PANGEA

July 25, 2008

VIA ALAMEDA COUNTY FTP SITE

Mr. Paresh C. Kharti
Alameda County Environmental Health
1331 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Re: **Site Conceptual Model with Preferential Pathway Evaluation and Investigation Workplan**
Guy's Service Station
3820 San Leandro Street
Oakland, California
ACEH Fuel Leak Case No. RO0000089
Global ID T0600102250

Dear Mr. Kharti:

On behalf of Kelly Engineer, Pangea Environmental Services, Inc. has prepared this *Site Conceptual Model with Preferential Pathway Evaluation and Investigation Workplan* for the subject site. The report recommends installing of one or more downgradient monitoring wells, conducting soil gas sampling, evaluating natural attenuation, and performing groundwater monitoring semi-annually. This report was requested by your letter dated April 10, 2008.

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

Bob Clark-Riddell, P.E.
Principal Engineer

cc: Kelly Engineer, All Star, Inc., 1791 Pine Street, Concord, California, 94520
SWRCB Geotracker (electronic copy)

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SITE CONCEPTUAL MODEL
WITH PREFERENTIAL PATHWAY EVALUATION
AND INVESTIGATION WORKPLAN

Guy's Service Station
3820 San Leandro Street
Oakland, California
ACEH Fuel Leak Case No. RO0000089

July 25, 2008

Prepared for:

Kelly Engineer
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Prepared by:

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1.0 INTRODUCTION

On behalf of Mr. Kelly Engineer, Pangea Environmental Services, Inc. (Pangea) has prepared this *Site Conceptual Model with Preferential Pathway Evaluation and Investigation Workplan* for the subject site (Figure 1). The above report was requested in an April 10, 2008 letter from Mr. Paresh Kharti of the Alameda County Environmental Health (ACEH). The initial site conceptual model is presented as a basis for evaluating potential preferential pathways and developing an investigation workplan. Our conclusions and recommendations are also presented below.

2.0 SITE BACKGROUND

2.1Site Description

The site is a relatively level parcel occupying approximately 5,500 square feet on the northern corner of San Leandro Street and 39th Avenue in Oakland, California. The surrounding properties are primarily residential, although commercial/retail businesses occupy San Leandro Street east and west of the site. The site has operated as a retail gasoline/diesel service station since at least 1993 when Mr. Engineer commenced operations, and also includes a very small convenience store. A Phillips 66 station operated at the site for many years beforehand.

2.2 Previous Work

Four fuel (two diesel and two gasoline) underground storage tanks (USTs) were reportedly removed by American Consulting Remediation and Construction in January 1998 and new 20,000-gallon fuel USTs were installed soon thereafter. Soil samples collected during tank removal activities contained elevated concentrations of petroleum hydrocarbons. Total petroleum hydrocarbons as gasoline (TPHg) concentrations in soil ranged from 34 to 2,600 parts per million (ppm), while total petroleum hydrocarbons as diesel (TPHd) ranged from 11 to 3,700 ppm. As a result of the detected contamination an unauthorized release form (URF) was issued for the site and excavation of petroleum impacted soil was conducted to the extent practicable onsite as shown on Figure 2. According to Mr. Engineer, no final excavation report was prepared but the excavation extended to near the property boundary in all directions except the northwestern direction. Based on the approximate 16 ft depth of the excavation and the former UST volume, a total of approximately 1,200 tons of soil was excavated and disposed off site. During UST installation, the excavation was backfilled with pea gravel.

Soil and groundwater investigations have been conducted at the site since 1998. In July 1998, Brunsing Associates, Inc. drilled six soil borings and installed three groundwater monitoring wells to assess soil and groundwater conditions. ACC Environmental Consultants, Inc. (ACC) conducted periodic groundwater monitoring at the site from September 2000 to June 2004. In August 2003, ACC completed eight direct-push borings to further characterize the presence of petroleum hydrocarbons and MTBE in onsite and offsite soil and groundwater at the site. Analytical results from historic soil sampling are included in Appendix A. Historic groundwater analytical results are summarized on Table 1. Pangea began groundwater monitoring at the site in May 2008. Pangea also conducted monitoring of tank backfill well BW-1 and obtained well elevation survey data for well BW-1 for groundwater elevation calculation.

3.0 SITE CONCEPTUAL MODEL

This section presents a site conceptual model (SCM). The SCM is a representation of site conditions based on available data, and summarizes important site issues and provides a guide for future assessment and/or remediation. This SCM includes figures and tables with historical groundwater analytical data, geologic cross-sections, and groundwater isoconcentration maps. Groundwater depth, elevation, and analytical data are summarized on Table 1.

3.1 SCM Overview

Based on the previous investigations described in Section 2, the site has been subject to past releases of petroleum hydrocarbons and fuel oxygenates (e.g., MTBE and TBA) that have impacted shallow groundwater (Figures 3 and 4) and pose a potential threat to workers at the site and residents nearby the site. No known municipal or private water wells are located in the vicinity of the site so impacts to domestic water supplies are not considered to be a concern. The releases are primarily associated with operation of the site as a gasoline station for well over 15 years. The top of the piezometric surface is shallow (typically 7 to 9.7 feet bgs) and groundwater is generally found in thin sandy or gravelly intervals within predominantly silty clay soils. Significant soil excavation was conducted during UST replacement in January 1998 when approximately 1,200 tons of impacted soil was removed. The residual impact appears to be located in soil adjacent the USTs at approximately 11 to 12 ft depth, and in groundwater near the site. While the lateral extent of the plume has not been fully characterized, the migration extent is likely limited by the predominant low permeability material at the site. Based on concentration reductions in wells MW-1 and MW-2, natural attenuation following the source removal is remediating contaminants in site groundwater. This suggests that the contaminant plume is shrinking even though contaminant concentrations remain elevated in well MW-3, located immediately adjacent the former excavation. The following sections describe the site conceptual model, including discussions of the source of contamination, geology and hydrogeology, distribution of groundwater contamination, conduit study, and potential receptors.

3.2 Source of Contamination

Petroleum hydrocarbon impact was first discovered during UST replacement activities in January 1998. No specific release points have been identified at the site, although elevated hydrocarbon concentrations in soil from borings and tank excavation samples suggest that the onsite USTs and piping were the likely source of contamination. Since groundwater is typically within 7 to 11 feet of the site surface, releases from the tanks have directly impacted groundwater.

3.3 Geology and Hydrogeology

Regional Geology

The site lies at an elevation of approximately 27 feet above mean sea level on the relatively flat-lying area east of San Francisco Bay (Figure 1), an area generally referred to as the East Bay Plain. The site is located on quaternary age alluvial fan deposits consisting of brown or tan, medium dense to dense, gravely sand or sandy gravel that generally grades upward to sandy or silty clay (Graymer, 2000). 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) (Figures, 1998). The Hayward Fault, a major active regional fault of the San Andreas Fault system, lies 2.2 miles east of the site.

Local Geology and Hydrogeology

Site soil consists of low permeability silty clay to approximately 10 ft bgs, which overlies a sandy clay/silty sand unit present from 10 to 20 feet bgs. This sandy clay/silty sand unit apparently constitute the primary water-bearing strata, and is laterally discontinuous, not extending across San Leandro Street. A large portion of the site subsurface consists of pea gravel backfill to approximately 16 ft depth within the former excavation and current UST area. Figure 5 shows the location of cross section A-A' and Figure 6 shows geologic cross section A-A', which illustrates the lateral and vertical distribution of these shallow subsurface units.

The water-bearing units beneath the site and adjacent areas consist of shallow alluvial materials composed of heterogeneous and laterally discontinuous clays, silts, sands and gravels, typical of an alluvial fan depositional environment. The top of the piezometric surface is shallow (typically 7 to 9.7 feet bgs) and groundwater is likely generally found in thin sandy or gravelly intervals within the predominantly silty clay soil. Boring logs for B-12, B-13, B-14 and B-16 (Appendix A) indicate that groundwater was encountered at depths of 18 ft bgs or below suggesting that groundwater in the area of San Leandro Street and 39th Avenue is under confined to semi-confined conditions. The predominately clay subsurface could explain the limited natural attenuation in source area well MW-3.

Groundwater Flow

Based on a review of depth-to-water data collected during past groundwater monitoring events, groundwater generally flows towards the south. Groundwater elevation data and inferred groundwater flow direction for the most recent quarterly monitoring event (second quarter 2008) are shown on Figure 7. The elevation data and inferred groundwater flow direction is consistent with previous monitoring results.

3.4 Hydrocarbon and Fuel Oxygenate Distribution in Soil and Groundwater

Soil analytical data suggests that contaminants are primarily located in the saturated zone near the property boundary, with the highest concentrations detected at depths ranging from 11 to 12 ft bgs. The primary source of onsite soil contamination was overexcavated to the extent practical (to 16 ft depth and to the property boundary on three sides), removing approximately 1,200 tons of soil and replacing it with pea gravel. The inferred lateral distribution of TPHg and benzene in groundwater at and adjacent to the site are illustrated on the contour maps on Figures 3 and 4, respectively. Although the lateral extent of petroleum hydrocarbons and oxygenates has not been fully delineated, the extent appears limited to approximately 150 ft from the site. During the most recent (2nd quarter 2008) groundwater monitoring event, the maximum detected chemical concentrations were 35,000 micrograms per liter (μg/L) TPHg, 8,300 μg/L benzene, and 20,000 μg/L MTBE, all in onsite well MW-3. The limited plume extent could be explained by the silty clay soil found in offsite borings. As depicted on the geologic cross section on Figure 6, a significantly lower impact (4,100 μg/L TPHg and 25 μg/L benzene) was detected in offsite boring B-13. The impact in B-13 is likely due to contaminant migration within layers/('stringers') of higher permeability materials. Regarding the vertical distribution, no hydrocarbons or MTBE was detected within the deepest soil sample collected from 24 ft bgs (B-12). Decreasing hydrocarbon concentration trends in wells MW-1 and MW-2 suggest the plume is naturally attenuating and shrinking.

3.5 Preferential Pathway Study

To evaluate the potential for contaminant migration via preferential pathways, Pangea surveyed subsurface utilities beneath the site and nearby vicinity and compared utility depths to groundwater depth and contaminants in site monitoring wells. Additionally, Pangea requested a well survey for all wells within ¼ mile radius of the site from Alameda County Public Works Agency (ACPWA). No downgradient active or former wells were identified within a ¼ mile of the site as shown on Figure 8 and Table 2. Given the upgradient or crossgradient location of the closest wells and the limited offsite plume migration, contaminants emanating from the site do not pose an apparent risk to identified wells or to the Ascend K-8 School, which is located approximately 150 ft upgradient of the site. The closest surface water is the tidal canal between Oakland and Alameda located approximately ½ mile downgradient of the site.

To conduct the conduit study, Pangea first requested construction diagrams and blueprints from the site owner and the City of Oakland (the provided diagrams and blueprints are included in Appendix B). Pangea then conducted a survey to locate and measure depths of subsurface utilities within nearby manholes. A site plan indicating the approximate location and depth of identified subsurface utilities is shown as Figure 9. The conduit study identified several subsurface utilities at or near the site (Figure 9). Given the historical range of depth to water in site monitoring wells of approximately 7 to 9.7 ft bgs, all *onsite* utilities are shallower than site groundwater and do not likely act as preferential pathways for contamination migration. The identified subsurface utilities on the site include fuel product lines, a water supply line, and a sanitary sewer lateral at approximately 36” bgs. The sanitary sewer line commences beneath the station building, connects to a clean out near the UST field, and proceeds southeast towards the 8” sanitary sewer line in 39th Avenue. The sewer line reaches a depth of approximately 66” bgs (5.5 ft bgs) as it crosses San Leandro Street. The 6” sewer line southwest of the site beneath San Leandro Street commences in the middle of the block at a depth of approximately 3 ft bgs and connects to the 8 “ line beneath 39th Avenue.

The primary conduits of concern are the storm drain lines adjacent to the site. A 24” diameter storm drain line southeast of the site beneath 39th Avenue reaches a depth of approximately 108” bgs (9 ft bgs) as it crosses San Leandro Street. The 15” diameter storm drain line beneath San Leandro Street along the southwestern edge of the site at a depth of approximately 75” bgs (6.5 ft bgs), and intersects the 24” diameter line at the southern corner of the site. From the San Leandro Street and 39th Avenue intersection the storm drain flows to the southwest to the corner of 39th and Wattling Streets where it connects to a 30” main line.

These estimated depths are based on field measurements within nearby manholes and elevations supplied by the City of Oakland Engineering Department.

Given the historical range of depth to water in site wells of approximately 7 to 9.7 ft bgs, both the 15" diameter and 24" diameter storm drain lines have the potential to intersect groundwater. However, based on the boring logs for B-12, B-13, B-14 and B-16, where groundwater was encountered at approximately 18 ft depth or deeper, it appears that groundwater may be under confined to semi-confined conditions in this area. Furthermore, the storm drain lines are likely surrounded by the predominantly low permeability material (silty clay) generally encountered above 10 ft depth. This information, therefore, suggests that the 15" and 24" diameter storm drain lines do *not* likely act as a preferential pathways for significant contaminant migration. Finally, several borings (B-12 through B-15) completed adjacent the storm drain main heading down 39th Avenue did not detect significant contaminant concentrations. Further evaluation is proposed below.

3.6 Site Conceptual Model Summary

The information 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 due to leaks associated with the USTs and/or product piping at the site. No SPH have been observed at the site, although elevated concentrations of hydrocarbons and MTBE have been detected in site monitoring wells and grab groundwater samples.

- The primary impact area was overexcavated to the extent practical (to 16 ft depth and to the property boundary on three sides) during UST removal activities in January 1998. Residual hydrocarbons remain in silty clay soil primarily at approximately 11 to 12 ft depth, and in groundwater beneath the site, and likely within discontinuous units of relatively higher permeability material downgradient of the site. Based on concentration reductions in wells MW-1 and MW-2, natural attenuation following the source removal is remediating contaminants in site groundwater. This suggests that the contaminant plume is shrinking even though contaminant concentrations remain elevated in well MW-3, located immediately adjacent the former excavation.

- The primary chemicals of concern (COCs) at the site are benzene and MTBE, which could potentially represent a vapor intrusion hazard. Secondary COCs are TPHd, TPHg, toluene, ethylbenzene and xylenes, which all exceed ceiling ESLs for commercial sites based on the potential to degrade groundwater resources.

- Potential receptors include nearby residents and indoor workers who might inhale petroleum vapors migrating from groundwater into buildings, and construction workers who might be exposed to contaminated soil and groundwater when conducting excavation at the site.

- The 15" and 24" storm drain lines beneath San Leandro Street and 39th Avenue, respectively, could potentially intersect groundwater and act as preferential pathways for contaminant migration. However, these storm drains are apparently surrounded by low permeability native material and are likely above the deeper thin water-bearing 'units' apparently under semi-confined or confined conditions where preferential groundwater flow likely occurs. Also, no significant contamination was detected in borings B-12 through B-15 located near the offsite conduits.

- Groundwater flows generally southwards to southeastwards, primarily through relatively thin and laterally discontinuous sandy clay and silty sand layers (e.g., 'stringers') within the predominantly clay subsurface.

- While the lateral extent of the plume has not been fully characterized, the migration extent is likely limited by the predominant low permeability material at the site. A downgradient groundwater monitoring well is proposed below to further delineate the lateral extent of contamination. The proposed soil gas sampling will help determine if the shallow clayey soil limits significant soil gas impact to the offsite residential buildings near the contaminant plume.

4.0 INVESTIGATION WORKPLAN

The objectives of the proposed investigation is to characterize the downgradient lateral magnitude and extent of contamination near the intersection of San Leandro Street and 39th Avenue, and to evaluate soil gas concentrations near potential receptors. The proposed scope of work to accomplish these investigation objectives, detailed below, involves the installation of one to two groundwater monitoring well(s) and sampling soil gas at one onsite and two offsite locations. If elevated contaminant concentrations are detected in the new well(s), Pangea may recommend additional grab sampling or installation of additional offsite downgradient monitoring wells. All field activities will be conducted in accordance with the Standard Operating Procedures (SOPs) detailed in Appendix C.

4.1 Pre-Field Activities

Prior to initiating field activities, Pangea will conduct the following tasks:

- Obtain encroachment and excavation permits from the City of Oakland and drilling permits from Alameda County Public Works Agency as necessary;

- Pre-mark the boring 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 and laboratory subcontractors and other involved parties.

4.2 Soil Gas Sampling

Pangea proposes shallow soil gas sampling at one onsite and two offsite locations. The proposed onsite location (SGP-1) is along the northeastern edge of the site between the dispenser islands and the adjacent commercial building to the northeast. Probe SGP-2 is proposed across San Leandro Street near the residential property on the western corner of San Leandro Street and 39th Avenue, which reportedly contains a partial subsurface basement (presumably for a garage and storage). Probe SGP-3 is proposed near the residential property on the southern corner of San Leandro Street and 39th Avenue (Figure 10). If the soil has insufficient permeability to allow sample collection, Pangea will move over to a new location and attempt to sample shallower soil gas in soil/ rock just below the asphalt or concrete surface (e.g., subslab gas sampling), consistent with prior guidance from Dr. Roger Brewer of the SFRWQCB. Soil and/or subslab gas samples will be collected within Summa canisters and submitted to a state-certified laboratory for analysis.

The subslab/soil gas sampling will be conducted in general accordance with procedures described in Pangea's Standard Operating Procedures (SOPs) for Soil Gas Sampling (Appendix C). The overall procedure involves using an AMS gas vapor probe kit with slide-hammer and solid extensions to drill a hole to approximately 4.5 ft depth, removing the extensions and installing the hollow extensions with new sample tubing and sampling tip to approximately 5 ft depth. The hollow rods are then removed from the borehole leaving the sampling tip exposed to the subsurface formation and approximately 6 inches of sand is poured around the sample tip. Granular bentonite is added to the borehole from the top of the sand to the surface and water is added to hydrate the bentonite. The sample tubing is then connected to a sampling manifold to facilitate sample collection in a 1-liter Summa canister. An analytical laboratory will provide sampling assemblies and certified summa canisters for sampling and purging.

The summa canisters will come under a complete vacuum of approximately 30 inches of mercury. Prior to sample collection a vacuum/leak test will be conducted on the sampling assembly with the purging summa canister to confirm no leakage and the maintenance of the initial vacuum (approximately 30 inches of mercury) in the sampling manifold system. After a minimum of 10 minutes of vacuum/leak testing, the sampling summa canister will be opened for sample collection. The pre-set valve will regulate the vapor flow to approximately 150 to 200 milliliters of air per minute, which equates to approximately 5 to 7 minutes to fill the 1-liter canister (a different valve may be employed if 6-liter summa canisters are used). Sample collection is typically discontinued when the vacuum decreases to below 5 inches of mercury but not below 1 inch of mercury. To further evaluate potential leakage within the sampling system, a leak-check enclosure (shroud) will be placed over the sampling assembly, and an absorbent material will be lightly moistened with isopropyl alcohol and placed within the leak-check enclosure. A photo-ionization detector (PID) will be used to monitor the concentration of isopropyl alcohol within the enclosure during sample collection. This method allows Pangea to calculate the volume of air from within the enclosure (if any) that enters the sample summa canister by dividing the concentration of isopropyl alcohol in the sample canister by the concentration detected in the leak check summa canister, and multiplying the resultant ratio by the volume of the sample canister.

4.3 Monitoring Well Installation

Pangea proposes to install one to two offsite downgradient groundwater monitoring well(s) to further evaluate potential contaminant migration via the 24" storm drain line beneath 39th Avenue and to evaluate the lateral extent of contamination in the downgradient direction. As shown on Figure 10, proposed well MW-4 is located across 39th Avenue near former boring B-14 where prior groundwater sampling was unsuccessful. The proposed well location is also nearby and downgradient of boring location B-13 where contamination was detected in groundwater (4,100 µg/L TPHg and 25 µg/L benzene). If a more permeable water-bearing zone is encountered below approximately 22 ft depth, then Pangea plans to install two nested wells at the proposed MW-4 location. Well MW-4A would be screened from approximately 7 to 17 ft bgs and well MW-4B would be screened from approximately 20 to 25 ft bgs. Final well screen intervals will be determined in the field based on lithology. If elevated contaminant concentrations are detected in new well(s) MW-4 or MW-4A/B, Pangea may recommend additional grab sampling or installation of additional offsite downgradient monitoring wells.

Soil sampling will be conducted during the well installation. To control cost, Pangea proposes to conduct the soil sampling and well installation with direct-push drilling techniques. The direct-push sampling rig will be equipped with a hydraulic hammer and steel drive rods to advance the borings to total depth. With hydraulic-push drilling, continuous soil collection is conducted using acetate liners and samples are typically collected on four foot intervals. Soil samples will be obtained by cutting 6-inch subsections, trimming the excess soil from the ends, and capping the ends with Teflon® tape and plastic caps. Additional soil samples may be collected near the water table and at lithologic changes. The soil samples will classified according to the Unified Soil Classification System (USCS) and screened for field indications of petroleum hydrocarbons using visual and olfactory observations and a photo-ionization device (PID). For this site, Pangea anticipates analysis of soil from 8, 12, 16 and 20 ft bgs to evaluate shallow conditions and conditions above and below the 15 ft depth (the only depth where gasoline-range hydrocarbons and BTEX compounds were detected by the 1994 soil borings).

All site investigation will be performed under the supervision of a California Registered Civil Professional Engineer (P.E.), Professional Geologist (P.G.), or Certified Hydrogeologist (C.Hg.). The boring will be completed as a groundwater monitoring well as described below. Additional soil and assessment procedures are presented in our Standard Operating Procedures for Soil Borings (Appendix C).

Well Installation

The monitoring well will be screened into an identified potential water-bearing zone. The depth and thickness of the recommended screen interval will be selected based on geologic logging of the well boring. The screened section in the well will be selected to avoid hydraulic connection between multiple water-bearing units separated by low permeability strata. Boring logs from B-12 and B-14 suggest that site subsurface soil consists of silty clay to approximately 20 ft bgs, with moisture encountered at 18 ft bgs in boring B-14.

Pangea anticipates screening the well from approximately 7 to 22 ft bgs. This well screen interval will avoid potential submerged screen condition due to water level fluctuation and help ensure sufficient groundwater is available to sample. If a more permeable water-bearing zone is encountered below approximately 22 ft depth, then Pangea plans to install two nested wells at the proposed MW-4 location. Well MW-4A would be screened from approximately 7 to 17 ft bgs and well MW-4B would be screened from approximately 20 to 25 ft bgs. Final well screen intervals will be determined in the field based on lithology.

The wells will be pre-pack wells installed with the direct-push rig. The pre-pack well will consist of 1.0-inch Schedule 40 polyvinyl chloride (PVC) casing, 0.01-inch factory-slotted PVC screen and #2-12 sand, with a bentonite seal and grout to the surface. Pre-pack well information is included in Appendix D. The well will be protected by a traffic-rated well vault.

Well Development and Sampling

The monitoring well will be developed approximately 72 hours after installation has been completed. The well will be intermittently surged with a surge block, and groundwater will be evacuated using a bailer, hand pump, peristaltic pump or submersible pump until the groundwater is visibly clear and/or has a low turbidity. During purging, measurements of temperature, pH, conductivity, and turbidity will be recorded on monitoring well development forms. At least 48 hours following development (during regularly scheduled monitoring), three casing volumes will be purged from the well and groundwater samples will be collected from the new well. Further details of well installation, development and sampling procedures are presented in Pangea's Standard Operating Procedures (Appendix C), modified for use of pre-pack well materials. Groundwater samples will be analyzed for TPHg/BTEX/MTBE by EPA Method 8015Cm/8021B.

4.4 Natural Attenuation Evaluation

Based on concentration reductions in wells MW-1 and MW-2, natural attenuation following the source removal is remediating contaminants in site groundwater. This suggests that the contaminant plume is shrinking even though contaminant concentrations remain elevated in well MW-3, located immediately adjacent the former excavation. To further evaluate natural attenuation at the site, Pangea proposes to collect dissolved oxygen (DO) and oxygen reduction potential (ORP) readings from all site wells during periodic groundwater monitoring after installation of the proposed monitoring well(s).

4.5 Waste Management and Disposal

Soil cuttings, monitoring well purge water, and other investigation-derived waste will be stored onsite in Department of Transportation (DOT)-approved 55-gallon drums. The drums and their contents will be held onsite pending laboratory analytical results. Upon receipt of the analytical reports, the waste will be transported to an appropriate disposal/recycling facility.

4.6 Surveying

Upon completing all drilling activities, Pangea will retain a licensed surveyor to survey the coordinates and elevations of the new monitoring well for uploading to the state Geotracker database.

4.7 Report Preparation

Upon completion of assessment activities, Pangea will prepare a technical report. The report will describe the investigation activities, present tabulated analytical data, and offer conclusions and recommendations.

5.0 CLEANUP LEVELS AND GOALS

As requested by the April 10, 2008 ACEH letter, Pangea discusses remediation objective and cleanup levels and goals in this section. Note that proposed cleanup levels and goals may be modified after potential groundwater yield testing at the site, and during preparation of the requested feasibility study/corrective action plan (FS/CAP)

With elevated contaminant concentrations in saturated soil and groundwater that exceed RWQCB Environmental Screening Levels (ESLs) and with natural attenuation improving groundwater quality further from the former excavation area, the *overall* remedial objective is to perform active remediation of residual impact near the former excavation limits (current UST area) 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* by enhancing natural attenuation. 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* for offsite groundwater 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 offsite 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 and goal are presented on Table 3. For offsite soil gas and offsite groundwater, the proposed cleanup *level* is the ESL for indoor air protection assuming residential site use due to impact near the offsite residences south 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.

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 use in the site vicinity and 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). Furthermore, Pangea offers the following contingent cleanup *levels*/*goals* in the event that any active 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 require source removal, adequate site characterization, plume stability, and no significant risk to human health or the environment posed by residual contaminants.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the above information, Pangea offers the following conclusions and recommendations:

- The hydrocarbon and MTBE plume is apparently primarily located onsite and beneath San Leandro Street, and does not migrate significantly along any preferential pathways. The proposed monitoring well(s) should significantly improve knowledge of the lateral extent of the plume and evaluate potential migration of contaminants along the 24-inch diameter storm drain line beneath 39th Avenue.

- The proposed soil gas probes will provide important information regarding contaminant concentrations in soil gas near potential receptors. It is possible that the apparent confined nature of site groundwater and the presence of shallow, low permeability clayey soil will limit the potential for subsurface contaminants to impact shallower soil gas beneath the offsite receptors.

- Concentration reductions in wells MW-1 and MW-2 suggest that prior excavation removed sufficient mass for natural attenuation to further remediate contaminants in site groundwater, and that the plume is shrinking. To further evaluate natural attenuation and plume shrinkage at the site, Pangea proposes to collect dissolved oxygen (DO) and oxygen reduction potential (ORP) readings from all site wells during periodic groundwater monitoring.

- Since groundwater monitoring data suggest that contaminant concentrations are decreasing, Pangea recommends conducting groundwater monitoring on a semi-annual basis (second and fourth quarter). Pangea respectfully requests that the Alameda County Environmental Health (ACEH) concur with this recommendation.

7.0 REFERENCES

California Regional Water Quality Control Board – San Francisco Bay Region (CRWQCB-SF), 2005, Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Interim Final, February.

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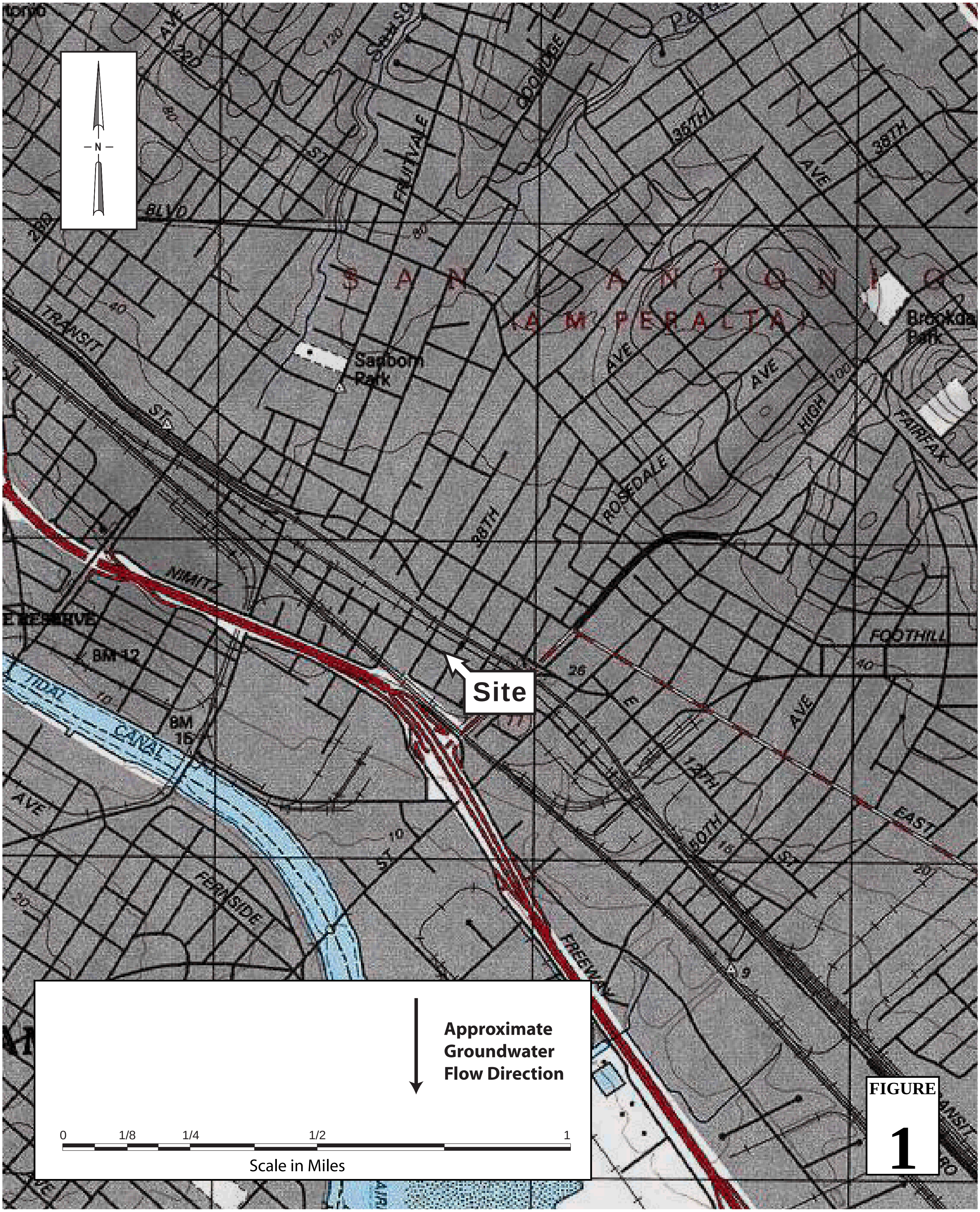

3820 San Leandro Street
Oakland, California

PANGEA

Vicinity Map

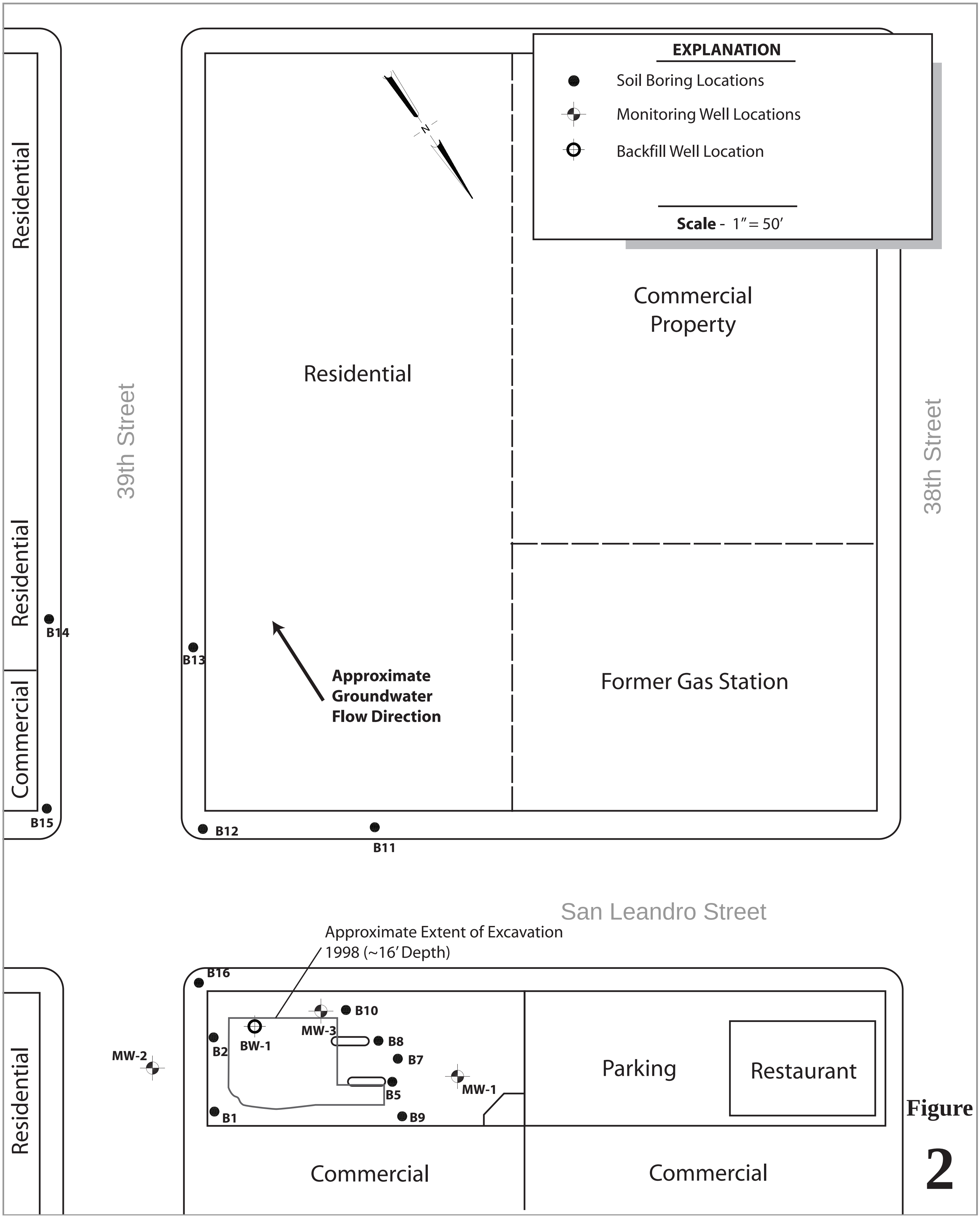

Figure
2

3820 San Leandro Street
Oakland, California

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Site Map

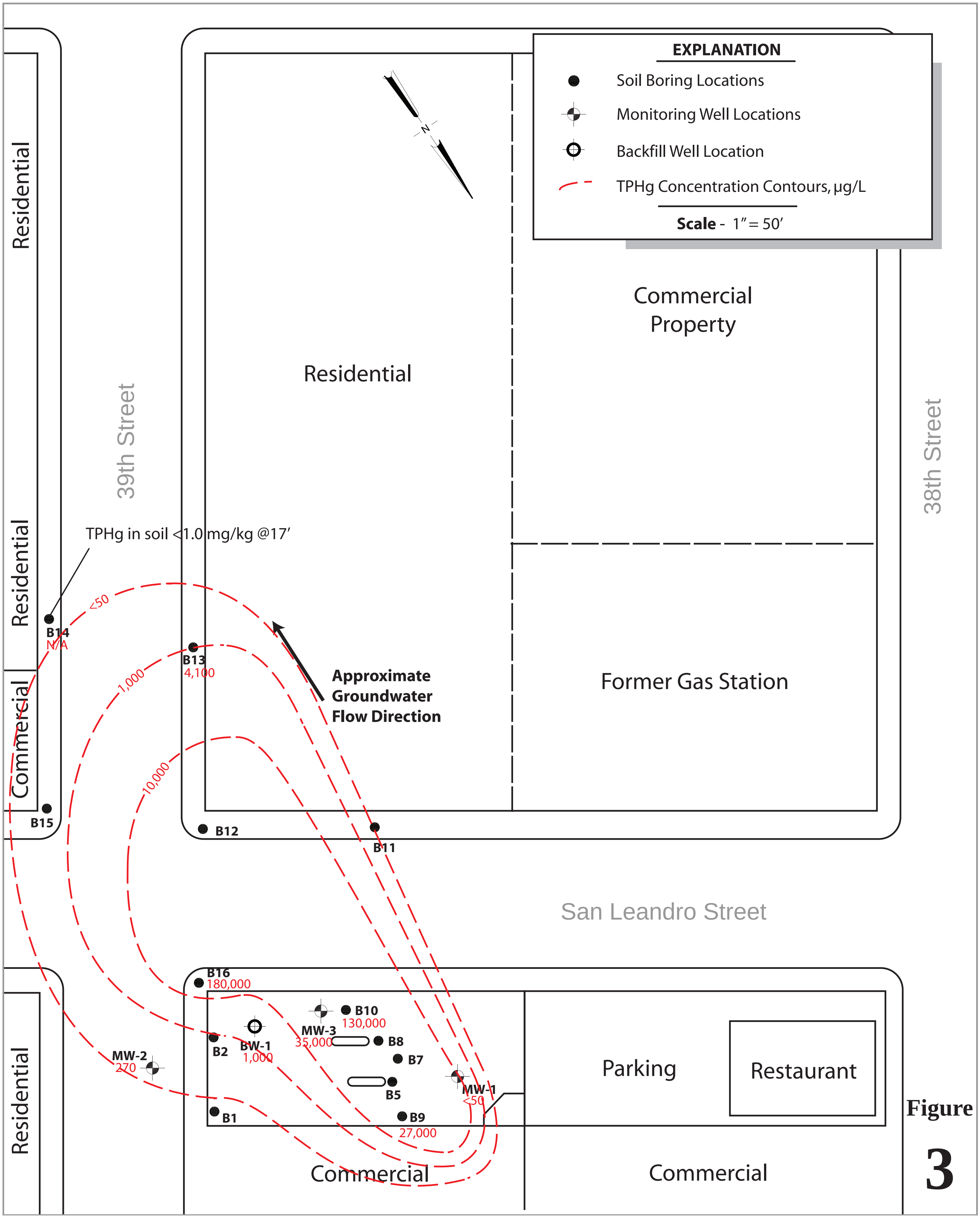

Figure 3

3820 San Leandro Street
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TPHg Concentrations in Groundwater Map

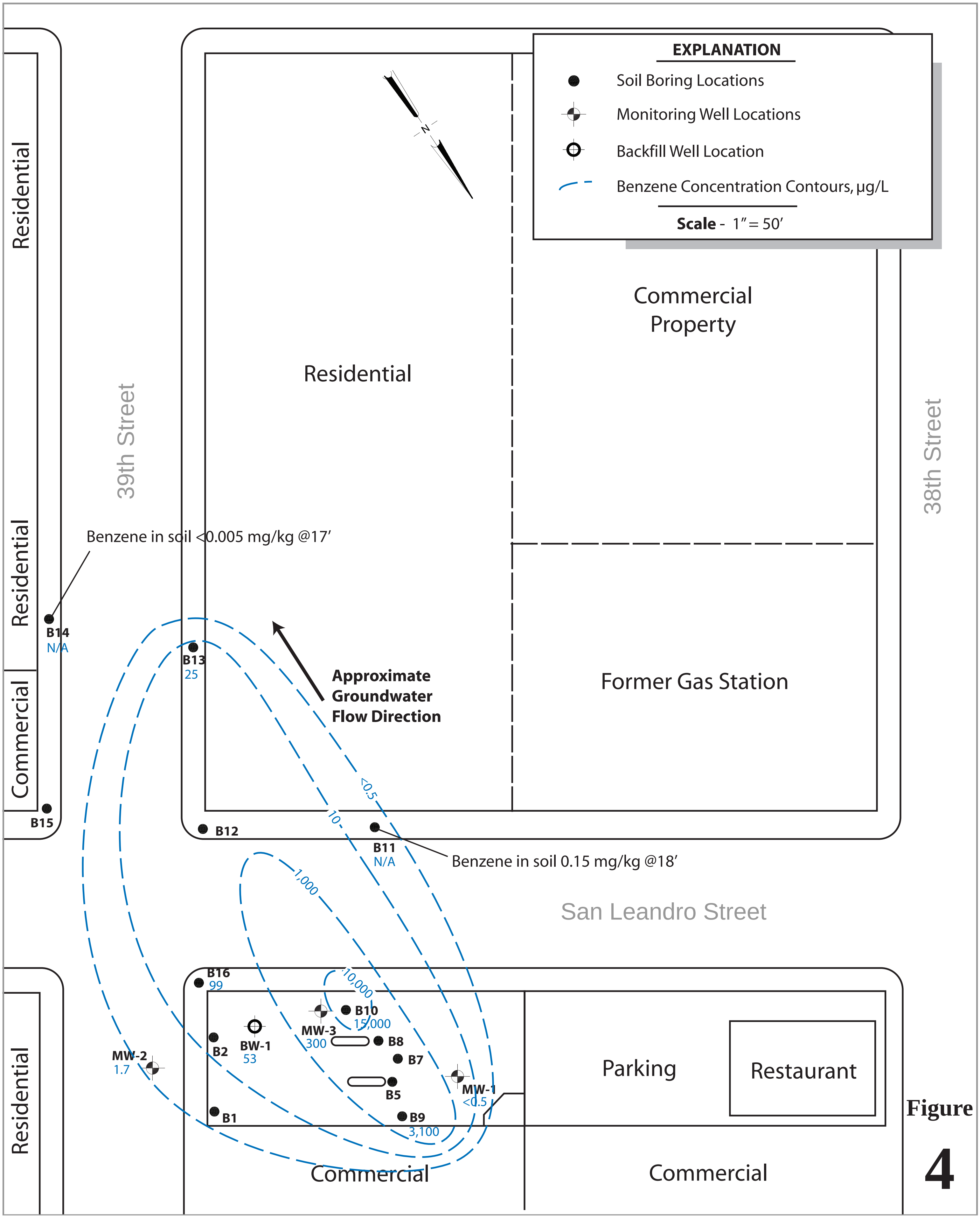

Figure
4

3820 San Leandro Street
Oakland, California

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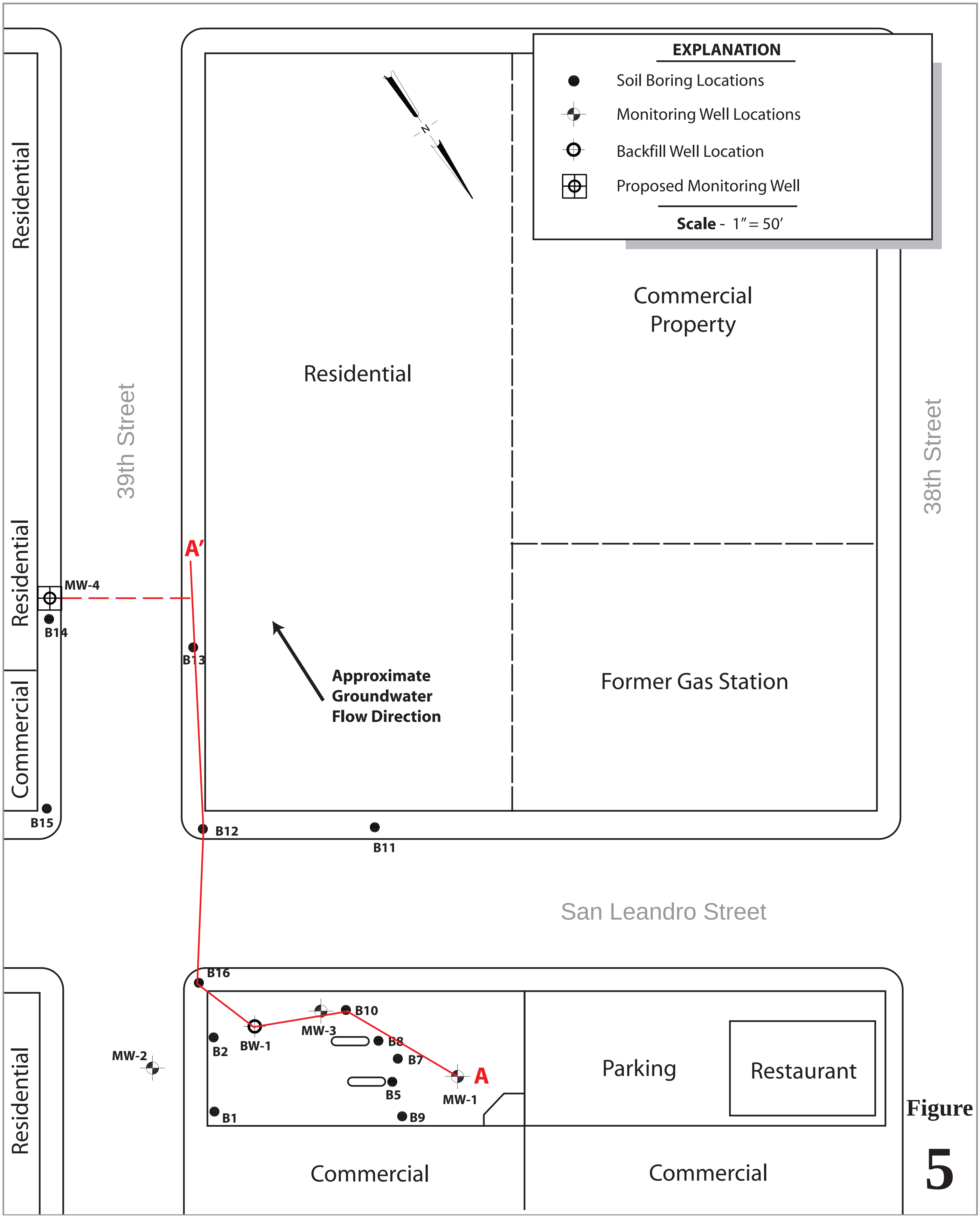
Benzene Concentrations in
Groundwater Map



Figure

5

3820 San Leandro Street
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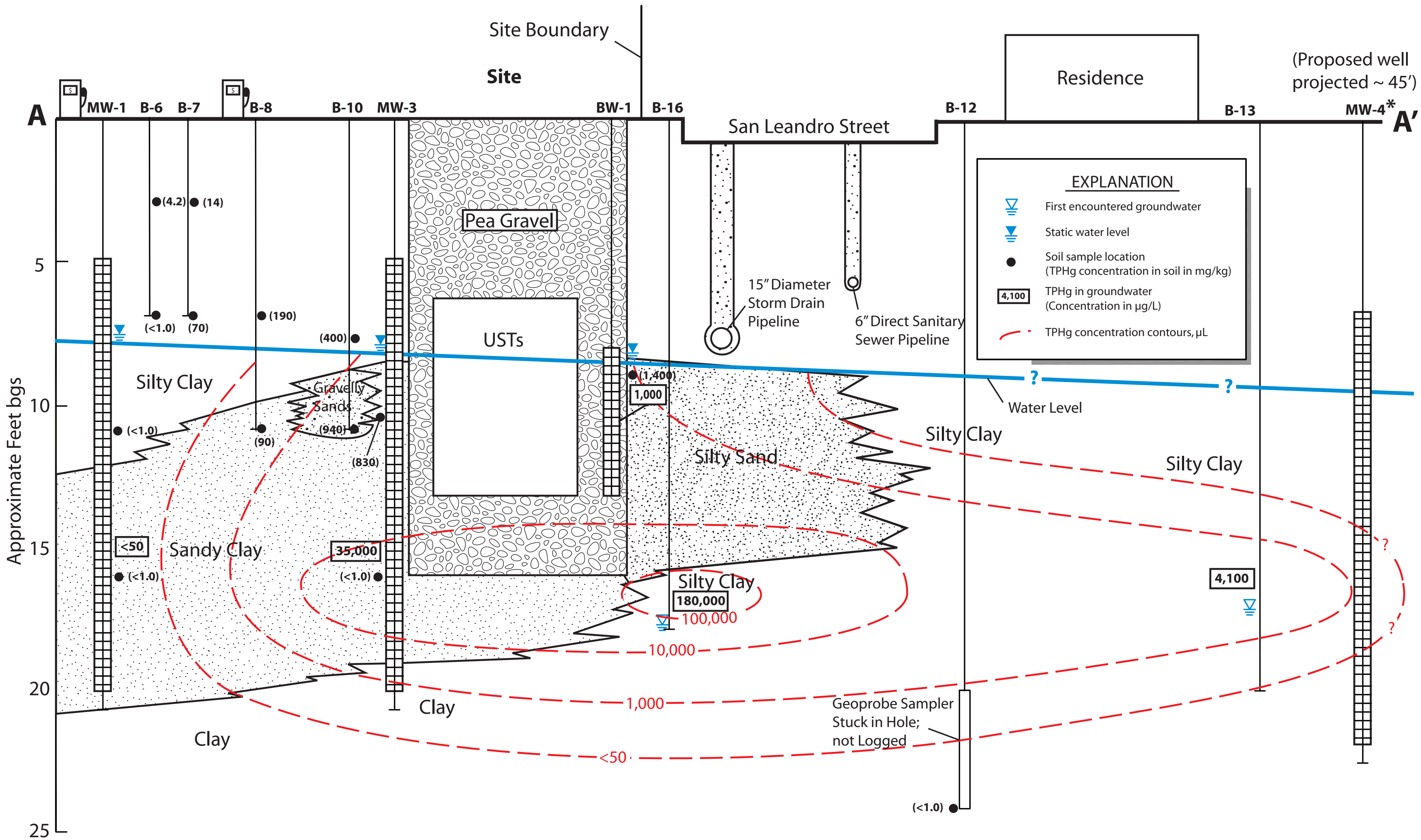
Cross Section Location Map



*NOTE: If a more permeable unit is encountered below 22′ depth, Pangea will construct two wells; MW-4A screened from approximately 7-17′ and MW-4B screened from approximately 20-25′.

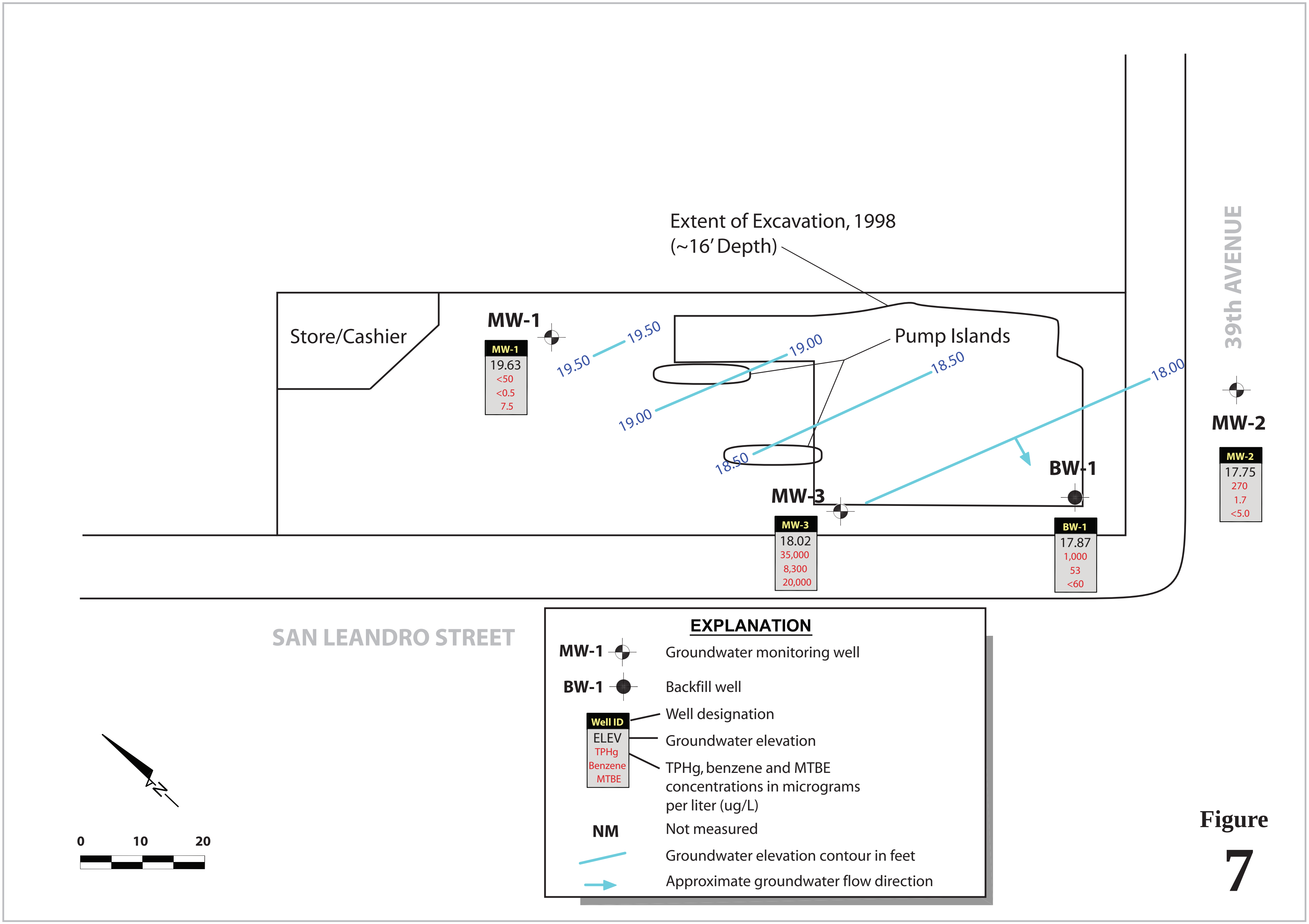
0 25
Approximate Scale (in feet)

Figure
6

3820 San Leandro Street
Oakland, California

PANGEA

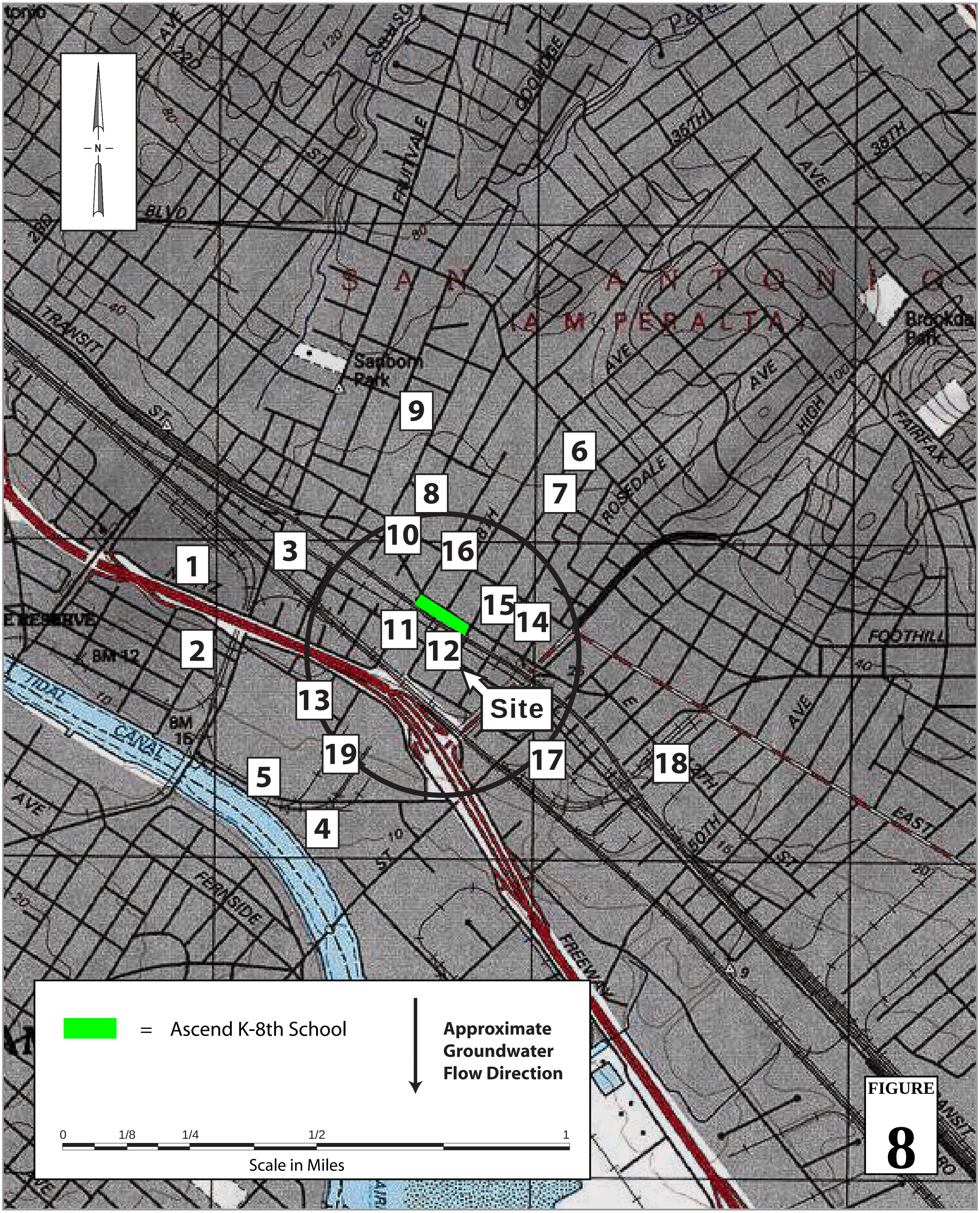
Geologic Cross Section A-A’ Showing TPHg Plume Extent



Guy's Service Station
3820 San Leandro Street
Oakland, California

PANGEA

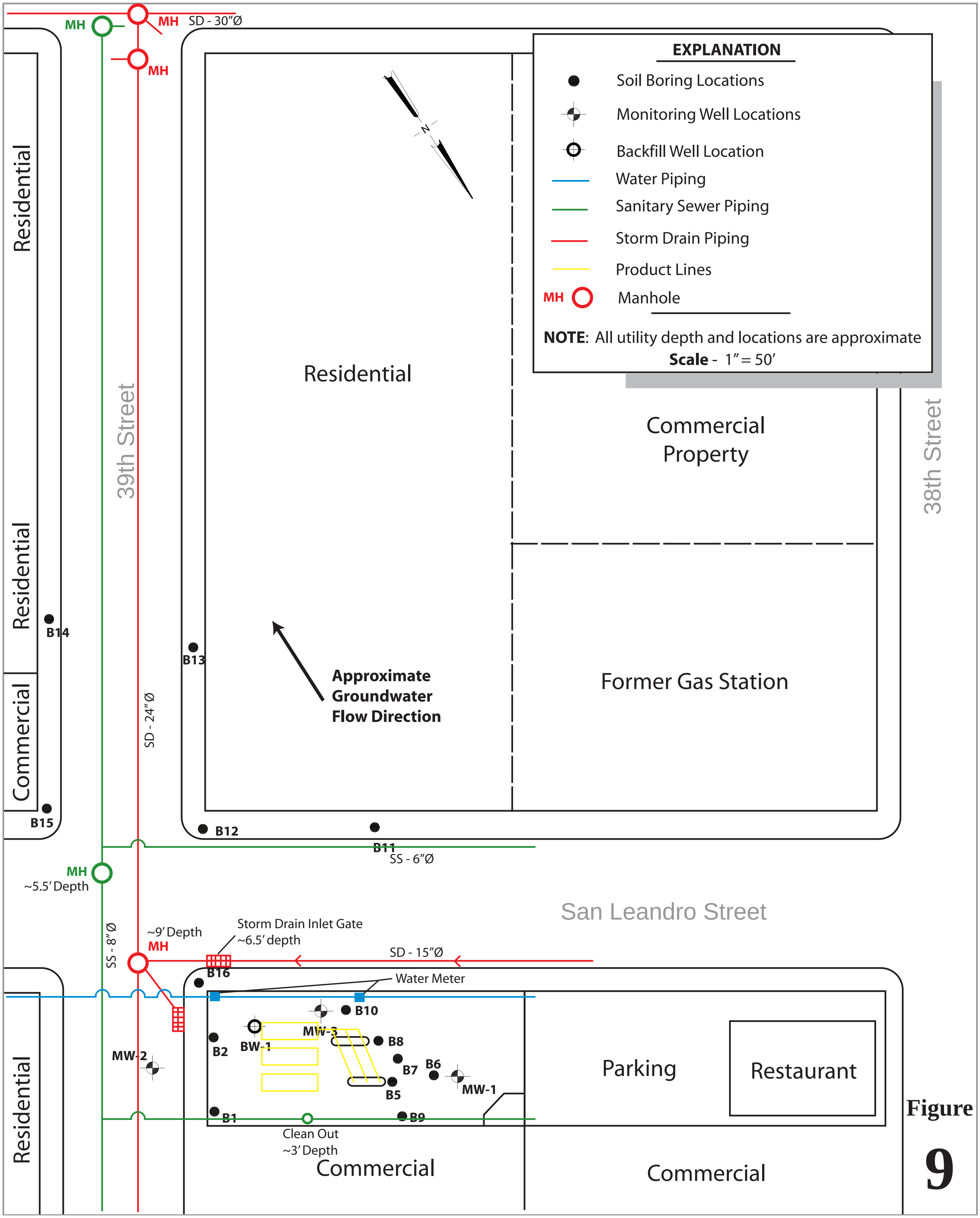
Groundwater Elevation and Hydrocarbon Concentration Map
May 7, 2008



3820 San Leandro Street
Oakland, California

PANGEA

Quarter Mile Radius Well
Search Results Map



Figure

9

3820 San Leandro Street
Oakland, California

PANGEA

Subsurface Utility Map

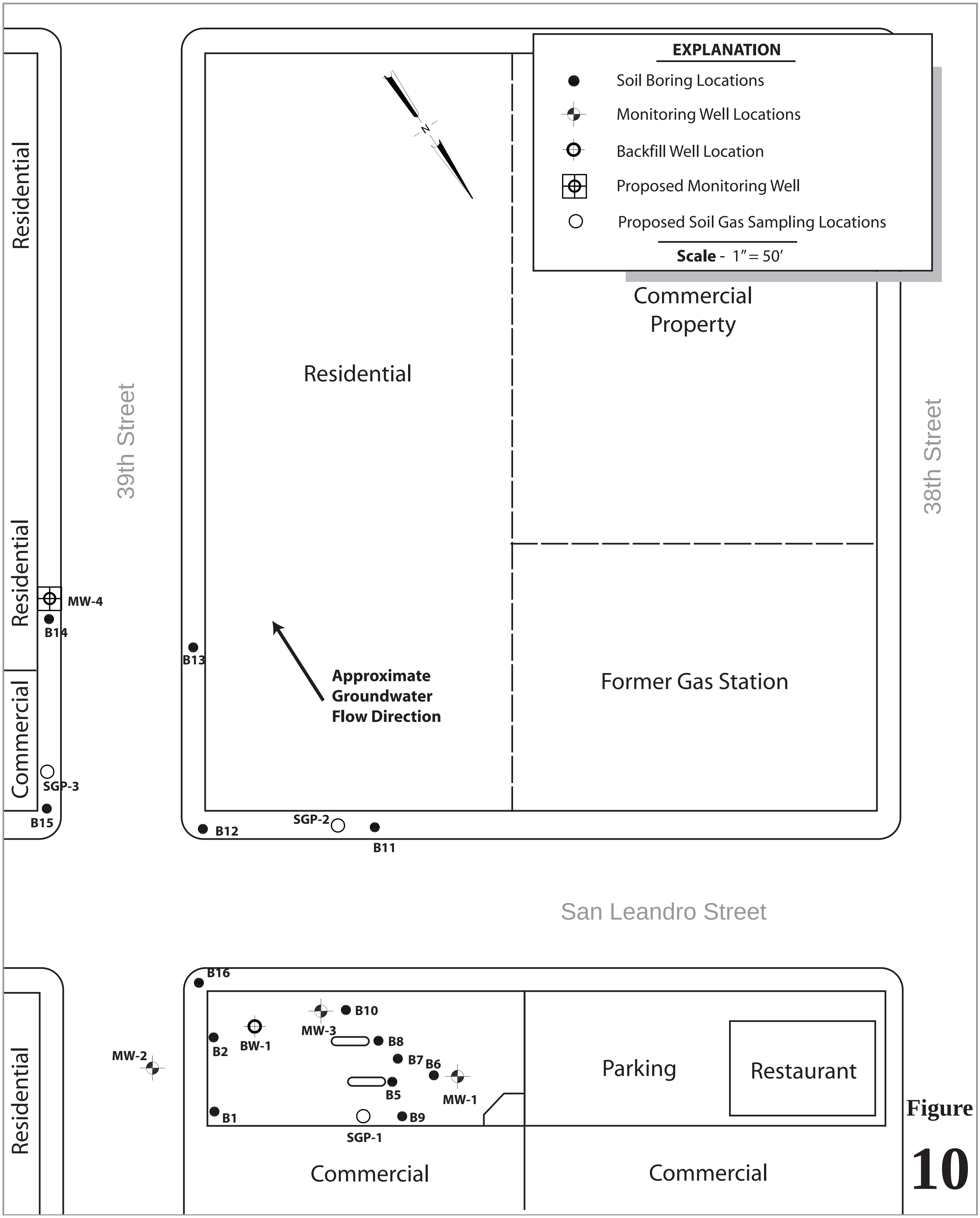


Figure **10**

3820 San Leandro Street
Oakland, California

PANGEA

Proposed Soil Gas Probe and Monitoring Well Locations

Table 1. Groundwater Analytical Data: Petroleum Hydrocarbons - Guy's Gas Station, 3820 San Leandro Street, Oakland, California

Well ID *TOC Elev* *(ft)*	Date Sampled	Groundwater Elevation (ft)	Depth to Water (ft)	TPHd	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE
				←			μg/L			→
Monitoring Wells										
BW-1	7/2/1998	--	--	<50	1,300	300	3.5	<0.5	2.8	580
(26.00)	**5/7/2008**	17.87	**8.13**	**--**	**1,000**	**53**	**5.5**	**<0.5**	**1.1**	**<60**
MW-1	7/6/1998	19.77	7.77	<100	4,100	36	53	<5.0	20	80
(27.54)	9/10/2000	--	--	1,800	1,000	4.8	<0.50	6.2	1.2	<5.0
	4/10/2001	20.20	7.34	--	1,100	12	7.7	<2.5	<2.5	73
	7/17/2001	18.54	9.00	320	920	6.2	1.1	<0.50	<0.50	49
	1/15/2003	20.60	6.94	86	360	5.5	<0.50	4.3	1.3	19
	4/17/2003	20.53	7.01	<50	<50	<0.50	<0.50	<0.50	<1.0	11
	7/17/2003	18.83	8.71	95	380	19	<0.50	3.7	1.5	5.6
	11/21/2003	17.93	9.61	160	600	4.7	<0.50	8.8	2	4.3
	3/23/2004	20.23	7.31	120	140	1.3	<0.50	1.2	<1.0	11
	6/9/2004	18.89	8.65	84	570	1.6	<0.50	1.5	<1.0	11
	5/7/2008	**19.63**	**7.91**	**--**	**<50**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**7.5**
MW-2	7/6/1998	17.82	8.15	<100	6,400	190	14	13	12	210
(25.97)	9/10/2000	--	--	270	760	19	<0.50	<0.50	<0.50	110
	4/10/2001	18.65	7.32	--	320	3.6	1.1	1.2	0.79	<5.0
	7/17/2001	17.01	8.96	68	440	6.0	<0.50	6.2	<0.50	<5.0
	1/15/2003	18.72	7.25	250	750	13	<0.50	<0.50	<0.50	78
	4/17/2003	18.54	7.43	120	180	<0.50	<0.50	<0.50	<1.0	8.1
	7/17/2003	17.08	8.89	400	640	10	<0.50	<0.50	<1.0	27
	11/21/2003	16.56	9.41	1,100	980	2.2	0.62	<0.50	1.1	54
	3/23/2004	18.38	7.59	350	660	0.81	<0.50	<0.50	<1.0	7.7
	6/9/2004	17.22	8.75	1,300	1,000	8.9	0.55	<0.50	<1.0	28
	5/7/2008	**17.75**	**8.22**	**--**	**270**	**1.7**	**3.6**	**<0.5**	**0.77**	**<5.0**
MW-3	7/6/1998	18.10	8.42	<100	36,000	6,700	72	6.2	530	13,000
(26.52)	9/10/2000	--	--	4,200	20,000	9,200	70	710	79	6,400
	4/10/2001	18.79	7.73	--	15,000	4,500	27	320	140	8,800
	7/17/2001	18.10	8.42	8,000	28,000	7,000	<50	270	75	15,000
	1/15/2003	18.92	7.60	11,000	40,000	10,000	110	680	210	20,000
	4/17/2003	18.45	8.07	3,200	39,000	11,000	<100	870	<200	34,000
	7/17/2003	17.45	9.07	5,100	58,000	16,000	<250	850	<500	28,000
	11/21/2003	16.79	9.73	7,500	80,000	15,000	<200	1,300	<400	27,000
	3/23/2004	18.67	7.85	12,000	41,000	12,000	130	1,100	<200	27,000
	6/9/2004	17.52	9.00	13,000	50,000	16,000	<250	1,200	<500	32,000
	5/7/2008	**18.02**	**8.50**	**--**	**35,000**	**8,300**	**74**	**140**	**28**	**20,000**
Grab Groundwater Sampling										
B9-W	8/6/2003	--	--	8,600	27,000	3,100	210	1,600	780	96
B10-W	8/6/2003	--	--	840,000	130,000	15,000	<250	5,200	5,100	40,000
B13-W	8/6/2003	--	--	1,700	4,100	25	<2.5	21	<5.0	28
B16-W	8/6/2003	--	--	18,000,000	180,000	99	<50	<50	<100	7,000

Abbreviations:

μg/L = Micrograms per liter [commonly referred to as parts per billion (ppb)].

TPHd = Total petroleum hydrocarbons as diesel by EPA Method 8260B.

TPHg = Total petroleum hydrocarbons as gasoline by EPA Method 8260B on and prior to 6/9/2004, and by EPA Method 8015Cm thereafter.

BTEX = Benzene, toluene, ethylbenzene, xylenes by EPA Method 8260B on and prior to 6/9/2004, and by EPA Method 8021B thereafter.

MTBE = Methyl tert butyl ether by EPA Method 8260B on and prior to 6/9/2004, and by EPA Method 8021B thereafter.

Table 2. Quarter Mile Radius Well Search - Guy's Gas Station, 3820 San Leandro Street, Oakland, California

Map #	Permit	Tr	Section	Address	Longcity	Owner	Update	Xcoord	Ycoord	Match level	Tsrqq	Rec code	Phone	City	Drilldate	Elev	Total depth	Water depth	Dia-meter	Use
1		2S/3W	7H 4	3100 East 9th St	Oakland	Del Monte USA	7/16/1997	122226628	37773300	1	2S/3W 7H	0	0	OAK	1/95	0	35	25	2	MON
2	96805	2S/3W	7H 5	3129 Elmwood Av	Oakland	An-Fo Manufacturing	12/26/1997	122227616	37772711	1	2S/3W 7H	0	0	OAK	Nov-96	0	25	17	2	MON
2	96805	2S/3W	7H 6	3129 Elmwood Av	Oakland	An-Fo Manufacturing	12/26/1997	122227616	37772711	1	2S/3W 7H	0	0	OAK	Nov-96	0	25	14	2	MON
2	96805	2S/3W	7H 7	3129 Elmwood Av	Oakland	An-Fo Manufacturing	12/26/1997	122227616	37772711	1	2S/3W 7H	0	0	OAK	Nov-96	0	25	14	2	MON
3		2S/3W	7H 1	880 Fruitvale Ave	Oakland	State Shingle Company	3/22/1991	122226202	37773928	0	2S/3W 7H	1436	0	OAK	2/90	168	35	27	2	MON
3		2S/3W	7H 2	880 Fruitvale Ave	Oakland	State Shingle Company	3/22/1991	122226202	37773928	0	2S/3W 7H	1437	0	OAK	Oct-90	29	30	17	2	MON
3		2S/3W	7H 3	880 Fruitvale Ave	Oakland	State Shingle Company	3/22/1991	122226202	37773928	0	2S/3W 7H	1438	0	OAK	Oct-90	29	30	17	2	MON
3		2S/3W	7H	880 Fruitvale Ave	Oakland	State Shingle Company	3/27/1991	122226202	37773928	0	2S/3W 7H	1481	0	OAK	7/90	0	26	12	6	MON
4		2S/3W	7J35	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8138	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J36	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8139	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J37	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8140	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J38	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8141	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J39	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8142	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J40	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8143	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J41	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8144	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J42	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8145	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J43	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8146	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J44	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8147	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J45	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8148	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J46	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8149	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J47	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8150	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J48	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8151	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J49	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8152	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J50	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8153	0	OAK	6/91	0	0	0	0	DES
4		2S/3W	7J51	3675 Alameda Ave	Oakland	Lerner Props	9/30/1992	122227320	37768546	1	2S/3W 7J	8154	0	OAK	6/91	0	0	0	0	DES
5		2S/3W	7J18	3600 ALAMEDA AVE	Oakland	OWENS ILLINOIS GLASS	3/19/1987	122226740	37768531	0	2S/3W 7J	2963	0	OAK	Jul-86	0	16	0	2	MON
5		2S/3W	7J20	3600 ALAMEDA AVE	Oakland	OWENS ILLINOIS GLASS	3/19/1987	122226740	37768531	0	2S/3W 7J	2964	0	OAK	Nov-86	0	32	17	2	MON
5		2S/3W	7J21	3600 ALAMEDA AVE	Oakland	OWENS ILLINOIS GLASS	3/19/1987	122226740	37768531	0	2S/3W 7J	2965	0	OAK	Nov-86	0	27	19	2	MON
5		2S/3W	7J22	3600 ALAMEDA AVE	Oakland	OWENS ILLINOIS GLASS	3/19/1987	122226740	37768531	0	2S/3W 7J	2966	0	OAK	Dec-86	0	27	14	2	MON
5		2S/3W	7J23	3600 ALAMEDA AVE	Oakland	OWENS ILLINOIS GLASS	3/19/1987	122226740	37768531	0	2S/3W 7J	2967	0	OAK	Nov-86	0	27	14	2	MON
5		2S/3W	7J24	3600 ALAMEDA AVE	Oakland	OWENS ILLINOIS GLASS	3/19/1987	122226740	37768531	0	2S/3W 7J	2968	0	OAK	Dec-86	0	30	13	2	MON
5		2S/3W	7J25	3600 ALAMEDA AVE	Oakland	OWENS ILLINOIS GLASS	3/19/1987	122226740	37768531	0	2S/3W 7J	2969	0	OAK	Dec-86	0	25	13	2	MON
5		2S/3W	7J26	3600 ALAMEDA AVE	Oakland	OWENS ILLINOIS GLASS	3/19/1987	122226740	37768531	0	2S/3W 7J	2970	0	OAK	Dec-86	0	25	12	2	MON
5		2S/3W	7J27	3600 ALAMEDA AVE	Oakland	OWENS ILLINOIS GLASS	3/19/1987	122226740	37768531	0	2S/3W 7J	2971	0	OAK	Dec-86	0	25	10	2	MON
5		2S/3W	7J 3	3600 ALAMEDA AVE	Oakland	OWENS=ILLINOIS	12/8/1986	122226740	37768531	0	2S/3W 7J	2956	0	OAK	Sep-86	0	31	14	2	MON
5		2S/3W	7J 1	3600 ALAMEDA AVE	Oakland	OWENS-ILLINOIS	12/8/1986	122226740	37768531	0	2S/3W 7J	2954	0	OAK	Sep-86	0	30	11	2	MON
5		2S/3W	7J 2	3600 ALAMEDA AVE	Oakland	OWENS-ILLINOIS	12/8/1986	122226740	37768531	0	2S/3W 7J	2955	0	OAK	Sep-86	0	30	18	2	MON
5		2S/3W	7J 4	3600 ALAMEDA AVE	Oakland	OWENS-ILLINOIS	2/3/1987	122226740	37768531	0	2S/3W 7J	2957	0	OAK	Sep-86	0	30	13	2	MON
5		2S/3W	7J 5	3600 ALAMEDA AVE	Oakland	OWENS-ILLINOIS	12/8/1986	122226740	37768531	0	2S/3W 7J	2958	0	OAK	Sep-86	0	30	18	2	MON
5		2S/3W	7J 6	3600 ALAMEDA AVE	Oakland	OWENS-ILLINOIS	12/8/1986	122226740	37768531	0	2S/3W 7J	2959	0	OAK	Sep-86	0	30	19	2	MON
5		2S/3W	7J 7	3600 ALAMEDA AVE	Oakland	OWENS-ILLINOIS	12/8/1986	122226740	37768531	0	2S/3W 7J	2960	0	OAK	Sep-86	0	25	18	2	MON
5		2S/3W	7J 8	3600 ALAMEDA AVE	Oakland	OWENS-ILLINOIS	12/8/1986	122226740	37768531	0	2S/3W 7J	2961	0	OAK	Oct-86	0	30	18	2	MON
5		2S/3W	7J 9	3600 ALAMEDA AVE	Oakland	OWENS-ILLINOIS	12/8/1986	122226740	37768531	0	2S/3W 7J	2962	0	OAK	Oct-86	0	25	15	2	MON
4		2S/3W	7J28	3675 Alameda Ave	Oakland	Unocal Corp VMW1	9/24/1992	122227320	37768546	1	2S/3W 7J	8052	0	OAK	Dec-91	0	10	0	2	MON
4		2S/3W	7J29	3675 Alameda Ave	Oakland	Unocal Corp VMW2	9/24/1992	122227320	37768546	1	2S/3W 7J	8053	0	OAK	Dec-91	0	10	0	2	MON
4		2S/3W	7J30	3675 Alameda Ave	Oakland	Unocal Corp VMW3	9/24/1992	122227320	37768546	1	2S/3W 7J	8054	0	OAK	Dec-91	0	10	0	2	MON
4		2S/3W	7J31	3675 Alameda Ave	Oakland	Unocal Corp VMW4	9/24/1992	122227320	37768546	1	2S/3W 7J	8055	0	OAK	Dec-91	0	10	0	2	MON
4		2S/3W	7J32	3675 Alameda Ave	Oakland	Unocal Corp VMW5	9/24/1992	122227320	37768546	1	2S/3W 7J	8056	0	OAK	Dec-91	0	9	0	2	MON
4		2S/3W	7J33	3675 Alameda Ave	Oakland	Unocal Corp VMW7	9/24/1992	122227320	37768546	1	2S/3W 7J	8057	0	OAK	Dec-91	0	11	0	2	MON
6		2S/3W	8C 2	39TH & FOOTHILL BLVD	Oakland	PG&E	7/30/1984	122216794	37777347	9	2S/3W 8C	3017	0	OAK	1/75	0	120	0	0	CAT
7		2S/3W	8C 1	39TH AVE/82 2ND AVE	Oakland	TRUST FOR PUBLIC LAND-SF	7/30/1984	122216794	37777347	9	2S/3W 8C	3016	0	OAK	7/77	0	30	18	4	IRR
8		2S/3W	8D 1	1466 36th Avenue	Oakland	August Manufacturing	7/31/1990	122220312	37776460	0	2S/3W 8D	805	0	OAK	Mar-90	0	35	16	2	MON
8		2S/3W	8D 2	1466 36th Avenue	Oakland	August Manufacturing	6/12/1991	122220312	37776460	0	2S/3W 8D	1680	0	OAK	1/91	0	15	13	2	MON
8		2S/3W	8D 3	1466 36th Avenue	Oakland	August Manufacturing	6/12/1991	122220312	37776460	0	2S/3W 8D	1681	0	OAK	2/91	17	11	9	8	BOR*
9		2S/3W	8D 4	1500 34TH AVE	Oakland	Franciscan	1/6/1999	122221837	37778154	1	2S/3W 8D	0	536	OAK	1/99	0	200	0	0	IRR
10	97118	2S/3W	8E 9	3609 E 14th St	Oakland	Abolghassem Razi	10/19/1997	122220442	37775335	1	2S/3W 8E	0	0	OAK	8/96	0	25	0	2	MON
10	97118	2S/3W	8.00E+10	3609 E 14th St	Oakland	Abolghassem Razi	10/19/1997	122220442	37775335	1	2S/3W 8E	0	0	OAK	9/96	0	25	0	2	MON
10	97118	2S/3W	8.00E+11	3609 E 14th St	Oakland	Abolghassem Razi	10/19/1997	122220442	37775335	1	2S/3W 8E	0	0	OAK	9/96	0	25	0	2	MON
10	95563	2S/3W	8.00E+13	3609 E. 14th St	Oakland	Abolghassem Razi	2/17/1998	122220442	37775335	1	2S/3W 8E	0	0	OAK	8/95	0	27	16	2	MON

Table 2. Quarter Mile Radius Well Search - Guy's Gas Station, 3820 San Leandro Street, Oakland, California

Map #	Permit	Tr	Section	Address	Longcity	Owner	Update	Xcoord	Ycoord	Match level	Tsrqq	Rec code	Phone	City	Drilldate	Elev	Total depth	Water depth	Dia-meter	Use
10	95563	2S/3W	8.00E+14	3609 E. 14th St	Oakland	Abolghassem Razi	2/17/1998	122220442	37775335	1	2S/3W 8E	0	0	OAK	8/95	0	26	21	2	MON
10	95563	2S/3W	8.00E+15	3609 E. 14th St	Oakland	Abolghassem Razi	2/17/1998	122220442	37775335	1	2S/3W 8E	0	0	OAK	8/95	0	26	17	2	MON
10	95563	2S/3W	8.00E+16	3609 E. 14th St	Oakland	Abolghassem Razi	2/17/1998	122220442	37775335	1	2S/3W 8E	0	0	OAK	8/95	0	26	16	2	MON
10	95563	2S/3W	8.00E+17	3609 E. 14th St	Oakland	Abolghassem Razi	2/17/1998	122220442	37775335	1	2S/3W 8E	0	0	OAK	8/95	0	27	15	2	MON
10		2S/3W	8E 5	3609 E 14th St	Oakland	Abolghassem Razi	8/20/1997	122220443	37775329	1	2S/3W 8E	0	0	OAK	8/93	0	30	16	2	MON
10		2S/3W	8E 6	3609 E 14th St	Oakland	Abolghassem Razi	8/20/1997	122220443	37775329	1	2S/3W 8E	0	0	OAK	8/93	0	30	16	2	MON
10	93446	2S/3W	8E 7	3609 E 14th St	Oakland	Abolghassem Razi	8/20/1997	122220443	37775329	1	2S/3W 8E	0	0	OAK	8/93	0	30	0	2	MON
10	93623	2S/3W	8E 8	3609 E 14th St	Oakland	Abolghassem Razi	8/20/1997	122220443	37775329	1	2S/3W 8E	0	0	OAK	Nov-93	0	20	10	2	MON
11		2S/3W	8E 3	3616 San Leandro St.	Oakland	Chevron MW-2	7/13/1993	122221945	37773314	1	2S/3W 8E	0	0	OAK	2/93	29	21	9	2	MON
11		2S/3W	8E 4	3616 San Leandro St.	Oakland	Chevron MW-3	7/13/1993	122221945	37773314	1	2S/3W 8E	0	0	OAK	2/93	28	21	9	2	MON
11	95503	2S/3W	8.00E+12	3616 San Leandro St	Oakland	Chevron USA Products Comp	2/4/1998	122222004	37773352	1	2S/3W 8E	0	0	OAK	8/95	28	20	15	2	MON
12	98WR259	2S/3W	8.00E+18	3820 San Leandro St	Oakland	Kelly Engineer	9/29/1998	122220085	37772469	1	2S/3W 8E	0	0	OAK	7/98	0	20	9	2	MON
12	98WR259	2S/3W	8.00E+19	3820 San Leandro St	Oakland	Kelly Engineer	9/29/1998	122220085	37772469	1	2S/3W 8E	0	0	OAK	7/98	0	20	9	2	MON
12	98WR259	2S/3W	8.00E+20	3820 San Leandro St	Oakland	Kelly Engineer	9/29/1998	122220085	37772469	1	2S/3W 8E	0	0	OAK	7/98	0	20	9	2	MON
13		2S/3W	8E 1	W. 37TH AVE	Oakland	PG&E	7/30/1984	122221447	37773609	9	2S/3W 8E	3018	0	OAK	Dec-73	0	120	0	0	CAT
11		2S/3W	8E 2	3614 SAN LEANDRO ST.	Oakland	VERNON MCILRAITH	6/28/1989	122222027	37773362	0	2S/3W 8E	3019	0	OAK	Aug-88	0	30	13	4	MON
11		2S/3W	8E 2					0	0	9	2S/3W 8E	7031	0		Aug-88	0	30	13	4	MON
14	98WR051	2S/3W	8F13	1234 40th Ave	Oakland	Motor Partners	9/29/1998	122217425	37772862	1	2S/3W 8F	0	0	OAK	2/98	0	21	0	2	MON
14		2S/3W	8F 5	1234 40th Av	Oakland	Motor Partners	7/17/1997	122217460	37772864	1	2S/3W 8F	0	0	OAK	2/96	27	25	15	2	MON
14		2S/3W	8F 7	1234 40th Av	Oakland	Motor Partners	8/22/1997	122217460	37772864	1	2S/3W 8F	0	0	OAK	6/94	0	23	9	2	MON
14		2S/3W	8F 8	1234 40th Av	Oakland	Motor Partners	8/22/1997	122217460	37772864	1	2S/3W 8F	0	0	OAK	6/94	0	22	13	2	MON
14		2S/3W	8F 9	1234 40th Av	Oakland	Motor Partners	8/22/1997	122217460	37772864	1	2S/3W 8F	0	0	OAK	6/94	0	23	8	2	MON
15	96586	2S/3W	8F10	3927 E 14th St	Oakland	Ruben Hausauer	11/3/1997	122217525	37773983	1	2S/3W 8F	0	0	OAK	8/96	30	17	0	2	MON
15	96586	2S/3W	8F11	3927 E 14th St	Oakland	Ruben Hausauer	11/3/1997	122217525	37773983	1	2S/3W 8F	0	0	OAK	8/96	32	17	0	2	MON
15	97WR210	2S/3W	8F12	3927 E. 14th St	Oakland	Ruben Hausauer	3/29/1998	122217525	37773983	1	2S/3W 8F	0	0	OAK	Nov-97	0	15	8	1	MON
15		2S/3W	8F 6	3927 E 14th St	Oakland	Ruben Hausauer	7/24/1997	122217526	37773977	1	2S/3W 8F	0	0	OAK	3/94	0	20	9	0	MON
16		2S/3W	8F 4	3750 East 14th Street	Oakland	Shell Oil Company	4/15/1993	122219199	37775000	1	2S/3W 8F	0	0	OAK	6/92	34	25	12	4	MON
16		2S/3W	8F 1	3570 East 14th Street	Oakland	Shell Oil Company	5/30/1990	122221106	37775896	0	2S/3W 8F	75	0	OAK	4/90	35	2	14	4	MON
16		2S/3W	8F 2	3750 East 14th Street	Oakland	Shell Oil Company	5/30/1990	122219210	37774991	0	2S/3W 8F	76	0	OAK	4/90	35	29	14	4	MON
16		2S/3W	8F 3	3750 East 14th Street	Oakland	Shell Oil Company	5/30/1990	122219210	37774991	0	2S/3W 8F	77	0	OAK	4/90	33	28	14	4	MON
17	94652	2S/3W	8L46	900 High St	Oakland	Oakland Unified School Di	12/26/1997	122216873	37769644	1	2S/3W 8L	0	0	OAK	Oct-94	0	24	16	2	MON
17	94652	2S/3W	8L47	900 High St	Oakland	Oakland Unified School Di	12/26/1997	122216873	37769644	1	2S/3W 8L	0	0	OAK	Oct-94	0	23	17	2	MON
17	94652	2S/3W	8L48	900 High St	Oakland	Oakland Unified School Di	12/26/1997	122216873	37769644	1	2S/3W 8L	0	0	OAK	Oct-94	0	24	18	2	MON
18		2S/3W	8L 1	4901 E 12TH ST	Oakland	PG&E	7/30/1984	122210260	37767935	0	2S/3W 8L	3034	0	OAK	/19	0	300	81	0	ABN
18		2S/3W	8L36					0	0	9	2S/3W 8L	7032	0		Jul-89	0	35	0	0	DES
18		2S/3W	8L36					0	0	9	2S/3W 8L	7033	0		Jul-89	0	35	0	0	DES
18		2S/3W	8L36					0	0	9	2S/3W 8L	7034	0		Jul-89	0	35	0	0	DES
19		2S/3W	8M 1	EAST 8TH ST	Oakland	AMERICAN CAN CO	10/6/1986	122250250	37789700	2	2S/3W 8M	3076	0	OAK	Jun-86	0	22	13	2	MON
19		2S/3W	8M	3801 EAST 8TH AVE	Oakland	AMERICAN CAN CO	5/21/1986	122221464	37770139	9	2S/3W 8M	6658	0	OAK	Jan-86	0	30	13	2	BOR
19	95628	2S/3W	8M31	3801 E. 8th St	Oakland	American National Can	2/4/1998	122221862	37770484	1	2S/3W 8M	0	0	OAK	9/95	0	23	10	2	MON
19	95628	2S/3W	8M32	3801 E. 8th St	Oakland	American National Can	2/4/1998	122221862	37770484	1	2S/3W 8M	0	0	OAK	9/95	0	25	12	2	MON
19	95628	2S/3W	8M33	3801 E. 8th St	Oakland	American National Can	2/4/1998	122221862	37770484	1	2S/3W 8M	0	0	OAK	9/95	0	20	12	2	MON
19	95628	2S/3W	8M34	3801 E. 8th St	Oakland	American National Can	2/4/1998	122221862	37770484	1	2S/3W 8M	0	0	OAK	9/95	0	22	11	2	MON
19	95628	2S/3W	8M35	3801 E. 8th St	Oakland	American National Can	2/4/1998	122221862	37770484	1	2S/3W 8M	0	0	OAK	9/95	0	25	14	2	MON
19	95628	2S/3W	8M36	3801 E. 8th St	Oakland	American National Can	2/4/1998	122221862	37770484	1	2S/3W 8M	0	0	OAK	9/95	0	25	11	2	MON
19	95628	2S/3W	8M37	3801 E. 8th St	Oakland	American National Can	2/4/1998	122221862	37770484	1	2S/3W 8M	0	0	OAK	9/95	0	25	12	2	MON
19	95628	2S/3W	8M38	3801 E. 8th St	Oakland	American National Can	2/4/1998	122221862	37770484	1	2S/3W 8M	0	0	OAK	9/95	0	24	11	2	MON
19		2S/3W	8M	3801 East 8th Street	Oakland	American National Can Co.	7/6/1990	122222076	37770577	0	2S/3W 8M	477	0	OAK	8/89	0	0	0	12	BOR*
19		2S/3W	8M 2	3801 East 8th Street	Oakland	American National Can Co.	7/6/1990	122222076	37770577	0	2S/3W 8M	478	0	OAK	8/89	15	24	0	4	MON
19		2S/3W	8M 3	3801 East 8th Street	Oakland	American National Can Co.	7/6/1990	122222076	37770577	0	2S/3W 8M	479	0	OAK	8/89	13	25	0	4	ON
19		2S/3W	8M 4	3801 East 8th Street	Oakland	American National Can Co.	7/6/1990	122222076	37770577	0	2S/3W 8M	480	0	OAK	8/89	12	20	0	4	MON
19		2S/3W	8M 5	3801 East 8th Street	Oakland	American National Can Co.	7/6/1990	122222076	37770577	0	2S/3W 8M	481	0	OAK	8/89	12	22	0	4	MON
19		2S/3W	8M 6	3801 East 8th Street	Oakland	American National Can Co.	7/6/1990	122222076	37770577	0	2S/3W 8M	482	0	OAK	8/89	18	18	0	4	MON
19		2S/3W	8M 7	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1804	0	OAK	4/91	0	180	41	7	IRR
19		2S/3W	8M 8	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1805	0	OAK	3/91	0	25	11	0	MON
19		2S/3W	8M 9	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1806	0	OAK	4/91	16	20	12	4	MON
19		2S/3W	8M10	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1807	0	OAK	3/91	15	20	12	4	MON
19		2S/3W	8M11	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1808	0	OAK	3/91	15	19	9	4	MON
19		2S/3W	8M12	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1809	0	OAK	3/91	16	19	13	4	MON

Pangea

Table 2. Quarter Mile Radius Well Search - Guy's Gas Station, 3820 San Leandro Street, Oakland, California

Map #	Permit	Tr	Section	Address	Longcity	Owner	Update	Xcoord	Ycoord	Match level	Tsrqq	Rec code	Phone	City	Drilldate	Elev	Total depth	Water depth	Dia-meter	Use
19		2S/3W	8M13	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1810	0	OAK	3/91	15	19	12	4	MON
19		2S/3W	8M14	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1811	0	OAK	3/91	13	22	10	4	MON
19		2S/3W	8M15	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1812	0	OAK	3/91	16	18	13	4	MON
19		2S/3W	8M16	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1813	0	OAK	3/91	13	18	10	4	MON
19		2S/3W	8M17	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1814	0	OAK	3/91	12	23	10	4	MON
19		2S/3W	8M18	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1815	0	OAK	3/91	13	18	10	4	MON
19		2S/3W	8M19	3801 East 8th Street	Oakland	American National Can Co.	7/31/1991	122222076	37770577	0	2S/3W 8M	1816	0	OAK	3/91	15	19	11	4	MON
19		2S/3W	8M	3801 East 8th Street	Oakland	American National Can Co.	8/14/1991	122222076	37770577	0	2S/3W 8M	1949	0	OAK	3/91	0	7	5	8	BOR*
19		2S/3W	8M29	3801 E 8th St	Oakland	American National Can Com	7/22/1997	122221863	37770479	1	2S/3W 8M	0	0	OAK	3/94	0	19	0	4	MON
19		2S/3W	8M30	3801 E 8th St	Oakland	American National Can Com	7/22/1997	122221863	37770479	1	2S/3W 8M	0	0	OAK	3/94	0	19	0	4	MON
19		2S/3W	8M25	3801 East 8th St	Oakland	American National Can TW1	10/1/1992	122222076	37770577	1	2S/3W 8M	8222	0	OAK	Oct-91	18	23	5	6	TES
19		2S/3W	8M20	3801 E 8th ST	Oakland	American National CanMW1	9/24/1992	122222076	37770577	1	2S/3W 8M	8025	0	OAK	1/92	10	15	4	2	MON
19		2S/3W	8M21	3801 E 8th ST	Oakland	American National CanMW1	9/24/1992	122222076	37770577	1	2S/3W 8M	8026	0	OAK	1/92	13	19	4	2	MON
19		2S/3W	8M22	3801 E 8th ST	Oakland	American National CanMW1	9/24/1992	122222076	37770577	1	2S/3W 8M	8027	0	OAK	1/92	13	20	4	2	MON
19		2S/3W	8M23	3801 E 8th ST	Oakland	American National CanMW2	9/24/1992	122222076	37770577	1	2S/3W 8M	8028	0	OAK	1/92	14	19	4	2	MON
19		2S/3W	8M24	3801 E 8th ST	Oakland	American National CanMW2	9/24/1992	122222076	37770577	1	2S/3W 8M	8029	0	OAK	1/92	13	19	4	2	MON
19		2S/3W	8M26	3801 East 8th St	Oakland	American Natl Can MW14	10/1/1992	122222076	37770577	1	2S/3W 8M	8223	0	OAK	Oct-91	12	19	2	4	MON
19		2S/3W	8M27	3801 East 8th St	Oakland	American Natl Can MW15	10/1/1992	122222076	37770577	1	2S/3W 8M	8224	0	OAK	Oct-91	18	21	5	4	MON
19		2S/3W	8M28	3801 East 8th St	Oakland	American Natl Can MW16	10/1/1992	122222076	37770577	1	2S/3W 8M	8225	0	OAK	Oct-91	13	19	2	4	MON
19		2S/3W	8M	3801 E. 8th St.	Oakland	American Nat'l Can Co. TB	12/13/1994	122222067	37770586	1	2S/3W 8M	0	0	OAK	Dec-94	0	24	0	0	GEO
19		2S/3W	8M					0	0	9	2S/3W 8M	7035	0		Jan-86	0	15	13	0	BOR

Table 3 - Proposed Cleanup Levels and Goals – 3820 San Leandro Street, Oakland, California

	Benzene[1]			**TPH**		
Media	Current Maximum	Cleanup Level	Cleanup Goal	Current Maximum	Cleanup Level	Cleanup Goal
Soil Gas - Offsite ***(Primary Cleanup Level)***	**Unknown** ug/m^3 (To be determined by proposed sampling)	**84** ug/m^3 Residential ESL for indoor air, due to risk to adjacent offsite apts	**84** ug/m^3 Same as Cleanup Level	**Unknown** ug/m^3 (To be determined by proposed sampling)	**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
Soil Gas - Onsite	**Unknown** ug/m^3 (To be determined by proposed sampling)	**280** ug/m^3 Commercial ESL for indoor air	**280** ug/m^3 Same as Cleanup Level	**Unknown** ug/m^3 (To be determined by proposed sampling)	**29,000** ug/m^3 Commercial ESL for indoor ai	**10,000** ug/m^3 Same as Cleanup Level
Groundwater-Offsite ***(Secondary Cleanup Level)***	**25** ug/L **offsite** (B-13W; 8/03)	**540** ug/L Residential ESL for indoor air, due to risk to offsite residences	**1** ug/L** Final ESL for DW (Same for Residential and Commercial)	**4,100 TPHg** ug/L **offsite** (B-13W; 8/03) **1,700 TPHg** ug/L **offsite** (B-13W; 8/03)	**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-Onsite	**8,300** ug/L **onsite** (MW-3; 5/08)	**1,800** ug/L Commercial ESL for indoor air		**35,000 TPHg** ug/L **onsite** (MW-3; 5/08) **13,000 TPHd** ug/L **onsite** (MW-3; 6/04)		
Soil	**34** mg/kg (#2 Exc) (11.5 ft)	**0.044** mg/kg Final ESL for DW (Same for Residential and Commercial)	**0.044** mg/kg** Same as Cleanup Level	**2,600** mg/kg **TPHg** (#2 Exc) (11.5 ft) **3,700** mg/kg **TPHd** (#3 Exc) (11.5 ft)	**83** mg/kg Final ESL for DW (Same for Residential and Commercial)	**83** mg/kg** Same as Cleanup Level

<u>*Notes and abbreviations:*</u>
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
1 = Proposed ESL rationale for benzene is similar for toluene, ethylbenzene, and xylenes.
* = 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 use near the site and groundwater yield to determine if non-drinking water ESLs could be applicable to this site.

Table 3 - Proposed Cleanup Levels and Goals (cont'd) – 3820 San Leandro Street, Oakland, California

	MTBE		
Media	Current Maximum	Cleanup Level	Cleanup Goal
Soil Gas - Offsite ***(Primary Cleanup Level)***	**Unknown** ug/m^3 (To be determined by proposed sampling)	**9,400** ug/m^3 Residential ESL for indoor air, due to risk to adjacent offsite apts	**9,400** ug/m^3 Same as Cleanup Level
Soil Gas - Onsite	**Unknown** ug/m^3 (To be determined by proposed sampling)	**31,000** ug/m^3 Commercial ESL for indoor air	**31,000** ug/m^3 Same as Cleanup Level
Groundwater-Offsite ***(Secondary Cleanup Level)***	**7,000** ug/L **offsite** (B-13W; 8/03)	**24,000** ug/L Residential ESL for indoor air, due to risk to offsite residences	**13** ug/L** Final ESL for DW (Same for Residential and Commercial)
Groundwater-Onsite	**20,000** ug/L **onsite** (MW-3; 5/08)	**80,000** ug/L Commercial ESL for indoor air	
Soil	**6.8** mg/kg (MW-3-11') (11 ft)	**0.023** mg/kg Final ESL for DW (Same for Residential and Commercial)	**0.023** mg/kg** Same as Cleanup Level

<u>*Notes and abbreviations:*</u>
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
1 = Proposed ESL rationale for benzene is similar for toluene, ethylbenzene, and xylenes.
* = 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 use near the site and groundwater yield to determine if non-drinking water ESLs could be applicable to this site.

APPENDIX A

Historic Soil Analytical Data and Boring Logs

Table 1
Analytical Results for Tank Removal Samples
Guy's Diesel, 3820 San Leandro Street, Oakland, California

Descriptor	TPH-diesel (mg/kg)	TPH-gasoline (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	Total Lead (mg/kg)
#1	180	34	0.11	<0.05	0.12	0.24	nr
#2	3,200	2,600	34	5.3	47	170	nr
#3	3,700	1,400	5.0	3.5	26	6.5	nr
#4	11	170	0.88	0.48	1.5	0.71	nr
#5	510	130	0.82	0.42	2.2	8.6	nr
Comp. (A,B, C)	1,700	260	0.16	0.40	1.0	4.2	nr
Comp. (D,E,F)	1,200	750	0.14	0.34	1.5	7.0	nr
Comp. (1,2,3,4)	180	2.6	<0.005	<0.005	<0.005	<0.005	3.4
Comp. (5,6,7,8)	500	220	<0.0625	<0.0625	<0.0625	1.4	5.3
Comp. (9,10,11,12)	450	79	<0.125	<0.125	<0.125	0.87	nr

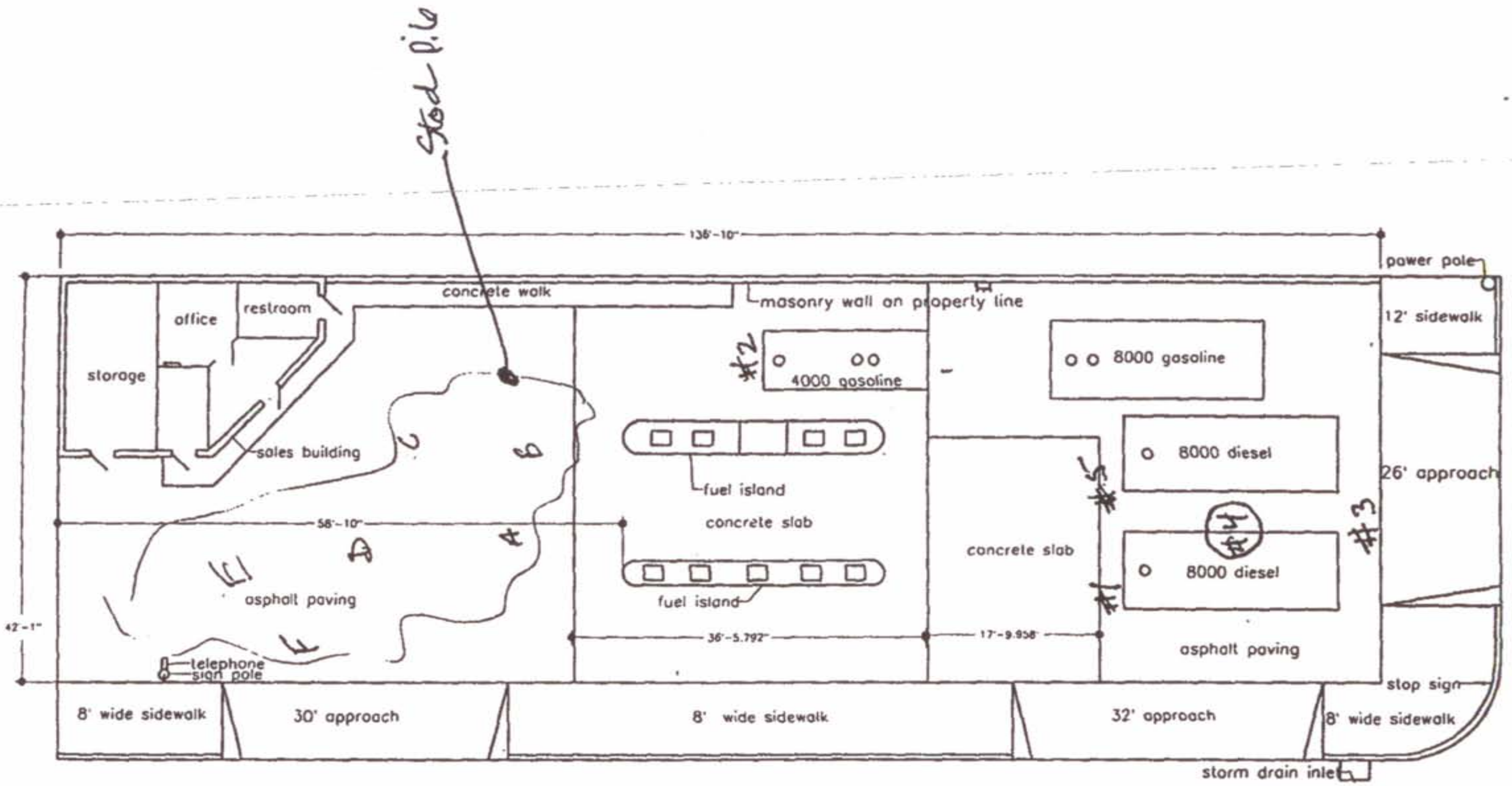
Comp. samples are 4-point composite stockpile samples.

mg/kg = milligrams per kilogram which is essentially equivalent to parts per million (ppm).

nr = Analysis not requested.

TPH = Total Petroleum Hydrocarbons

MTBE = Methyl tert Butyl Ether



1. The building, sign and pole and telephone will remain.
2. The concrete slab at the west end of the property between the building and the sidewalk will reamin.
3. The underground tanks, pump islands and equipment and all concrete and asphalt paving is to be removed.
4. The fuel piping is to be removed.
5. The concrete walk at the building is to be removed.
6. The island booth is to be removed.
7. The newer of the island light poles and rectangular fixtures are to be salvaged and reused.

717demo

DEMOLITION PLAN

UST REMOVAL SAMPLE LOCATIONS

#1, 2, 3 + 5 AT 11.5 FT DEPTH PER REPORT TEXT (GW ENTERED ~12 FT)

#4 FROM EXC FLOOR

Table 2
Current Investigation Soil Analytical Results
Guy's Diesel, 3820 San Leandro Street, Oakland, California

Date	Descriptor	TPH-gasoline (mg/kg)	TPH-diesel (mg/kg)	Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Xylenes (µg/kg)	MTBE (µg/kg)	
7/2/98	MW-1-11'	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<50	
7/2/98	MW-1-16'	<1.0	<1.0	10	<5.0	8.9	<5.0	<50	
7/2/98	MW-2-11'	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<50	
7/2/98	MW-2-16'	3.0	<1.0	<5.0	8.3	10	15	<50	
7/2/98	MW-3-11'	830	2,500	11,000	4,400	19,000	22,000	6,800	← near GW
7/2/98	MW-3-16'	<1.0	<1.0	170	7.9	24	24	220	
7/1/98	B1-6'	<1.0	<1.0	<5.0	<5.0	10	300	<50	
7/1/98	B1-11'	330	120	460	2,200	1,800	3,400	2,200	
7/1/98	B2-6'	12	230	18	50	87	33	100	
7/1/98	B2-11'	650	3300	1,100	5,100	3,800	4,400	1,600	
7/1/98	B2-16'	2.3	6.7	9.6	10	13	14	100	
7/1/98	B5-7'	<1.0	<1.0	18	<5.0	<5.0	<5.0	100	
7/1/98	B5-12'	210	200	470	2,500	2,600	3,000	1,900	
7/1/98	B5-16'	1.0	<1.0	100	17	24	38	<50	
7/1/98	B6-3'	4.2	<1.0	54	27	6.7	24	300	
7/1/98	B6-7'	<1.0	<1.0	14	<5.0	<5.0	7.9	<50	
7/1/98	B7-3'	14	110	90	43	10	30	1,000	
7/1/98	B7-7'	70	610	92	360	260	1,700	1,300	
7/1/98	B8-7'	190	760	1,300	4,000	4,600	22,000	5,400	
7/1/98	B8-11'	90	140	1,100	190	1,200	4,700	1,900	

B

Notes:

mg/kg = milligrams per kilogram which is essentially equivalent to parts per million (ppm).

µg/Kg = micrograms per kilogram which is essentially equivalent to parts per billion (ppb).

TPH = Total petroleum hydrocarbons.

MTBE = Methyl tert butyl ether.

Site Address: 3820 San Leandro Street, Oakland, California **Project #** 6651-001.01
Sampling Date: *08/06/03*

Table 3 - Soil Sample Analytical Results

Sample ID	TPHd	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylene	MTBE
B9-8.0	1.4	1.1	0.019	<0.005	<0.005	<0.005	0.23
B9-11.0	5.4	2.5	<0.0081	<0.0081	<0.0081	<0.0081	<0.0081
B10-8.0	220	400	2.8	<0.5	<0.5	<0.5	2.3
B10-11.0	2,500	940	3.2	<0.5	24	8.8	0.93
B11-18.0	1.2	22	0.15	<0.024	0.38	0.16	<0.024
B12-24.0	<1.0	<1.0	<0.045	<0.005	<0.0086	<0.005	<0.005
B14-17.0	<1.0	<1.0	<0.005	<0.005	<0.005	<0.005	0.0077

Notes: Soil sample results are in milligrams per kilogram (mg/kg), approximately equal to parts per million (ppm)

< = analytical results under laboratory reporting limit

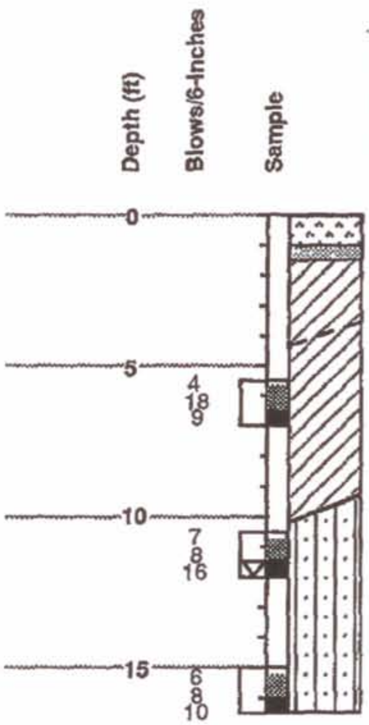
RBSL levels are reported in parts per million (ppm) for soil and parts per billion (ppb) for groundwater

NA = Sample not analyzed for this constituent

Log of Boring B-5

Equipment: 8" Hollow-Stem Auger

Drill Date: 7/1/98 **Logged by:** JB



Concrete

Sand

DARK BROWN BLACK CLAY (CL)
slightly moist, slight hydrocarbon odor

GREEN SILTY CLAY (CL)
medium stiff, slightly moist, hydrocarbon odor, trace sand

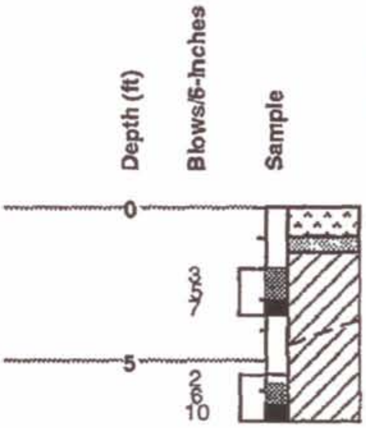
BROWN SILTY SAND (SM)
medium dense to loose, moist to wet, fine grained

MOTTLED GREEN AND BROWN SILTY SAND (SM)
medium dense, moist, hydrocarbon odor, fine grained

Log of Boring B-6

Equipment: 8" Hollow-Stem Auger

Drill Date: 7/1/98 **Logged by:** JB



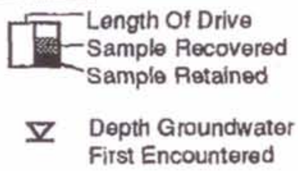
Concrete

Sand

DARK BROWN-BLACK CLAY (CL)
soft, slightly moist, slight hydrocarbon odor

GREEN SILTY CLAY (CL)
soft to medium stiff, wet, fine grained sand, hydrocarbon odor

LEGEND:



PROJECT NO.: 581.2		
DRAWN BY:	KPS	8/3/98
CHECKED BY:	JB	
APPROVED BY:	DMD	
REVISED BY:	KPS	8/7/98

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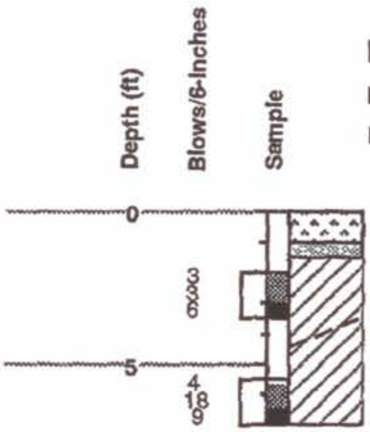
PLATE A2
LOGS OF BORINGS B-5 AND B-6
Guy's Diesel
3820 San Leandro Street
Oakland, California

Log of Boring B-7

Equipment: 8" Hollow-Stem Auger

Drill Date: 7/1/98 **Logged by:** JB



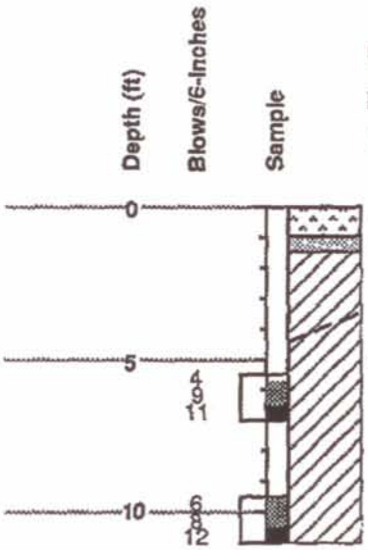
Concrete
Sand
DARK BROWN BLACK CLAY (CL)
soft, slightly moist

GREEN SILTY CLAY (CL)
soft to medium stiff, slightly moist, trace sand

Log of Boring B-8

Equipment: 8" Hollow-Stem Auger

Drill Date: 7/1/98 **Logged by:** JB



Concrete
Sand
DARK BROWN-BLACK CLAY (CL)
soft, slightly moist

GREEN SILTY CLAY (CL)
soft to medium stiff, moist, trace fine grained sand, hydrocarbon odor

some sand, wet

LEGEND:

Length Of Drive
Sample Recovered
Sample Retained

▽ Depth Groundwater First Encountered

PROJECT NO.: 581.2		
DRAWN BY:	KPS	8/3/98
CHECKED BY:	JB	
APPROVED BY:	DMD	
REVISED BY:	KPS	8/7/98

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PLATE A3
LOGS OF BORINGS B-7 AND B-8
Guy's Diesel
3820 San Leandro Street
Oakland, California

EQUIPMENT: Geoprobe Hydraulic Sampling Device
OPERATED BY: Environmental Control Associates
LOGGED BY: Ed Giacometti
LOCATION: 3820 San Leandro Street, Oakland, CA
WORK DATE: 8/6/03
BORING: B10

Soil Color Color Code (Munsell Soil Color Chart)	PID (ppm)	SAMPLE ID	depth below ground surface (ft)	Description
			0	Asphalt
			2	Silty-clays (CL), black, dry, diesel odor
10YR-3/3	178	B10-4.0	4	
			6	Silty-clays (CL), gray-green, gas/diesel odor, dry, medium stiff
	78.9	B10-8.0	8	
5Y-6/3			10	Gravelly sands (SP), green discoloration and strong gasoline odor, soft, slight moisture (only able to get a 3 foot drive) Water @ 11.0
	171	B10-11.0		
		B10-W	12	TOTAL DEPTH OF BORING: 11 feet bgs
			14	
			16	
			18	
			20	
			22	
			24	
			26	
			28	

ACC Environmental Consultants, Inc.
7977 Capwell Drive, Suite 100
Oakland, California 94621
(510)638-8400 FAX: (510)638-8404

Project Number
6601-001.01

Date: **9/8/03**

Title: LOG OF SOIL BORING 10
3820 San Leandro Street
Oakland, California

EQUIPMENT: Geoprobe Hydraulic Sampling Device
OPERATED BY: Environmental Control Associates
LOGGED BY: Ed Giacometti
LOCATION: 3820 San Leandro Street, Oakland, CA
WORK DATE: 8/6/03
BORING: B12

Soil Color Color Code (Munsell Soil Color Chart)	PID (ppm)	SAMPLE ID	depth below ground surface (ft)	Description
			0	Concrete
10YR-3/3			2	Silty clay (CL), dark brown, no odor or discoloration, dry, stiff
	5.1	B12-4.0	4	
			6	Silty clay (CL), same as above
	4.3	B12-8.0	8	
10YR-6/3			10	Silty clay (CL), light brown, no odor or discoloration, dry, medium stiff
	8.5	B12-12.0	12	
			14	Silty clay (CL), same as above
	9.4	B12-16.0	16	
			18	Silty clay (CL), same as above
10YR-3/3	9.1	B12-20.0	20	Silty clay (CL), brown, no odor or discoloration, medium stiffness, damp (Lost core sampler in the hole. Unable to continue sampling to deeper depths)
			22	
	10.1	B12-24.0	24	TOTAL DEPTH OF BORING: 24 feet bgs
			26	
			28	

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Oakland, California 94621
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Project Number 6601-001.01

Date: 9/8/03

Title: LOG OF SOIL BORING 12
3820 San Leandro Street
Oakland, California

Soil Color Color Code (Munsell Soil Color Chart)	PID (ppm)	SAMPLE ID	SAMPLE INTERVAL	depth below ground surface (ft)	EQUIPMENT: Geoprobe Hydraulic Sampling Device OPERATED BY: Environmental Control Associates LOGGED BY: Ed Giacometti LOCATION: 3820 San Leandro Street, Oakland, CA WORK DATE: 8/6/03 BORING: B13
				0	Concrete
10YR-3/3				2	Silty clay (CL), dark brown, no odor or discoloration, dry, stiff
	8.9	B13-4.0		4	
				6	Silty clay (CL), same as above
	3.1	B13-8.0		8	
10YR-3/3				10	Silty clay (CL), same as above
	2.9	B13-12.0		12	
				14	Silty clay (CL), same as above
10YR-3/3	12.2	B13-16.0		16	
				18	Silty clay (CL), same as above, increased moisture content observed at 18.0 feet
	25.2	B13-W		20	TOTAL DEPTH OF BORING: 20 feet bgs
				22	Water sample collected August 7, 2003
				24	
				26	
				28	

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Project Number
6601-001.01

Date: **9/8/03**

Title: LOG OF SOIL BORING 13
3820 San Leandro Street
Oakland, California

Soil Color Color Code (Munsell Soil Color Chart)	PID (ppm)	SAMPLE ID	SAMPLE INTERVAL	depth below ground surface (ft)	EQUIPMENT: Geoprobe Hydraulic Sampling Device OPERATED BY: Environmental Control Associates LOGGED BY: Ed Giacometti LOCATION: 3820 San Leandro Street, Oakland, CA WORK DATE: 8/6/03 BORING: B16
				0	Concrete
				2	Silty clay (CL), green discoloration, slight gas and diesel odor, dry, stiff
10YR-3/3	31.8	B10-4.0		4	
				6	Silty clay (CL), same as above
	18.1	B10-8.0		8	
10YR-5/3				10	Silty sand (SM), soft, slight moisture, green petroleum discoloration and gasoline odor (Only able to perform a 3 foot drive)
	99.1	B11-12.0		12	
				14	Silty sand (SM), same as above moisture increasing with depth
10YR-5/3				16	Silty clay (SM), strong gasoline odor, no discoloration, water at 18 feet w/ strong gas odor
	150	B13-W		18	TOTAL DEPTH OF BORING: 18 feet bgs
				20	
				22	
				24	
				26	
				28	

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Project Number
6601-001.01

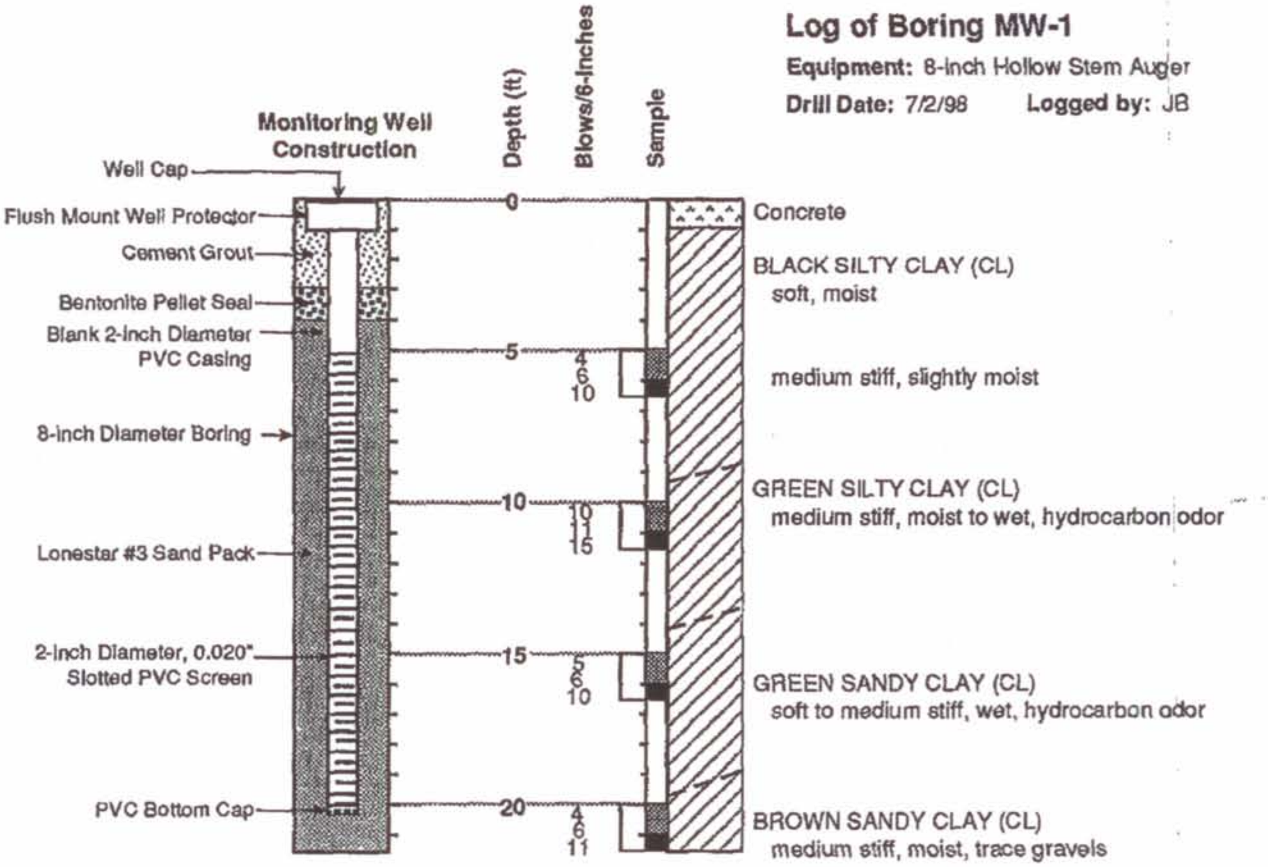
Date: **9/8/03**

Title: LOG OF SOIL BORING 16
3820 San Leandro Street
Oakland, California

Log of Boring MW-1

Equipment: 8-inch Hollow Stem Auger

Drill Date: 7/2/98 **Logged by:** JB



LEGEND:

Length Of Drive
Sample Recovered
Sample Retained

Depth Groundwater First Encountered

PROJECT NO.: 581.2		
DRAWN BY:	KPS	8/3/98
CHECKED BY:	JB	
APPROVED BY:	DMD	
REVISED BY:	KPS	8/7/98

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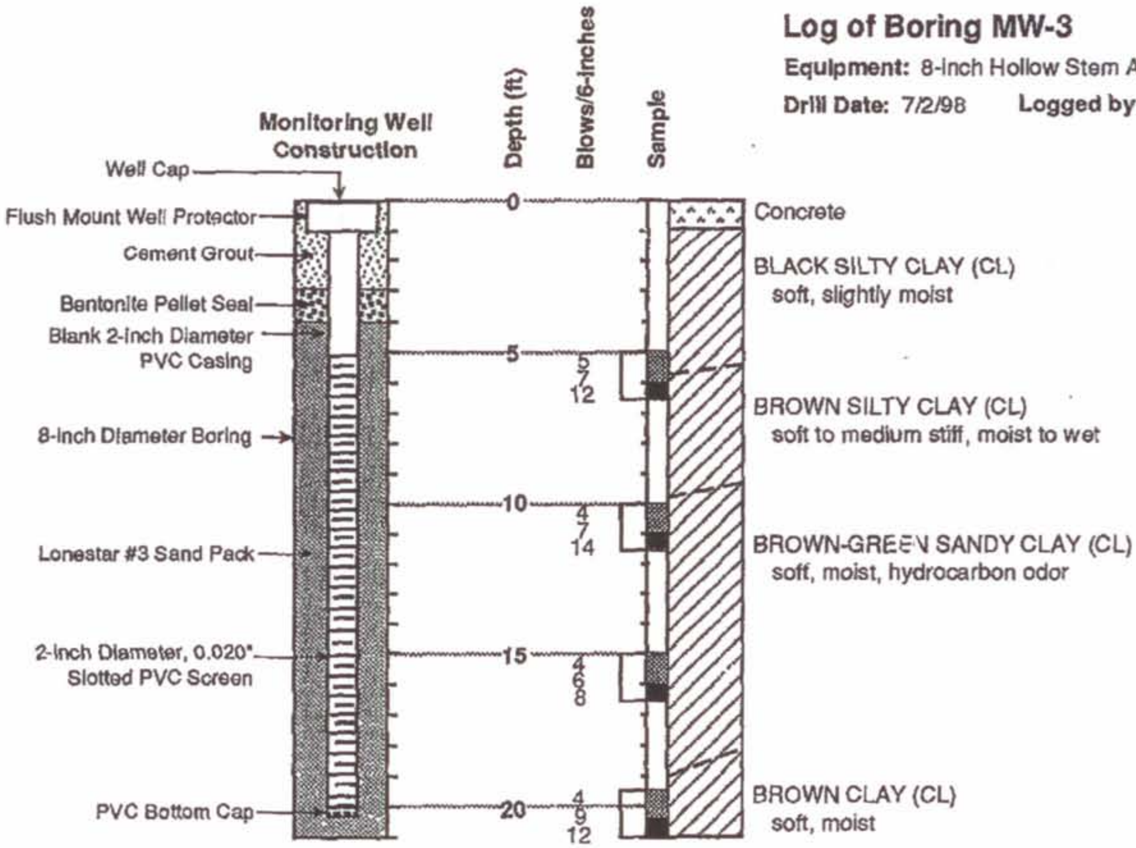
A Division Of
Brunsing Associates, Inc.

PLATE A4
Log and Well Construction Details, MW-1
Guy's Diesel
3820 San Leandro Street
Oakland, California

Log of Boring MW-3

Equipment: 8-inch Hollow Stem Auger

Drill Date: 7/2/98 **Logged by:** JB



moist

LEGEND:

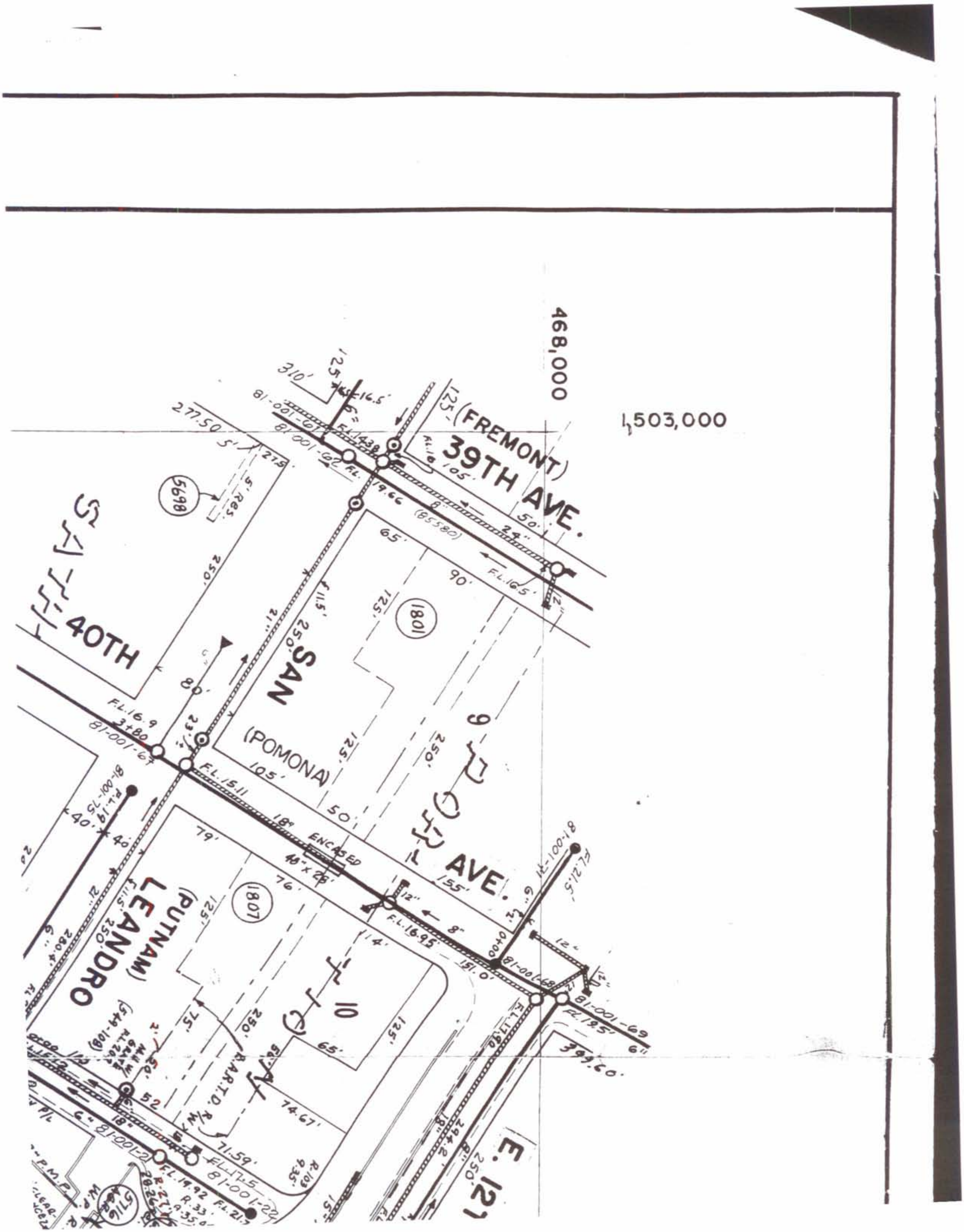
Length Of Drive
Sample Recovered
Sample Retained

Depth Groundwater First Encountered

PROJECT NO.: 581.2			BACE Environmental *A Division Of* Brunsing Associates, Inc.	**PLATE A6** Log and Well Construction Details, MW-3 Guy's Diesel 3820 San Leandro Street Oakland, California
DRAWN BY:	KPS	8/3/98		
CHECKED BY:	JB			
APPROVED BY:	DMD			
REVISED BY:	KPS	8/7/98		

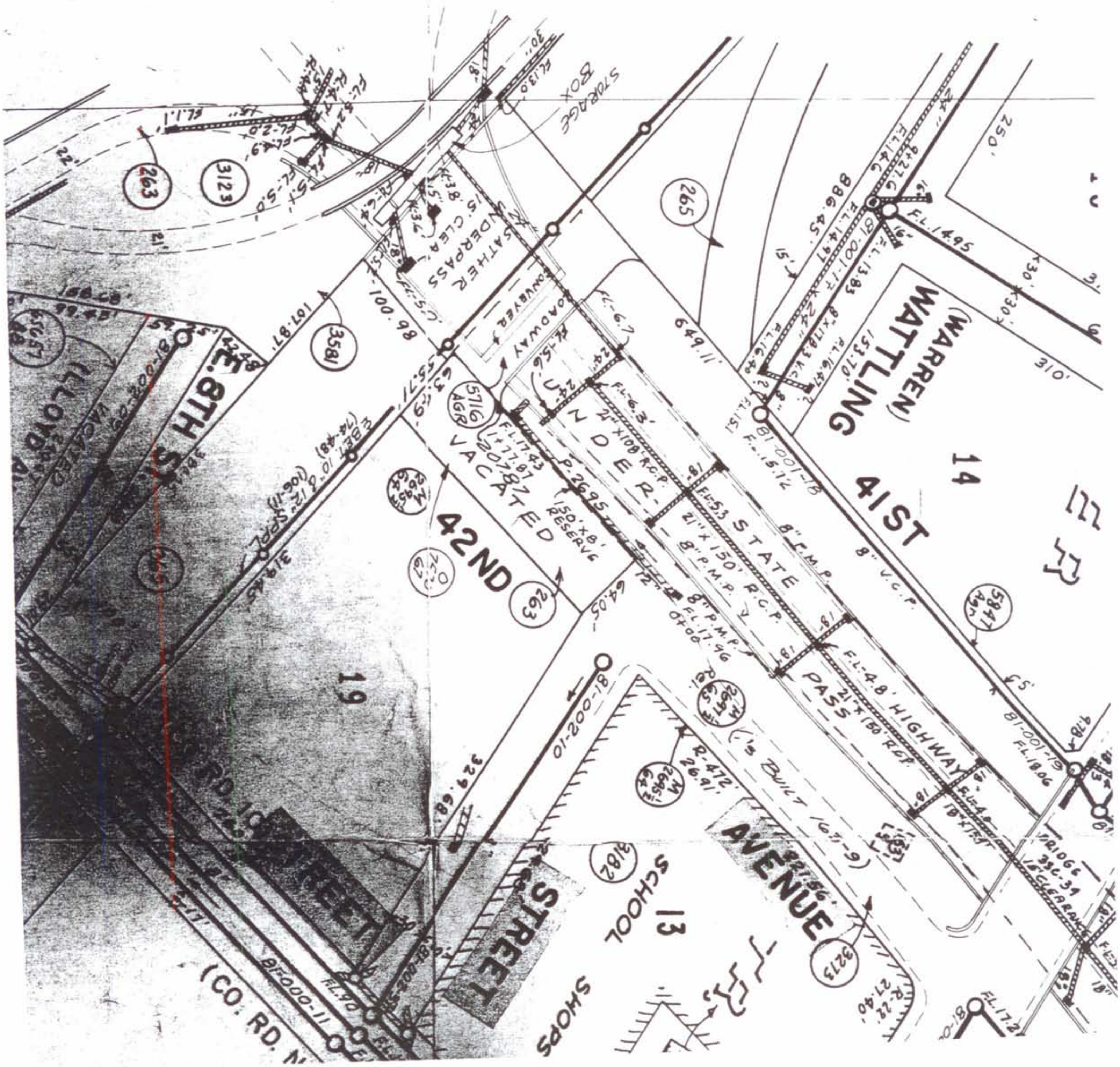
APPENDIX B

Diagrams and Blueprints

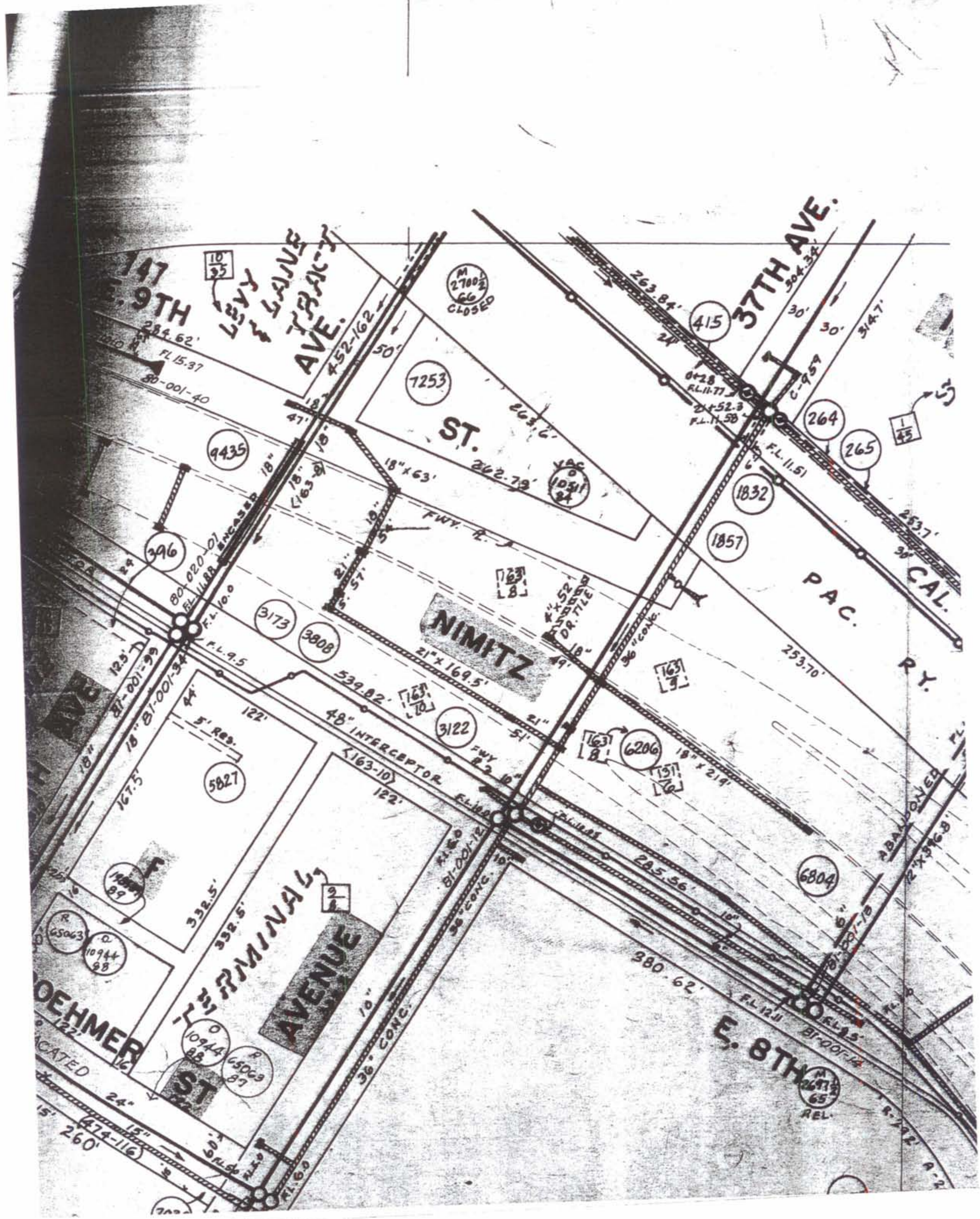

468,000
1,503,000
(FREMONT)
39TH AVE.
40TH
SAN
(POMONA)
AVE.
(PUTNAM)
LEANDRO
E. 12
ENCASED
48" x 28"
B.A.R.T.D. R/W
1801
1807
5698
81-001-67
81-001-62
81-001-64
81-001-68
81-001-69
399.60'

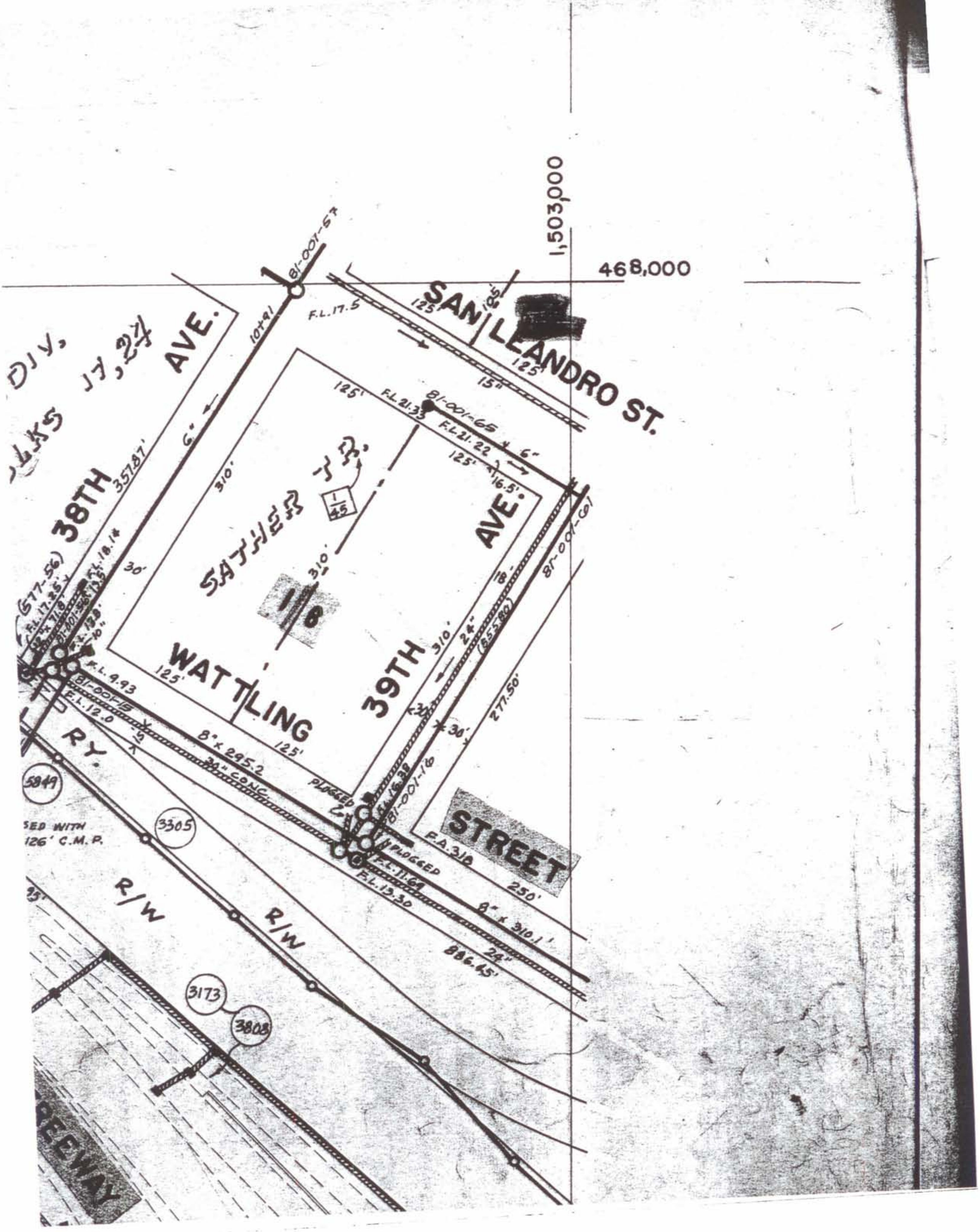
-21-96.

109

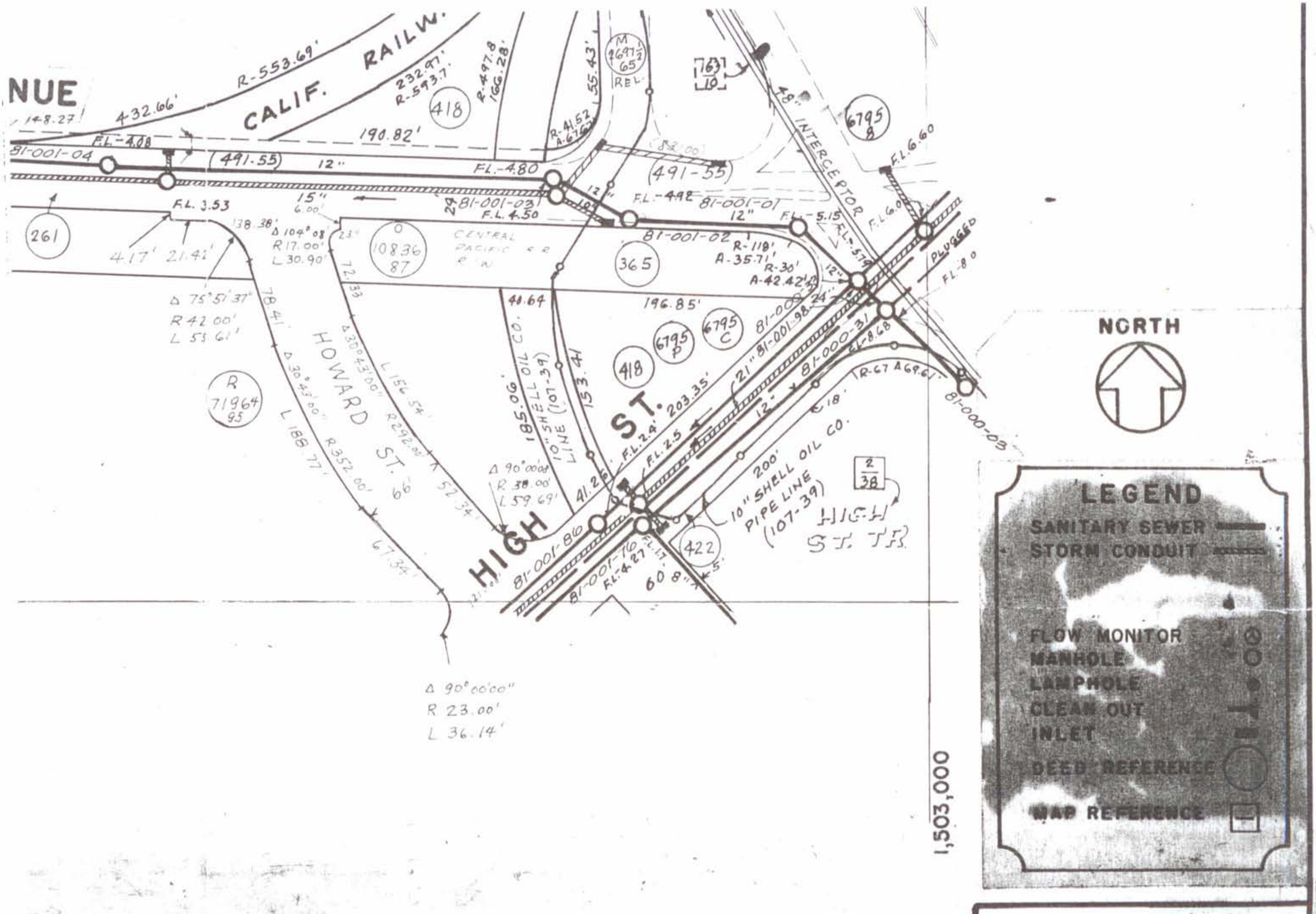


(WARREN)
WATTLING
41ST
14
42ND
VACATED
19
13
STATE
HIGHWAY
UNDER
PASS
AVENUE
SCHOOL
SHOPS
STREET
E. 8TH ST
STORAGE
BOX
ROADWAY


E. 9TH
LEVY & LANVE TRACT
AVE.
37TH AVE.
ST.
NIMITZ
PAC.
CAL.
R.Y.
48" INTERCEPTOR
TERMINAL
AVENUE
OEHMER
ST
E. 8TH
ABANDONED
CLOSED
18" x 63'
21" x 169.5'
18" x 219'
4" x 52' DR. TILE
36" CONC.
539.82'
285.56'
380.62'
263.84'
262.79'
253.70'
7253
9435
396
3173
3808
3122
5827
6206
6804
1857
1832
264
265
415



SAN LEANDRO ST.
38TH AVE.
39TH AVE.
WATTLING STREET
SATHER TR.
1/6
1/45
468,000
1,503,000
81-001-57
81-001-65
81-001-60
81-001-16
81-001-15
F.L.17.5
F.L.21.33
F.L.21.22
F.L.9.93
F.L.12.0
F.L.11.69
F.L.13.30
F.L.18.14
F.A.3/8
PLUGGED
8" x 295.2
30" CONC.
8" x 310.1'
886.45'
277.50'
357.87'
250'
125'
310'
30'
24"
15"
16.5'
R/W
RY.
3305
5849
3173
3808
126' C.M.P.



1500B466

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APPENDIX C

Standard Operating Procedures

STANDARD OPERATING PROCEDURES FOR SOIL GAS SAMPLING

1.0 PURPOSE

This standard operating procedure (SOP) describes the procedures for collecting shallow soil gas vapor samples using temporary vapor probes and evacuated, stainless-steel Summa canisters. The SOP is modified from procedures and information presented in California Regional Water Quality Control Board – Los Angeles Region (LARWQCB), 1997, Cal/EPA 2004, and discussions (September 2006) with K Prime (Santa Rosa, California) laboratory staff.

2.0 REQUIRED EQUIPMENT

- Drill rig or hammer drill with 1” bit and smaller bits (slightly larger than vapor probe tip)
- Tubing for cleaning boring
- Vapor probes and tubing with Swagelok threaded compression fitting and vapor-tight cap.
- Rubber stopper or Teflon disk
- Powdered bentonite or expanding Portland cement
- 6-Liter Summa canister (evacuated with approximately 30” Hg vacuum) with vacuum gauge for purging and leak testing
- 6-Liter Summa canister with vacuum gauge for each sample (including duplicates)
- 1-Liter Summa canister for leak-check compound
- K Prime Inc. stainless-steel sampling manifold (see Figure 2) (request that laboratory leak-check manifold prior to mobilization)
- Leak-check compound (e.g. isopropyl alcohol) and absorbent material (e.g. gauze)
- Photoionization detector (PID)
- Isobutylene for PID calibration
- Tedlar bags for sampling leak-check compound
- Leak-check enclosure (plastic container with flexible weatherstripping and openings for vapor probe tubing and for sampling enclosure atmosphere)
- Record-keeping materials
- Latex or nitrile gloves

3.0 PROCEDURES

3.1 Boring Clearance

Prior to installing temporary soil vapor probes, ensure that a utility clearance has been conducted to ensure that subsurface utility and rebar locations have been identified and marked.

3.2 Vapor Probe Installation

1. To protect surfaces, lay plastic sheeting around the probe location.
2. Use a rotary hammer drill or concrete-coring equipment to create an approximately 1-inch or greater diameter hole that penetrates the slab.
3. In general, the drive rod is driven to a predetermined depth and then pulled back to expose the inlets of the soil gas probe either by exposing a short screened section or by leaving a disposable drop-off tip in the hole. After sample collection, both the drive rod and tubing are removed.

4. During installation of the probe, hydrated bentonite should be used to seal around the drive rod at ground surface to prevent ambient air intrusion from occurring.
5. The inner soil gas pathway from probe tip to the surface should be continuously sealed (e.g., a sampling tube attached to a screw adapter fitted with an o-ring and connected to the probe tip) to prevent infiltration.
6. Equilibration Time: During probe emplacement, subsurface conditions are disturbed. To allow for subsurface conditions to equilibrate, the following equilibration times are recommended:

   For probes installed with the direct push method where the drive rod remains in the ground, purge volume test, leak test, and soil gas sampling should not be conducted for at least 20 minutes following probe installation.

   For probes installed with the direct push method where the drive rod does not remain in the ground, purge volume test, leak test, and soil gas sampling should not be conducted for at least 30 minutes following probe installation.

   For probes installed with hollow stem drilling methods, purge volume test, leak test, and soil gas sampling should not be conducted for at least 48 hours (depending on site lithologic or drilling conditions) after the soil gas probe installation.
7. Probe installation time should be recorded in the field log book.
8. Decontamination: After each use, drive rods and other reusable components should be properly decontaminated to prevent cross contamination. These methods include:

   3-stage wash and rinse (e.g., wash equipment with a non-phosphate detergent, rinse with tap water, and finally rinse with distilled water); and/or

   Steam-cleaning.

3.3 Vapor Sampling

During vapor sampling, record all valve open/close times and canister/manifold vacuum readings at each step.

Setup

1. Calculate and record the volume of the sampling assembly, tubing vapor probe, and any permeable annular space around the vapor probe tip.

   Volume =3.14 x (1/2*ID) x (1/2*ID) *L,

   where ID = tubing or manifold inside diameter and L = length of tubing/manifold segment.
2. Wear latex or nitrile gloves while handling sampling equipment. Change gloves whenever a new sample is collected and after handling leak-check compound.
3. Replace the vapor probe cap with a closed Swagelok valve. Connect the sampling manifold to the vapor probe, sample Summa canister and purge Summa canister using Swagelok fittings and stainless-steel, Teflon or Tygon tubing. Check all fittings for tightness (do not overtighten).
4. Close all valves. Record pre-test vacuum readings on both canisters.

Flow and Leak Check

1. Open both manifold valves and valve on purge Summa canister. Do *not* open valve on sample port. Allow manifold/tubing vacuum to stabilize at approximately 30” Hg.

2. Close purge canister valve and wait at least 10 minutes. Monitor manifold vacuum gauge to test for leaks. If the vacuum decreases, rectify the leak before proceeding.
3. If vacuum is stable, open purge canister valve and open vapor probe valve. After approximately *5 seconds*, close the canister valve and estimate flow rate by recording the elapsed time after valve closure for manifold vacuum to drop to 5” vacuum, as indicated on the following chart (specific to K-Prime sampling manifold)

K PRIME, INC. SOIL GAS MANIFOLD FLOW RATE AND VACUUM LEVEL ESTIMATES

T (seconds)	PV	F (ml/minute)
5	0	135
10	5	115
15	10	90
30	15	60
120	20	40
480	25	20

Source: K Prime, Inc. – July 24, 2006

NOTES:
T = Time duration from full vacuum to less than 5" vacuum after closing purge canister.
PV = Approximate vapor probe vacuum level based on measured T
F = Approximate sampling flow rate based on measured T

4. This procedure should also be conducted several times at the beginning of sampling to ensure that flow rate is sufficient. If no significant flow is attained, either the sampling line is plugged or the vapor probe is positioned in an impermeable or saturated layer. Such a situation should be rectified before sample collection.
5. Place absorbent materials (e.g., gauze) *lightly* moistened (e.g., five drops) with leak-check compound (isopropyl alcohol) inside the leak-check enclosure. Do not allow liquid to come in direct contact with tubing or sampling assembly.
6. Place leak-check enclosure over vapor probe and seal to floor using weatherstripping or duct tape. Ensure that PID has been calibrated with isobutylene gas. Note that the isopropyl alcohol response factor is approximately 5.6 (i.e. a reading of 2 ppm on the PID indicates 5.6 x 2 = 11.2 ppm of isopropyl alcohol in the sample). Record both the observed PID reading and the calculated isopropyl alcohol concentration. If the PID reading is below 10 ppm, slowly reapply leak-check compound.
7. Record PID reading for leak-check enclosure at least once every 5 minutes during purging and sampling. Slowly reapply leak-check compound if PID reading drops more than 20% below initial readings in an attempt to return to the initial readings.

Purge and Sample

1. Open purge canister valve and vapor probe valve and purge the appropriate number of purge volumes. For vapor sampling in support of risk-assessments for regulatory review, a step-purge test should be conducted at a “worst case” sampling point, using 1, 3 and 7 purge volumes to determine the appropriate purge volume that yields the highest target compound concentration. For soil gas screening, or where a purge test is not feasible, purge approximately 3 to 5 purge volumes of the tubing and sampling assembly. Do *not* over-purge. Include the purging conducted during the leak-check step above in the purge

volume.

2. Close purge canister valve and open sample canister valve. Sampling should take approximately 30 minutes for a 6-liter Summa canister.

3. During sampling, the integrated flow rate should be checked periodically by closing the sample canister valve and checking the elapsed time versus the sampling volume. Sampling volume for a 6-liter canister can be estimated based on the following table.

Relationship between Final Canister Vacuum and Volume Sampled

Final Vacuum (“Hg)	0	2.5	5	7.5	10	12.5	15	17.5	20
Volume Sampled (L)	6	5.5	5	4.5	4	3.5	3	2.5	2

Source: Air Toxics, Inc.

4. Close sampling canister valve when vacuum decreases to between 1” and 5” mercury. Do *not* allow vacuum to fall below this range.

5. Use a 1-liter Summa canister to collect a sample from the leak-check enclosure. Submit canister for analysis of leak-check compound only.

6. Disassemble sampling assembly, and cap (or remove and restore) vapor sampling point.

7. Fill out chain-of-custody form, including analysis for chemicals of concern and leak-check compound. Also analyze for oxygen, carbon dioxide and methane. Include final vacuum reading and serial numbers of canister and flow restrictor.

8. Collect at least one duplicate sample per site per sampling event from the sampling point with the anticipated highest vapor concentrations. The duplicate sample should be collected by attaching a fresh sample canister following collection of the initial sample. If a new manifold is used, follow the same purging and sampling procedures used for the original sample. If the same manifold is used, collect a sample without further purging, using the same sampling procedures used for the original sample

Decontamination and Decommissioning

9. Use separate sampling manifold and tubing for each sample location. Return equipment to laboratory for decontamination.

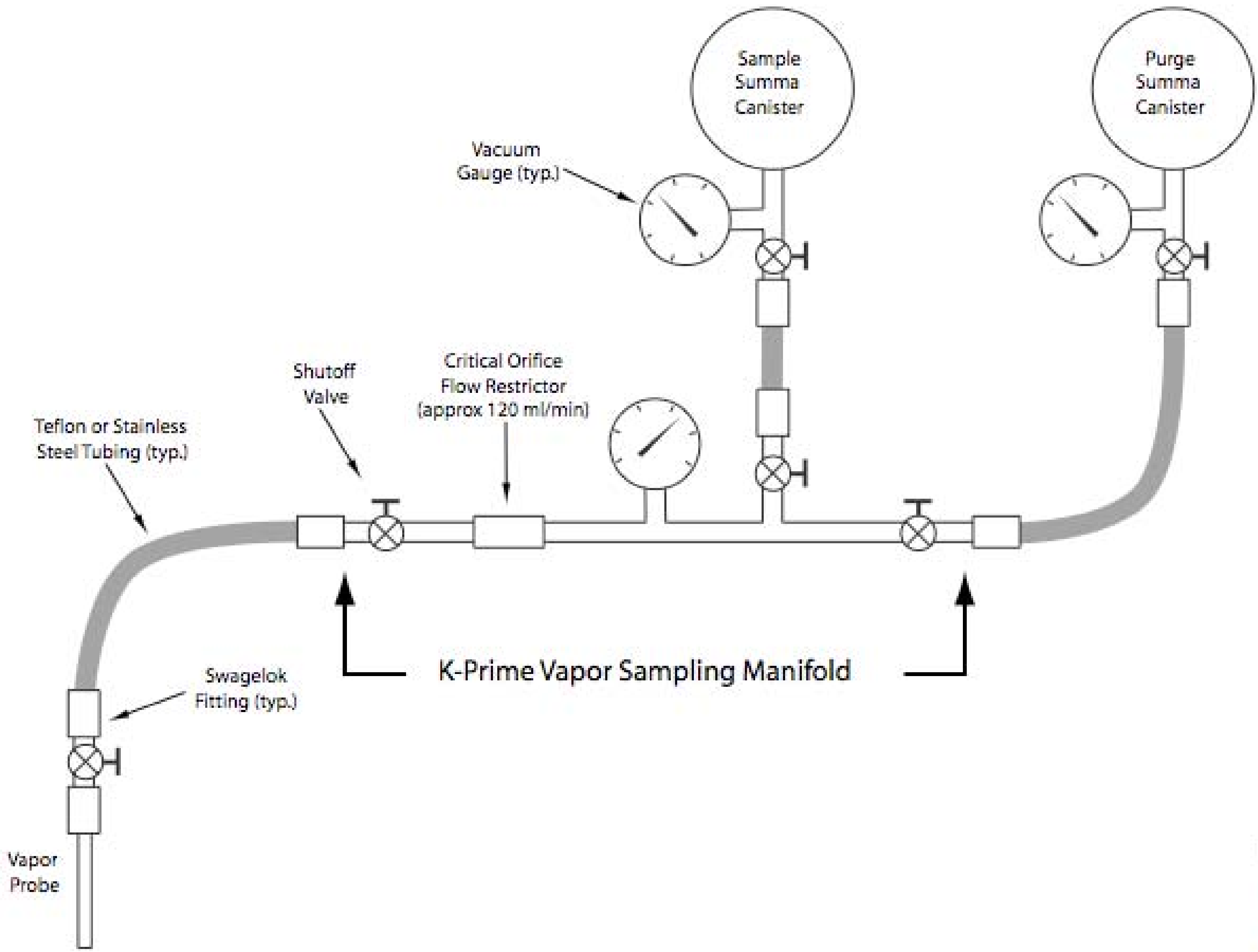
10. Backfill soil vapor probe holes with bentonite slurry.

REFERENCES

California Regional Water Quality Control Board – Los Angeles Region (LARWQCB), 1997, Interim guidance for active soil gas investigation, February 25.

Cal/EPA, 2003, Advisory – Active soil gas investigations, California Environmental Protection Agency, Department of Toxic Substances Control, January 28.

Cal/EPA, 2004, Interim final guidance for the evaluation and mitigation of subsurface vapor intrusion to indoor air, California Environmental Protection Agency, Department of Toxic Substances Control, December 15 (revised February 7, 2005).



Figure

2

Subslab and Soil Vapor Sampling Manifold Schematic

PANGEA

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.

STANDARD FIELD PROCEDURES FOR SOIL BORINGS

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

Objectives

Soil samples are collected to characterize subsurface lithology, assess whether the soils exhibit obvious hydrocarbon or other compound vapor odor or staining, estimate ground water depth and quality, and to submit samples for chemical analysis.

Soil Classification/Logging

All soil samples are classified according to the Unified Soil Classification System by a trained geologist, scientist or engineer working under the supervision of a California Registered Engineer, California Registered Geologist (RG) or a Certified Engineering Geologist (CEG). The following soil properties are noted for each soil sample:

- Principal and secondary grain size category (i.e. sand, silt, clay or gravel)
- Approximate percentage of each grain size category,
- Color,
- Approximate water or product saturation percentage,
- Observed odor and/or discoloration,
- Other significant observations (i.e. cementation, presence of marker horizons, mineralogy), and
- Estimated permeability.

Soil Boring and Sampling

Soil borings are typically drilled using hollow-stem augers or hydraulic-push technologies. At least one and one half ft of the soil column is collected for every five ft of drilled depth. Additional soil samples are collected near the water table and at lithologic changes. With hollow-stem drilling, samples are collected using lined split-barrel or equivalent samplers driven into undisturbed sediments beyond the bottom of the borehole. With hydraulic-push drilling, samples are typically collected using acetate liners. The vertical location of each soil sample is determined by measuring the distance from the middle of the soil sample tube to the end of the drive rod used to advance the split barrel sampler. All sample depths use the ground surface immediately adjacent to the boring as a datum. The horizontal location of each boring is measured in the field from an onsite permanent reference using a measuring wheel or tape measure.

Drilling and sampling equipment is steam-cleaned prior to drilling and between borings to prevent cross-contamination. Sampling equipment is washed between samples with trisodium phosphate or an equivalent EPA-approved detergent.

Sample Storage, Handling and Transport

Sampling tubes or cut acetate liners chosen for analysis are trimmed of excess soil and capped with Teflon tape and plastic end caps. Soil samples are labeled and stored at or below 4°C on either crushed or dry ice, depending upon local regulations. Samples are transported under chain-of-custody to a State-certified analytic laboratory.

Field Screening

Soil samples collected during drilling will be analyzed in the field for ionizable organic compounds using a photo-ionization detector (PID) with a 10.2 eV lamp. The screening procedure will involve placing an undisturbed soil sample in a sealed container (either a zip-lock bag, glass jar, or a capped soil tube). The container will be set aside, preferably in the sun or warm location. After approximately fifteen minutes, the head space within the container will be tested for total organic vapor, measured in parts per million on a volume to volume basis (ppmv) by the PID. The PID instrument will be calibrated prior to boring using hexane or isobutylene. PID measurements are used along with the field observations, odors, stratigraphy and ground water depth to select soil samples for analysis.

Water Sampling

Water samples collected from borings are either collected from the open borehole, from within screened PVC inserted into the borehole, or from a driven Hydropunch-type sampler. Groundwater is typically extracted using a bailer, check valve and/or a peristaltic pump. The ground water samples 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.

Pangea often performs electrical conductivity (EC) logging and/or continuous coring to identify potential water-bearing zones. Hydropunch-type sampling is then performed to provide discrete-depth grab groundwater sampling within potential water-bearing zones for vertical contaminant delineation. Hydropunch-type sampling typically involves driving a cylindrical sheath of hardened steel with an expendable drive point to the desired depth within undisturbed soil. The sheath is retracted to expose a stainless steel or PVC screen that is sealed inside the sheath with Neoprene O-rings to prevent infiltration of formation fluids until the desired depth is attained. The groundwater is extracted using tubing inserted down the center of the rods into the screened sampler.

Duplicates and Blanks

Blind duplicate water samples are collected usually collected only for monitoring well sampling programs, at a rate of one blind sample for every 10 wells sampled. Laboratory-supplied trip blanks accompany samples collected for all sampling programs to check for cross-contamination caused by sample handling and transport. These trip blanks are analyzed if the internal laboratory QA/QC blanks contain the suspected field contaminants. An equipment blank may also be analyzed if non-dedicated sampling equipment is used.

Grouting

If the borings are not completed as wells, the borings are filled to the ground surface with cement grout poured or pumped through a tremie pipe.

Waste Handling and Disposal

Soil cuttings from drilling activities are usually stockpiled onsite on top of and covered by plastic sheeting. At least four individual soil samples are collected from the stockpiles for later compositing at the analytic laboratory. The composite sample is analyzed for the same constituents analyzed in the borehole samples. Soil cuttings are transported by licensed waste haulers and disposed in secure, licensed facilities based on the composite analytic results.

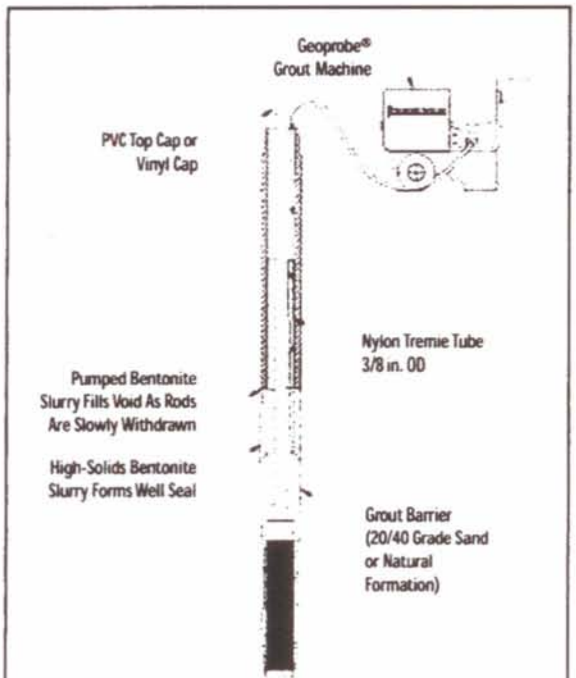
Ground water removed during sampling and/or rinsate generated during decontamination procedures are stored onsite in sealed 55 gallon drums. Each drum is labeled with the drum number, date of generation, suspected contents, generator identification and consultant contact. Disposal of the water is based on the analytic results for the well samples. The water is either pumped out using a vacuum truck for transport to a licensed waste treatment/disposal facility or the individual drums are picked up and transported to the waste facility where the drum contents are removed and appropriately disposed.

APPENDIX D

Pre-Pack Well Information

Prepack Screen Monitoring Wells

Well covers and locking and non-locking well plugs are available to "cap" off monitoring well projects.



Bentonite Seal Above Screen

Geoprobe® Prepack Screen Monitoring Wells are available in the following sizes (counterclockwise)

- 0.5 in. x 1.4 in.
- 1.0 in. x 2.5 in.
- 0.75 in. x 1.4 in.
- 1.5 in. x 2.5 in.

ACTUAL SIZE

Prepack Screen Monitoring Wells

The environmental industry relies on Geoprobe® prepacks!

Look for the new ASTM Practice (D 6725) for installation of direct push prepack screen monitoring wells published by the American Society for Testing and Materials (ASTM).

The most cost effective method for installing permanent monitoring wells!

- Available in sizes ranging from 0.5-inch through 1.5-inch ID.
- Manufactured using PVC and high quality stainless steel screens to assure high integrity samples.
- Assures accurate placement of filter media across desired interval.
- Fully groutable design protects the environment.
- Installation through cased borehole provides high integrity well construction and sample quality.
- Use with Geoprobe® Pneumatic Bladder Pump for collection of high integrity water quality samples.

What are the advantages of Geoprobe® prepack monitoring wells?

- Meets new ASTM Standard D6725 for Direct Push Monitoring Well Installation.
- Meets basic EPA and RCRA construction requirements.
- Direct push (DP) methods for installing monitoring wells are being accepted by many state regulatory agencies.
- DOD and EPA studies reveal no statistically significant difference between water quality samples collected from paired DP and conventionally drilled wells.
- Recently published research shows even small diameter DP wells can be slug tested to accurately determine hydraulic conductivity of the formation.

	SLOTTED PIPE min. I.D.	SAND PACK	LENGTH	ROD SIZE O.D.	ROD SIZE I.D.	PART NO.
1.4 in. OD Prepack Screens	0.5 in. Sch. 80 PVC 0.010 in. slots	20/40 grade sand factory packed	3 feet 1 m	2.125 in. 54 mm	1.5 in. 38 mm	GW2010
	0.5 in. Sch. 80 PVC 0.010 in. slots	20/40 grade sand factory packed	5 feet 1.5 m	2.125 in. 54 mm	1.5 in. 38 mm	GW2020
	0.75 in. Sch. 40 PVC 0.010 in. slots	20/40 grade sand factory packed	3 feet 1 m	2.125 in. 54 mm	1.5 in. 38 mm	11678
	0.75 in. Sch. 40 PVC 0.010 in. slots	20/40 grade sand factory packed	5 feet 1.5 m	2.125 in. 54 mm	1.5 in. 38 mm	17466
2.5 in. OD Prepack Screens	1.0 in. Sch. 40 PVC 0.010 in. slots	20/40 grade sand factory packed	5 feet 1.5 m	3.25 in. 83 mm	2.625 in. 67 mm	17467
	1.0 in. Sch. 40 PVC 0.010 in. slots	20/40 grade sand field packed	5 feet 1.5 m	3.25 in. 83 mm	2.625 in. 67 mm	11679
	1.5 in. Sch. 40 PVC 0.010 in. slots	20/40 grade sand factory packed	5 feet 1.5 m	3.25 in. 83 mm	2.625 in. 67 mm	17401