Site Conceptual Model and Data Gap Work Plan

Former F&M Auto Service UST Site

1839 Foothill Boulevard

Oakland, California

Fuel Leak Case No. RO0003077

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Prepared for:

Alameda County
Health Care Services Agency

Department of Environmental Health

November 2012

Submitted by:

SIERRA WEST
CONSULTANTS, INC.

November 19, 2012

Ms. Karel Detterman
Alameda County Health Care Services Agency
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502

Re: Site Conceptual Model and Data Gap Work Plan
Former F&M Auto Service UST Site
1839 Foothill Boulevard, Oakland, California
Orphan Site Cleanup Account (OSCA) Grant No. 10-701-550

Dear Ms. Detterman:

On behalf of Ms. Mary Wright, current property owner, and Mr. James Balsley, prospective property owner, Sierra West Consultants, Inc. is pleased to submit the enclosed report for the Former F&M Auto Service UST Site. As the authorized representative of Ms. Wright and Mr. Balsley, I have examined and am familiar with the enclosed report, and to the best of my knowledge, the report is true, complete, and accurate.

This report is provided in accordance with Alameda County's letter dated August 29, 2012. We look forward to continuing the investigation field work as soon as practical and appreciate your timely review. We are currently scheduled to begin the field work in February 2013.

Thank you for your assistance on this project. If you have questions or need any additional information, please call me at (916) 863-3220.

Sincerely,

Jeffrey C. Bensch, P.E.
Principal Engineer

Brian Whalen
Project Geologist

enclosure

CC: Ms. Mary Wright, Property Owner
Mr. James Balsley, Prospective Property Owner
Ms. Marisa Rodarte, Orphan Site Cleanup Fund

November 19, 2012

Reference: Site Conceptual Model and Data Gap Work Plan
Former F&M Auto Service UST Site
1839 Foothill Boulevard
Oakland, Alameda County, California 94606

Alameda County, Case #: RO 3077

PERJURY STATEMENT

As the Responsible Party (RP) for this Site, I declare that to the best of my knowledge at the present time, that the information and/or recommendations contained in the attached document are true and correct.

Mary K. Wright
Responsible Party

Contents

1.0 Introduction 1

2.0 Site Conceptual Model 2

2.1 Site Location and Former Land Use 2

2.2 Summary of Previous Environmental Investigations 2

2.2.1 UST Excavation and Removal 2

2.2.2 Preliminary Soil and Groundwater Investigation 2

2.3 Geology and Hydrogeology 3

2.3.1 Regional Geology and Hydrology 3

2.3.2 Local Geology and Hydrology 3

2.4 Preferential Pathway Study 4

2.4.1 Subsurface Utility Survey 4

2.4.2 DWR Well Survey 4

2.4.3 Watershed Data Review 4

2.5 Nature and Extent of Impacts 5

2.5.1 Vicinity of Former UST#1 and UST#2 5

2.5.2 Vicinity of Former UST#3 5

2.5.3 Vicinity of Former UST#4 5

2.5.4 Upgradient 6

2.6 Cleanup Goals 6

2.6.1 Environmental Screening Levels 6

2.6.2 Low-Threat Underground Storage Tank Case Closure Policy 6

3.0 Data Gap Work Plan 7

3.1 Groundwater Monitoring Well Installation 7

3.1.1 Drilling and Well Installation 7

3.1.2 Soil and Groundwater Sampling and Analysis 7

3.1.3 Well Development and Sampling 8

3.1.4 Monitoring Well Survey 8

3.2 Characterization of Shallow Soils and Soil Vapor 8

3.2.1 Soil Vapor Sampling Equipment 8

3.2.2 Purging and Leak Testing 9

3.2.3 Soil Vapor Sample Collection and Analysis 9

3.2.4 Soil Sample Collection and Analysis 9

3.3 Characterization and Disposal of Investigation Derived Waste 9

4.0 Schedule and Reporting 10

List of Figures

Figure 1 Site Location Map
Figure 2 Site Plan
Figure 3 Excavation and Soil Sample Locations
Figure 4 Soil Concentration Map
Figure 5 Grab Groundwater Concentration Map
Figure 6 San Antonio Creek Watershed Map
Figure 7 Geologic Cross Section Location Map
Figure 8 Geologic Cross Section A – A'
Figure 9 Geologic Cross Section B – B'
Figure 10 Groundwater Elevation Map
Figure 11 Subsurface Utility Location Map
Figure 12 Well Search Results Map
Figure 13 Groundwater Concentration Map
Figure 14 Proposed Monitoring Well Locations
Figure 15 Proposed Well Construction Details
Figure 16 Proposed Vapor Sampling Locations

List of Tables

Table 1 Initial Site Conceptual Model
Table 2 Data Gaps and Proposed Investigation
Table 3 Summary of UST Removal Soil Sample Analytical Data
Table 4 Soil Analytical Data Summary
Table 5 Grab Groundwater Analytical Data Summary
Table 6 Groundwater Elevation and Analytical Results
Table 7 Summary of Well Search Results

List of Appendicies

Appendix A Boring Logs

1.0 Introduction

On behalf of Ms. Mary Wright, current property owner, and Mr. James Balsley, prospective property owner, Sierra West Consultants, Inc. (Sierra West) is pleased to present this *Site Conceptual Model and Data Gap Work Plan* (Work Plan) for the Former F&M Auto Service Underground Storage Tank (UST) Site located at 1839 Foothill Boulevard, Oakland, California (Site). The Site is located at the northwest corner of the intersection of Foothill Boulevard and 19th Avenue, in Oakland, California. A Site Location Map is included as **Figure 1**.

On March 9, 2012, Sierra West submitted the *Site Conceptual Model with Soil and Groundwater Investigation Results Report* to Alameda County Environmental Health (ACEH). Included in this report were recommendations for future site characterization to resolve apparent data gaps in the Site Conceptual Model. ACEH provided comments in a letter dated August 29, 2012, and requested the following tasks be performed for the Site:

- Revise the Site Conceptual Model (SCM) to include a tabular summary of the various SCM components and current data gaps; and,

- Prepare a work plan to address the current data gaps identified in the revised SCM.

The information and scope of work presented herein addresses the tasks listed above, and also includes a schedule for implementation of the proposed work and summary of information to be reported following implementation of the work.

2.0 Site Conceptual Model

The SCM has been revised in accordance with ACEH's letter dated August 29, 2012. As requested, a tabular summary of the individual SCM components is included as **Table 1**. Also, a tabular summary of data gaps and proposed investigation activities is included as **Table 2**.

2.1 Site Location and Former Land Use

The Site is identified by Alameda County Assessors Parcel Number 20-164-6, and is a rectangular lot surrounded by a chain link fence with approximate dimensions of 100 feet long by 40 feet wide. The Site is a former gasoline service station believed to have been constructed sometime during the 1950's. The service station ceased operation in 1995 and an auto detailing service operated at the property from 1997 through 2001. The property has been unoccupied since 2001 and the buildings and USTs were removed in 2011.

The southern section of the Site consisted of a small metal-framed retail building with an overhead canopy that covered a concrete pad and a dispenser island containing three gasoline pumps. The northern section of the Site consisted of a metal-framed structure that included a storage shed, an auto service garage, and a canopy that covered waste oil containers and other equipment.

There were a total of four USTs at the Site. UST#1 and UST#2 each had a capacity of 1,000-gallons, likely contained unleaded gasoline during operation of the service station, and were located at the southern end of the Site. UST#3 had a capacity of 550-gallons, likely contained leaded and unleaded gasoline during operation of the service station, and was located in the central portion of the Site. UST#4 had a capacity of 100-gallons, likely contained oil during operation of the service station, and was located at the northern end of the Site. Locations of Site features, including former structures and USTs, are shown on the Site Plan included as **Figure 2**.

2.2 Summary of Previous Environmental Investigations

2.2.1 UST Excavation and Removal

The four USTs and surrounding soils were removed from March 29 to April 8, 2011. Soil samples were collected from beneath the USTs, product piping, dispenser islands, and from the sidewalls of each excavation. Petroleum hydrocarbon impacts to soil were observed under each UST, and were confirmed by laboratory analytical results. The primary constituents of concern (COC) at the Site are total petroleum hydrocarbons as gasoline (TPHg), benzene, toluene, ethylbenzene, xylenes (BTEX), and methyl tertiary butyl ether (MTBE). COC concentration data were compared to the applicable Regional Water Quality Control Board, San Francisco Bay Region (SFRWQCB) Environmental Screening Limits (ESLs). COCs exceeding their respective ESLs were detected in three of six soil samples collected from the excavation of UST#1 and UST#2, and in one of four soil samples collected from the excavation of UST#3. COC concentrations were less than their respective ESLs in soil samples collected from the excavations of UST#4, the product piping, or dispenser islands.

Analytical results from soil samples collected during excavation and UST removal are shown on **Figure 3**, and are summarized in **Table 3**.

2.2.2 Preliminary Soil and Groundwater Investigation

Three soil borings (B-1 through B-3) and four monitoring wells (MW-1 through MW-4) were drilled and installed at the Site on January 23 and 24, 2012. The soil borings and monitoring wells were installed to investigate the extent of soil contamination and determine whether groundwater contamination was present beneath the Site. The greatest COC impacts were observed in the vicinity of former UST#1 and UST#2, with COC

concentrations exceeding their respective ESLs in groundwater samples collected from MW-1 and B-2, and in the soil sample collected from MW-1 at a depth of 10.5 feet below ground surface (bgs). COC concentrations exceeding their ESLs were also observed in MW-2, downgradient of former UST#3, in the groundwater sample and the soil sample collected from 14.5 feet bgs. The groundwater sample collected from MW-3, located near former UST#4, had low-level detections of COCs that were below their respective ESLs. Soil samples from MW-3 and MW-4, and the groundwater sample from MW-4 did not have any COC concentrations above laboratory detection limits.

Analytical results from soil samples collected during the drilling of B-1 through B-3 and MW-1 through MW-4 are shown on **Figure 4**, and are summarized in **Table 4**. Analytical results from grab groundwater samples collected during the drilling of B-1 through B-3 and MW-1 through MW-4 are shown on **Figure 5**, and are summarized in **Table 5**.

2.3 Geology and Hydrogeology

2.3.1 Regional Geology and Hydrology

The Site is located along the eastern margin of the San Francisco Bay within the East Bay Plain (Hickenbottom and Muir, 1988). The surficial deposits are mapped as Pleistocene alluvial fan and fluvial deposits consisting of poorly sorted, dense, sandy or gravelly clay, and Pleistocene marine terrace deposits (Graymer, 2000). The active northwest trending Hayward fault is located approximately 3½ miles east of the Site.

The East Bay Plain is regionally divided into two major groundwater basins: the San Pablo and the San Francisco Basin. These basins are tectonic depressions that are filled primarily with a sequence of coalescing alluvial fans. The San Francisco Basin is further divided into seven sub-areas. The Site is located in the Oakland Sub-Area, which is filled primarily by alluvial deposits that range from 300 to 700 feet thick with no well-defined aquitards (CRWQCB, 1999). Under natural conditions, the direction of groundwater flow in the East Bay Plain is east to west. Groundwater recharge in the shallow aquifer occurs by infiltration from precipitation, irrigation, and stream flow.

The Site is located in the San Antonio Creek watershed, where water is drained to the south and southwest into San Antonio Creek; more commonly called the Oakland Estuary, or the Oakland Inner Harbor. The Site does not overlie any former buried or drained creeks, and does not appear to be in a location of significance to the watershed. **Figure 6** shows the location of the Site in relation to the watershed.

The Site is located approximately 2,000 feet northeast of the Brooklyn Basin. The basin is connected to the Oakland Estuary tidal canal which connects to San Leandro Bay to the south and the Oakland Inner Harbor to the west, that connects to San Francisco Bay. The San Francisco Bay is located approximately 5 miles west and 2 miles south of the Site.

2.3.2 Local Geology and Hydrology

The Site is located on a hill that slopes to the southwest with an approximate gradient of 15%. The local geology of the Site has been evaluated using boring logs from this investigation, and from observations made during excavation and removal of the former USTs. The lithology of the site consists primarily of fine-grained clastic sediments such as silts and clays. Layers of sandy silt and sandy clay are present at approximate depths of 10 and 20 feet. A one-foot thick lens of gravelly silt was observed in the MW-4 boring at an approximate depth of 17 feet, but was not observed in any of the other soil borings. Boring logs for B-1 through B-3 and MW-1 through MW-4 are included in **Appendix A**. Geological cross sections showing the interpreted subsurface lithology are included as **Figures 7 through 9**.

At the time of well installation, groundwater was first encountered at approximately 21 feet deep in each boring. Following well installation, groundwater levels rose to approximately eight feet deep. Based on the

difference between first encountered and static groundwater levels, and the topographical slope, the aquifer appears confined or semi-confined.

Groundwater level measurements have been collected quarterly following well installation from MW-1 through MW-4. Groundwater flow across the Site has ranged from the south to the southwest with a relatively steep hydraulic potentiometric gradient ranging from approximately 0.04 to 0.06 feet per foot (ft/ft). A groundwater elevation contour map from the third quarter 2012 groundwater monitoring event is included as **Figure 10**. Historical groundwater elevation data and analytical results are summarized in **Table 6**.

2.4 Preferential Pathway Study

Pursuant to ACEH's letter dated October 14, 2011, preferential pathways for constituent migration were evaluated. This evaluation consists of a subsurface utility survey, a Department of Water Resources (DWR) well survey, and an evaluation of watershed data including: creeks, former creeks, underground culverts, and engineered channels.

2.4.1 Subsurface Utility Survey

Precision Locating performed the subsurface utility survey using a RadioDetection RD4-433 HCTX2 Transmitter and RD-8000-PDL Reciever. Additionally, a Fischer TW-6 metal detector was used to confirm the locations of subsurface utilities. Results of the survey show that the only utility lines to enter or exit the site are the former water and sewer lines, located in the southern corner of the Site. The water service lateral to the Site has a depth of approximately two to three feet, and the main pipeline under the street and sidewalk is expected to be three to four feet deep. The sewer service lateral to the Site has a depth of approximately two feet, and the main pipeline under the street is approximately eight feet deep. No other subsurface utilities such as electric, gas, or communications were identified at the Site. The locations of subsurface utilities are shown on **Figure 11**. The contaminant impacts identified in the vicinity of former UST#1 occur 10 feet or deeper in the subsurface, which is below the water and sewer pipelines. As such, these utilities do not likely serve as a conduit for constituent migration.

2.4.2 DWR Well Survey

The Alameda County Public Works Agency (ACPWA) and DWR provided well completion data associated with 16 different environmental investigation sites ranging from 1,100 feet to 3,750 feet away from the F&M Auto Service UST Site. Well completion reports were also received for two privately owned water supply wells, located 3,600 feet and 4,400 feet away from the Site. Based on the results of the well survey, it does not appear that any wells are at risk of being impacted by contaminants from the Site. A summary of the results from the well search is included as **Table 7**. Locations of the environmental investigation sites and privately owned water supply wells are shown on **Figure 12**.

2.4.3 Watershed Data Review

Sierra West reviewed the *Creek & Watershed Map of Oakland & Berkeley* (Sowers, J.M., and Richard, C.M., 2009) to evaluate whether contaminant migration could be affected by the locations of creeks, former creeks, underground culverts, or engineered channels. The Site appears to be located between two former creeks that drain to the west-southwest into the Brooklyn Basin. However each of these creeks is located approximately 1,500 feet away from the Site, in the cross-gradient direction of groundwater flow. Given the relatively fine-grained nature of the subsurface beneath the Site, that inhibits long distance contaminant migration, it is unlikely the creeks would be impacted or have any effect on contaminant migration at the Site. The locations of nearby creeks and channels with respect to the Site are shown on the watershed map included as **Figure 6**.

2.5 Nature and Extent of Impacts

The primary COCs in soil and groundwater beneath the Site are TPHg, BTEX, and MTBE. The COC concentrations are compared in the tables to their applicable ESLs, as defined by the SFRWQCB in *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater* – Table B (May 2008) for shallow soils where groundwater is not a current or potential source of drinking water. Concentrations of COCs in soil are shown on **Figures 1 and 2**, and are summarized in **Tables 3 and 4**. Concentrations of COCs in groundwater from the third quarter 2012 groundwater monitoring event are shown on **Figure 13**.

Based on the sample results from both the UST removal, the drilling of B-1 through B-3 and MW-1 through MW-4, and groundwater monitoring, contaminant impacts to soil and groundwater appear greatest in the vicinity of former UST#1 and UST#2.

2.5.1 Vicinity of Former UST#1 and UST#2

The highest concentrations of TPHg and BTEX occurred in shallow soil from MW-1. TPHg and BTEX exceeded ESLs at 10.5 feet below ground surface (ft bgs), but vertically decreased below ESLs by 18.5 ft bgs. In the MW-1 boring, TPHg was reported as 791 milligrams per kilogram (mg/kg) at 10.5 ft bgs decreasing to 0.6 and 0.4 mg/kg at 18.5 and 25 ft bgs, respectively. In soil samples collected from B-1 through B-3, TPHg and BTEX were detected at low-level concentrations, below their respective ESLs. B-2, placed between the former UST#1 and UST#2 locations, had concentrations of TPHg at 50.9, 31.0, and 16.2 mg/kg, at depths of 12.5, 22.5, and 28.0 ft bgs, respectively.

The grab groundwater sample collected from MW-1 contained the highest measured concentrations of TPHg, TPHd, and BTEX. MTBE was also detected at a concentration of 443 micrograms per liter (µg/L). The groundwater sample collected from MW-1 following well development had similar concentrations to the grab sample, however, dissolved lead was below the reporting limit of 10 µg/L in the grab sample, but reported as 86.4 µg/L in the sample collected following well development. The ESL for dissolved lead in groundwater is 2.5 µg/L. The grab groundwater sample from B-2 contained concentrations of TPHg, TPHd, ethylbenzene, and xylenes that exceeded their respective ESLs, but at lower levels than observed in MW-1. With the exception of TPHd at 199 µg/L in B-3, no other COCs exceeded their ESLs in grab groundwater samples collected from borings B-1 or B-3.

2.5.2 Vicinity of Former UST#3

Soil and groundwater sample results from the MW-2 boring indicate moderate impacts near the former location of UST#3. Similar to the MW-1 results, TPHg reported in MW-2 exceeded the ESL at 14.5 ft bgs, but decreased below the ESL at greater depths. In the MW-2 boring, TPHg was reported as 830 mg/kg at 14.5 ft bgs decreasing to 94.8 and <0.100 mg/kg at 20.5 and 28 ft bgs, respectively. The grab groundwater sample collected from MW-2 contained concentrations of TPHd, TPHg, and ethylbenzene that exceeded their respective ESLs. The groundwater sample collected from MW-2 following well development exhibited a similar concentration of TPHg to the grab sample, but significantly higher benzene, MTBE, and dissolved lead.

2.5.3 Vicinity of Former UST#4

Soil and groundwater results from the MW-3 boring indicate that contaminant impacts are limited near the former location of UST#4. Soil samples lacked detectable COCs, and groundwater contained only relatively low concentrations of TPHg and/or TPHd, BTEX, and MTBE. Additionally, soil and groundwater samples lacked detectable Oil and Grease, EDB, EDC, PCBs, PCP, PNAs, 1,4-dioxane, or creosote compounds. Detected concentrations of Cd, Cr, Ni, and Zn are below their respective ESLs, and are likely representative of background levels.

2.5.4 Upgradient

Well MW-4 was installed upgradient of the former USTs, and with one exception, lacked detectable COCs in both soil and groundwater. TPHd was reported in the MW-4 grab groundwater sample and the sample collected following well development, at the relatively low concentrations of 67.6 and 50.2 µg/L, respectively.

Sierra West attributes the frequent detections of TPHd to weathered gasoline because diesel was not a regular product of the former service station.

2.6 Cleanup Goals

2.6.1 Environmental Screening Levels

The ESLs as defined by the SFRWQCB in *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater – Table B (May, 2008)*, are summarized below for shallow soils on commercial land use sites where groundwater is not a current or potential source of drinking water:

Media	TPHd	TPHg	B	T	E	X	MTBE	TBA	Lead
Groundwater (µg/L)	210	210	46	130	43	100	1,800	18,000	2.5
Soil (mg/kg)	180	180	0.27	9.3	4.7	11	8.4	110	750

The ESLs presented above have been used in evaluating constituent concentrations in soil and groundwater samples collected at the Site.

2.6.2 Low-Threat Underground Storage Tank Case Closure Policy

Effective August 17, 2012, the State Water Resources Control Board (SWRCB) adopted the Low-Threat UST Case Closure Policy. This policy establishes specific criteria to be used by regulatory agencies in evaluating closure requests for UST sites. The low threat closure policy lists the following general criteria that must be satisfied by all candidate sites to be considered for closure:

a. The unauthorized release is located within the service area of a public water system;
b. The unauthorized release consists only of petroleum;
c. The unauthorized ("primary") release from the UST system has been stopped;
d. Free product has been removed to the maximum extent practicable;
e. A conceptual site model that assesses the nature, extent, and mobility of the release has been developed;
f. Secondary source has been removed to the extent practicable;
g. Soil or groundwater has been tested for MTBE and results reported in accordance with Health and Safety Code section 25296.15; and,
h. Nuisance as defined by Water Code section 13050 does not exist at the site.

In addition to the general criteria listed above, there are media specific criteria that must be satisfied for contaminants in groundwater, soil, and soil vapor. Groundwater specific criteria are based on the plume length, distance to water supply wells or surface water bodies, and concentrations of benzene and MTBE. Soil and soil vapor specific criteria are based on concentrations of benzene, ethylbenzene, and naphthalene, as well as depth to groundwater and concentrations of oxygen in soil vapor.

While most of these general criteria are satisfied, the SCM has not yet established the extent of impacts in groundwater or the level of impact in soil vapor. As such, further investigation is warranted.

3.0 Data Gap Work Plan

The proposed scope of work was developed to address data gaps in the SCM, and includes the following activities:

- Installing three downgradient groundwater monitoring wells to determine the extent of constituent migration; and,
- Collecting ten soil vapor samples to evaluate inhalation exposure risks to soil vapor.

Sierra West will obtain well installation permits from the ACPWA for the installation of three groundwater monitoring wells, and for the advancement of ten temporary soil vapor borings. Sierra West will procure a private utility locating service to assess the locations of utilities or other subsurface obstructions. At least 48 hours prior to conducting field work, Sierra West will contact ACEH, ACPWD, and Underground Service Alert to schedule regulatory and utility inspections.

The existing Site Health and Safety Plan will be modified to include the proposed scope of work. The selected drilling contractor will be required to have a California C-57 drilling license, and have prepared an independent health and safety plan prior to performing the work.

3.1 Groundwater Monitoring Well Installation

Sierra West proposes to install three groundwater monitoring wells MW-5 through MW-7 along 19th Avenue to the south and southwest of the Site, as shown on **Figure 14**. These wells will be able to assess the extent of impacts downgradient of the source area.

3.1.1 Drilling and Well Installation

Each monitoring well boring will be advanced using hollow stem auger drilling equipment. The upper five feet of each boring will be advanced using a hand auger to clear for subsurface obstructions or utilities. Soil samples will be collected from each boring at approximate five-foot intervals, and soils encountered will be logged using the Unified Soils Classification System (USCS) visual and manual methods, and using Munsell soil color charts. Additionally, a photo-ionization detector (PID) equipped with a 10.6 electron volt lamp will be used to field-screen soils for volatile organic compounds volatile organic compounds (VOCs).

Each monitoring well will be installed using 8-inch diameter hollow stem augers to an approximate depth of 22 ft bgs. The monitoring wells will be installed using 2-inch diameter schedule 40 poly-vinyl chloride casing, with a five to eight foot long section of 0.010-inch machine-slotted screened interval situated such that a portion of the screen extends above static groundwater. The remainder of each well will be constructed with blank PVC riser casing. A filter pack of #2/12 sand will be emplaced around the screened interval and will extend approximately two feet above the top of the screen. A three foot thick bentonite transition seal will be placed above the filter pack, followed by cement grout in the remaining annular space to approximately one ft bgs. Each well will be completed at the surface with a locking well cap, and a traffic-rated well box set in concrete.

Final well construction details will be determined by the field geologist during well installation, based on site specific conditions. Proposed well construction details for MW-5 through MW-7 are included as **Figure 15**.

3.1.2 Soil and Groundwater Sampling and Analysis

Discrete soil samples will be collected based on observed field conditions, including PID readings, depth, and lithology. At least two soil samples from each boring will be submitted for chemical analysis. Soil samples will be placed in laboratory provided sample containers. Additionally, one grab groundwater sample will be collected from each completed boring and submitted for chemical analysis. Soil and groundwater samples will

be labeled and transported to a California State-certified laboratory under chain-of-custody protocol. Samples will be analyzed for TPHd by Environmental Protection Agency (EPA) Method 8015M; and for TPHg, BTEX, MTBE, diisopropyl ether (DIPE), ethyl tertiary butyl ether (ETBE), tertiary amyl methyl ether (TAME), and tertiary butyl alcohol (TBA) by EPA Method 8260B. Soil samples will be analyzed for total lead and grab groundwater samples will be analyzed for dissolved lead by EPA Method 6010B.

3.1.3 Well Development and Sampling

At least 72 hours following installation, MW-5 through MW-7 will be developed by surging over the length of the screened interval and then purging. The wells will be developed until pH, electrical conductivity, temperature, and turbidity have stabilized, or until the well goes dry. After the parameters stabilize, groundwater samples will be collected from each well and analyzed for TPHd by EPA Method 8015M; TPHg, BTEX, MTBE, DIPE, ETBE, TAME, and TBA by EPA Method 8260B; and, for dissolved lead by EPA Method 6010B.

3.1.4 Monitoring Well Survey

Following installation of MW-5 through MW-7, the top-of-casing elevations will be surveyed relative to mean sea level within 0.01-foot accuracy by a California licensed surveyor. Horizontal coordinates by global positioning system (GPS) to sub-meter accuracy will also be obtained by the surveyor. Surveying will be conducted consistent with GeoTracker requirements.

3.2 Characterization of Shallow Soils and Soil Vapor

Ten temporary soil vapor well borings will be advanced to assess constituent concentrations in shallow soils and in soil vapor. The sample locations are selected using a grid geometry overlying the property and former Site structures. The sampling grid has dimensions of 40 feet by 100 feet and is divided by gridlines with 20-foot spacing, resulting in a total of ten grid cells. Proposed sample locations in each cell were determined randomly, and may be modified in the field based on site-specific conditions. The grid layout and proposed sample locations (V-1 through V-10) are shown on **Figure 16**.

The proper collection of soil vapor samples is important in producing reliable concentration data. A number of factors are involved in ensuring the reliability of the data; therefore, soil vapor sampling methods will be conducted in accordance with the Department of Toxic Substance Control (DTSC) guidance document, *Advisory – Active Soil Gas Investigations* (April, 2012).

3.2.1 Soil Vapor Sampling Equipment

Each temporary soil vapor well boring will be manually advanced using gas vapor probe equipment to a total depth of five ft bgs. The gas vapor probe equipment will have an internal retractable liner, that when retracted exposes the inlets of the probe and creates a temporary soil vapor sampling point. Following probe installation, soil gas sampling will not be conducted for at least two hours to allow for subsurface conditions to equilibrate.

All gauges and flow control manifolds will be connected by laboratory-supplied stainless steel tubing, and dedicated flexible-Teflon airtight tubing that has a low capacity for adsorbing VOCs. A sample train will be assembled using 0.25-inch outside diameter Teflon tubing for all vapor sampling. Compression fittings will be used for all connections between tubing and other sampling components. A valve between the sample train and soil gas probe will be used for leak testing.

All samples will be collected in Summa canisters provided by the analytical laboratory. Each canister will be field verified to have a minimum vacuum of minus 25 inches of mercury (inches Hg) before sampling. A vacuum will be created by opening the Summa canisters to draw the soil vapor to the surface. A three-way

valve will be used to isolate the purging canister from a separate tube that is connected to the vapor sample canister.

3.2.2 Purging and Leak Testing

Prior to collecting a soil vapor sample, the sample tubing will be purged using a purge canister to ensure that the vapor samples collected will be representative of actual soil vapor concentrations. Field notes containing dimensions and specifications of the tubing, sampling equipment, and below-ground tubing will be used to calculate the purge volume. The flow rate for purging will be the same as the flow rate used for subsequent sampling (<200 milliliters per minutes [mL/min]). Three purge volumes will be extracted before sampling. The calculated purge volume, purge rate, and duration will be recorded for each soil vapor sampling point.

Leakage of atmospheric air into the sampling equipment during sampling can compromise sample integrity and dilute measured soil vapor hydrocarbon concentrations. Sampling equipment will be thoroughly inspected to ensure tight fittings between all components. Prior to sampling, the purge Summa canister valve will be opened to the sampling manifold with the valve between the sample train and soil gas probe closed, for ten minutes. The sample train will be considered to pass the leak test if constant vacuum pressure is maintained for the ten minutes.

Isopropyl alcohol will be used as a tracer to test for air leakage into the sampling system for the purpose of sample integrity verification. Isopropyl alcohol will be applied to clean gauze and placed around all connections in the sampling train in order to evaluate potential leaks of ambient air. The top of each boring will be sealed using hydrated bentonite to reduce ambient air effects on sampling.

3.2.3 Soil Vapor Sample Collection and Analysis

Sample collection from each location will begin immediately after purging. A constant flow rate of <200 mL/min will be maintained over a half-hour period. A vacuum gauge on the flow controller, supplied by the analytical laboratory, will be used to monitor sampling progress. The initial and final vacuum, start and finish times, and estimated flow rate will be documented in field notes. The sampling completion time should be approximately 0.5 hours. Low permeability soils characterized by low soil vapor flow rates may require sampling to cease before the canister vacuum has decreased to minus five inches Hg.

Samples will be labeled according to standard chain of custody protocols, and transported to the analytical laboratory within 24 hours of collection. Soil vapor samples will be analyzed for TPHg, BTEX, MTBE, DIPE, TAME, ETBE, TBA, naphtlanene, and isopropyl alcohol by EPA Method TO-15. Analytical results will be reported in micrograms per cubic meter or micrograms per liter. Samples will also be analyzed for oxygen, carbon dioxide, and methane by ASTM Method D-1946 modified, to be evaluated as naturally occurring atmospheric tracer gases.

3.2.4 Soil Sample Collection and Analysis

Undisturbed soil samples collected from borings V-1 and V-5 will be submitted for geotechnical analysis and analyzed for grain size distribution by ASTM Method D-422, bulk density and moisture content by ASTM Method D-2937, porosity and hydraulic conductivity by ASTM 5084 Method C, and total organic carbon by ASTM Method D-2974.

3.3 Characterization and Disposal of Investigation Derived Waste

Soil cuttings generated will be stored on Site in Department of Transportation rated 55-gallon drums. Groundwater displaced during well installation, and generated during well development will be stored in separate 55-gallon drums. Composite soil and groundwater samples will be collected from the drums for waste characterization. Upon receipt of analytical results, the drums will be removed from the Site and transported to the appropriate facility for disposal according to applicable protocols.

4.0 Schedule and Reporting

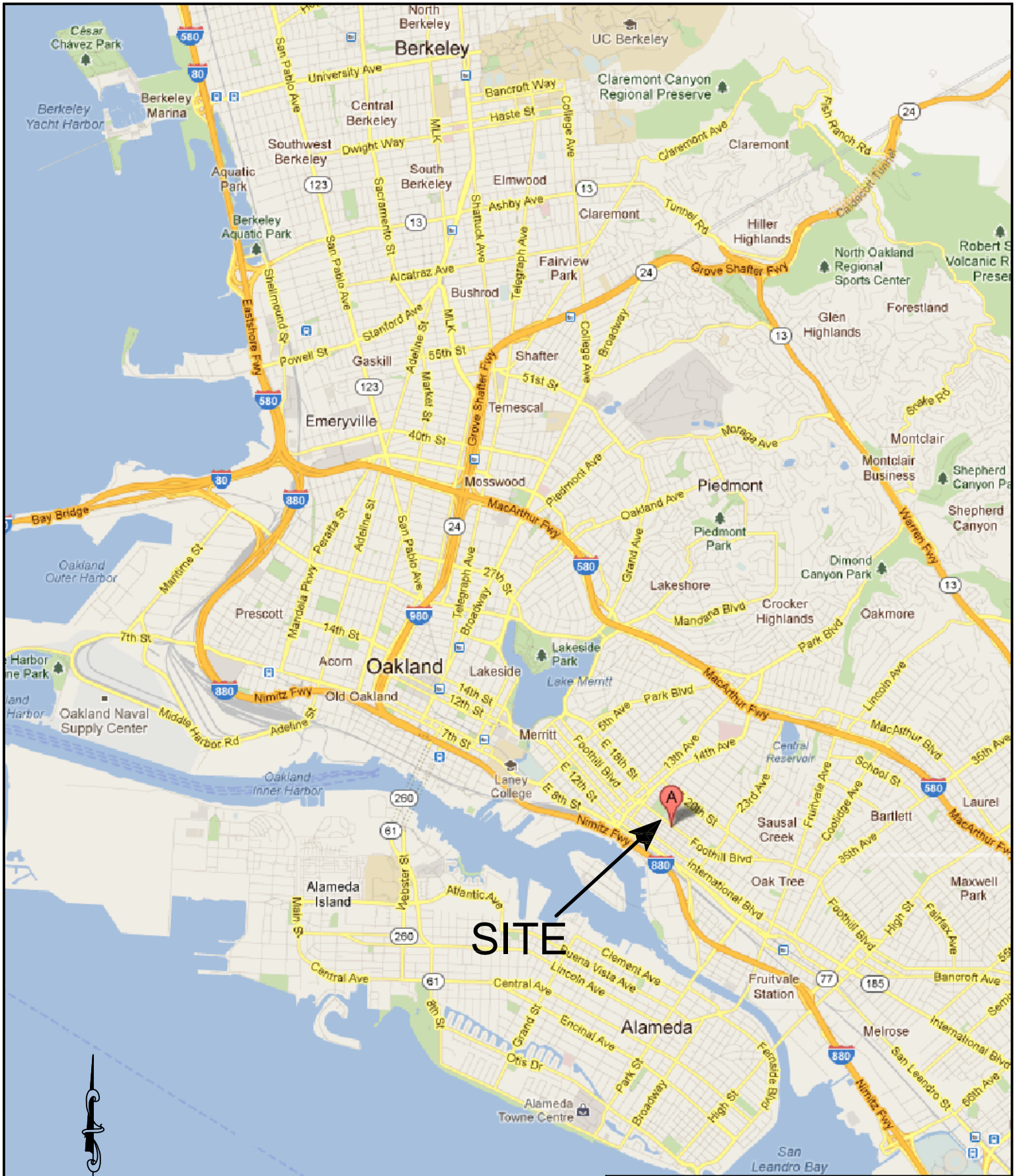
The F&M Auto Service UST Site environmental investigation is funded by the Orphan Site Cleanup Fund (OSCF), and the timeframe for funding through OSCF is limited. As such, Sierra West intends to implement well installation and soil vapor sampling activities in February 2013. If ACEH has any comments or requests to be incorporated to the proposed scope of work, Sierra West respectfully requests that they be made prior to the beginning of January 2013.

Following completion of the scope of work presented herein, Sierra West will prepare and submit a report to ACEH documenting the above tasks. This report will include the following elements:

- A discussion of field activities;
- An evaluation of the results, including a comparison of soil, groundwater, and soil vapor data to applicable ESLs;
- Data tables and figures, as necessary;
- Applicable permits, boring logs, and copies of the DWR well completion reports;
- Certified laboratory analytical reports with chain-of-custody documentation;
- Monitoring well survey data;
- Field sheets from soil vapor sampling and well development; and,
- Documentation of waste characterization and disposal.

Results will be reported within 60 days of the conclusion of field activites.

Figures



TITLE:	Site Location Map
LOCATION:	F&M Auto Service UST Site 1839 Foothill Blvd., Oakland, CA

Source: Google Maps, 2012

0mi 1/2mi 1mi 2mi

SCALE 1" = 1 mile
(Scale is approximate)

SIERRA WEST CONSULTANTS, INC.

FIGURE: 1

Legend:

⌖ - Monitoring Well

0' 5' 10' 15' 30'

SCALE 1" = 30'

Notes:

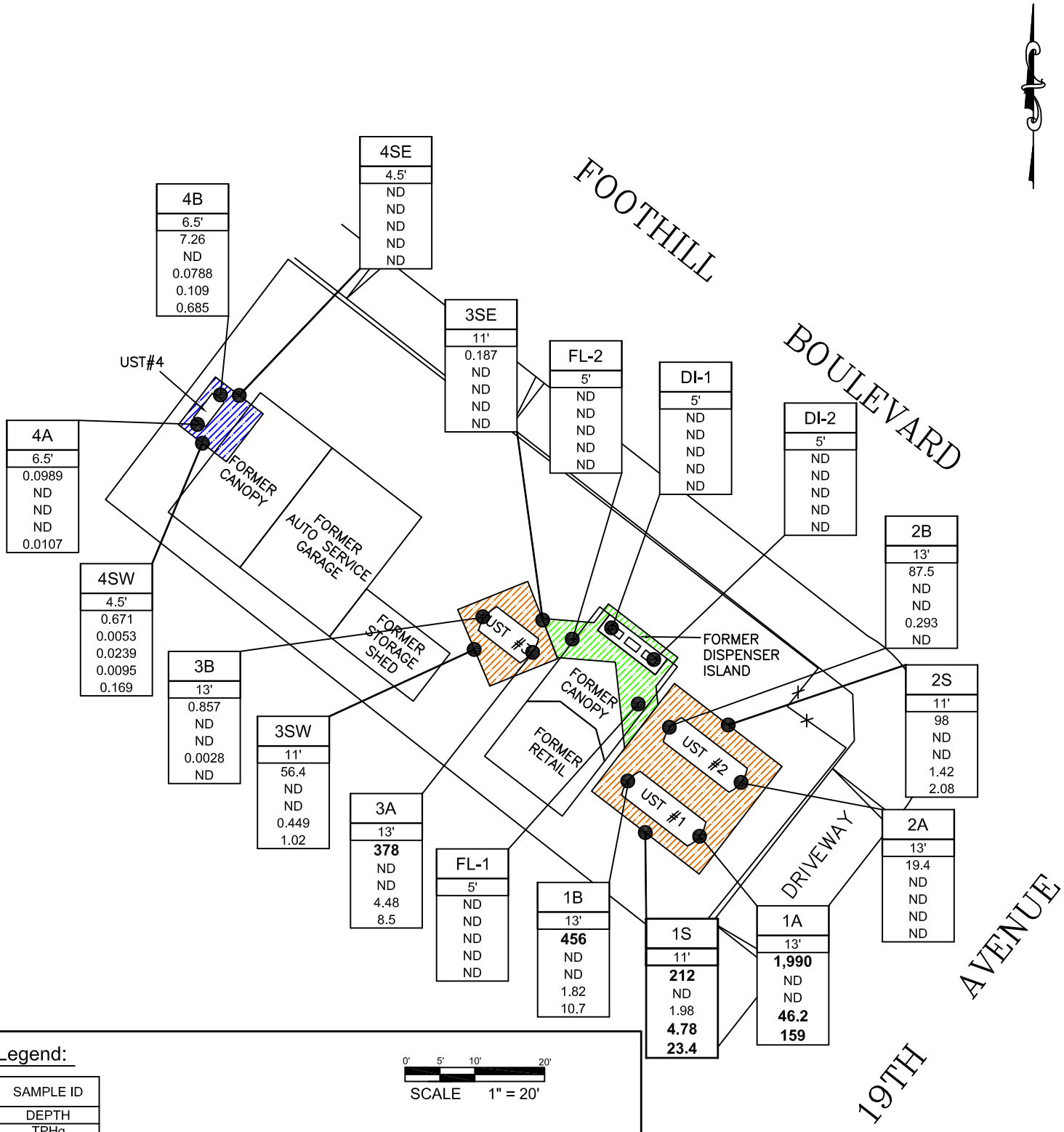
1) Well locations based on survey data provided by Virgil Chavez Land Surveying on 1/31/2012.
2) Locations of USTs and former Site structures are approximate.
3) Former Site structures were demolished on March 31, 2011.
4) USTs were removed on April 6, 2011.

TITLE: Site Plan

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 2



Legend:

SAMPLE ID
DEPTH
TPHg
Benzene
Toluene
Ethylbenzene
Xylenes

- Soil Concentrations in milligrams per kilogram (mg/kg).
- Concentrations exceeding Environmental Screening Limits presented in bold.
- Concentrations below laboratory detection limits presented as ND.

0' 5' 10' 20'

SCALE 1" = 20'

EXCAVATION TO DEPTH OF 13'

EXCAVATION TO DEPTH OF 5'

EXCAVATION TO DEPTH OF 6.5'

Notes:

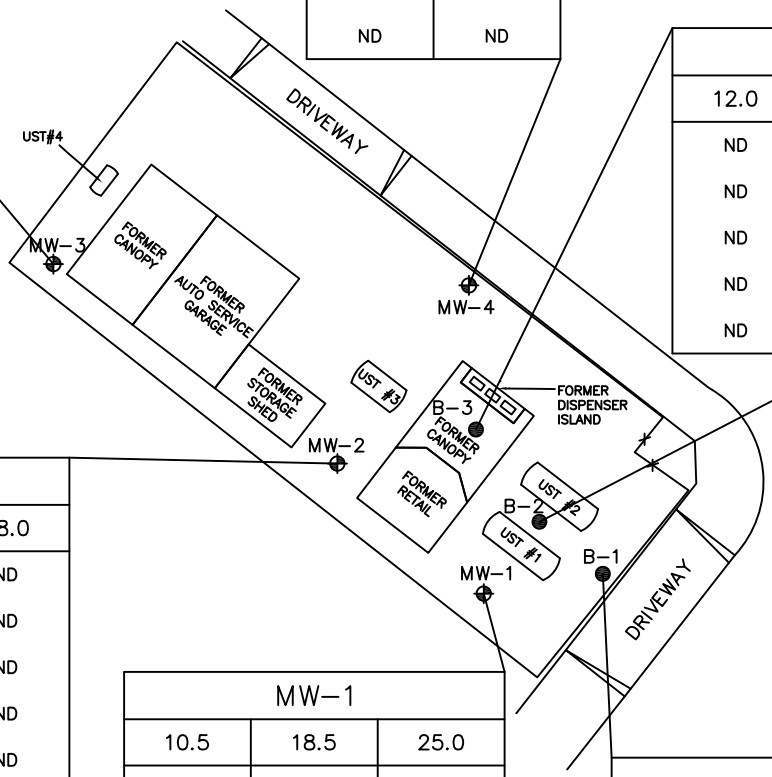
1) Site base map provided by Virgil Chavez Land Surveying on 1/31/2012.
2) Locations of USTs and former Site structures are approximate.
3) Former Site structures were demolished on March 31, 2011.
4) USTs were removed on April 6, 2011.

TITLE: Excavation and Soil Sample Locations
April 2011

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 3



MW-4	
22.0	28.0
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND

MW-3	
22.0	28.0
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND

B-3		
12.0	22.5	28.0
ND	0.686	0.510
ND	ND	ND
ND	ND	ND
ND	ND	ND
ND	ND	ND

B-2		
12.5	22.5	28.0
50.9	31.0	16.2
ND	ND	ND
ND	ND	ND
0.291	0.294	0.163
0.562	0.830	0.448

MW-2		
14.5	20.5	28.0
830.0	94.8	ND
ND	ND	ND
ND	ND	ND
2.510	ND	ND
ND	ND	ND

MW-1		
10.5	18.5	25.0
791.0	0.596	0.383
5.94	0.0032	0.0030
36.2	0.0048	0.0041
12.0	0.0012	0.0011
69.8	0.0050	0.0043

B-1		
11.5	20.5	28.0
0.389	0.379	ND
ND	ND	ND
ND	ND	ND
ND	0.0014	ND
ND	ND	ND

Legend:

- ⌖ - Monitoring Well
- ● - Soil Boring

0' 5' 10' 15' 30'
SCALE 1" = 30'

Well / Boring ID	
Depth	Depth
TPHg	TPHg
Benzene	Benzene
Toluene	Toluene
Ethylbenzene	Ethylbenzene
Xylenes	Xylenes

- Soil Concentrations in milligrams per kilogram (mg/kg).
- Concentrations exceeding Environmental Screening Limits presented in bold.
- Concentrations below laboratory detection limits presented as ND.

Notes:

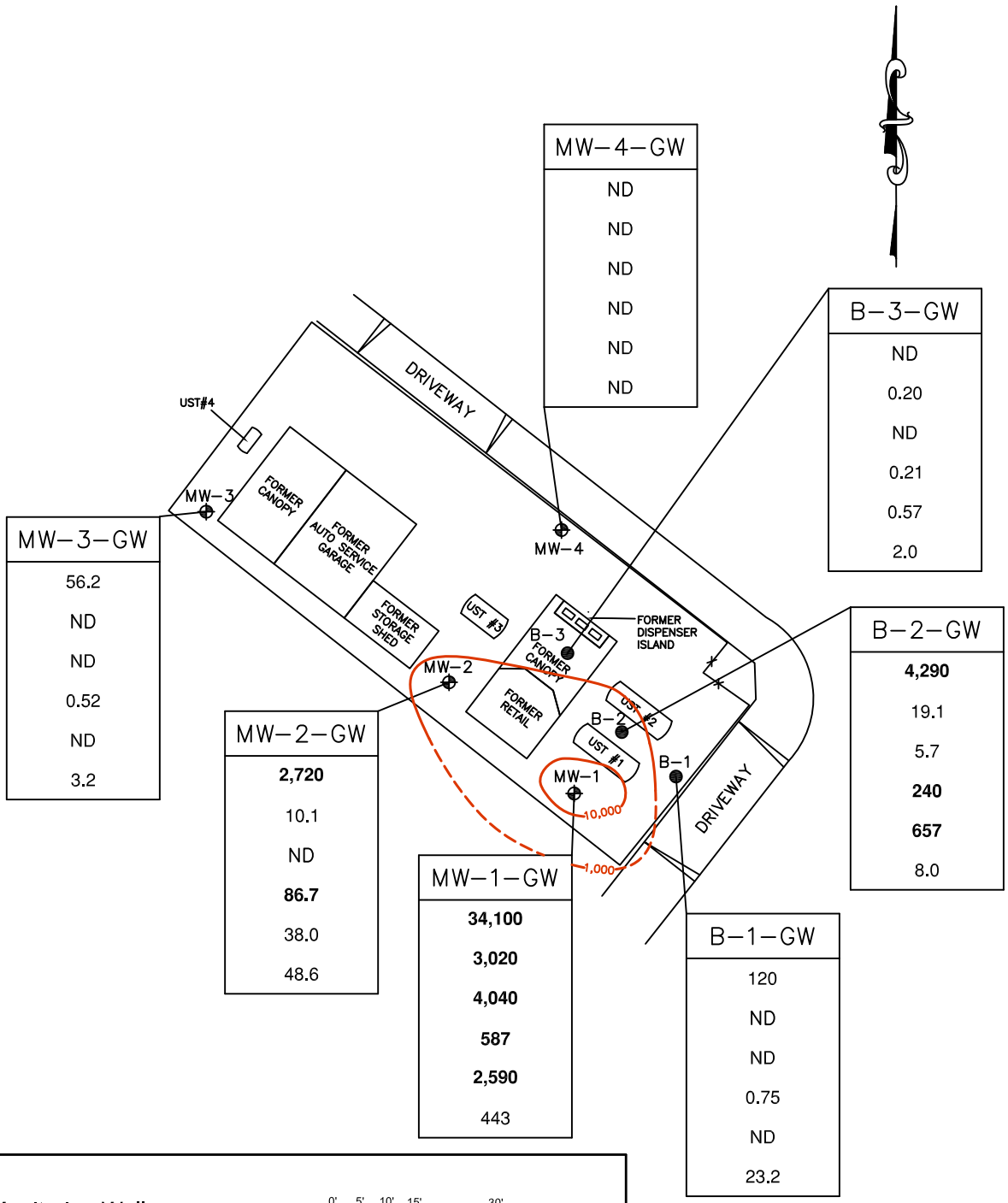
1) Well locations based on survey data provided by Virgil Chavez Land Surveying on 1/31/2012.
2) Locations of USTs and former Site structures are approximate.
3) Former Site structures were demolished on March 31, 2011.
4) USTs were removed on April 6, 2011.

TITLE: Soil Concentration Map
January 2012

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 4



Legend:

- Monitoring Well
- Soil Boring
- 1,000 - TPHg Isocontour (Dashed where inferred)

0' 5' 10' 15' 30'
SCALE 1" = 30'

Well / Boring ID
TPHg
Benzene
Toluene
Ethylbenzene
Xylenes
MTBE

- Grab Groundwater Concentrations in micrograms per liter (ug/L).
- Concentrations exceeding Environmental Screening Limits presented in bold.
- Concentrations below laboratory detection limits presented as ND.

Notes:

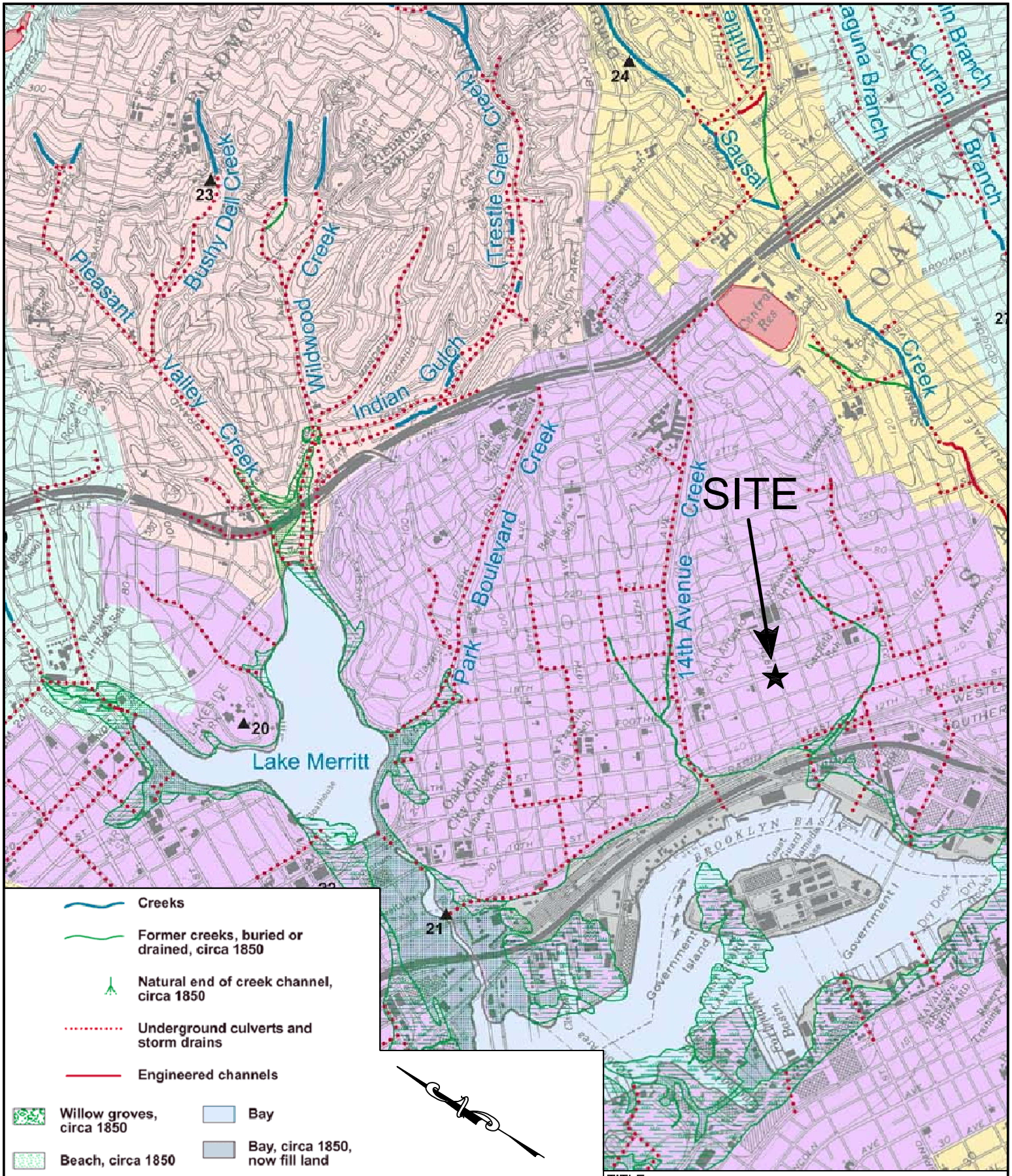
1) Well locations based on survey data provided by Virgil Chavez Land Surveying on 1/31/2012.
2) Locations of USTs and former Site structures are approximate.
3) Former Site structures were demolished on March 31, 2011.
4) USTs were removed on April 6, 2011.

TITLE: Grab Groundwater Concentration Map
January 2012

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 5



Source: Map referenced from Creek & Watershed Map of Oakland & Berkeley (Sowers, J.M., and Richard, C.M., 2009)

TITLE: San Antonio Creek Watershed Map

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

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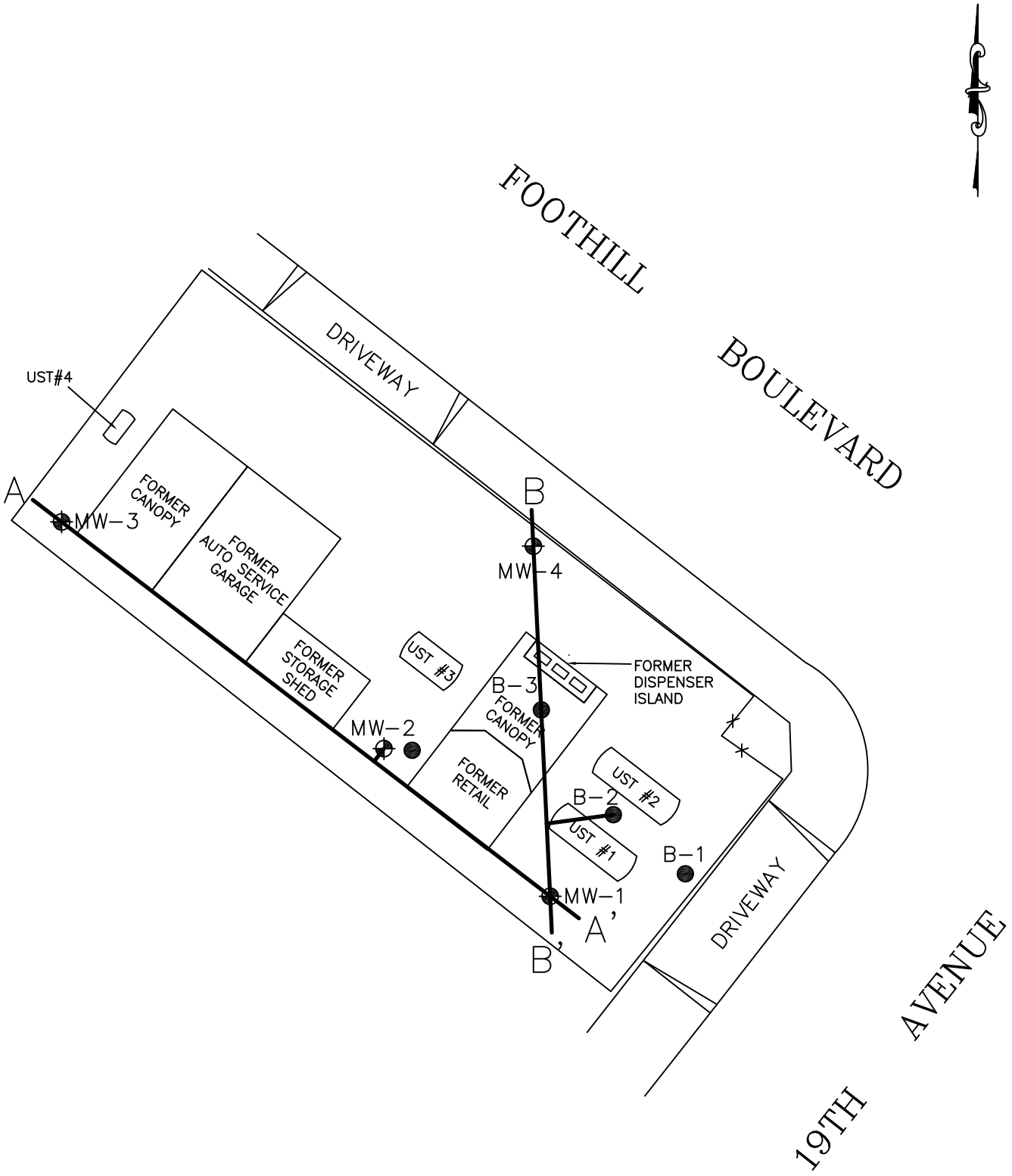
FIGURE: 6



Legend:

- Monitoring Well
- Soil Boring

SCALE 1" = 20'

Notes:

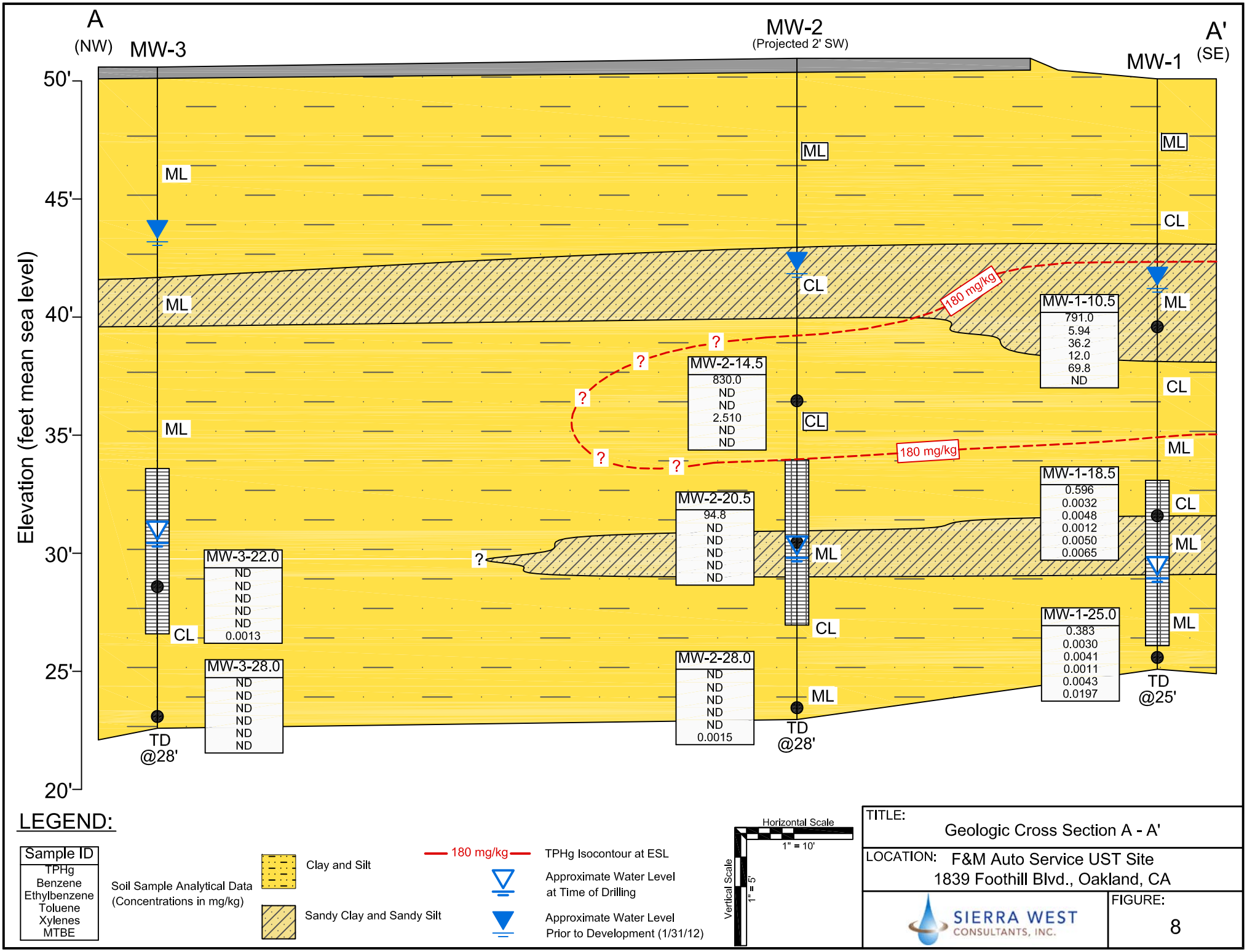
1) Site base map provided by Virgil Chavez Land Surveying on 1/31/2012.
2) Locations of USTs and former Site structures are approximate.
3) Former Site structures were demolished on March 31, 2011.
4) USTs were removed on April 6, 2011.

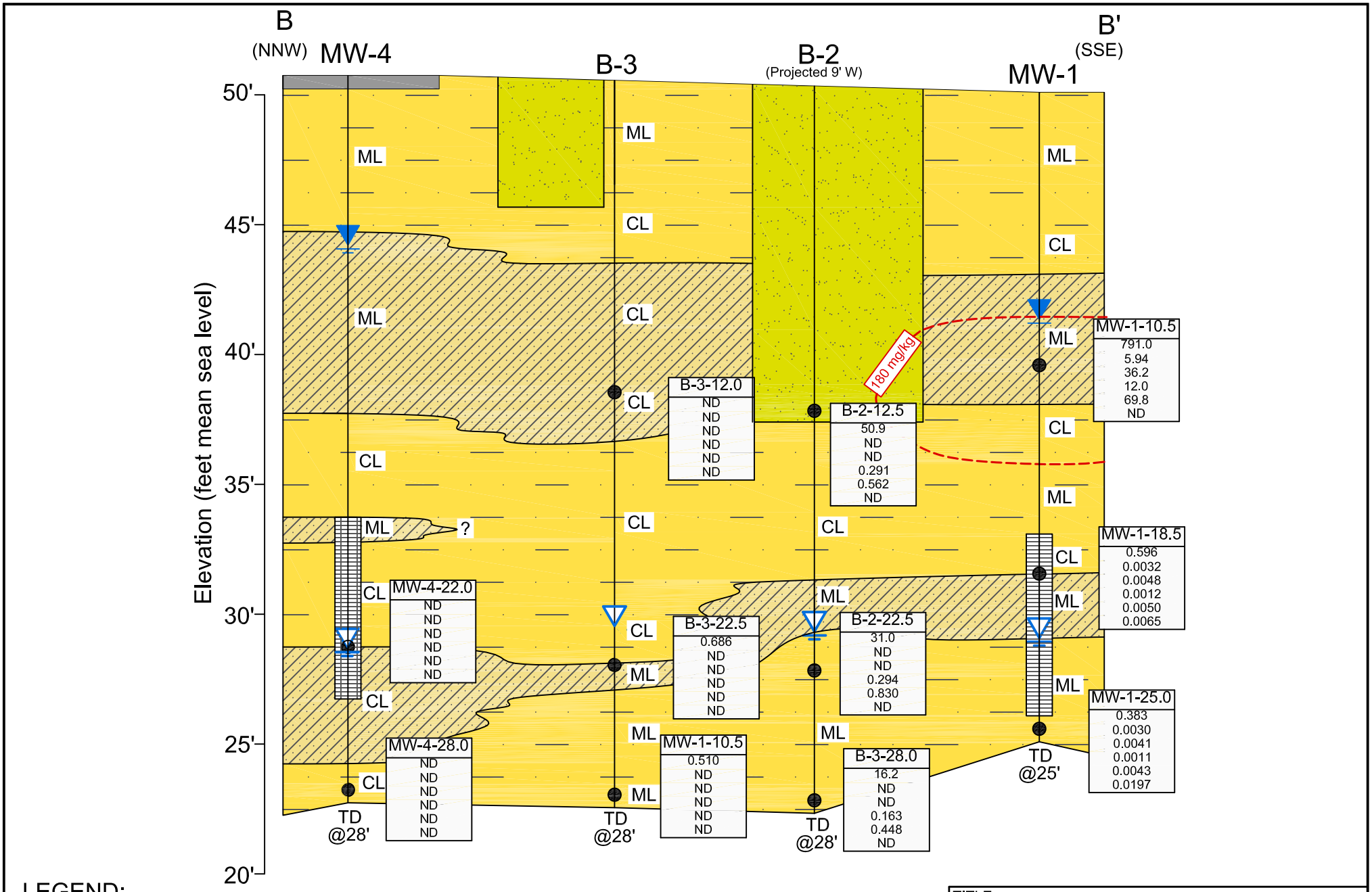
TITLE: Geologic Cross Section Location Map

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 7


A
(NW)
MW-3
MW-2
(Projected 2' SW)
MW-1
A'
(SE)
Elevation (feet mean sea level)
50'
45'
40'
35'
30'
25'
20'
ML
CL
180 mg/kg
?
MW-1-10.5
791.0
5.94
36.2
12.0
69.8
ND
MW-2-14.5
830.0
ND
ND
2.510
ND
ND
MW-1-18.5
0.596
0.0032
0.0048
0.0012
0.0050
0.0065
MW-2-20.5
94.8
ND
ND
ND
ND
ND
MW-3-22.0
ND
ND
ND
ND
ND
0.0013
MW-1-25.0
0.383
0.0030
0.0041
0.0011
0.0043
0.0197
MW-3-28.0
ND
ND
ND
ND
ND
ND
MW-2-28.0
ND
ND
ND
ND
ND
0.0015
TD
@28'
TD
@25'
LEGEND:
Sample ID
TPHg
Benzene
Ethylbenzene
Toluene
Xylenes
MTBE
Soil Sample Analytical Data
(Concentrations in mg/kg)
Clay and Silt
Sandy Clay and Sandy Silt
180 mg/kg
TPHg Isocontour at ESL
Approximate Water Level
at Time of Drilling
Approximate Water Level
Prior to Development (1/31/12)
Horizontal Scale
1" = 10'
Vertical Scale
1" = 5'
TITLE:
Geologic Cross Section A - A'
LOCATION:
F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA
SIERRA WEST
CONSULTANTS, INC.
FIGURE:
8

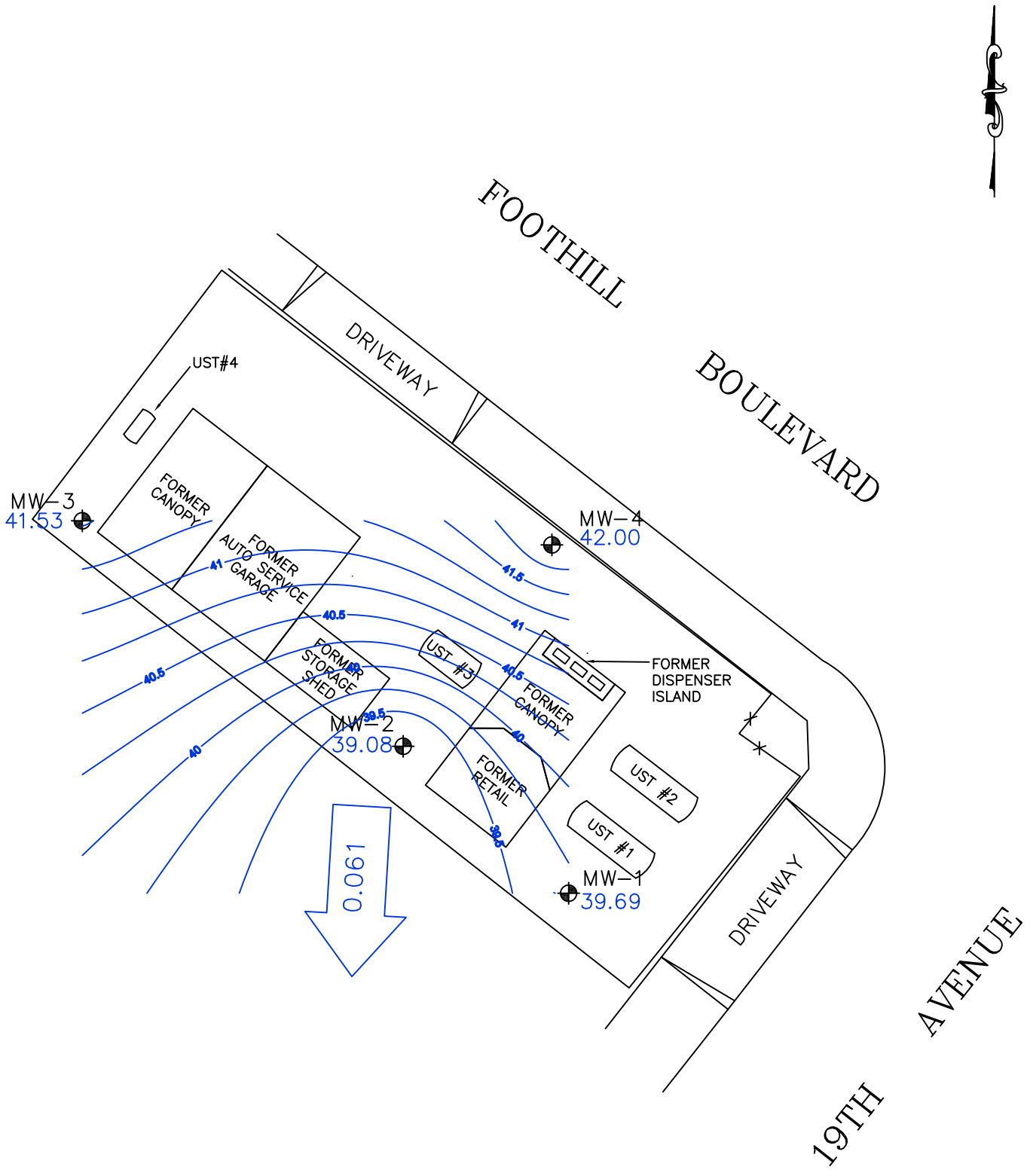


TITLE: Geologic Cross Section B - B'

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 9



Legend:

⊕ - Monitoring Well

0' 5' 10' 15' 30'

SCALE 1" = 30'

Notes:

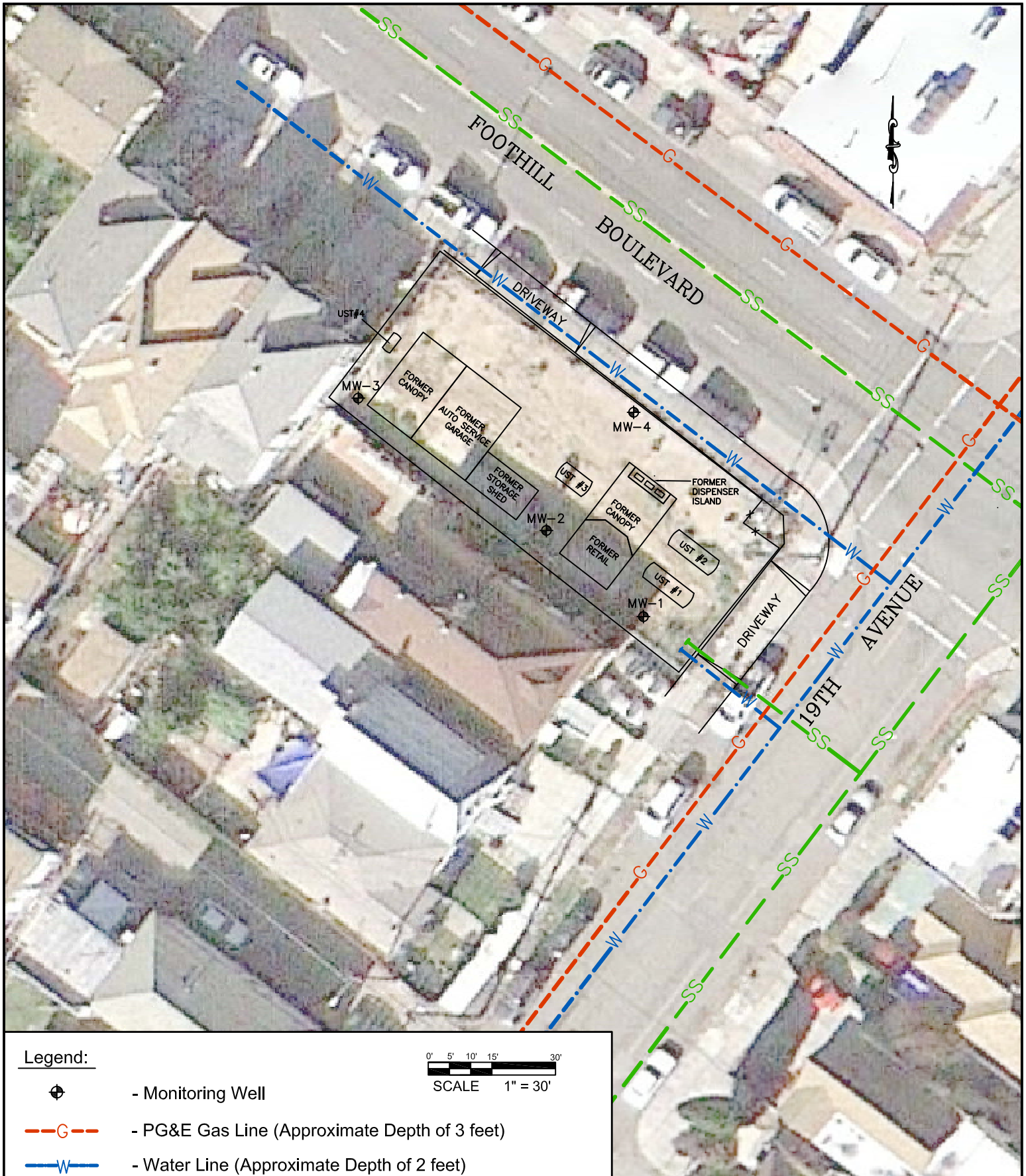
1) Groundwater elevation was measured on July 23, 2012.
2) Well locations based on survey data provided by Virgil Chavez Land Surveying on 1/31/2012.
3) Locations of USTs and former Site structures are approximate.
4) Former Site structures were demolished on March 31, 2011.
5) USTs were removed on April 6, 2011.

TITLE: Groundwater Elevation Map

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 10



Legend:

- Monitoring Well
- G - PG&E Gas Line (Approximate Depth of 3 feet)
- W - Water Line (Approximate Depth of 2 feet)
- SS - Sanitary Sewer Line (Approximate Depth of 8 feet)

SCALE 1" = 30'

Notes:

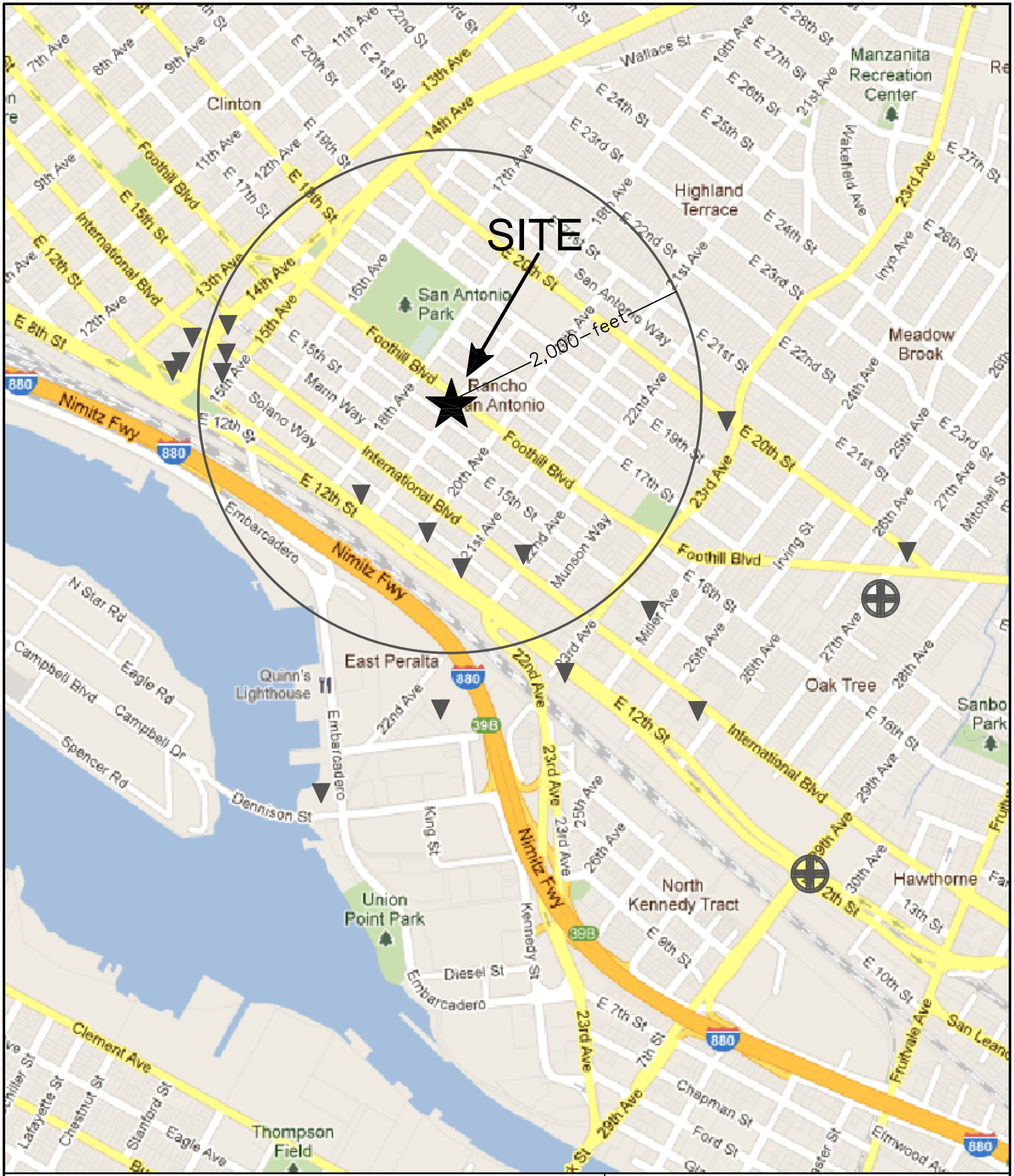
1) Well locations based on survey data provided by Virgil Chavez Land Surveying on 1/31/2012.
2) Locations of USTs and former Site structures are approximate.
3) Former Site structures were demolished on March 31, 2011.
4) USTs were removed on April 6, 2011.
5) Location of subsurface utilities based on survey performed by Precision Locating on January 13, 2012. Utility location performed using RadioDetection RD4-433 HCTX2 Transmitter, RD-8000-PDL Reciever, and Fischer PW-6 metal detector.

TITLE: Subsurface Utility Location Map

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 11



LEGEND:

▼ Environmental Monitoring Well Site (one or more wells per location)

⊕ Private Supply Well

0mi 500 ft 1,000 ft 2,000 ft

SCALE 1" = 1,000 feet
(Scale is approximate)

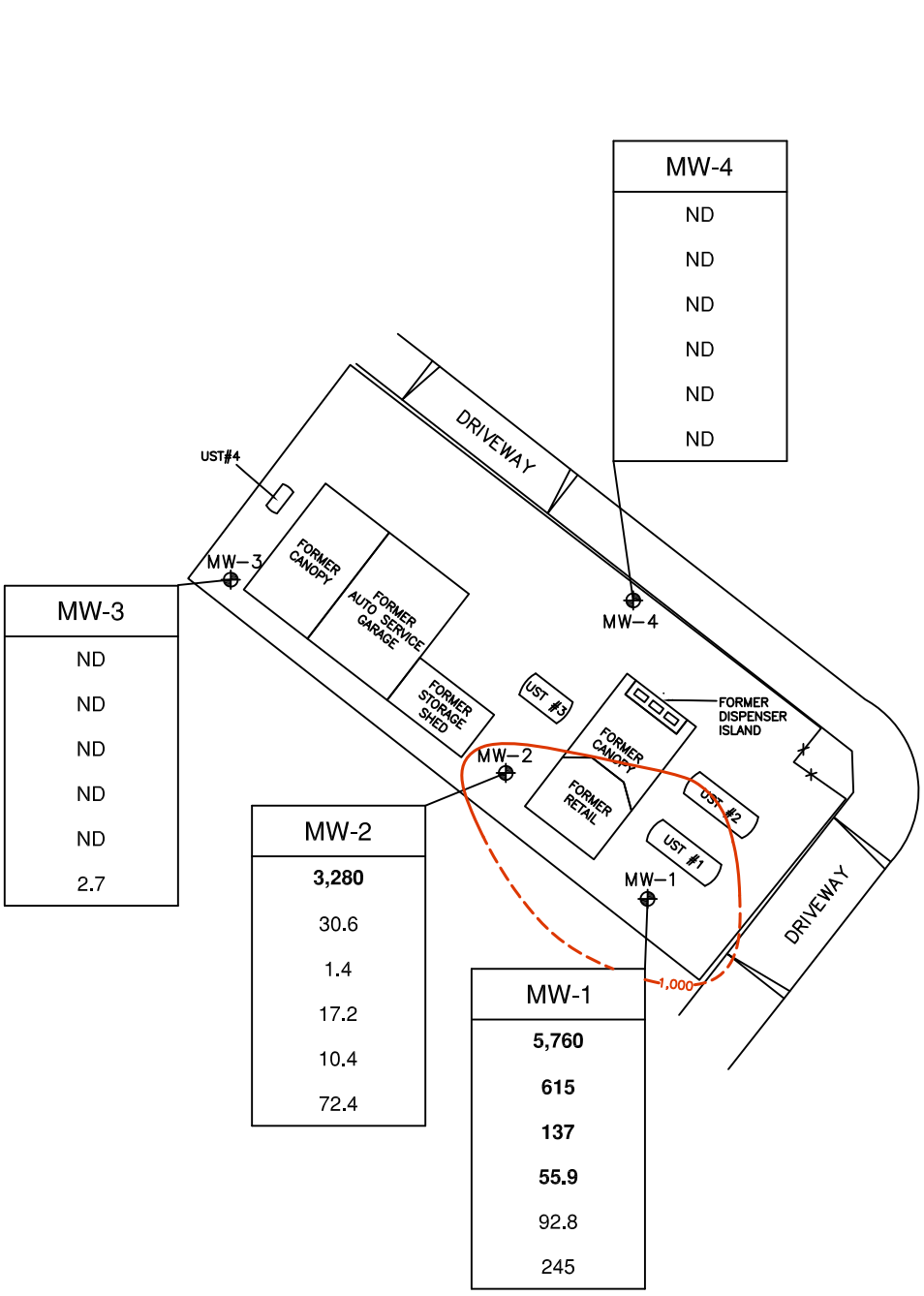
Notes:
- Well search results from California Department of Water Resources, Alameda County Public Works Agency, and GeoTracker Database
- Base Map Source: Google Maps, 2012

TITLE: Well Search Results Map

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 12



Legend:

- Monitoring Well

SCALE 1" = 30'

1,000 - TPHg Isocontour (Dashed where inferred)

Well / Boring ID
TPHg
Benzene
Toluene
Ethylbenzene
Xylenes
MTBE

- Grab Groundwater Concentrations in micrograms per liter (ug/L).
- Concentrations exceeding Environmental Screening Limits presented in bold.
- Concentrations below laboratory detection limits presented as ND.

Notes:

1) Well locations based on survey data provided by Virgil Chavez Land Surveying on 1/31/2012.
2) Locations of USTs and former Site structures are approximate.
3) Former Site structures were demolished on March 31, 2011.
4) USTs were removed on April 6, 2011.

TITLE: Groundwater Concentration Map
July 23, 2012

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 13

Legend:

- Monitoring Well
- Proposed Monitoring Well

SCALE 1" = 30'

Notes:

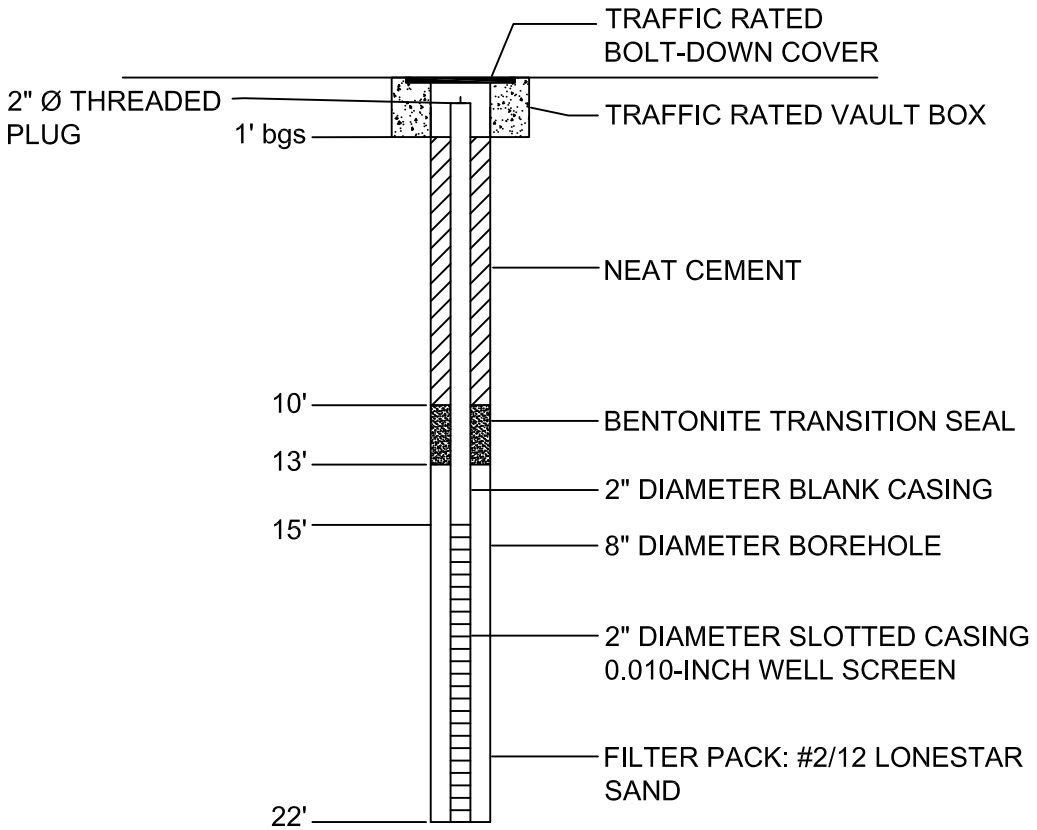
1) Well locations based on survey data provided by Virgil Chavez Land Surveying on 1/31/2012.
2) Locations of USTs and former Site structures are approximate.
3) Former Site structures were demolished on March 31, 2011.
4) USTs were removed on April 6, 2011.

TITLE: Proposed Monitoring Well Locations

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 14



Note: Final total depth and screened interval to be determined by field geologist based on site specific conditions.

TITLE: Proposed Well Construction Details	
LOCATION: F&M Auto Service UST Site 1839 Foothill Blvd., Oakland, CA	
SIERRA WEST CONSULTANTS, INC.	FIGURE: 15

Legend:

- Monitoring Well
- Proposed Vapor Sampling Point

SCALE 1" = 30'

Notes:

1) Well locations based on survey data provided by Virgil Chavez Land Surveying on 1/31/2012.
2) Locations of USTs and former Site structures are approximate.
3) Former Site structures were demolished on March 31, 2011.
4) USTs were removed on April 6, 2011.

TITLE: Proposed Vapor Sampling Locations

LOCATION: F&M Auto Service UST Site
1839 Foothill Blvd., Oakland, CA

SIERRA WEST CONSULTANTS, INC.

FIGURE: 16

Tables

Table 1

Initial Site Conceptual Model

Former F&M Auto Service UST Site
1839 Foothill Boulevard, Oakland, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Geology and Hydrogeology	Regional	The Site is located along the eastern margin of the San Francisco Bay within the East Bay Plain (Hickenbottom and Muir, 1988). The surficial deposits are mapped as Pleistocene alluvial fan and fluvial deposits consisting of poorly sorted, dense, sandy or gravelly clay, and Pleistocene marine terrace deposits (Graymer, 2000). The active northwest trending Hayward fault is located approximately 3½ miles east of the Site. The East Bay Plain is regionally divided into two major groundwater basins: the San Pablo and the San Francisco Basin. These basins are tectonic depressions that are filled primarily with a sequence of coalescing alluvial fans. The San Francisco Basin is further divided into seven sub-areas. The Site is located in the Oakland Sub-Area, which is filled primarily by alluvial deposits that range from 300 to 700 feet thick with no well-defined aquitards (CRWQCB, 1999). Under natural conditions, the direction of groundwater flow in the East Bay Plain is east to west. Groundwater recharge in the shallow aquifer occurs by infiltration from precipitation, irrigation, and stream flow. The Site is located in the San Antonio Creek watershed, where water is drained to the south and southwest into San Antonio Creek; more commonly called the Oakland Estuary, or the Oakland Inner Harbor. The Site does not overlie any former buried or drained creeks, and does not appear to be in a location of significance to the watershed.	None	NA
	Site	The Site is located on a hill that slopes to the southwest with an approximate gradient of 15%. The local geology of the Site has been evaluated using boring logs from this investigation, and from observations made during excavation and removal of the former USTs. The lithology of the site consists primarily of fine-grained clastic sediments such as silts and clays. Layers of sandy silt and sandy clay are present at approximate depths of 10 and 20 feet. A one-foot thick lens of gravelly silt was observed in the MW-4 boring at an approximate depth of 17 feet, but was not observed in any of the other soil borings. At the time of well installation, groundwater was first encountered at approximately 21 feet deep in each boring. Following well installation, groundwater levels rose to approximately eight feet deep. Based on the difference between first encountered and static groundwater levels, and the topographical slope, the aquifer appears confined or semi-confined. Groundwater level measurements have been taken from MW-1 through MW-4 on a quarterly frequency. Groundwater flow across the Site was generally to the south with a relatively steep hydraulic potentiometric gradient of approximately 0.06 ft/ft.	None	NA
Surface Water Bories		The Site is located approximately 2,000 feet northeast of the Brooklyn Basin. The basin is connected to the Oakland Estuary tidal canal which connects to San Leandro Bay to the south and the Oakland Inner Harbor to the west, that connects to San Francisco Bay. The San Francisco Bay is located approximately 5 miles west and 2 miles south of the Site.	None	NA

Table 1

Initial Site Conceptual Model

Former F&M Auto Service UST Site
1839 Foothill Boulevard, Oakland, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Nearby Wells and other Environmental Investigation Sites	Nearby Wells	Well completion reports were received for two privately owned water supply wells, located 3,600 feet and 4,400 feet away from the Site. Based on the results of the well survey, it does not appear that any wells are at risk of being impacted by hydrocarbons from the Site.	None	NA
	Nearby Sites	ACPWA and DWR provided well completion data associated with 16 different environmental investigation sites ranging from 1,100 feet to 3,750 feet away from the F&M Auto Service UST Site. The GeoTracker database was also referenced. The nearest site was listed in the ACPWA data and is located at 1832 E 12th Street, 1,100 feet to the southwest of the Site. The next nearest site is the William Wurzbach Company site that was closed in 2010 and is located 1,300 feet to the south.	It is not anticipated that impacts from the F&M Auto Service Station would have migrated far enough from their source to reach these downgradient sites. However, the downgradient extent of impacts is still unknown.	The downgradient extent of impacts will be assessed by installing additional monitoring wells to the south of MW-1.
Constituents of Concern		The primary constituents of concern (COCs) in soil and groundwater beneath the Site are TPHg, BTEX, and MTBE. Based on the sample results from both the UST removal and the drilling work, contaminant impacts to soil and groundwater appear greatest in the vicinity of former UST#1 and UST#2.	None	NA
Potential Sources	On-Site	There were a total of four USTs at the Site. UST#1 and UST#2 each had a capacity of 1,000-gallons, likely contained unleaded gasoline during operation of the service station, and were located at the southern end of the Site. UST#3 had a capacity of 550-gallons, likely contained leaded gasoline during operation of the service station, and was located in the central portion of the Site. UST#4 had a capacity of 100-gallons, likely contained oil during operation of the service station, and was located at the northern end of the Site. Dispenser islands and associated piping were formerly located on the southern end of the site, in the vicinity of UST#1, UST#2, and UST#3. All of the USTs, dispenser islands, and product piping were removed from March 29 to April8, 2011.	None	NA
	Off-Site	The site is located in an area with mixed land-use, consisting mostly of residential properties with few small businesses to the east and southeast of the site including a restaurant, landromat, and convenience store. Groundwater samples collected from MW-4, located upgradient of the former USTs, do not show evidence of impacts, and it is not likely that there are any relevant off-site sources.	A specific off-site source is not known at this time. It is possible that additional research or investigations will be warranted at a later time, pending the results of future investigations.	NA
Potential Presence of NAPL		Based on the currently available information, there does not appear to be separate-phase product (i.e., LNAPL) in soil or groundwater at the Site. LNAPL was not encountered during excavation, drilling, or well sampling activities. The highest observed concentration of TPHg in groundwater was 34,100µg/L in the grab sample collected from MW-1, well below concentrations normally associated with the presence of LNAPL.	None	NA

Table 1

Initial Site Conceptual Model

Former F&M Auto Service UST Site
1839 Foothill Boulevard, Oakland, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Nature and Extent of Impacts	Extent in Soil	TPHg, benzene, and MTBE impacts are the greatest in the vicinity of the former UST#1, UST#2, and UST#3, as observed in MW-1, MW-2, B-1, and B-2. Significant impacts to soil were not observed upgradient of the former USTs and product piping, or in the vicinity of UST#4.	The extent of soil impacts downgradient of MW-1 are unknown. However, given the fine-grained soil types, soil contamination is not anticipated to be extensive.	The downgradient extent of soil impacts will be assessed by installing additional monitoring wells to the south of MW-1.
	Extent in Groundwater	The greatest constituent concentrations in groundwater have been observed in MW-1. MW-1 is located immediately downgradient of the former location of UST#1 and UST#2, where the highest concentrations were observed during UST removal and excavation. Concentrations of TPHd, TPHg, and BTEX constituents have all exceeded their respective ESLs in samples collected from MW-1. Constituent concentrations exceeding their respective ESLs were also observed in samples collected from MW-2, near the former location of UST#3. Samples collected from MW-3 and MW-4 have not had any constituent concentrations exceeding their respective ESLs. TPHd and MTBE have been detected at low levels in samples from MW-3. No constituents have been detected above laboratory reporting limits in samples collected from MW-4. Groundwater analytical results have been generally consistent with data collected during UST removal in April 2011 and monitoring well installation in January 2012.	The extent of groundwater impacts downgradient of MW-1 are unknown. Constituent migration in groundwater is likely limited by the fine-grained soils, although potentially accelerated by the relatively steep hydraulic gradient.	The downgradient extent of groundwater impacts will be assessed by installing additional monitoring wells to the south of MW-1.
	Extent in Soil Vapor	Soil vapor samples have not been collected, and the presence and extent of impacts is unknown.	Soil vapor samples have not been collected, and the extent of impacts is unknown.	Sierra West proposes collecting samples from ten temporary soil vapor well borings to assess constituent concentrations in soil vapor near the source area.
Migration Pathways	Former Creeks or Channels	Sierra West reviewed the Creek & Watershed Map of Oakland & Berkeley (Sowers, J.M., and Richard, C.M., 2009) to evaluate whether contaminant migration could be affected by the locations of creeks, former creeks, underground culverts, or engineered channels. The Site appears to be located between two former creeks that drain to the west-southwest into the Brooklyn Basin. However each of these creeks is located approximately 1,500 feet away from the Site, in the cross-gradient direction of groundwater flow. Given the relatively fine-grained nature of the subsurface beneath the Site, that inhibits long distance contaminant migration, it is unlikely the creeks would be impacted or have any effect on contaminant migration at the Site.	None	NA
	Buried Utilities	Precision Locating performed the subsurface utility survey using a RadioDetection RD4-433 HCTX2 Transmitter and RD-8000-PDL Reciever. Additionally, a Fischer TW-6 metal detector was used to confirm the locations of subsurface utilities. Results of the survey show that the only utility lines to enter or exit the site are the former water and sewer lines, located in the southern corner of the Site. The water service lateral to the Site has a depth of approximately one foot, and the main pipeline under the street and sidewalk is approximately two feet deep. The sewer service lateral to the Site has a depth of approximately one foot, and the main pipeline under the street is approximately eight feet deep. No other subsurface utilities such as electric, gas, or communications were identified at the Site. The locations of subsurface utilities are shown on Figure 4. The petroleum hydrocarbon impacts identified in the vicinity of former UST#1 occur deeper in the subsurface than the water and sewer pipelines, therefore, these utilities do not serve as a conduit for constituent migration.	Contaminant migration along subsurface is not considered to be significant, as the depth of utility pipelines near the source area are approximately 2 to 3 ft bgs, and the depth to contamination is greater than 10 ft bgs.	NA

Table 1

Initial Site Conceptual Model

Former F&M Auto Service UST Site
1839 Foothill Boulevard, Oakland, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Potential Receptors / Risk	On-Site	The Site is currently an unoccupied, vacant lot surrounded by a fence. The property iz zoned as vacant commercial land. Future receptors at the site could include the following: - Future construction worker via soil, groundwater, and soil vapor. - Future resident via vapor intrusion to indoor air. - Future maintenance worker via soil and soil vapor.	Potential impacts to on-Site receptors are not known.	Human health risks will be calculated following additional data collection and site characterization.
	Off-Site	There are several residences to the south, west, and east of the Site, and it is unknown whether impacts from the Site have migrated beneath them.	Groundwater samples have not been collected downgradient, and the extent of impacts is unknown.	Depending on the proposed groundwater investigation results, additional investigations may be warranted.

Abbreviations

µg/L = micrograms pet liter
ESLs = Environmental Screening Limits
ft bgs = feet below ground surface
ft/ft = feet per foot
LNAPL = Light non-aqueous phase liquid
NAPL = Non-aqueous phase liquid

Table 2

Data Gaps and Proposed Investigation

Former F&M Auto Service UST Site
1839 Foothill Boulevard, Oakland, California

Item	Data Gap	Proposed Investigation	Rationale	Analysis
1	Evaluate the extent of impacts to soil and groundwater downgradient of the source area and MW-1.	Drill and install three monitoring wells to the south and southwest of MW-1. Wells will be installed and constructed similar to existing wells at the Site. Collect soil and grab groundwater samples from each well during installation.	The highest constituent concentrations have been observed in MW-1, located downgradient of the former USTs. Additional investigation is warranted to evaluate the extent of contaminant migration downgradient of the source area.	Soil and groundwater samples will be analyzed for TPHg, TPHd, BTEX constituents, MTBE, DIPE, ETBE, TAME, and TBA.
2	Evaluate the extent of impacts to soil vapor in the source area.	Sierra West proposes collecting samples from ten temporary soil vapor well borings to assess constituent concentrations in soil vapor near the source area.	Soil vapor samples have not been collected, and the extent of impacts is unknown.	Soil vapor samples will be analyzed for TPHg, BTEX constituents, MTBE, DIPE, ETBE, TAME, and TBA. Atmospheric gases (O2, CO2, CH4) and isobutylene (tracer gas) will also be analyzed.
3	Evaluate human health risks to future on-Site receptors such as construction workers, residents, and maintenance workers.	Human health risks will be calculated following additional data collection and site characterization.	Further evaluation is warranted prior to performing human health risk calculations.	NA

Abbreviations

USTs = Underground storage tanks
TPHg = Total petroleum hydrocarbons as gasoline
TPhd = Total petroleum hydrocarbons as diesel
BTEX constituents = Benzene, toluene, ethylbenzene, and xylenes
MTBE = Methyl tertiary butyl ether
DIPE = Diisopropyl ether
ETBE = Ethyl tertiary butyl ether
TAME = Tertiary amyl methyl ether
TBA = Tertiary butyl alcohol
O2 = Oxygen
CO2 = Carbon dioxide
CH4 = Methane

Table 3
Summary of UST Removal Soil Sample Analytical Data
Former F&M Auto Service Station
1839 Foothill Boulevard
Oakland, California

Sample ID	Date Collected	Depth	TPHg (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	MTBE (mg/kg)	Total Lead (mg/kg)
Samples from UST#1 and UST#2 excavation									
1A	4/6/2011	13'	**1,990**	<7.1	<7.1	**46.2**	**159**	<4.8	71.2
1B	4/6/2011	13'	**456**	<1.5	<1.5	1.82 (1)	10.7	<0.970	28.8
1S	4/7/2011	11'	**212**	<0.500	1.98	**4.78**	**23.4**	<0.330	7.1
2A	4/6/2011	13'	19.4	<0.093	<0.093	<0.093	<0.250	<0.062	4.5
2B	4/6/2011	13'	87.5	<0.240	<0.240	0.293 (1)	<0.640	<0.160	12.0
2S	4/7/2011	11'	98	<0.240	<0.240	1.42	2.08	<0.160	6.9
Samples from UST#3 excavation									
3A	4/7/2011	13'	**378**	<0.910	<0.910	4.48	8.5	<0.610	9.3
3B	4/7/2011	13'	0.857	<0.0025	<0.0025	0.0028 (1)	<0.0067	0.0154	6.3
3SE	4/7/2011	11'	0.187	<0.0015	<0.0015	<0.0015	<0.0039	0.0156	3.7
3SW	4/7/2011	11'	56.4	<0.090	<0.090	0.449	1.02	<0.060	6.4
Samples from UST#4 excavation									
4A	4/6/2011	6.5'	0.0989 (1)	<0.0015	<0.0015	<0.0015	0.0107	<0.00099	8.2
4B	4/6/2011	6.5'	7.26	<0.072	0.0788 (1)	0.109 (1)	0.685	<0.048	37.5
4SE	4/6/2011	4.5'	<0.049	<0.0015	<0.0015	<0.0015	<0.0039	<0.00097	13.7
4SW	4/6/2011	4.5'	0.671	0.0053	0.0239	0.0095	0.169	<0.00097	40.1
Samples from bottom of fuel line excavation									
FL-1	4/7/2011	5'	<0.049	<0.0015	<0.0015	<0.0015	<0.0039	<0.00098	17.0
FL-2	4/7/2011	5'	<0.048	<0.0014	<0.0014	<0.0014	<0.0038	<0.00096	5.0
Soil samples from bottom of dispenser island excavation									
DI-1	4/7/2011	5'	<0.049	<0.0015	<0.0015	<0.0015	<0.0039	<0.00098	18.1
DI-2	4/7/2011	5'	<0.049	<0.0015	<0.0015	<0.0015	<0.0039	<0.00099	7.6
Environmental Screening Limits [2]			**180**	**0.27**	**9.3**	**4.7**	**11**	**8.4**	**750**

Notes:

(1) = Laboratory J-Flag below reporting limit/Estimated Value
(2) = Environmental Screening Limits referenced from *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Table B (*California Regional Water Quality Control Board San Francisco Bay Region, May 2008), for shallow soils on commercial land use sites where groundwater is not a current or potential source of drinking water

TPHg = Total petroleum hydrocarbons as gasoline
MTBE = Methyl tert-butyl ether
(mg/kg) = milligrams per kilogram

*Values presented in bold letters are above applicable Environmental Screening Limits

TABLE 4
Soil Analytical Data Summary
Former F&M Auto Service UST Site
1839 Foothill Boulevard, Oakland, California

SAMPLE LOCATION	SAMPLE DEPTH (feet)	SAMPLE DATE	TPHd (mg/kg)	TPHg (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL-BENZENE (mg/kg)	XYLENES (mg/kg)	OXYGENATES					LEAD (mg/kg)
									MTBE (mg/kg)	DIPE (mg/kg)	ETBE (mg/kg)	TAME (mg/kg)	TBA (mg/kg)	
MW-1	10.5	1/24/2012	81.8	**791.0**	**5.94**	**36.2**	**12.0**	**69.8**	<5.0	<5.0	<5.0	<5.0	<40	5.6
	18.5	1/24/2012	<10	0.596	0.0032 [1]	0.0048 [1]	0.0012 [1]	0.0050 [1]	0.0065	<0.0050	<0.0050	<0.0050	<0.040	3.0
	25.0	1/24/2012	<10	0.383	0.0030 [1]	0.0041 [1]	0.0011 [1]	0.0043 [1]	0.0197	<0.0049	<0.0049	<0.0049	<0.039	5.5
MW-2	14.5	1/23/2012	70.60	**830.0**	<4.100	<4.100	2.510	<8.300	<4.100	<4.100	<4.100	<4.100	<33.000	7.5
	20.5	1/23/2012	7.94 [1]	94.8	<0.490	<0.490	<0.490	<0.970	<0.490	<0.490	<0.490	<0.490	<3.900	5.6
	28.0	1/23/2012	<10	<0.100	<0.0050	<0.0050	<0.0050	<0.010	0.0015 [1]	<0.0050	<0.0050	<0.0050	<0.040	6.6
MW-3	22.0	1/23/2012	<10	<0.098	<0.0049	<0.0049	<0.0049	<0.0098	0.0013 [1]	<0.0049	<0.0049	<0.0049	<0.039	6.1
	28.0	1/23/2012	<10	<0.099	<0.0050	<0.0050	<0.0050	<0.0099	<0.0050	<0.0050	<0.0050	<0.0050	<0.040	4.9
MW-4	22.0	1/23/2012	<10	<0.100	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.040	5.0
	28.0	1/23/2012	<10	<0.100	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.040	5.0
B-1	11.5	1/23/2012	<10	0.389	<0.0050	<0.0050	<0.0050	<0.010	0.0040 [1]	<0.0050	<0.0050	<0.0050	0.0135	7.2
	20.5	1/23/2012	<10	0.379	<0.0050	<0.0050	0.0014 [1]	<0.0099	0.0056	<0.0050	<0.0050	<0.0050	<0.040	4.2
	28.0	1/23/2012	<10	<0.099	<0.0050	<0.0050	<0.0050	<0.0099	<0.0050	<0.0050	<0.0050	<0.0050	<0.040	7.7
B-2	12.5	1/23/2012	20.5	50.9	<0.320	<0.320	0.291	0.562	<0.320	<0.320	<0.320	<0.320	<2.600	1.9
	22.5	1/23/2012	3.74 [1]	31.0	<0.220	<0.220	0.294	0.830	<0.220	<0.220	<0.220	<0.220	<1.700	6.5
	28.0	1/23/2012	4.23 [1]	16.2	<0.250	<0.250	0.163 [1]	0.448 [1]	<0.250	<0.250	<0.250	<0.250	<2.000	9.9
B-3	12.0	1/23/2012	<10	<0.098	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.0049	<0.0049	<0.0049	<0.039	3.5
	22.5	1/23/2012	8.06 [1]	0.686 [2]	<0.0050	<0.0050	<0.0050	<0.0100	<0.0050	<0.0050	<0.0050	<0.0050	<0.040	4.8
	28.0	1/23/2012	3.49 [1]	0.510 [2]	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.0049	<0.0049	<0.0049	<0.039	4.8
Environmental Screening Limits [4]			**180**	**180**	**0.27**	**9.3**	**4.7**	**11**	**8.4**	**-- [3]**	**-- [3]**	**-- [3]**	**110**	**750**

Notes:

[1] = Estimated value.
[2] = Not a typical gasoline pattern.
[3] = ESL not established for this constituent
[4] = Environmental Screening Limits referenced from Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Table B (California Regional Water Quality Control Board San Francisco Bay Region, May 2008), for shallow soils on commercial land use sites where groundwater is not a current or potential source of drinking water.

*Values presented in bold letters are above applicable Environmental Screening Limits

TPHd = Total petroleum hydrocarbons as diesel
TPHg = Total petroleum hydrocarbons as gasoline
MTBE = Methyl tertiary butyl ether
DIPE = Diisopropyl ether
ETBE = Ethyl tertiary butyl ether
TAME = Tert-amyl methyl ether
TBA = Tert Butanol
(mg/kg) = milligrams per kilogram

TABLE 5
Grab Groundwater Analytical Data Summary
Former F&M Auto Service UST Site
1839 Foothill Boulevard, Oakland, California

SAMPLE LOCATION	SAMPLE DATE	TPHd (µg/L)	TPHg (µg/L)	BENZENE (µg/L)	TOLUENE (µg/L)	ETHYL-BENZENE (µg/L)	XYLENES (µg/L)	OXYGENATES					LEAD (µg/L)
								MTBE (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	TBA (µg/L)	
MW-1	1/24/2012	**4,650**	**34,100**	**3,020**	**4,040**	**587**	**2,590**	443	<200	<200	<200	<1,000	<10
MW-2	1/23/2012	**2,580**	**2,720**	10.1	<10	**86.7**	38.0	48.6	<20	<20	<20	<100	<10
MW-3	1/23/2012	**645**	56.2	<1.0	<1.0	0.52	<2.0	3.2	<2.0	<2.0	<2.0	<10	-- [2]
MW-4	1/23/2012	67.6 [1]	<50	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<2.0	<2.0	<10	<10
B-1	1/23/2012	143	120	<1.0	<1.0	0.75 [1]	<2.0	23.2	<2.0	<2.0	<2.0	<10	<10
B-2	1/23/2012	**1,580**	**4,290**	19.1	5.7 [1]	**240**	**657**	8.0 [1]	<20	<20	<20	<100	<10
B-3	1/23/2012	**199**	<50	0.20 [1]	<1.0	0.21 [1]	0.57 [1]	2.0	<2.0	<2.0	<2.0	<10	<10
Environmental Screening Limits [4]		**180**	**180**	**46**	**130**	**43**	**100**	**1,800**	**-- [3]**	**-- [3]**	**-- [3]**	**18,000**	**2.5**

Notes:

[1] = Estimated value.
[2] = Sample not analyzed due to laboratory error in sample bottles supply.
[3] = ESL not established for this constituent
[4] = Environmental Screening Limits referenced from Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Table B (California Regional Water Quality Control Board San Francisco Bay Region, May 2008), for shallow soils on commercial land use sites where groundwater is not a current or potential source of drinking water

*Values Presented in bold letters are above applicable Environmental Screening Limits

TPHd = Total petroleum hydrocarbons as diesel
TPHg = Total petroleum hydrocarbons as gasoline
MTBE = Methyl tertiary butyl ether
DIPE = Diisopropyl ether
ETBE = Ethyl tertiary butyl ether
TAME = Tert-amyl methyl ether
TBA = Tert Butanol
(µg/L) = micrograms per liter

TABLE 6
GROUNDWATER ELEVATION AND ANALYTICAL RESULTS
Former F&M Auto Service UST Site
1839 Foothill Boulevard, Oakland, California

SAMPLE LOCATION (TOC Elevation) [1]	DATE SAMPLED	DEPTH TO WATER (ft. bgs)	GROUND-WATER ELEVATION (ft. msl)	TPHd (µg/L)	TPHg (µg/L)	BENZENE (µg/L)	TOLUENE (µg/L)	ETHYL-BENZENE (µg/L)	XYLENES (µg/L)	OXYGENATES					LEAD (µg/L)
										MTBE (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	TBA (µg/L)	
MW-1	1/31/2012	8.73	40.98	**2,220**	**27,800**	**2,750**	**3,470**	**577**	**2,840**	507	<100	<100	<100	<500	**86.4**
49.71	4/20/2012	6.45	43.26	**802**	**11,100**	**2,280**	**795**	**207**	**544**	563	<100	<100	<100	<500	**10.5**
	7/23/2012	10.02	39.69	**262**	**5,760**	**615**	**137**	**55.9**	92.8	245	<20	<20	<20	<100	<10
MW-2	1/31/2012	8.97	41.56	**1,120**	**3,390**	38.8	2.8 [2]	7.6 [2]	9.5 [2]	116	<20	4.5 [2]	<20	<100	**63.5**
50.53	4/20/2012	7.27	43.26	**743**	**5,000**	**64.1**	2.6 [2]	36.3	27.1	115	<10	4.6 [2]	<10	<50	<10
	7/23/2012	11.45	39.08	**603**	**3,280**	30.6	1.4 [2]	17.2	10.4	72.4	<10	2.6 [2]	<10	<50	<10
MW-3	1/31/2012	7.25	43.34	**324**	<50	<1.0	<1.0	<1.0	<2.0	6.1	<2.0	<2.0	<2.0	<10	**14.1**
50.59	4/20/2012	6.65	43.94	123	<50	<1.0	<1.0	<1.0	<2.0	4.7	<2.0	<2.0	<2.0	<10	<10
	7/23/2012	9.06	41.53	87.6 [2]	<50	<1.0	<1.0	<1.0	<2.0	2.7	<2.0	<2.0	<2.0	<10	<10
MW-4	1/31/2012	6.52	43.95	50.2 [2]	<50	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<2.0	<2.0	<10	<10
50.47	4/20/2012	5.62	44.85	45.5 [2]	<50	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<2.0	<2.0	<10	<10
	7/23/2012	8.47	42.00	<94	<50	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<2.0	<2.0	<10	<10
Environmental Screening Limits [3]				180	180	46	130	43	100	1,800	--	--	--	18,000	2.5

Notes:

[1] = Wells surveyed by Virgil Chavez Land Surveying on 1/31/2012.
[2] = Estimated value
[3] = Environmental Screening Limits referenced from *Screening for Environmental Concerns at Sites ith Contaminated Soil and Groundwater*, Table B (California Regional Water Quality Control Board, San Francisco Bay Region, May 2008), for shallow soils on commercial land use sites where groundater is not a current or potential source of drinking water. Concentrations exceeding their respective ESLs are presented in **bold**.

ft. bgs = Feet below ground surface (measured from top of casing)
ft. msl = Feet above mean sea level
µg/L = Micrograms per liter

TPHd = Total petroleum hydrocarbons as diesel
TPHg = Total petroleum hydrocarbons as gasoline
MTBE = Methyl tertiary butyl ether
DIPE = Diisopropyl ether
ETBE = Ethyl tertiary butyl ether
TAME = Tert-amyl methyl ether
TBA = Tert butanol
LEAD = Dissolved lead

Table 7
Summary of Well Search Results
Former F&M Auto Service Station
1839 Foothill Boulevard, Oakland, California

Monitoring Well Sites				
Site Name	**Site Address**	**Active**	**Distance from F&M Site**	**Direction from F&M Site**
Unknown	1832 E 12TH Street OAKLAND, CA 94606	Unknown	1,100 feet	Southwest
WILLIAM WURZBACH COMPANY	1200 20TH OAKLAND, CA 94606	Closed	1,300 feet	South
EXXON #7-7516 / CONTINENTAL AUTO SALES	2200 INTERNATIONAL OAKLAND, CA 94606	Closed	1,500 feet	South-Southeast
SHELL STATION	2142 E 12TH STREET OAKLAND, CA 94601	Closed	1,500 feet	South-Southeast
Unknown	1518 E 12TH STREET OAKLAND, CA 94601	Unknown	1,600 feet	West
General Tire	1201 14TH AVE OAKLAND, CA 94601	Open	1,700 feet	West
Davlin Paint Company	1401 14TH AVE OAKLAND, CA 94601	Closed	1,750 feet	West-Northwest
City of Oakland Cleanup Site SLT2O134140	1235 14TH STREET OAKLAND, CA 94601	Open	2,050 feet	West
Foss Lampshade Studios	1353 E 14TH STREET OAKLAND, CA 94601	Open	2,050 feet	West-Northwest
CHURCH OF GOD	1951 23RD AVE OAKLAND, CA 94606	Unknown	2,100 feet	East
MEL SENNA BRAKE SERVICE	2301 E 12TH STREET OAKLAND, CA 94601	Open	2,200 feet	South-Southeast
TAXI TAXI INC	2345 INTERNATIONAL OAKLAND, CA 94601	Open	2,320 feet	South-Southeast
KILPATRICKS BAKERY	2100 LIVINGSTON OAKLAND, CA 94606	Closed	2,525 feet	South-Southeast
STANDARD BRANDS PAINT	2530 E 14TH STREET OAKLAND, CA 94601	Closed	3,100 feet	Southeast
PORT OF OAKLAND EMBARCDERO COVE	2000 EMBARCADERO OAKLAND, CA 94607	Open	3,250 feet	South-Southwest
STOP N GO #1006	2710 FOOTHILL OAKLAND, CA 94601	Closed	3,750 feet	East-Southeast

Private Supply Wells				
Well Name / ID	**Well Address / Location**	**Currently In Use**	**Distance from F&M Site**	**Direction from F&M Site**
PRIVATE WELL #1	1754 27TH AVE OAKLAND, CA 94601	Unknown	3,600 feet	East-Southeast
PRIVATE WELL #2	29TH AVE & E 14TH AVE OAKLAND, CA 94601	Unknown	4,400 feet	Southeast

Appendix A

Boring Logs

SIERRA WEST CONSULTANTS, INC.

PROJECT NAME:	**Former F&M Auto Service UST Site**	**LOG OF BORING:**	**B-1**
SITE ADDRESS:	1839 Foothill Boulevard Oakland, California	BOREHOLE DIAM. (in): MONITORING WELL DIAM. (in):	2 N/A
DATE STARTED: DATE COMPLETED:	January 23, 2012 January 24, 2012	DRILLER/COMPANY:	Bobby Deason Gregg Drilling and Testing C-57# 485165
DRILLING METHOD:	Drilled and Sampled using 2"-Diameter Direct Push	GEOLOGIST/ENGINEER:	B. Whalen Sierra West Consultants, Inc.

DEPTH (Feet)	Sample Interval	Recovery (%)	PID (ppm)	SAMPLE NUMBER	USCS SYMBOL	DESCRIPTION	Well Construction	DEPTH (Feet)
0	HAND AUGER		0.0 0.0 0.0		ML	**SILT:** 90% silt, non-plastic, soft, moist, dark brown (7.5YR 3/2). 10% fine sand.		0
						4.5'		
					CL	**CLAY:** 100% clay, medium-plasticity, stiff, moist, dark greenish gray (GLEY1 4/5GY)		
5	Direct Push	100%	0.0 0.0 0.2			5.5' **SILT:** 90% silt, non-plastic, medium-stiff, moist, yellowish brown (10YR 5/4). 10% fine sand.		5
	Direct Push	100%	7.4 8.4			@8.5' - 10% fine, sub-angular gravel.		
						9.5'		
10	Direct Push	100%	2.4 44.2	B-1-11.5	CL	**CLAY WITH SAND:** 80% clay, medium-plasticity, stiff, moist, dark greenish gray (GLEY1 4/10Y). 20% fine sand.		10
	Direct Push	100%	6.8 36.6 0.3			14.5'		
15	Direct Push	100%	0.0 1.2 3.6 0.0		CL	**CLAY:** 100% clay, high-plasticity, stiff, moist, dark greenish gray (GLEY1 4/10Y).		15
			0.0			20.5'		
20	Direct Push	100%	0.0	B-1-20.5	ML	**SILT:** 90% silt, non-plastic, soft, moist, light yellowish brown (2.5Y 6/3). 10% fine sand.		20
			0.0 0.0 0.0 0.0			@21' - Soil becomes wet.		
25	Direct Push	100%	0.0 0.0					25
			0.0	B-1-28.0				
						Geologist Terminated Boring at 28' - Target Depth Achieved First encountered groundwater at depth of 21'		
30						Boring backfilled with neat cement grout via tremmie pipe.		30

SIERRA WEST CONSULTANTS, INC.

PROJECT NAME:	**Former F&M Auto Service UST Site**	**LOG OF BORING:**	**B-2**
SITE ADDRESS:	1839 Foothill Boulevard Oakland, California	BOREHOLE DIAM. (in): MONITORING WELL DIAM. (in):	2 N/A
DATE STARTED: DATE COMPLETED:	January 23, 2012 January 24, 2012	DRILLER/COMPANY:	Bobby Deason Gregg Drilling and Testing C-57# 485165
DRILLING METHOD:	Drilled and Sampled using 2"-Diameter Direct Push	GEOLOGIST/ENGINEER:	B. Whalen Sierra West Consultants, Inc.

DEPTH (Feet)	Sample Interval	Recovery (%)	PID (ppm)	SAMPLE NUMBER	USCS SYMBOL	DESCRIPTION	Well Construction	DEPTH (Feet)
0	HAND AUGER		0.0		SW	**WELL GRADED SAND WITH SILT (UST EXCAVATION BACKFILL MATERIAL):** 85% sand, fine- to medium-grained, loose, wet, brown (7.5YR 4/5). 15% silt, non-plastic.		0
			0.0					
			0.0					
5	Direct Push	100%	0.0					5
			0.0					
			0.0					
	Direct Push	NR						
10								10
		25%	0.0			12.5'		
	Direct Push	100%	16.0	B-2-12.5	CL	**CLAY:** 100% clay, high-plasticity, stiff, moist, greenish gray (GLEY1 5/10Y).		
			0.5					
			0.3					
15			0.0					15
	Direct Push	NR				19'		
		25%	1.6		ML	**SANDY SILT:** 60% silt, non-plastic, stiff, moist, dark greenish gray (GLEY1 4/10Y). 40% sand, fine- to medium-grained, mostly medium, sub-angular. Few fine sub-rounded gravel, with max size of 3/4" at depth of 20'		
20			3.2			21'		20
	Direct Push	100%	2.2		ML	**SILT:** 90% silt, non-plastic, medium stiff, wet, greenish gray (GLEY1 5/10Y). 10% fine sand.		
			24.8	B-2-22.5				
			18.6					
25	Direct Push	NR						25
		25%	0.0	B-2-28.0				
						Geologist Terminated Boring at 28' - Target Depth Achieved First encountered groundwater at depth of 21'		
30						Boring backfilled with neat cement grout via tremmie pipe.		30

SIERRA WEST CONSULTANTS, INC.

PROJECT NAME:	**Former F&M Auto Service UST Site**	**LOG OF BORING:**	**B-3**
SITE ADDRESS:	1839 Foothill Boulevard Oakland, California	BOREHOLE DIAM. (in): MONITORING WELL DIAM. (in):	2 N/A
DATE STARTED: DATE COMPLETED:	January 23, 2012 January 24, 2012	DRILLER/COMPANY:	Bobby Deason Gregg Drilling and Testing C-57# 485165
DRILLING METHOD:	Drilled and Sampled using 2"-Diameter Direct Push	GEOLOGIST/ENGINEER:	B. Whalen Sierra West Consultants, Inc.

DEPTH (Feet)	Sample Interval	Recovery (%)	PID (ppm)	SAMPLE NUMBER	USCS SYMBOL	DESCRIPTION	Well Construction	DEPTH (Feet)
0	HAND AUGER				ML	**SILT:** 90% silt, non-plastic, soft, moist, yellowish brown (10YR 5/6). 10% fine sand. No hydrocarbon odor. @2' - Color grades to very dark grayish brown (10YR 3/2). 4'		0
					CL	**CLAY:** 95% clay, medium-plasticity, stiff, moist, yellowish brown (10YR 5/4). 10% fine sand. No hydrocarbon odor. 7'		
5	Direct Push	100%			CL	**SANDY CLAY**: 65% clay, medium plasticity, stiff, moist, yellowish brown (10YR 5/4). 35% fine sand, MgO staining. No hydrocarbon odor. 11'		5
	Direct Push	NR						
10		75%			CL	**SANDY CLAY WITH GRAVEL:** 65% clay, medium-plasticity, stiff, moist, grayish brown (10YR 5/2). 20% sand, fine- to coarse-grained, sub-angular. 15% fine gravel, sub-angular. Very slight hydrocarbon odor. 14'		10
	Direct Push	100%		B-3-12.0	CL	**CLAY WITH SAND:** 85% clay, medium-plasticity, stiff, moist, brown (10YR 5/3). 15% fine sand. Slight hydrocarbon odor. @18.5' - Color grades to yellowish brown (10YR 5/4). 20'		
15	Direct Push	100%						15
20	Direct Push	100%			CL	**CLAY:** 100% clay, medium plasticity, medium-stiff, moist, grayish brown (10YR 5/2). Moderate hydrocarbon odor. 22.5'		20
				B-3-22.5	ML	**SANDY SILT:** 80% silt, non-plastic, medium-stiff, wet, greenish gray (GLEY1 5/10GY). 20% sand, fine- to medium-grained. Strong hydrocarbon odor. 23.5'		
					ML	**SILT:** 100% silt, non-plastic, soft, wet, yellowish brown (10YR 5/4). Slight hydrocarbon odor. 27'		
25	Direct Push	NR						25
		50%		B-3-28.0	ML	**SILT WITH SAND:** 85% silt, non-plastic, medium-stiff, wet, greenish gray (GLEY1 5/10GY). 15% fine sand. Slight hydrocarbon odor.		
30						Geologist Terminated Boring at 28' - Target Depth Achieved First encountered groundwater at depth of 21' Boring backfilled with neat cement grout via tremmie pipe. PID readings not available due to equipment malfunction.		30

SIERRA WEST CONSULTANTS, INC.

PROJECT NAME:	**Former F&M Auto Service UST Site**	**LOG OF BORING:**	**MW-1**
SITE ADDRESS:	1839 Foothill Boulevard Oakland, California	BOREHOLE DIAM. (in): MONITORING WELL DIAM. (in):	8 2
DATE STARTED: DATE COMPLETED:	January 24, 2012 January 24, 2012	DRILLER/COMPANY:	Bobby Deason Gregg Drilling and Testing C-57# 485165
DRILLING METHOD:	Sampled using 2"-Diameter Direct Push Well Installed using Hollow Stem Auger	GEOLOGIST/ENGINEER:	B. Whalen Sierra West Consultants, Inc.

DEPTH (Feet)	Sample Interval	Recovery (%)	PID (ppm)	SAMPLE NUMBER	USCS SYMBOL	DESCRIPTION	Well Construction	DEPTH (Feet)
0	HAND AUGER		0.0 0.0 0.0		ML	**SILT WITH SAND:** 85% silt, non-plastic, soft, wet, brown (10YR 4/3). 15% fine-grained sand.		0
5	Direct Push	100%	395.2 352.8 546.8		CL	**CLAY WITH SAND:** 85% clay, low-plasticity, medium-stiff, moist, grayish brown (10YR 5/2). 15% fine-grained sand.		5
	Direct Push	100%	1,567 581.6		ML	**SANDY SILT:** 70% silt, non-plastic, medium-stiff, moist, greenish gray (GLEY1 5/5GY). 30% fine- to medium-grained sand, mostly fine.		
10	Direct Push	100%	1,792 391.0 207.2	MW-1-10.5	CL	**CLAY:** 90% clay, medium-plasticity, medium-stiff, moist, dark greenish gray (GLEY1 4/10Y). 10% fine-grained sand.		10
	Direct Push	100%	104.8 145.2 47.9		ML	**SILT WITH SAND:** 80% silt, non-plastic, stiff, moist, greenish gray (GLEY1 5/5GY). 20% fine- to coarse-grained sand, sub-angular to sub-rounded, poorly graded.		
15	Direct Push	100%	4.7 14.0 6.9	MW-1-18.5	CL	**CLAY:** 100% clay, high-plasticity, medium-stiff, moist, pale brown (10YR 6/3).		15
			2.4		ML	**SANDY SILT WITH GRAVEL:** 60% silt, non-plastic, stiff, moist, greenish gray (GLEY1 5/5G). 20% fine- to coarse-grained sand, sub-angular to sub-rounded, poorly graded. 20% fine gravel, sub-angular, with max. gravel size of 3/4-inches.		
20	Direct Push	100%	3.2 58.1 5.7 5.1		ML	**SILT:** 100% silt, non-plastic, soft, wet, greenish gray (GLEY1 5/5G). @23' - Color grades to brown (10YR 5/3).		20
	DP	100%	1.0	MW-1-25.0				
25						Geologist Terminated Boring at 25' - Target Depth Achieved First encountered groundwater at depth of 21'		25
30						- Well Constructed using 2-inch diameter SCH40 PVC from 0' - 17' - 0.010-inch machine-slotted SCH40 PVC screen from 17' - 24' - Neat cement seal placed from 1' - 14' - Medium bentonite chips (hydrated in place) placed from 14' - 16' - #2/12 sand placed from 16' - 25' - Completed with flush-mount, traffic-rated, bolt-down well box with twist-lock well-cap		30

SIERRA WEST CONSULTANTS, INC.

PROJECT NAME:	**Former F&M Auto Service UST Site**	**LOG OF BORING:**	**MW-2**
SITE ADDRESS:	1839 Foothill Boulevard Oakland, California	BOREHOLE DIAM. (in): MONITORING WELL DIAM. (in):	8 2
DATE STARTED: DATE COMPLETED:	January 23, 2012 January 24, 2012	DRILLER/COMPANY:	Bobby Deason Gregg Drilling and Testing C-57# 485165
DRILLING METHOD:	Sampled using 2"-Diameter Direct Push Well Installed using Hollow Stem Auger	GEOLOGIST/ENGINEER:	B. Whalen Sierra West Consultants, Inc.

DEPTH (Feet)	Sample Interval	Recovery (%)	PID (ppm)	SAMPLE NUMBER	USCS SYMBOL	DESCRIPTION	Well Construction	DEPTH (Feet)
0	HAND AUGER		0.0		ML	**6-Inches Concrete** **SILT:** 90% non-plastic, soft, wet, very dark grayish brown (10YR 3/2). 10% fine sand.		0
			0.0					
			0.0					
5	Direct Push	100%	0.0					5
			0.2					
			0.0			8'		
	Direct Push	100%	0		CL	**SANDY CLAY WITH GRAVEL:** 75% clay, low-plasticity, stiff, moist, greenish gray (GLEY1 5/10GY). 20% sand, fine- to coarse-grained, sub-angular. 5% fine gravel, sub-angular.		
10			7.3					10
			112			11'		
			52.7		CL	**CLAY:** 95% clay, low-plasticity, stiff, moist, dark greenish gray (GLEY1 4/5GY). 5% fine sand.		
	Direct Push	100%	5.2					
			164.9					
			843.7	MW-2-14.5				
15			391.1					15
	Direct Push	100%	30.0					
			152.4					
			25.1					
			11.3			@19' - Soil becomes soft.		
20						20'		20
	Direct Push	100%	4.4	MW-2-20.5	ML	**SANDY SILT:** 65% silt, non-plastic, stiff, moist, brown (10YR 4/3). 35% sand, fine- to coarse-grained, sub-angular to sub-rounded.		
			6.7			@21' - Soil becomes wet.		
			14.4			22'		
			5.0		CL	**CLAY:** 100% clay, high-plasticity, medium-stiff, wet, greenish gray (GLEY1 5/5G).		
		NR						
25	Direct Push	75%	4.1			26'		25
			7.4		ML	**SILT:** 100% silt, non-plastic, soft, wet, yellowish brown (10YR 5/6).		
			1.6	MW-2-28.0				
						Geologist Terminated Boring at 28' - Target Depth Achieved First encountered groundwater at depth of 21'		
30						- Well Constructed using 2-inch diameter SCH40 PVC from 0' - 17' - 0.010-inch machine-slotted SCH40 PVC screen from 17' - 24' - Neat cement seal placed from 1' - 14' - Medium bentonite chips (hydrated in place) placed from 14' - 16' - #2/12 sand placed from 16' - 25' - Direct-push boring backfilled with medium bentonite chips from 25' - 28' - Completed with flush-mount, traffic-rated, bolt-down well box with twist-lock well-cap		30

SIERRA WEST CONSULTANTS, INC.

PROJECT NAME:	**Former F&M Auto Service UST Site**	**LOG OF BORING:**	**MW-3**
SITE ADDRESS:	1839 Foothill Boulevard Oakland, California	BOREHOLE DIAM. (in): MONITORING WELL DIAM. (in):	8 2
DATE STARTED: DATE COMPLETED:	January 23, 2012 January 24, 2012	DRILLER/COMPANY:	Bobby Deason Gregg Drilling and Testing C-57# 485165
DRILLING METHOD:	Sampled using 2"-Diameter Direct Push Well Installed using Hollow Stem Auger	GEOLOGIST/ENGINEER:	B. Whalen Sierra West Consultants, Inc.

DEPTH (Feet)	Sample Interval	Recovery (%)	PID (ppm)	SAMPLE NUMBER	USCS SYMBOL	DESCRIPTION	Well Construction	DEPTH (Feet)
0	HAND AUGER		0.0		ML	**6-Inches Concrete** **SILT:** 90% silt, non-plastic, soft, wet, dark gray (10YR 4/1). 10% sand, fine- to medium-grained, sub-angular.		0
			0.0					
			0.0			@4' - Color grades to brown (10YR 5/3).		
5	Direct Push	100%	0.0					5
			0.0					
			0.0			9'		
	Direct Push	100%	0		ML	**SANDY SILT WITH GRAVEL:** 65% silt, non-plastic, soft, moist, brown (10YR 5/3). 25% sand, fine- to medium-grained, sub-angular. 10% fine gravel, sub-angular.		
10			0.2					10
			0			11'		
			0.0		ML	**SILT WITH SAND:** 85% silt, non-plastic, dense, moist, dark yellowish brown (10YR 4/4). 15% fine sand. Some MgO staining.		
	Direct Push	NR 50%	0.0					
15			0.0					15
	Direct Push	NR						
						20'		
20	Direct Push	100%	0.0		CL	**CLAY WITH SAND:** 85% clay, medium-plasticity, stiff, wet, brown (10YR 4/3). 15% sand, fine- to coarse-grained, poorly graded.		20
			0.0					
			0.0	MW-3-22.0				
			0.0					
25	Direct Push	NR						25
		50%	0.0					
			0.0	MW-3-28.0				
						Geologist Terminated Boring at 28' - Target Depth Achieved First encountered groundwater at depth of 20'		
30						- Well Constructed using 2-inch diameter SCH40 PVC from 0' - 17' - 0.010-inch machine-slotted SCH40 PVC screen from 17' - 24' - Neat cement seal placed from 1' - 14' - Medium bentonite chips (hydrated in place) placed from 14' - 16' - #2/12 sand placed from 16' - 25' - Direct-push boring backfilled with medium bentonite chips from 25' - 28' - Completed with flush-mount, traffic-rated, bolt-down well box with twist-lock well-cap		30

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PROJECT NAME:	**Former F&M Auto Service UST Site**	**LOG OF BORING:**	**MW-4**
SITE ADDRESS:	1839 Foothill Boulevard Oakland, California	BOREHOLE DIAM. (in): MONITORING WELL DIAM. (in):	8 2
DATE STARTED: DATE COMPLETED:	January 23, 2012 January 24, 2012	DRILLER/COMPANY:	Bobby Deason Gregg Drilling and Testing C-57# 485165
DRILLING METHOD:	Sampled using 2"-Diameter Direct Push Well Installed using Hollow Stem Auger	GEOLOGIST/ENGINEER:	B. Whalen Sierra West Consultants, Inc.

DEPTH (Feet)	Sample Interval	Recovery (%)	PID (ppm)	SAMPLE NUMBER	USCS SYMBOL	DESCRIPTION	Well Construction	DEPTH (Feet)
0	HAND AUGER		0.0		ML	**6-Inches Concrete** **SILT WITH SAND:** 85% silt, non-plastic, soft, moist, very dark gray (10YR 3/1). 15% fine sand. @2' - Color grades to brown (10YR 5/3).		0
5	Direct Push	100%	0.0		ML	**SANDY SILT:** 75% silt, non-plastic, soft, moist, grayish brown (10YR 5/2). 20% fine sand. 5% fine gravel, sub-rounded.		5
10	Direct Push	100%	0.0		CL	**CLAY WITH SAND:** 85% clay, low-plasticity, stiff, moist, brown (10YR 5/3). 15% fine sand. Some MgO staining. @15' - 10% fine gravel, sub-angular.		10
15	Direct Push	100%	0.0		ML CL	**GRAVELLY SILT:** 65% silt, non-plastic, stiff, moist, brown (10YR 5/3). 10% sand, fine- to medium-grained, sub-angular to sub-rounded. 25% fine gravel, sub-angular. **CLAY:** 100% clay, high-plasticity, stiff, brown (10YR 5/3).		15
20	Direct Push	NR 63%	0.0	MW-4-22.0	CL	**SANDY CLAY:** 75% clay, high-plasticity, stiff, wet, grayish brown (10YR 5/2). 20% well-graded sand. 5% fine gravel, sub-angular to sub-rounded.		20
25	Direct Push	NR 37.5%	0.0	MW-4-28.0	CL	**CLAY:** 100% clay, high-plasticity, stiff, wet, grayish brown (10YR 5/2).		25
30						Geologist Terminated Boring at 28' - Target Depth Achieved First encountered groundwater at depth of 22' - Well Constructed using 2-inch diameter SCH40 PVC from 0' - 17' - 0.010-inch machine-slotted SCH40 PVC screen from 17' - 24' - Neat cement seal placed from 1' - 14' - Medium bentonite chips (hydrated in place) placed from 14' - 16' - #2/12 sand placed from 16' - 25' - Direct-push boring backfilled with medium bentonite chips from 25' - 28' - Completed with flush-mount, traffic-rated, bolt-down well box with twist-lock well-cap		30