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Alameda County
Environmental Health

Mr. Keith Nowell
Alameda County
Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Re: Foothill Mini Mart, 6600 Foothill Boulevard, Oakland, California
(ACEHS Case No. RO0000175)

Dear Mr. Nowell:

Stratus Environmental, Inc. (Stratus) has recently prepared a *Corrective Action Plan* on my behalf. The report was prepared in regards to Alameda County Fuel Leak Case No. RO0000175, located at 6600 Foothill Boulevard, Oakland, California.

I have reviewed a copy of this report, sent to me by representatives of Stratus, and "I declare, under penalty of perjury, that the information and or/recommendations contained in the attached document or report is true and correct to the best of my knowledge."

Sincerely,

Ravi Sekhon

STRATUS
ENVIRONMENTAL, INC.

3330 Cameron Park Drive, Ste 550
Cameron Park, California 95682
(530) 676-6004 ~ Fax: (530) 676-6005

June 21, 2012
Project No. 2087-6600-01

Mr. Keith Nowell
Alameda County Environmental Health Department
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Re: Corrective Action Plan
Foothill Mini Mart
6600 Foothill Boulevard
Oakland, California

Dear Mr. Nowell:

On behalf of Mr. Ravi Sekhon, Stratus Environmental, Inc. (Stratus) has prepared this *Corrective Action Plan* (CAP), for the Foothill Mini Mart, located at 6600 Foothill Boulevard, Oakland, California (see Figures 1 and 2). Petroleum hydrocarbon impact to the soil and groundwater has previously been documented at the subject property. During the spring and summer months of 2011, Stratus personnel conducted remediation pilot testing at the subject property to evaluate the feasibility of using dual phase extraction (DPE) and in-situ chemical oxidation (ISCO) by ozone and hydrogen peroxide injection to mitigate site contaminants. The pilot testing was performed after completing a feasibility study and cost analysis of three potential remedial approaches for mitigating site contaminants (presented in an August 2010 report). Based on the findings of this pilot testing, Stratus recommended, in a report dated September 23, 2011, that a full-scale ISCO remediation project be implemented at the subject property. After reviewing the September 2011 report, Alameda County Environmental Health Department (ACEHD) personnel generally concurred with Stratus' recommendation and requested, in a letter dated December 2, 2011, that a CAP be prepared for the subject site.

This document proposes to design, construct, and operate an ozone and hydrogen peroxide ISCO remediation system at the subject site. Details associated with the proposed remedial approach, equipment, operational procedures of this remedial system, and a proposed supplemental groundwater monitoring program for the site, are discussed in the following subsections of this CAP. This document also includes a proposal to install additional injection wells within the known area of petroleum hydrocarbon impact to groundwater to enable implementation of the proposed ISCO remediation project.

SITE DESCRIPTION

The subject site is an active retail fueling station located at the northeast corner of the intersection of Havenscourt Boulevard and Foothill Boulevard in the city of Oakland. The property is situated in a mixed residential and commercial neighborhood. The station (now Golden Gasoline) dispenses fuel from two pump islands which contain two dispensers on each island. The general layout of the site is depicted on Figure 2. Service stations have operated on the subject property since approximately 1959, under Beacon, ARCO, and Shell branding. Mr. Sekhon purchased the service station from Beacon in 1998.

The property is situated on the East Bay Plain, immediately west of the Oakland Hills and approximately 2 miles east of San Francisco/San Leandro Bay. The service station is located roughly 60 feet above mean sea level (MSL). Residential buildings are located north of the site, a vacant building occupies the property to the east, and a vacant lot is present south of the site.

A service station formerly operated on the vacant lot situated south of the site, across Foothill Boulevard (6601 Foothill Boulevard). This property is not currently in the ACEHD oversight program; however, analytical data from a soil sample collected in the western portion of this property suggest that a fuel leak could have historically occurred on this property. Additional data would be needed to confirm or deny that a fuel leak occurred at 6601 Foothill Boulevard.

SITE BACKGROUND

Historical Site Assessment Activities

This information, regarding environmental activities performed to date at the site, is summarized from documents uploaded to the State of California's GeoTracker Database; these reports were prepared by consultants previously representing Mr. Sekhon (Advanced Assessment and Remediation Services [AARS] and Environmental Risk Specialties Corporation [ERS]).

A suspected fuel leakage was discovered in November 1998, at the time of removal of an 8,000-gallon steel underground storage tank (UST) and upgrading of the fuel storage and delivery system. The following summarizes site characterization work activities that have been completed since removal and replacement of the former USTs and fuel delivery equipment:

- Compliance sampling of soil and groundwater was completed in December 1998. A sheen was observed on the groundwater situated within the cavity of the 8,000-gallon UST at this time. Prior to backfilling of this UST pit, batch extraction of groundwater was performed. Soil generated during construction work was hauled offsite for proper disposal.
- AARS directed the installation of three groundwater monitoring wells (MW-1 through MW-3) in June 2001.
- AARS oversaw the completion of three additional monitoring wells (MW-4 through MW-6), and two exploratory soil borings (SB-1 and SB-2) in June 2002.
- Intermittent groundwater monitoring and sampling was performed between 2001 and 2011 (17 total sampling events).
- An additional subsurface investigation, which consisted of advancing twelve additional exploratory soil borings (SB-3 through SB-14) was conducted in August 2005.
- A sensitive receptor survey and preferential pathway study was performed by ERS in 2008.
- ERS oversaw the installation of 8 additional groundwater monitoring wells (MW-5B, MW-6B, MW-7, MW-10, MW-11, MW-12A, MW-12B, and MW-13A) and advancement of 10 soil borings (SB-15 through SB-17, SMW-13, USB-2, USB-5, USB-7, USB-8, USB-10, and USB-11) in September 2009. This project included an assessment of the lateral and vertical extent of contaminant distribution in the subsurface, and an evaluation of contaminant migration within underground utility corridors.
- In April 2011, Stratus directed the installation of an extraction well (EX-1), two nested injection wells (IW-1A/B and IW-2A/B), and two soil vapor monitoring wells (SGW-1 and SGW-2) for use during remediation pilot testing.
- Between April 26 and 28, 2011, a DPE pilot test was performed.
- An ozone and hydrogen peroxide injection pilot test was completed between May 26 and June 28, 2011.
- Groundwater monitoring and sampling at the site is being completed on an ongoing basis; currently, Stratus is collecting samples from each of the site monitoring wells on a semi-annual basis.

Table 1 presents available information regarding the construction of the site monitoring and remediation wells.

Site Geology and Hydrogeology

Soil conditions beneath the site consist of heterogeneous mixtures of fine grained soils (silt/clay mixtures) and coarser grained soils (silty sand, sand, clayey gravel, sandy gravel, and gravel) from surface grade to approximately 50 feet below ground surface (bgs), the maximum depth explored beneath the site. In most of the boreholes, one to two intervals of coarser grained soils, typically about 2 to 5 feet in thickness, were logged between the depths of about 4 to 20 feet bgs. These coarser grained soil strata are typically saturated, and it is likely that lateral migration of contaminants within the subsurface (discussed in more detail below) occur within the coarser grained soils at these depths.

Below approximately 20 feet bgs, fine grained soils were predominately noted, although silty sand and clayey gravel were also encountered. In particular, offsite well MW-12B appears to be screened within the more permeable coarse grained soil. Based on the relatively low levels of contaminants reported in samples collected from 3 wells screened below first encountered groundwater (MW-5B, MW-6B, and MW-12B, discussed below) relative to concentrations of contaminants within first encountered groundwater, it appears as though soils between the uppermost water bearing strata and the screening interval of the 3 deeper monitoring wells are of sufficiently low permeability to retard vertical migration of contaminants at the site. Bedrock was not encountered in the upper 50 feet of the subsurface. Appendix A provides historical geological cross sections prepared for the subject site.

Between 2001 and 2011, groundwater levels fluctuated between approximately 6.5 and 11 feet bgs in onsite wells MW-1 through MW-3. Seasonal water level fluctuations of about 2 feet in the wells are typical. In 2002 and 2003, groundwater elevation contour maps that were available to Stratus generally depict southeast and south groundwater flow, and based on the distribution of contaminants in the subsurface (discussed below), site contaminants appear to be migrating towards the southeast and south in the saturated zone. Since 2004, significantly variable groundwater flow directions have been reported, using updated surveying data collected following site assessment work near this time. The apparent discrepancy between the groundwater flow directions calculated since 2004, and the noticeable orientation of the plume of groundwater contaminants in the south-southeast direction, has not been resolved. A groundwater elevation contour map that was prepared using groundwater elevations measured during the fourth quarter 2011 is presented as Figure 3.

Petroleum Hydrocarbon Impact to Soil

Gasoline range organics (GRO), benzene, toluene, ethylbenzene, and xylenes (BTEX constituents), methyl tertiary butyl ether (MTBE), and tertiary butyl alcohol (TBA) have been detected in soil samples collected in the site vicinity. The highest concentrations of contaminants in soil appear to be present between approximately 7.5 and 10 feet bgs, which is near the static groundwater level at the site. Onsite, the highest concentrations of petroleum hydrocarbons and MTBE appear to be situated immediately south and southeast of the former UST complex. GRO was reported at concentrations of 410 milligrams per kilogram (mg/Kg) and 73 mg/Kg in samples collected from onsite borings SB-16 and SB-17, respectively, in September 2009. Soil contamination offsite extends predominately in the southeast direction, and to a lesser extent to the south of the site. The highest concentrations of GRO offsite have been reported in samples collected from the two borings located furthest away from the site in the southeast direction (borings SMW-13 and MW-13A, GRO at levels of 170 mg/Kg and 800 mg/Kg, respectively, at depths of 7.5 to 8 feet bgs). Concentrations of petroleum hydrocarbons and fuel oxygenates in soil do not appear to consistently decrease with distance from the source(s) of the fuel leak; instead, contaminants appear irregularly distributed in areas where shallow groundwater has provided a transport mechanism for these contaminants. These soils of elevated permeability appear to include both natural material and fill that has been placed around municipal water piping buried beneath the Foothill Boulevard roadway.

GRO was reported in a soil sample collected from offsite boring SB-4 at 11 feet bgs (4.7 mg/Kg). ERS (who collected this sample) has indicated their belief that the reported contaminants at boring SB-4 originated from a fuel leak at the former 6601 Foothill Boulevard service station. No soil samples from the vadose zone of boring SB-4 were submitted for chemical analysis, and thus, given the available data set, Stratus is unable to definitively determine whether or not a separate fuel contamination source originating from 6601 Foothill Boulevard exists. Further subsurface investigation work at this vacant lot would be useful in evaluating whether or not a fuel release has occurred in this area, in particular, submittal of vadose zone soil samples for chemical analysis.

Petroleum Hydrocarbon Impact to Groundwater

GRO, BTEX, MTBE, and TBA have been detected in groundwater in the site vicinity. Figures 4 through 7 illustrate the approximate extent of GRO, benzene, MTBE, and TBA impact to shallow groundwater, respectively, using data collected from the site's shallow monitoring well network during the fourth quarter 2011. Appendix B provides concentrations versus time graphs for GRO, MTBE, and TBA concentrations at wells MW-1, MW-2, MW-4, MW-5, and MW-6 (other downgradient wells with impact have only a short groundwater monitoring history). The highest concentrations of contaminants in groundwater are generally present southeast of the former UST pit, in offsite groundwater monitoring wells. GRO, MTBE, and TBA impact a relatively large area, with each plume extending at least 200 feet offsite in the southeast direction. GRO, benzene, MTBE, and TBA were detected at maximum concentrations of 6,400 micrograms per liter (μg/L), 77 μg/L, 420 μg/L, and 2,800 μg/L, respectively, for samples collected in December 2011. The lateral extent of GRO, MTBE, and TBA impact southeast of the site does not appear to be fully characterized.

During a subsurface investigation performed in September 2009, grab groundwater samples were collected from 5 hand-augered soil borings (USB-5, USB-7, USB-8, USB-10, and USB-11) located along the northern portion of the Foothill Boulevard right-of-way. Each boring was located near an underground utility corridor containing a water main. The samples were collected from depths ranging from about 7 to 8 feet bgs. GRO and TBA were detected in each groundwater sample, at concentrations ranging from 3,700 μg/L to 81,000 μg/L and 16 μg/L to 95 μg/L, respectively. Low levels of MTBE were also detected in 4 of the 5 samples, at concentrations ranging from 1.7 μg/L to 8.6 μg/L. Although each of these 5 borings were situated within the limits of the contaminant plumes depicted on Figures 4, 6, and 7, the consultant who performed the investigation (ERS) concluded that the water main utility corridor was allowing for preferential eastward migration of contaminants.

Petroleum hydrocarbon and fuel oxygenate impact below the uppermost 10 to 15 feet of the saturated zone appears to be limited, based on well sampling data from wells MW-5B, MW-6B, and MW-12B. These three wells were installed in September 2009 in order to assess concentrations of contaminants deeper within the saturated zone, and are screened between the depths of approximately 35 to 45 feet bgs, 35 to 50 feet bgs, and 33 to 43 feet bgs, respectively. In the December 2011 samples, no petroleum hydrocarbons or fuel oxygenates were detected in the samples collected from wells MW-6B and MW-12B, and only a low concentration of MTBE (7.5 μg/L) was reported in the sample collected from well MW-5B. Given the available data set, the vertical extent of contaminant distribution in groundwater appears adequately characterized.

DPE Pilot Testing

Stratus conducted a 34-hour DPE pilot test, using well EX-1 for extraction, in April 2011. The test was conducted using a 250 cubic feet per minute (cfm) DPE system equipped with a 20-horsepower liquid ring pump. During the test, wells MW-1, MW-2, MW-5, MW-5B, MW-6, MW-6B, and MW-4 were used for observation of depth to groundwater and induced vacuum. During the test, an average applied vacuum of 10.2 inches of mercury ("Hg) resulted in an average influent soil vapor flow rate of 58.68 cfm. Negligible or no induced vacuum was measured in the observation wells, likely in part due to the presence of groundwater across most of the screened interval of these wells. Photoionization detector (PID) readings of the influent air stream ranged from 1 to 100 parts per million by volume (ppmv), generally declining during the test period. Groundwater was extracted at a rate of approximately 0.6 gallons per minute (gpm). Low to non detectable concentrations of petroleum hydrocarbons and fuel oxygenates were detected in laboratory analyzed samples of the extracted air stream.

After conducting the 34-hour DPE test using EX-1, a second well (MW-4) was used for extraction for a period of approximately two hours. However, due to a mechanical malfunction of a generator powering the equipment, the multi-well DPE test was terminated after two hours of test time.

A report documenting the findings of the DPE pilot testing was submitted by Stratus on July 14, 2011. The report concluded that DPE was not a viable or cost effective remedial approach for the site.

ISCO Pilot Testing

A 33-day ISCO pilot test, which consisted of injection of ozone and hydrogen peroxide into the shallow saturated interval, was completed in May and June 2011. The test utilized two onsite injection wells (IW-1A/B and IW-2A/B) for completion of ISCO within the southeastern portion of the service station property, which is within the limits of the petroleum hydrocarbon/fuel oxygenate plume. An H_2O Engineering, Inc. ozone and hydrogen peroxide injection system (model MOSU20-52LINJ) was used to perform this test. This equipment generated approximately 2.74 pounds of ozone per day for delivery to the subsurface. A 10-percent solution of hydrogen peroxide was metered into the subsurface simultaneously with injection of ozone.

During the ISCO pilot study, six wells (EX-1, MW-2, MW-4, MW-5, MW-6, and MW-10) were used to complete monitoring and sampling of groundwater. Stratus measured geochemical parameters of groundwater (such as dissolved oxygen, pH, etc.) within these wells before, during, and after pilot testing work. Stratus also collected groundwater samples before, during, and after testing in order to evaluate test performance on dissolved contaminants and other analytes. Select data collected during the ISCO pilot test may be referenced in Appendix C.

After reviewing the findings of the ISCO pilot testing, Stratus concluded that ozone and hydrogen peroxide injection was a viable remedial alternative for mitigating site contaminants. Dissolved oxygen concentrations increased significantly at five of the six monitoring/observation wells. Stratus noted that in five of the six wells impacted with MTBE, concentrations of MTBE increased shortly following implementation of ISCO, but then declined by the end of the test period. Stratus concluded (in the September 23, 2011 report) that this data trend likely indicated de-sorption of MTBE from the fine grained soil during the initial part of the test, followed by destruction of the contaminant that resulted in lower dissolved MTBE concentrations. ISCO pilot testing also did not result in significant generation of hexavalent chromium in groundwater.

PROJECT APPROACH

Given the apparent lateral extent of contaminants in groundwater, and ACEHD's requirement for completing corrective action, it appears as though the site's environmental case cannot be closed without implementing a remedial project at the site. Given this condition, the objective of the proposed scope of work is to manage the site's environmental case towards closure in a timely manner by actively remediating contaminants impacting shallow groundwater. In order to accomplish this objective, Stratus is proposing to conduct full-scale groundwater remediation using ISCO by ozone and hydrogen peroxide injection. Successful pilot testing results obtained in May and June 2011, and the feasibility analysis prepared and submitted in August 2010, were used as the basis for selecting ozone/hydrogen peroxide injection for use at the subject site.

A review of Figures 4 through 7 illustrates that a majority of the area impacted with dissolved petroleum hydrocarbons is situated offsite. Given this condition, completion of both onsite and offsite remediation appears warranted in order to implement full-scale remediation. This CAP proposes to inject ozone and hydrogen peroxide onsite, on the adjacent property east-southeast of the site (at 6620 Foothill Boulevard), in the roadway edge/gutter area across Foothill Boulevard, and on an offsite property across Foothill Boulevard (at 6633 Foothill Boulevard). Stratus proposes to inject hydrogen peroxide and ozone through ten injection wells situated within the plume; the locations of these wells, which include existing wells IW-1A/B and IW-2A/B, and proposed wells IW-3A/B through IW-10A/B, are provided on Figure 8. A scope of work to install the eight additional injection wells is included in this CAP.

Once the system has been installed, the equipment would operate continuously on a 24-hour per day, 7-day per week, basis. Ozone and hydrogen peroxide would be delivered to each well on a cycled basis. Ozone and hydrogen peroxide would be injected at each of the 10 injection well locations for 15 minutes at each well location, over a 150-minute (2.5-hour) continuous cycle. Representatives from Stratus would visit the property at least twice per month in order to perform operation and maintenance for the equipment, and to collect groundwater field measurements and/or samples that would be used to evaluate the performance of remedial efforts.

SCOPE OF WORK

The proposed scope of work has been subdivided into six tasks, as outlined below. All work will be conducted under the direct supervision of a State of California Professional Geologist or Professional Engineer, and will be conducted in accordance with standards established by the *Tri-Regional Board Staff Recommendations of Preliminary Investigation and Evaluation of Underground Tank Sites* (RWQCB, April 2004) and ACEHD guidelines. A generalized description of field practices and procedures that will be used by Stratus during drilling work is provided in Appendix D.

Task 1 – Soil Boring and Well Installation Activities

Pre-field Activities

Following approval of this scope of work by ACEHD, the following activities will be completed:

- Obtain permits from the City of Oakland, as needed, including a traffic control permit, an obstruction permit, and an excavation permit,
- Secure access agreements, as needed, for the properties at 6600, 6620, and 6633 Foothill Boulevard,
- Obtain a drilling/well installation permit from Alameda County Public Works Agency (ACPWA),
- Retain and schedule a licensed C-57 drilling contactor,
- Update the health and safety plan for the site,
- Mark drilling locations and contact Underground Service Alert (USA) to locate underground utilities in the vicinity of the work site, and
- Notify the City of Oakland, ACEHD, ACPWA, property owners, and USA of the scheduled field activities.

Field Activities

Task 1A - Soil Borings

A licensed well driller will advance the well borings IW-3A/B through IW-10A/B to approximately 27 feet bgs using a truck mounted or limited access drill rig equipped with appropriately sized hollow stem augers. Based on the soil types encountered during installation, the depth of each boring may be modified in order to allow for injection of ozone and/or hydrogen peroxide within coarser grained strata. The borings will be converted to nested ozone and hydrogen peroxide injection wells as described below. The initial 5 feet of the borings will be advanced with a hand auger and/or posthole digger to reduce the possibility of damaging underground utilities.

Soil samples will be collected at approximately 2.5-foot intervals using a California-type, split-spoon sampler equipped with clean brass tubes. The samples will be used to assist in determining the depth for the injection wells and to evaluate petroleum hydrocarbon concentrations in soil. Soil from each sampled interval will be screened in the field with a portable photoionization detector (PID). Stratus will record PID readings, soil types, and other pertinent geologic data on the borehole logs. The sample ends will be covered with Teflon™ sheets and tight fitting plastic caps. Each sample will then be labeled, placed in a resealable plastic bag, and stored in an ice-chilled cooler. The samples will remain chilled until relinquished to a state-certified analytical laboratory. Strict chain-of-custody procedures will be followed from the time the samples are collected until the time the samples are relinquished to the laboratory. A minimum of two soil samples will be submitted for chemical analysis from each boring. Additional samples may be selected for chemical analysis based on conditions observed in the field at the time of drilling.

Task 1B –Injection Well Installation

Wells IW-3A/B through IW-10A/B will be constructed through 8-inch diameter hollow stem augers using 0.75 or 1-inch diameter blank Schedule 80 PVC casing connected to a gas diffusor (for ozone sparging) and a stainless steel well casing/tubing (1-inch diameter or less, for injection of hydrogen peroxide). This well design will be similar to the construction of existing wells IW-1A/B and IW-2A/B. The ozone injection gas diffusor will be situated from approximately 24 to 26 feet bgs and the slotted stainless steel well screen will be situated from approximately 20.5 to 21.5 feet bgs. A filter pack of Lonestar™ #2/12 sand will be placed from the base of the boring to approximately one foot above the top of the sparge point (about 23 to 27 feet bgs). Coated bentonite pellets will be placed from approximately 22 to 23 feet bgs. Additional filter pack sand will be placed from approximately 19 to 22 feet bgs. Bentonite chips or pellets will then be placed from about 16 to 19 feet bgs, around stainless steel well casing. Neat cement containing a maximum of 5% bentonite powder will be used to backfill the remaining annular space around the well casing to surface grade, around the riser pipes of both the PVC ozone injection well and stainless steel hydrogen peroxide injection well. A watertight locking cap will be placed over the top of the well casing, and a traffic-rated vault box will be installed around the top of the well. Actual well construction may be modified in the field based on soil conditions encountered at the time of the investigation.

Task 1C - Waste Management

All drill cuttings and wastewater generated during the field activities will be contained in U.S. Department of Transportation-approved 55-gallon steel drums. The drums will be appropriately labeled and stored at 6600 Foothill Boulevard pending proper disposal. A licensed contractor will transport the soil and wastewater to an appropriate facility for disposal.

Task 1D - Laboratory Analysis

Soil samples collected during the well boring activities will be submitted to a state-certified analytical laboratory and analyzed for GRO using USEPA Method 8015B/DHS LUFT, and for BTEX, MTBE, and TBA using USEPA Method 8260B.

Task 2 – Well Installation Report Preparation

A report will be prepared to document the well installation activities. The report will include, at a minimum, a scaled site plan, documentation regarding the well installation procedures, well details, tabulated soil analytical results, a certified laboratory report, and documentation regarding uploading of appropriate data to Geotracker.

Task 3 – Corrective Action Plan

Stratus will prepare and submit design drawings to procure any permits needed to allow for construction of the remediation system and enclosure. The design drawings will include, but will not be limited to, the following:

- Construction details illustrating the system layout and remediation compound.
- Details for construction of the process piping manifold and instrumentation.
- Construction details for installation of electrical service to the system.
- A construction specifications document to support the design drawings.

In addition, Stratus will:

- Secure a building permit from the City of Oakland, if necessary.
- Obtain a permit to operate the ozone injection system from the local fire department, if necessary.
- Investigate the possibility of obtaining electrical service from existing power panels at either 6620 or 6600 Foothill Boulevard. If electrical service cannot be obtained from one of these sources, a new application for electrical service will be submitted to Pacific Gas and Electric Company (PG&E).

Task 4 – Construction and System Installation

A Stratus field construction supervisor will oversee field activities and ensure conformity with the construction requirements set forth in the plans and specifications. Stratus will supervise trenching, sub-grade and aboveground pipe installation, backfill, compaction, and resurfacing where necessary. All construction work will be performed by appropriately licensed contractors as required by permits governing the work activities.

Figure 8 includes approximate locations of subgrade conveyance trenches extending from the proposed offsite remediation system enclosure area to each of the 10 injection wells.

Stratus intends to mobilize an H_2O Engineering Inc. model MOSU20-52LINJ remediation system, or similar, for injection of ozone and hydrogen peroxide to nested wells IW-1A/B through IW-10A/B. The system consists of a self-contained cabinet housing an O_2 concentrator, ozone generation system, compressors to inject air and ozone, hydrogen peroxide injection/distribution system, and associated instrumentation. The ozone injection system is capable of generating up to 2.74 lbs/day of ozone at a concentration of 6%, which can be injected at flow rates of up to 24 standard cubic feet per hour (scfh) at 20 pounds per square inch (psi) pressure. The system also incorporates a booster compressor rated at approximately 180 cubic feet per hour (cfh) (equivalent to 3.0 cfm) to deliver air enriched with ozone to the injection wells. Hydrogen peroxide will be delivered using a chemical pump designed to handle hydrogen peroxide at a pressure slightly over breakthrough pressure. Stratus proposes to constantly meter into each shallow-set well a stream of 10% hydrogen peroxide solution at a rate of approximately 5 milliliters per minute (ml/min).

Task 5 – Start-up, Operation, Maintenance, and Groundwater Monitoring

Stratus proposes to initiate injection of ozone-enriched air at a flow rate of 3 to 5 cfm, at low injection pressures (approximately 100% to 125% of the static head breakthrough pressure or approximately 4 to 6 psi, depending on water levels). The operating parameters will be optimized to achieve steady state conditions based on data collected from the monitoring wells.

The MOSU20-52LINJ system contains 10 ozone injection ports, and when operating, will be able to deliver ozone to wells IW-1B through IW-10B. The ten port ozone injection system will be programmed to inject ozone for a 15-minute time period into the ten wells connected to the system, completing a 2.5 hour injection cycle. Injection of ozone will be completed on a continuous basis (24-hours per day, 7-days per week). Stratus will visit the property approximately twice per month in order to conduct operation and maintenance on the remediation system.

Approximately once per month (every other site visit), Stratus personnel will measure pH, oxidation-reduction potential (ORP), conductivity, temperature, and dissolved oxygen (DO) concentrations within select wells in order to evaluate shallow groundwater for changes in geochemical conditions resulting from remedial work. Stratus proposes to use wells EX-1, MW-2, MW-4, MW-5, MW-6, MW-12A, and MW-13A during the supplemental groundwater monitoring program associated with remedial efforts.

Stratus proposes to continue the groundwater sampling program at the site on a semi-annual schedule. In addition to the current suite of chemical analyses within the site's monitoring wells, Stratus proposes to analyze samples collected from wells MW-2, MW-4, MW-5, MW-6, MW-12A, and MW-13A for the presence of hexavalent chromium (using APHA/EPA Methods by a State-Certified laboratory).

Task 6 – Reporting

Data regarding operation of the ozone and hydrogen peroxide injection system will be included with semi-annual groundwater monitoring reports prepared for the property. The reports will provide, at a minimum, all measurements obtained during site visits, uptime estimates for the remediation equipment, documentation regarding any repairs to the system, any deviations from the scope of work presented in this CAP (if appropriate), tabulated analytical results, certified analytical reports, and documentation regarding uploading of appropriate data to the State of California's Geotracker database. Stratus will also prepare an interpretive discussion regarding the progress of remediation work, which will largely be based on changes in groundwater contaminant levels in the groundwater monitoring wells following initiation of ISCO.

If you have any questions or comments concerning this CAP, please contact Scott Bittinger at (530) 676-2062 or Gowri Kowtha at (530) 676-6001.

Sincerely,

STRATUS ENVIRONMENTAL, INC.

REGISTERED GEOLOGIST
Scott G. Bittinger
No. 7477
STATE OF CALIFORNIA

Scott G. Bittinger, P.G.
Project Manager

Gowri S. Kowtha, P.E.
Principal Engineer

Attachments:

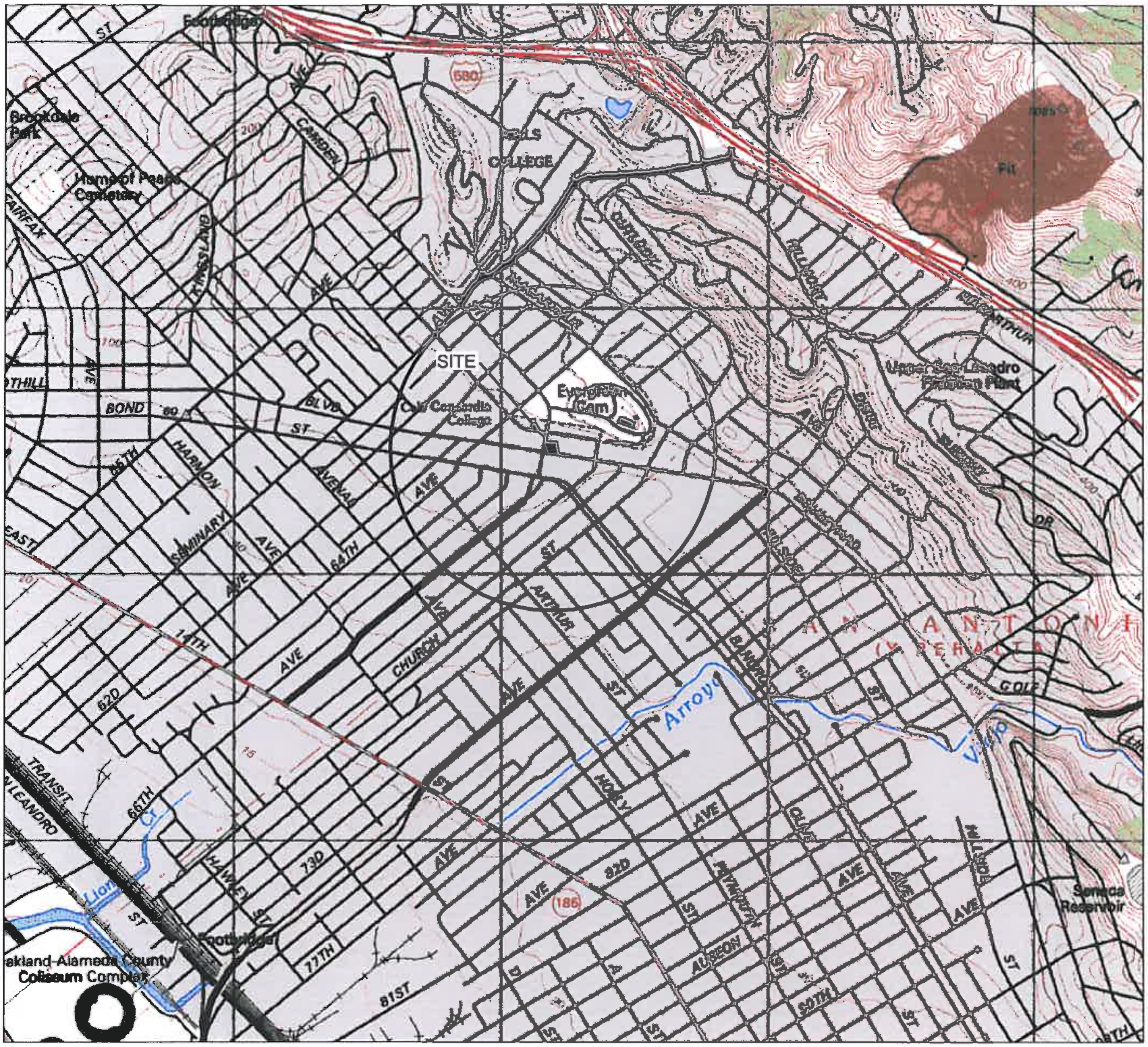
Table 1	Well Construction Detail Summary
Figure 1	Site Location Map
Figure 2	Site Plan
Figure 3	Groundwater Elevation Contour Map, Fourth Quarter 2011
Figure 4	GRO Iso-Concentration Contour Map, Fourth Quarter 2011
Figure 5	Benzene Iso-Concentration Contour Map, Fourth Quarter 2011
Figure 6	MTBE Iso-Concentration Contour Map, Fourth Quarter 2011
Figure 7	TBA Iso-Concentration Contour Map, Fourth Quarter 2011
Figure 8	Site Plan Depicting Locations of Proposed Injection Wells
Appendix A	Geologic Cross Sections
Appendix B	Concentration Versus Time Graphs for Wells MW-1, MW-2, MW-4, MW-5, and MW-6
Appendix C	Select Data from 2011 ISCO Pilot Test
Appendix D	Field Practices and Procedures

cc: Mr. Ravi Sekhon

TABLE 1
WELL CONSTRUCTION DETAIL SUMMARY
Foothill Mini Mart, 6600 Foothill Boulevard, Oakland, California

Boring/Well I.D.	Date Installed	Boring Depth (feet)	Boring Diameter (inches)	Well Diameter (inches)	Well Depth (feet)	Screen Interval (feet bgs)	Slot Size (inches)	Drilling Method
Shallow Groundwater Monitoring Wells								
MW-1	06/04/01	25	8	2	25	10-25	0.01	HSA
MW-2	06/04/01	25	8	2	25	10-25	0.01	HSA
MW-3	06/04/01	25	8	2	25	10-25	0.01	HSA
MW-4	06/26/02	20	8	2	20	7.5-20	0.01	HSA
MW-5	06/26/02	20	8	2	20	7.5-20	0.01	HSA
MW-6	06/26/02	20	8	2	20	7.5-20	0.01	HSA
MW-7	09/23/09	25	8	2	25	10-25	0.01	HSA
MW-10	09/22/09	25	8	2	25	15-25	0.01	HSA
MW-11	09/23/09	25	8	2	25	10-25	0.01	HSA
MW-12A	09/22/09	25	8	2	25	10-25	0.01	HSA
MW-13A	09/24/09	25	8	2	25	5--25	0.01	HSA
Deeper Groundwater Monitoring Wells								
MW-5B	09/23/09	45	8	2	45	35-45	0.01	HSA
MW-6B	09/24/09	50	8	2	50	35-50	0.01	HSA
MW-12B	09/22/09	43	8	2	43	33-43	0.01	HSA
Remediation Wells								
EX-1	04/04/11	30	10	4	30	10-30	0.02	HSA
IW-1A/B	04/06/11	28	8	1	21.5	20.5-21.5	0.02	HSA
				1	27	25-27	microporous	
IW-2A/B	04/06/11	28	8	1	21.5	20.5-21.5	0.02	HSA
				1	27	25-27	microporous	
Soil Gas Monitoring Wells								
SGW-1	04/06/11	2.5	6	0.25	2.5	2-2.5	mesh	hand digging
SGW-2	04/07/11	1.5	6	0.25	1.5	1-1.5	mesh	hand digging

Notes:
HSA = hollow stem auger



GENERAL NOTES:
BASE MAP FROM U.S.G.S.
OAKLAND EAST, CA.
7.5 MINUTE TOPOGRAPHIC
PHOTOREVISED 1980

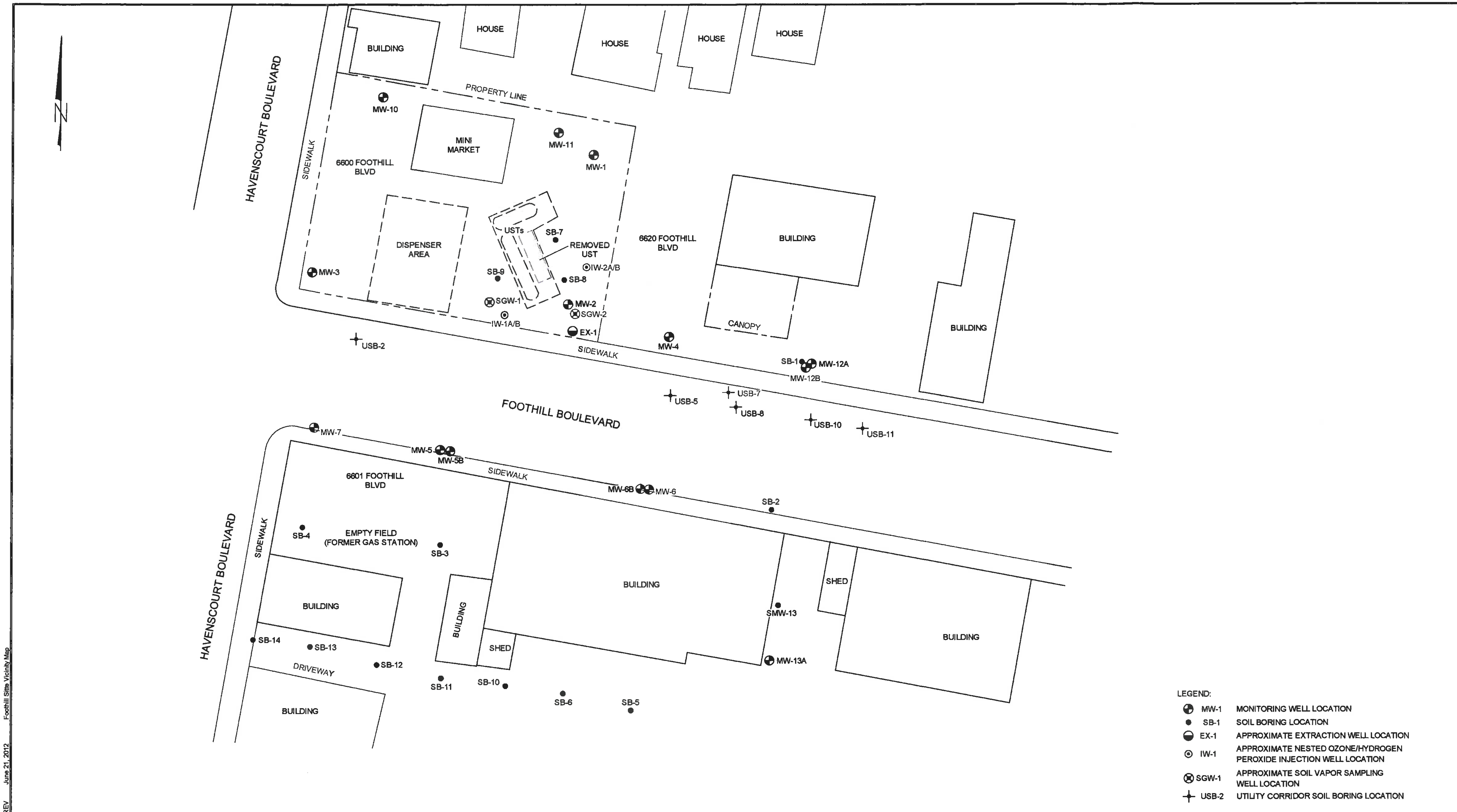
N

QUADRANGLE LOCATION

0 2000 FT

SCALE 1:24,000

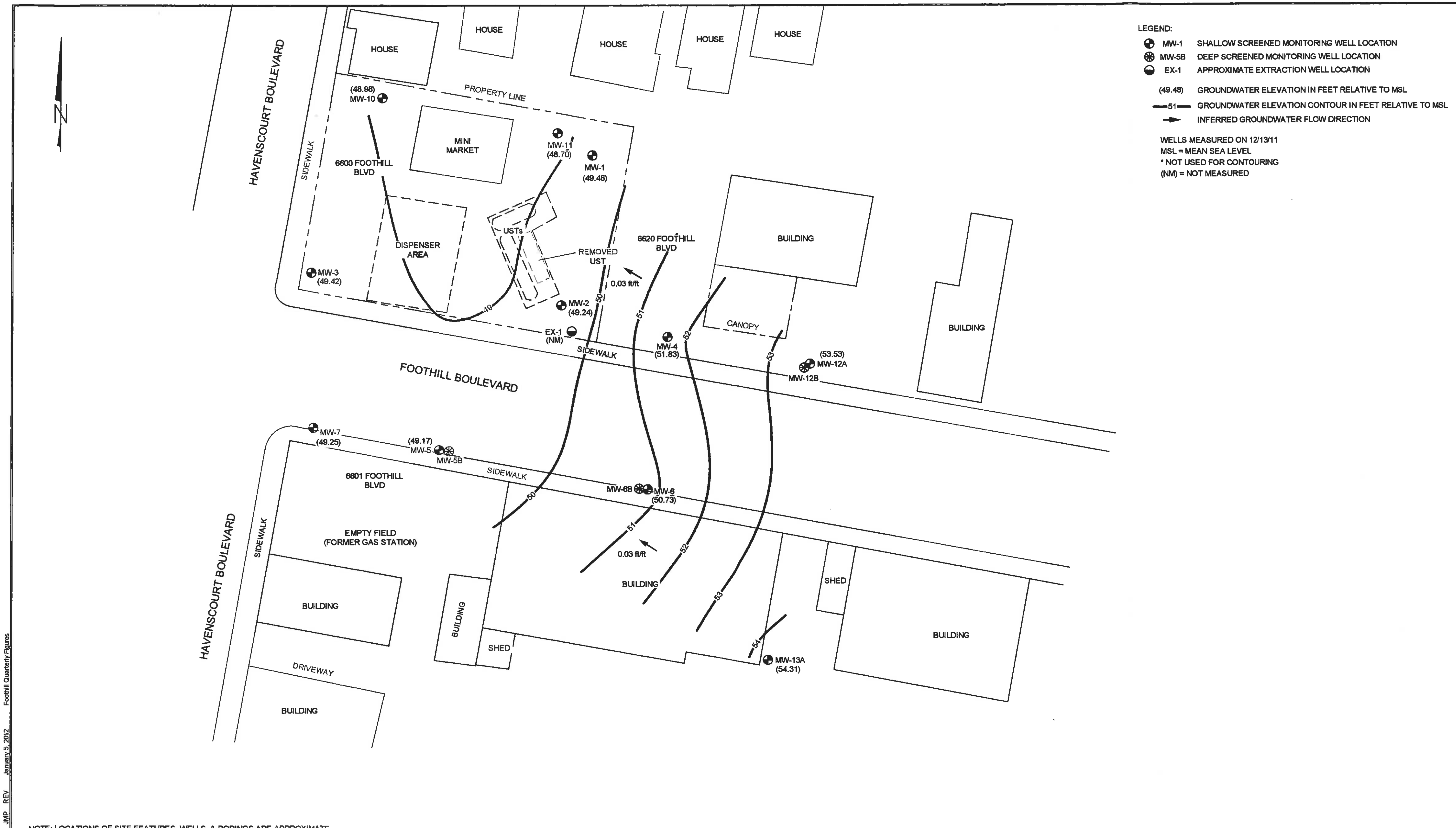
STRATUS ENVIRONMENTAL, INC.	FOOTHILL MINI MART 6600 FOOTHILL BOULEVARD OAKLAND, CALIFORNIA SITE LOCATION MAP	FIGURE 1 PROJECT NO. 2087-6600-01



NOTE: LOCATIONS OF SITE FEATURES, WELLS, & BORINGS ARE APPROXIMATE

STRATUS ENVIRONMENTAL, INC.	0 40 FT SCALE	FOOTHILL MINI MART 6600 FOOTHILL BOULEVARD OAKLAND, CALIFORNIA SITE PLAN	FIGURE 2 PROJECT NO. 2087-6600-01

Foothill Mini Mart JMP REV June 21, 2012 Foothill Site Vicinity Map



NOTE: LOCATIONS OF SITE FEATURES, WELLS, & BORINGS ARE APPROXIMATE

STRATUS ENVIRONMENTAL, INC.

0 40 FT
SCALE

FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD
OAKLAND, CALIFORNIA

GROUNDWATER ELEVATION CONTOUR MAP
SHALLOW SCREENED WELLS
4th QUARTER 2011

FIGURE
3

PROJECT NO.
2087-6600-01

Foothill Mini Mart\Quarterly Foothill Quarterly Figures JMP REV January 5, 2012

NOTE: LOCATIONS OF SITE FEATURES, WELLS, & BORINGS ARE APPROXIMATE

STRATUS ENVIRONMENTAL, INC.

0 40 FT
SCALE

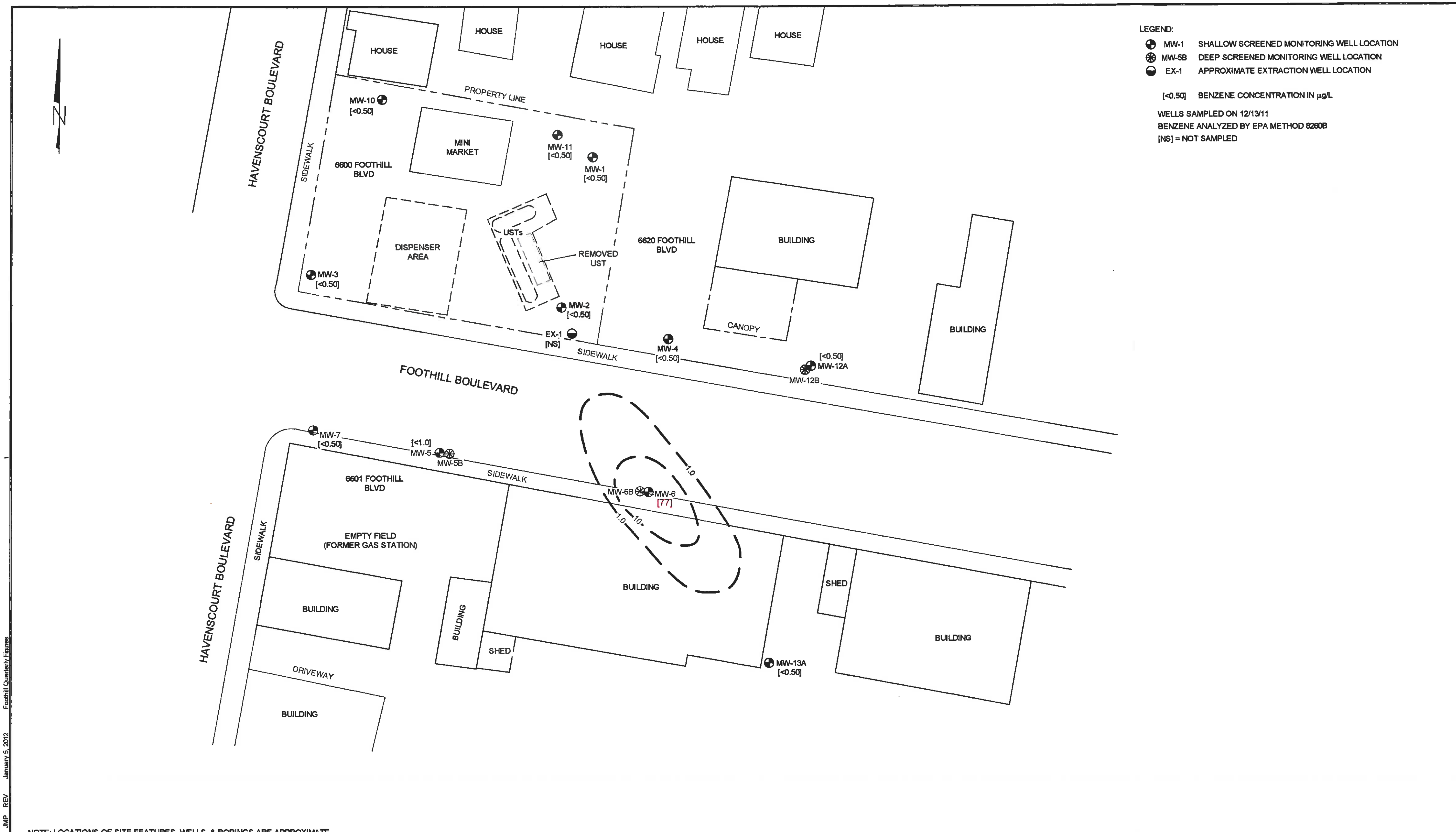
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD
OAKLAND, CALIFORNIA

GRO ISO-CONCENTRATION CONTOUR MAP
SHALLOW SCREENED WELLS
4th QUARTER 2011

FIGURE 4

PROJECT NO. 2087-6600-01

Foothill Mini Mart\Quarterly JMP REV January 5, 2012 Foothill Quarterly Figures



NOTE: LOCATIONS OF SITE FEATURES, WELLS, & BORINGS ARE APPROXIMATE

STRATUS ENVIRONMENTAL, INC.

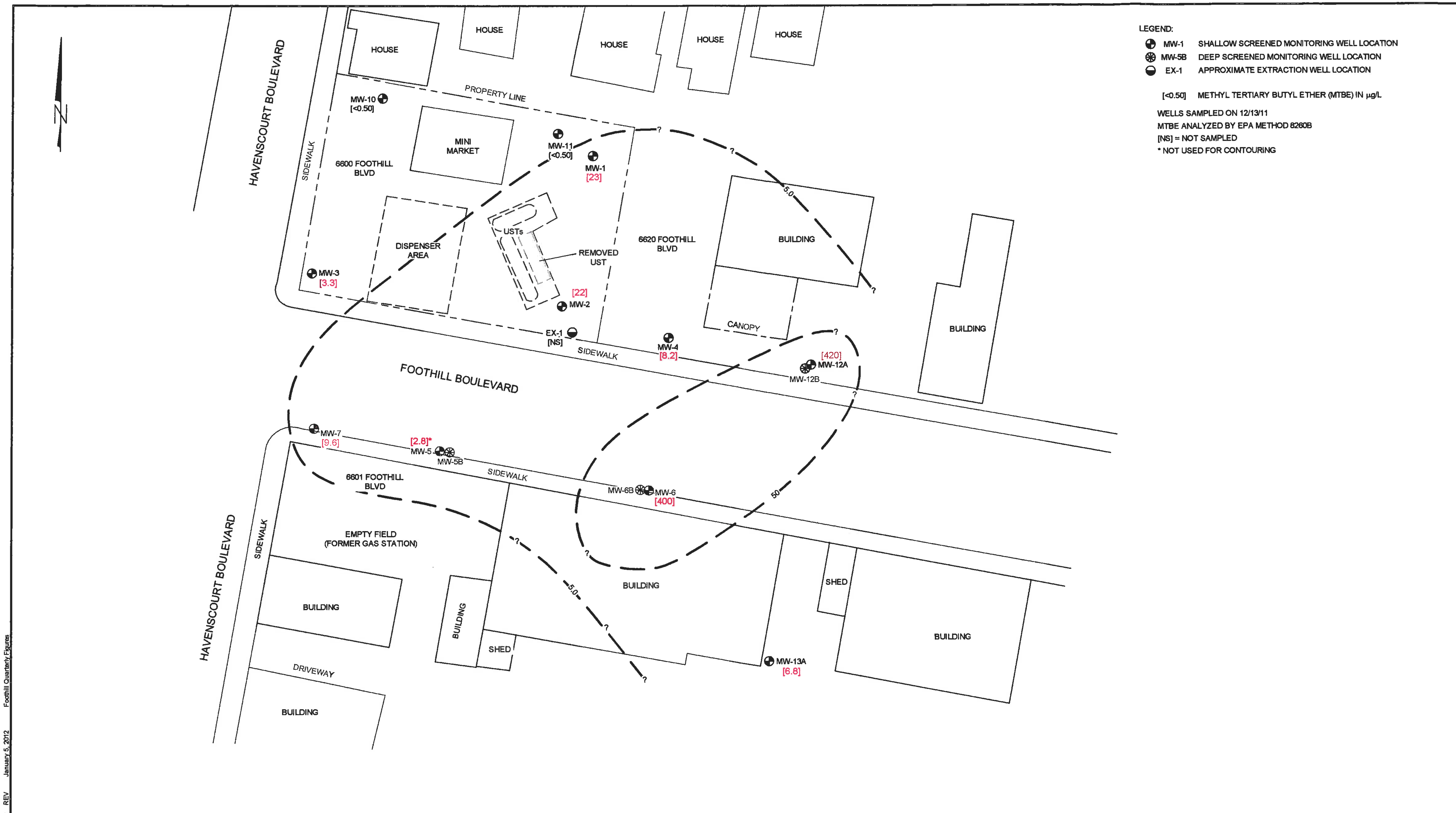
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD
OAKLAND, CALIFORNIA

BENZENE ISO-CONCENTRATION CONTOUR MAP
SHALLOW SCREENED WELLS
4th QUARTER 2011

FIGURE 5

PROJECT NO. 2087-6600-01

Foothill Mini Mart\Quarterly JMP REV January 5, 2012 Foothill Quarterly Figures



NOTE: LOCATIONS OF SITE FEATURES, WELLS, & BORINGS ARE APPROXIMATE

STRATUS ENVIRONMENTAL, INC.

0 40 FT
SCALE

FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD
OAKLAND, CALIFORNIA

MTBE ISO-CONCENTRATION CONTOUR MAP
SHALLOW SCREENED WELLS
4th QUARTER 2011

FIGURE
6

PROJECT NO.
2087-6600-01

Foothill Mini MartQuarterly JMP REV January 5, 2012 Foothill Quarterly Figures

NOTE: LOCATIONS OF SITE FEATURES, WELLS, & BORINGS ARE APPROXIMATE

STRATUS ENVIRONMENTAL, INC.

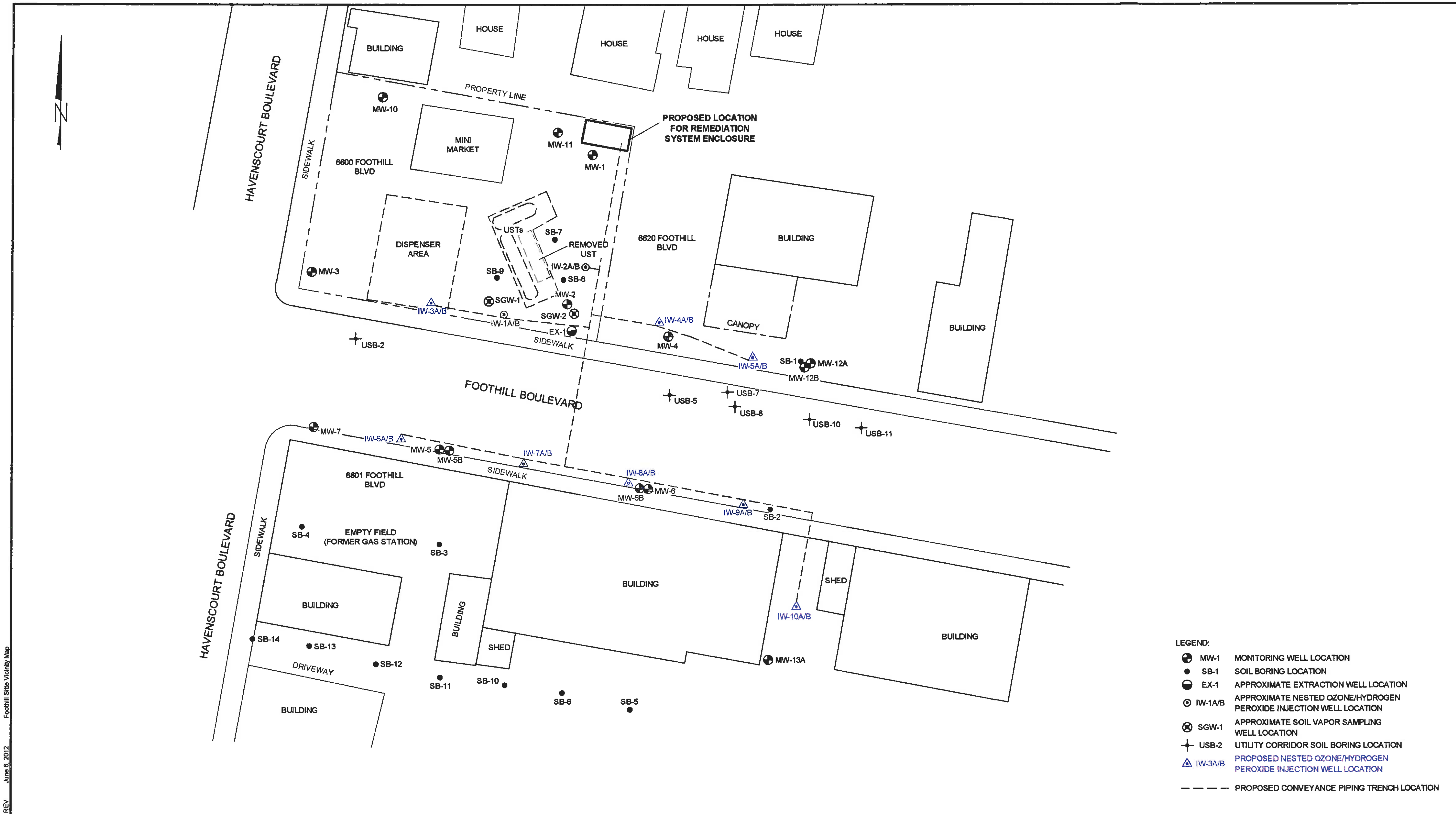
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD
OAKLAND, CALIFORNIA

TBA ISO-CONCENTRATION CONTOUR MAP
SHALLOW SCREENED WELLS
4th QUARTER 2011

FIGURE 7

PROJECT NO. 2087-6600-01

Foothill Mini MartQuarterly JMP REV January 5, 2012 Foothill Quarterly Figures



NOTE: LOCATIONS OF SITE FEATURES, WELLS, & BORINGS ARE APPROXIMATE

STRATUS ENVIRONMENTAL, INC.

0 40 FT
SCALE

FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD
OAKLAND, CALIFORNIA

SITE PLAN DEPICTING LOCATIONS OF PROPOSED INJECTION WELLS

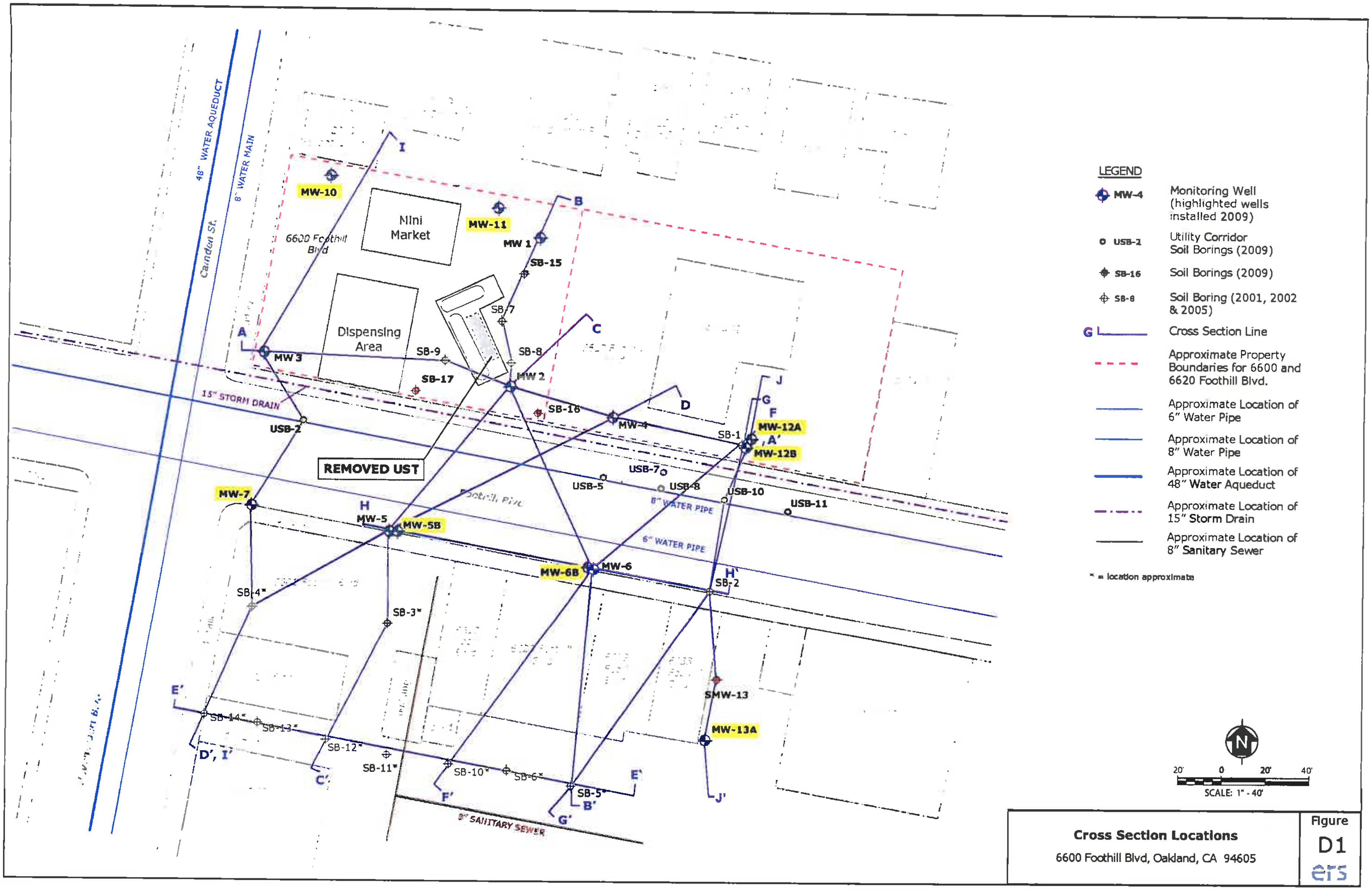
FIGURE 8

PROJECT NO. 2087-6600-01

Foothill Mini MartCAP JMP REV June 6, 2012 Foothill Site Vicinity Map

APPENDIX A

GEOLOGIC CROSS SECTIONS



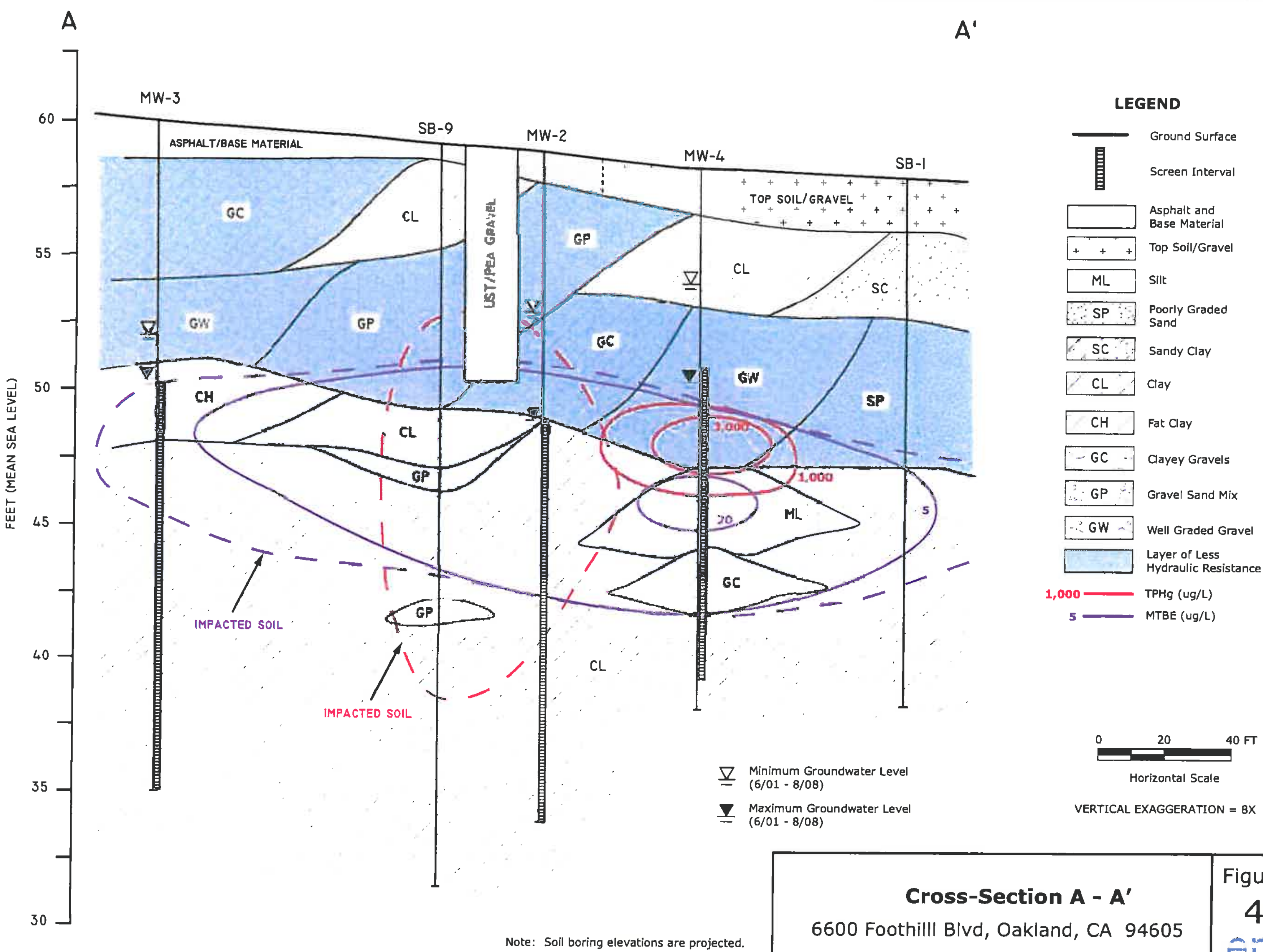
Cross Section Locations

6600 Foothill Blvd, Oakland, CA 94605

Figure D1

ers

Environmental Risk Specialties Corp

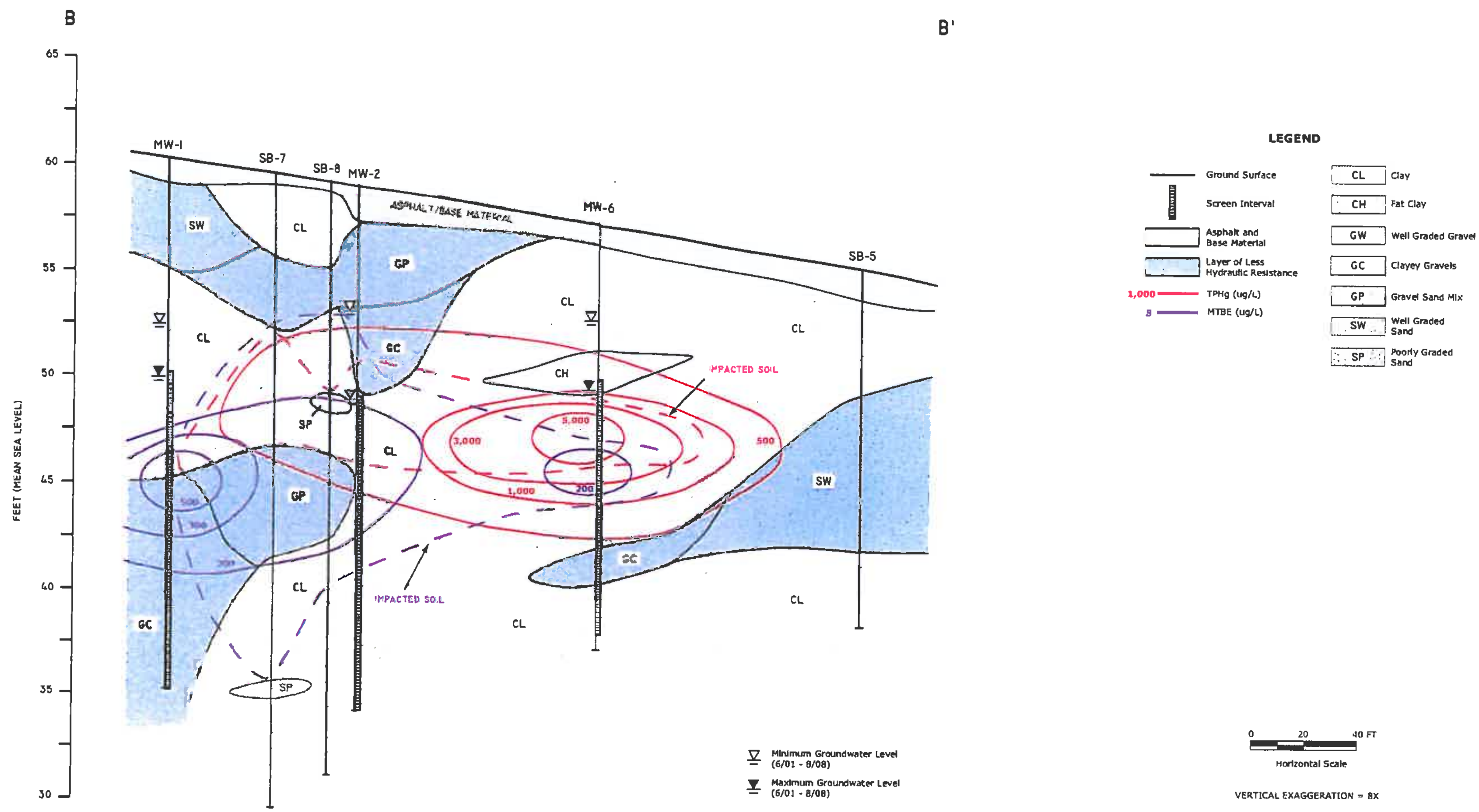


Cross-Section A - A'

6600 Foothilll Blvd, Oakland, CA 94605

Figure 4

Environmental Risk Services Corporation



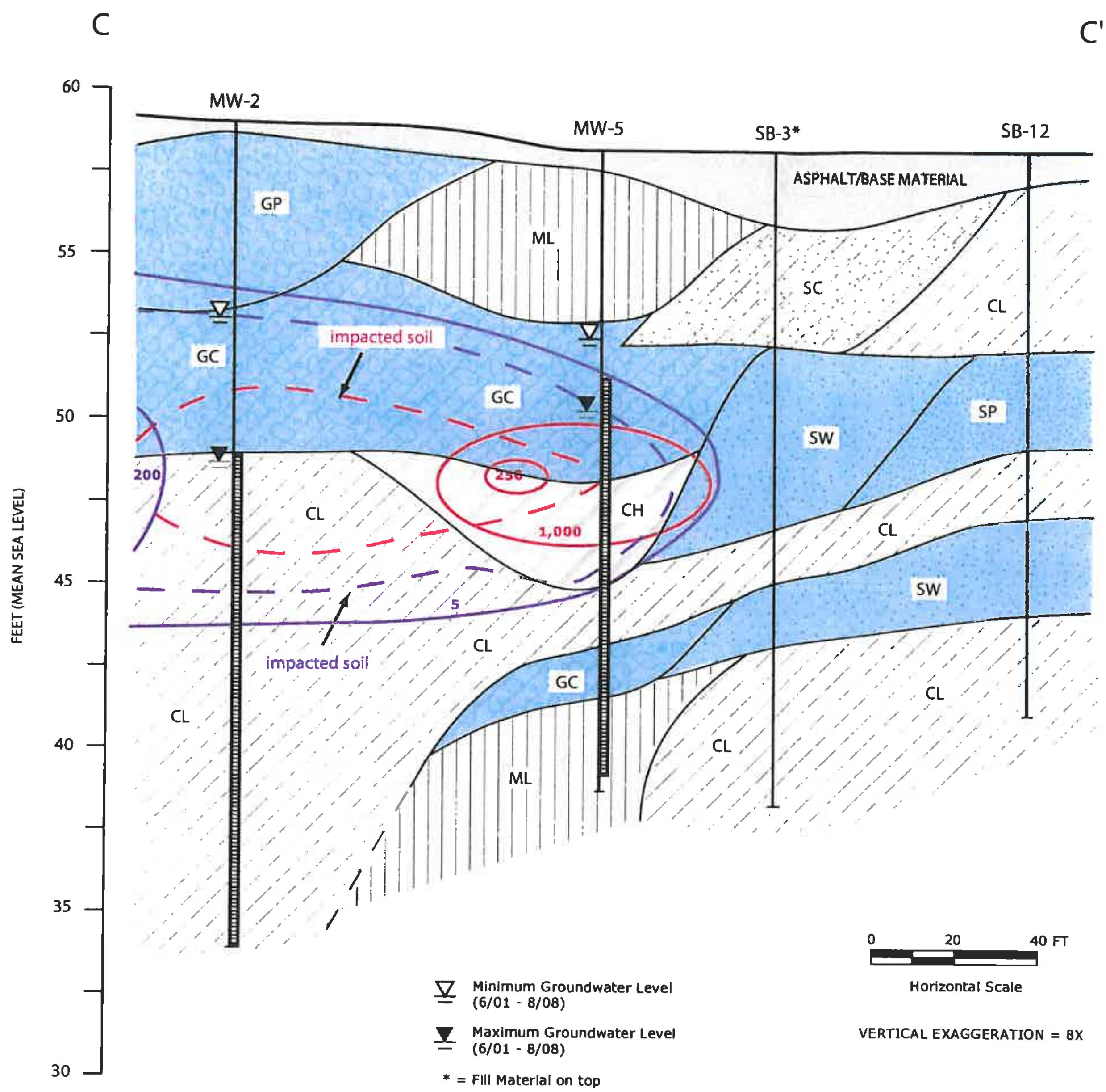
Note: Soil boring elevations are projected

Cross-Section B - B'

6600 Foothilll Blvd, Oakland, CA 94605

Figure 5

Environmental Risk Services Corporation



LEGEND

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

Note: Soil boring elevations are projected

Cross-Section C - C'

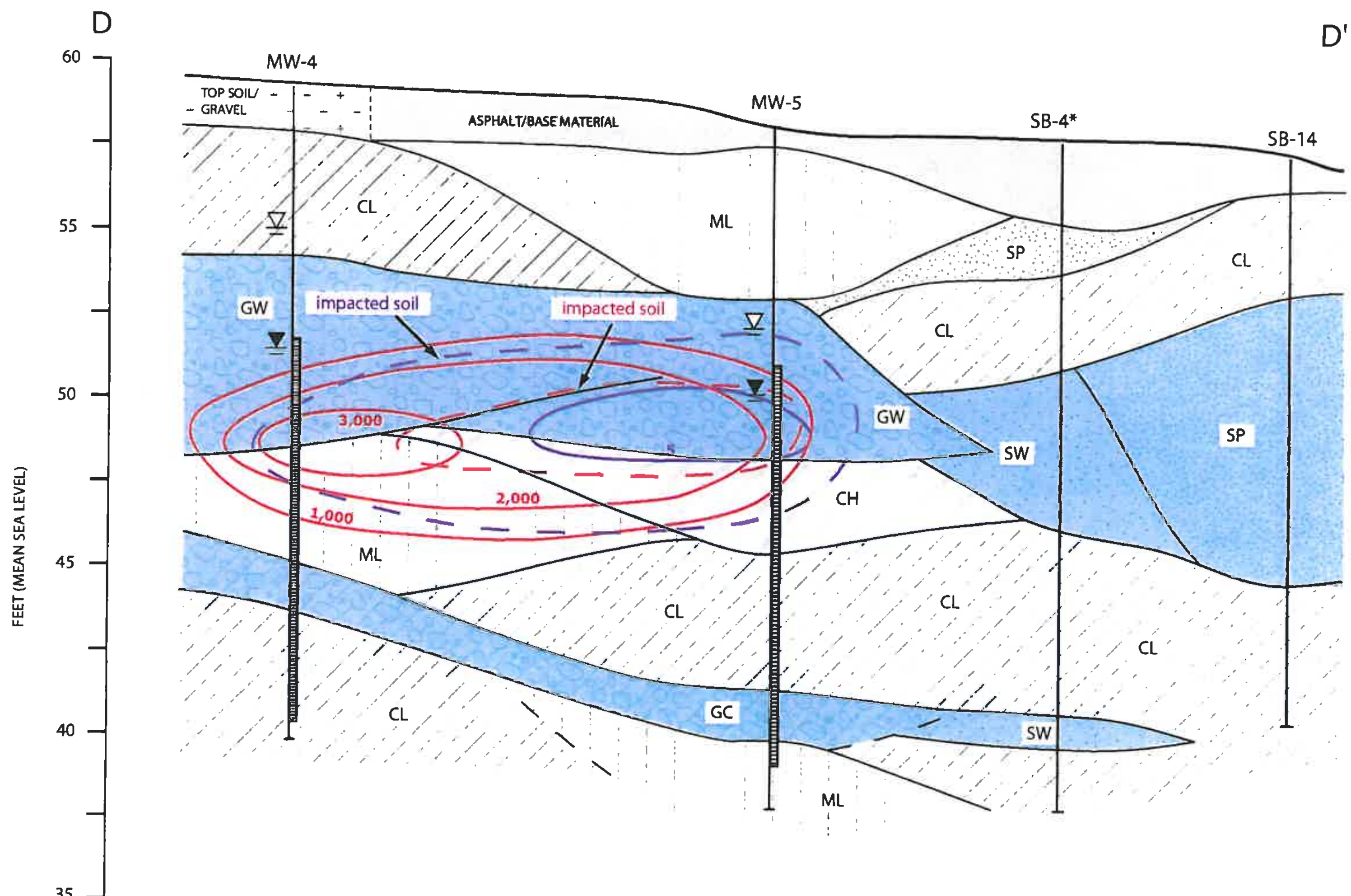
6600 Foothilll Blvd, Oakland, CA 94605

Figure

D2

ers

Environmental Risk Specialties Corporation



LEGEND

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

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

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

* = Fill Material on top

0 20 40 FT

Horizontal Scale

VERTICAL EXAGGERATION = 8X

Note: Soil boring elevations are projected.

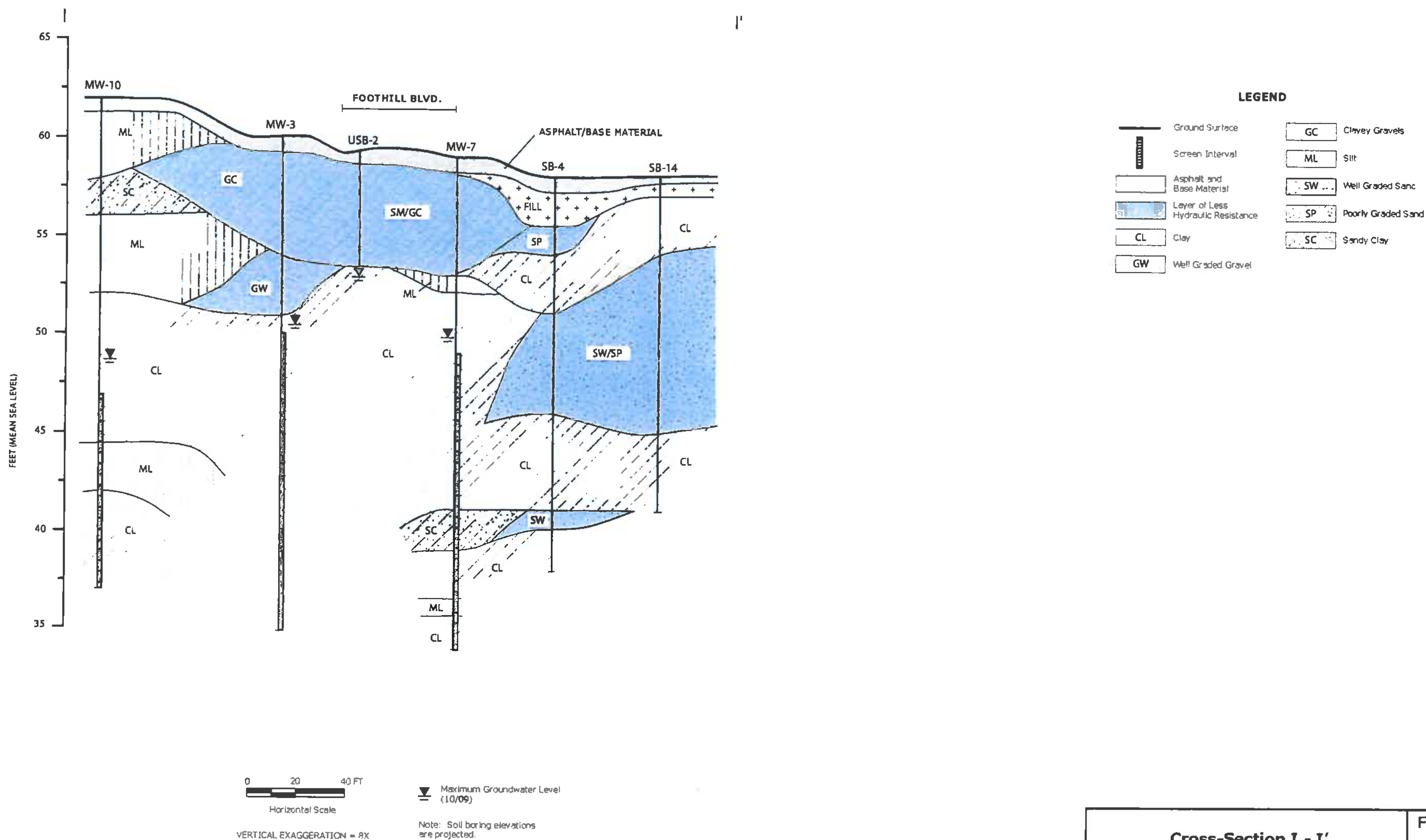
Cross-Section D - D'

6600 Foothilll Blvd, Oakland, CA 94605

Figure D3

ers

Environmental Risk Specialties Corporation



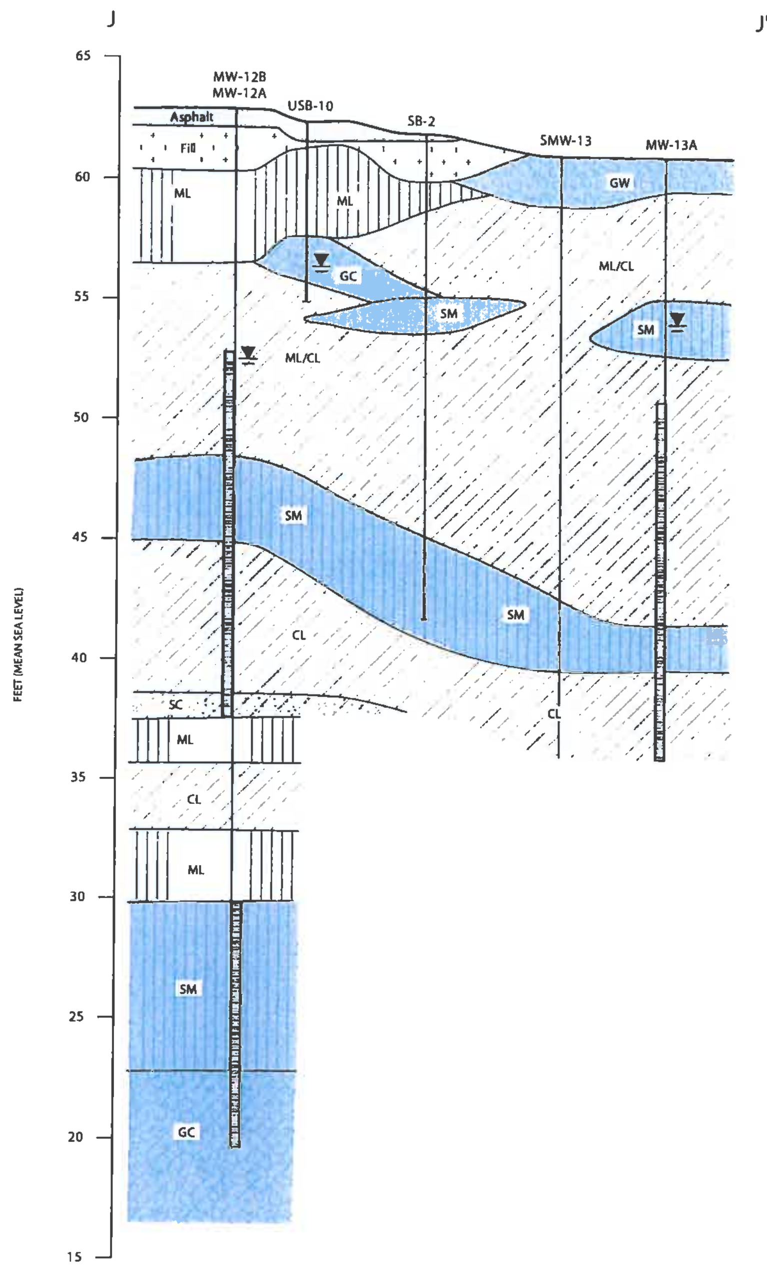
Cross-Section I - I'

6600 Foothill Blvd, Oakland, CA 94605

Figure D4

ers

Environmental Risk Specialties Corp



LEGEND

Ground Surface		SC	Sandy Clay
Screen Interval		SM	Silty Sand
Asphalt and Base Material		GC	Clayey Gravels
Layer of Less Hydraulic Resistance		GW	Well Graded Gravel
Fill Material		ML	Silt
Maximum Groundwater Level (10/2009)		CL	Clay

Note: Soil boring elevations are projected

0 20 40 FT

Horizontal Scale

VERTICAL EXAGGERATION = 8X

Cross-Section J - J'

6600 Foothilll Blvd, Oakland, CA 94605

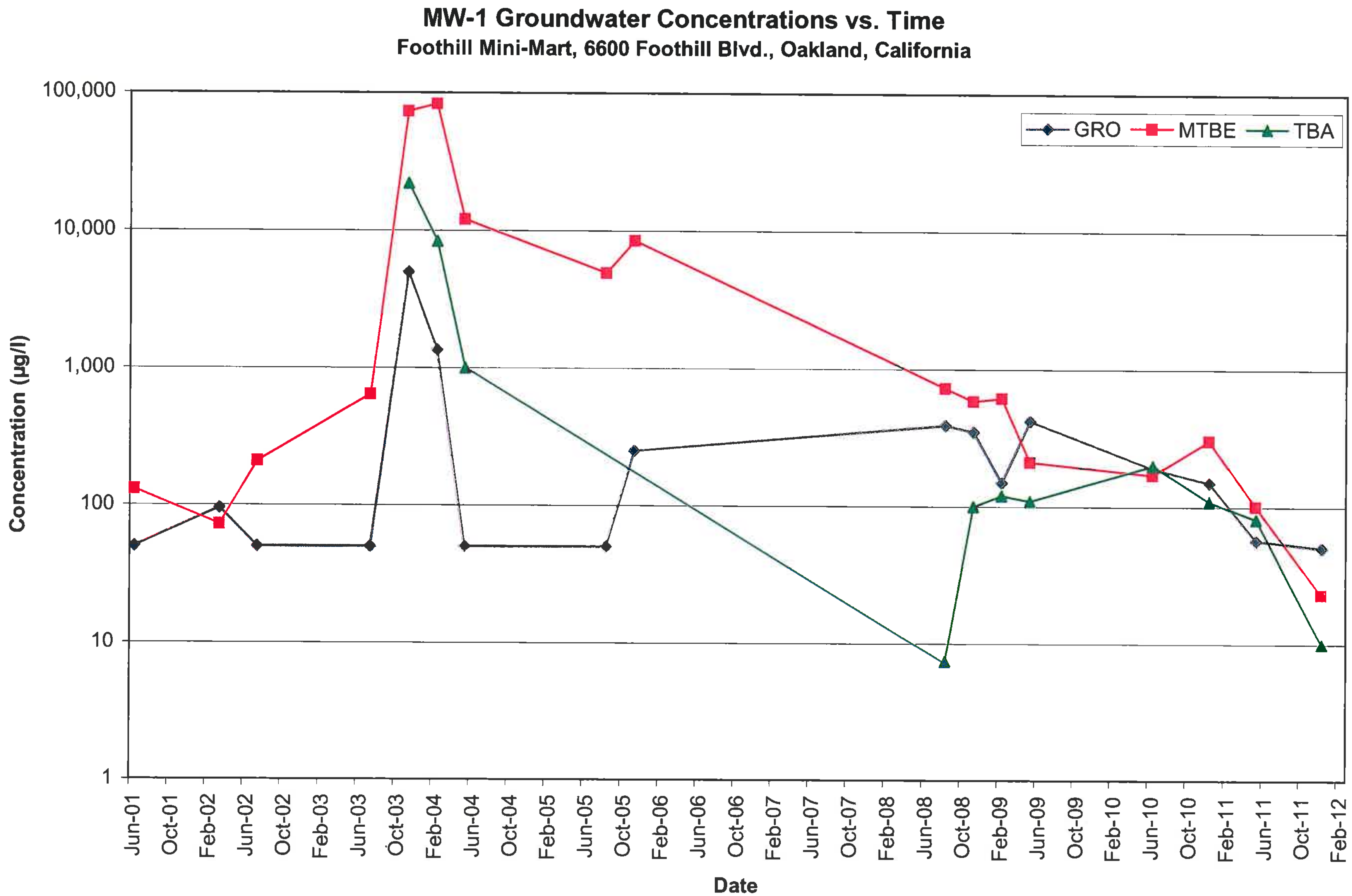
Figure D5

ers

Environmental Risk Specialties Corp

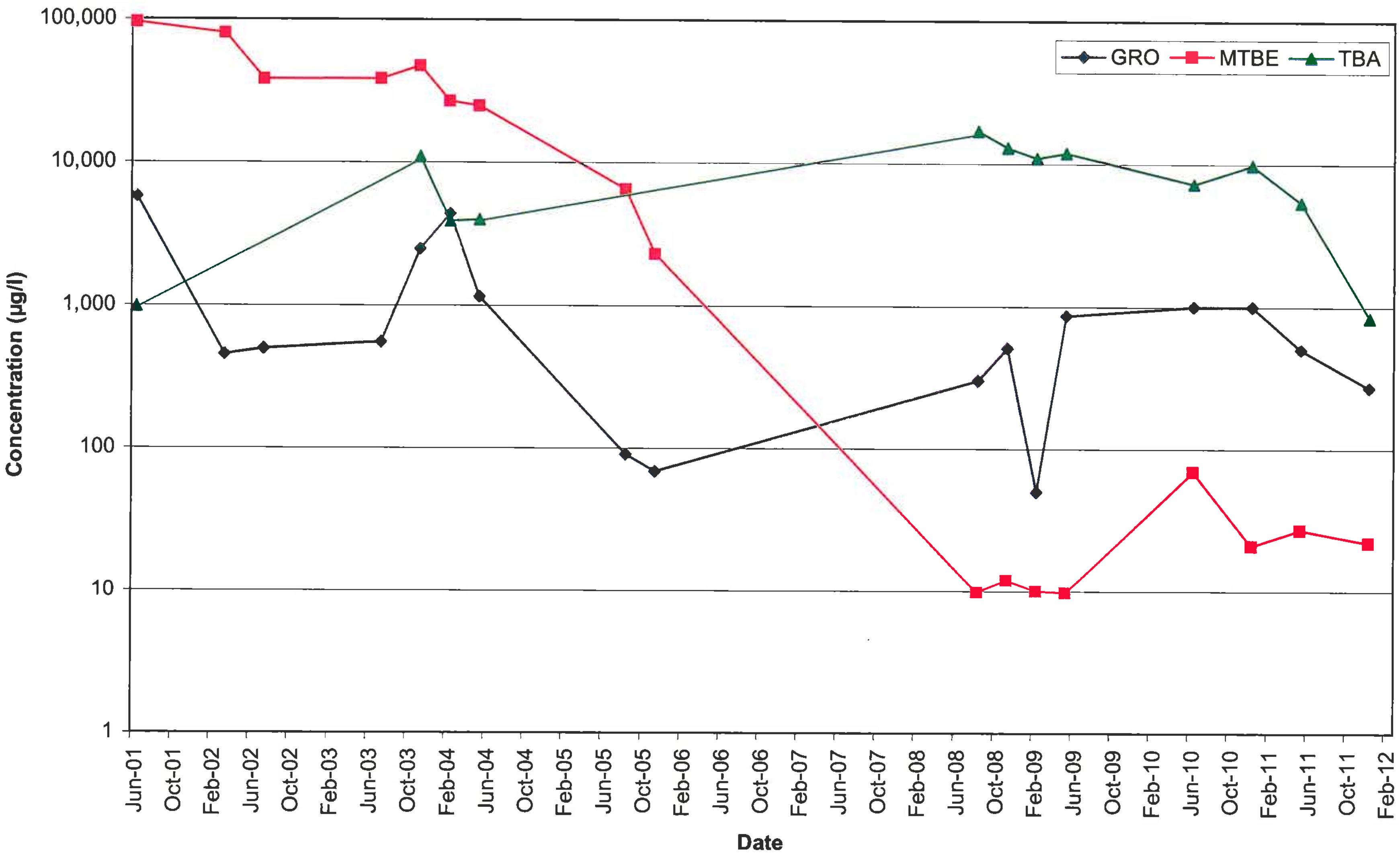
APPENDIX B

CONCENTRATION VERSUS TIME GRAPHS FOR WELLS MW-1, MW-2, MW-4, MW-5, AND MW-6

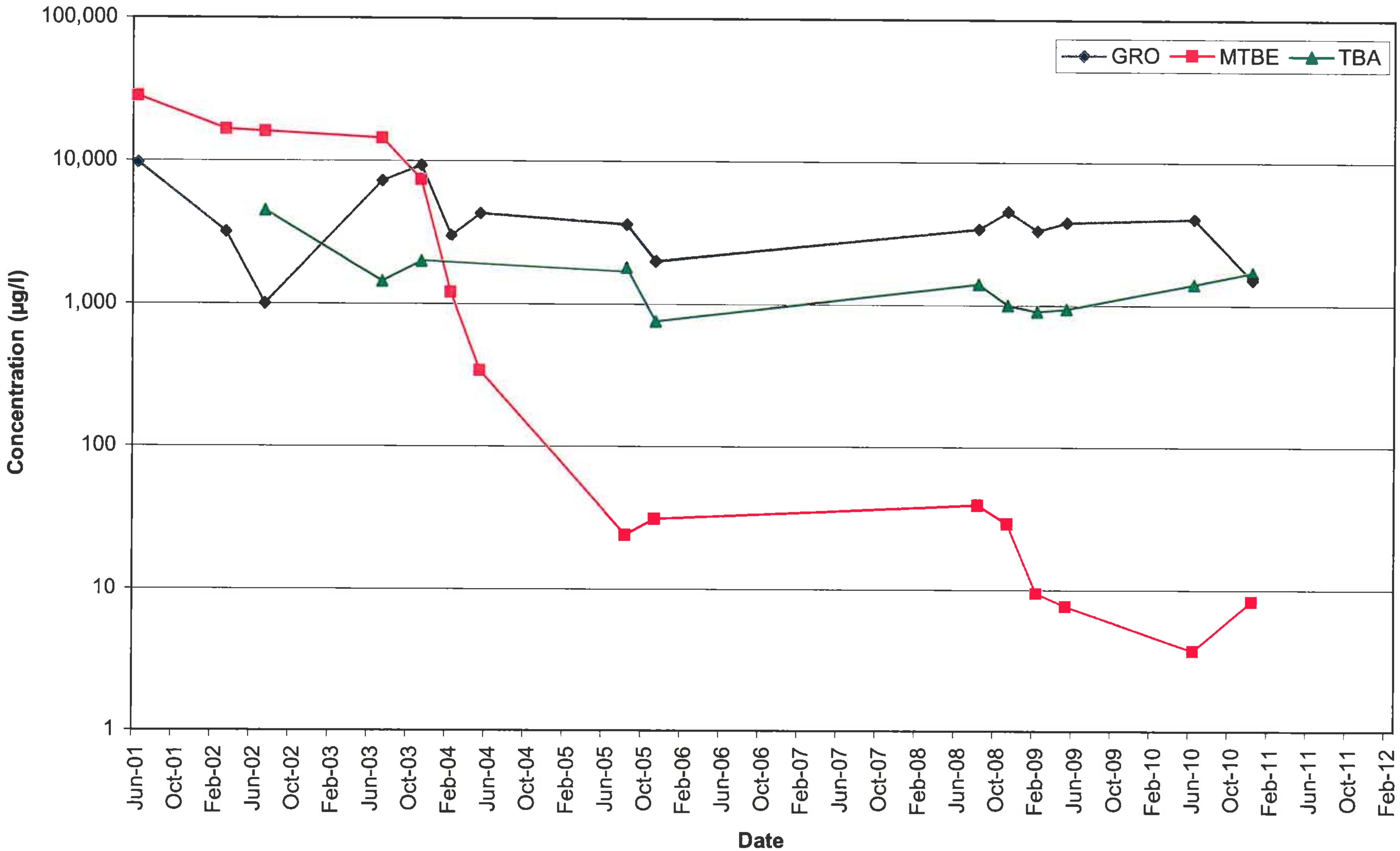

MW-1 Groundwater Concentrations vs. Time
Foothill Mini-Mart, 6600 Foothill Blvd., Oakland, California
GRO
MTBE
TBA
Concentration (µg/l)
100,000
10,000
1,000
100
10
1
Date
Jun-01
Oct-01
Feb-02
Jun-02
Oct-02
Feb-03
Jun-03
Oct-03
Feb-04
Jun-04
Oct-04
Feb-05
Jun-05
Oct-05
Feb-06
Jun-06
Oct-06
Feb-07
Jun-07
Oct-07
Feb-08
Jun-08
Oct-08
Feb-09
Jun-09
Oct-09
Feb-10
Jun-10
Oct-10
Feb-11
Jun-11
Oct-11
Feb-12

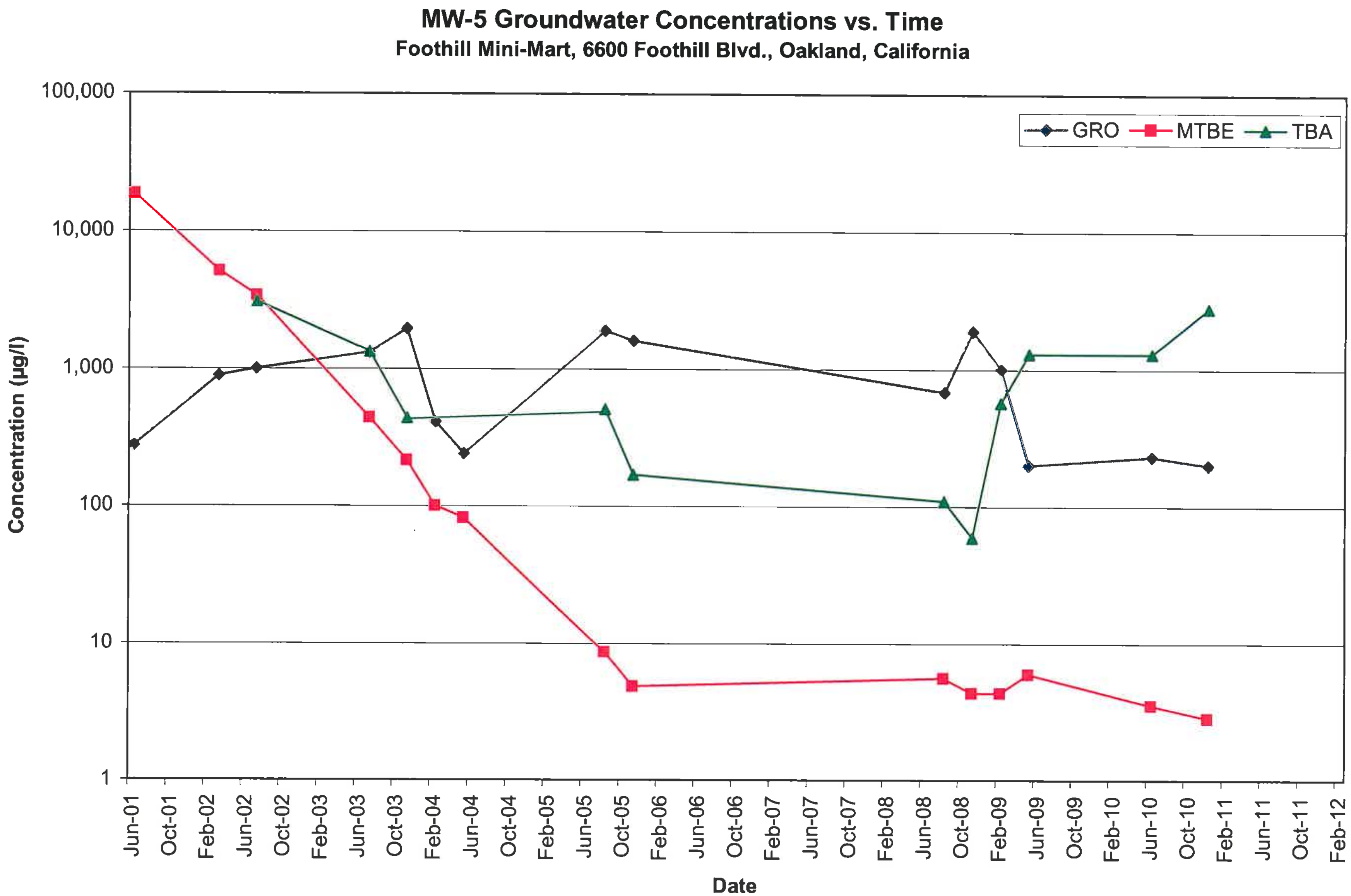
MW-2 Groundwater Concentrations vs. Time

Foothill Mini-Mart, 6600 Foothill Blvd., Oakland, California



MW-4 Groundwater Concentrations vs. Time
Foothill Mini-Mart, 6600 Foothill Blvd., Oakland, California

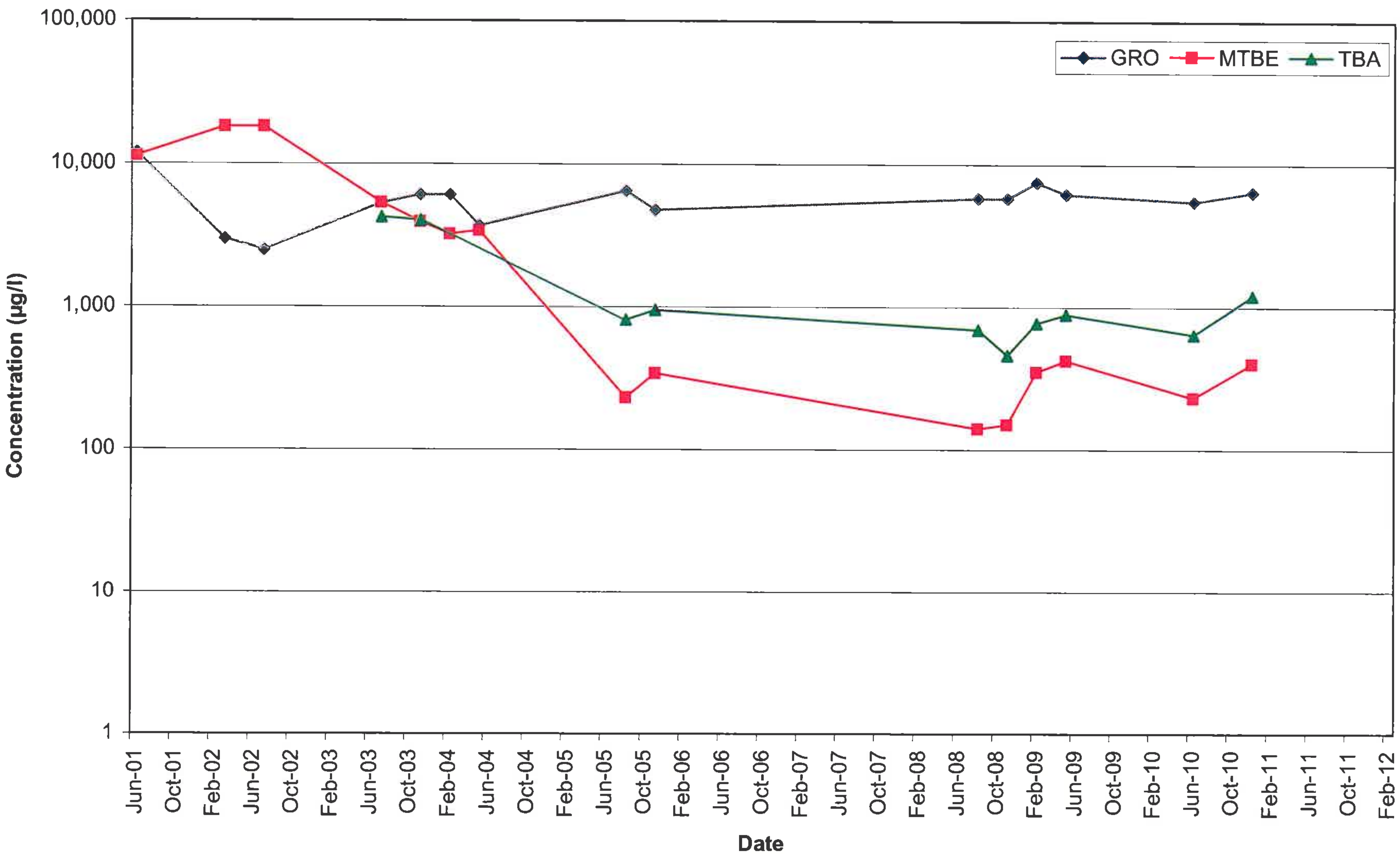




MW-5 Groundwater Concentrations vs. Time
Foothill Mini-Mart, 6600 Foothill Blvd., Oakland, California
GRO
MTBE
TBA
100,000
10,000
1,000
100
10
1
Concentration (µg/l)
Jun-01
Oct-01
Feb-02
Jun-02
Oct-02
Feb-03
Jun-03
Oct-03
Feb-04
Jun-04
Oct-04
Feb-05
Jun-05
Oct-05
Feb-06
Jun-06
Oct-06
Feb-07
Jun-07
Oct-07
Feb-08
Jun-08
Oct-08
Feb-09
Jun-09
Oct-09
Feb-10
Jun-10
Oct-10
Feb-11
Jun-11
Oct-11
Feb-12
Date

MW-6 Groundwater Concentrations vs. Time

Foothill Mini-Mart, 6600 Foothill Blvd., Oakland, California



APPENDIX C

SELECT DATA FROM 2011 ISCO PILOT TEST

TABLE 2
FIELD PARAMETER MEASUREMENTS
IN-SITU GROUNDWATER REMEDIATION PILOT TEST
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Well ID	Date	DTW (feet bgs)	pH	DO (mg/L)	Cond.	ORP (mV)	Temp. (deg C)
EX-1	**Baseline Measurement**						
	5/26/2011*	10.26	6.21	2.44	487	155	17.7
	ISCO Pilot Test Measurements						
	6/1/2011	9.35	6.84	7.68	551	252	18.3
	6/8/2011	11.10	6.90	9.84	519	208	17.7
	6/14/2011	7.40	7.00	14.20	510	314	19.3
	6/22/2011	9.42	6.94	3.99	502	354	19.2
	6/28/2011	8.93	7.08	5.68	473	316	18.4
	Post Injection Monitoring						
	7/11/2011	12.05	6.09	3.83	446	197	18.9
MW-2	**Baseline Measurement**						
	5/26/2011*	10.51	6.17	2.91	567	151	17.9
	ISCO Pilot Test Measurements						
	6/1/2011	8.85	6.18	5.53	629	246	17.8
	6/8/2011	6.32	6.34	10.23	648	250	18.5
	6/14/2011	4.62	6.41	12.43	615	306	19.2
	6/22/2011	6.42	6.42	3.89	610	349	19.1
	6/28/2011	6.77	6.10	7.01	617	311	18.4
	Post Injection Monitoring						
	7/11/2011	7.85	6.12	2.42	536	165	17.6
MW-4	**Baseline Measurement**						
	5/26/2011*	5.87	6.64	0.61	353	-62	18.5
	ISCO Pilot Test Measurements						
	6/1/2011	7.40	6.36	4.63	392	242	17.3
	6/8/2011	5.13	6.56	9.35	367	274	17.1
	6/14/2011	5.35	6.68	10.45	347	199	18.3
	6/22/2011	5.60	NM	3.84	368	203	18.3
	6/28/2011	5.71	6.82	4.90	390	357	17.3
	Post Injection Monitoring						
	7/11/2011	5.74	6.96	3.80	508	302	18.0
MW-5	**Baseline Measurement**						
	5/26/2011*	8.08	6.43	4.12	337	241	16.4
	ISCO Pilot Test Measurements						
	6/1/2011	8.11	6.90	3.17	344	236	16.0
	6/8/2011	7.38	6.56	1.92	347	179	16.3
	6/14/2011	7.67	6.56	2.02	322	289	18.2
	6/22/2011	7.99	6.28	3.17	336	195	17.9
	6/28/2011	8.12	6.51	3.30	352	335	17.1
	Post Injection Monitoring						
	7/11/2011	8.03	6.34	3.54	338	253	17.1

TABLE 2
FIELD PARAMETER MEASUREMENTS
IN-SITU GROUNDWATER REMEDIATION PILOT TEST
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Well ID	Date	DTW (feet bgs)	pH	DO (mg/L)	Cond.	ORP (mV)	Temp. (deg C)
MW-6	**Baseline Measurement**						
	5/26/2011*	5.73	6.63	0.75	362	64	17.5
	ISCO Pilot Test Measurements						
	6/1/2011	6.22	6.65	1.26	458	276	16.5
	6/8/2011	5.02	6.63	2.42	440	229	16.6
	6/14/2011	5.39	6.44	2.95	456	245	17.7
	6/22/2011	5.74	6.52	3.72	463	282	18.0
	6/28/2011	7.93	6.46	2.52	460	154	17.3
	Post Injection Monitoring						
	7/11/2011	5.82	6.36	2.84	439	160	17.0
MW-10	**Baseline Measurement**						
	5/26/2011*	10.45	6.27	3.11	392	192	16.2
	ISCO Pilot Test Measurements						
	6/1/2011	10.72	6.28	2.44	411	238	15.9
	6/8/2011	7.40	6.12	1.32	427	255	17.0
	6/14/2011	8.12	6.70	7.19	402	267	17.7
	6/22/2011	8.98	7.32	4.14	402	323	17.7
	6/28/2011	9.51	6.28	4.64	398	243	16.8
	Post Injection Monitoring						
	7/11/2011	10.81	6.23	3.36	380	132	16.2

Notes
* = Baseline measurements were taken as pre-well purge measurements, collected at the time of the second quarter 2011 well sampling event in order to be consistent with monitoring during and following the pilot tests, when no well purging was conducted.
mV = millivolts
mg/L = milligrams per liter
bgs = below ground surface
DTW = Depth to water
DO = Dissolved oxygen
Cond. = Conductivity
ORP = Oxidation - reduction potential
Temp = Temperature
deg C = degrees in celsius
NM = Not measured

TABLE 3
PETROLEUM HYDROCARBON AND FUEL ADDITIVE GROUNDWATER ANALYTICAL RESULTS
IN-SITU GROUNDWATER REMEDIATION PILOT TEST
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	Date Collected	GRO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	TBA (µg/L)	Methanol (µg/L)	Ethanol (µg/L)
EX-1	**Baseline Monitoring**												
	05/26/11	**600**	<2.5*	<2.5*	<2.5*	<2.5*	**730**	<5.0*	<5.0*	<5.0*	**6,700**	<50	<5.0
	ISCO Pilot Test Sampling												
	06/08/11	**640**	<1.0*	<1.0*	<1.0*	<1.0*	**1,100**	NA	NA	NA	**620**	NA	NA
	06/28/11	**84**	<0.5	<0.5	<0.5	<0.5	**170**	NA	NA	NA	**12**	NA	NA
	Post Injection Monitoring												
	07/11/11	**910**	<1.0*	<1.0*	<1.0*	<1.0*	**130**	NA	NA	NA	**3,100**	NA	NA
MW-2	**Baseline Monitoring**												
	05/26/11	<500*	<2.5*	<2.5*	<2.5*	<2.5*	**27**	<5.0*	<5.0*	<5.0*	**5,400**	<50	<5.0
	ISCO Pilot Test Sampling												
	06/08/11	**1,200**	<1.5*	<1.5*	<1.5*	<1.5*	**2,000**	NA	NA	NA	**690**	NA	NA
	06/28/11	**830**	<2.5*	<2.5*	<2.5*	<2.5*	**1,700**	NA	NA	NA	**110**	NA	NA
	Post Injection Monitoring												
	07/11/11	**140**	<0.5	<0.5	<0.5	<0.5	**39**	NA	NA	NA	**280**	NA	NA

TABLE 3

PETROLEUM HYDROCARBON AND FUEL ADDITIVE GROUNDWATER ANALYTICAL RESULTS

IN-SITU GROUNDWATER REMEDIATION PILOT TEST

FOOTHILL MINI MART

6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	Date Collected	GRO (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Ethyl-benzene (μg/L)	Total Xylenes (μg/L)	MTBE (μg/L)	DIPE (μg/L)	ETBE (μg/L)	TAME (μg/L)	TBA (μg/L)	Methanol (μg/L)	Ethanol (μg/L)
MW-4	**Baseline Monitoring**												
	05/26/11	**4,000**	<2.5*	<2.5*	**2.6**	<2.5*	**3.7**	<5.0*	<5.0*	<5.0*	**1,400**	<50	<5.0
	ISCO Pilot Test Sampling												
	06/08/11	**1,400**	<1.5*	<1.5*	<1.5*	<1.5*	**1,700**	NA	NA	NA	**570**	NA	NA
	06/28/11	**910**	<1.0*	<1.0*	<1.0*	<1.0*	**830**	NA	NA	NA	**2,000**	NA	NA
	Post Injection Monitoring												
	07/11/11	**2,100**	<1.0*	<1.0*	**1.2**	<1.0*	**270**	NA	NA	NA	**2,900**	NA	NA
MW-5	**Baseline Monitoring**												
	05/26/11	**230**	<1.0*	<1.0*	<1.0*	<1.0*	**3.5**	<2.0*	<2.0*	<2.0*	**1,300**	<50	<5.0
	ISCO Pilot Test Sampling												
	06/08/11	<200*	<1.0*	<1.0*	<1.0*	<1.0*	**11**	NA	NA	NA	**980**	NA	NA
	06/28/11	<200*	<1.0*	<1.0*	<1.0*	<1.0*	**3.3**	NA	NA	NA	**1,300**	NA	NA
	Post Injection Monitoring												
	07/11/11	**60**	<0.5	<0.5	<0.5	<0.5	**3.2**	NA	NA	NA	**870**	NA	NA

TABLE 3
PETROLEUM HYDROCARBON AND FUEL ADDITIVE GROUNDWATER ANALYTICAL RESULTS
IN-SITU GROUNDWATER REMEDIATION PILOT TEST
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	Date Collected	GRO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	TBA (µg/L)	Methanol (µg/L)	Ethanol (µg/L)
MW-6	**Baseline Monitoring**												
	05/26/11	**5,500**	**54**	<1.0*	**23**	**30.4**	**230**	<2.0*	<2.0*	<2.0*	**640**	<50	<5.0
	ISCO Pilot Test Sampling												
	06/08/11	**3,900**	**60**	<1.0*	**41**	**61.6**	**300**	NA	NA	NA	**630**	NA	NA
	06/28/11	**7,500**	**69**	<2.5*	**56**	**91.9**	**270**	NA	NA	NA	**880**	NA	NA
	Post Injection Monitoring												
	07/11/11	**6,000**	**63**	<2.0*	**57**	**94.2**	**240**	NA	NA	NA	**620**	NA	NA
MW-10	**Baseline Monitoring**												
	05/26/11	<50	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	<10	<50	<5.0
	ISCO Pilot Test Sampling												
	06/08/11	<50	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	<10	NA	NA
	06/28/11	<50	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	<10	NA	NA
	Post Injection Monitoring												
	07/11/11	<50	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	<10	NA	NA

TABLE 3
PETROLEUM HYDROCARBON AND FUEL ADDITIVE GROUNDWATER ANALYTICAL RESULTS
IN-SITU GROUNDWATER REMEDIATION PILOT TEST
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	Date Collected	GRO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MTBE (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	TBA (µg/L)	Methanol (µg/L)	Ethanol (µg/L)

Explanation
GRO = Gasoline range organics
BTEX = Benzene, toluene, ethylbenzene, and xylenes
MTBE = Methyl tertiary butyl ether
TBA=Tertiary butyl alcohol
DIPE =Di-isopropyl ether
ETBE = Ethyl tertiary butyl ether
TAME = Tertiary amyl methyl ether
µg/L = micrograms per liter
* = Reporting limits increased due to high concentrations of target analytes
NA = Not analyzed
ISCO = In-situ chemical oxidation

Analytical Methods
GRO analyzed using EPA Method SW8015B/DHS LUFT Manual
BTEX, MTBE, DIPE, ETBE, TAME, and TBA analyzed using EPA Method SW8260B
Methanol and Ethanol analyzed using EPA Method SW8260B-DI

Analytical Laboratory
Alpha Analytical, Inc. (ELAP #2019)

TABLE 4
GROUNDWATER ANALYTICAL RESULTS FOR METALS
IN-SITU GROUNDWATER REMEDIATION PILOT TEST
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	Date Collected	Hexavalent Chromium (μg/L)	Magnesium (μg/L)	Aluminum (μg/L)	Potassium (μg/L)	Calcium (μg/L)	Manganese (μg/L)	Nickel (μg/L)	Copper (μg/L)	Arsenic (μg/L)	Barium (μg/L)
EX-1	**Baseline Monitoring**										
	05/26/11	<1.0	**26,000**	**560**	**900**	**45,000**	**460**	**21**	<10	<5.0	**96**
	ISCO Pilot Test Sampling										
	06/08/11	<1.0	**44,000**	**110,000**	**14,000**	**51,000**	**1,900**	**390**	**150**	**21**	**980**
	06/28/11	**3.4**	**86,000**	**290,000**	**32,000**	**66,000**	**4,600**	**1,100**	**350**	**52**	**2,200**
	Post Injection Monitoring										
	07/11/11	<1.0	**63,000**	**170,000**	**15,000**	**41,000**	**3,200**	**640**	**160**	**32**	**930**
MW-2	**Baseline Monitoring**										
	05/26/11	<1.0	**38,000**	**31,000**	**3,900**	**39,000**	**1,400**	**150**	**40**	**14**	**500**
	ISCO Pilot Test Sampling										
	06/08/11	<1.0	**64,000**	**170,000**	**21,000**	**55,000**	**3,200**	**860**	**280**	**46**	**2,400**
	06/28/11	<1.0	**78,000**	**160,000**	**18,000**	**68,000**	**4,200**	**1,000**	**310**	**47**	**2,700**
	Post Injection Monitoring										
	07/11/11	<1.0	**98,000**	**280,000**	**21,000**	**39,000**	**3,200**	**1,000**	**250**	**48**	**2,900**

TABLE 4
GROUNDWATER ANALYTICAL RESULTS FOR METALS
IN-SITU GROUNDWATER REMEDIATION PILOT TEST
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	Date Collected	Hexavalent Chromium (µg/L)	Magnesium (µg/L)	Aluminum (µg/L)	Potassium (µg/L)	Calcium (µg/L)	Manganese (µg/L)	Nickel (µg/L)	Copper (µg/L)	Arsenic (µg/L)	Barium (µg/L)
MW-4	**Baseline Monitoring**										
	05/26/11	<1.0	**38,000**	**33,000**	**3,700**	**34,000**	**5,900**	**71**	**43**	**16**	**420**
	ISCO Pilot Test Sampling										
	06/08/11	<1.0	**43,000**	**110,000**	**14,000**	**33,000**	**4,400**	**220**	**150**	**22**	**1,100**
	06/28/11	<1.0	**61,000**	**150,000**	**17,000**	**43,000**	**5,800**	**320**	**200**	**30**	**1,400**
	Post Injection Monitoring										
	07/11/11	<1.0	**51,000**	**81,000**	**9,400**	**33,000**	**5,300**	**150**	**81**	**16**	**640**
MW-5	**Baseline Monitoring**										
	05/26/11	<1.0	**25,000**	**2,700**	<500	**26,000**	**3,500**	**88**	<10	**6.5**	**140**
	ISCO Pilot Test Sampling										
	06/08/11	<1.0	**24,000**	**2,200**	**590**	**29,000**	**3,300**	<10	<10	**13**	**130**
	06/28/11	<1.0	**32,000**	**31,000**	**4,700**	**29,000**	**3,500**	**91**	**66**	**14**	**420**
	Post Injection Monitoring										
	07/11/11	<1.0	**29,000**	**17,000**	**3,400**	**26,000**	**2,900**	**64**	**33**	**9.6**	**240**

TABLE 4
GROUNDWATER ANALYTICAL RESULTS FOR METALS
IN-SITU GROUNDWATER REMEDIATION PILOT TEST
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	Date Collected	Hexavalent Chromium (µg/L)	Magnesium (µg/L)	Aluminum (µg/L)	Potassium (µg/L)	Calcium (µg/L)	Manganese (µg/L)	Nickel (µg/L)	Copper (µg/L)	Arsenic (µg/L)	Barium (µg/L)
MW-6	**Baseline Monitoring**										
	05/26/11	<1.0	**33,000**	**3,700**	**520**	**30,000**	**4,700**	**12**	<10	**7.3**	**120**
	ISCO Pilot Test Sampling										
	06/08/11	<1.0	**37,000**	**18,000**	**2,800**	**33,000**	**4,400**	**44**	**30**	**11**	**240**
	06/28/11	<1.0	**42,000**	**30,000**	**4,500**	**35,000**	**4,500**	**76**	**46**	**9.3**	**300**
	Post Injection Monitoring										
	07/11/11	<1.0	**43,000**	**22,000**	**3,300**	**31,000**	**4,700**	**110**	**28**	**9.0**	**200**
MW-10	**Baseline Monitoring**										
	05/26/11	<1.0	**14,000**	**790**	<500	**17,000**	**16**	**30**	<10	<5.0	**85**
	ISCO Pilot Test Sampling										
	06/08/11	<1.0	**15,000**	**1,500**	**520**	**19,000**	**20**	<10	<10	<5.0	**92**
	06/28/11	<1.0	**20,000**	**7,200**	**1,400**	**18,000**	**98**	**53**	<10	<5.0	**100**
	Post Injection Monitoring										
	07/11/11	<1.0	**17,000**	**7,500**	**1,600**	**17,000**	**170**	**120**	<10	<5.0	**110**

TABLE 4
GROUNDWATER ANALYTICAL RESULTS FOR METALS
IN-SITU GROUNDWATER REMEDIATION PILOT TEST
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	Date Collected	Hexavalent Chromium (µg/L)	Magnesium (µg/L)	Aluminum (µg/L)	Potassium (µg/L)	Calcium (µg/L)	Manganese (µg/L)	Nickel (µg/L)	Copper (µg/L)	Arsenic (µg/L)	Barium (µg/L)

Explanation
µg/L = micrograms per liter
ISCO = In-situ chemical oxidation

Analytical Methods
Hexavalent chromium analyzed using APHA/EPA Methods
All other analyses for metals performed using EPA Method SW6020 / SW6020A

Analytical Laboratory
Alpha Analytical, Inc. (ELAP #2019, except hexavalent chromium)
California Laboratory Services, Inc. (ELAP #1233, hexavalent chromium)

TABLE 5
ADDITIONAL GROUNDWATER ANALYTICAL RESULTS
IN-SITU GROUNDWATER REMEDIATION PILOT TEST
FOOTHILL MINI MART

6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	Date Collected	Nitrite (µg/L)	Bromide (µg/L)	Nitrate (µg/L)	Sulfate (µg/L)	Sulfide (µg/L)	Bromate (µg/L)
SHALLOW SCREENED WELLS							
EX-1	**Baseline Monitoring**						
	05/26/11	<250	**530**	**870**	**25,000**	<100	<1.0
	ISCO Pilot Test Sampling						
	06/08/11	<250	**470**	**1,900**	**33,000**	**350**	<1.0
	06/28/11	<250	**560**	**450**	**30,000**	<100	**1.3**
	Post Injection Monitoring						
	07/11/11	<250	**330**	<250	**21,000**	<100	<1.0
MW-2	**Baseline Monitoring**						
	05/26/11	<250	<250	<250	**29,000**	<100	<1.0
	ISCO Pilot Test Sampling						
	06/08/11	<250	**470**	<250	**220,000**	<100	<1.0
	06/28/11	<250	**610**	<250	**250,000**	<100	<1.0
	Post Injection Monitoring						
	07/11/11	<250	**320**	<250	**130,000**	**140**	<1.0
MW-4	**Baseline Monitoring**						
	05/26/11	<250	<250	<250	**4,700**	<100	<1.0
	ISCO Pilot Test Sampling						
	06/08/11	<250	<250	<250	**8,200**	**110**	<1.0
	06/28/11	<250	<250	<250	**7,400**	<100	<1.0
	Post Injection Monitoring						
	07/11/11	<250	<250	<250	**3,000**	<100	<1.0
MW-5	**Baseline Monitoring**						
	05/26/11	<250	<250	<250	**6,000**	<100	<1.0
	ISCO Pilot Test Sampling						
	06/08/11	<250	<250	<250	**11,000**	<100	<1.0
	06/28/11	<250	<250	<250	**6,200**	<100	<1.0
	Post Injection Monitoring						
	07/11/11	<250	<250	<250	**7,500**	<100	<1.0

TABLE 5
ADDITIONAL GROUNDWATER ANALYTICAL RESULTS
IN-SITU GROUNDWATER REMEDIATION PILOT TEST
FOOTHILL MINI MART
6600 FOOTHILL BOULEVARD, OAKLAND, CALIFORNIA

Sample ID	Date Collected	Nitrite (μg/L)	Bromide (μg/L)	Nitrate (μg/L)	Sulfate (μg/L)	Sulfide (μg/L)	Bromate (μg/L)
MW-6	**Baseline Monitoring**						
	05/26/11	<250	**280**	<250	<500	**240**	<1.0
	ISCO Pilot Test Sampling						
	06/08/11	<250	**370**	<250	<500	<100	<1.0
	06/28/11	<250	**340**	<250	**590**	<100	<1.0
	Post Injection Monitoring						
	07/11/11	<250	**300**	<250	<500	<100	<1.0
MW-10	**Baseline Monitoring**						
	05/26/11	<250	<250	**10,000**	**65,000**	<100	<1.0
	ISCO Pilot Test Sampling						
	06/08/11	<250	<250	**9,600**	**62,000**	<100	<1.0
	06/28/11	<250	<250	**11,000**	**59,000**	<100	<1.0
	Post Injection Monitoring						
	07/11/11	<250	<250	**12,000**	**50,000**	<100	<1.0

Explanation
μg/L = micrograms per liter
ISCO = In-situ chemical oxidation

Analytical Methods
Nitrite, bromide, nitrate, and sulfate analyzed using EPA Method 300.0
Sulfide analyzed using EPA Method 4500-S D
Bromate analyzed using EPA Method 317

Analytical Laboratory
Alpha Analytical, Inc. (ELAP #2019, all analyses except bromate)
MWH Laboratories (ELAP #1422, bromate analysis)

APPENDIX D

FIELD PRACTICES AND PROCEDURES

FIELD PRACTICES AND PROCEDURES

General procedures used by Stratus in site assessments for drilling exploratory borings, collecting samples, and installing monitoring wells are described herein. These general procedures are used to provide consistent and reproducible results; however, some procedure may be modified based on site conditions. A California state-registered geologist supervises the following procedures.

PRE-FIELD WORK ACTIVITIES

Health and Safety Plan

Field work performed by Stratus at the site is conducted according to guidelines established in a Site Health and Safety Plan (SHSP). The SHSP is a document which describes the hazards that may be encountered in the field and specifies protective equipment, work procedures, and emergency information. A copy of the SHSP is at the site and available for reference by appropriate parties during work at the site.

Locating Underground Utilities

Prior to commencement of any work that is to be below surface grade, the location of the excavation, boring, etc., is marked with white paint as required by law. An underground locating service such as Underground Service Alert (USA) is contacted. The locating company contacts the owners of the various utilities in the vicinity of the site to mark the locations of their underground utilities. Any invasive work is preceded by hand augering to a minimum depth of five feet below surface grade to avoid contact with underground utilities.

FIELD METHODS AND PROCEDURES

Exploratory Soil Borings

Soil borings will be drilled using a truck-mounted, hollow stem auger drill rig. Soil samples for logging will be obtained from auger-return materials and by advancing a modified California split-spoon sampler equipped with brass or stainless steel liners into undisturbed soil beyond the tip of the auger. Soils will be logged by a geologist according to the Unified Soil Classification System and standard geological techniques. Drill cuttings well be screened using a portable photoionization detector (PID) or a flame ionization detector (FID). Exploratory soil borings not used for monitoring well installation will be backfilled to the surface with a bentonite-cement slurry pumped into the boring through a tremie pipe.

Soil sampling equipment will be cleaned with a detergent water solution, rinsed with clean water, and equipped with clean liners between sampling intervals. Augers and samplers will be steam cleaned between each boring to reduce the possibility of cross contamination. Steam cleaning effluent will be contained in 55-gallon drums and temporarily stored on site. The disposal of the effluent will be the responsibility of the client.

Drill cuttings generated during the drilling procedure will be stockpiled on site. Stockpiled drill cuttings will be placed on and covered with plastic sheeting. The stockpiled soil is typically characterized by collecting and analyzing composite samples from the stockpile. Stratus Environmental will recommend an appropriate method for disposition of the cuttings based on the analytical results. The client will be responsible for disposal of the drill cuttings.

Soil Sample Collection

During drilling, soil samples will be collected in cleaned brass, two by six inch tubes. The tubes will be set in an 18-inch-long split-barrel sampler. The sampler will be conveyed to bottom of the borehole attached to a wire-line hammer device on the drill rig. When possible, the split-barrel sampler will be driven its entire length, either hydraulically or by repeated pounding a 140-pound hammer using a 30-inch drop. The number of drops (blows) used to drive the sampler will be recorded on the boring log. The sampler will be extracted from the borehole, and the tubes containing the soil samples will be removed. Upon removal, the ends of the lowermost tube will be sealed with Teflon sheets and plastic caps. Soil samples for chemical analysis will be labeled, placed on ice, and delivered to a state-certified analytical laboratory, along with the appropriate chain-of-custody documentation.

Soil Classification

As the samples are obtained in the field, they will be classified by the field geologist in accordance with the Unified Soil Classification System. Representative portions of the samples will be retained for further examination and for verification of the field classification. Logs of the borings indicating the depth and identification of the various strata and pertinent information regarding the method of maintaining and advancing the borehole will be prepared.

Soil Sample Screening

Soil samples selected for chemical analysis will be determined from a head-space analysis using a PID or an FID. The soil will be placed in a Ziploc® bag, sealed, and allowed to reach ambient temperature, at which time the PID probe will be inserted into the Ziploc® bag. The total volatile hydrocarbons present are detected by the PID and reported in parts per million by volume (ppmv). The PID will be calibrated to an isobutylene standard.

Generally two soil samples from each soil boring will be submitted for chemical analysis unless otherwise specified in the scope of work. Soil samples selected for analysis typically represent the highest PID reading recorded for each soil boring and the sample just above first-encountered groundwater.

Stockpiled Drill Cuttings and Soil Sampling

Soil generated during drilling operations will be stockpiled on-site. The stockpile will be set on and covered by plastic sheeting in a manner to prevent rain water from coming in contact with the soil. Prior to collecting soil samples, Stratus personnel will calculate the approximate volume of soil in the stockpile. The stockpile will then divided into sections, if warranted, containing the predetermined volume sampling interval. Soil samples will be collected at 0.5 to 2 feet below the surface of the stockpile. Four soil samples will be collected from the stockpile and composited into one sample by the laboratory prior to analysis. The soil samples will be collected in cleaned brass, two by six inch tubes using a hand driven sampling device. To reduce the potential for cross-contan1ination between samples, the sampler will be cleaned between each sampling event. Upon recovery, the sample container will be sealed at each end with Teflon sheeting and plastic caps to minimize the potential of volatilization and cross-contan1ination prior to chemical analysis. The soil sample will be labe1ed, placed on ice, and delivered to a state-certified analytical laboratory, along with the appropriate chain-of-custody documentation.

Direct Push Technology, Soil Sampling

GeoProbe™ is a drilling method of advancing small diameter borings without generating soil cuttings. The GeoProbe™ system consists of a 2-inch diameter, 5-feet long, stainless steel soil sampling tool that is hydraulically advanced into subsurface soils by a small, truck-mounted rig. The sampling tool is designed similar to a California-modified split-spoon sampler, and lined with a 5-foot long, clear acrylic sample tube that enables continuous core sampling.

To collect soil samples, the sampler is advanced to the desired sampling depth. The mouth of the sampling tool is plugged to prevent soil from entering the sampler. Upon reaching the desired sampling depth, the plug at the mouth of the sample tool is disengaged and retracted, the sampler is advanced, and the sampler is filled with soil. The sample tool is then retrieved from the boring, and the acrylic sample tube removed. The sample tool is then cleaned, a new acrylic tube is placed inside and the sampling equipment is advanced back down the borehole to the next sample interval.

The Stratus geologist describes the entire interval of soil visible in the acrylic tube. The bottom-most 6-inch long section is cut off and retained for possible chemical analysis. The ends of the chemical sample are lined with Teflon™ sheets, capped, labeled, and placed in an ice-chilled cooler for transport to California Department of Health Services-certified analytical laboratory under chain-of-custody.

Direct Push Technology, Water Sampling

A well known example of direct push technology for water sampling is the Hydropunch®. For the purpose of this field method the term hydropunch will be used instead of direct push technology for water sampling.

The hydropunch is typically used with a drill rig. A boring is drilled with hollow stem-augers to just above the sampling zone. In some soil conditions the drill rig can push directly from the surface to the sampling interval. The hydropunch is conveyed to the bottom of the boring using drill rods. Once on bottom the hydropunch is driven a maximum of five feet. The tool is then opened by lifting up the drill rod no more than four feet. Once the tool is opened, water enters and a sample can be collected with a bailer or tubing utilizing a peristaltic pump. Soil particles larger than silt are prevented from entering the tool by a screen within the tool. The water sample is collected, labeled, and handled according to the Quality Assurance Plan.

Monitoring Well Installation

Monitoring wells will be completed by installing 2 to 6 inch-diameter Schedule 40 polyvinyl chloride (PVC) casing. The borehole diameter for a monitoring well will be a minimum of four inches larger than the outside diameter of the casing. The 2-inch-diameter flush-threaded casing is generally used for wells dedicated for groundwater monitoring purposes.

A monitoring well is typically cased with threaded, factory-perforated and blank Schedule 40 PVC. The perforated interval consists of slotted casing, generally with 0.01 or 0.02 inch-wide by 1.5-inch-long slots, with 42 slots per foot. The screened sections of casing are factory machine slotted and will be installed approximately 5 feet above and 10 feet below first-encountered water level. The screened interval will allow for seasonal fluctuation in water level and for monitoring floating product. A threaded or slip PVC cap is secured to the bottom of the casing. The slip cap can be secured with stainless steel screws or friction; no solvents or cements are used. Centering devices may be fastened to the casing to ensure even distribution of filter material and grout within the borehole annulus. The well casing is thoroughly washed and/or steam cleaned, or may be purchased as pre-cleaned, prior to completion.

A filter pack of graded sand will be placed in the annular space between the PVC casing and the borehole wall. Sand will be added to the borehole through the hollow stem of the augers to provide a uniform filter pack around the casing and to stabilize the borehole. The sand pack will be placed to a maximum of 2 feet above the screens, followed by a minimum 1-foot seal consisting of bentonite pellets.

Cement grout containing 5 percent bentonite or concrete will be placed above the bentonite seal to the ground surface. A concrete traffic-rated vault box will be installed over the monitoring well(s). A watertight locking cap will be installed over the top of the well casing. Reference elevations for each monitoring well will be surveyed when more than two wells will be located on site. Monitoring well elevations will be surveyed by a California licensed surveyor to the nearest 0.01-foot relative to mean sea level (MSL). Horizontal coordinates of the wells will be measured at the same time.

Exploratory boring logs and well construction details will be prepared for the final written report.