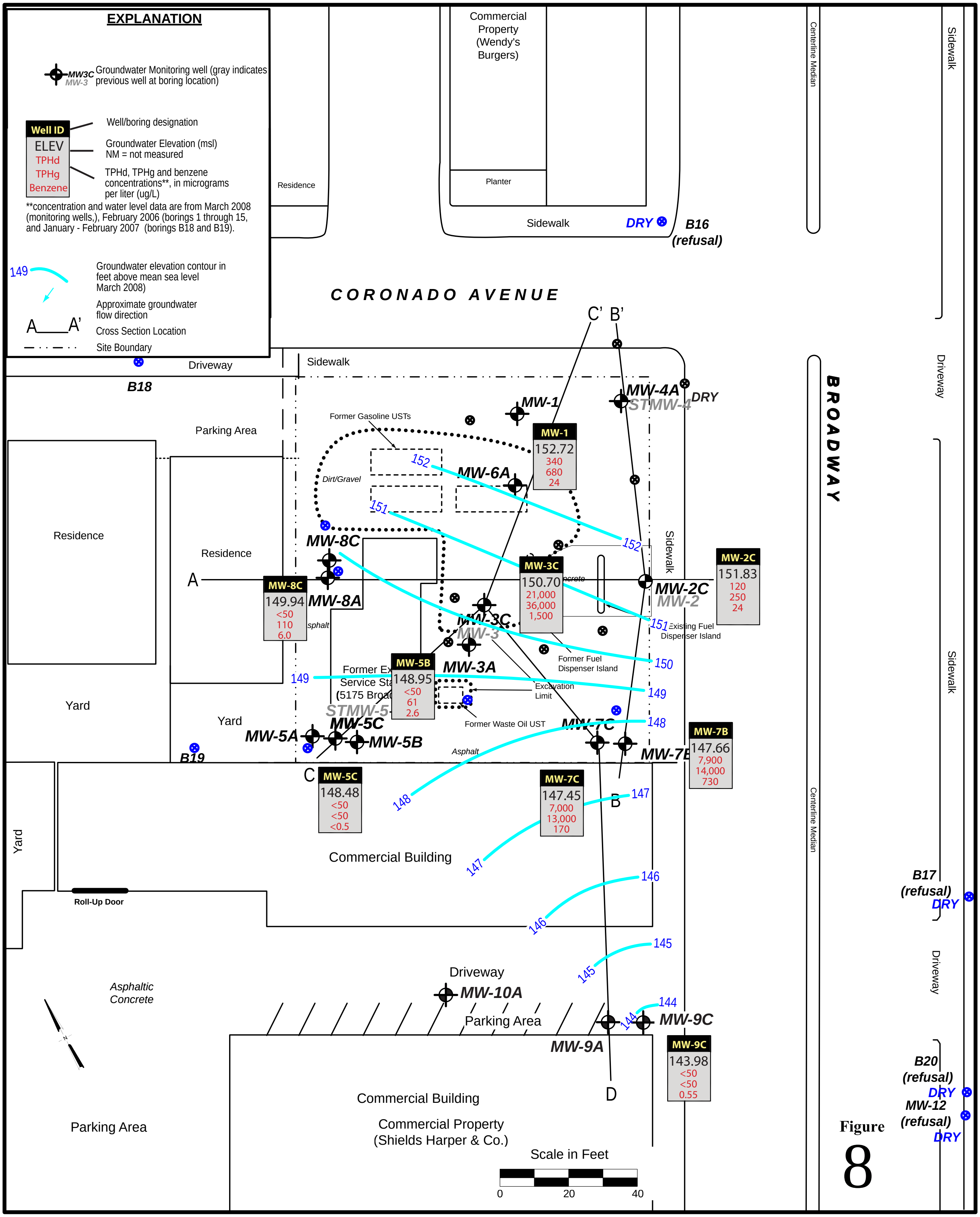


Figure
8

Former Exxon Station
5175 Broadway
Oakland, California

Groundwater Elevations and Hydrocarbon Concentrations in Deep Groundwater

PANGEA

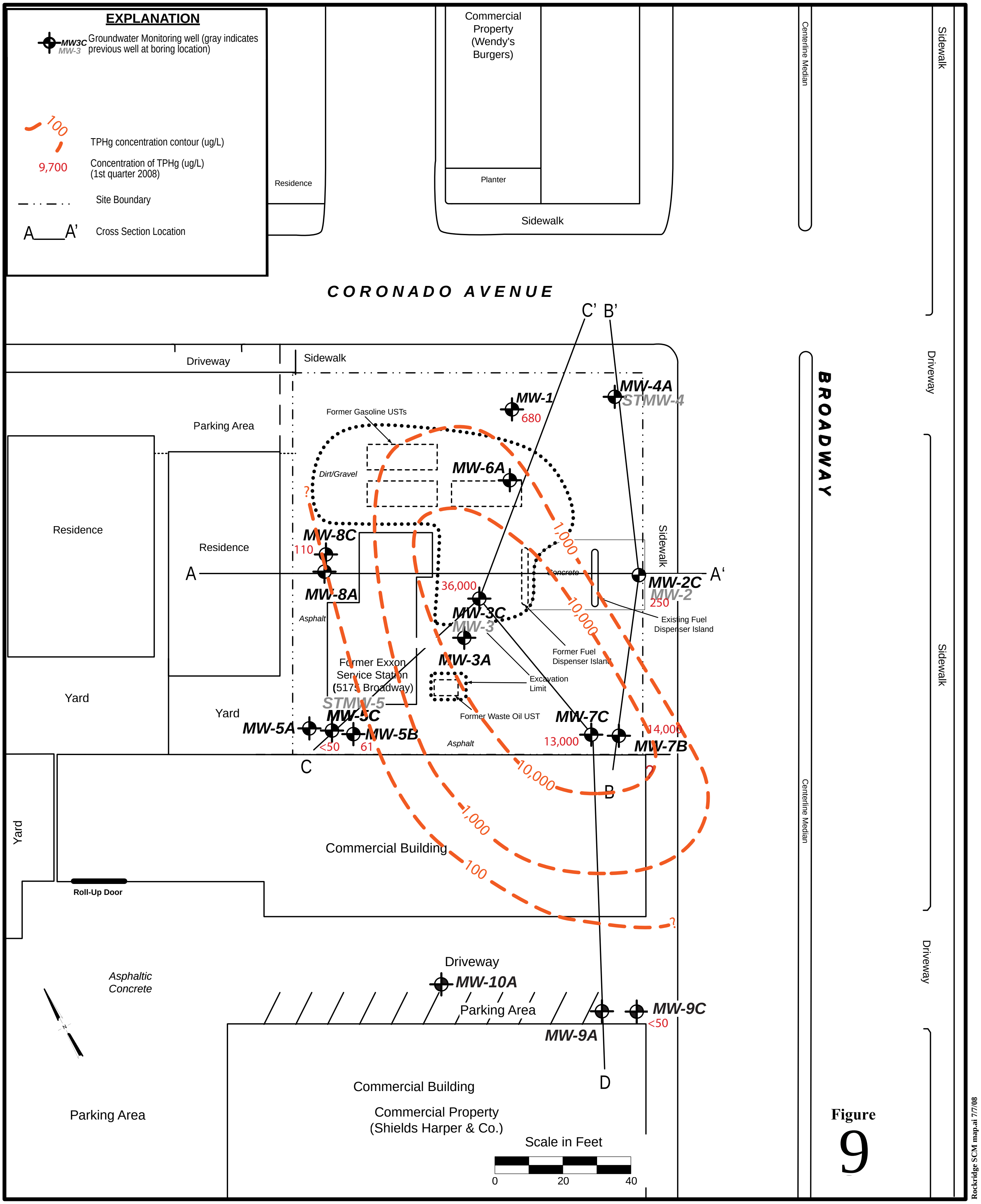


Figure
9

Former Exxon Station
5175 Broadway
Oakland, California

Contour Map of TPHg Concentrations
in Deep Groundwater

PANGEA

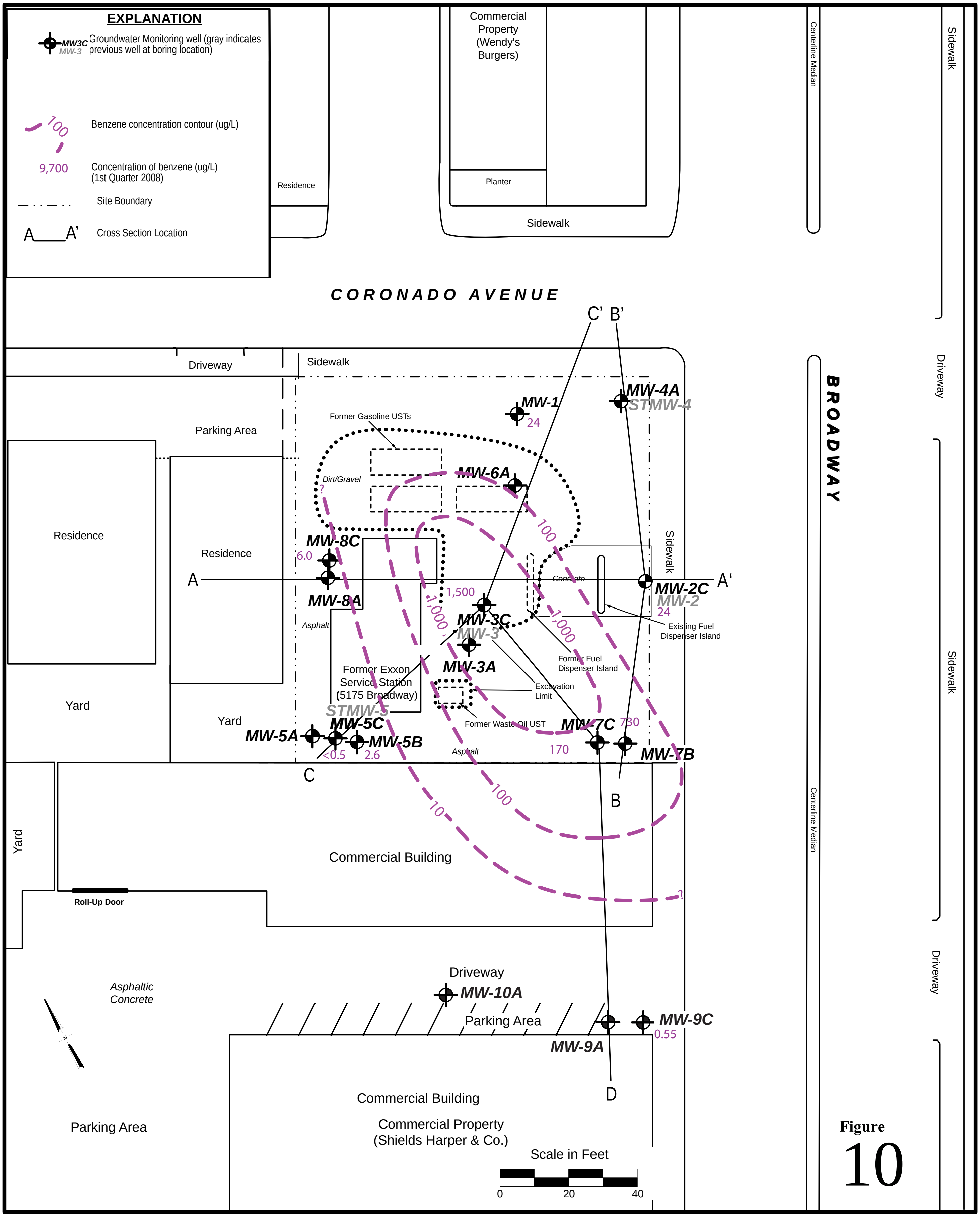


Figure
10

Rockridge SCM map.ai 7/7/08

Former Exxon Station
5175 Broadway
Oakland, California

Contour Map of Benzene Concentrations
in Deep Groundwater

PANGEA

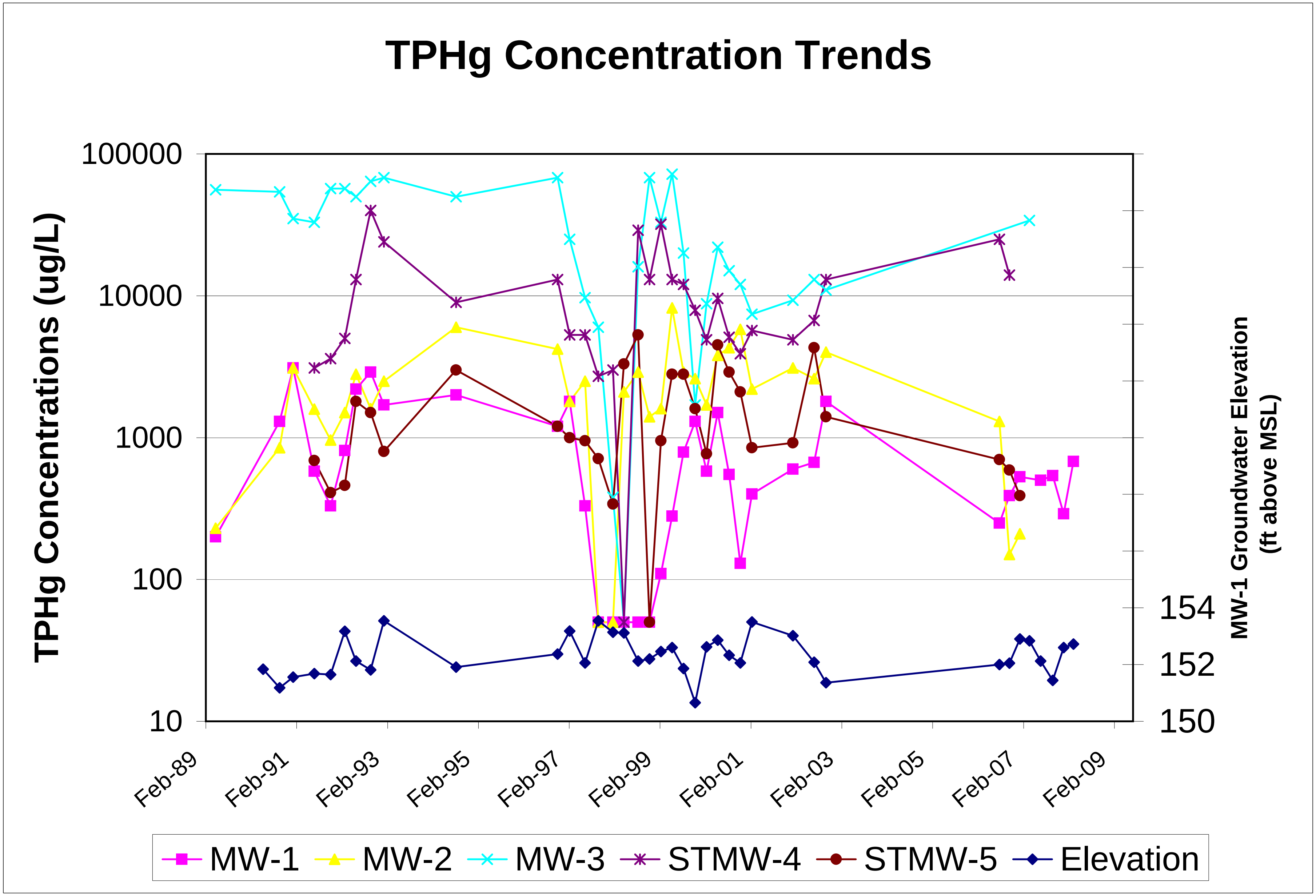


Figure 11. TPHg Concentration Trends in Selected Wells

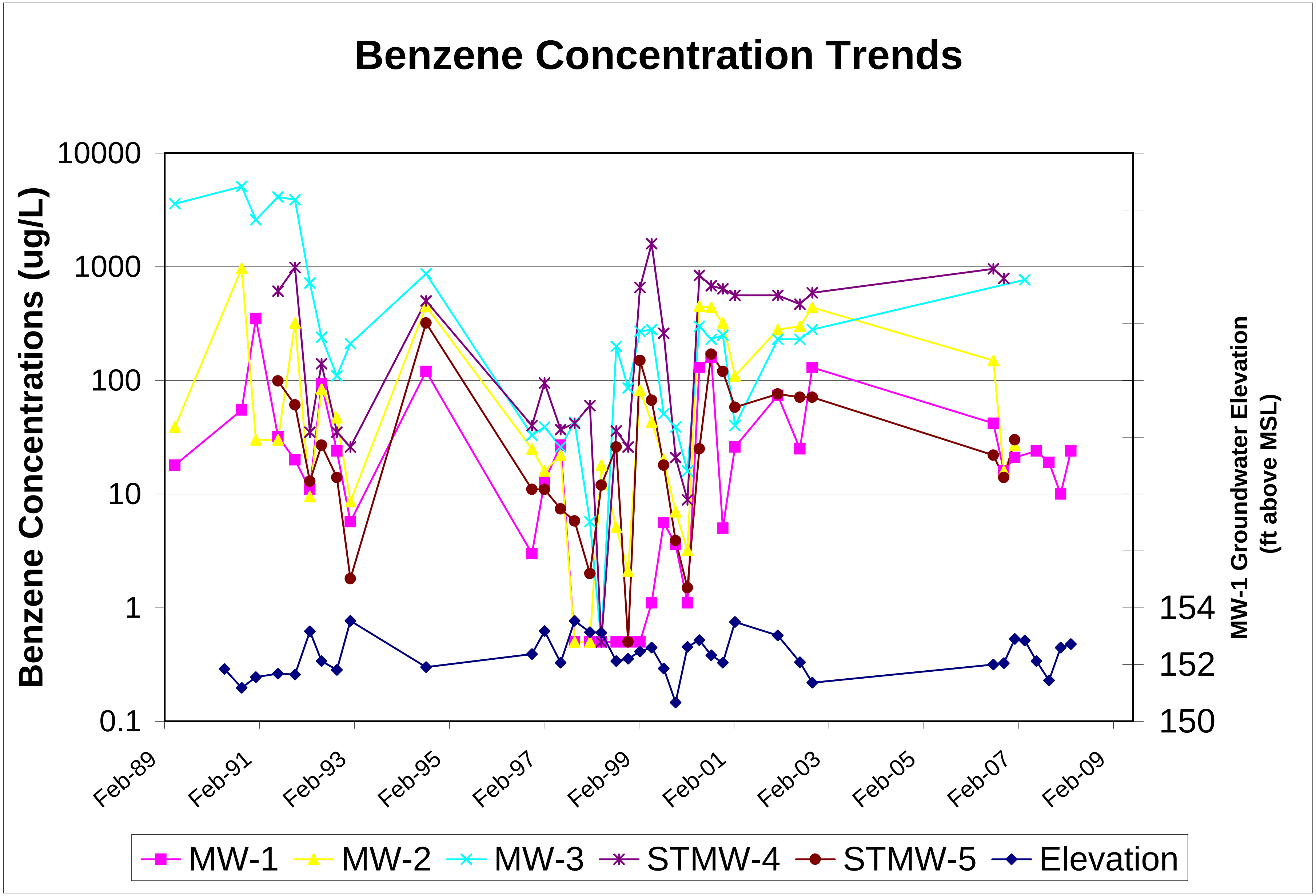
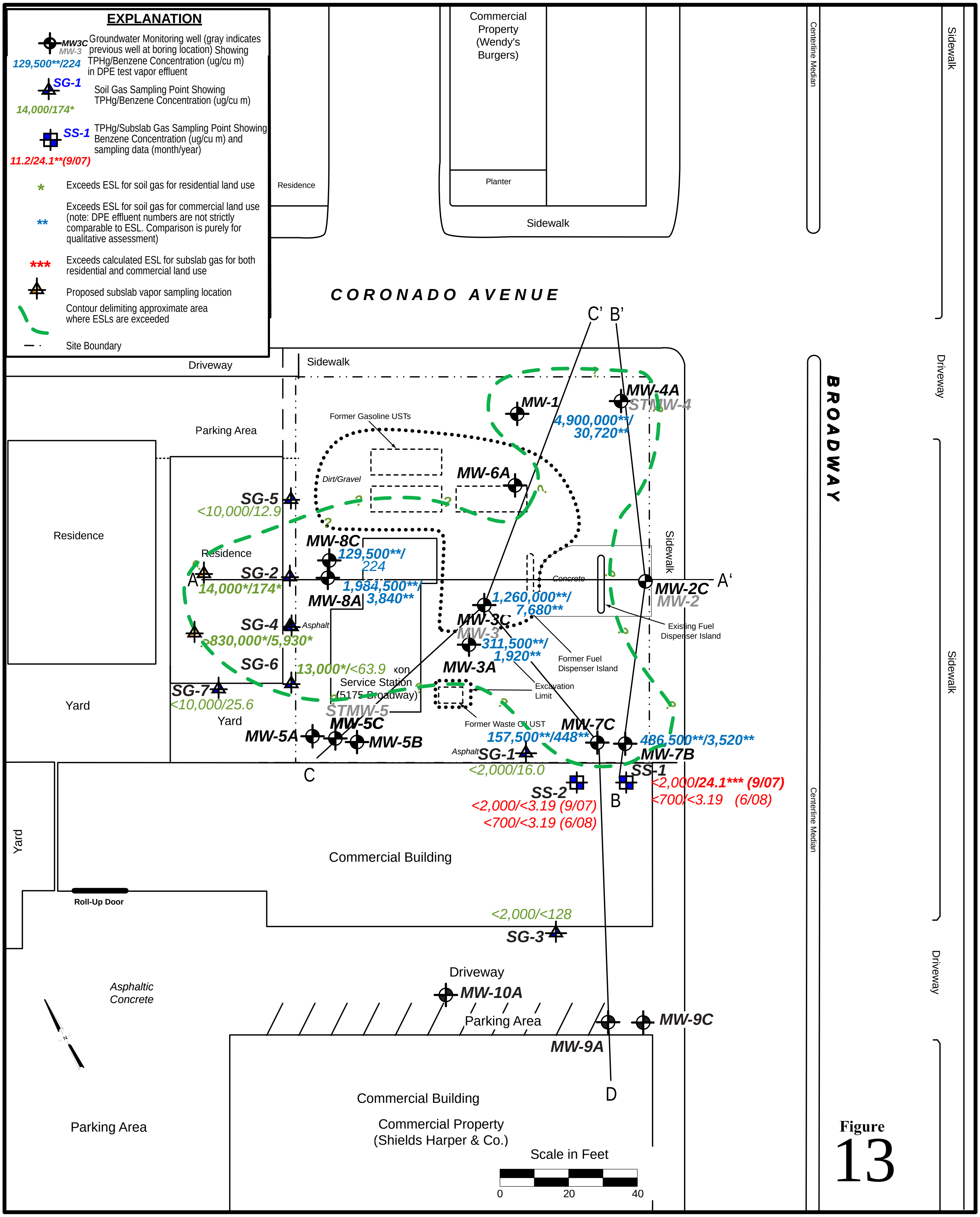


Figure 12. Benzene Concentration Trends in Selected Wells



Former Exxon Station
5175 Broadway
Oakland, California

Soil Gas and Subslab Gas Concentration Map

PANGEA

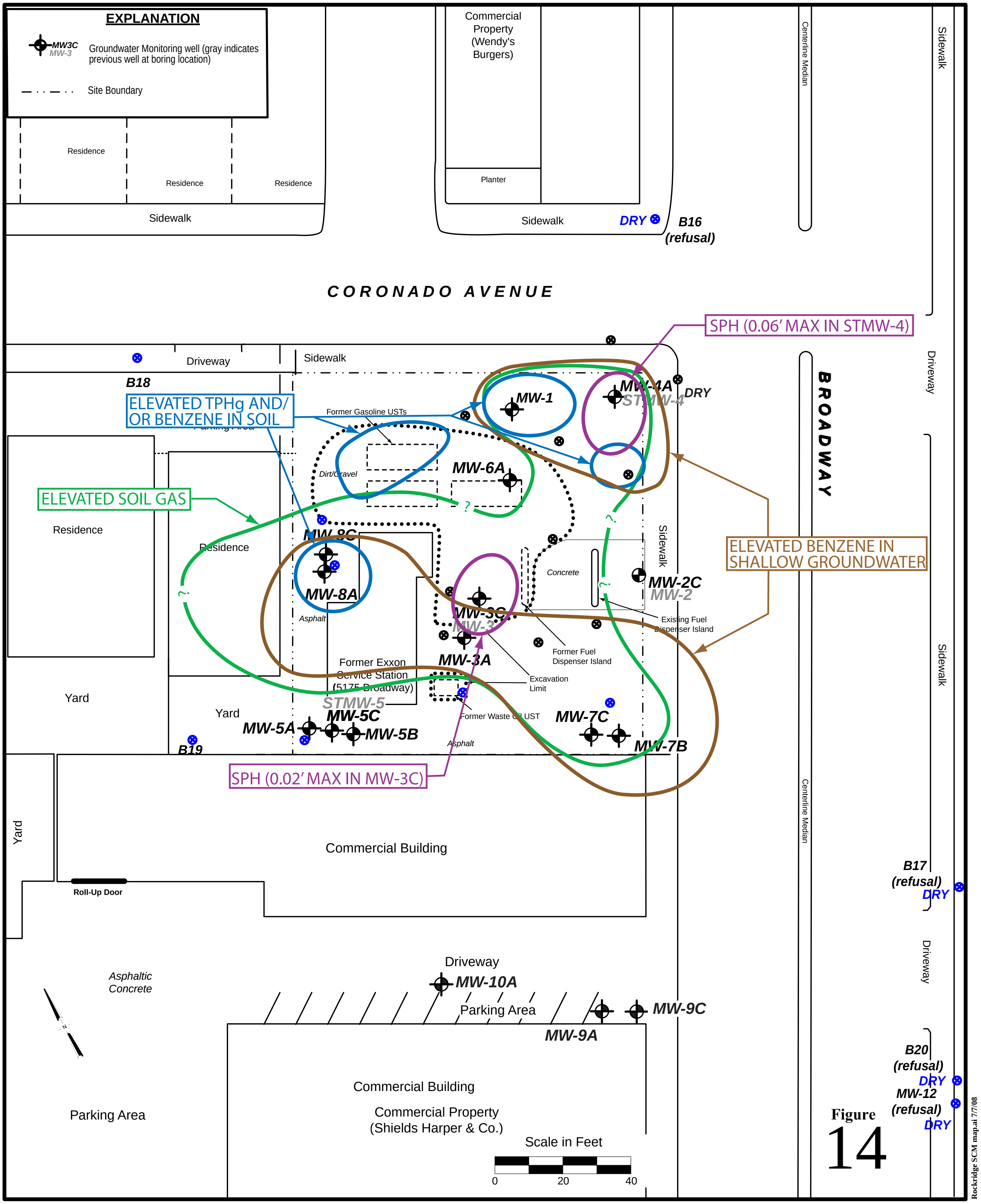


Figure
14

Former Exxon Station
5175 Broadway
Oakland, California

Summary of Shallow Impacts

PANGEA

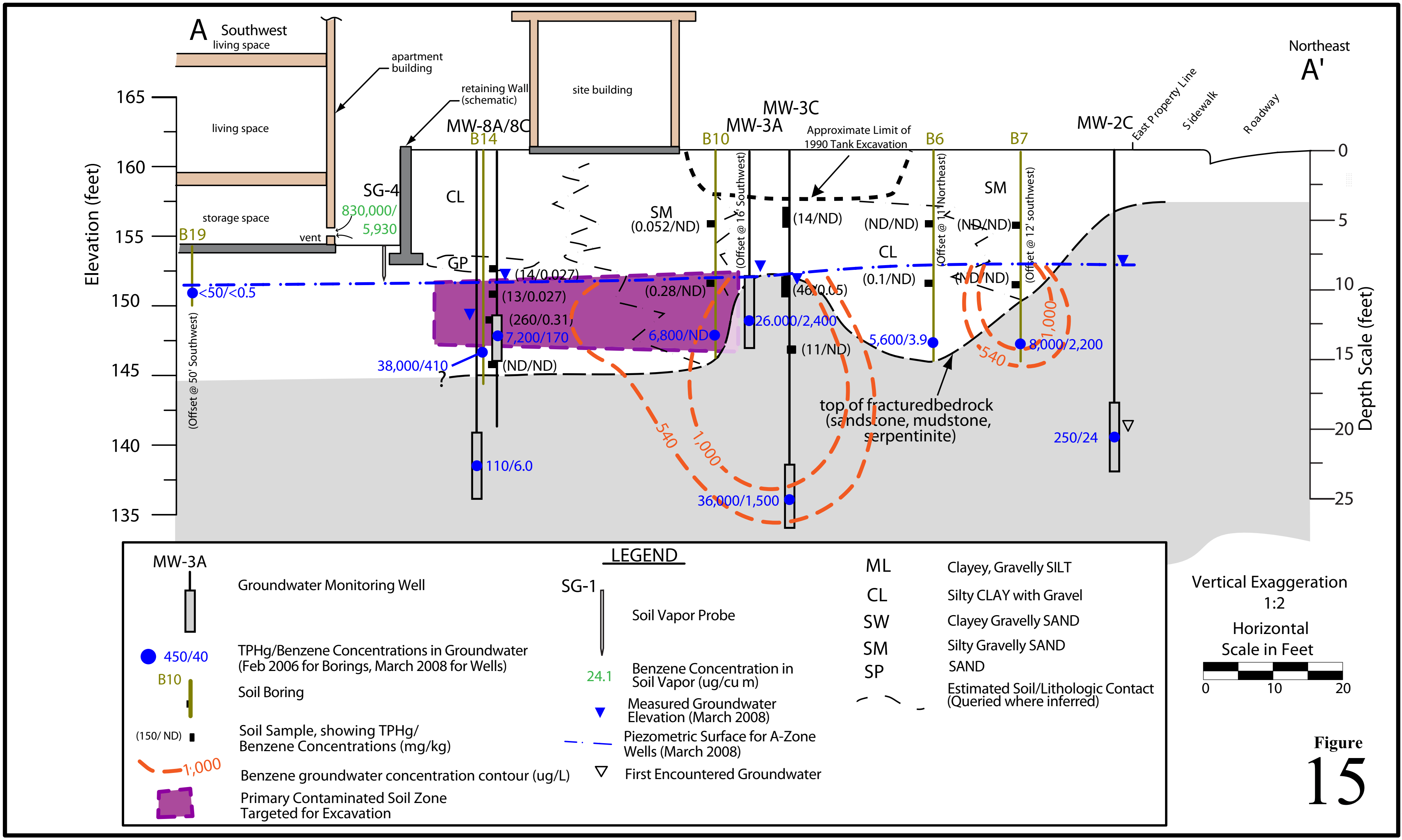


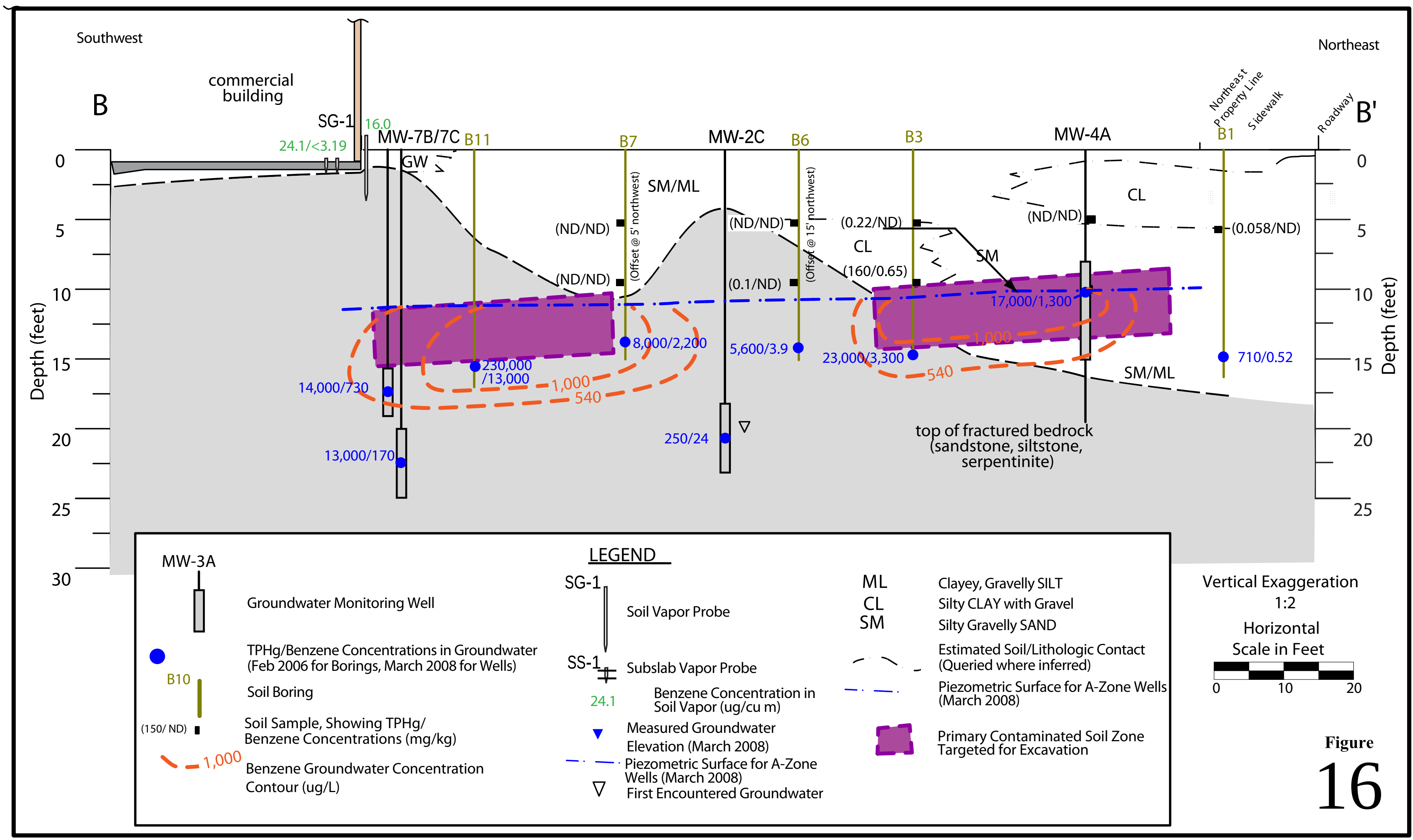
Figure
15

Rock Hgts SCM sectA.ai 6/08

Proposed Excavation on Geologic Cross Section A-A'

Former Exxon Station
5175 Broadway
Oakland, California

PANGEA



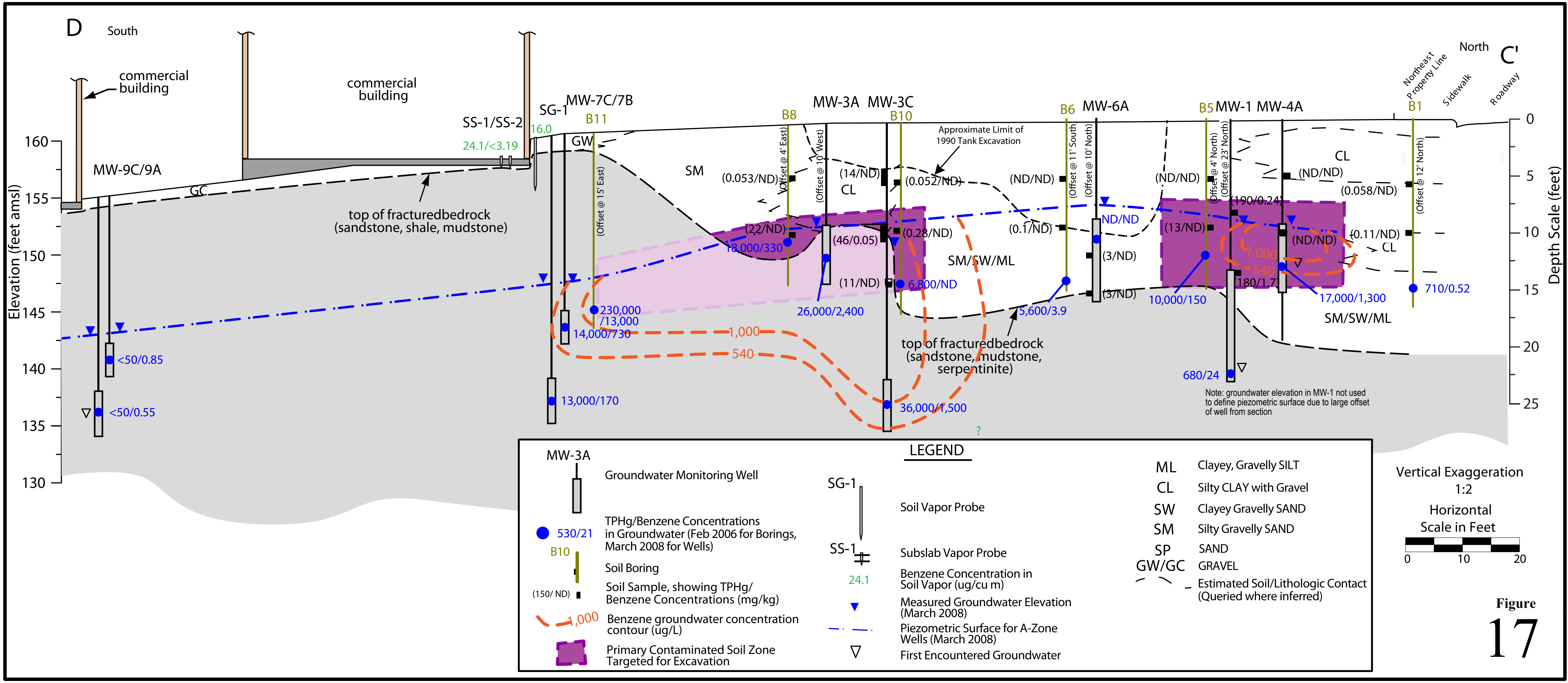
Figure

16

Former Exxon Station
5175 Broadway
Oakland, California

Proposed Excavation on Geologic Cross Section B-B'

PANGEA



Figure

17

Former Exxon Station
5175 Broadway
Oakland, California

PANGEA

Proposed Excavation on Geologic Cross Section D-C'

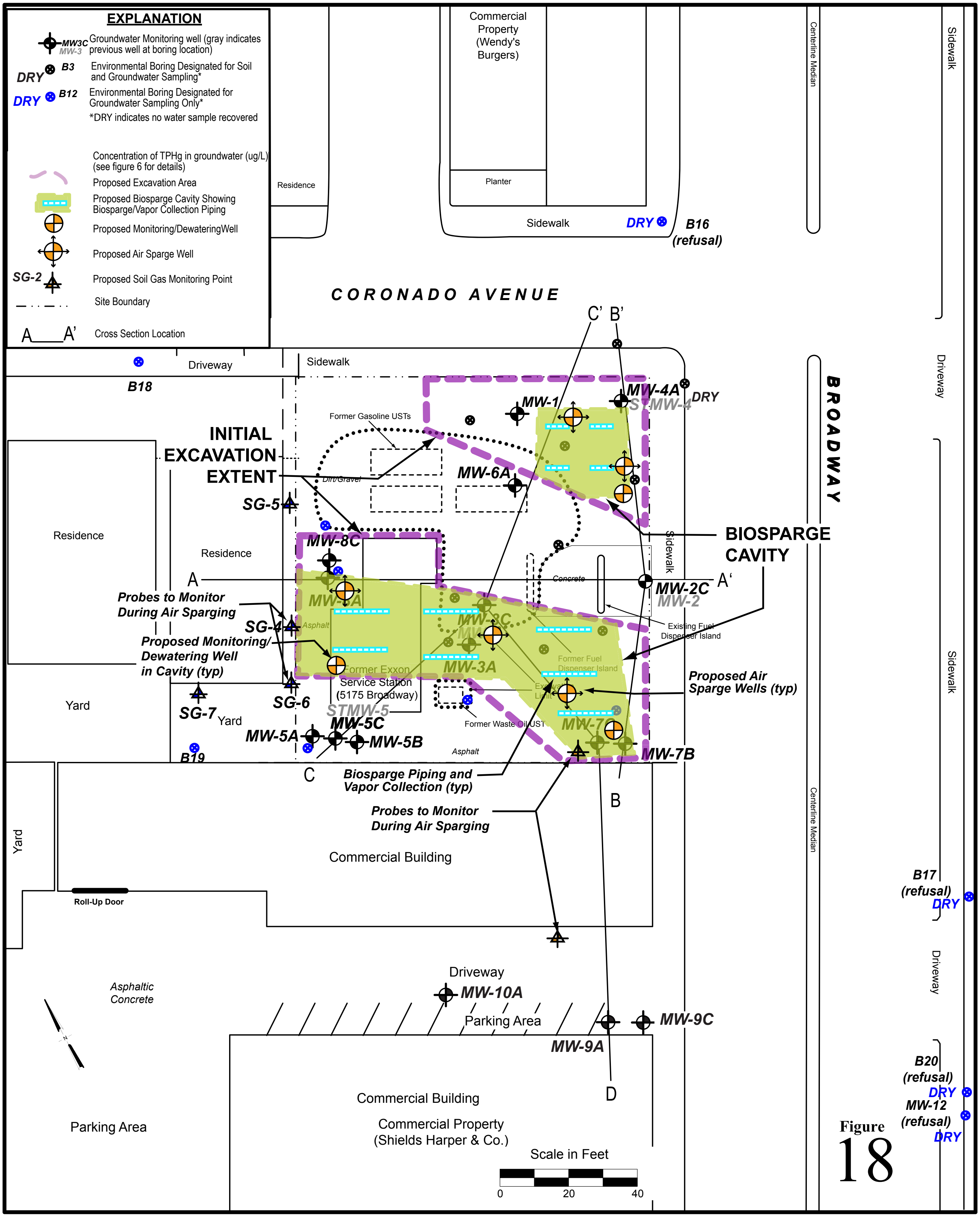


Figure
18

Former Exxon Station
5175 Broadway
Oakland, California

Excavation/Biosparging Approach

PANGEA

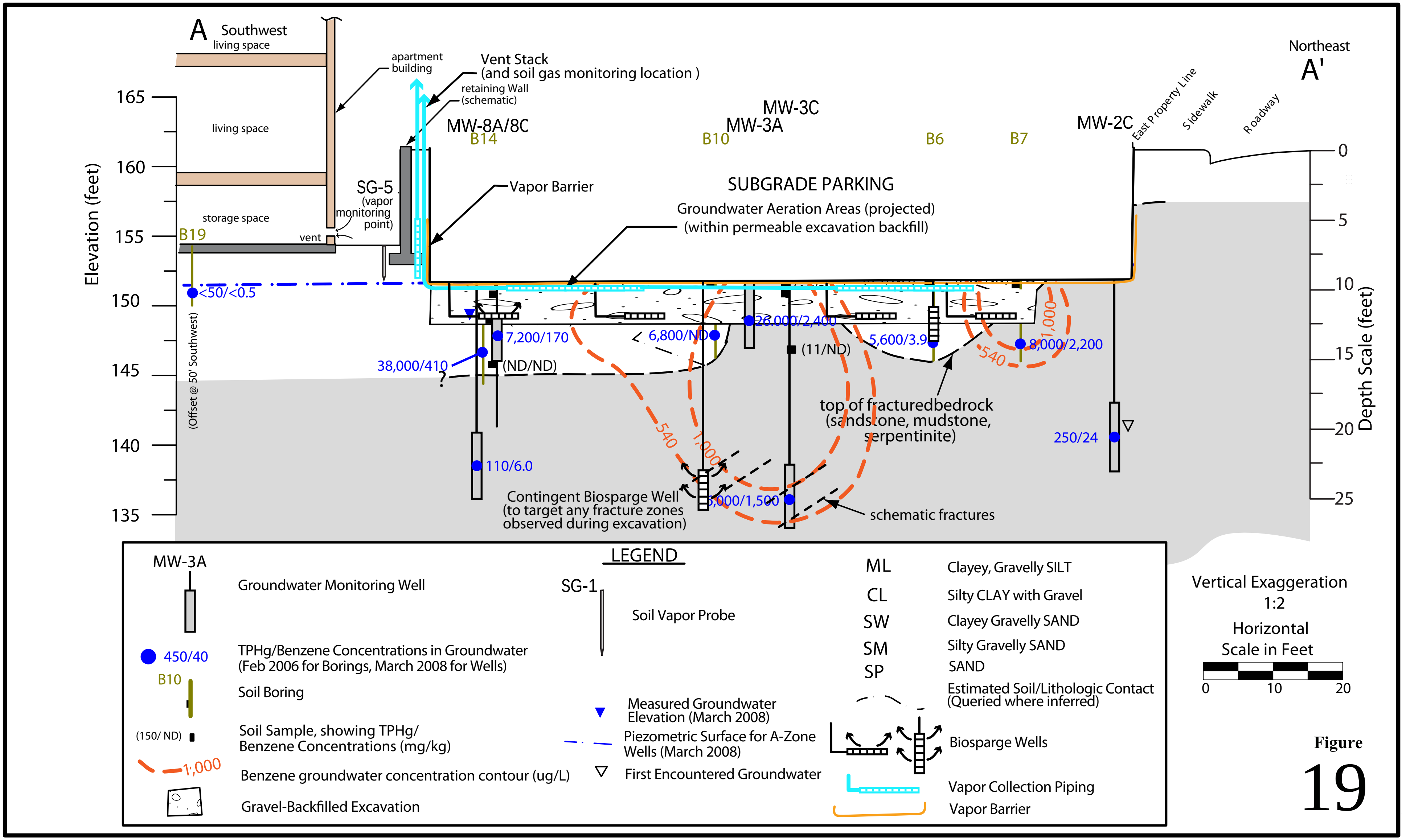


Figure
19

Rock Hgts SCM sectA.ai 6/08

Former Exxon Station
5175 Broadway
Oakland, California

Geologic Cross Section A-A'
Showing Proposed Biosparging System
Below Subgrade Garage

PANGEA

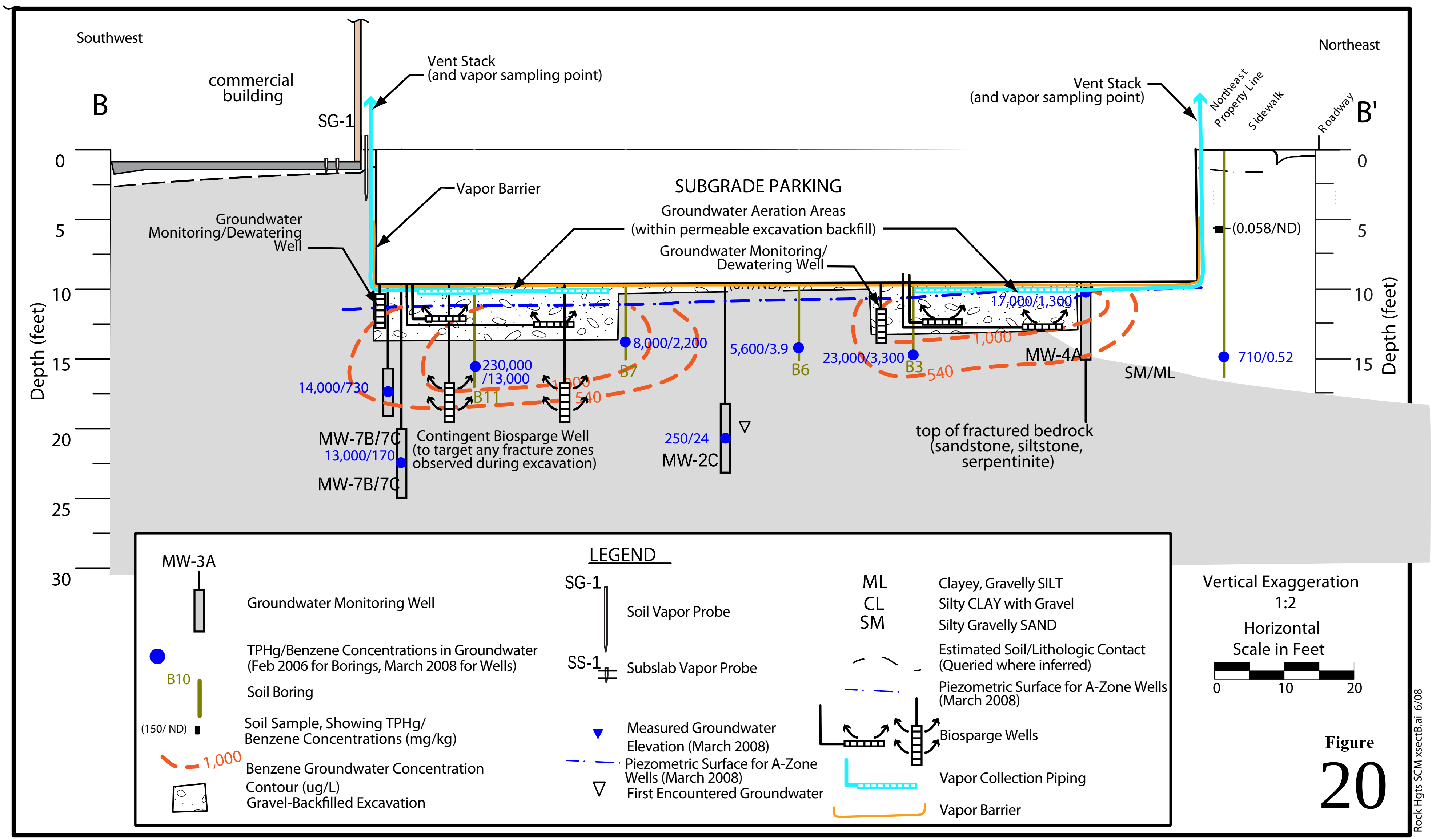


Figure
20

Former Exxon Station
5175 Broadway
Oakland, California

Geologic Cross Section B-B’
Showing Proposed Biosparging System
Below Subgrade Garage

PANGEA

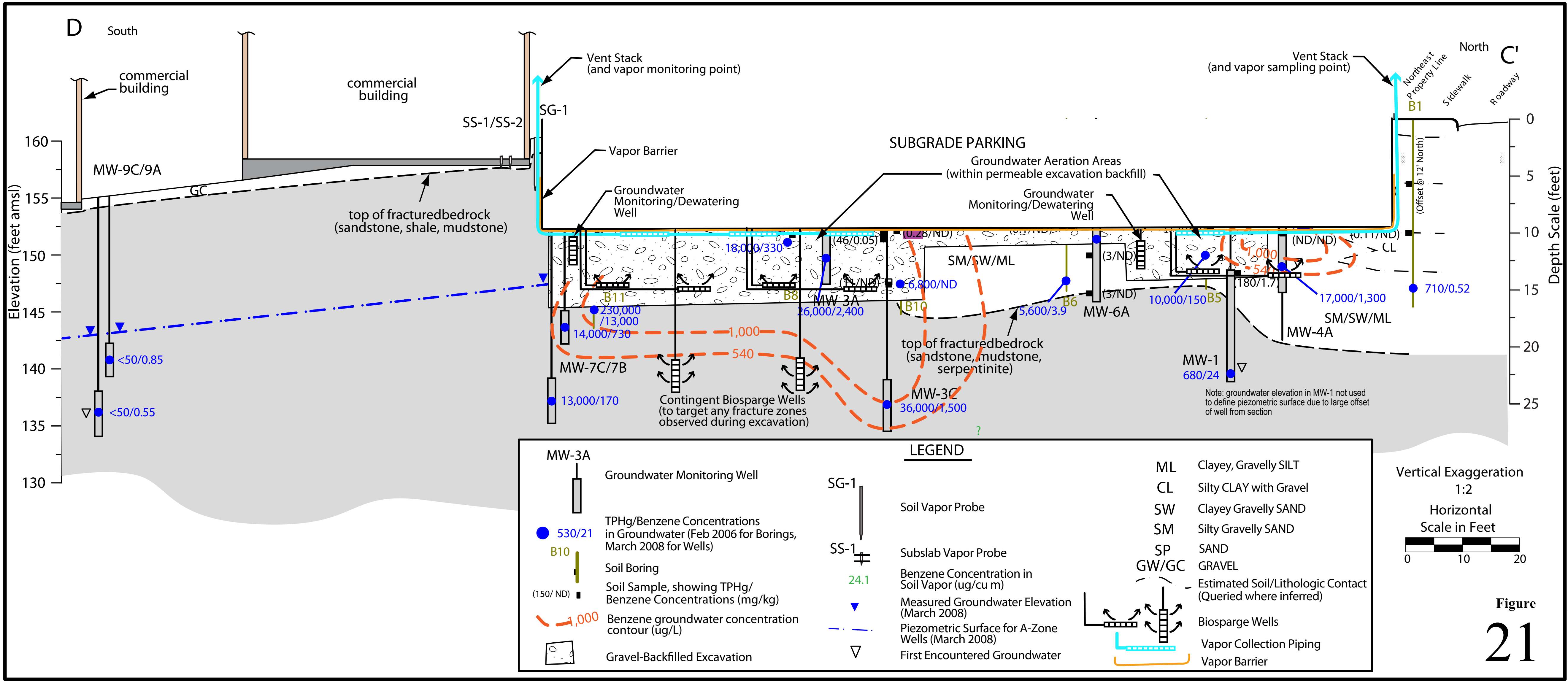


Figure
21

Former Exxon Station
5175 Broadway
Oakland, California

PANGEA

Geologic Cross Section D-C'
Showing Proposed Biosparging System
Below Subgrade Garage

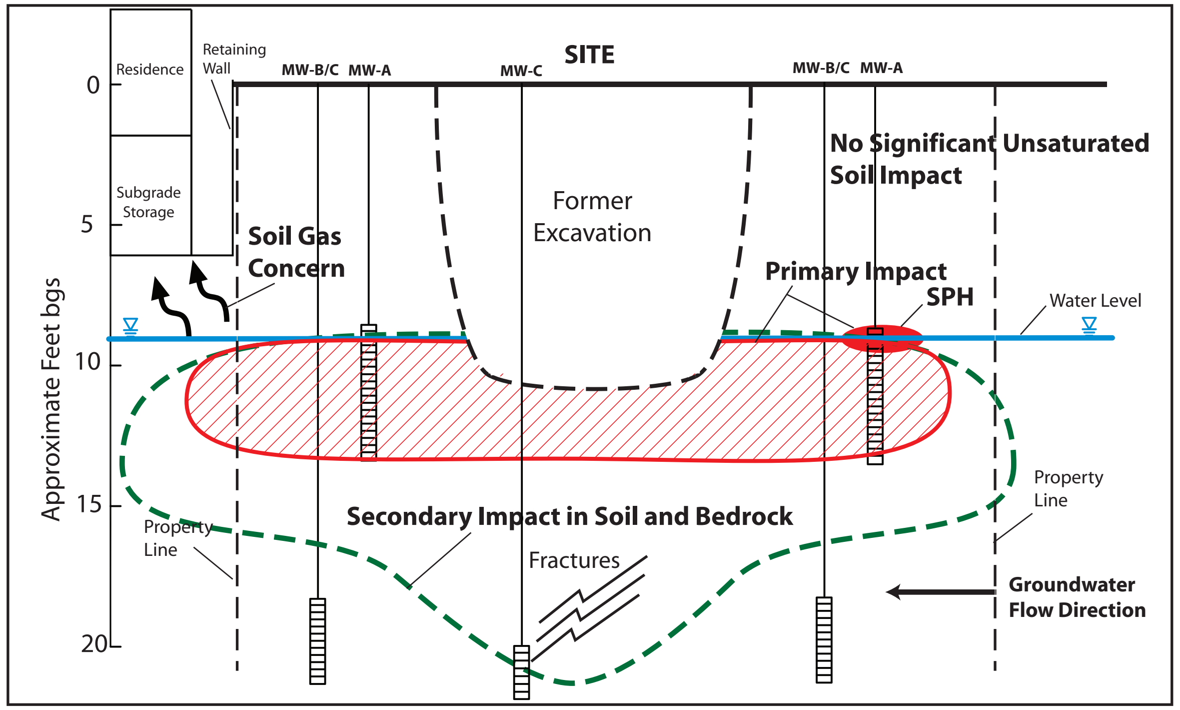
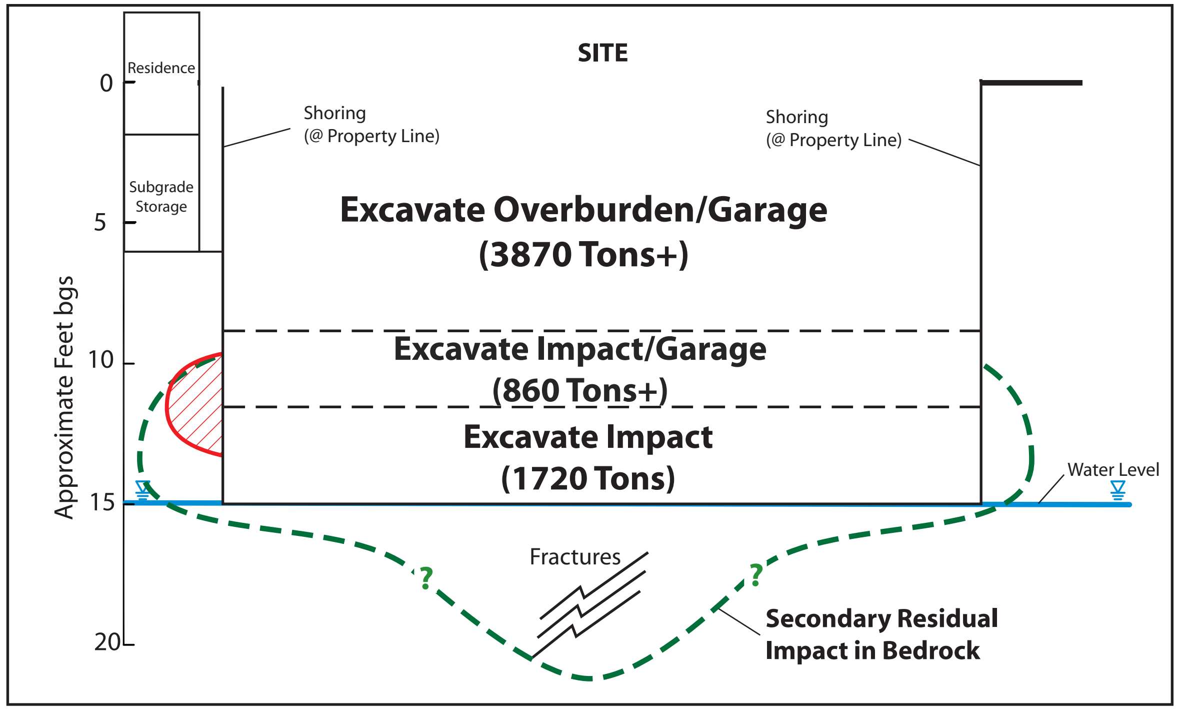
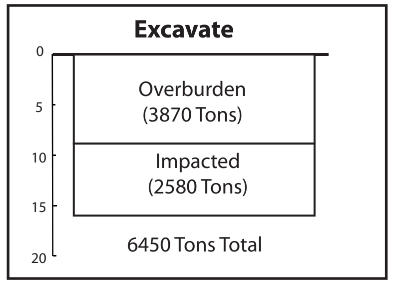
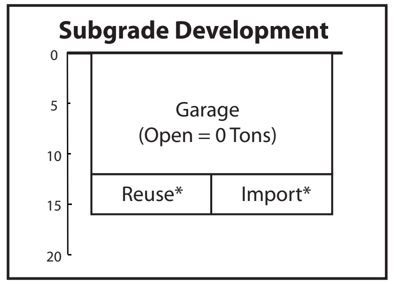


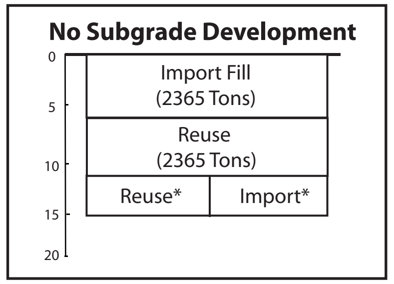
Illustration of primary impact in capillary fringe/shallow groundwater zone, with soil gas concern for adjacent residences with subgrade storage area. Primary hydrocarbon impact is SPH, absorbed to soil, in interstitial pore space, in bedrock fractures, and dissolved in groundwater.



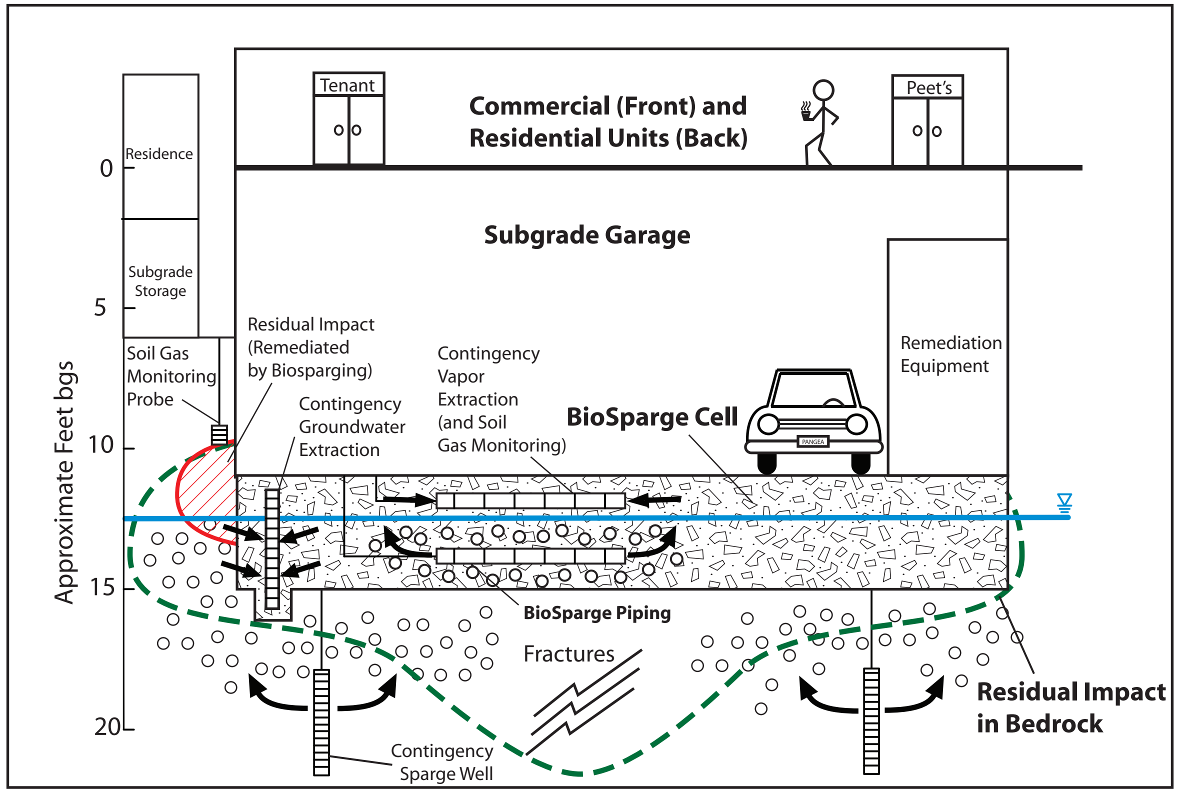
Excavation (6450 tons) can target primary impact and some of secondary impact. Approved development with subgrade garage will expedite cleanup and provide sufficient cost savings for excavation, backfilling and dewatering costs to make this approach very cost-effective. (+ = Estimated volume to target impact area, not entire garage area.)







NOTE: *Assumes one-half (860 tons) of the subgarage biosparge area of 1720 tons is backfilled with reuseable overburden rock or soil.



Excavation allows installation of sparging treatment cell to cost-effectively target residual impact in fractured bedrock and soil both onsite and offsite.

Figure

22

Former Exxon Station
5175 Broadway
Oakland, California

PANGEA

Conceptual Model for Excavation and Biosparging

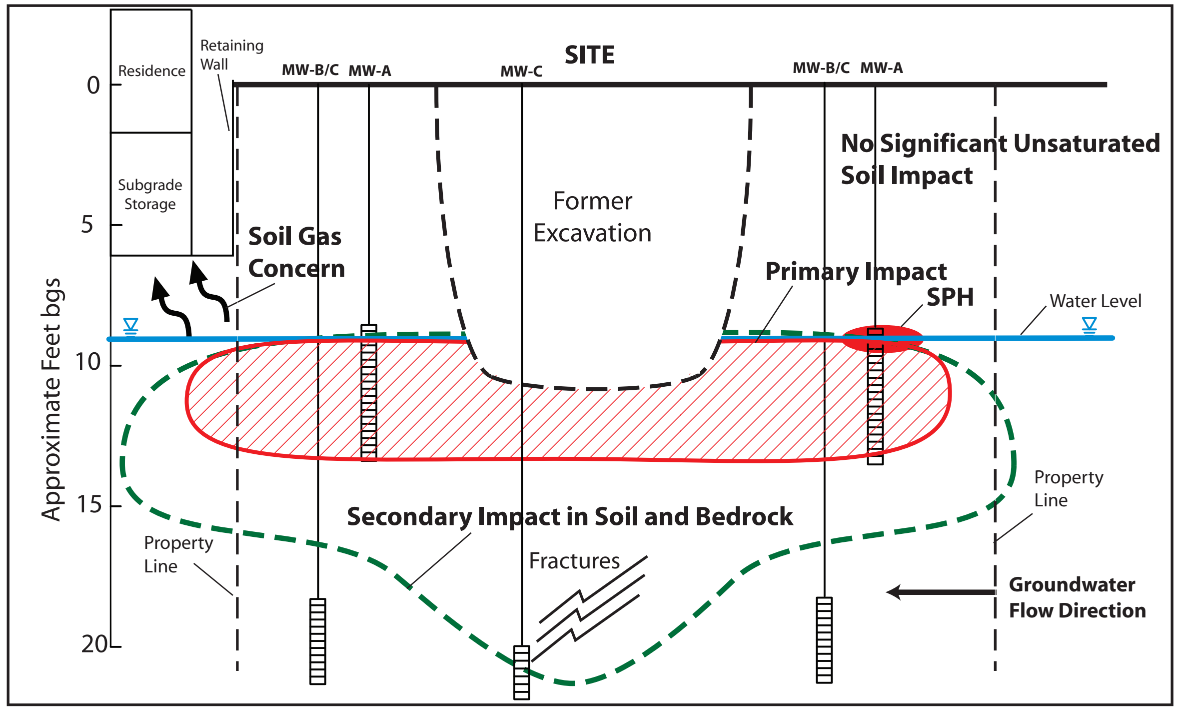
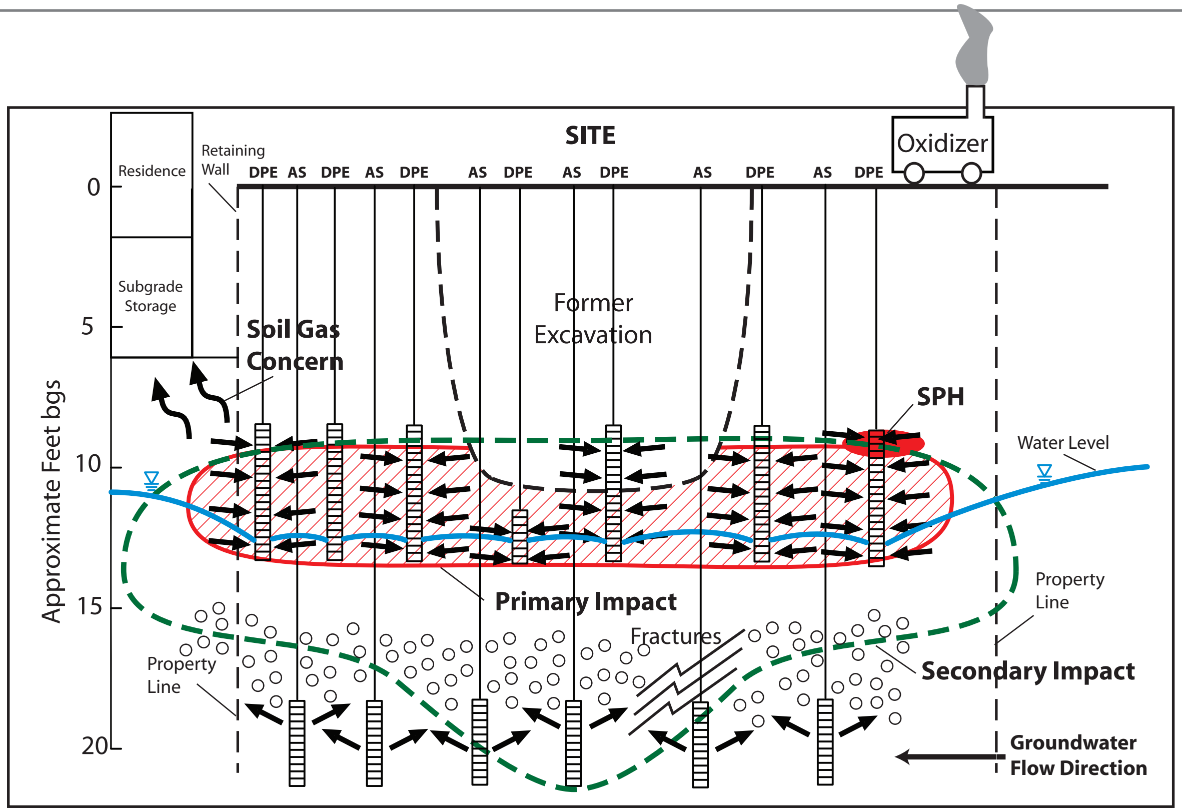
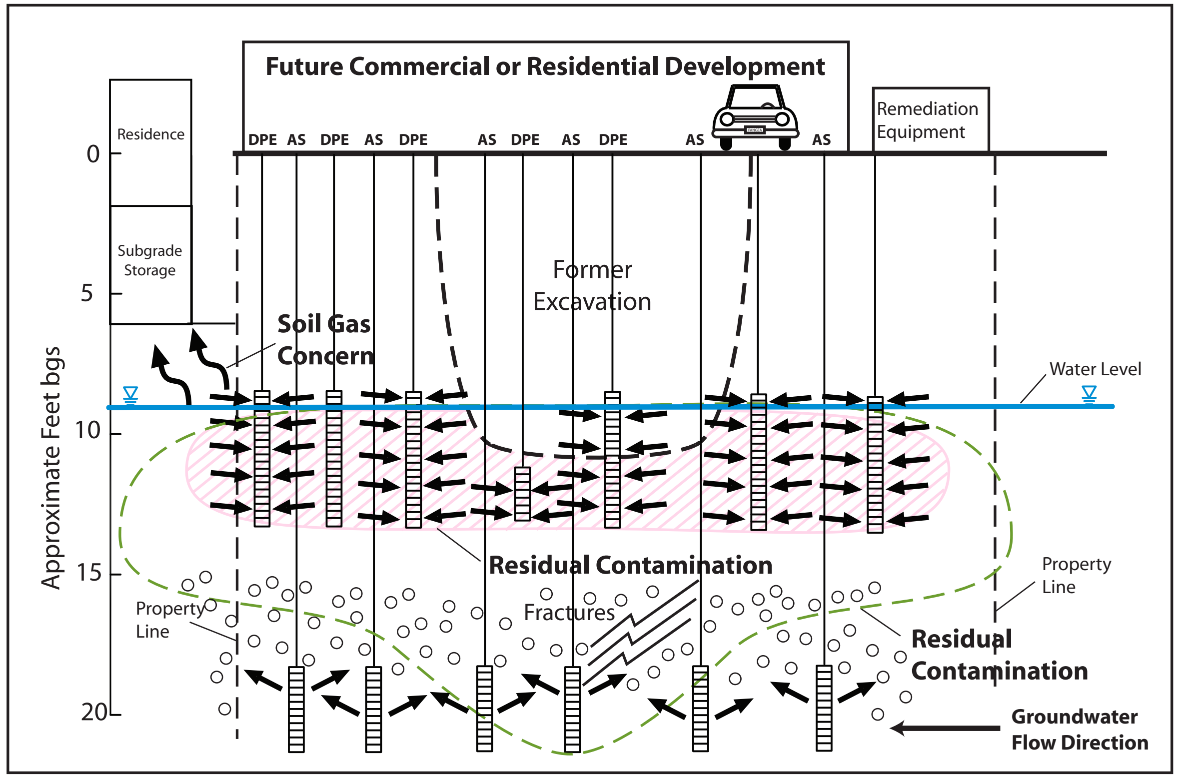


Illustration of primary impact in capillary fringe/shallow groundwater zone, with soil gas concern for adjacent residences with subgrade storage area. Primary hydrocarbon impact is SPH, absorbed to soil, in interstitial pore space, in bedrock fractures, and dissolved in groundwater.



Dual phase extraction and air sparging (DPE/AS) could cost effectively target the impact area, in the event subgrade excavation/development is not performed (and associated excavation/cleanup cost savings not provided). DPE/AS could be conducted before, during or after surface redevelopment.



After intial aggressive DPE/AS, less aggressive DPE/AS or biosparging can be performed, as merited, to target residual impact during and after any future surface redevelopment.

NOTE: DPE = Dual Phase Extraction
AS = Air Sparging

Figure
23

Former Exxon Station
5175 Broadway
Oakland, California

PANGEA

Conceptual Model for Dual Phase Extraction and Air Sparging

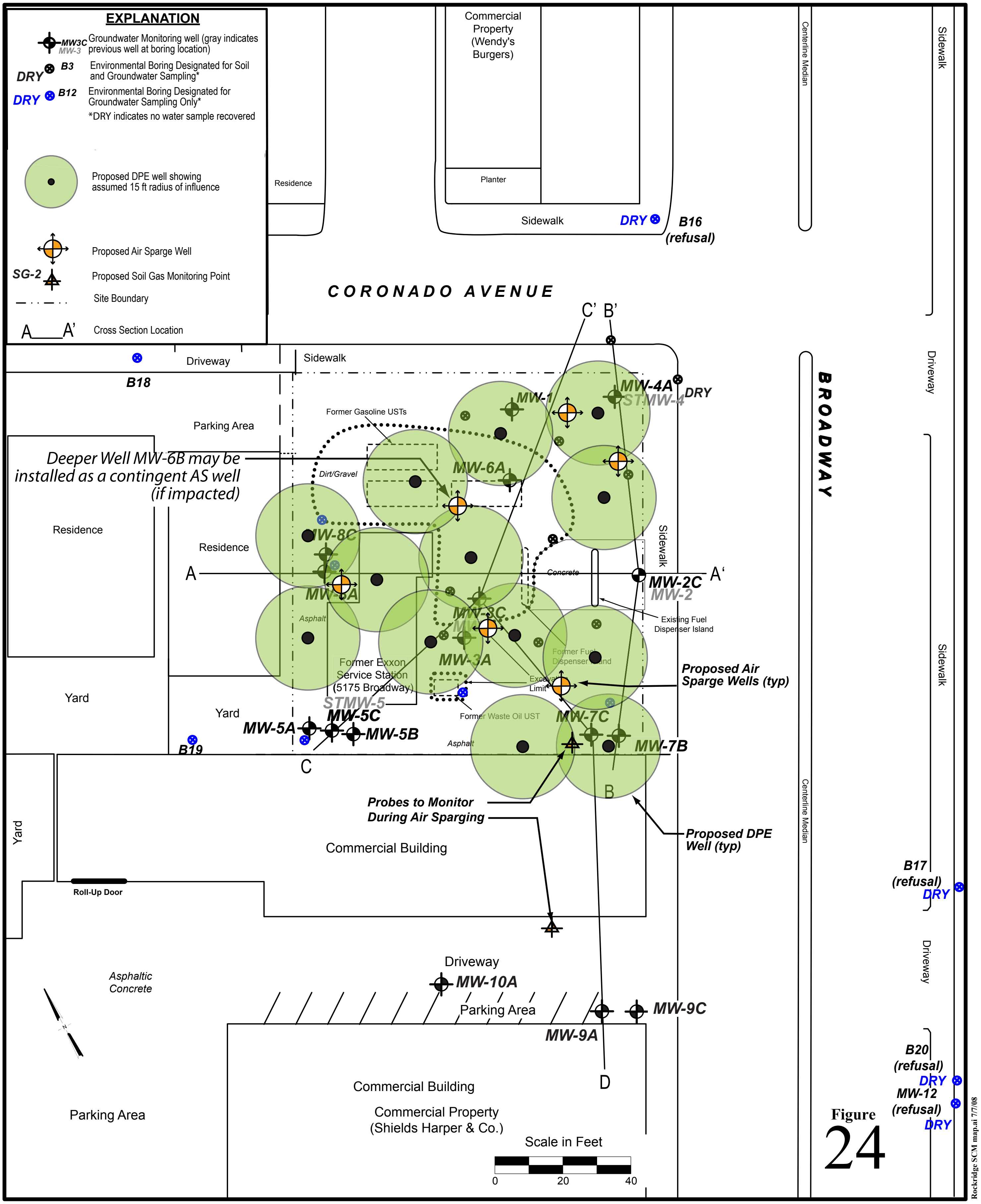


Figure
24

Former Exxon Station
5175 Broadway
Oakland, California

Alternative In Situ Approach of DPE/AS

PANGEA

Table 1. Soil Analytical Data - 5175 Broadway, Oakland, California

Sample ID	**Date Sampled**	**Sample Depth (ft bgs)**	**TPHd (mg/kg)**	**TPHg (mg/kg)**	**Benzene (mg/kg)**	**Toluene (mg/kg)**	**Ethyl benzene (mg/kg)**	**Xylenes (mg/kg)**	**MTBE (mg/kg)**	**TBA (mg/kg)**
Residential ESL, drinking water			**83**	**83**	**0.044**	**2.9**	**3.3**	**2.3**	**0.023**	**0.075**
Residential ESL, non-drinking water			100	100	0.12	9.3	4.7	11	8.4	100
Commercial ESL, drinking water			**83**	**83**	**0.044**	**2.9**	**3.3**	**2.3**	**0.023**	**0.075**
Commercial ESL, non-drinking water			180	180	0.27	9.3	4.7	11	8.4	110
WELL INSTALLATION & BORINGS - 2007										
MW-6A-12	1/22/2007	12.0	--	<50	<0.5	<0.5	<0.5	<0.5	<5.0	--
MW-6A-15	1/22/2007	15.0	--	2.9	<0.5	0.0087	<0.5	<0.5	<5.0	--
MW-8A-8.5	1/22/2007	8.5	--	14	0.027	0.027	0.013	0.072	<5.0	--
MW-8A-10	1/22/2007	10.0	--	13	0.027	<0.5	<0.5	0.039	<5.0	--
MW-8A-12	1/22/2007	12.0	--	**260**	**0.31**	0.16	0.083	0.73	<0.25	--
MW-8A-15	1/22/2007	15.0	--	<50	<0.5	<0.5	<0.5	<0.5	<5.0	--
BORINGS - 2006										
B1-6	2/1/2006	6.0	<100	0.058	<0.005	<0.005	<0.005	<0.01	<0.005	--
B1-10	2/1/2006	10.0	<100	0.11	<0.005	<0.005	<0.005	<0.01	<0.005	--
B2-6	2/1/2006	6.0	--	0.15	<0.005	<0.005	<0.005	<0.01	<0.005	--
B2-9	2/1/2006	9.0	--	<0.05	<0.005	<0.005	<0.005	<0.01	<0.005	--
B3-5	2/6/2006	5.0	--	0.22	<0.005	<0.005	<0.005	<0.01	<0.005	--
B3-9	2/6/2006	9.0	--	160	<0.65	<0.500	<0.500	<1.000	<0.500	--
B4-5	2/6/2006	5.0	--	<0.05	<0.005	<0.005	<0.005	<0.01	<0.005	--
B4-9	2/6/2006	9.0	--	140	<0.500	<0.500	0.66	<1.000	<0.500	--
B5-5	2/6/2006	5.0	--	<0.05	<0.005	<0.005	<0.005	<0.01	<0.005	--
B5-9	2/6/2006	9.0	<2.5	13	<0.25	<0.25	<0.25	<0.5	<0.25	--
B6-5	2/6/2006	5.0	--	<0.05	<0.005	<0.005	<0.005	<0.01	<0.005	--
B6-9	2/6/2006	9.0	<2.5	0.10	<0.005	<0.005	<0.005	<0.01	<0.005	--
B7-5	2/6/2006	5.0	--	<0.05	<0.005	<0.005	<0.005	<0.01	<0.005	--
B7-9	2/6/2006	9.0	<2.5	<0.05	<0.005	<0.005	<0.005	<0.01	<0.005	--
B8-5	2/6/2006	5.0	--	0.053	<0.005	<0.005	<0.005	<0.01	<0.005	--
B8-9	2/6/2006	9.0	--	22	<0.25	<0.25	<0.25	<0.5	<0.25	--
B9-5	2/6/2006	5.0	--	1.8	<0.005	<0.005	<0.005	<0.01	<0.005	--
B9-9	2/6/2006	9.0	<2.5	**180**	<0.500	<0.500	<0.500	<1.000	<0.500	--
B10-5	2/6/2006	5.0	--	0.052	<0.005	<0.005	<0.005	<0.01	<0.005	--
B10-9	2/6/2006	9.0	--	0.28	<0.005	<0.005	<0.005	<0.01	<0.005	--
WELL INSTALLATION - 1990 & 1991										
MW-1	4/17/1990	8.0-8.5	--	**190**	**0.24**	0.21	0.92	0.6	--	--
MW-1	4/17/1990	13.5-14	--	**180**	**1.7**	1.4	2.4	**6.4**	--	--
MW-2	4/24/1990	3.0-4.5	--	≤5	0.0061	0.005	0.0057	0.026	--	--
MW-2	4/24/1990	8.0-9.0	--	≤5	0.006	0.005	0.0089	0.013	--	--
MW-3	4/17/1990	4.0-5.5	--	14	≤5.0	≤5.0	≤5.0	0.1	--	--
MW-3	4/17/1990	9.0-10.0	--	46	**0.05**	≤5.0	0.4	0.2	--	--
MW-3	4/17/1990	14.0-14.5	--	11	≤5.0	≤5.0	≤5.0	0.1	--	--
STMW-4	6/21/1991	5.0	--	≤5	≤5.0	≤5.0	≤5.0	≤5.0	--	--
STMW-4	6/21/1991	10.0	--	≤5	≤5.0	≤5.0	≤5.0	≤5.0	--	--
STMW-5	6/21/1991	5.0	--	≤5	≤5.0	≤5.0	≤5.0	≤5.0	--	--
STMW-5	6/21/1991	10.0	--	≤5	≤5.0	<5.0	≤5.0	≤5.0	--	--

Table 1. Soil Analytical Data - 5175 Broadway, Oakland, California

Sample ID	**Date Sampled**	**Sample Depth (ft bgs)**	**TPHd (mg/kg)**	**TPHg (mg/kg)**	**Benzene (mg/kg)**	**Toluene (mg/kg)**	**Ethyl benzene (mg/kg)**	**Xylenes (mg/kg)**	**MTBE (mg/kg)**	**TBA (mg/kg)**
Residential ESL, drinking water			**83**	**83**	**0.044**	**2.9**	**3.3**	**2.3**	**0.023**	**0.075**
Residential ESL, non-drinking water			100	100	0.12	9.3	4.7	11	8.4	100
Commercial ESL, drinking water			**83**	**83**	**0.044**	**2.9**	**3.3**	**2.3**	**0.023**	**0.075**
Commercial ESL, non-drinking water			180	180	0.27	9.3	4.7	11	8.4	110
TANK REMOVAL & OVEREXCAVATION										
S-1-W	1/10/1990	7.0	10	≤5	≤5.0	≤5.0	≤5.0	≤5.0	--	--
S-2-N	1/10/1990	10.0	--	**970**	≤5.0	≤5.0	**13**	**15**	--	--
S-3-N	1/10/1990	10.0	--	**120**	≤5.0	≤5.0	≤5.0	≤5.0	--	--
S-3-S	1/10/1990	10.0	--	**930**	≤5.0	≤5.0	≤5.0	14	--	--
S-4-N	1/10/1990	10.0	--	12	≤5.0	≤5.0	≤5.0	0.13	--	--
S-4-S	1/10/1990	10.0	--	55	≤5.0	≤5.0	≤5.0	0.8	--	--
S-P-1	1/31/1990	2.0-3.0	--	≤5	≤5.0	≤5.0	≤5.0	≤5.0	--	--
S-P-2	1/31/1990	2.0-3.0	--	≤5	≤5.0	≤5.0	≤5.0	≤5.0	--	--
S-P-3	1/31/1990	2.0-3.0	--	34	≤5.0	≤5.0	≤5.0	≤5.0	--	--

Abbreviations and Methods:

ESL = Environmental Screening Levels for shallow soil with residential and/or commercial/industrial land use, established by the SFBRWQCB, Interim Final - November 2007 (Revised May 2008).

970 = Concentrations in **bold** indicate soil exceeding the final ESL (residential and commercial) protective of groundwater as a drinking water resource.

ft bgs = feet below ground surface.

mg/kg = milligrams per kilogram.

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

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

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

MTBE = Methyl tertiary butyl ether by EPA Method 8260.

-- = Not collected, not analyzed, or not applicable.

ND = Not detected above laboratory reporting limits.

Table 2. Groundwater Analytical Data - Former Exxon Station, 5175 Broadway, Oakland, CA

Well ID *TOC Elev* *(ft)*	Date Sampled	SPH (ft)	Groundwater Elevation (ft)	Depth to Water (ft)	TPHd	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	DIPE	1,2-DCA	Dissolved Oxygen mg/L
					←				µg/L				→	
Final ESL, **dw**		--	--	--	**100**	**100**	**1**	**40**	**30**	**20**	**5**	**--**	**0.5**	**--**
Final ESL, **non-dw**		--	--	--	210	210	46	130	43	100	1,800	--	200	--
Residential ESL,indoor air		--	--	--	SG	SG	540	380,000	170,000	160,000	24,000		200	
Commercial ESL, indoor air		--	--	--	SG	SG	1,800	530,000	170,000	160,000	80,000	--	690	--
Drinking Water Toxicity, dw:					210	210	1.0	150	300	1,800	13		1	
Ceiling Value, **dw**:					100	100	170	40	30	20	5		7,000	
Aquatic Habitat Goal:					210	210	46	130	43	100	8,000		2,000	
MW-1	04/30/89	--	--	--	--	200	18	5	2	12	--	--	--	--
(97.71)	05/17/90	--	151.84	9.26	--	--	--	--	--	--	--	--	--	--
	09/26/90	--	151.18	9.92	--	1,300	55	31	120	100	--	--	--	--
	01/14/91	--	151.56	9.54	--	3,100	350	83	86	130	--	--	--	--
(102.04)	07/03/91	--	151.68	9.42	--	580	32	41	40	55	--	--	--	--
	11/11/91	--	151.65	9.45	--	330	20	2	2	11	--	--	--	--
(101.83)	03/04/92	--	153.17	7.93	--	810	11	5	10	23	--	--	--	--
	06/02/92	--	152.12	8.98	--	2,200	93	32	40	120	--	--	--	--
	09/28/92	--	151.81	9.29	--	2,900	24	78	19	37	--	--	--	--
	01/11/93	--	153.54	7.56	--	1,700	5.7	6	11	28	--	--	--	--
	08/15/94	--	151.91	9.19	--	2,000	120	3	6	16	--	--	--	--
(97.50)	11/07/96	--	152.37	8.73	270	1,200	3	1.1	1.5	3.8	<0.5	--	--	--
	02/12/97	--	153.18	7.92	<50	1,800	13	5.7	4.8	17	<0.5	--	--	--
	06/16/97	--	152.06	9.04	<50	330	27	<0.5	<0.5	1.2	<0.5	--	--	--
	09/30/97	--	153.54	7.56	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
(97.50)	01/27/98	--	153.14	7.96	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
	04/24/98	--	153.12	7.98	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
	08/17/98	--	152.12	8.98	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
	11/16/98	--	152.20	8.90	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
	02/16/99	--	152.46	8.64	<50	110	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
	05/17/99	--	152.60	8.50	--	280	1.1	0.6	<0.5	<0.5	<0.5	--	--	--
	08/17/99	--	151.86	9.24	86	790	5.6	4.3	4.5	11	<5.0	--	--	--
	11/17/99	--	150.66	10.44	--	1,300	3.6	1.9	2.7	6.6	<1.0	--	--	--
	02/17/00	--	152.62	8.48	--	580	1.1	2.3	3.6	4.9	<5.0	--	--	--
	05/17/00	--	152.86	8.24	--	1,500	130	6.8	6.1	<5.0	<5.0	--	--	--
	08/17/00	--	152.33	8.77	--	550	160	<25	<25	<25	<25	--	--	--
	11/15/00	--	152.06	9.04	--	130	<5.0	<5.0	<5.0	<5.0	<5.0	--	--	--
	02/16/01	--	153.50	7.60	--	400	26	<5.0	<5.0	<5.0	<5.0	--	--	--
	01/11/02	--	153.02	8.08	160	600	74	53	14	52	110	--	--	--
(161.03)	07/01/02	--	152.08	9.02	280	670	25	<5.0	<5.0	<5.0	<5.0	--	--	--
	10/04/02	--	151.36	9.74	520	1,800	130	7.8	8.1	14	<5.0	--	--	--
	07/28/06	--	152.00	9.10	86	250	42	1.7	1.4	3.1	<1.0	51	1.5	0.21
	10/16/06	--	152.05	9.05	110	390	16	<0.5	1.5	2.2	<0.5	41	1.6	0.17
(161.10)	01/09/07	--	152.90	8.20	160	530	21	1.7	2.8	5.1	--	--	--	0.22
	03/26/07	--	152.84	8.26	--	--	--	--	--	--	--	--	--	--
	06/24/07	--	152.12	8.98	220	500	24	1.1	2.2	4.2	<5.0	--	--	--
	09/29/07	--	151.44	9.66	180	540	19	1.2	2.3	5.3	<5.0	--	--	--
	12/27/07	--	152.60	8.50	200	290	10	0.65	1.2	3.0	<5.0	--	--	--
	03/15/08	--	**152.72**	**8.38**	**340**	**680**	**24**	1.1	1.9	2.9	<10	**--**	**--**	**--**

Table 2. Groundwater Analytical Data - Former Exxon Station, 5175 Broadway, Oakland, CA

Well ID *TOC Elev*	Date Sampled	SPH	Groundwater Elevation	Depth to Water	TPHd	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	DIPE	1,2-DCA	Dissolved Oxygen
(ft)		(ft)	(ft)	(ft)	← µg/L →									mg/L
Final ESL, **dw**		--	--	--	**100**	**100**	**1**	**40**	**30**	**20**	**5**	**--**	**0.5**	**--**
Final ESL, **non-dw**		--	--	--	210	210	46	130	43	100	1,800	--	200	--
Residential ESL,indoor air		--	--	--	SG	SG	540	380,000	170,000	160,000	24,000		200	
Commercial ESL, indoor air		--	--	--	SG	SG	1,800	530,000	170,000	160,000	80,000	--	690	--
Drinking Water Toxicity, dw:					210	210	1.0	150	300	1,800	13		1	
Ceiling Value, **dw**:					100	100	170	40	30	20	5		7,000	
Aquatic Habitat Goal:					210	210	46	130	43	100	8,000		2,000	
MW-2	04/30/89	--	--	--	--	230	39	18	5	23	--	--	--	--
(97.78)	05/17/90	--	87.78	10.00	--	--	--	--	--	--	--	--	--	--
	09/29/90	--	86.95	10.83	--	850	970	5	25	47	--	--	--	--
	01/14/91	--	87.15	10.63	--	3,100	30	52	24	34	--	--	--	--
(102.02)	07/03/91	--	91.94	10.08	--	1,590	30	52	24	34	--	--	--	--
	11/11/91	--	91.81	10.21	--	960	320	15	4	29	--	--	--	--
	03/04/92	--	93.32	8.70	--	1,500	9.5	8.4	9.8	22	--	--	--	--
	06/02/92	--	92.50	9.52	--	2,800	84	41	59	95	--	--	--	--
MW-2	09/28/92	--	91.93	10.09	--	1,600	47	20	47	97	--	--	--	--
(continued)	01/11/93	--	93.50	8.52	--	2,500	8.6	10	17	32	--	--	--	--
(97.49)	08/15/94	--	87.58	9.91	--	6,000	450	60	100	95	--	--	--	--
	11/07/96	--	87.47	10.02	780	4,200	25	4.9	8.1	14	<0.5	--	--	--
	02/12/97	--	88.58	8.91	5,700	1,800	16	3.1	3.4	8.8	<0.5	--	--	--
	06/16/97	--	87.74	9.75	<50	2,500	22	5.1	7.8	11	<0.5	--	--	--
	09/30/97	--	89.60	7.89	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
	01/27/98	--	89.11	8.38	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
	04/24/98	--	88.81	8.68	1,400	2,100	18	6.5	4.8	21	<0.5	--	--	--
	08/17/98	--	87.75	9.74	<50	2,900	5.1	4.5	5.8	17	<0.5	--	--	--
	11/16/98	--	87.35	10.14	<50	1,400	2.1	1.9	2.3	4.8	<0.5	--	--	--
	02/16/99	--	88.57	8.92	<50	1,600	82	16	<2.5	40	59	--	--	--
	05/17/99	--	88.23	9.26	--	8,200	43	73	140	100	<250	--	--	--
	08/17/99	--	87.45	10.04	260	2,900	20	81	17	38	<5.0	--	--	--
	11/17/99	--	85.97	11.52	<50	2,600	7	3.7	5.3	12.9	<1.0	--	--	--
	02/17/00	--	87.99	9.50	--	1,700	3.2	6.8	11	12.3	<5.0	--	--	--
	05/17/00	--	88.65	8.84	--	3,800	450	65	110	80	<25	--	--	--
	08/17/00	--	88.99	8.50	--	4,300	440	<50	78	<50	<50	--	--	--
	11/15/00	--	87.55	9.94	--	5,800	320	41	78	64	<25	--	--	--
	02/16/01	--	88.97	8.52	--	2,200	110	20	38	33	<5.0	--	--	--
	01/11/02	--	88.67	8.82	620	3,100	280	86	84	110	<50	--	--	--
(160.98)	07/01/02	--	151.34	9.64	940	2,600	300	29	45	27	<10	--	--	--
	10/04/02	--	150.46	10.52	390	4,000	440	66	140	120	<25	--	--	--
	07/28/06	--	150.96	10.02	340	1,300	150	9.9	6	18	<0.5	3.6	<0.5	0.17
	10/16/06	--	150.45	10.53	76	150	16	1.0	3.5	2.2	<0.5	1.2	<0.5	0.19
	01/09/07	--	151.65	9.33	84	**210**	**27**	2.6	8.1	6.8	--	--	--	0.14
	01/25/07	--					Well Abandoned							

Table 2. Groundwater Analytical Data - Former Exxon Station, 5175 Broadway, Oakland, CA

Well ID *TOC Elev*	Date Sampled	SPH	Groundwater Elevation	Depth to Water	TPHd	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	DIPE	1,2-DCA	Dissolved Oxygen
(ft)		(ft)	(ft)	(ft)	←				µg/L				→	mg/L
Final ESL, **dw**		--	--	--	**100**	**100**	**1**	**40**	**30**	**20**	**5**	**--**	**0.5**	**--**
Final ESL, **non-dw**		--	--	--	210	210	46	130	43	100	1,800	--	200	--
Residential ESL,indoor air		--	--	--	SG	SG	540	380,000	170,000	160,000	24,000		200	
Commercial ESL, indoor air		--	--	--	SG	SG	1,800	530,000	170,000	160,000	80,000	--	690	--
Drinking Water Toxicity, dw:					210	210	1.0	150	300	1,800	13		1	
Ceiling Value, **dw**:					100	100	170	40	30	20	5		7,000	
Aquatic Habitat Goal:					210	210	46	130	43	100	8,000		2,000	
MW-3	04/30/90	--	--	--	--	56,000	3,600	8,600	1,300	7,200	--	--	--	--
(98.14)	05/17/90	--	85.72	12.42	--	--	--	--	--	--	--	--	--	--
	09/26/90	--	84.64	13.50	--	54,000	5,100	420	1,600	8,000	--	--	--	--
	01/14/91	--	85.56	12.58	--	35,000	2,600	6,600	1,500	5,700	--	--	--	--
(102.46)	07/03/91	--	90.38	12.08	--	33,000	4,120	4,300	1,400	4,800	--	--	--	--
	11/11/91	--	90.17	12.29	--	57,000	3,900	8,400	2,100	14,000	--	--	--	--
(102.18)	03/04/92	--	91.92	10.26	--	57,000	720	870	81	3,100	--	--	--	--
(97.94)	06/02/92	--	86.54	11.40	--	50,000	240	240	220	740	--	--	--	--
	09/28/92	--	85.30	12.64	--	64,000	110	93	97	250	--	--	--	--
	01/11/93	--	87.84	10.10	--	68,000	210	280	360	990	--	--	--	--
	08/15/94	--	85.74	12.20	--	50,000	870	1,200	1,300	3,000	--	--	--	--
	11/07/96	--	85.54	12.40	470	68,000	33	27	63	120	<0.5	--	--	--
	02/12/97	--	87.71	10.23	3,500	25,000	39	43	15	91	<0.5	--	--	--
	06/16/97	--	86.15	11.79	<50	9,700	26	29	45	81	<0.5	--	--	--
	09/30/97	--	88.54	9.40	1,600	6,000	43	36	12	11	<0.5	--	--	--
	01/27/98	--	88.14	9.80	560	380	5.7	4.1	1.7	9.1	<0.5	--	--	--
	04/24/98	--	88.04	9.90	680	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
	08/17/98	--	86.48	11.46	<50	16,000	200	18	31	82	<0.5	--	--	--
	11/16/98	--	85.54	12.40	<50	68,000	86	54	69	130	<0.5	--	--	--
	02/16/99	--	87.22	10.72	<50	33,000	270	110	<5.0	770	170	--	--	--
MW-3	05/17/99	--	87.40	10.54	--	72,000	280	230	320	890	<250	--	--	--
(continued)	08/17/99	--	85.99	11.95	1,800	20,000	51	41	61	130	<5.0	--	--	--
	11/17/99	--	84.34	13.60	--	1,700	39	22	31	84	<1.0	--	--	--
	02/17/00	--	87.26	10.68	--	8,800	16	39	74	90	<5.0	--	--	--
	05/17/00	--	87.69	10.25	--	22,000	300	260	410	940	<5.0	--	--	--
	08/17/00	--	86.10	11.84	--	15,000	230	140	470	750	<50	--	--	--
	11/15/00	--	86.12	11.82	--	12,000	250	210	390	700	<25	--	--	--
	02/16/01	--	88.26	9.68	--	7,400	40	72	700	250	<25	--	--	--
	01/11/02	--	88.36	9.58	1,900	9,300	230	200	290	580	<25	--	--	--
(161.43)	07/01/02	--	150.29	11.14	5,200	13,000	230	220	450	890	<13	--	--	--
	10/04/02	--	148.61	12.82	4,900	11,000	280	170	450	730	<25	--	--	--
	07/28/06	--	Not Sampled - Unable to locate well											
	10/16/06	--	Not Sampled - Unable to locate well											
	01/09/07	--	Not Sampled - Unable to locate well											
	01/22/07	--	149.81	11.62	**93,000**	**34,000**	**770**	**250**	**760**	**2,000**	<1,000	--	--	--
	03/16/07	--				Well Abandoned								

Table 2. Groundwater Analytical Data - Former Exxon Station, 5175 Broadway, Oakland, CA

Well ID *TOC Elev* *(ft)*	Date Sampled	SPH (ft)	Groundwater Elevation (ft)	Depth to Water (ft)	TPHd	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	DIPE	1,2-DCA	Dissolved Oxygen mg/L
					←				µg/L				→	
Final ESL, **dw**		--	--	--	**100**	**100**	**1**	**40**	**30**	**20**	**5**	**--**	**0.5**	--
Final ESL, **non-dw**		--	--	--	210	210	46	130	43	100	1,800	--	200	--
Residential ESL,indoor air		--	--	--	SG	SG	540	380,000	170,000	160,000	24,000		200	
Commercial ESL, indoor air		--	--	--	SG	SG	1,800	530,000	170,000	160,000	80,000	--	690	--
Drinking Water Toxicity, dw:					210	210	1.0	150	300	1,800	13		1	
Ceiling Value, **dw**:					100	100	170	40	30	20	5		7,000	
Aquatic Habitat Goal:					210	210	46	130	43	100	8,000		2,000	
STMW-4	07/03/91	--	92.58	11.00	--	3,100	610	62	39	150	--	--	--	--
(103.58)	11/11/91	--	92.50	11.08	--	3,600	990	15	2.6	180	--	--	--	--
(101.08)	03/04/92	--	91.64	9.44	--	5,000	35	20	22	71	--	--	--	--
(98.80)	06/02/92	--	88.48	10.32	--	13,000	140	45	63	210	--	--	--	--
	09/28/92	--	88.04	10.76	--	40,000	35	20	48	110	--	--	--	--
	01/11/93	--	89.52	9.28	--	24,000	26	88	92	280	--	--	--	--
	08/15/94	--	88.26	10.54	--	9,000	500	34	46	130	--	--	--	--
	11/07/96	--	88.43	10.37	180	13,000	40	2.9	7.8	19	<0.5	--	--	--
	02/12/97	--	89.44	9.36	5,700	5,300	95	5.3	5.9	18	<0.5	--	--	--
	06/16/97	--	88.40	10.40	<50	5,300	37	6.2	1.7	11	<0.5	--	--	--
	09/30/97	--	90.30	8.50	<50	2,700	42	7.7	5.7	26	<0.5	--	--	--
	01/27/98	--	89.90	8.90	300	3,000	60	17	12	49	<0.5	--	--	--
	04/24/98	--	89.30	9.50	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
	08/17/98	--	88.44	10.36	<50	29,000	36	24	59	160	<0.5	--	--	--
	11/16/98	--	88.24	10.56	<50	13,000	26	21	20	41	--	--	--	--
	02/16/99	--	89.16	9.64	<50	32,000	660	16	16	150	<100	--	--	--
	05/17/99	--	88.84	9.96	--	13,000	1600	30	45	78	<250	--	--	--
	08/17/99	--	88.16	10.64	990	12,000	260	22	33	72	<5.0	--	--	--
	11/17/99	--	86.78	12.02	--	7,900	21	12	17	40	<1.0	--	--	--
	02/17/00	--	89.48	9.32	--	4,900	8.9	21	38	50	<5.0	--	--	--
	05/17/00	--	89.15	9.65	--	9,600	840	<50	61	<50	<50	--	--	--
	08/17/00	--	88.46	10.34	--	5,100	680	<50	62	<50	<50	--	--	--
	11/15/00	--	88.28	10.52	--	3,900	640	<25	26	27	<25	--	--	--
	02/16/01	--	89.60	9.20	--	5,700	560	<25	<25	<25	<25	--	--	--
	01/11/02	--	89.22	9.58	930	4,900	560	59	25	<25	<250	--	--	--
(162.13)	07/01/02	--	151.85	10.28	6,700	6,700	470	18	32	45	<13	--	--	--
	10/04/02	--	151.05	11.08	2,900	13,000	590	26	65	110	<25	--	--	--
	07/28/06	0.04	151.53	10.60	39,000	25,000	960	21	73	130	<5.0	65	<5.0	0.22
	10/16/06	0.06	151.30	10.83	**14,000**	**14,000**	**790**	28	**81**	**130**	<5.0	30	<5.0	0.26
	01/09/07	0.03	152.20	9.93	Not Sampled - SPH									0.24
	01/26/07				Well Abandoned									0.24
STMW-5	07/03/91	--	147.36	13.29	--	690	99	81	19	98	--	--	--	--
(101.99)	11/11/91	--	146.65	14.00	--	410	61	2.4	1.4	20	--	--	--	--
(101.36)	03/04/92	--	148.85	11.80	--	460	13	6.5	11	18	--	--	--	--
	06/02/92	--	147.59	13.06	--	1,800	27	20	21	43	--	--	--	--
	09/28/92	--	146.61	14.04	--	1,500	14	6.1	18	22	--	--	--	--
	01/11/93	--	149.04	11.61	--	800	1.8	3	3.1	9.4	--	--	--	--
	08/15/94	--	146.80	13.85	--	3,000	320	62	34	220	--	--	--	--
(97.14)	11/07/96	--	146.98	13.67	330	1,200	11	1.7	4.4	13	<0.5	--	--	--
	02/17/97	--	148.58	12.07	3,700	1,000	11	17	1.7	9.7	<0.5	--	--	--

Table 2. Groundwater Analytical Data - Former Exxon Station, 5175 Broadway, Oakland, CA

Well ID *TOC Elev*	Date Sampled	SPH	Groundwater Elevation	Depth to Water	TPHd	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	DIPE	1,2-DCA	Dissolved Oxygen
(ft)		(ft)	(ft)	(ft)	←				µg/L				→	mg/L
Final ESL, **dw**		--	--	--	**100**	**100**	**1**	**40**	**30**	**20**	**5**	**--**	**0.5**	--
Final ESL, **non-dw**		--	--	--	210	210	46	130	43	100	1,800	--	200	--
Residential ESL,indoor air		--	--	--	SG	SG	540	380,000	170,000	160,000	24,000		200	
Commercial ESL, indoor air		--	--	--	SG	SG	1,800	530,000	170,000	160,000	80,000	--	690	--
Drinking Water Toxicity, dw:					210	210	1.0	150	300	1,800	13		1	
Ceiling Value, **dw**:					100	100	170	40	30	20	5		7,000	
Aquatic Habitat Goal:					210	210	46	130	43	100	8,000		2,000	
STMW-5	06/19/97	--	147.32	13.33	2,300	950	7.4	1	1	7.2	<0.5	--	--	--
(cont'd)	09/30/97	--	149.41	11.24	1,100	710	5.8	4	1	1	<0.5	--	--	--
	01/27/98	--	149.01	11.64	1,100	340	2	1.8	1.6	8.2	<0.5	--	--	--
	04/24/98	--	148.81	11.84	<50	3,300	12	9.4	8.5	37	<0.5	--	--	--
	08/17/98	--	147.45	13.20	<50	5,300	26	17	14	39	<0.5	--	--	--
	11/16/98	--	146.91	13.74	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
	02/16/99	--	148.43	12.22	<50	950	150	3.8	1.4	14	11	--	--	--
	05/17/99	--	148.07	12.58	--	2,800	67	9.4	<2.5	16	30	--	--	--
	08/17/99	--	147.17	13.48	230	2,800	18	17	18	36	<5.0	--	--	--
	11/17/99	--	145.77	14.88	--	1,600	3.9	2.3	3.2	7.5	<1.0	--	--	--
	02/17/00	--	148.09	12.56	--	770	1.5	3.2	5.8	7	<5.0	--	--	--
	05/17/00	--	148.57	12.08	--	4,500	<25	<25	<25	<25	<25	--	--	--
	08/17/00	--	147.09	13.56	--	2,900	170	64	100	250	<10	--	--	--
	11/15/00	--	147.37	13.28	--	2,100	120	24	40	54	<5.0	--	--	--
	02/16/01	--	149.05	11.60	--	850	58	9.8	9.4	18	<5.0	--	--	--
	01/11/02	--	148.93	11.72	<50	920	76	16	16	28	13	--	--	--
(160.65)	07/01/02	--	147.51	13.14	1,500	4,300	71	14	14	36	<5.0	--	--	--
	10/04/02	--	146.13	14.52	60	1,400	71	17	26	35	<5.0	--	--	--
	07/28/06	--	147.30	13.35	370	700	22	4.3	1.2	6.6	<0.5	<0.5	<0.5	0.24
	10/16/06	--	146.91	13.74	240	590	14	1.6	1.3	3.2	<0.5	<0.5	<0.5	0.21
	01/09/07	--	148.19	12.46	**180**	**390**	**30**	3.2	1.8	3.2	--	--	--	0.17
	01/18/07						Well Abandoned							
MW-2C	03/09/07	--	152.24	8.41	140	450	40	9.3	2.9	16	<10	--	--	--
(160.65)	03/26/07	--	151.93	8.72	--	--	--	--	--	--	--	--	--	--
	06/24/07	--	151.21	9.44	160	440	30	1.8	5.9	7.4	<5.0	--	--	--
	09/29/07	--	150.45	10.20	120	200	13	<0.5	<0.5	2.0	<5.0	--	--	--
	12/27/07	--	151.42	9.23	83	190	13	0.83	<0.5	1.9	<5.0	--	--	--
	03/15/08	**--**	**151.83**	**8.82**	**120**	**250**	**24**	2.2	5.2	4.5	<5.0	**--**	**--**	**--**
MW-3A	03/09/07	--	152.20	9.35	4,500	39,000	3,800	220	830	2,800	<500	--	--	--
(161.55)	03/26/07	--	152.33	9.22	--	--	--	--	--	--	--	--	--	--
(161.57)	06/24/07	--	151.61	9.94	11,000	34,000	3,200	330	990	3,200	<250	--	--	--
	09/29/07	--	150.21	11.36	11,000	43,000	3,500	150	730	2,200	<1,000	--	--	--
	12/27/07	--	150.20	11.37	8,700	30,000	2,500	24	520	930	<100	--	--	--
	03/15/08	**--**	**152.27**	**9.30**	**10,000**	**26,000**	**2,400**	**110**	**700**	**1,200**	<250	**--**	**--**	**--**
MW-3C	03/26/07	--	151.15	10.64	--	--	--	--	--	--	--	--	--	--
(161.79)	04/16/07	--	150.87	10.92	36,000	32,000	1,200	710	600	1,900	<500	--	--	--
	06/24/07	--	149.43	12.36	200,000	50,000	2,200	4,100	860	6,100	<500	--	--	--
	09/29/07	--	148.33	13.46	48,000	37,000	1,700	3,300	830	4,800	<1,000	--	--	--
	12/27/07	--	149.79	12.00	29,000	28,000	590	900	630	2,000	<500	--	--	--
	03/15/08	**--**	**150.70**	**11.09**	**21,000**	**36,000**	**1,500**	**2,400**	**570**	**3,700**	<500	**--**	**--**	**--**

Table 2. Groundwater Analytical Data - Former Exxon Station, 5175 Broadway, Oakland, CA

Well ID *TOC Elev*	Date Sampled	SPH	Groundwater Elevation	Depth to Water	TPHd	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	DIPE	1,2-DCA	Dissolved Oxygen
(ft)		(ft)	(ft)	(ft)	←				μg/L				→	mg/L
Final ESL, **dw**		--	--	--	**100**	**100**	**1**	**40**	**30**	**20**	**5**	**--**	**0.5**	**--**
Final ESL, **non-dw**		--	--	--	210	210	46	130	43	100	1,800	--	200	--
Residential ESL,indoor air		--	--	--	SG	SG	540	380,000	170,000	160,000	24,000		200	
Commercial ESL, indoor air		--	--	--	SG	SG	1,800	530,000	170,000	160,000	80,000	--	690	--
Drinking Water Toxicity, dw:					210	210	1.0	150	300	1,800	13		1	
Ceiling Value, **dw**:					100	100	170	40	30	20	5		7,000	
Aquatic Habitat Goal:					210	210	46	130	43	100	8,000		2,000	
MW-4A	03/09/07	--	152.88	9.56	3,600	16,000	1,600	36	37	150	<250	--	--	--
(162.44)	03/26/07	--	152.56	9.88	--	--	--	--	--	--	--	--	--	--
	06/24/07	--	152.02	10.42	110,000	87,000	1,500	59	290	800	<500	--	--	--
	09/29/07	--	151.33	11.11	170,000	130,000	2,700	69	400	1,400	<240	--	--	--
	12/27/07	--	152.33	10.11	19,000	27,000	1,600	31	100	320	<90	--	--	--
	03/15/08	**--**	**152.51**	**9.93**	**38,000**	**17,000**	**1,300**	<50	**120**	**380**	<500	**--**	**--**	**--**
MW-5A	03/09/07	--	150.40	10.42	56	<50	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
(160.82)	03/26/07	--	150.00	10.82	--	--	--	--	--	--	--	--	--	--
	06/24/07	--	148.94	11.88	<50	180	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
	09/29/07	--	147.86	12.96	--	--	--	--	--	--	--	--	--	--
	12/27/07	--	148.40	12.42	--	--	--	--	--	--	--	--	--	--
	03/15/08	**--**	**149.96**	**10.86**	<50	**180**	0.91	<0.5	<0.5	<0.5	<5.0	**--**	**--**	**--**
MW-5B	03/09/07	--	146.42	15.08	59	140	1.3	0.77	<0.5	1.6	<5.0	--	--	--
(161.50)	03/26/07	--	148.88	12.62	--	--	--	--	--	--	--	--	--	--
	06/24/07	--	147.98	13.52	53	52	1.1	<0.5	<0.5	<0.5	<5.0	--	--	--
	09/29/07	--	146.60	14.90	<50	<50	0.95	<0.5	<0.5	<0.5	<5.0	--	--	--
	12/27/07	--	148.41	13.09	<50	58	1.4	<0.5	0.60	<0.5	<5.0	--	--	--
	03/15/08	**--**	**148.95**	**12.55**	<50	61	**2.6**	1.1	1.1	3.0	<5.0	**--**	**--**	**--**
MW-5C	03/09/07	--	148.12	12.91	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
(161.03)	03/26/07	--	148.41	12.62	--	--	--	--	--	--	--	--	--	--
	06/24/07	--	147.58	13.45	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
	09/29/07	--	146.41	14.62	66	<50	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
	12/27/07	--	148.10	12.93	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
	03/15/08	**--**	**148.48**	**12.55**	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	**--**	**--**	**--**
MW-6A	03/09/07	--	154.91	6.67	380	<50	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
(161.58)	03/26/07	--	154.41	7.17	--	--	--	--	--	--	--	--	--	--
	06/24/07	--	153.79	7.79	590	140	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
	09/29/07	--	152.84	8.74	540	52	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
	12/27/07	--	154.27	7.31	170	94	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
	03/15/08	**--**	**154.42**	**7.16**	**150**	<50	<0.5	<0.5	<0.5	<0.5	<5.0	**--**	**--**	**--**
MW-7B	03/09/07	--	147.97	11.18	930	18,000	1,500	1,600	140	1,800	<600	--	--	--
(159.15)	03/26/07	--	148.10	11.05	--	--	--	--	--	--	--	--	--	--
	06/24/07	--	147.54	11.61	40,000	30,000	1,800	2,400	240	2,800	<700	--	--	--
(159.02)	09/29/07	--	146.91	12.11	16,000	37,000	1,300	1,500	180	2,700	<500	--	--	--
	12/27/07	--	147.37	11.65	7,700	18,000	810	880	38	1,600	<50	--	--	--
	03/15/08	**--**	**147.66**	**11.36**	**7,900**	**14,000**	**730**	**820**	**110**	**1,200**	<250	**--**	**--**	**--**

Table 2. Groundwater Analytical Data - Former Exxon Station, 5175 Broadway, Oakland, CA

Well ID *TOC Elev* *(ft)*	Date Sampled	SPH (ft)	Groundwater Elevation (ft)	Depth to Water (ft)	TPHd	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	DIPE	1,2-DCA	Dissolved Oxygen mg/L
					←				µg/L				→	
Final ESL, **dw**		--	--	--	**100**	**100**	**1**	**40**	**30**	**20**	**5**	--	**0.5**	--
Final ESL, **non-dw**		--	--	--	210	210	46	130	43	100	1,800	--	200	--
Residential ESL,indoor air		--	--	--	SG	SG	540	380,000	170,000	160,000	24,000		200	
Commercial ESL, indoor air		--	--	--	SG	SG	1,800	530,000	170,000	160,000	80,000	--	690	--
Drinking Water Toxicity, dw:					210	210	1.0	150	300	1,800	13		1	
Ceiling Value, **dw**:					100	100	170	40	30	20	5		7,000	
Aquatic Habitat Goal:					210	210	46	130	43	100	8,000		2,000	
MW-7C	03/09/07	--	145.44	13.09	190	3,600	970	100	12	90	<120	--	--	--
(158.53)	03/26/07	--	147.53	11.00	--	--	--	--	--	--	--	--	--	--
	06/24/07	--	146.65	11.88	7,100	16,000	510	520	190	1,300	<100	--	--	--
	09/29/07	--	146.21	12.32	11,000	29,000	580	1,400	600	4,800	<1,000	--	--	--
	12/27/07	--	146.74	11.79	56,000	29,000	250	410	430	3,300	<50	--	--	--
	03/15/08	--	**147.45**	**11.08**	**7,000**	**13,000**	**170**	**58**	**170**	**1,300**	<100	--	--	--
MW-8A	03/09/07	--	152.05	9.52	4,200	10,000	430	18	<10	88	<100	--	--	--
(161.57)	03/26/07	--	151.74	9.83	--	--	--	--	--	--	--	--	--	--
	06/24/07	--	151.40	10.17	17,000	12,000	720	500	230	880	<300	--	--	--
	09/29/07	--	150.64	10.95	5,300	7,500	440	67	26	240	<90	--	--	--
(161.59)	12/27/07	--	152.00	9.59	13,000	9,600	290	100	90	360	<100	--	--	--
	03/15/08	--	**151.79**	**9.80**	**7,500**	**7,200**	**170**	28	**270**	**110**	<100	--	--	--
MW-8C	03/09/07	--	149.18	12.15	<50	150	9.8	1.3	2.0	3.9	<5.0	--	--	--
(161.33)	03/26/07	--	149.56	11.77	--	--	--	--	--	--	--	--	--	--
	06/24/07	--	148.96	12.37	<50	<50	0.57	<0.5	<0.5	<0.5	<5.0	--	--	--
	09/29/07	--	148.35	12.98	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
	12/27/07	--	149.84	11.49	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
	03/15/08	--	**149.94**	**11.39**	<50	**110**	**6.0**	1.7	2.4	2.4	<5.0	--	--	--
MW-9A	09/29/07	--	142.76	12.61	86	<50	2.6	<0.5	<0.5	<0.5	<5.0	--	--	--
(155.37)	12/27/07	--	143.51	11.86	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	--	--	--
	03/15/08	--	**143.35**	**12.02**	<50	<50	0.85	<0.5	<0.5	<0.5	<5.0	--	--	--
MW-9C	09/29/07	--	142.67	12.27	390	68	2.2	0.88	<0.5	<0.5	<5.0			
(154.94)	12/27/07	--	143.40	11.54	<50	<50	0.84	<0.5	<0.5	<0.5	<5.0			
	03/15/08	--	**143.98**	**10.96**	<50	<50	0.55	<0.5	<0.5	<0.5	<5.0			
MW-10A	09/29/07	--	144.35	10.53	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0			
(154.88)	12/27/07	--	145.50	9.38	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0			
	03/15/08	--	**145.96**	**8.92**	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0			

Table 2. Groundwater Analytical Data - Former Exxon Station, 5175 Broadway, Oakland, CA

Well ID *TOC Elev*	Date Sampled	SPH	Groundwater Elevation	Depth to Water	TPHd	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	DIPE	1,2-DCA	Dissolved Oxygen
(ft)		(ft)	(ft)	(ft)	←				µg/L				→	mg/L
Final ESL, **dw**		--	--	--	**100**	**100**	**1**	**40**	**30**	**20**	**5**	**--**	**0.5**	--
Final ESL, **non-dw**		--	--	--	210	210	46	130	43	100	1,800	--	200	--
Residential ESL,indoor air		--	--	--	SG	SG	540	380,000	170,000	160,000	24,000		200	
Commercial ESL, indoor air		--	--	--	SG	SG	1,800	530,000	170,000	160,000	80,000	--	690	--
Drinking Water Toxicity, dw:					210	210	1.0	150	300	1,800	13		1	
Ceiling Value, **dw**:					100	100	170	40	30	20	5		7,000	
Aquatic Habitat Goal:					210	210	46	130	43	100	8,000		2,000	
GRAB GROUNDWATER SAMPLING - 2007														
B-18	01/23/07	--	--	7.1	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
B-19	03/19/07	--	--	4	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
GRAB GROUNDWATER SAMPLING - 2006														
B1-W	02/01/06	--	--	9.5	<84	**710**	(0.52)	(0.59)	(<0.50)	(0.66)	<1.0	<5.0	<0.50	--
B3-W	02/08/06	--	--	9.63	<280	**23,000**	**(3,300)**	**(660)**	**(170)**	**(910)**	<50	380	<25	--
B4-W	02/08/06	--	--	8.24	--	**9,700**	**(320)**	(13)	**(200)**	**(180)**	<20	1,300	**12**	--
B5-W	02/08/06	--	--	6.96	--	**10,000**	**(150)**	(11)	**(210)**	**(190)**	<10	<50	<5.0	--
B6-W	02/06/06	--	--	12.1	--	**5,600**	**(3.9)**	(3.1)	**(54)**	**(61)**	<5.0	<25	<2.5	--
B7-W	02/08/06	--	--	11.72	--	**8,000**	**(2,200)**	**(300)**	**(240)**	**(830)**	<20	<100	**53**	--
B8-W	02/08/06	--	--	9.97	--	**18,000**	**(330)**	(53)	**(440)**	**(1,200)**	<20	<100	**11**	--
B10-W	02/06/06	--	--	13.3	--	**6,800**	**(<5.0)**	(5.7)	**(170)**	**(69)**	<10	<50	<5.0	--
B11-W	02/10/06	--	--	14.3	--	**230,000**	**(13,000)**	**(19,000)**	**(960)**	**(20,000)**	<200	<1,000	**150**	--
B12-W	02/03/06	--	--	7.92	--	**460**	**(1.6)**	(2.1)	(1.6)	(3.5)	<1.0	<5.0	**0.62**	--
B13-W	02/03/06	--	--	11.67	<60	**1,700**	**(12)**	(9.4)	(18)	**(22)**	<5.0	<25	<2.5	--
B14-W	02/06/06	--	--	13.1	--	**38,000**	**(410)**	(25)	**(290)**	**(95)**	<50	<250	<25	--
B15-W	02/01/06	--	--	8.75	<620	**2,700**	**(3.2)**	(2.7)	(22)	(4.3)	<5.0	<25	<2.5	--

Abbreviations:

µg/L = Micrograms per liter - approximately equal to parts per billion = ppb.

mg/L = Milligrams per liter - approximately equal to parts per million = ppm.

SPH = Separate-phase hydrocarbons encountered in well (value in parentheses is thickness in feet).

Groundwater elevation is calculated according to the relationship: groundwater elevation = TOC (elevation) - (depth to water) + (0.8)(SPH thickness).

TPHg = Total petroleum hydrocarbons as gasoline by EPA Method 8015Cm.

TPHd = Total petroleum hydrocarbons as diesel by EPA Method 8015C.

BTEX = Benzene, toluene, ethylbenzene, xylenes by EPA Method 8021B.

MTBE = Methyl tertiary-butyl ether by EPA Method 8021B. (Concentrations in parentheses are by EPA Method 8260B).

DIPE = Diisopropyl ether by EPA Method 8260B.

1,2-DCA = 1,2-Dichloroethane by EPA Method 8260B.

ESL = Environmental Screening Levels for residential and/or commercial groundwater established by the SFBRWQCB, Interim Final - November 2007 (Revised May 2008).

1,500 = Concentrations in **bold** indicate groundwater from most recent sampling exceed the final ESL protective of groundwater as a drinking water resource (residential or commercial use).

Table 3. Soil Gas Analytical Data - Rockridge Heights, 5175 Broadway, Oakland, California

Boring/ Sample ID	Date Sampled	Sample Depth (ft - ft bgs)	Benzene	Toluene	Ethylbenzene	Xylene (M+P)	Xylene (O)	TPH Gasoline (C2-C10)	Isopropanol	Notes
			ug/m^3							
Residential ESL for shallow **soil gas**:			84	63,000	980	21,000	21,000	10,000	--	For SG samples
Commercial ESL for shallow **soil gas**:			280	180,000	3,300	58,000	58,000	29,000	--	For SG samples
Residential ESL for **subslab gas** (indoor air X 100):			8.4	6,300	98	2,100	2,100	1,000	--	For SS samples
Commercial ESL for **subslab gas** (indoor air X 100):			14	8,800	160	2,900	2,900	1,400	--	For SS samples
Soil Gas Probe Samples										
SG-4	6/17/2008	4.0-4.5	**5,930**	<754	**17,200**	15,600	<868	**830,000**	<983	
SG-5	6/17/2008	4.5-5.0	12.9	7.08	61.4	57.2	<4.34	<10,000	<492	
SG-6	6/17/2008	3.5-4.0	<63.9	<75.4	97.9	<86.8	<86.8	**13,000**	<490	
SG-7	6/17/2008	3.5-4.0	25.6	10.8	<4.34	4.78	<4.34	<10,000	<492	
SG-1	9/12/2007	3.8-4.0	16.0	294	6.21	19.6	5.91	<2000	85.4	
SG-2	9/12/2007	3.8-4.0	**174**	200	93.6	77.2	<21.7	**14,000**	70.1	
SG-3	9/12/2007	2.5-2.7	<128	151	<174	<174	<174	<2000	21,300	Isoproponal = 0.7% of total sample volume*
Subslab Gas Samples										
SS-1	6/17/2008	0.5-0.7	<3.19	<3.77	<4.34	<4.34	<4.34	<700	<492	
SS-2	6/17/2008	0.5-0.7	<3.19	<3.77	<4.34	<4.34	<4.34	<700	<492	
SS-1	9/12/2007	0.5-0.7	**24.1**	187	5.38	16.8	5.91	<2000	11.2	
SS-2	9/12/2007	0.5-0.7	<3.19	5.24	<4.34	<4.34	<4.34	<2000	<4.92	Leak Check Sample not analyzed - no detected Isopropanol.
Leak Check Samples										
SS-1 Check	9/12/2007	--	--	--	--	--	--	--	622,000	
SG-1 Check	9/12/2007	--	--	--	--	--	--	--	5,900,000	
SG-2 Check	9/12/2007	--	--	--	--	--	--	--	1,070,000	
SG-3 Check	9/12/2007	--	--	--	--	--	--	--	3,020,000	
Extracted Soil Vapor During DPE Testing										
MW-3A	4/17/2007	9.0-14.0**	**1,920**	--	--	--	--	**311,500**	--	From DPE Testing
MW-4A	4/17/2007	8.0-15.0**	**30,720**	--	--	--	--	**4,900,000**	--	From DPE Testing
MW-8A	4/19/2007	8.0-15.0**	**3,840**	--	--	--	--	**1,984,500**	--	From DPE Testing
MW-7B	4/17/2007	15.5-18.5**	**3,520**	--	--	--	--	**486,500**	--	From DPE Testing
MW-3C	4/19/2007	22.0-27.0**	**7,680**	--	--	--	--	**1,260,000**	--	From DPE Testing
MW-7C	4/19/2007	20.0-25.0**	**448**	--	--	--	--	**157,500**	--	From DPE Testing
MW-8C	4/19/2007	20.0-25.0**	224	--	--	--	--	**129,500**	--	From DPE Testing

Abbreviations:

SG-1 = Soil Gas Sample

SS-1 = Subslab Sample

ug/m3 = Micrograms per cubic meter of air results calculated by laboratory from parts per billion results using normal temperature and pressure (NPT).

ft - ft bgs = Depth interval below ground surface (bgs) in feet.

Volatile organic compounds by EPA Method TO-15 (partial list), uses GC/MS scan.

< n = Chemical not present at a concentration in excess of detection limit shown.

MRL = Method reporting limit. Laboratory reporting limit based on parts per billion on volume to volume basis (ppbv/v) and converted to ug/m3.

ESL = Environmental Screening Level for Shallow Soil Gas with Residential and Commercial/Industrial Land Use, for samples less than five feet below a building foundation or ground surface (Table E).

ESL for indoor air multiplied by 100 for samples collected below foundation concrete slab per Department of Toxic Substances Control/Cal - EPA *Vapor Intrusion Guidance Document - Final Interim* December

ESL established by the SFBRWQCB, Interim Final - February 2005, and amended in November 2006.

DPE = Dual phase extraction.

Bold = Concentrations above ESLs for Residential and/or Commercial Land Use for shallow soil gas (SG samples) and for indoor air multiplied by 100 (SS samples).

* = Since the air flow regulators on the sampling and leak check summa canisters were setup identically, the percentage of sample that leaked from ambient air within the leak-check enclosure into the sample probe can be determined by dividing the concentration of isopropanol in the sample canister by the concentration of isopropanol in the leak-check canister.

** = Likely that vapor flow was from the shallow portion of the screened interval, once exposed by dual phase extraction (DPE).

Table 4 - Well Construction Details–5175 Broadway, Oakland, CA

Well ID	Total Depth of Well (feet bgs)	Screened Interval (ft bgs)	Well Casing Nominal Diameter (inches)	Sand & Slot Size
Existing Wells				
MW-1	23	13-23	4	8x20 – 0.02 Slot
MW-2C	23	18-23	2	#2/12 – 0.01 Slot
MW-3A	14	9-14	2	#2/12 – 0.01 Slot
MW-3C	27	22-27	2	#2/12 – 0.01 Slot
MW-4A	15	8-15	2	#2/12 – 0.01 Slot
MW-5A	14	10-14	2	#2/12 – 0.01 Slot
MW-5B	20	17-20	2	#2/12 – 0.01 Slot
MW-5C	27	22-27	2	#2/12 – 0.01 Slot
MW-6A	17	8-17	2	#2/12 – 0.01 Slot
MW-7B	18.5	15.5-18.5	2	#2/12 – 0.01 Slot
MW-7C	25	20-25	2	#2/12 – 0.01 Slot
MW-8A	15	8-15	2	#2/12 – 0.01 Slot
MW-8C	25	20-25	2	#2/12 – 0.01 Slot
MW-9A	15.5	7.5-15.5	2	#2/12 – 0.01 Slot
MW-9C	21	17-21	2	#2/12 – 0.01 Slot
MW-10A	18	8-18	2	#2/12 – 0.01 Slot
Destroyed Wells				
MW-2	23	8-23	4	8x20 – 0.02 Slot
MW-3	27	7-27	4	8x20 – 0.02 Slot
STMW-4	19.5	7.5-19.5	4	#4 – 0.02 Slot
STMW-5	24	8-24	2	#4 – 0.02 Slot

bgs = below ground surface

Table 5 - Proposed Cleanup Levels and Goals – 5175 Broadway, Oakland, California

	Benzene			**TPH**		
Media	Current Maximum	Cleanup Level	Cleanup Goal	Current Maximum	Cleanup Level	Cleanup Goal
SPH (Free Product)	**Removal All Free Product** (Maximum detected SPH thickness was 0.06 ft in abandoned well STMW-4 in October 2006) (A 0.02 ft thickness of SPH was detected in bailer within MW-3C in June 2007 following April 2007 DPE test)					
Soil Gas ***(Primary Cleanup Level)***	**5,930** ug/m^3 (SG-4) **30,720** ug/m^3 (MW-4A@DPE)	**84** ug/m^3 Residential ESL for indoor air, due to risk to adjacent offsite apts	**84** ug/m^3 Same as Cleanup Level	**830,000 TPHg** ug/m^3 (SG-4) **4,900,000 TPHg** ug/m^3 (MW-4A@DPE) No TPHd soil gas data	**10,000** ug/m^3 Residential ESL for indoor air, due to risk to adjacent offsite apts	**10,000** ug/m^3 Same as Cleanup Level
Groundwater (Shallow) ***(Secondary Cleanup Level)***	**2,400** ug/L (MW-3A; 3/08)	**540** ug/L Residential ESL for indoor air, due to risk to adjacent offsite apts	**1** ug/L****** Final ESL for DW (Same for Residential and Commercial)	**17,000 TPHg** ug/L (MW-4A; 3/08) **3,600 TPHd** ug/L (MW-4A; **pre** DPE, 3/07) **38,000 TPHd** ug/L (MW-4A; **post** DPE, 3/08)	**SG*** & **1,000** ug/L** Indoor air ESL defers to soil gas. 1000 ug/L cleanup level is 10x cleanup goal	**100** ug/L goal** Final ESL for DW (Same for Residential and Commercial)
Groundwater (Deeper)	**1,500** ug/L (MW-3C; 3/08)			**36,000 TPHg** ug/L (MW-3C; 3/08) **21,000 TPHd** ug/L (MW-3C; **post** DPE, 3/08)		
Soil	**1.7** mg/kg (13.5-14 ft)	**0.044** mg/kg Final ESL for DW (Same for Residential and Commercial)	**0.044** mg/kg** Same as Cleanup Level	**970** mg/kg **TPHg** (10 ft bgs) **10** mg/kg **TPHd** (limited data)	**83** mg/kg Final ESL for DW (Same for Residential and Commercial)	**83** mg/kg** Same as Cleanup Level

Notes and abbreviations:

Cleanup *Level* represents target concentration for remedial efforts, while Cleanup *Goal* represents long-term target concentration following natural attenuation of residual impact.

ESL = Environmental Screening Level Established by the SFBRWQCB, Interim Final - November 2007 (Revised May 2008).

DW = Refers to ESL for site where groundwater is considered a current or potential source of drinking water (DW).

NA = Not Available or Not Applicable

* = Use soil gas ESLs per SFBRWQCB ESL guidance (Revised May 2008). Collect final confirmation soil gas samples following subsurface equilibration of at least one week.

** = If soil gas cleanup levels have been achieved and hydrocarbon concentrations in groundwater (or in system influent) are asymptotic but still above cleanup levels/goals, Pangea will request case closure by virtue of achieving *low-risk closure criteria* for groundwater cases. Furthermore, since the current cleanup goals for soil and groundwater are based on ESLs protective of potential drinking water use, it may be appropriate at that time to further evaluate groundwater yield to determine if non-drinking water ESLs could be applicable to this site.

Table 6 – Comparison of Remediation Alternatives: 5175 Broadway, Oakland

	Alternative 1 Excavation / Biosparging with Subgrade Mixed Use Development (Contingent SVE and GWE in Sparge Cells)	Alternative 2 Excavation / Biosparging for Commercial Use – No Subgrade Development (Contingent SVE in Sparge Cells)	Alternative 3 DPE / AS (No Subgrade Development)
Remediation Description	Excavate subgrade area and deeper impacted soil. Two biosparge cells. (Contingent SVE to capture sparge vapors and GWE to expose SVE screen)	Excavate impacted soil. Same as Alternative 1 except reuse more overburden and import backfill to return site to grade.	DPE/AS for 2 Years. 13 DPE wells and 6 AS wells
Unsaturated Soil Cleanup	●	●	◉
Saturated Soil + Groundwater Cleanup	◉	◉	◉
Fastest to Closure	●	●	◉
Most Cost Effective	●	○	◉
Design, Permit, Oversight, Reporting	$25,000	$25,000	$35,000
Excavation Analytical Costs	$10,000	$15,000 (higher for soil reuse analyses)	$0
Shoring	$0 (Development Benefit)	$0 (None used; may limit exc. extent)	$0
Excavate Overburden/Garage (0-9 ft)	$25,000 (5 days @$5k/day)	$25,000 (5 days @$5k/day)	$0
Excavate Impact (9-15 ft)	$25,000 (5 days @$5k/day)	$25,000 (5 days @$5k/day)	$0
Overburden Impacted Soil Offhaul (0-9 ft) (Assume ½ of 3,870 t reuseable)	$68,000 (1,935 tons @$35/ton for <50 ppm TPHg)	$68,000 (1,935 tons @$35/ton for <50 ppm TPHg)	$0
Impacted Soil Offhaul (9-15 ft bgs) 2,580 tn	$116,000 ($45/ton, >50 ppm TPHg)	$116,000 ($45/ton, >50 ppm TPHg)	$0
Stockpile/Handle for Reuse (0-9')	$ 0 (None; Development Benefit)	$ 25,000 (5 days @$5k/day)	$0
Backfill Import 0-11 ft (2,365 tons for reuse ½ of 4,370 tons)	$ 0 (None; Development Benefit)	$ 83,000 (2,365 tons @$35/ton=½ baserock, ½ loam)	$0
Backfill Labor 0-11 ft (4,730 tons w/reuse)	$ 0 (None; Development Benefit)	$ 50,000 (10 days @$5k/day)	$0
Backfill 11-15 ft (Assume ½ reuseable; 860 tons = ½ of 1,720 tons)	$ 43,000 (860 tons @$50/ton rock)	$ 43,000 (860 tons @$50/ton rock)	$0
Backfill Labor 11-15 (1,720 tons)	$ 15,000 (3 days @$5k/day)	$ 15,000 (3 days @$5k/day)	$0
System Installation	$ 50,000 (Biosparge+Contingent Wells)	$ 50,000 (Biosparge+Contingent Wells)	$ 285,000 (45k Wells/30k Util Install/120k Install/90k Equip)
System O&M (Labor, Utility, Fee, Rpt)	$ 24,000 (2 years Biosparge) ($1,000/month)	$ 24,000 (2 years Biosparge) ($1,000/month)	$ 100,800 (2 yrs DPE/AS) ($4,500/month)
GW Monitoring Cost ($6,000/qtr)	$ 72,000 (3 Years)(Starts 1 yr before other alts)	$ 96,000 (4 Years)(1 yr delay til start excavation)	$ 96,000 (4 Years=1 yr plan/prep, 2 yrs O&M, 1 yr gw mon)
Total Estimated Cost	***$ 473,000***	***$ 660,000***	***$ 524,000***
Contingency Cost	$ 50,000 Extra Excavation $ 50,000 SVE/GWE + O&M	$ 50,000 Extra Excavation $ 35,000 SVE Install + O&M	$ 100,000 DPE/AS Expansion or Longer Operation
Total Cost w/ Contingency	***$ 573,000***	***$ 745,000***	***$ 624,000***
Active Remediation Time / Time Til CLosure	2 years / 3 years	2 years / 4 years	2 years / 4 years
Advantages	• Faster and more reliable than insitu treatment by directly removing source material. • Savings for select costs paid by development. • Shoring allows excavation near impacted property line • Allows exposure of subsurface to determine impact area in clayey soil + bedrock fractures. Helps target residual.	• Faster and more reliable than insitu treatment by directly removing source material. • Allows exposure of subsurface to determine impact area in clayey soil and bedrock fractures. • Help target any residual secondary impact.	• Provides site cleanup without extensive soil excavation. • Can be performed before, during or after site development. • Additional cost savings if less than 2 years of operation required.
Disadvantages	• Requires extensive soil handling. • Contingent remediation may be required for residual	• No costs paid by development since no subgrade work. • Significant costs for import and compaction of backfill. • No shoring to better target impact near property line.	• High energy and utility costs. Requires well + system install. • Slower than excavation for primary contaminant removal. • Ongoing noise and air emissions from equipment
Recommended Alternative	● (Rec for Subgrade Development)	○ (Not Recommended)	◉ (Rec if No Subgrade Development)

● = Very Effective, High Rating ◉ = Moderately Effective, Moderate Rating ○ = Not Applicable, Not Effective, Not Recommended

APPENDIX A

Well Survey, Well Construction Details and Boring Logs

Table 4 - Well Construction Details–5175 Broadway, Oakland, CA

Well ID	Total Depth of Well (feet bgs)	Screened Interval (ft bgs)	Well Casing Nominal Diameter (inches)	Sand & Slot Size
Existing Wells				
MW-1	23	13-23	4	8x20 – 0.02 Slot
MW-2C	23	18-23	2	#2/12 – 0.01 Slot
MW-3A	14	9-14	2	#2/12 – 0.01 Slot
MW-3C	27	22-27	2	#2/12 – 0.01 Slot
MW-4A	15	8-15	2	#2/12 – 0.01 Slot
MW-5A	14	10-14	2	#2/12 – 0.01 Slot
MW-5B	20	17-20	2	#2/12 – 0.01 Slot
MW-5C	27	22-27	2	#2/12 – 0.01 Slot
MW-6A	17	8-17	2	#2/12 – 0.01 Slot
MW-7B	18.5	15.5-18.5	2	#2/12 – 0.01 Slot
MW-7C	25	20-25	2	#2/12 – 0.01 Slot
MW-8A	15	8-15	2	#2/12 – 0.01 Slot
MW-8C	25	20-25	2	#2/12 – 0.01 Slot
MW-9A	15.5	7.5-15.5	2	#2/12 – 0.01 Slot
MW-9C	21	17-21	2	#2/12 – 0.01 Slot
MW-10A	18	8-18	2	#2/12 – 0.01 Slot
Destroyed Wells				
MW-2	23	8-23	4	8x20 – 0.02 Slot
MW-3	27	7-27	4	8x20 – 0.02 Slot
STMW-4	19.5	7.5-19.5	4	#4 – 0.02 Slot
STMW-5	24	8-24	2	#4 – 0.02 Slot

bgs = below ground surface

Virgil Chavez Land Surveying
721 Tuolumne Street
Vallejo, California 94590
(707) 553-2476 • Fax (707) 553-8698

April 10, 2007
Project No.: 2588-04

Morgan Gillies
Pangea Enviromental Services, Inc.
1710 Franklin Street, Ste 200
Oakland, CA

Subject: Monitoring Well Survey
Former Exxon Station
5175 Broadway
Oakland, CA

Dear Morgan:

This is to confirm that we have proceeded at your request to survey the ground water monitoring wells located at the above referenced location. The survey was completed on April 5, 2007. The benchmark for this survey was a cut square on top of easterly curb of Broadway, opposite entrance to house #5718 Broadway. The latitude, longitude and coordinates are for top of casings and are based on the California State Coordinate System, Zone III (NAD83). Benchmark Elevation = 180.06 feet (NGVD 29).

Latitude	Longitude	Northing	Easting	Elev.	Desc.
				161.28	RIM MW-1
37.8356915	-122.2519535	2131491.69	6055757.84	161.10	TOC MW-1
				161.18	RIM MW-2C
37.8355228	-122.2519238	2131430.11	6055765.28	160.65	TOC MW-2C
				161.86	RIM MW-3A
37.8355271	-122.2520974	2131432.62	6055715.16	161.55	TOC MW-3A
				162.08	RIM MW-3C
37.8355738	-122.2520889	2131449.55	6055717.94	161.79	TOC MW-3C
				162.88	RIM MW-4A
37.8356562	-122.2518599	2131478.33	6055784.63	162.44	TOC MW-4A
				161.11	RIM MW-5A
37.8355207	-122.2523005	2131431.37	6055656.48	160.82	TOC MW-5A
				161.69	RIM MW-5B
37.8355004	-122.2522497	2131423.70	6055671.02	161.50	TOC MW-5B
				161.38	RIM MW-5C
37.8355152	-122.2522822	2131429.26	6055661.72	161.03	TOC MW-5C
				161.94	RIM MW-6A
37.8356459	-122.2519958	2131475.30	6055745.31	161.58	TOC MW-6A
				159.33	RIM MW-7A
37.8354200	-122.2520260	2131393.22	6055735.04	159.15	TOC MW-7A

Virgil Chavez Land Surveying
721 Tuolumne Street
Vallejo, California 94590
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April 10, 2007
Project No.: 2588-04
Page Two

Monitoring Well Survey
Former Exxon Station
5175 Broadway
Oakland, CA

Latitude	Longitude	Northing	Easting	Elev.	Desc.
				158.78	RIM MW-7C
37.8354092	-122.2519954	2131389.13	6055743.82	158.53	TOC MW-7C
				161.78	RIM MW-8A
37.8356541	-122.2521975	2131479.37	6055687.12	161.57	TOC MW-8A
				161.48	RIM MW-8C
37.8356713	-122.2521866	2131485.59	6055690.39	161.33	TOC MW-8C

LICENSED LAND SURVEYOR
VIRGIL D. CHAVEZ
No. 6323
Exp. 12-31-08
STATE OF CALIFORNIA

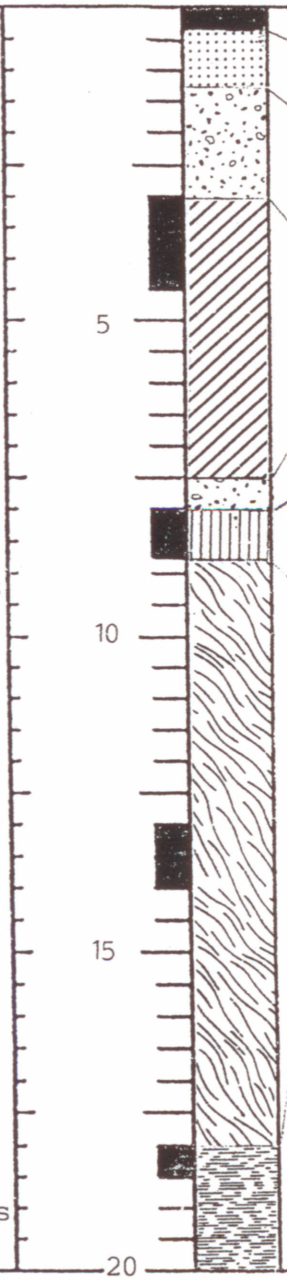
Sincerely,

Virgil D. Chavez, PLS 6323

LOG OF EXPLORATORY BORING

PROJECT NUMBER 104
BORING NO. MW-1
PROJECT NAME 5175 Broadway, Oakland, California
PAGE 1 Of 2
BY J. Mrakovich DATE 4/17/90
SURFACE ELEV 156 ±

Recovery (ft/ft)	PID (ppm)	Penetration (blws/ft)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHO-GRAPHIC COLUMN	DESCRIPTION
1.5/1.5		13					
.75/.75		47 for 9 inches					
1.0/1.0		52					
.5/.5		34 for 6 inches					



Asphalt surface

Fill: Aggregate base of sand and gravel (SP), orange to dark brown, dry.

Fill: Clayey, gravelly, sand (SW), dark red brown with brick fragments, 5% medium sand, rootlets, damp, no odor.

Silty clay (CL), brown, stiff, damp, no odor.
@ 6.5' color change to brown-orange.

Gravelly sand (SW), olive-brown, dry, no odor.

Clayey silt (ML), 30% shale/ claystone fragments, probably weathered bedrock, mottled blue-green/brown, strong gasoline odor, damp, dense.

Serpentine, mottled blue-green/brown, highly fractured, damp, very dense, strong gasoline odor.

Claystone/shale, brown to black, fractured, moist, very dense, slight odor.

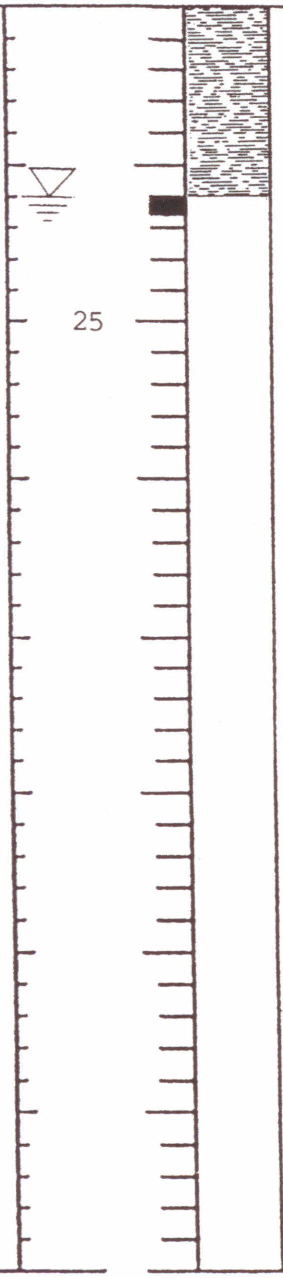
REMARKS

Boring drilled with continuous-flight hollow-stem 10-inch O.D. augers (6.625-inch I.D.). Samples collected in a 3-inch O.D. modified California sampler.

LOG OF EXPLORATORY BORING

PROJECT NUMBER 104
BORING NO. MW-1
PROJECT NAME 5175 Broadway, Oakland, California
PAGE 2 Of 2
BY J. Mrakovich DATE 4/17/90
SURFACE ELEV 156 ±

Recovery (ft/ft)	PID (ppm)	Penetration (blws/ft)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHOGRAPHIC COLUMN	DESCRIPTION
							@ 23.0' wet
.17/.17		50 for 2 inches					Boring terminated at 23 feet. Sampled to 23.17 feet.
				25			



REMARKS

WELL DETAILS

PROJECT NUMBER 104

PROJECT NAME 5175 Broadway

LOCATION Oakland, CA

WELL PERMIT NO. 90222

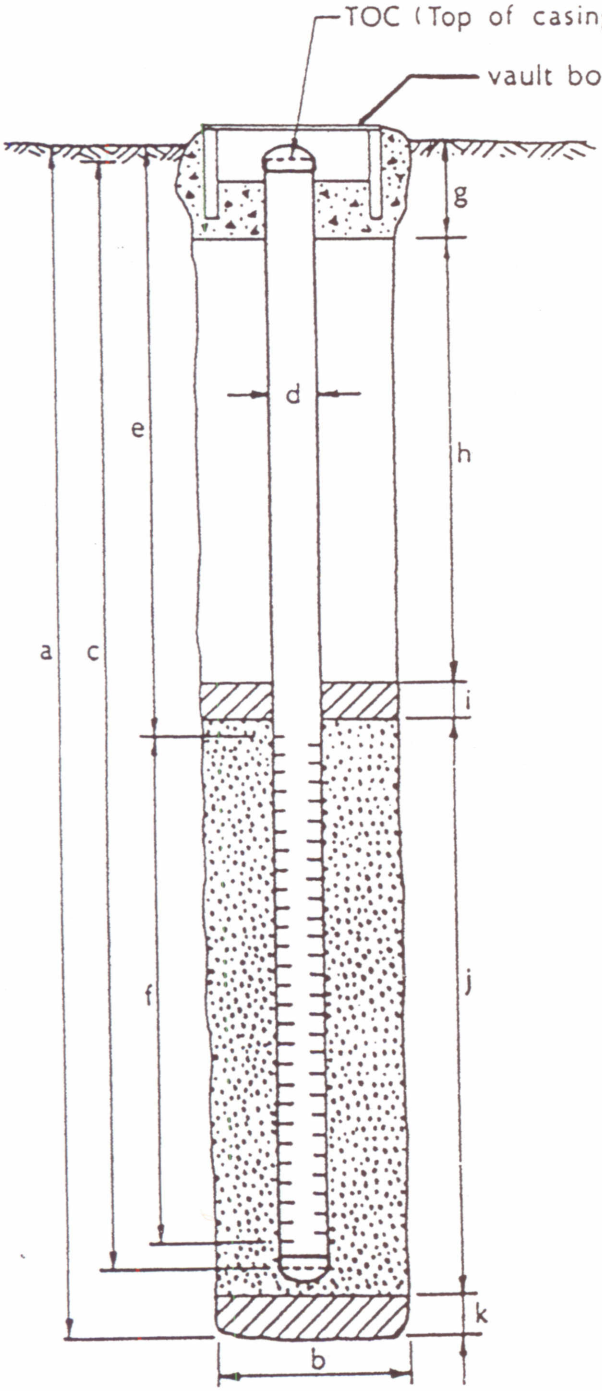
BORING / WELL NO. MW-1

TOP OF CASING ELEV. 155.03

GROUND SURFACE ELEV. 156 ±

DATUM Mean sea level

INSTALLATION DATE 4/17/90



EXPLORATORY BORING

a. Total depth 23 ft.

b. Diameter 10 in.

Drilling method Hollow-stem auger

WELL CONSTRUCTION

c. Total casing length 23 ft.

Material Schedule 40 PVC

d. Diameter 4 in.

e. Depth to top perforations 13.0 ft.

f. Perforated length 10.0 ft.

Perforated interval from 23.0 to 13.0 ft.

Perforation type Machine slot

Perforation size .020-inch

g. Surface seal 1.0 ft.

Seal material Concrete

h. Backfill 8.5 ft.

Backfill material Cement

i. Seal 1.0 ft.

Seal material Bentonite

j. Gravel pack 12.5 ft.

Pack material 8x20 filter sand

k. Bottom seal 0.0 ft.

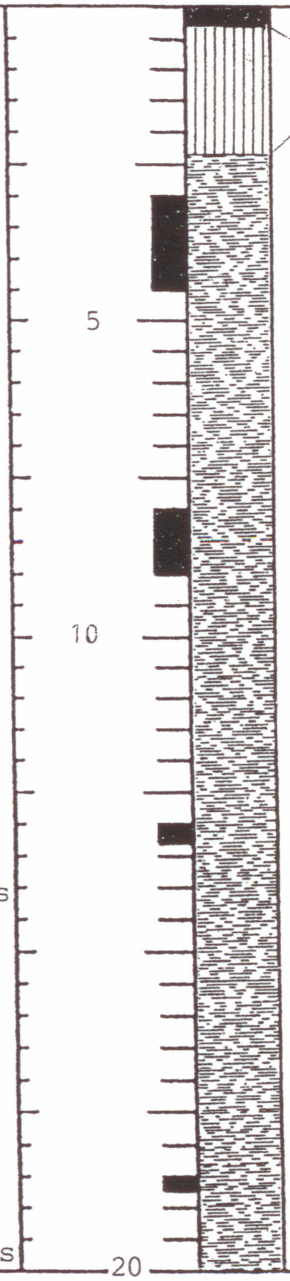
Seal material N/A

LOG OF EXPLORATORY BORING

PROJECT NUMBER 104 BORING NO. MW-2

PROJECT NAME 5175 Broadway, Oakland, California PAGE 1 Of 2

BY J. Mrakovich DATE 4/24/90 SURFACE ELEV. 156 ±



Recovery (ft/ft)	PID (ppm)	Penetration (blws/ft)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHO-GRAPHIC COLUMN	DESCRIPTION
							Concrete
							Clayey silt (ML), mottled yellow-brown and olive brown, damp, slight odor.
							Claystone, mottled yellow-brown with minor blue-green, highly fractured (blocky), upper 9-inches weathered to a clayey consistency, very dense, damp, no odor.
1.25/1.5		97					
				5			
1.0/1.0		84					@ 8.0' color change to include more blue-green, slight gasoline odor.
				10			@ 10.0' hard drilling 10-12 feet, strong gasoline odor while drilling.
.42/.42		80 for 5 inches					@ 13.0-13.4' insufficient sample for analysis, no odor.
.25/.25		50 for 3 inches					@ 18.0-18.25' insufficient sample for analysis, no odor.
				20			

REMARKS

Boring drilled with continuous-flight hollow-stem 10-inch O.D. (6.625-inch I.D.). Samples collected in a 3-inch O.D. modified California sampler.

LOG OF EXPLORATORY BORING

PROJECT NUMBER 104
BORING NO. MW-2
PROJECT NAME 5175 Broadway, Oakland, California
PAGE 2 of 2
BY J. Mrakovich DATE 4/24/90
SURFACE ELEV 156 ±

Recovery (ft/ft)	PID (ppm)	Penetration (blws/ft)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHOGRAPHIC COLUMN	DESCRIPTION
			▽			▨	
.17/.17		50 for 2 inches			■		@ 23.0-23.17' insufficient sample for analysis, no odor.
				25			Boring terminated at 23 feet. Sampled to 23.17 feet.

REMARKS

WELL DETAILS

PROJECT NUMBER 104

PROJECT NAME 5175 Broadway

LOCATION Oakland, CA

WELL PERMIT NO. 90222

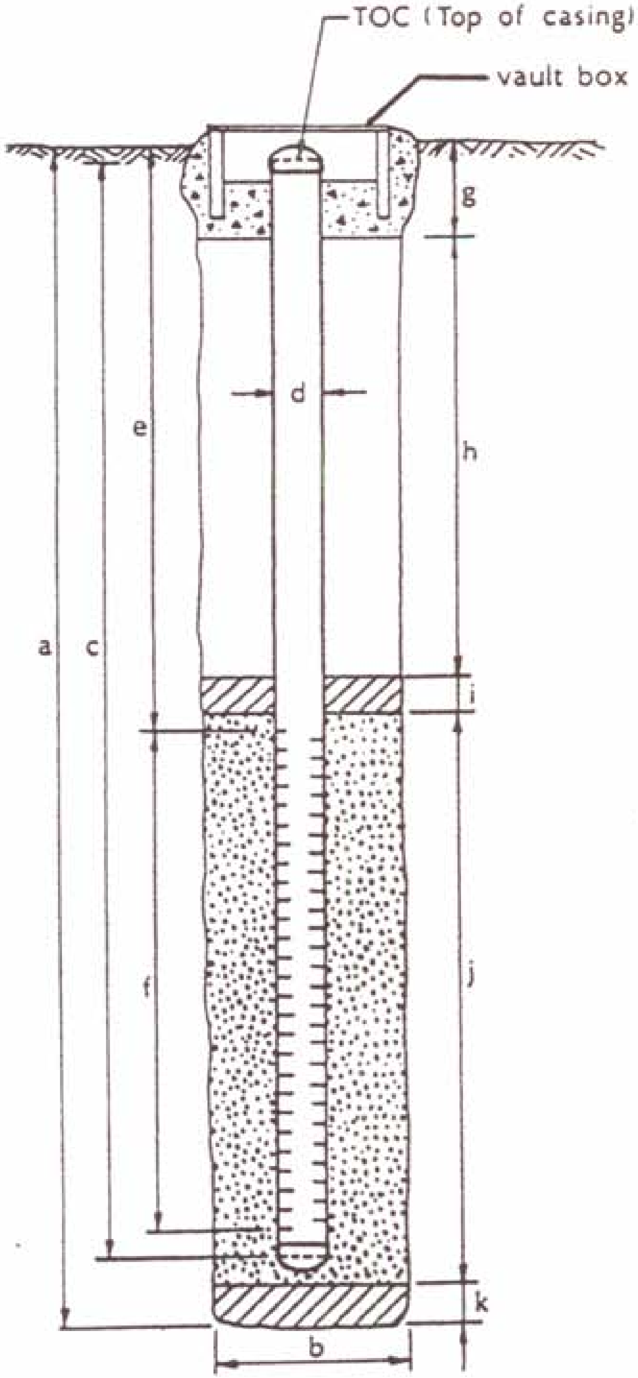
BORING / WELL NO. MW-2

TOP OF CASING ELEV. 154.97

GROUND SURFACE ELEV. 156 ±

DATUM Mean sea level

INSTALLATION DATE 4/24/90



EXPLORATORY BORING

a. Total depth 23.0 ft.

b. Diameter 10 in.

Drilling method Hollow-stem auger

WELL CONSTRUCTION

c. Total casing length 23.0 ft.

Material Schedule 40 pvc

d. Diameter 4 in.

e. Depth to top perforations 8.0 ft.

f. Perforated length 15.0 ft.

Perforated interval from 23.0 to 8.0 ft.

Perforation type Machine slot

Perforation size .020-inch

g. Surface seal 1.0 ft.

Seal material Concrete

h. Backfill 4.0 ft.

Backfill material Cement

i. Seal 1.0 ft.

Seal material Bentonite

j. Gravel pack 17.0 ft.

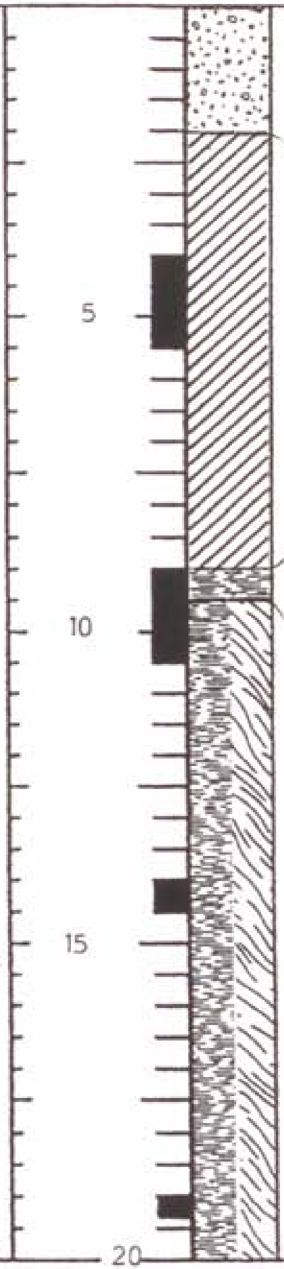
Pack material 8x20 filter sand

k. Bottom seal 0.0 ft.

Seal material N/A

LOG OF EXPLORATORY BORING

PROJECT NUMBER 104
PROJECT NAME 5175 Broadway, Oakland, California
BY J. Mrakovich DATE 4/17/90
BORING NO. MW-3
PAGE 1 Of 2
SURFACE ELEV 156 ±



Recovery (ft/ft)	PID (ppm)	Penetration (blws/ft)	Ground Water Levels	Depth in Ft.	Samples	Lithographic Column	Description
							Fill: Clayey, gravelly, sand (SW), dark brown and black. Hard object encountered at 3 feet, dry, no odor.
							Silty clay (CL), black, slightly damp, firm, slight gasoline odor.
1.5/1.5		7		5			
							@ 7.0' color change to grey, gasoline odor, damp.
1.5/1.5		75		10			Claystone, yellow-brown, weathered to a clayey consistency, damp, strong gasoline odor.
							Claystone/serpentine, mottled green and dark brown, weathered, highly fractured, very dense, damp, strong gasoline odor.
.5/.5		50 for 6 inches		15			@ 14.0'-14.5', slight gasoline odor, damp.
.33/.33		50 for 4 inches		20			@ 19.0'-19.33', slight gasoline odor, insufficient sample for analysis, moist.

REMARKS

Boring drilled with continuous hollow-stem 10-inch O.D. augers (6.625-inch I.D.). Samples collected in a 3-inch O.D. modified California sampler.

LOG OF EXPLORATORY BORING

PROJECT NUMBER 104

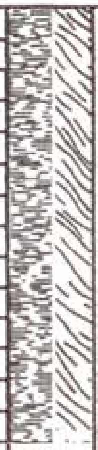
BORING NO. MW-3

PROJECT NAME 5175 Broadway, Oakland, California

PAGE 2 Of 2

BY J. Mrakovich DATE 4/17/90

SURFACE ELEV 156 ±

Recovery (ft/ft)	PID (ppm)	Penetration (blws/ft)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHO-GRAPHIC COLUMN	DESCRIPTION
				25			
							Boring terminated at 27 feet.

REMARKS

WELL DETAILS

PROJECT NUMBER 104

PROJECT NAME 5175 Broadway

LOCATION Oakland, CA

WELL PERMIT NO. 90222

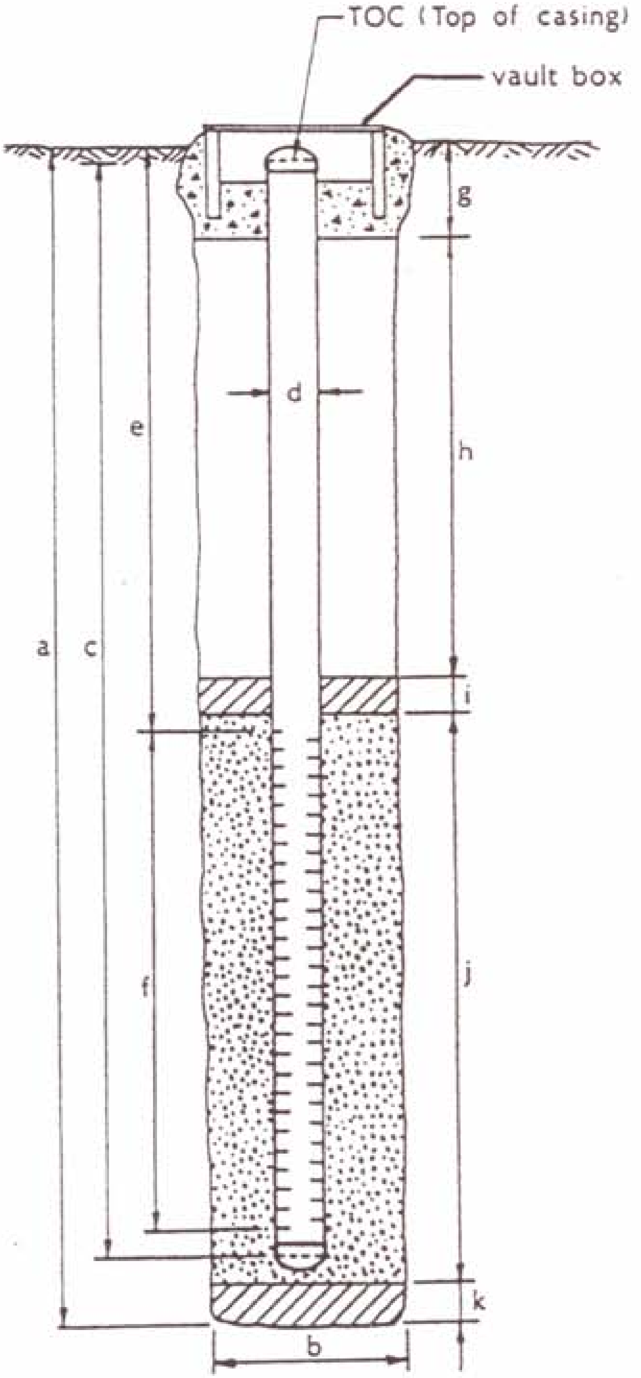
BORING / WELL NO. MW-3

TOP OF CASING ELEV. 155.93

GROUND SURFACE ELEV. 156 ±

DATUM Mean sea level

INSTALLATION DATE 4/17/90



EXPLORATORY BORING

a. Total depth 27.0 ft.

b. Diameter 10 in.

Drilling method Hollow-stem auger

WELL CONSTRUCTION

c. Total casing length 27.0 ft.

Material Schedule 40 PVC

d. Diameter 4 in.

e. Depth to top perforations 7.0 ft.

f. Perforated length 20.0 ft.

Perforated interval from 27.0 to 7.0 ft.

Perforation type Machine slot

Perforation size .020-inch

g. Surface seal 1.0 ft.

Seal material Concrete

h. Backfill 4.0 ft.

Backfill material Cement

i. Seal 1.5 ft.

Seal material Bentonite

j. Gravel pack 21.5 ft.

Pack material 8x20 filter sand

k. Bottom seal 0.0 ft.

Seal material N/A

File No 8-90-420-GI

Logged By: Noori Ameli	Exploratory Boring Log	Boring No. STMW-4
Date Drilled 6/21/91	Approx. Elevation	Boring Diameter 8-inch
Drilling Method Mobile drill rig B-40L	Sampling Method	

Depth, Ft.	Sample No.	Field Test for Total Ionization	Penetration Resistance Blows/6"	Unified Soil Classification	DESCRIPTION
					2-inch asphalt, 2-inch baserock.
1					
2					Reddish-brown silty clay, stiff.
3					Light brown silty clay, stiff.
4					Light brown silty gravelly clay.
5	4-5				Light brown clayey gravelly silt, stiff.
6					
7					
8					
9					
0	4-10				Light brown clayey gravelly silt, mild petroleum odor.
1					Medium size rocks (½ inch - 1 inch).
2					
3					∇ Groundwater level encountered at 13 feet. Stronger odor, moist.
4					
5					Color changes to darker.
6					

Remarks

.ogged By: Noori Ameli

Date Drilled: 6/21/91

Exploratory Boring Log

Approx. Elevation

Boring No. STMW-4

Boring Diameter 8-inch

Drilling Method Mobile drill rig B-40L

Sampling Method

Dep	Sample No.	Field Test for Total Ionization	Penetration Resistance Blows/6"	Unified Soil Classification	DESCRIPTION
'					Color changes to darker.
L8					
L9					Boring terminated at 19-feet 6-inches.
.J					
1					
2					
3					
4					
5					
6					
7					
3					
3					
)					

emarks

Logged By Noori Ameli	Exploratory Boring Log	Boring No. STMW-5
Date Drilled. 6/21/91	Approx. Elevation	Boring Diameter 8-inch

Drilling Method Mobile drill rig B-40L	Sampling Method

Depth, Ft.	Sample No.	Field Test for Total Ionization	Penetration Resistance Blows/Ft.	Unified Soil Classification	DESCRIPTION
1					4-inch asphalt, 3-inch baserock.
2					Medium brown silty clay with some gravel.
3					
4					
5	5-5				Medium brown/dark grey silty clay, firm.
6					
7					
8					
9					
10	5-10				Dark greenish-grey silty clay with some pea gravel.
11					
12					
13					
14					Olive-green silty clay with some medium size gravel.
15					More gravel in the soil.
16					Light petroleum odor. Olive-green silty clayey gravel.

Remarks

Logged By: Noori Ameli

Date Drilled: 6/21/91

Exploratory Boring Log

Approx. Elevation

Boring No. STMW-5

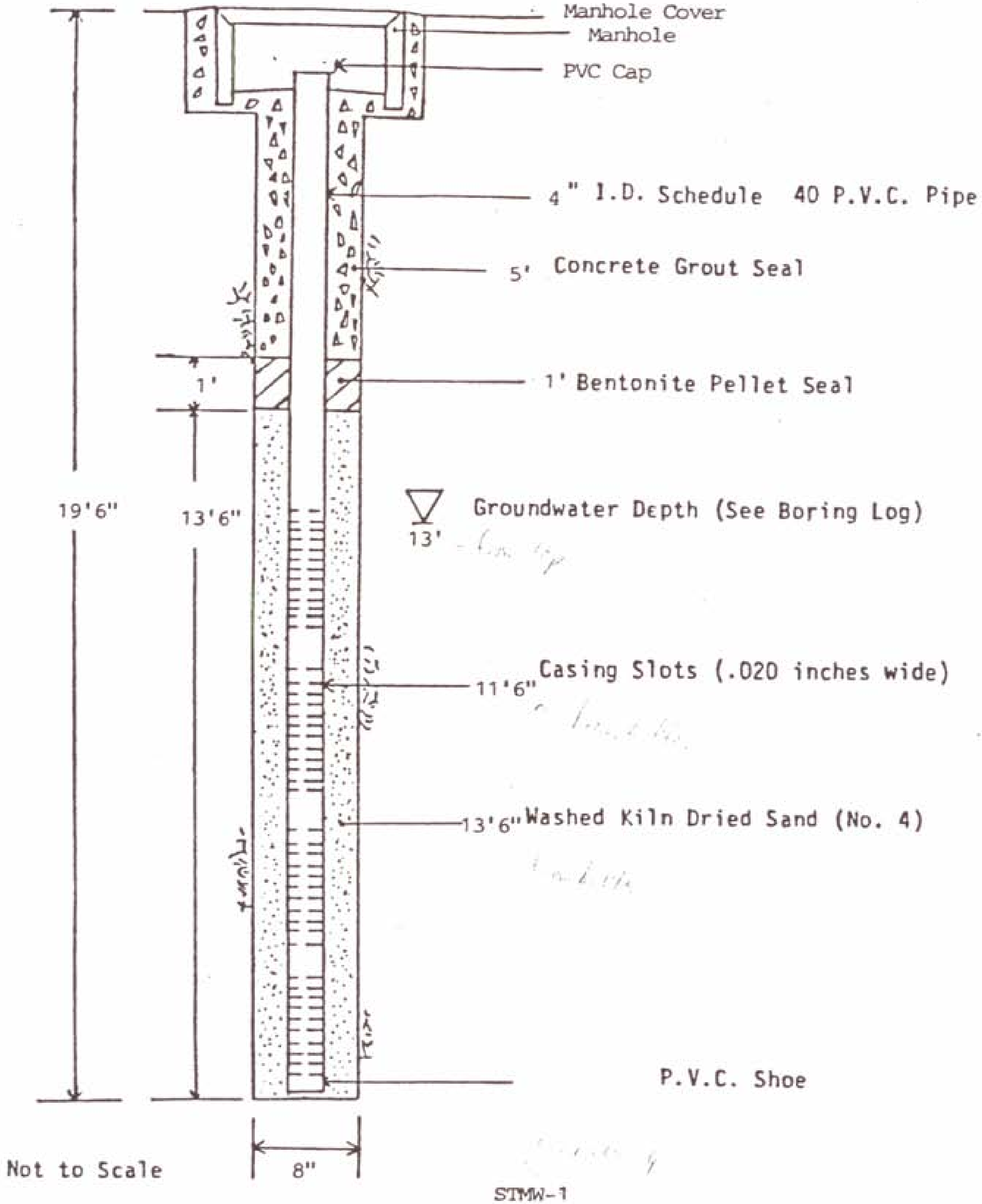
Boring Diameter 8-inch

Drilling Method Mobile drill rig B-40L

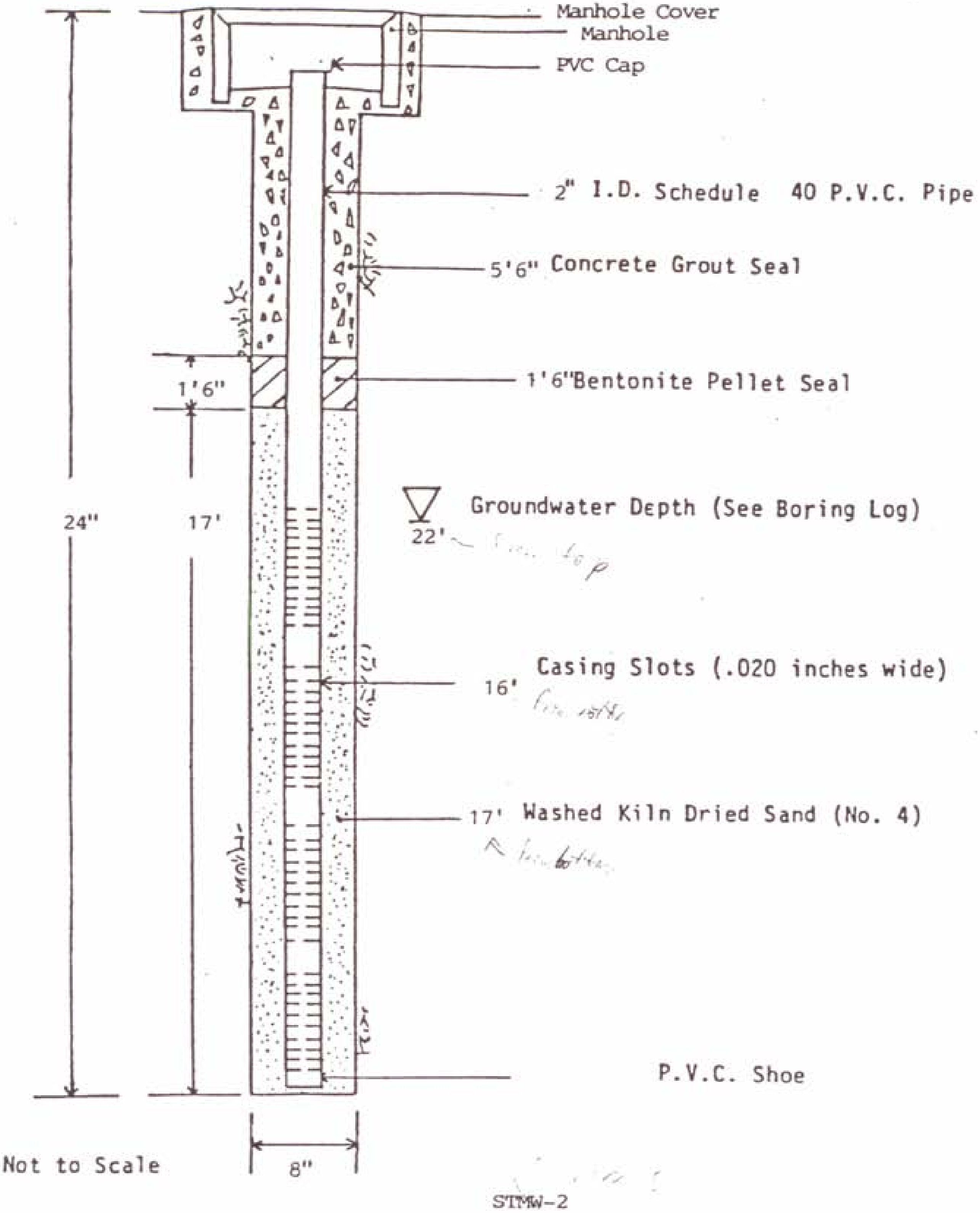
Sampling Method

Depth, Ft.	Sample No.	Field Test for Total Ionization	Penetration Resistance Blows/6"	Unified Soil Classification	DESCRIPTION
7					Olive-green silty clayey gravel.
18					
19					
0	5-20				Olive-green silty clay with some pea gravel.
1					Olive-brown silty clay with small and medium size gravel.
2					▽ Groundwater level encountered at 22 feet.
3					
4					Boring terminated at 24 feet.
5					
6					
7					
8					
9					
0					

marks



Piezometer Schematic



Piezometer Schematic

Pangea Environmental Services, Inc.
1710 Franklin Street, Suite 200
Oakland, CA 94612
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Fax: 510-836-3709

WELL NUMBER MW-2C

PAGE 1 OF 1

CLIENT Feiner

PROJECT NAME Rockridge Heights

PROJECT NUMBER 1145.001

PROJECT LOCATION 5175 Broadway

DATE STARTED 1/25/07 **COMPLETED** 1/25/07

GROUND ELEVATION **HOLE SIZE** 10"

DRILLING CONTRACTOR RSI

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger - 10"

AT TIME OF DRILLING ---

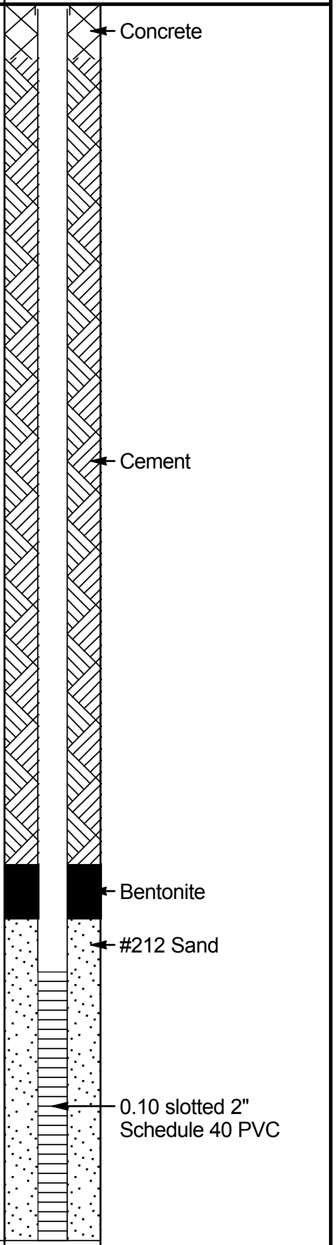
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell

AT END OF DRILLING ---

NOTES

AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	BORING DIAGRAM
0					**See boring log MW-2 from PTE report from 1990.**	
23.0					Bottom of hole at 23.0 feet.	



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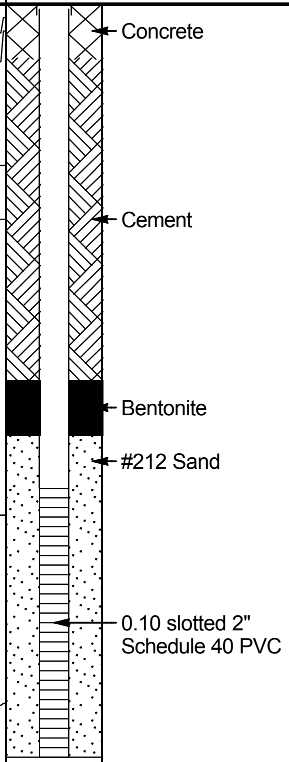
WELL NUMBER MW-3A

PAGE 1 OF 1

CLIENT Feiner
PROJECT NAME Rockridge Heights
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway
DATE STARTED 1/19/07 **COMPLETED** 1/19/07
GROUND ELEVATION **HOLE SIZE** 8"
DRILLING CONTRACTOR RSI
GROUND WATER LEVELS:
DRILLING METHOD Direct Push - Dual Tube
AT TIME OF DRILLING ---
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					0.3 Asphalt
					0.5 Baserock
			CL		**Clay with gravel (CL)**; dark brown; 60-70% medium to high plasticity fines; 20-30% fine gravel to 1/2"; dry. 3.0
			GP		**Poorly-graded Gravels (GP)**; red and green; 60-70% coarse gravels to 1"; 30-40% fine- to coarse-grain sand; loose; dry. 4.0
5			CL		**Clay (CL)**; black; 90-100% medium plasticity fines; no odor; soft. **Clay (CL)**; green; 90-100% medium plasticty fines; hydrocarbon odor; soft. **Clay with gravel (CL)**; greenish brown; 70-80% medium plasticity fines; 20-30% fine gravels to 1/2"; trace fine-grain sand; hydrocarbon odor; dry. 9.5
10					**Mudstone**; grey; easily broken with fingers; difficult to drill; dry. 13.0 Refusal
					Bottom of hole at 13.0 feet.

BORING DIAGRAM



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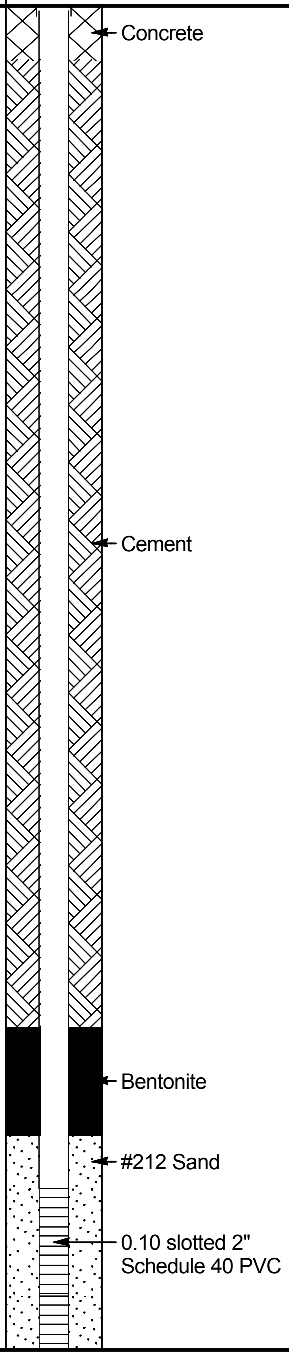
WELL NUMBER MW-3C

CLIENT Feiner
PROJECT NAME Rockridge Heights
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway
DATE STARTED 3/16/07 **COMPLETED** 3/16/07
GROUND ELEVATION **HOLE SIZE** 10"
DRILLING CONTRACTOR RSI
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger - 10"
AT TIME OF DRILLING ---
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	BLOW COUNTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0						**For representative lithology see boring number MW-3 from GGTR's report dated September 12, 2005.**	
5							
10							
15							
20							
25							



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WELL NUMBER MW-3C

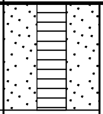
CLIENT Feiner

PROJECT NAME Rockridge Heights

PROJECT NUMBER 1145.001

PROJECT LOCATION 5175 Broadway

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	BLOW COUNTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
25							
						27.0	
						Bottom of hole at 27.0 feet.	



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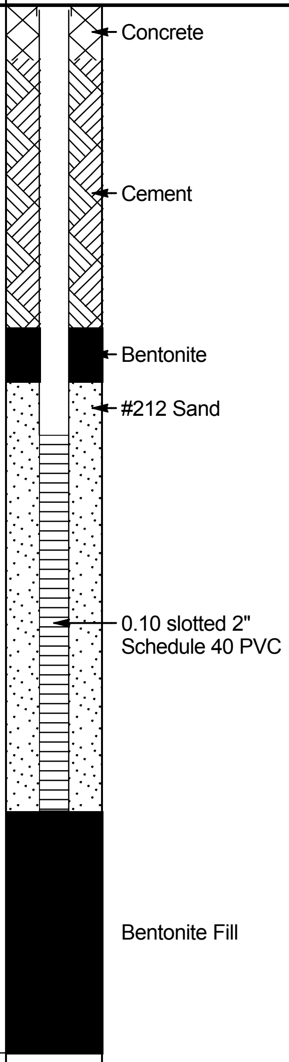
WELL NUMBER MW-4A

PAGE 1 OF 1

CLIENT Feiner
PROJECT NAME Rockridge Heights
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway
DATE STARTED 1/26/07 **COMPLETED** 1/26/07
GROUND ELEVATION ______ **HOLE SIZE** 10"
DRILLING CONTRACTOR RSI
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger - 10"
AT TIME OF DRILLING ---
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell
AT END OF DRILLING ---
NOTES ______
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					**See boring STMW-4 from Soil Tech Engineering, Inc., for lithology.**
5					
10					
15					
					19.5
					Bottom of hole at 19.5 feet.

BORING DIAGRAM



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WELL NUMBER MW-5A

PAGE 1 OF 1

CLIENT Feiner

PROJECT NAME Rockridge Heights

PROJECT NUMBER 1145.001

PROJECT LOCATION 5175 Broadway

DATE STARTED 1/26/07 **COMPLETED** 1/26/07

GROUND ELEVATION **HOLE SIZE** 10"

DRILLING CONTRACTOR RSI

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger - 10"

AT TIME OF DRILLING ---

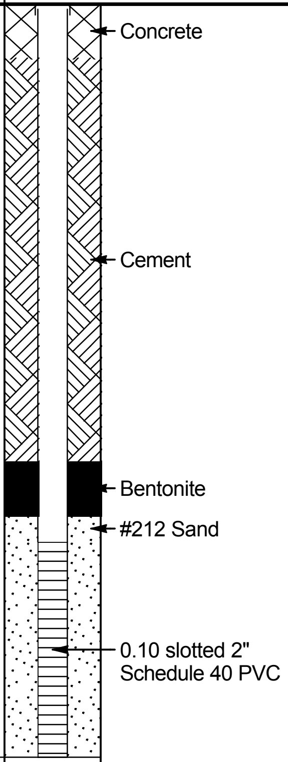
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell

AT END OF DRILLING ---

NOTES

AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	BORING DIAGRAM
0					**See boring MW-5B for representative lithology.**	
5						
10						
					14.0	
					Bottom of hole at 14.0 feet.	



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1710 Franklin Street, Suite 200
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Fax: 510-836-3709

WELL NUMBER MW-5B

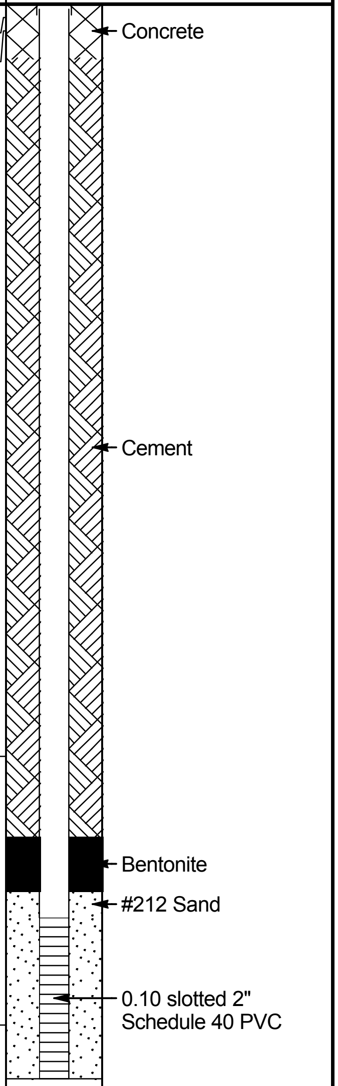
PAGE 1 OF 1

CLIENT Feiner
PROJECT NAME Rockridge Heights
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway
DATE STARTED 1/18/07 **COMPLETED** 1/18/07
GROUND ELEVATION **HOLE SIZE** 8"
DRILLING CONTRACTOR RSI
GROUND WATER LEVELS:
DRILLING METHOD Dual Tube Direct Push/Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				0.3	Asphalt
				0.5	Baserock
			GC		**Clayey Gravel (GC)**; brown; 40-50% fine gravel to 3/4"; 40-50% medium plasticity fines; stiff; dry.
5					**Clayey Gravel (GC)**; black; 40-50% fine gravel to 3/4"; 40-50% medium plasticity fines; hydrocarbon odor; loose; moist.
					Gravel (GC); grey; 95-100% coarse gravel to 1"; no hydrocarbon odor; dry.
10					**Gravelly Clay (GC)**; black; 50-60% medium plasticity fines; 40-50% fine gravel to 3/4"; moist; hydrocarbon odor.
					Clayey Gravel (GC); 70-80% gravel (shale); 20-30% medium plasticity fines; dry; no hydrocarbon odor.
				14.0	**Mudstone**; grey; easily broken with fingers; dry; diffcult to drill through.
15					
				19.0	Refusal

Bottom of hole at 19.0 feet.

BORING DIAGRAM



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1710 Franklin Street, Suite 200
Oakland, CA 94612
Telephone: 510-836-3700
Fax: 510-836-3709

WELL NUMBER MW-5C

CLIENT Feiner

PROJECT NAME Rockridge Heights

PROJECT NUMBER 1145.001

PROJECT LOCATION 5175 Broadway

DATE STARTED 1/18/07 **COMPLETED** 1/18/07

GROUND ELEVATION **HOLE SIZE** 8"

DRILLING CONTRACTOR RSI

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger - 8"

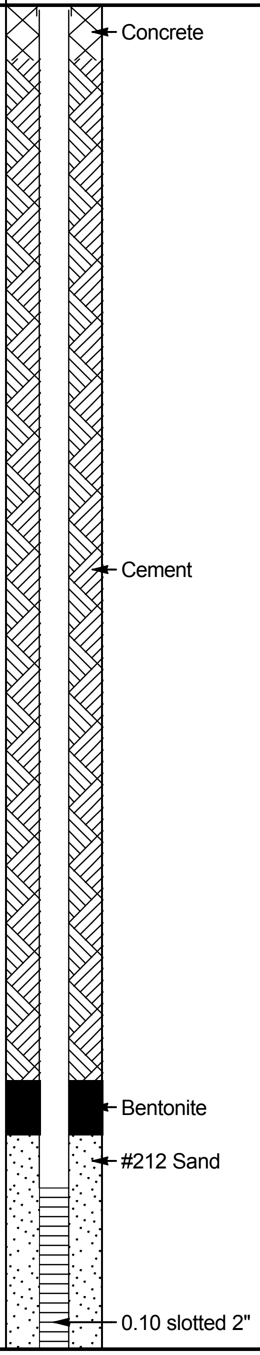
AT TIME OF DRILLING ---

LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell

AT END OF DRILLING ---

NOTES

AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	BORING DIAGRAM
0 5 10 15 20 25					**See boring MW-5B for representative lithology.**	

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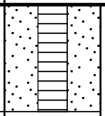
CLIENT Feiner
PROJECT NAME Rockridge Heights
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	BORING DIAGRAM
25						Schedule 40 PVC
					27.0 **See boring MW-5B for representative lithology.** *(continued)*	
					Bottom of hole at 27.0 feet.	

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WELL NUMBER MW-6A

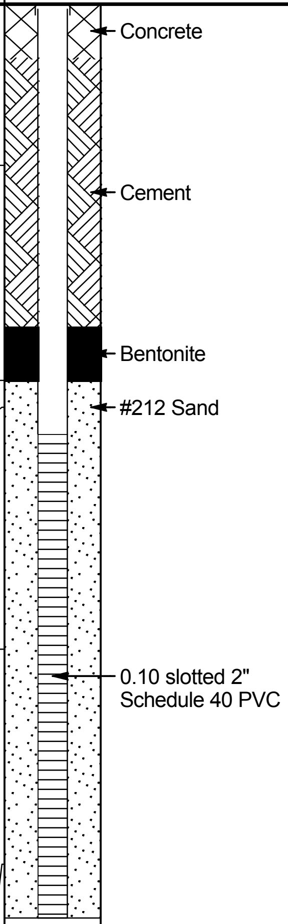
PAGE 1 OF 1

CLIENT Feiner
PROJECT NAME Rockridge Heights
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway
DATE STARTED 1/22/07 **COMPLETED** 1/22/07
GROUND ELEVATION
HOLE SIZE 8"
DRILLING CONTRACTOR RSI
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger - 8"/ Direct Push
▽ **AT TIME OF DRILLING** 7.5 ft
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			GP	3.0	**Poorly-graded Gravels (GP)**; brown; 60-70% fine gravels to 3/4"; 30-40% medium-grain sand; dry; loose.
5			GC	7.0	**Gravelly Clay (GC)**; 60-70% medium plasticity fines; 30-40% fine gravels; moist.
			GW	7.5	▽ **Well-graded Gravel (GW)**; 90-100% fine gravels to 3/4"; dry; loose.
10			GC	12.0	**Clayey Gravel (GC)**; brown; 60-70% medium plasticity fines; 30-40% fine gravels; wet.
	MW-6A-12		SW		**Well-graded Gravelly Sand (SW)**; grey with green; 60-70% fine-grain sands; 30-40% fine gravel; trace fines; wet.
15	MW-6A-15			16.0	**Mudstone**; grey; easily broken with fingers; dry; difficult to drill.
					Refusal

Bottom of hole at 16.0 feet.

BORING DIAGRAM



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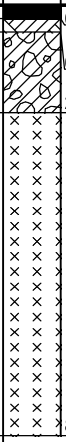
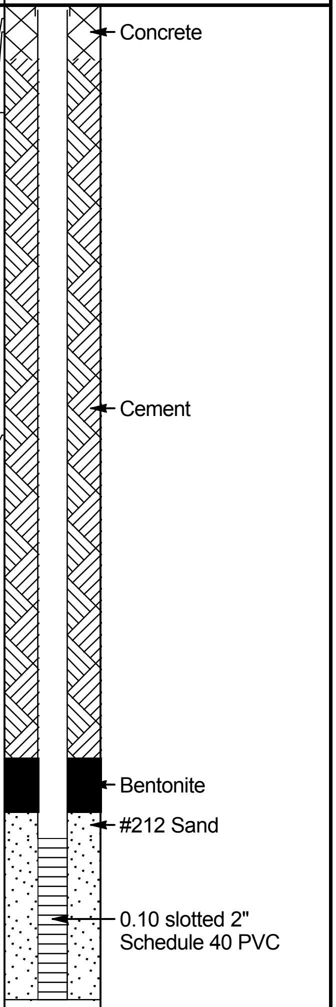
WELL NUMBER MW-7B

CLIENT Feiner
PROJECT NAME Rockridge Heights
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway
DATE STARTED 1/19/07 **COMPLETED** 1/19/07
GROUND ELEVATION **HOLE SIZE** 8"
DRILLING CONTRACTOR RSI
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger - 8"/ Direct Push
AT TIME OF DRILLING ---
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	BORING DIAGRAM
0					0.3 Asphalt	
					0.5 Baserock	
			GC		2.0 **Well-graded Gravel (GW)**; 90-100% fine gravels to 3/4"; dry; loose.	
5					**Mudstone.**	
					8.0 Refusal	
					Bottom of hole at 8.0 feet.	

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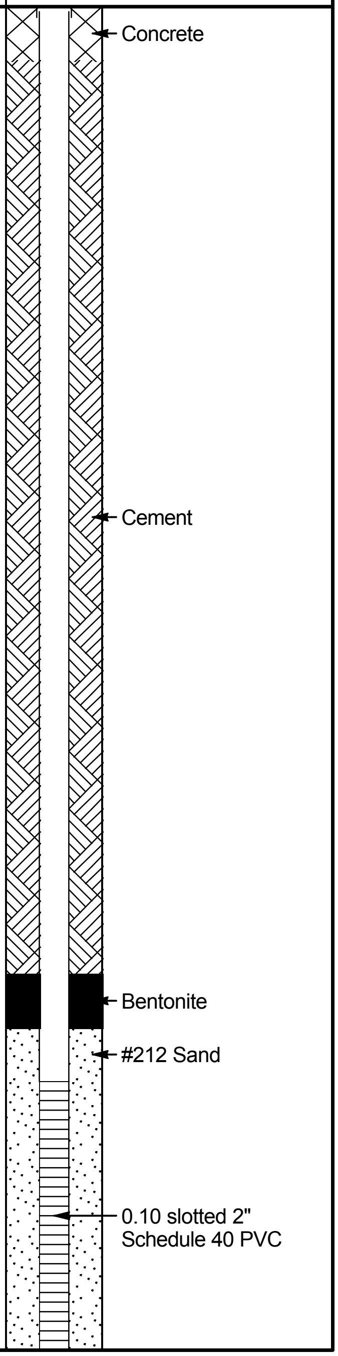
WELL NUMBER MW-7C

CLIENT Feiner
PROJECT NAME Rockridge Heights
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway
DATE STARTED 1/19/07 **COMPLETED** 1/19/07
GROUND ELEVATION **HOLE SIZE** 8"
DRILLING CONTRACTOR RSI
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger - 8"
AT TIME OF DRILLING ---
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	BORING DIAGRAM
0						
					See boring 7B for representative lithology.	
5						
10						
15						
20						
25					25.0	

Bottom of hole at 25.0 feet.

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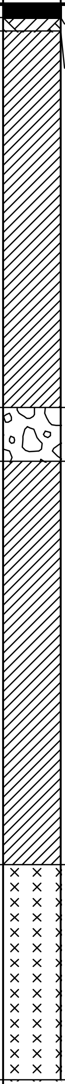
WELL NUMBER MW-8A

PAGE 1 OF 1

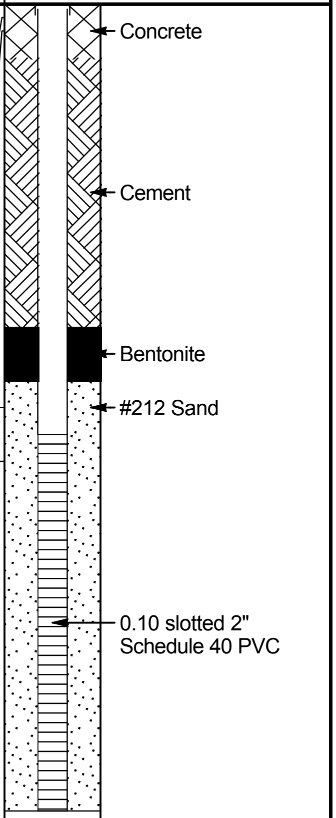
CLIENT Feiner
PROJECT NAME Rockridge Heights
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway
DATE STARTED 1/22/07 **COMPLETED** 1/22/07
GROUND ELEVATION **HOLE SIZE** 8"
DRILLING CONTRACTOR RSI
GROUND WATER LEVELS:
DRILLING METHOD Direct Push - Dual Tube
AT TIME OF DRILLING ---
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.3					Asphalt
0.5					Baserock
7.5			CL		**Clay with gravel (CL)**; brown; 70-80% medium to high plasticity fines; 20-30% fine gravel to 3/4"; dry; stiff.
8.5			GP		**Poorly-graded Gravels (GP)**; grey; 60-70% fine gravels to 3/4"; 30-40% fine- to medium-grain sand; dry; loose.
16.0	MW-8A-8.5 MW-8A-10 MW-8A-12 MW-8A-15		CL		**Clay (CL)**; black; 90-95% medium to high plasticity fines; 5-10% coarse-grain sand; moist to wet; soft; hydrocarbon odor. **Gravelly Clay (CL)**; grey; 60-70% medium to high plasticity fines; 30-40% coarse-grain sand to fine gravels; moist; soft; hydrocarbon odor. **Gravelly Clay (CL)**; brown; 60-70% medium to high plasticity fines; 30-40% fine gravels; dry; stiff; hydrocarbon odor.
20.0					**Mudstone**; grey; easily broken with fingers; difficult to drill; dry. Refusal



Bottom of hole at 20.0 feet.

BORING DIAGRAM



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WELL NUMBER MW-8C

PAGE 1 OF 1

CLIENT Feiner

PROJECT NAME Rockridge Heights

PROJECT NUMBER 1145.001

PROJECT LOCATION 5175 Broadway

DATE STARTED 1/26/07 **COMPLETED** 1/26/07

GROUND ELEVATION **HOLE SIZE** 8"

DRILLING CONTRACTOR RSI

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger - 8"

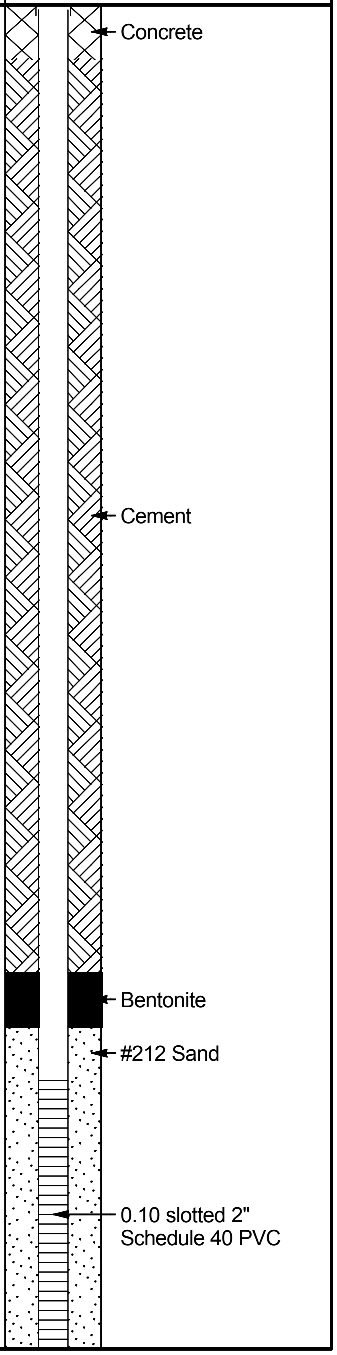
AT TIME OF DRILLING ---

LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell

AT END OF DRILLING ---

NOTES

AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	BORING DIAGRAM
0					**See boring 8A for representative lithology.**	
5						
10						
15						
20						
25					25.0	

Bottom of hole at 25.0 feet.

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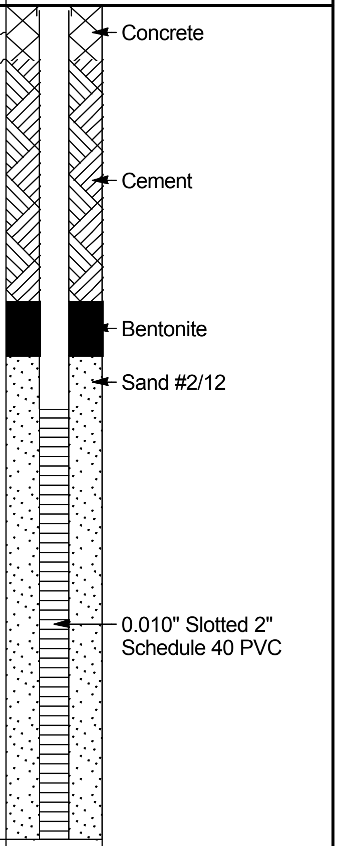
WELL NUMBER MW-9A

PAGE 1 OF 1

CLIENT Feiner
PROJECT NAME Rockridge
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway
DATE STARTED 8/28/07 **COMPLETED** 8/28/07
GROUND ELEVATION **HOLE SIZE** 8"
DRILLING CONTRACTOR RSI
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING Dry
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell
AT END OF DRILLING Dry
NOTES Hand Augered to 1' (bedrock)
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	BLOW COUNTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					0.5	Asphalt
				GM	1.0	**Silty Gravel (GM)** with Jagged Bedrock.
5 10 15					15.5	Bedrock; friable shale (sandstone).
						Bottom of hole at 15.5 feet.

WELL DIAGRAM



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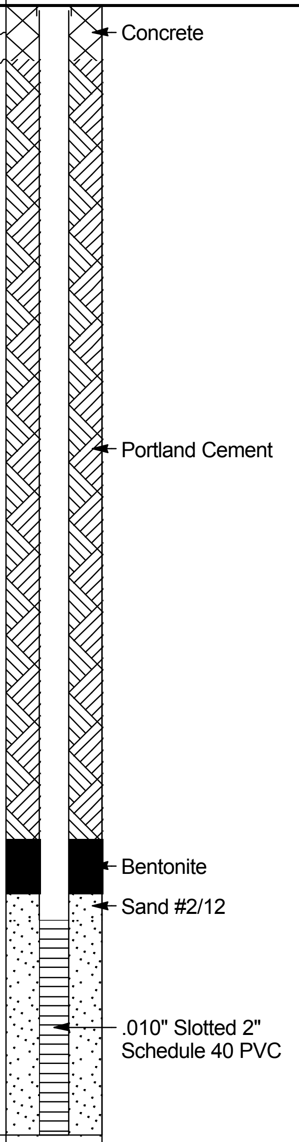
WELL NUMBER MW-9C

PAGE 1 OF 1

CLIENT Feiner
PROJECT NAME Rockridge
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway
DATE STARTED 8/28/07 **COMPLETED** 8/28/07
GROUND ELEVATION **HOLE SIZE** 8"
DRILLING CONTRACTOR RSI
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell
▼ **AT END OF DRILLING** 19.2 ft
NOTES Hand augered to 1' (bedrock)
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	BLOW COUNTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION
0						0.5	Asphalt
				GM		1.0	**Silty Gravel (GM)**.
							Bedrock; friable shale (sandstone).
5							
10							
15							
							▼
20							
						21.0	
							Bottom of hole at 21.0 feet.

WELL DIAGRAM



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WELL NUMBER MW-10A

PAGE 1 OF 1

CLIENT Feiner

PROJECT NAME Rockridge

PROJECT NUMBER 1145.001

PROJECT LOCATION 5175 Broadway

DATE STARTED 8/28/07 **COMPLETED** 8/28/07

GROUND ELEVATION **HOLE SIZE** 8"

DRILLING CONTRACTOR RSI

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

AT TIME OF DRILLING ---

LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell

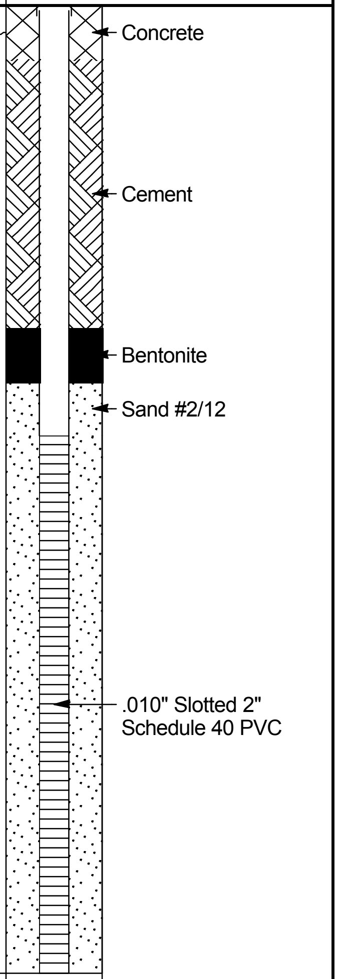
▼ **AT END OF DRILLING** 17.2 ft

NOTES Hand Augered to 3' (bedrock encountered)

▽ **AFTER DRILLING** 14.0 ft

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	BLOW COUNTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 Asphalt
						Jagged bedrock; silty gravel.
						Bedrock; friable shale (sandstone).
5						
10						
15						▽
						▼
						18.0
						Bottom of hole at 18.0 feet.

WELL DIAGRAM



GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
				■	Asphalt (4")	▨ Concrete (0'-0.5')
1	Hand Auger			SM	Moist, moderate to dark yellowish brown (10YR 5/4, 4/2)silty **SAND** with gravel	
5	☒			GM	@ 4.5 fbg, wet silty gravel; strong hydrocarbon odor (flowing water)	
	B2-6		0	SM	Wet, moderate yellowish brown (10YR 5/4) gravelly **SAND**	Portland Type I-II Cement (0.5'-9')
	B2-9		0		Refusal @ 9 fbg (utility corridor)	
10					Total Boring Depth @ 9 fbg	2.0"
15						
20						
25						

Fn:8679.sc1.B2

BORING NUMBER: B2

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA

PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Direct Push
DRILLING DATE: February 1, 2006

LEGEND/NOTES:

Page 1 of 1

fbg = feet below grade
ppm = parts per million
NR = no recovery

▽ = Approximate depth to non-static groundwater (fbg)

☒ = Sample Interval

■ = Retained Sample

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
					Asphalt (4")	Concrete (0'-0.5')
1	Hand Auger			SM	Moist, moderate to dark yellowish brown (10YR 5/4, 4/2)silty **SAND** with gravel	
				GM	@ 4.5 fbg, wet silty gravel; strong hydrocarbon odor (flowing water)	
5	B2-6		0	SM	Wet, moderate yellowish brown (10YR 5/4) gravelly **SAND**	Portland Type I-II Cement (0.5'-9')
	B2-9		0		Refusal @ 9 fbg (utility corridor)	
10					Total Boring Depth @ 9 fbg	2.0"
15						
20						
25						

Fn:8679.sc1.B2

BORING NUMBER: B2

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Direct Push
DRILLING DATE: February 1, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

▽ = Approximate depth to non-static groundwater (fbg)

☒ = Sample Interval

■ = Retained Sample

Page 1 of 1

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
	Hand Auger			■	Asphalt (4")	Concrete (0'-0.5')
1				SM	Moist, loose, dark yellowish brown (10YR 4/2) silty **SAND** / sandy **SILT** with gravel	
5	☒ B3-5	50/6	0	CL	Moist, hard, dark yellowish brown (10YR 4/2) **CLAY**	Portland Type I-II Cement (0.5'-15')
				Not Logged		
9.63▼	☒ B3-9	50/6	0	CL	Same; wet, with foliated rock fragments (≥50%)	
10				Not Logged		
15	☒ B3-14	50/6	0	CL	Same	
					Total Boring Depth @ 15 fbg	8"
20						
25						

Fn:8679.sc1.B3

BORING NUMBER: B3

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Rotary Hollow Stem Auger
DRILLING DATE: February 6, 2006

Page 1 of 1

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

9.63▼ = Approximate depth to static groundwater (fbg), measured on February 8, 2006
☒ = Sample Interval

▨ = Retained Sample

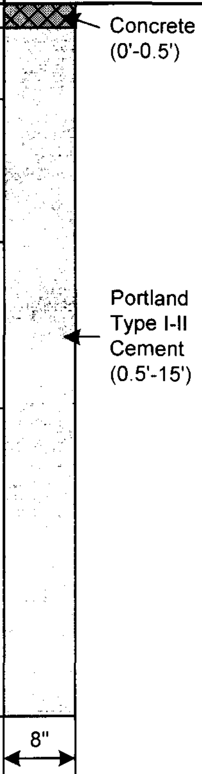
Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description
				■	Asphalt (2")
1	Hand Auger				Dry, loose, silty, gravelly sand (baserock/fill)
				SM	Moist, loose, moderate yellowish brown (10YR 5/4) silty **SAND** ; grades to clay @ 3 fbg
5	☒ B4-5	2,4,8	0	CL	Moist, stiff, dark yellowish brown (10YR 4/2) **CLAY**
				Not Logged	
8.24 ▼					
	☒ B4-9	27, 50/6	0	CL	Wet, hard, moderate yellowish brown (10YR 5/4) and greenish gray (5GY 6/1), **CLAY** with foliated rock fragments
10					
				Not Logged	
15	☒ B4-15	54/3"	0	CL	Same
					Total Boring Depth @ 15 fbg
20					
25					

Boring Backfill Detail



Fn:8679.sc1.B4

BORING NUMBER: B4

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Rotary Hollow Stem Auger
DRILLING DATE: February 6, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery
8.24▼ = Approximate depth to static groundwater (fbg), measured on February 8, 2006
☒ = Sample Interval
■ = Retained Sample

Page 1 of 1

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
					Asphalt (2")	Concrete (0'-0.5')
1	Hand Auger				Dry, loose, silty, gravelly sand (baserock/fill)	
				SM	Moist, dark yellowish brown (10YR 4/2) silty **SAND**	
5	☒ B5-5	3,4,5	0		Moist, loose, dark yellowish brown (10YR 4/2), fine- to medium-grained **SAND** and brick fragments	
6.96▼				Not Logged		Portland Type I-II Cement (0.5'-15')
	☒ B5-9	50/6	0	**SM**	Moist, dense, dark yellowish brown (10YR 4/2), fine- to medium-grained **SAND; grades to** decomposed rock fragments	
10				Not Logged		
15	☒ NR	54/2"	0		Rock in Shoe	
					Total Boring Depth @ 15 fbg	8"
20						
25						

Fn:8679.sc1.B5

BORING NUMBER: B5

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA

PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Rotary Hollow Stem Auger
DRILLING DATE: February 6, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

Page 1 of 1

6.96▼ = Approximate depth to static groundwater (fbg), measured on February 8, 2006
☒ = Sample Interval
▨ = Retained Sample

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
0	Hand Auger			GM	Dry sandy, gravel (UST Excavation backfill)	Concrete (0'-0.5')
1				SM	Moist to wet, dark yellowish brown (10YR 4/2) loose, silty, gravelly sand (baserock/fill)	
5	☒ B6-5	1,2,5	0	CL	Moist, firm, dark yellowish brown (10YR 4/2) silty **CLAY**	
				Not Logged		Portland Type I-II Cement (0.5'-15')
10	☒ B6-9	8,12,27	0	CL	Wet, hard, dark yellowish brown (10YR 4/2) gravelly **CLAY** (≤40% gravel); slight hydrocarbon odor	
12.1 ▽				Not Logged		
	☒ NR	15,3,4	0			
15					Total Boring Depth @ 15 fbg	8"
20						
25						

Fn:8679.sc1.B6

BORING NUMBER: B6

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Rotary Hollow Stem Auger
DRILLING DATE: February 6, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

12.1▽ = Approximate depth to non-static groundwater (fbg)

☒ = Sample Interval

▨ = Retained Sample

Page 1 of 1

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
0	Hand Auger				Asphalt (2")	Concrete (0'-0.5')
1				SM	Dry, loose, silty, gravelly sand (baserock/fill)	
5	☒ B7-5	10,12,18	0	ML	Moist, medium dense, moderate yellowish brown (10YR 5/4) gravelly, sandy **SILT**	
				Not Logged		Portland Type I-II Cement (0.5'-15')
9	☒ B7-9	50/4	0	ML	Moist, hard, moderate yellowish brown (10YR 5/4) gravelly, sandy **SILT** (≤20% gravel)	
10						
11.7▼				Not Logged		
15	☒ B7-15	50/4	0	SM	Wet, hard, dark yellowish brown (10YR 4/2) **SANDSTONE/SHALE** (Decomposed Bedrock)	
					Total Boring Depth @ 15 fbg	8"
20						
25						

Fn:8679.sc1.B7

BORING NUMBER: B7

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Rotary Hollow Stem Auger
DRILLING DATE: February 6, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

11.7▼ = Approximate depth to static groundwater (fbg), measured on February 8, 2006
☒ = Sample Interval
▨ = Retained Sample

Page 1 of 1

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
	Hand Auger				Asphalt (2")	Concrete (0'-0.5')
1					Dry, loose, silty, gravelly sand (baserock/fill)	
				SM	Moist, medium dense, dark yellowish brown (10YR 4/2), silty **SAND** with gravel (≤30%)	
5	☒ B8-5	2,4,18	0	CL	Moist, medium dense, dark yellowish orange (10YR 6/6) **CLAY**; grades to olive gray (5Y 3/2)	Portland Type I-II Cement (0.5'-15')
				Not Logged		
	☒ B8-9	50/4	0	SM	Moist, dense, moderate dark yellowish brown (10YR 4/2), silty **SAND**	
9.97 ▼ 10						
				Not Logged		
15	☒ NR	50/1			Wet, hard, decomposed bedrock (rock in shoe)	
					Total Boring Depth @ 15 fbg	8"
20						
25						

Fn:8679.sc1.B8

BORING NUMBER: B8

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Rotary Hollow Stem Auger
DRILLING DATE: February 6, 2006

LEGEND/NOTES:

Page 1 of 1

fbg = feet below grade
ppm = parts per million
NR = no recovery

9.97▼ = Approximate depth to static groundwater (fbg), measured on February 8, 2006
☒ = Sample Interval
▨ = Retained Sample

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
1	Hand Auger				Asphalt (2")	Concrete (0'-0.5')
					Dry, loose, silty, gravelly sand (baserock/fill)	
				SM	Moist, dark yellowish brown (10YR 4/2), silty **SAND** and gravel	
5	☒ B9-5	50/6	0	Not Logged	Moist, dense, dusky yellowish brown (10YR 2/ 2), silty **SAND** with gravel	Portland Type I-II Cement (0.5'-15')
	☒ B9-9	10,12,16	0	CL	Moist, very stiff, olive gray (5Y 4/1) **CLAY**; strong hydrocarbon odor	
10				Not Logged		
15	☒ NR	50/6		SM	Wet, hard, decomposed bedrock	
					Total Boring Depth @ 15 fbg	8"
20						
25						

Fn:8679.sc1.B9

BORING NUMBER: B9

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Rotary Hollow Stem Auger
DRILLING DATE: February 6, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

☒ = Sample Interval

▭ = Retained Sample

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
				■	Topsoil/Gravel Fill	
					Moist, loose, silty, gravelly sand (baserock/fill)	
1	Hand Auger			SM	Moist, dark yellowish brown (10YR 4/2), silty **SAND** and gravel	
5	☒ B10-5	4,6,8	0		Moist, loose, dark yellowish brown (10YR 2/2), clayey, silty **SAND** with gravel	
				Not Logged		Portland Type I-II Cement (0'-15')
	☒ B10-9	8,16,21	0	SM	Same	
10				Not Logged		
13.3∇						
15	☒ B10-15	3,50/3		SM	Moist, dense, dark yellowish brown (10YR 2/2), clayey **SAND** (poorly graded)	
					Total Boring Depth @ 15 fbg	8"
20						
25						

Fn:8679.sc1.B10

BORING NUMBER: B10

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Rotary Hollow Stem Auger
DRILLING DATE: February 6, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

13.3∇ = Approximate depth to non-static groundwater (fbg)

☒ = Sample Interval

▭ = Retained Sample

Page 1 of 1

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
	Hand Auger			▆	Asphalt (2")	Concrete (0'-0.5')
1				SM	Moist, loose, moderate yellowish brown (10YR 5/4) silty **SAND** and gravel	
5				Not Logged		Portland Type I-II Cement (0.5'-17')
10						
15						
					Total Boring Depth @ 17 fbg	2.0"
20						
25						

Fn:8679.sc1.B11

BORING NUMBER: B11

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Direct Push (Hydropunch)
DRILLING DATE: February 6, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

☒ = Sample Interval

▬ = Retained Sample

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
				▆	Asphalt (2")	Concrete (0'-0.5')
1	Hand Auger			**SM**	Moist, loose, moderate to dark yellowish brown (10YR 5/4, 4/2) silty **SAND** and gravel (≤40%); grades to dark yellowish orange (10YR 6/6) at 3.5 fbg	
5				Not Logged		Portland Type I-II Cement (0.5'-13.5')
10					Obstruction @ 13.5 fbg (concrete/rock)	
15					Total Boring Depth @ 13.5 fbg	2.0"
20						
25						

Fn:8679.sc1.B12

Page 1 of 1

BORING NUMBER: B12

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Direct Push (Hydropunch)
DRILLING DATE: February 1, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

☒ = Sample Interval

▬ = Retained Sample

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
0–0.5	Hand Auger			■	Asphalt	Concrete (0'-0.5')
1				**SM**	Moist, dark yellowish brown (10YR 4/2) silty **SAND** with gravel	
2–5				CL	Moist, moderate to dark yellowish brown (10YR 5/4, 4/2) mottled **CLAY**	
5–9	☒ NR			Not Logged		Portland Type I-II Cement (0.5'-17')
9–13 11.7 ▽	☒ NR				Obstruction @ 10 fbg (possible continuation of former foundation at 5230 Coronado Avenue)	
13–17	☒ NR					
17					Total Boring Depth @ 17 fbg	2.0"
20						
25						

Fn:8679.sc1.B13

BORING NUMBER: B13

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA

PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Direct Push
DRILLING DATE: February 1, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

11.7 ▽ = Approximate depth to non-static groundwater (fbg) measured on February 3, 2006
☒ = Sample Interval
■ = Retained Sample

Page 1 of 1

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
	Hand Auger			▬	Asphalt (2")	Concrete (0'-0.5')
1				SM	Dry, loose, silty, gravelly sand (baserock/fill)	
				CL	Moist, dusky brown (5YR 2/2) and olive grey (5Y 4/1) sandy **CLAY** and gravel (>20%); slight hydrocarbon odor	
5				Not Logged		Portland Type I-II Cement (0.5'-15')
10						
13.1 ▽						
15					Total Boring Depth @ 15 fbg	2.0"
20						
25						

Fn:8679.sc1.B14

Page 1 of 1

BORING NUMBER: B14

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Direct Push (Hydropunch)
DRILLING DATE: February 6, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

$_{13.1}\nabla$ = Approximate depth to non-static groundwater (fbg)

☒ = Sample Interval

▨ = Retained Sample

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

GEOLOGIC BORING LOG

Depth (fbg)	Recovery/ Sample ID	Blow Counts (#/6")	Organic Vapor (ppm)	USCS Soil Type	Description	Boring Backfill Detail
0	Hand Auger (0-5)			■	Asphalt (2")	Concrete (0'-0.5')
1				SM	Dry, loose, silty, gravelly sand (baserock/fill)	
				CL	Moist, moderate to dark yellowish brown (10YR 5/4, 4/2) **CLAY**	
5				Not Logged		Portland Type I-II Cement (0.5'-15')
8.75▽						
10						
15					Total Boring Depth @ 15 fbg	2.0"
20						
25						

Fn:8679.sc1.B15

Page 1 of 1

BORING NUMBER: B15

LOCATION: Former Exxon Station
5175 Broadway
Oakland, CA
PROJECT NO: 8679
DRILLING CONTRACTOR: Gregg Drilling, Inc.
DRILLING METHOD: Direct Push (Hydropunch)
DRILLING DATE: February 6, 2006

LEGEND/NOTES:
fbg = feet below grade
ppm = parts per million
NR = no recovery

8.75▽ = Approximate depth to non-static groundwater (fbg)

☒ = Sample Interval

▨ = Retained Sample

Logged By: G. Wolf **Reviewed By:** B. Wheeler

Golden Gate Tank Removal, Inc.

PANGEA
Pangea Environmental Services, Inc.
1710 Franklin Street, Suite 200
Oakland, CA 94612
Telephone: 510-836-3700
Fax: 510-836-3709

BORING NUMBER B-16

PAGE 1 OF 1

CLIENT Feiner

PROJECT NAME Rockridge Heights

PROJECT NUMBER 1145.001

PROJECT LOCATION 5175 Broadway

DATE STARTED 1/23/07 **COMPLETED** 1/23/07

GROUND ELEVATION **HOLE SIZE** 8"

DRILLING CONTRACTOR RSI

GROUND WATER LEVELS:

DRILLING METHOD Macrocore Direct Push

AT TIME OF DRILLING ---

LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell

AT END OF DRILLING ---

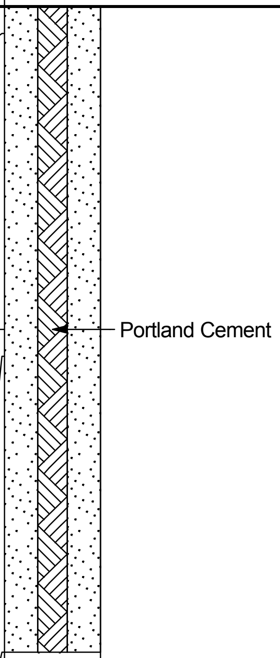
NOTES Hand augered to 4'.

AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				0.5	Concrete Coring
			GP	6.0	**Sandy Gravel (GP)**; hand augering. **Sandy Gravel (GP)**; 60-70% fine gravels to 1/2"; 25-30% fine- to medium-grain sand; 5-10% low plasticity fines; dry; loose.
5			GC	6.5	**Clayey Gravel (GC)**; 60-70% fine gravels to 3/4"; 30-40% low plasticity fines; dry.
10				12.0	**Mudstone**; grey; easily broken with fingers; difficult to drill; dry. Refusal

Bottom of hole at 12.0 feet.

BORING DIAGRAM



PANGEA

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BORING NUMBER B-17

PAGE 1 OF 1

CLIENT Feiner

PROJECT NAME Rockridge Heights

PROJECT NUMBER 1145.001

PROJECT LOCATION 5175 Broadway

DATE STARTED 1/23/07 **COMPLETED** 1/23/07

GROUND ELEVATION **HOLE SIZE** 2.25"

DRILLING CONTRACTOR RSI

GROUND WATER LEVELS:

DRILLING METHOD Direct Push - Dual Tube

AT TIME OF DRILLING ---

LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell

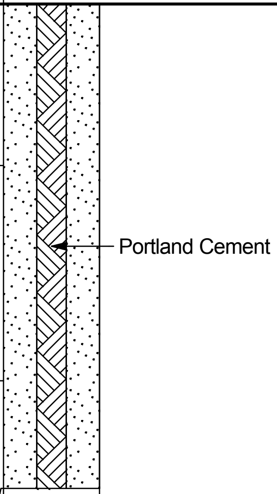
AT END OF DRILLING ---

NOTES Hand augered to 4'.

AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	BORING DIAGRAM
0					Not logged.	
			GP	3.0	**Sandy Gravel (GP)**; brown; 60-70% fine gravel; 30-40% medium-grain sand; dry; loose. **Sandy Gravel (GP)**; grey; 70-80% fine to coarse gravel to 1"; 20-30% fine sand; dry; loose.	
5						
				7.0	**Mudstone**; grey; easily broken with fingers; difficult to drill; dry.	
				9.0	Refusal	

Bottom of hole at 9.0 feet.



Pangea Environmental Services, Inc.
1710 Franklin Street, Suite 200
Oakland, CA 94612
Telephone: 510-836-3700
Fax: 510-836-3709

BORING NUMBER B-18

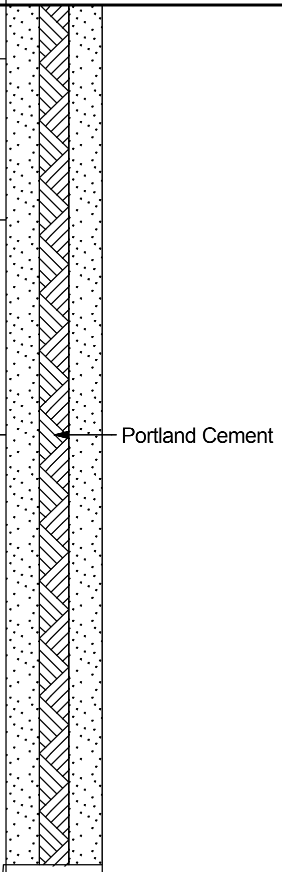
PAGE 1 OF 1

CLIENT Feiner
PROJECT NAME Rockridge Heights
PROJECT NUMBER 1145.001
PROJECT LOCATION 5175 Broadway
DATE STARTED 1/23/07 **COMPLETED** 1/23/07
GROUND ELEVATION **HOLE SIZE**
DRILLING CONTRACTOR RSI
GROUND WATER LEVELS:
DRILLING METHOD Direct Push - Dual Tube
AT TIME OF DRILLING ---
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell
▼ **AT END OF DRILLING** 7.1 ft
NOTES Hand augered to 4'.
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				1.0	Concrete Coring
			GP	4.0	**Sandy Gravel (GP)**; hand augering. **Sandy Gravel (GP)**; brown; 60-70% fine gravel; 30-40% fine-grain sand; tight.
5			CL	8.0	**Clay (CL)**; black; 90-95% medium to high plasticity fines; trace coarse-grain sand; soft; wet. ▼ **Clay (CL)**; brown; 90-95% medium to high plasticity fines; trace coarse-grain sand; stiff; moist.
10					No recovery.
15				16.0	Refusal *(@16' Set temporary casing and collected grab groundwater sample.)*

Bottom of hole at 16.0 feet.

BORING DIAGRAM



Pangea Environmental Services, Inc.
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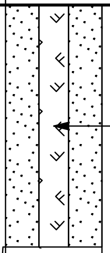
BORING NUMBER B-19

PAGE 1 OF 1

CLIENT Feiner
PROJECT NAME Rockridge Heights
PROJECT NUMBER 1145.001
PROJECT LOCATION 5230 Cornado Avenue
DATE STARTED 3/19/07 **COMPLETED** 3/19/07
GROUND ELEVATION
HOLE SIZE 2"
DRILLING CONTRACTOR - -
GROUND WATER LEVELS:
DRILLING METHOD Hand Auger
▽ **AT TIME OF DRILLING** 4.0 ft
LOGGED BY Greg Bentley **CHECKED BY** Bob Clark-Riddell
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	BORING DIAGRAM
0						
	B-19-1		ML		**Sandy Silt (ML)**; dark brown; 75% non-plastic fines; 20% fine- to coarse-grain sand; 5% fine gravel; moist.	 Backfilled with soil cuttings
					▽ @4' Wet.	
	B-19-4			4.5	*(Boring terminated @4.5' and a grab groundwater sample was collected using a disposable bailer.)*	
					Bottom of hole at 4.5 feet.	

Pangea Environmental Services, Inc.
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BORING NUMBER B-20

PAGE 1 OF 1

CLIENT Feiner

PROJECT NAME Rockridge Heights

PROJECT NUMBER 1145.001

PROJECT LOCATION 5175 Broadway

DATE STARTED 3/16/07 **COMPLETED** 4/4/07

GROUND ELEVATION **HOLE SIZE**

DRILLING CONTRACTOR RSI

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

AT TIME OF DRILLING ---

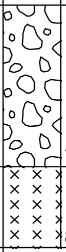
LOGGED BY Bryce Taylor **CHECKED BY** Bob Clark-Riddell

AT END OF DRILLING ---

NOTES Hand augered to 4'.

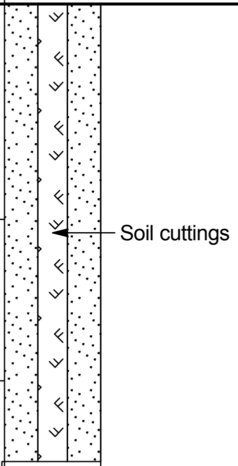
AFTER DRILLING ---

DEPTH (ft bgs)	SAMPLE TYPE NUMBER	PID (ppm)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Not logged.
				4.0	**Sandy Gravel (GP)**; brown; 60-70% fine gravel; 30-40% medium-grain sand; dry; loose.
5			GP		
				7.0	**Mudstone**; grey; easily broken with fingers; difficult to drill; dry.
				8.5	Refusal @8.5'. *(On March 16, 2007 attempted boring with power probe 9630 Hollow Stem Auger/Direct Push Combo rig. Hit refusal at approximately 7' bgs. On April 5, 2007 attempted boring at same location with CME75 rig. Hit refusal at approximately 8.5' bgs.)*



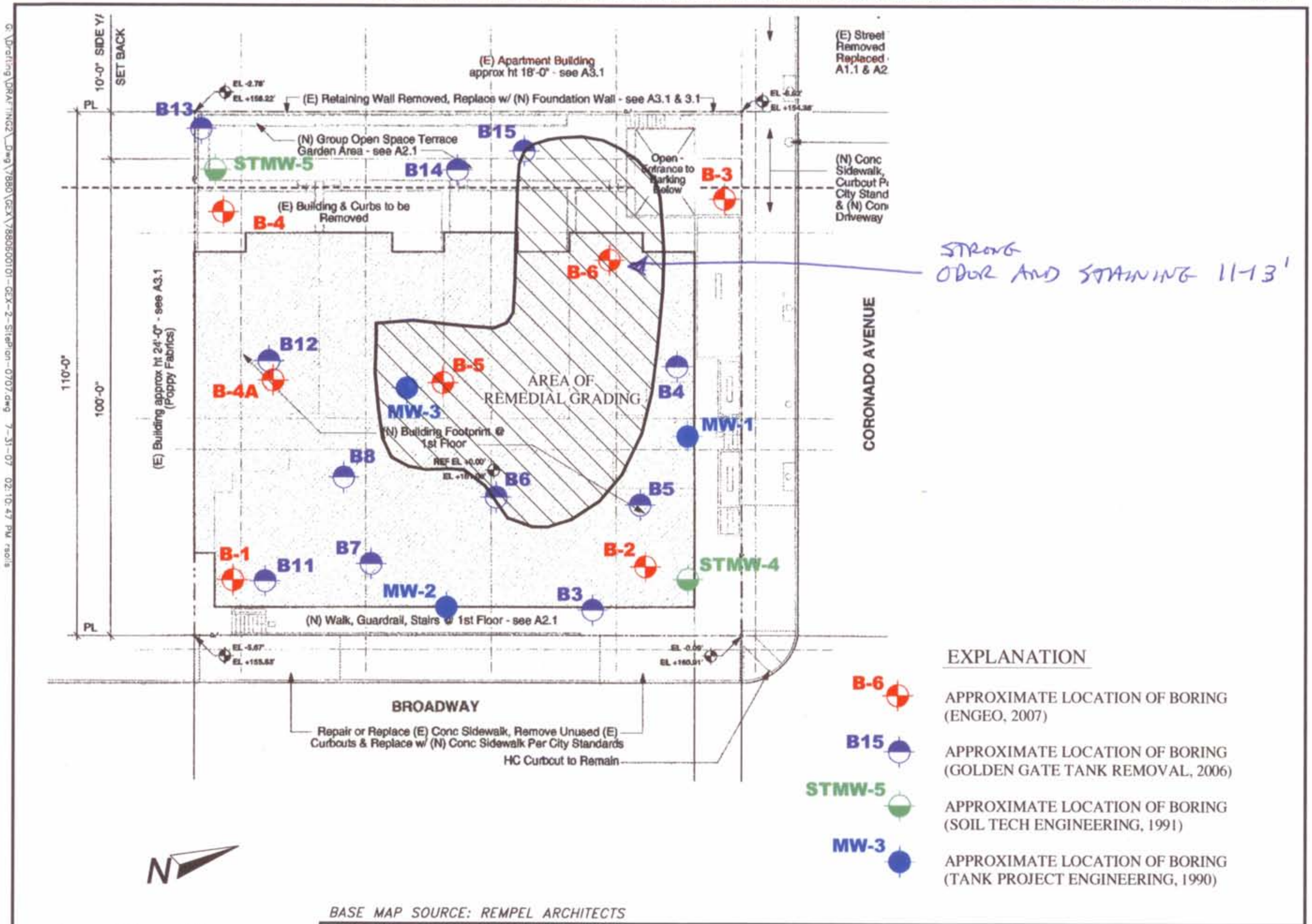
Bottom of hole at 8.5 feet.

BORING DIAGRAM



APPENDIX B

Excerpts from July 2007 Geotechnical Report



STRONG ODOR AND STAINING 11-13'

EXPLANATION

B-6	APPROXIMATE LOCATION OF BORING (ENGEO, 2007)
B15	APPROXIMATE LOCATION OF BORING (GOLDEN GATE TANK REMOVAL, 2006)
STMW-5	APPROXIMATE LOCATION OF BORING (SOIL TECH ENGINEERING, 1991)
MW-3	APPROXIMATE LOCATION OF BORING (TANK PROJECT ENGINEERING, 1990)

BASE MAP SOURCE: REMPEL ARCHITECTS

ENGEO
INCORPORATED
EXCELLENT SERVICE SINCE 1971

SITE PLAN
5175 BROADWAY
OAKLAND, CALIFORNIA

PROJECT NO.: 7880.6.001.01
DATE: JULY 2007
DRAWN BY: PC
CHECKED BY: DW
FIGURE NO. 2

G:\Drafting\DRAFTING2_Dwg\7880\GEX\7880600101-GEX-2-SitePlan-0707.dwg 7-31-07 02:10:47 PM rsolis

ORIGINAL FIGURE PRINTED IN COLOR

Subsurface Stratigraphy

Based on the existing data and our test boring, portions of the site are currently covered by asphaltic concrete, while other portions are covered with loose material. Our subsurface investigation found that the site is underlain by an undocumented fill with thicknesses ranging from 3 to 14 feet. The deepest areas of this fill coincide with the areas of the excavated fuel and oil tanks. In the area of the excavated tanks, the fill generally consists of stiff to very stiff clayey silt to silty clay with non-uniform gravel and layers of medium dense to dense silty sand to silty gravel. In exploratory Boring B-6 (Figure 2) we encountered a very wet clayey sand layer with a greenish blue color, and a strong hydrocarbon odor at a general depth of 11 to 13 feet below ground surface. In the south side of the site, the fill generally consists of medium stiff silty to sandy clay.

Underneath the fills, the native soils consist of very stiff silty to sandy clay with traces of bedrock. We encountered bedrock generally at 5 to 15 feet below ground surface. The shallower depths of bedrock are generally located in the southeastern side of the site. Our exploration found that the bedrock generally consists of friable to weak shale and friable sandstone.

Groundwater Conditions

We encountered groundwater in exploratory Boring B-6. The depth of the groundwater table stabilized at 11 feet below ground surface; however, from data collected and reported on the site characterization study by GGTR, we understand that the groundwater table depth ranged between 7 and 12 feet below ground surface. Fluctuations in groundwater levels may occur daily, seasonally and over a period of years because of precipitation, changes in drainage patterns, nearby creeks, irrigation, and other factors.

APPENDIX C

Standard Operating Procedures

STANDARD FIELD PROCEDURES FOR MONITORING WELLS

This document describes Pangea Environmental Services' standard field methods for drilling, installing, developing and sampling groundwater monitoring wells. These procedures are designed to comply with Federal, State and local regulatory guidelines. Specific field procedures are summarized below.

Well Construction and Surveying

Groundwater monitoring wells are installed in soil borings to monitor groundwater quality and determine the groundwater elevation, flow direction and gradient. Well depths and screen lengths are based on groundwater depth, occurrence of hydrocarbons or other compounds in the borehole, stratigraphy and State and local regulatory guidelines. Well screens typically extend 10 to 15 feet below and 5 feet above the static water level at the time of drilling. However, the well screen will generally not extend into or through a clay layer that is at least three feet thick.

Well casing and screen are flush-threaded, Schedule 40 PVC. Screen slot size varies according to the sediments screened, but slots are generally 0.010 or 0.020 inches wide. A rinsed and graded sand occupies the annular space between the boring and the well screen to about one to two ft above the well screen. A two feet thick hydrated bentonite seal separates the sand from the overlying sanitary surface seal composed of Portland type I, II cement.

Well-heads are secured by locking well-caps inside traffic-rated vaults finished flush with the ground surface. A stovepipe may be installed between the well-head and the vault cap for additional security. The well top-of-casing elevation is surveyed with respect to mean sea level and the well is surveyed for horizontal location with respect to an onsite or nearby offsite landmark.

Well Development

Wells are generally developed using a combination of groundwater surging and extraction. Surging agitates the groundwater and dislodges fine sediments from the sand pack. After about ten minutes of surging, groundwater is extracted from the well using bailing, pumping and/or reverse air-lifting through an eductor pipe to remove the sediments from the well. Surging and extraction continue until at least ten well-casing volumes of groundwater are extracted and the sediment volume in the groundwater is negligible. This process usually occurs prior to installing the sanitary surface seal to ensure sand pack stabilization. If development occurs after surface seal installation, then development occurs 24 to 72 hours after seal installation to ensure that the Portland cement has set up correctly.

All equipment is steam-cleaned prior to use and air used for air-lifting is filtered to prevent oil entrained in the compressed air from entering the well. Wells that are developed using air-lift evacuation are not sampled until at least 24 hours after they are developed.

Groundwater Sampling

Depending on local regulatory guidelines, three to four well-casing volumes of groundwater are purged prior to sampling. Purging continues until groundwater pH, conductivity, and temperature have stabilized. Groundwater samples are collected using bailers or pumps and are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4°C, and transported under chain-of-custody to the laboratory. Laboratory-supplied trip blanks accompany the samples and are analyzed to check for cross-contamination. An equipment blank may be analyzed if non-dedicated sampling equipment is used.