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RECEIVED
By Alameda County Environmental Health 8:34 am, Oct 20, 2016

Ms. Dilan Roe
Alameda County Health Care Services Agency
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: 1233 Bockman Road
San Lorenzo, California
ACEH Case No: RO00003217

Dear Ms. Roe:

PaulsCorp, LLC, has retained Pangea Environmental Services, Inc. (Pangea) for environmental consulting services for the project referenced above. Pangea is submitting the attached report on my behalf.

I declare, under penalty of perjury, that the information and/or recommendations contained in the attached report are true and correct to the best of my knowledge.

Sincerely,

Andrew J. Lavaux
Managing Director Multifamily Development

October 7, 2016 *(Revised October 14, 2016)*

Andrew Lavaux
PAULS Corporation, LLC
100 Saint Paul Street
Denver, Colorado 80206

Re: **Draft Corrective Action Plan**
Bockman Road Property
1233 Bockman Road
San Lorenzo, California 94577
ACDEH Case # RO00003217

Dear Mr. Lavaux:

On behalf of PAULS Corporation, LLC, PANGEA Environmental Services, Inc. (PANGEA) prepared this *Draft Corrective Action Plan* for the subject property. This corrective action plan was prepared to mitigate potential vapor intrusion in conjunction with development at the subject site. This plan addresses concerns expressed by the lead regulatory oversight agency for this case, Alameda County Department of Environmental Health.

If you have any questions or comments, please call me at (510) 435-8664 or email briddell@pangeaenv.com.

Sincerely,
PANGEA Environmental Services, Inc.

Bob Clark-Riddell, P.E.
Principal Engineer

Attachment: *Draft Corrective Action Plan*

DRAFT CORRECTIVE ACTION PLAN

1233 Bockman Road
San Lorenzo, CA 94577

October 7, 2016
(Revised October 14, 2016)

Prepared for:

PaulsCorp, LLC
100 Saint Paul Street
Denver, Colorado 80206

Prepared by:

PANGEA Environmental Services, Inc.
1710 Franklin Street, Suite 200
Oakland, California 94612

Written by:

REGISTERED PROFESSIONAL ENGINEER
ROBERT G. CLARK-RIDDELL
No. C 049629
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STATE OF CALIFORNIA

Ron Scheele, P.G.
Principal Geologist

Bob Clark-Riddell, P.E.
Principal Engineer

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ATTACHMENTS

1.0 INTRODUCTION

On behalf of PAULS Corporation, LLC (PaulsCorp, LLC), PANGEA Environmental Services, Inc. (PANGEA) has prepared this *Draft Corrective Action Plan* (CAP) for the subject property located at 1233 Bockman Road in San Lorenzo, California (Site) (Figure 1). This CAP was prepared to mitigate potential vapor intrusion in conjunction with development at the subject Site. This plan addresses concerns expressed by the lead regulatory oversight agency for this case, Alameda County Department of Environmental Health (ACDEH).

2.0 EXECUTIVE SUMMARY

The Site is currently under initial grading for residential development of 53 two-story residential units. Initial grading is occurring on the western portion of the Site, in compliance with the approved *Soil Management Plan* and agency correspondence. Extensive Site assessment was conducted to initially delineate the extent of volatile organic compounds (VOCs) in the site subsurface. The VOC impact is apparently due a historic dry cleaner at 1269 Bockman Road (eastern portion of Site), a former auto shop at 1415 Bockman Road (western portion of the Site), and potential offsite sources of petroleum hydrocarbons from 1210 Bockman (former Impulse Motors fueling station/auto repair facility) and 17093 Via Chiquita (commercial street sweeping business). The primary chemicals of concern (COCs) include the following chemicals that have been detected in shallow soil gas in excess of conservative Subslab/Soil Gas Vapor Intrusion: Human Health Risk Levels (Table SG-1), residential environmental screening levels (ESLs) established by the San Francisco Bay Region Water Quality Control Board (RWQCB): benzene, ethylbenzene, tetrachloroethene (also known as perchloroethene [PCE]). The following additional VOCs have been detected at the Site below ESLs: acetone; chloroform; 1,2-dichloroethane; naphthalene; 1,1,1-trichloroethylene (TCE); toluene; xylenes; and gasoline-range, diesel-range, and motor oil-range total petroleum hydrocarbons. No significant VOC impact has been detected in soil or groundwater based on data comparison to ESLs. Initial site assessment information is documented in PANGEA's *Site Assessment Report* dated August 26, 2016. Additional Site investigation for further VOC characterization will be ongoing to support the corrective action proposed in this plan.

This Draft CAP proposes excavation to target residual VOCs that pose a potential vapor intrusion risk for future Site residents. A Screening-level human health risk assessment was prepared to assist with CAP planning (Appendix B to this Draft CAP). A Site-specific human health risk assessment will be prepared after site remediation to confirm that post-excavation conditions sufficiently safeguard human health. Post-excavation soil gas testing will be conducted to confirm sufficient removal and mitigation of subsurface VOC impact. Mitigation measures will include installation of passive subslab ventilation systems under select Site buildings, with the provision to convert to active subslab ventilation if merited. Additional site data will be obtained to determine if mitigation measures will be required for remaining buildings planned for the Site. . PaulsCorp, LLC's objective is to conduct sufficient corrective action to allow case closure for unrestricted Site use in the near future.

3.0 SITE BACKGROUND

The Site background is described in this section.

3.1 Site Description and History

The Site consists of an approximately 3.87-acre lot along Bockman road in San Lorenzo, California (Figure 2). The property is owned and being redeveloped by PaulsCorp, LLC into 53 two-story residential units. The assessor parcel number (APN) for the Site is 411-63-17. The subject property is relatively flat and lies at an elevation of about 20 feet above mean sea level. There are currently no buildings on-site but historically the Site consisted of a strip mall and associated parking lot. The Site is surrounded in all directions by single and multi-family residences.

According to a Phase 1 Environmental Site Assessment (ESA) prepared on June 3, 2016, by ENGEO Incorporated (ENGEO), the Site was used a strip mall until the buildings were demolished in 2007. Two former tenants of note were identified: a dry cleaner that operated between approximately 1960 and 1979; and an automotive repair shop that operated hydraulic lifts. The report also noted that a gasoline service station previously existed on the adjacent parcel to the south of the Site across Bockman Road at 1210 Bockman Road.

3.2 Chemicals of Potential Concern

The chemicals of potential concern at this Site primarily include tetrachloroethene (PCE) and its potential breakdown products, and petroleum hydrocarbons. The following chemicals have been detected in shallow *soil gas* in excess of conservative residential soil vapor environmental screening levels (ESLs) and were identified as chemicals of concern (COCs): *benzene, ethylbenzene, and PCE,* as discussed in Appendix B. The following additional VOCs have been detected at the Site below ESLs: acetone; chloroform; 1,2-dichloroethane; naphthalene; 1,1,1-trichloroethylene (TCE); toluene; xylenes; and gas-range, diesel-range, and motor oil-range total petroleum hydrocarbons.

3.3 Summary of Previous Site Investigations

The following is a summary of previous environmental activities at the Site:

- **November 18, 2004, Phase I Environmental Site Assessment, Secor International Inc. (Secor):** A Phase 1 ESA revealed that the auto repair shop located on the western portion of the Site may have formerly had a fuel dispenser island and that an oil/water separator existed within the building. The possibility of a dry cleaner was noted but it was not determined if operations were on-site or if the business was just a drop-off location. A former gasoline station/automotive repair facility located at 1210 Bockman Road (adjacent to the Site to the south) was also indicated as an environmental concern due to the elevated levels of petroleum hydrocarbons detected in confirmation samples during tank removal activities in 2004.

- **December 21, 2004, Phase II Environmental Site Assessment, Secor:** A total of eight soil borings were advanced on site to a depth of 10 to 15 feet below ground surface (bgs), but sample data was not reported.

- **June 30, 2015, Phase I Environmental Site Assessment, ENGEO:** A Phase 1 ESA revealed the same three environmental concerns as the Phase 1 ESA completed in 2004: possible historical dry cleaner operations, the gas station adjacent and south of the Site, and the former automotive repair facility located on the western portion of the Site. Based on these findings and the lack of data from the Phase II ESA completed in 2004, ENGEO recommended completion of a new Phase II ESA.

- **July 2, 2015, Phase II Environmental Site Assessment, ENGEO:** Soil, groundwater, and soil gas were sampled to identify potential concerns related to the aforementioned historic operations. Three soil borings were advanced (S-1 through S-3) to a depth of 10 feet bgs in the vicinity of the former dry cleaner (S-1) and the former automotive repair facility (S-2 and S-3). Soil samples were collected at depths of 1, 5, and 10 feet bgs from each boring. Grab groundwater samples (GW-1 through GW-3) were also collected from three separate borings at depths ranging from 15 to 25 feet bgs depending on where groundwater was first observed. Soil and groundwater samples were analyzed for VOCs, CAM-17 metals, and total petroleum hydrocarbons as gasoline (TPHg), diesel (TPHd), and motor oil (TPHmo). While VOCs, TPHg, and metals were detected in groundwater samples, all analytes were below screening levels except arsenic (which likely represents background conditions). For the two analyzed soil gas samples (SG-1 and SG-2), no VOCs were reported above environmental screening levels.

- **May 16, 2016, Site Management Plan (SMP), ENGEO:** A SMP was developed for the City Building Department to provide procedures and protocols to address potential soil impacts that would be encountered while developing the Site.

- **June 3, 2016, Phase I Environmental Site Assessment Update, ENGEO:** The Phase 1 ESA completed in 2015 was updated to include the results of an environmental record search. No new environmental concerns were recognized.

- **August 2, 2016, Revised Phase II Environmental Site Assessment, ENGEO:** Additional Site assessment activities including installing and sampling six new temporary soil gas wells (SG-5 through SG-10) and collecting four grab groundwater samples (GW-1 through GW-4). The soil gas wells were installed to depths of 7 feet bgs (SG-6, SG-8, and SG-9) and 10 feet bgs (SG-5, SG-7, and SG-10) and sampled for TPHg and VOCs. PCE was detected in SG-6 and SG-9 at an identical concentration of 256 micrograms per cubic meter (µg/m^3). Grab groundwater borings GW-1 through GW-3 were advanced in close proximity to the borings by the same identity in 2015. All four borings were advanced to a depth of 16 to 17 feet bgs depending on where first encountered groundwater was observed. A sample was collected from each boring and analyzed for VOCs, TPHg, TPHd, TPHmo, and CAM-17 metals. VOCs, TPHg, and metals were detected below screening levels except for arsenic.

- **August 17, 2016, Site Management Plan Supplement, PANGEA**: Prepared to facilitate grading work at the western portion of the Site.

  - **August 26, 2016, Site Assessment Report, PANGEA:** A dynamic Site assessment was conducted involving the sampling of soil, groundwater, and shallow soil gas. Pangea employed MiHPT, a high resolution site characterization technique, to help delineate the extent of contaminants in the subsurface and to evaluate hydrogeologic conditions, primarily in the vicinity of the former drycleaners. No significant VOC impact was detected in soil and groundwater, however, shallow soil gas in the eastern portion of the Site is impacted with concentrations of PCE, benzene, and ethylbenzene that exceed their respective residential shallow soil gas ESLs.

  - **August and September, 2016, Additional Assessment, PANGEA;** Additional assessment was conducted on the western portion of the site subsequent to Pangea's August 26, 2016 assessment report. This additional assessment is described in Section 7.1 of this report. Additional soil and soil gas assessment is planned in the eastern and western portions of the Site to address remaining data gaps based on agency direction.

Another site report includes the *Geotechnical Investigation* dated October 1, 2015, prepared by Langan Treadwell Rollo.

3.4 Potential Offsite Sources of VOCs

1210 Bockman: A fueling station/auto repair facility (Impulse Motors, B.P.) was formerly located across the street from the Site and operated from the 1950s until 2004. In 2004, three fuel USTs, and two dispensers with associated piping were removed. Elevated levels of TPHg, TPHd and BTEX were detected in soil, groundwater and soil gas. The environmental case was granted closure by ACDEH in 2013. The case closure summary with historical maps and data is included in Appendix A. The 1210 Bockman property is located directly upgradient of the Site and may be the source or contributing source of select petroleum hydrocarbon compounds at the eastern boundary of the Site, where ethylbenzene concentrations in soil gas exceed ESLs. In 2013, dissolved-phased TPHd concentrations were reported in an irrigation well at a residential property (17109 Via Chiquita) located 155 feet north of the 1210 Bockman property.

17093 Via Chiquita: This property, immediately adjacent the Site's eastern property boundary, is currently occupied by a street sweeping business (Midnight Sweepers) with several commercial vehicles parked periodically at the property. PANGEA understands that historically numerous automotive vehicles are stored at this property. This property may be the source or contributing source of select petroleum hydrocarbon compounds at the eastern boundary of the Site, where ethylbenzene concentrations in soil gas exceed ESLs.

3.5 Site Geology and Hydrogeology

The Site property is located within the East Bay Plain subbasin, which is part of the larger Santa Clara Valley Groundwater Basin. The East Bay Plain subbasin is a northwest trending alluvial plain bounded to the north by San Pablo bay, to the east by the contact with Franciscan Basement rock, and to the south by the Niles Cone Groundwater basin. The basin extends beneath San Francisco Bay to the west. Groundwater is generally found very near the surface throughout the basin.

The East Bay Plain subbasin aquifer system consists of unconsolidated sediments of Quaternary age. The Early Holocene Temescal Formation is the most recently deposited and consists of primarily silts and clays with some gravel layers.

The relatively flat Site lies at an elevation of approximately 20 feet above mean sea level to the east of San Francisco Bay (Figure 1). Soil beneath the site consists of sandy gravel fill to approximately 1 ft bgs underlain by 2 to 3 feet of moderately plastic clay. The clay layer is underlain by silt and a discontinuous, one-foot thick sand lens observed intermittently between 6 and 10 feet bgs. Pangea observed groundwater between 7 and 9 feet bgs, while others reported first encountered groundwater deeper. Based on data from neighboring sites, static groundwater was approximately 8 ft bgs (1201 Bockman) and groundwater flows to the northwest. Lithologic and groundwater data is presented on geologic cross-section A-A' (Figure 3).

3.6 Agency Direction

On August 11 and September 21, 2016, PANGEA and PaulsCorp, LLC representatives met with ACDEH to discuss recent data, remedial actions, vapor mitigation plans, and case closure requirements for the active case. In advance of the first meeting, PaulsCorp, LLC entered a Voluntary Cleanup Agreement to facilitate ACDEH oversight. ACDEH tentatively concurred with the following approach to facilitate Site development and corrective action:

- Submittal of an *Addendum* to the *Site Management Plan* regarding assessment and contingent mitigation for the western portion of the Site. This *Addendum* was submitted on August 17, 2016 and approved by ACDEH on August 18, 2016.

- Submittal of a *Site Assessment Report* documenting recent Site assessment. PANGEA prepared the *Site Assessment Report* dated August 26, 2016.

- Submittal of a *Pilot Study Workplan* to confirm effectiveness of the proposed corrective action within the VOC impacted area within Buildings 5 and 8. PANGEA prepared the *Pilot Study Workplan* dated October 7, 2016.

- Submittal of a *Draft Corrective Action Plan* (CAP) and *Fact Sheet*. Following ACDEH review, PANGEA will perform the required 30-day Public Notice for the proposed corrective action and provide proof of service/notification.

- Upon completion of 30-day public notice, ACDEH will approve the Draft CAP and allow commencement of development plans within the eastern Site area upon satisfactory receipt of the following documentation described in ACDEH letter dated October 14, 2016:

    - *Interim Remediation Report* documenting interim excavation activities performed during initial site grading in accordance with the Site Management Plan (SMP);

    - *Data Gap Field Investigation Workplan* to further delineate contamination;

    - *Remedial Action Implementation Plan* presenting results of the Pilot Study, additional field investigation activities and revisions to the proposed corrective actions presented in the Draft CAP based on the results of the additional assessment and Pilot Study;

    - *Draft Post Construction SMP* presenting requirements for long-term site management of the proposed mitigation systems and residual soil contamination (to be finalized after construction is complete); and

    - *Record Report of Construction of Corrective Action and Mitigation Measures*.

PaulsCorp, LLC appreciates all efforts to expedite plan approval and corrective action commencement, to complete as much effort as possible before the winter rainy season.

4.0 SITE CONDITIONS

Based on PANGEA's *Site Assessment Report*, the Site conditions are summarized as follows:

- Soil beneath the Site consists of sandy gravel fill to approximately 1 ft bgs underlain by 2- to 3-feet of moderately plastic clay. The clay layer is underlain by silt and a discontinuous, one-foot thick sand lens observed intermittently between 6 and 10 feet bgs. The depth to static groundwater is approximately 8 feet bgs and groundwater flows to the northwest.

- *Soil* and *groundwater* on-site has not been significantly impacted by VOCs, TPHg, or lead. Soil data is summarized on Table 1 and Figure 4. Groundwater data is summarized on Table 2 and Figure 5.

- Shallow *soil gas* in the *eastern* portion of the Site is impacted with concentrations of PCE, benzene, and ethylbenzene that exceed their respective residential shallow soil gas ESLs. Soil gas data for these VOCs is summarized on Table 3 and Figures 6, 7, and 8.

Shallow *soil gas* in the *western* portion of the Site, adjacent the hoists from the former automotive repair building, contained PCE *below* residential shallow soil gas ESLs. Based on agency direction, PANGEA conducted additional assessment via soil borings and soil gas well sampling to further delineate this impact. The additional data is summarized on Figures 4 through 8 and the associated tables. Some assessment was conducted in the western portion of the Site via exploratory excavation and borings consistent with procedures of the *Site Management Plan*. The assessment and interim remediation conducted in the western portion of the Site will be documented in an Interim Remediation Report. A human health risk assessment to help guide remediation planning and to evaluate post-remediation conditions s for this Site are described below.

5.0 FEASIBILITY STUDY

PANGEA prepared a feasibility study/corrective action plan for addressing residual COCs at this Site. To help select a cost-effective and appropriate alternative for achieving remediation/mitigation objectives, PANGEA evaluated several remediation techniques applicable to sites with VOC impact. The evaluated remedial alternatives include:

- Excavation
- Soil Vapor Extraction (and Active Venting)
- Monitored Natural Attenuation (Soil Gas and Groundwater Monitoring)
- No Action

The evaluation of alternatives is presented below.

5.1 Excavation

Excavation is a proven and effective technique for remediation of VOC impact. Excavation is most appropriate for shallow soils, and especially for low permeability materials where in-situ remedial techniques have very limited effectiveness. This method is also a cost-effective option for undeveloped sites where the excavation area is accessible and not beneath structures or amongst subsurface utilities. Excavation can remove unsaturated soil, capillary fringe soil, and saturated soil. Soil is usually transported offsite for disposal, but soil can be treated and reused at the Site in accordance with regulatory guidelines and approval.

Based on the shallow nature of the VOC impact (primarily present in soil gas about 5 to 6 ft depth bgs), and the unimproved condition of the Site (all buildings have been demolished), excavation is a very appropriate and cost effective technique for Site remediation. Since no significant VOC impact has been detected in Site soil, the excavation will be conducted based on field screening to identify soil that may contact VOC source material impacted Site soil gas.

5.2 Soil Vapor Extraction (and Active Venting)

Soil vapor extraction (SVE) is a common approach for remediating unsaturated soil. This approach uses an aboveground vacuum blower to extract vapor-phase VOCs from the Site subsurface. SVE also effectively removes VOCs adsorbed to unsaturated soil that could pose a risk to groundwater quality. Extracted vapors are typically treated aboveground with granular activated carbon (chlorinated VOCs) or oxidizers (petroleum hydrocarbons).

Based on the predominantly fine-grained soil at this Site, SVE would likely have limited effectiveness due to low soil permeability. The shallow groundwater table (about 8 ft bgs) would also prevent application of a high vacuum to induce vapor flow in the fine-grained soil. SVE would effectively remove VOCs from the thin sandy materials, but VOC impact adsorbed to the surrounding clay would likely cause some rebound of VOCs in soil gas. Air permit requirements for SVE longer than short-term testing increase the time requirements for SVE. Therefore, for this Site would likely be a time-consuming process, and the Site development schedule requires more expeditious corrective action.

Vapor extraction (or active ventilation) would be very effective within the subslab permeable material planned beneath each building. Such active ventilation is an excellent approach for contingent vapor intrusion mitigation.

5.3 Monitored Natural Attenuation (Soil Gas and Groundwater Monitoring)

This alternative involves no active remediation, and assumes that residual COCs will attenuate naturally. To be selected as an appropriate alternative, residual contaminants are often required to attenuate (or are projected to attenuate) to water quality objectives or other applicable cleanup standards within a reasonable timeframe. In addition, subslab/soil gas are required to attenuate (or are projected to attenuate) to applicable cleanup standards within a reasonable timeframe.

Groundwater quality is already below water quality objectives. Soil gas monitoring could be conducted to evaluate VOC concentrations with respect to applicable screening levels. Given the schedule for Site development and desire for closure with unrestricted Site use, monitored natural attenuation is not a viable alternative.

5.4 No Action

This alternative involves no further action. Feasibility studies are often required to consider this alternative. Given the schedule for Site development with respect to Site conditions, no action is not a viable alternative.

6.0 CORRECTION ACTION PLAN APPROACH

Soil excavation has been selected as the most appropriate corrective action approach to address the potential vapor intrusion risk posed by the residual levels of VOCs in soil gas beneath the Site. PANGEA proposes the following steps for implementation of our proposed soil excavation plan:

- **Additional Site Assessment –** To further delineate contamination as required by ACDEH, additional future site assessment will be proposed in a Data Gap Field Investigation Workplan. Tentative additional assessment locations are shown on Figure 9. Note that additional soil gas sampling was recently completed to further delineate the extent of VOCs along the perimeter of the Site, as documented in Section 7.1 of this report. To assist with data review and remediation planning, this additional data is also summarized within Figures 4 through 8 and Tables 1 through 3 of this report. Additional soil sampling was also performed to provide physical soil property data for use with future human health risk assessment updates. The procedures for this additional site assessment will be incorporated into the Remedial Action Implementation Plan.

- **Soil Excavation Pilot Study, CAP Soil Excavation, and Vapor Barrier Slurry Wall –** Based on existing and upcoming Site assessment data, soil excavation will be completed to target PCE impact and select ethylbenzene in soil gas above ESLs established by the RWQCB. Overburden soil will be stockpiled and screened for potential reuse. A pilot study will be conducted in advance of implementation of the CAP to confirm the effectiveness of this excavation and overburden reuse approach, as documented in a separate Pilot Study Workplan. The CAP approach may be modified based on results and learned lessons from the pilot study and from additional Site assessment data. A bentonite clay and/or cement slurry wall will be installed along the eastern property boundary to prevent vapor migration across the property boundary.

- **Confirmation Sampling** – Following excavation and backfilling, confirmation soil and soil gas sampling will help confirm the excavation effectiveness for reducing PCE concentrations to below ESLs. If merited based on confirmation sampling results, additional excavation or other mitigation can be performed to reach ESLs, with supplemental confirmation sampling. PANGEA understands ACDEH will require confirmation sampling spanning several seasons to establish trends show stabilize soil gas conditions prior to a determination of no further action. This longer-term soil gas sampling will be conducted from existing or new soil gas monitoring wells.

- **Post-excavation Human Health Risk Assessment (HHRA)** – A Screening-level HHRA was prepared to present agency-recommended screening levels and preliminary Site-specific screening levels for residential use (provided as Appendix B to this Draft CAP). While Site-specific screening levels can be used to guide remediation and mitigation activities at the Site, ACDEH is requiring use of RWQCB ESLs to guide excavation activities for the PCE impact and elevated ethylbenzene impact due to lack of long-term soil gas data and a short-term construction schedule. After CAP implementation, the Screening-level HHRA may be updated to reflect soil physical parameter and additional soil gas data and post-excavation confirmation data to establish Site-specific screening levels. The post-excavation HHRA would evaluate post-excavation site conditions compared to ESLs and site-specific screening levels, and to confirm that estimated risks for the Site are at levels considered by U.S. EPA and Cal/EPA to be protective of human health assuming residential land use. PANGEA understands that ACDEH would require peer review of any HHRA used to incorporate site-specific screening levels into vapor intrusion risk evaluation and implementation of remediation or mitigation measures. Based on ACDEH direction, there are no plans to use site-specific screening levels into CAP implementation.

- **Vapor Mitigation System (VMS)** – The CAP goal is achievement of the site cleanup goal of ESLs for soil gas. ACDEH requires long-term data to confirm that post-remediation conditions do not pose a significant vapor intrusion risk to site residents. Since long-term monitoring cannot be completed before construction of the planned buildings, a vapor mitigation system will be installed beneath the five buildings where residual VOC impact exceeds ESLs, consistent with State guidance (CalEPA, 2011). The proposed VMS locations are shown on Figure 14. VMS systems may be installed beneath other buildings based on additional data findings and ACDEH direction. The vapor mitigation system will consist of a *passive* subslab ventilation (SSV) system with an underlying VOC-resistant sub-liner/vapor barrier consistent with State guidance (CalEPA, 2011). The SSV system will consist of a subslab piping network and vertical ventilation risers. *At least two sampling events of subslab gas within the passive ventilation piping will be conducted.* If subslab gas concentrations exceed applicable screening levels, the passive subslab ventilation piping will be converted to an *active* ventilation system (e.g., a subslab depressurization system [SSD]) using an powered extraction blower.

In summary, the initial goal of the CAP is to improve site conditions to levels that are protective of human health assuming residential site use. A vapor mitigation system will be installed under the five buildings overlying the known VOC impact area. VMS systems may be installed beneath other buildings based on additional data findings and ACDEH direction. As a contingency measure for further mitigation of potential vapor intrusion concerns, the SSD system can be converted to an active SSD system consistent with State guidance (CalEPA, 2011). The ultimate goal of the CAP is to help facilitate regulatory case closure within the relative near future with unrestricted site use, if feasible.

7.0 CORRECTIVE ACTION PLAN

The specific procedures for implementing the proposed CAP are detailed below.

7.1 Additional Site Assessment

To further delineate contamination as required by ACDEH, additional future site assessment will be proposed in a Data Gap Field Investigation Workplan. Note that additional soil gas sampling was recently completed to further delineate the extent of VOCs along the perimeter of the eastern portion of the Site, and to confirm conditions near the former auto shop within the western portion of the Site. The additional assessment locations are shown on Figure 9. Data from the additional assessment is summarized on Figures 4 through 8 and Tables 1 through 3. While significant Site assessment data is documented in the *Site Assessment Report* dated August 26, 2016, but that report does not document recent assessment data from late August and September 2016 that is included in this Draft CAP. The procedures for all additional site assessment will be incorporated into the Remedial Action Implementation Plan. During the additional soil sampling, PANGEA also obtained samples to provide physical soil property data to update the Screening-level HHRA and to provide a Site-specific human health risk assessment. The physical soil property data provided grain size, density, porosity, and moisture content consistent with the DTSC vapor intrusion guidance. Boring locations for physical soil property analyses are shown on Figure 10.

7.2 Excavation Pilot Study

Prior to full-scale CAP implementation, a pilot study will be used to confirm the effectiveness of this excavation and overburden reuse approach. The pilot study area will target the western edge of the PCE plume, as well as the ethylbenzene impact as shown on Figure 11. The pilot study work scope will be similar to the CAP approach detailed below. Upon completion of the pilot study excavation, plastic sheeting (e.g., 6 ml Visqueen) will be installed to minimize potential subsurface vapor migration from the future excavation area into the pilot test areas. The CAP excavation approach will be modified as necessary based on pilot study results and additional field data collection. The pilot test excavation area and temporary vapor barrier are shown on Figure 11. A *Pilot Study Workplan* dated October 7, 2016 was submitted separately to ACDEH. A Data Gap Field Investigation Workplan will be submitted to ACDEH.

7.3 Proposed Soil Excavation

The proposed soil excavation area will target the VOC impact in soil gas above ESLs within the eastern portion of the site as shown on Figures 11 and 12. The proposed excavation targets PCE in soil gas within and east of the former dry cleaner facility and also targets the ethylbenzene impact near the eastern property boundary.. The excavation area may be revised based on results of the pilot study and additional assessment data. (Note the ethylbenzene impact in the pilot study area will be targeted during the pilot study phase).

The proposed irregular-shaped excavation areas consist of approximately 23,000 total square feet. Assuming excavation to a depth of 7 feet, the proposed excavation soil volume is approximately 6,000 cubic yards. This is equivalent to approximately 10,000 tons of soil, assuming 1.7 tons/cubic yard. Note that the Site development plans include a net export of 2,000 cubic yards of soil.

Soil excavation will be performed by an appropriately licensed contractor. Excavation notification, preparation, and procedures are presented below.

7.3.1 Permitting and Notification

Prior to initiating field activities, the following tasks will be conducted:

- Obtain authorization from ACDEH and permits from the City of San Lorenzo, as necessary.
- Pre-mark the excavation area with white paint and notify Underground Service Alert (USA) of the excavation activities at least 48 hours before work begins;
- Prepare a Site-specific health and safety plan to educate personnel and minimize their exposure to potential hazards related to Site activities; and
- Coordinate with excavation and laboratory contractors and with involved parties.

7.3.2 Excavation Preparation

A Site-specific Health and Safety Plan (HASP) will be prepared for the excavation activities. The HASP is a requirement of the Occupational Safety and Health Administration (OSHA), "Hazardous Waste Operation and Emergency Response" guidelines (29 CFR 1910.120) and the California Occupational Safety and Health Administration (Cal/OSHA) "Hazardous Waste Operation and Emergency Response" guidelines (CCR Title 8, section 5192). The HASP is designed to address safety provisions during field activities and protect the field crew from physical and chemical hazards resulting from drilling and sampling. The HASP establishes personnel responsibilities, general safe work practices, field procedures, personal protective equipment standards, decontamination procedures, and emergency action plans. The HASP will be reviewed and signed by field staff and contractors prior to beginning field operations at the Site.

Prior to field activities, the proposed excavation area will be marked out using white paint and Underground Service Alert (USA) will be notified of the planned excavation areas. As reported in PANGEA's *Site Assessment Report*, the most recent ground penetrating radar survey did not identify any subsurface utilities in the planned excavation areas, but the initial survey did identify three shallow linear anomalies. These anomalies will be investigated during soil excavation activities.

Concrete, if present over the excavation area, may be saw cut. Perimeter barriers will be installed and maintained throughout excavation and backfilling activities. Because the excavation work is on private property, it is anticipated that *no* encroachment onto the public right of way will be necessary during soil excavation work.

7.3.3 Soil Excavation Sequence, Screening and Stockpiling

Based on our understanding of Site conditions, the upper 3 ft of soil is not significantly impacted by VOCs (note that select petroleum hydrocarbon impacts were found below ESLs at 1 ft bgs in borings B-1, B-2 and B-3 as summarized in Table 1). MiHPT and soil gas data indicates that some limited VOC impact is present in deeper soil approximately 4 to 6 ft bgs, within and near thin, laterally discontinuous sand materials near this depth. Therefore, the top 3 ft of soil will be considered 'overburden' soil, and will be removed, screened, and segregated separately for testing and potential reuse. Note that limited shallow soil impact may be present near the former dry cleaner where a surface release of PCE may have migrated downward to the thin sand zone approximately 5 to 6 ft bgs. PANGEA will carefully screen overburden soil near the former cleaners and MIP-2 where the only significant VOC impact was indicated. If the former PCE release was via a sewer release, there would not be significant VOC impact in the shallowest soil.

Excavated soil will be screened for offsite disposal or onsite reuse based on soil sampling and field screening procedures described in this section. Soil screening with be performed using a PID. (Visual observations may also assist with screening, although the limited VOC impact suggests there will be limited or no visual VOC manifestation). Field technicians will screen soil in the stockpile, within the excavator bucket, and within newly exposed soil. Soil will also be placed in a plastic bag for screening. Due to the silt and clay composition of site soil, technicians will loosen soil within the bag while screening for VOCs with the PID.

Based on PID readings, technicians will assist with segregation and stockpiling of the VOC-impacted soil. Initially, any soil with VOC impact (0.1 parts per million by volume [ppmv] or greater) will be stockpiled separately from 'clean' soil into 'impacted' soil stockpiles. Soil with PID readings may also be placed into separate stockpiled based on relative PID screening results, such as 'low' or 'high' VOC impact.

To facilitate soil screening, Pangea plans to systematically screen and coordinate soil stockpiling in approximate 100 cubic yard batches. Each batch or stockpile will represent an approximate 6 to 12-inch vertical cut within sections of the excavation area. Each stockpile will be approximately 30 ft long, 15 ft wide and average 6 ft high. After stockpiling each batch/lift, field technicians will conduct additional soil screening with a PID by placing stockpiled soil into bags for PID measurement. This soil screening with bag samples will be conducted at least one time for each 25 to 50 cubic yards. The planned soil stockpiling is shown on Figure 11.

Air monitoring will be conducted near each soil stockpile. If PID readings around any stockpile exceed 50 ppmv, the stockpile will be continuously covered with plastic sheeting to the extent practical during soil stockpiling activities. Air monitoring procedures during excavation are described below in Section 7.3.5.

At the conclusion of each work day, each soil stockpile will be covered with plastic sheeting. The plastic sheeting will be held in place by sand bags. On each morning, technicians will screen each plastic-covered stockpile for VOCs by inserting the PID tip into a small slit or hole cut in the plastic cover and inserting the PID intake. Based on this additional PID screening, the stockpiled soil will be consolidated into the 'clean' area or the 'impacted' area. Further screening of soil will be conducted in these secondary stockpiles.

At the conclusion of all soil screening, the most impacted soil will be disposed offsite. 'Clean' soil will be reused within the excavation area to facilitate subsequent confirmation testing to evaluate the remedial effectiveness. Based on our understanding of site conditions, Pangea estimates that approximately half of the soil within the VOC impact area or more may be eligible for reuse at the Site.

Note: The stockpiling plan shown on Figure 11 assumes that approximately 1,500 cubic yards of soil can be screened during each phase. With an estimated 6,000 cubic yards targeted for excavation, the CAP excavation would be conducted in an estimated four phases. Based on time, space and cost considerations, the excavation may proceed in fewer or more phases.

7.3.4 Soil Reuse Criteria and Soil Sampling

Our initial soil reuse criteria is as follows. For the PCE impact area, any stockpiled soil with final PID readings at or above 0.1 ppmv will not be reused. According to the National Institute of Occupational Safety and Health (NIOSH), the conversion of PCE is 1 ppmv equals 6,780 µg/m^3 (or 0.1 ppmv equals 680 µg/m^3). While empirically 0.1 ppmv PCE equals 680 µg/m^3, based on our experience correlating laboratory analysis with PID readings. a PID reading of 0.1 ppmv roughly correlates to a soil gas concentration of approximately 240 µg/m^3 (the residential soil gas ESL for PCE) Therefore, a PID reading of 0.1 ppmv is an appropriate screening levels for PCE-impacted soil to considered for reuse. For the ethylbenzene impact area, any stockpiled soil with final PID readings at or above 0.2 ppmv will not be reused since the residential soil gas ESL for ethylbenzene of 560 µg/m^3 is twice the corresponding ESL for PCE. For the area where the PCE and ethylbenzene impact overlaps, the lower screening level (0.1 ppmv) will be used.

For soil planned for reuse, soil analytical testing will be performed as follows: one discrete soil sample will be collected and analyzed for every 100 cubic yards of soil. The soil sample will be collected using EPA Method 5035 (e.g., TerraCore) and analyzed for VOCs by EPA Method 8260B using at a California-certified laboratory. Soil exceeding Tier 1 ESL criteria will not be reused at the site.

7.3.5 Soil Backfilling

Backfilling will commence after receipt of soil analytical data from the sidewall and floor sampling, described in Section 7.6. While the excavation pit is open, the excavation will be secured with fencing and sloping as required to comply with OSHA safety requirements. The excavation area will be backfilled initially with soil that meets the above reuse criteria. Other site soil available from grading operations may be used as backfill.

If necessary, fill material will be imported from an offsite source following procedure in Section 7.4.

7.3.6 Offsite Soil Disposal

Soil for offsite disposal will be profiled according to requirements of the soil accepting facility. To help facilitate offsite soil disposal, Pangea has provided initial soil analytical data and performed additional analysis of composite and discrete analysis within the pilot study area to meet City of Alameda requirements for disposal at the Chuck Corica Golf Complex. Greenway Golf Management, who manages the soil work for the golf complex, has deemed the completed soil profiling program as acceptable for their facility.

For the pilot study, Pangea collected several composite and discrete soil samples for analysis as documented in the *Pilot Study Workplan*. For the CAP excavation area, Pangea will collect 5 additional discrete soil samples for offsite disposal profiling. The sample analyses will include VOCs EPA Method 8260 EPA (with sample collection via Method 5035 [e.g., TerraCore]), TPHg/d/mo (Method 8015), semi-volatile compounds (SVOCs , Method 8270), poly-chlorinated biphenyls (PCBs, Method 8082), CAM-17 metals, pesticides, and asbestos. The Chuck Corica Golf Complex management has indicated that soil delivery may not be allowed after sometime in early to mid November. Alternate facilities will be contacted if the Chuck Corica Golf Complex is unable to accept the soil.

A State-licensed waste hauler will be used to transport any offsite disposal soil to an appropriate facility. Waste haulers will be required to follow the route prescribed by an approved transit plan provided by PaulsCorp.

Trucks transporting soil off the site will follow procedures described below in Section 7.3.10 and in the approved Storm Water Pollution Prevention Plan (SWPPP). Trucks will follow the approved transit plan involving routing along Bockman Road to access Highway 880.

Note that if little or no soil can be reused at the site because of project schedule and residual VOC concerns, additional truck traffic for soil offhaul as well as import of fill material will be required. The maximum estimated number of truck trips required to transport soil from the Site during the CAP phase is approximately 350 trips. The maximum number of truck trips for importing fill material is also 350 trips. Based on the anticipated soil reuse, the estimated number of trucks trips for offsite soil transport and fill import will be approximately half the estimated maximum.

7.3.7 Soil Excavation Practices

Throughout field activities, all applicable municipal codes and best management practices and standards will be followed. Mechanical and manual (hand digging) excavation techniques will be utilized during remedial activities. Procedures before and during excavation activity include:

- A competent person trained to identify hazardous conditions, with authority to take corrective action, will be in charge of excavation. This person will inspect excavations daily and after every rain event, and ensure that all equipment and materials are in good, working condition.

- Excavated or other materials as required will be stored 2 feet or more from the edge of the excavation. Workers will stay away from any equipment loading or unloading material. Perimeter protection will be provided at all times.

- Workers will have all appropriate training and wear the required personal protective equipment including hardhats, safety footwear, gloves, eye protection, hearing protection, and fall protection devices, as needed.

- Excavated material and the excavation pit will be monitored by hand-held screening instrumentation, (e.g., PID), as well as visual and olfactory indications of soil impact from petroleum hydrocarbons or chlorinated solvents (e.g., visible green or gray staining, odor).

- Stockpiles of materials will not be placed within the public right of way, will not obstruct drainage ways, will not be subject to erosion, will not endanger other properties and will not create a public nuisance or safety hazard. Stockpiles of any contaminated soil will be placed away from the north and east property boundaries to minimize any potential impact to offsite residences.

- Debris (brick, rubble, etc.) encountered during excavation as well as concrete and/or asphalt cuttings will be separated from the excavated soil and handled separately for recycling.

The contractor will comply with Cal/OSHA requirement to ensure a safe working environment and to keep the sides of the excavation stable. Excavation activities will be documented by photographs.

7.3.8 Dust, Odor and Noise Control

Air monitoring will be conducted during the excavation and handling of any contaminated soil. PID readings will be taken every hour along the north and east perimeters of the Site (down-wind direction) to ensure that the activities do not pose a threat to the adjacent offsite residences and exceed volatile organic compound (VOC) emissions of 50 ppmv in accordance with the Bay Area Air Quality Management's Regulation 8, Organic Compounds Rule 40. The downwind direction will be determined by a mounted windsock. If the Site is windless, PID readings will be taken from the northern, eastern and southern perimeter of the Site, which are the boundaries closest to the site activities. The 50 ppmv threshold also corresponds to an action level that is 50% of the 8 hour time-weighted-average permissible exposure limit for PCE and ethylbenzene established by Cal OSHA.

All graded surfaces of any nature shall be wetted, or otherwise suitably contained to prevent nuisance from dust or spillage on city streets or adjacent properties. Equipment, materials and roadways on the Site shall be used in a manner or treated as to prevent excessive dust conditions. Dust and dirt control activities shall not result in any material entering the storm drain system. Additional procedures are included in the Storm Water Pollution Prevention Plan (SWPPP) approved for the site grading operations.

Dust control measures during excavation, backfilling, and handling of soil will consist of spraying the minimum amount of water needed to suppress the dust onto the soil and work area. Vapor suppressant spray will also be utilized to control odors, as deemed necessary. Any soil not off-hauled from the Site the same day will be stockpiled on plastic sheeting and covered with plastic, if significant rain is expected, or if suspicious odors or visible dust is being generated from the stockpiles.

Noise generated during excavation will be monitored and modified accordingly, to ensure compliance with any applicable noise ordinances. According to the City of San Lorenzo Noise Ordinance 2003 - 005, excavation activities will only be conducted between the hours of 7 am to 7 pm on weekdays, and between 8 am to 7 pm on Saturdays and Sundays.

7.3.9 Groundwater Control

Although the excavation is not expected to encounter groundwater, if necessary, groundwater removal and disposal will be performed to manage any potential groundwater accumulation in the excavation. Depending on the volumes and recharge rates, groundwater will be pumped either directly into vacuum trucks for transport and disposal, or will be pumped into a recovery tank for storage and offsite recycling/disposal at an appropriate facility.

7.3.10 Grading and Erosion Control

In addition to procedures in the Storm Water Pollution Prevention Plan (SWPPP) approved for the site grading operations, the following grading and erosion control best management practices (BMP) will be observed and implemented throughout excavation activities:

- Delineate with field markers clearing limits, easements, setbacks, sensitive or critical areas, buffer zones, trees, and drainage courses.
- Stabilize all denuded areas and install and maintain all temporary erosion and sediment controls continuously between October 15th and April 15th.
- Perform clearing and earth moving activities only during dry weather (without significant rainfall).
- Provisions will be made for diverting on-site runoff around exposed areas and diverting offsite runoff around the Site.

- Provisions for preventing erosion and trapping sediment on Site, storm drain inlet protection, covers for soil stock piles, and/or other measures.

- Store, handle, and dispose of construction materials and wastes properly, so as to prevent their contact with stormwater.

- Control and prevent the discharge of all potential pollutants, including pavement cutting wastes, concrete, petroleum products, chemicals, washwater or sediments, and non-storm water discharges to storm drains and any nearby surface water.

- Avoid cleaning or maintaining vehicles on Site, except in a designated area where washwater is contained and treated.

- Protect adjacent properties and undisturbed areas from construction impacts.

- Limit construction access routes and stabilize designated access points.

- Avoid tracking dirt or other materials off Site; clean offsite paved areas and sidewalks using dry sweeping methods.

- Train and provide instruction to all employees and subcontractors regarding the construction BMPs.

If any storm water catch basins are found in close proximity to excavation, the contractor will implement the following procedures designed to ensure that grading and erosion control practices proposed for the above project comply with best management practices and standards.

- Any catch basin will be protected by silt fencing or other erosion sedimentation prevention devices at all times.

- Erosion control devices will not be moved or modified without approval of the project manager.

- All removable erosion protective devices shall be in place at the beginning and end of each working day at all times.

- All silt and debris shall be removed from streets and public right of way immediately.

- All immediate downstream inlets will be protected.

7.4 Criteria for Import of Backfill Material

For import of fill material from commercial sources or quarries, letters of certification will be provided by the quarry or commercial business providing the engineered fill, baserock or other material. If the certification information is deemed insufficient, additional soil characterization will be conducted to facilitate the use of imported fill.

For non-commercial facilities, documentation regarding the previous land use and any environmental site assessments performed at the source of the fill will be provided to minimize the potential of introducing contaminated fill material onto the site. If an environmental site assessment was performed at the fill source site, its findings will be provided.

If adequate documentation cannot be provided, the source fill material will be tested for potential impact to ensure that 'clean' fill is being brought onsite. Per ACDEH direction, the source fill material will be sampled and analyzed for TPH, VOCs, SVOCs, CAM-17 metals, PCBs, pesticides/herbicides, and asbestos and results will be compared to RWQCB Tier 1 ESLs. Samples will be submitted under chain-of-custody to a California certified laboratory.

7.5 Proposed Vapor Barrier Slurry Wall

To minimize potential subsurface vapor migration to or from the Site, a bentonite and/or cement slurry wall will be installed along the northeast boundary of the property. As shown on Figure 11, the trench approximately 120 ft long by 1 ft wide by 8 ft deep will be dug using an excavator. The trench will be backfilled with a bentonite and/or cement slurry. The top 2 or 3 feet of the trench will be backfilled with clay or bentonite. Specifications for this slurry wall will be provided within the Remedial Action Implementation Plan.

7.6 Confirmation Soil Sampling

Confirmation soil samples will be taken from the bottom and sidewalls of the CAP excavation area. Due to the lack of VOCs detected in prior soil borings (including borings in the apparent site source area and within the elevated soil gas impact), one sidewall sample will be collected for every 100 ft of sidewall and one floor sample will be collected for every 3,000 square feet of excavation floor. This yields approximately 5 sidewall and 8 floor samples for the planned excavation area. The sidewall samples will be collected at approximately 4 to 5 ft bgs based on prior MiHPT data or collected at depths corresponding to highest PID readings in the field. Each confirmation soil sample will be collected using EPA Method 5035 (e.g., TerraCore) and analyzed for VOCs by EPA Method 8260B using at a California-certified laboratory.

7.7 Confirmation Soil Gas Sampling

Soil gas sampling will be conducted to help verify that VOC levels in the CAP excavation have been reduced to well below ESLs. After excavation and backfilling, four soil vapor wells will be installed and sampled within the middle of the excavation backfill area. Pangea will also sample six existing soil gas wells to provide longer-term data. If the existing soil gas wells become damaged during site activity, they will be replaced with new soil gas wells located within the footprint of planned buildings. The proposed soil gas sampling locations are shown on Figure 13. Additional soil gas sampling may be proposed in the Remedial Action Implementation Report based on upcoming soil gas sampling of existing wells.

The soil vapor monitoring wells will be installed and sampled according to the State *Advisory – Active Soil Gas Investigations* (CalEPA/DTSC, 2015). The soil vapor wells will be constructed to a depth of 5.5 ft bgs. The wells will be constructed by setting a vapor implant attached to ¼-inch Teflon™ tubing at 5 feet bgs with six-inches of sand pack above and below it. A ½ foot of dry bentonite crumbles will be poured on top of the sand and the remaining annular space will be backfilled with hydrated bentonite. The Teflon™ tubing will be set in a 2-inch PVC riser and capped to prevent moisture from entering.

This is the same procedure used for prior sampling as documented in our *Site Assessment Report* dated August 26, 2016 (Pangea, 2016a). Note that due to the naturally tight formation, soil gas wells installed for the prior assessment were purged between 24 and 48 hours prior to sampling to allow collection of representative samples in this tight soil. If necessary for these new wells installed in the backfill, purging will be conducted about 24 hours in advance of sample collection. Samples will be collected by connecting a 1-liter Summa™ canister to the tubing through a flow rate regulator calibrated to a rate of approximately 100-200 milliliters per minute (mL/min). To further evaluate potential leakage within the sampling system, a leak-check enclosure/shroud will be placed over the sample train and isopropyl alcohol will be introduced into the shroud. A PID will be used to monitor the concentration of isopropyl alcohol within the shroud during sample collection.

Soil gas samples will be analyzed for VOCs by EPA Method TO-15. Shroud samples will be collected from select shrouds to correlate PID readings for the tracker gas. At least four soil gas samples from the excavation area will be analyzed for fixed gases (oxygen, carbon dioxide, and methane) by ASTM Method D-1946. Soil gas samples will be collected and analyzed a minimum of two events to evaluate soil gas trends and confirm stabilization, to help demonstrate that soil excavation is successfully helping remediate the source of the VOC vapor cloud and the vapor intrusion risk. Pangea will attempt to retain the soil gas monitoring wells to collect additional repeatable data for several seasons.

7.8 Human Health Risk Assessment (HHRA)

A Screening-level HHRA was prepared to present agency-recommended screening levels and preliminary Site-specific screening levels for residential use (provided as Appendix B to this Draft CAP). While Site-specific screening levels can be used to guide remediation and mitigation activities at the Site, ACDEH is requiring use of RWQCB ESLs to guide excavation activities for the PCE impact and elevated ethylbenzene impact due to the lack of long-term soil gas data and a short-term construction schedule. After CAP implementation, the Screening-level HHRA may be updated to reflect soil physical parameter and additional soil gas data and post-excavation confirmation data to establish Site-specific screening levels. The post-excavation HHRA would evaluate post-excavation site conditions compared to ESLs and site-specific screening levels, and to confirm that estimated risks for the Site are at levels considered by U.S. EPA and Cal/EPA to be protective of human health assuming residential land use. PANGEA understands that ACDEH would require peer review of any HHRA used to incorporate site-specific screening levels into vapor intrusion risk evaluation and implementation of remediation or mitigation measures. Based on ACDEH direction, there are no plans to use site-specific screening levels into CAP implementation.

For initial planning, PANGEA engaged GSI Environmental Inc. (GSI) to perform a screening-level HHRA. The screening-level HHRA, presented in Appendix B, includes Site-specific screening levels developed by GSI using site-specific soil type information provided by PANGEA. The screening-level HHRA presents agency-recommended and preliminary Site-specific screening levels. As shown below in Table A, preliminary vapor intrusion modeling suggested that site-specific screening levels would be approximately three times the very conservative RWQCB ESLs and one and a half times the default Department of Toxic Substance Control (DTSC) screening level for future residential buildings.

Table A – Site-Specific Screening Levels for Soil Gas

Chemical	**RWQCB Residential Tier 1 ESL**	DTSC Residential Current Building	DTSC Residential Future Building	**Site-Specific Screening Level**
	ug/m^3			
PCE	**240**	240	480	**725**
Benzene	**48**	49	97	**100**
Ethylbenzene	**560**	550	1,100	**1,342**

From our September 21, 2016 meeting, PANGEA understands ACDEH is concerned that disturbance of the existing clay soil layer and the use of engineered fill and utility trenches will affect the soil matrix assumptions of the HHRA. Therefore, the excavation extent presented in the CAP targets PCE and elevated ethylbenzene impact in soil gas above ESLs. PANGEA understands that ACDEH will require peer review of the HHRA if the CAP will incorporate site-specific screening levels into vapor intrusion risk evaluation and CAP implementation.

7.9 Vapor Mitigation System

The CAP goal is achievement of the site cleanup goal of ESLs for subslab gas and soil gas. ACDEH requires long-term data to confirm that post-remediation conditions do not pose a significant vapor intrusion risk to site residents. Since long-term monitoring cannot be completed before construction of the planned buildings, a vapor mitigation system will be installed beneath the five buildings where residual VOC impact exceeds ESLs, consistent with State guidance (CalEPA, 2011). VMS systems may be installed beneath other buildings based on additional data and ACDEH direction. The vapor mitigation system will include a *passive* subslab ventilation (SSV) with an underlying VOC-resistant sub-liner/vapor barrier consistent with State guidance (CalEPA, 2011). The proposed VMS system locations are shown on Figure 14.

The SSV system will consist of subslab low-profile piping network (e.g., VaporVent™) within the planned layer of permeable subgrade material, with collection pipes feeding to vertical risers that direct exhaust above the roofline. The SSV sub-liner (vapor barrier) will be sealed to the foundation and penetrations will be ‘booted’ for sealing. The SSV system with sub-liner vapor barrier is being designed separately by others. The SSV design will include a construction quality control plan.

At least two sampling events of subslab gas within the passive ventilation piping will be conducted. If subslab gas concentrations exceed applicable screening levels, the passive subslab ventilation piping will be converted to an *active* ventilation system (e.g., a subslab depressurization system [SSD]) using a powered extraction blower. The subslab screening levels are shown below on Table B.

Table B –Screening Levels for Subslab Gas

Compound	RWQCB Residential Tier 1 ESL
	ug/m^3
PCE	240
Benzene	48
Ethylbenzene	560

7.10 Reporting

- Consistent with the *Site Management Plan*, PANGEA will notify ACDEH of any new conditions discovered during subgrade development. PANGEA will keep ACDEH updated on progress of the Pilot Study and CAP implementation. As required by the ACDEH letter dated October 14, 2016, PANGEA will provide the following reports to facilitate ACDEH approval for CAP Implementation: Interim Remediation Report documenting interim excavation activities performed during initial site grading in accordance with the Site Management Plan (SMP):

- *Data Gap Field Investigation Workplan* to further delineation contamination;

- *Remedial Action Implementation Plan* presenting results of the Pilot Study, additional field investigation activities and revisions to the proposed corrective actions presented in the Draft CAP based on the results of the additional assessment and Pilot Study;

- *Draft Post Construction SMP* presenting requirements for long-term site management of the proposed mitigation systems and residual soil contamination (to be finalized after construction is complete); and

- *Record Report of Construction of Corrective Action and Mitigation Measures*.

Upon CAP implementation and completion of post-excavation soil gas compliance sampling, a technical report will be prepared to document initial CAP implementation and analytical results. The report will include a figure, tables and photographs. The report will describe backfilling activities and offsite soil disposal. Installation and testing of the VMS system will be provided in a separate report. A future report will document subslab gas conditions beneath the newly constructed building slabs, and any recommendations for contingency measures. PANGEA will discuss the appropriateness of the final mitigation measures with ACDEH, and any ACDEH requirements for case closure with unrestricted land use.

8.0 REFERENCES

CalEPA/DTSC, 2011, (CalEPA, 2011) *Vapor Intrusion Mitigation Advisory (VIMA),* October 2011

CalEPA/DTSC, 2015, (CalEPA, 2015) *Advisory – Active Soil Gas Investigations*, July 2015

Department of Water Resources, 2003, *Bulletin 118,* October 2003.

ENGEO, 2015, *Phase I Environmental Site Assessment*, June 2015.

ENGEO, 2015, *Phase II Environmental Site Assessment*, July 2015.

ENGEO, 2016, *Site Management Plan*, May 2016.

ENGEO, 2016, *Phase I Environmental Site Assessment Update*, June 2016.

ENGEO, 2016, *Revised Phase II Environmental Site Assessment*, August 2016.

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

PANGEA, 2016, *Site Assessment Report*. August 26, 2016.

Secor, 2004, *Phase I Environmental Site Assessment*, November 2004.

Secor, 2004, *Phase II Environmental Site Assessment*, December 2004.

1233 Bockman Road
San Lorenzo, California

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Vicinity Map

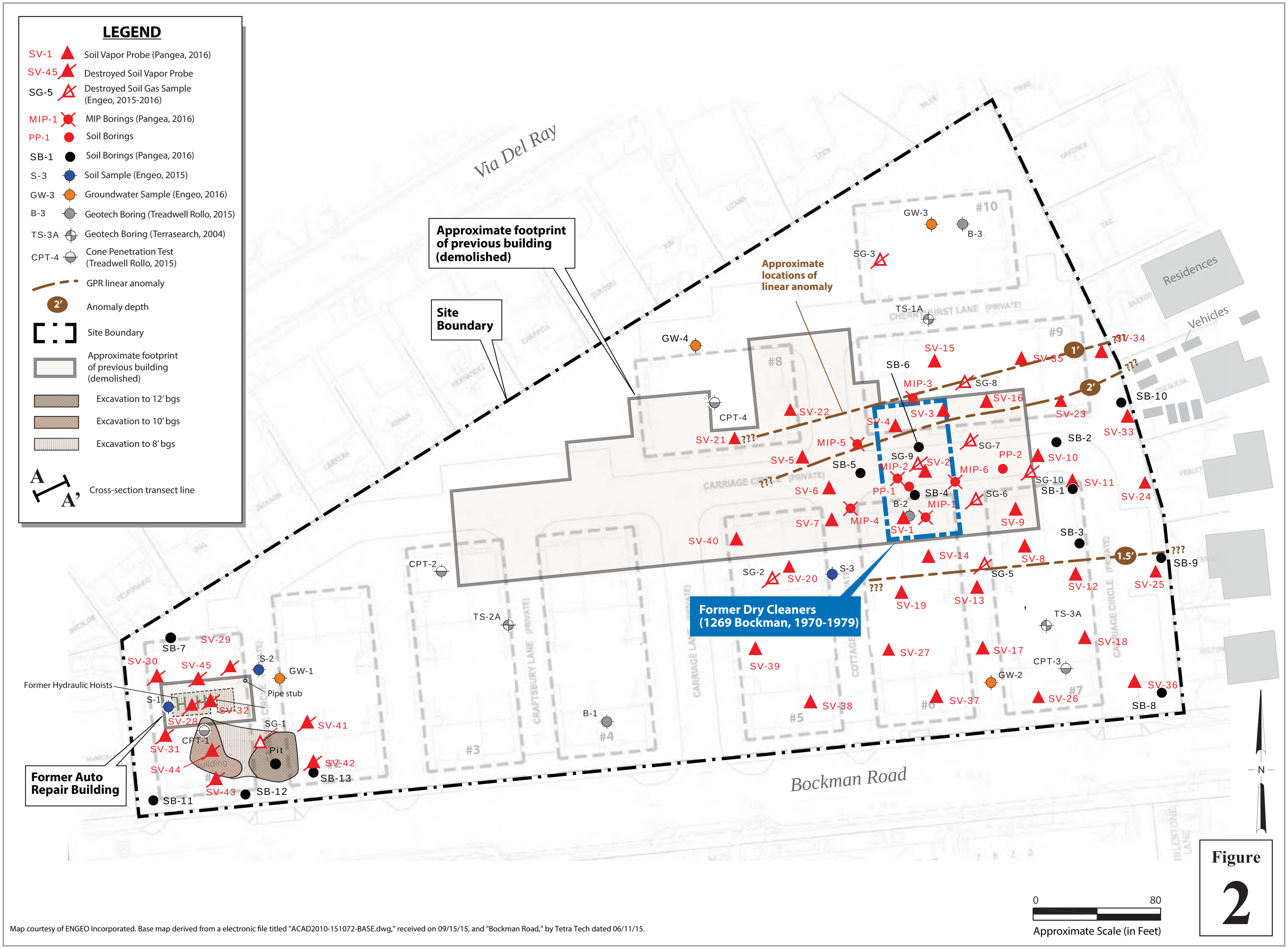

Figure 2

1233 Bockman Road
San Lorenzo, California

Site Map

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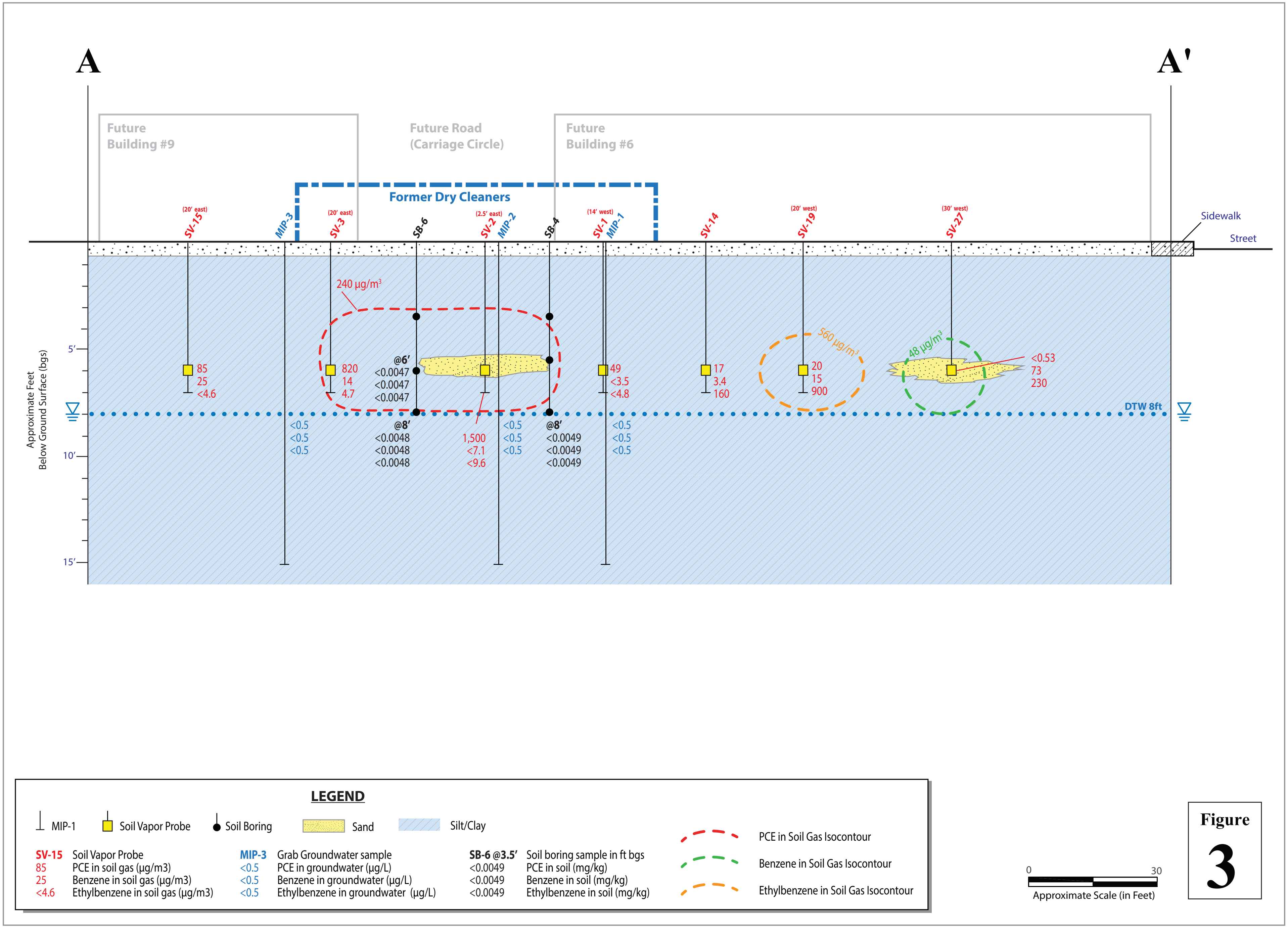

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Cross Section A-A'

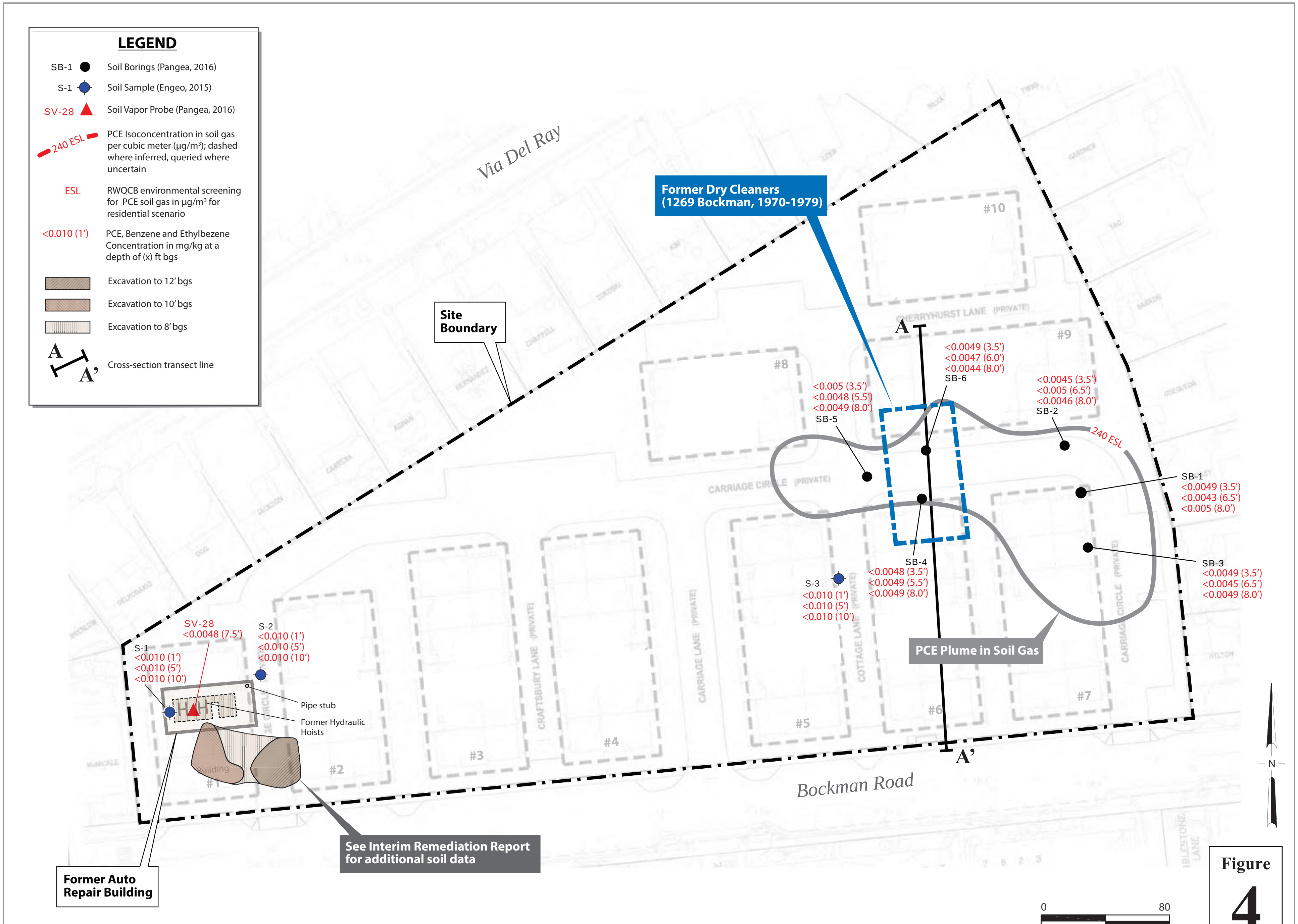

Figure 4

Map courtesy of ENGEO Incorporated. Base map derived from a electronic file titled "ACAD2010-151072-BASE.dwg," received on 09/15/15, and "Bockman Road," by Tetra Tech dated 06/11/15.

1233 Bockman Road
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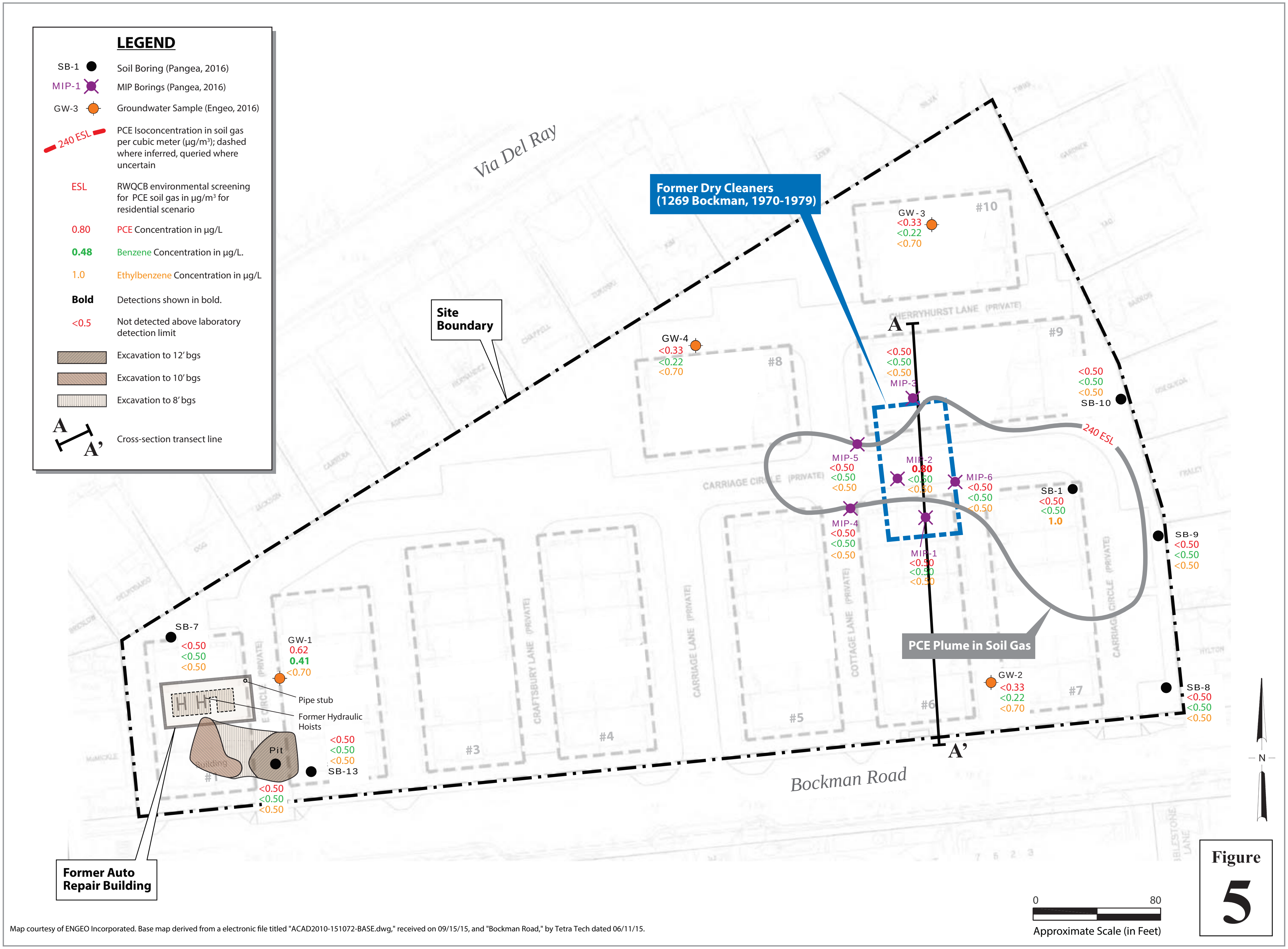
VOCs in Shallow Soil



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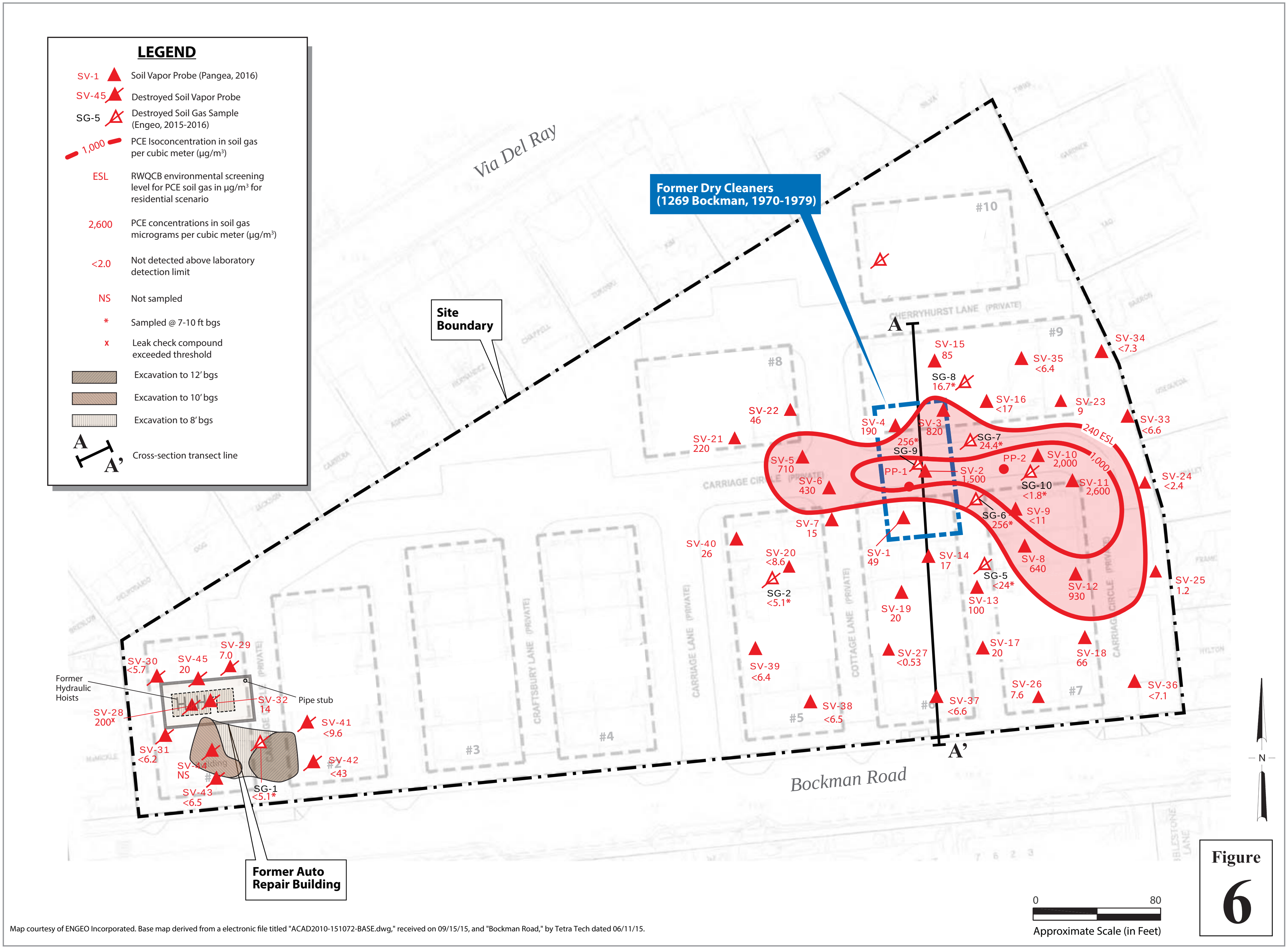
VOCs in Shallow Groundwater



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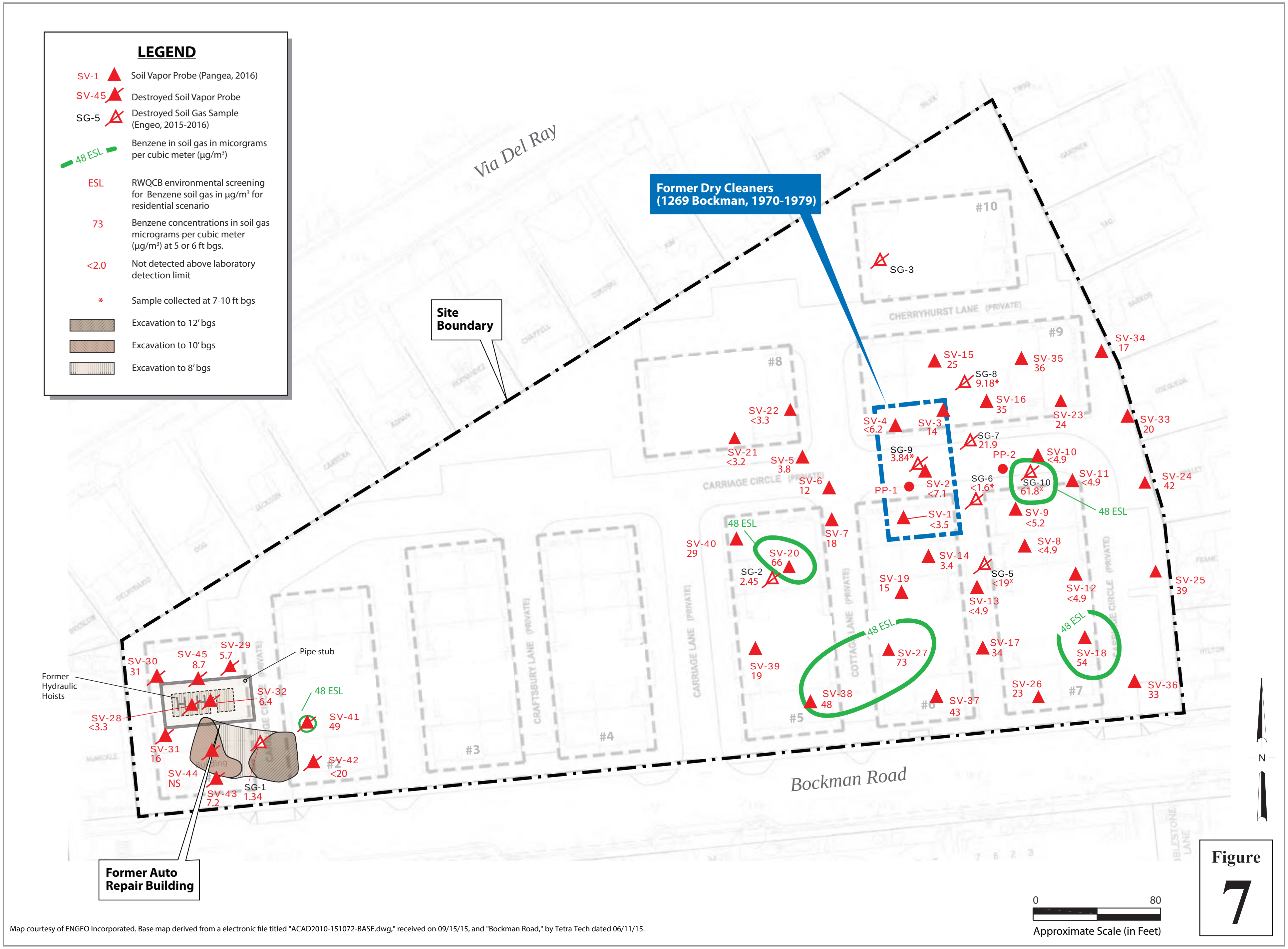
PCE in Soil Gas



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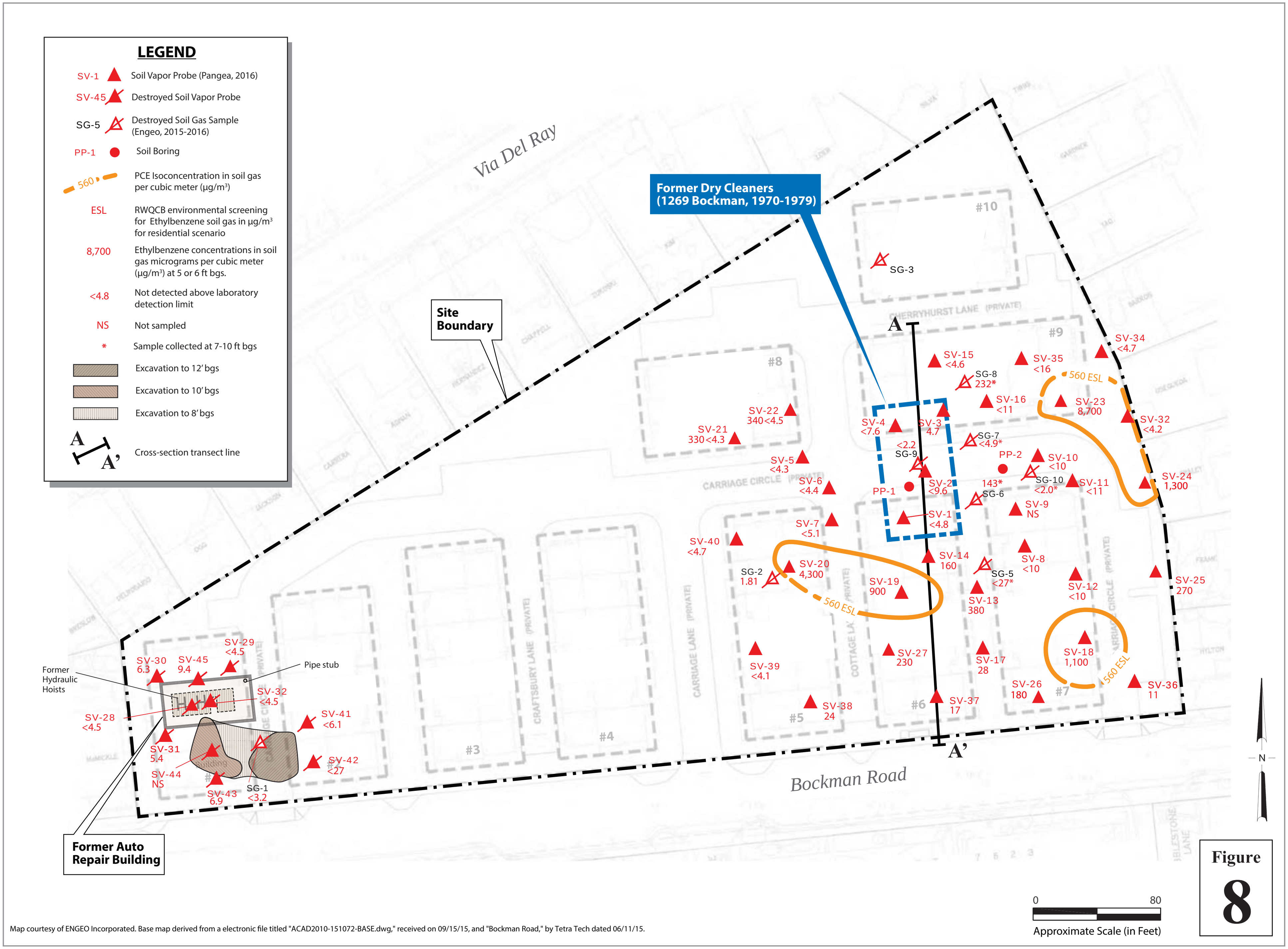
Benzene in Shallow Soil Gas



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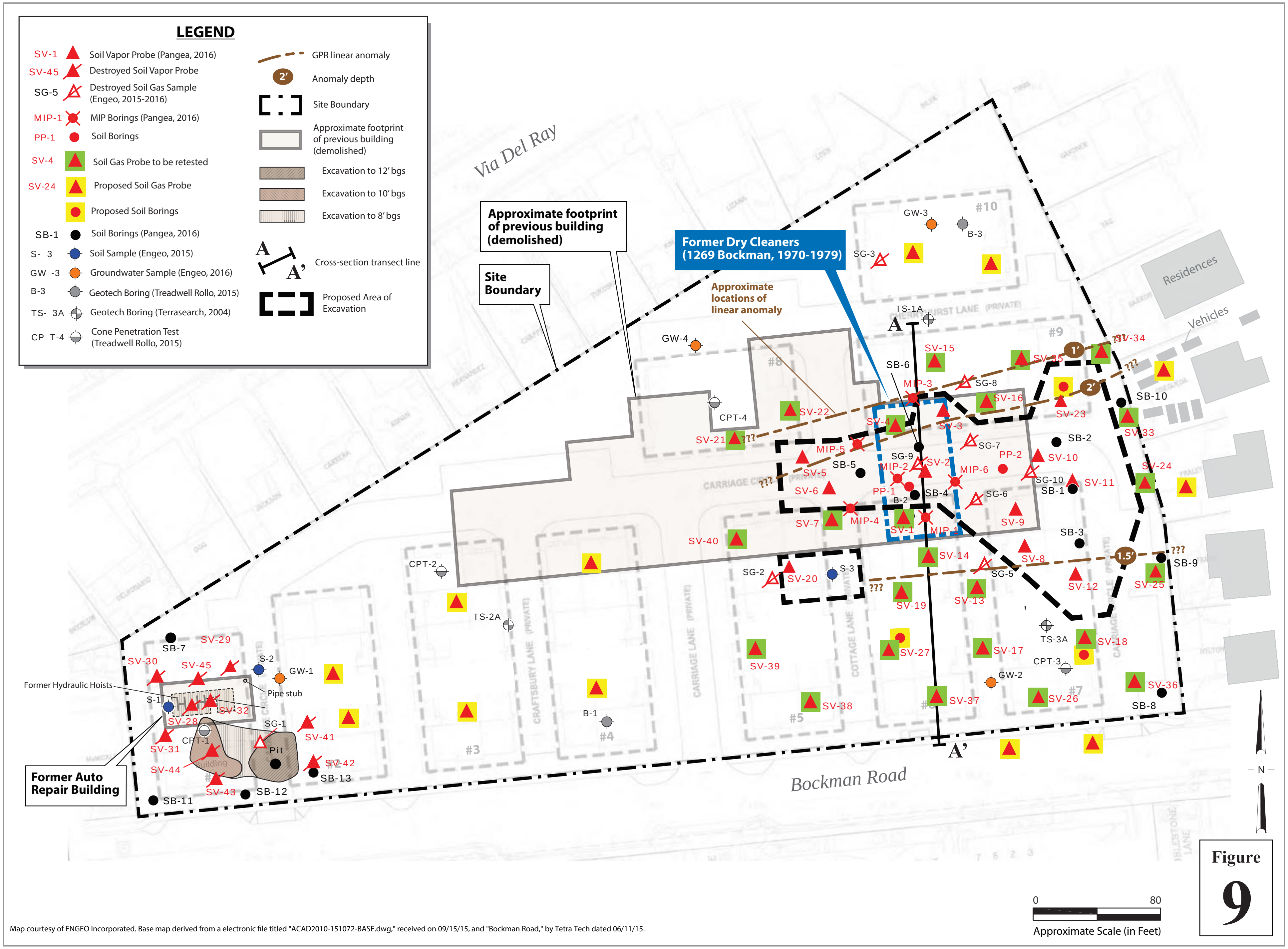
Ethylbenzene in Shallow Soil Gas



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Proposed Additional Assessment Locations

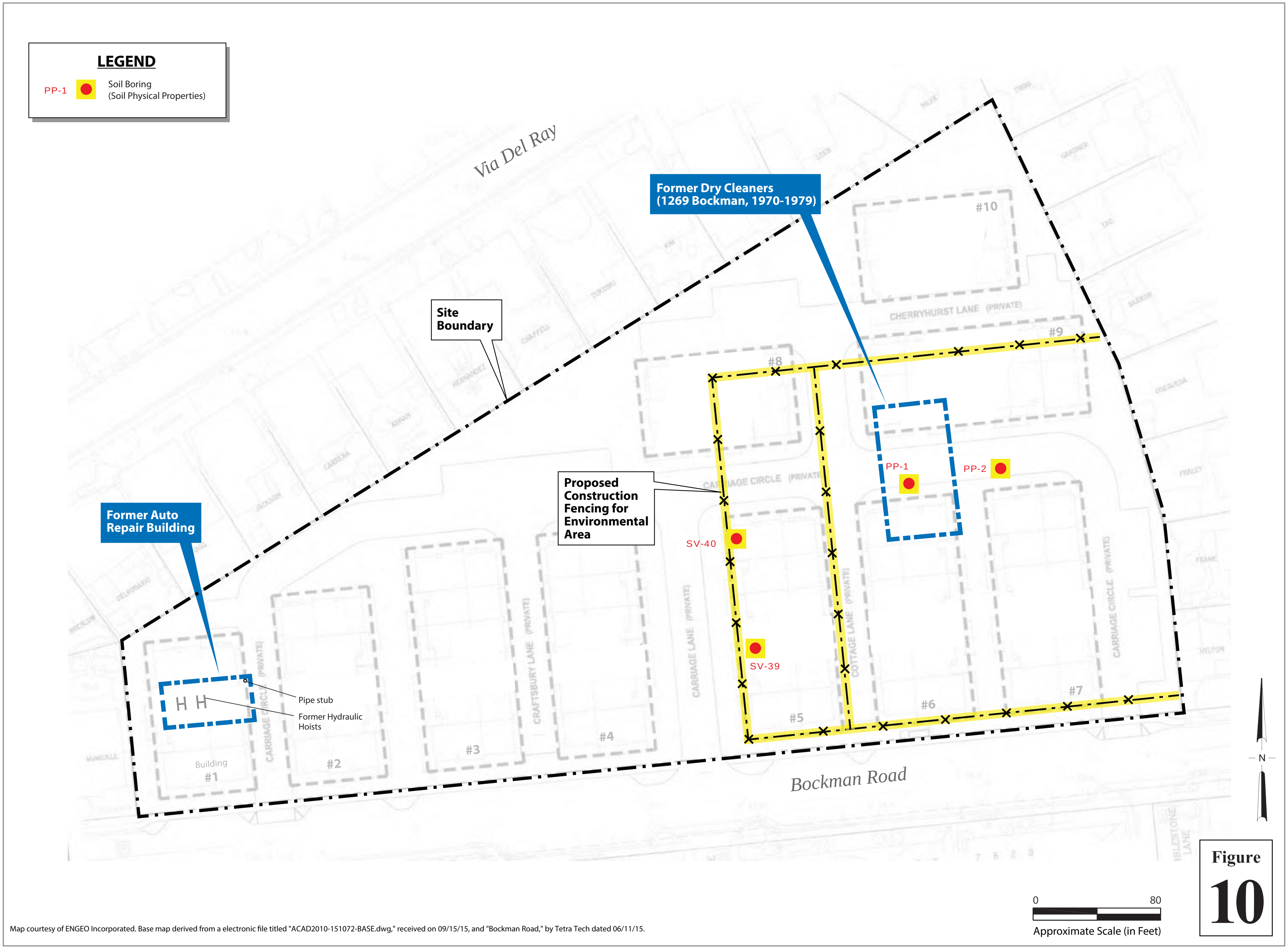

Figure
10

Map courtesy of ENGEO Incorporated. Base map derived from a electronic file titled "ACAD2010-151072-BASE.dwg," received on 09/15/15, and "Bockman Road," by Tetra Tech dated 06/11/15.

1233 Bockman Road
San Lorenzo, California

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Soil Physical Properties Sampling

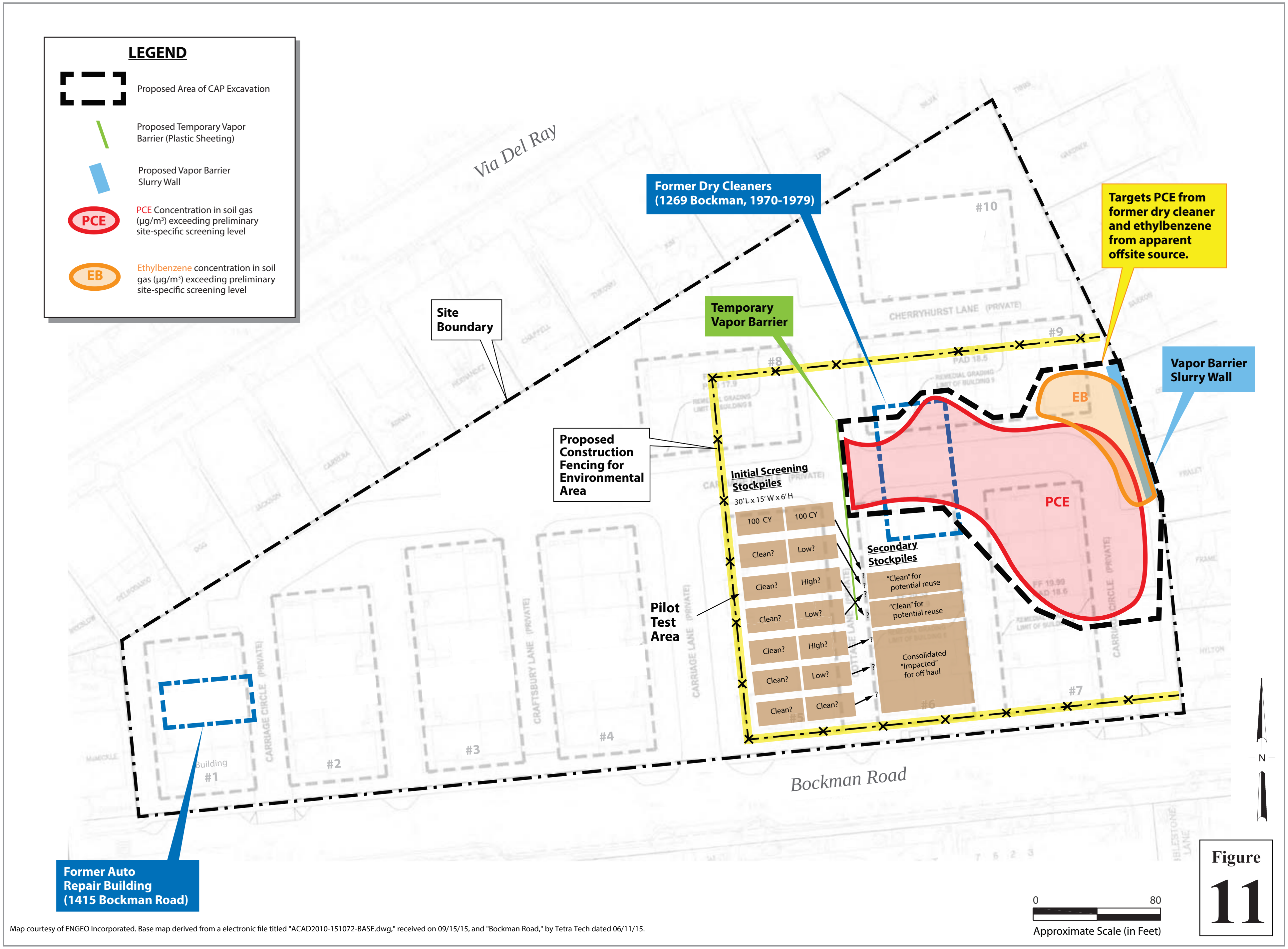

Figure 11

1233 Bockman Road
San Lorenzo, California

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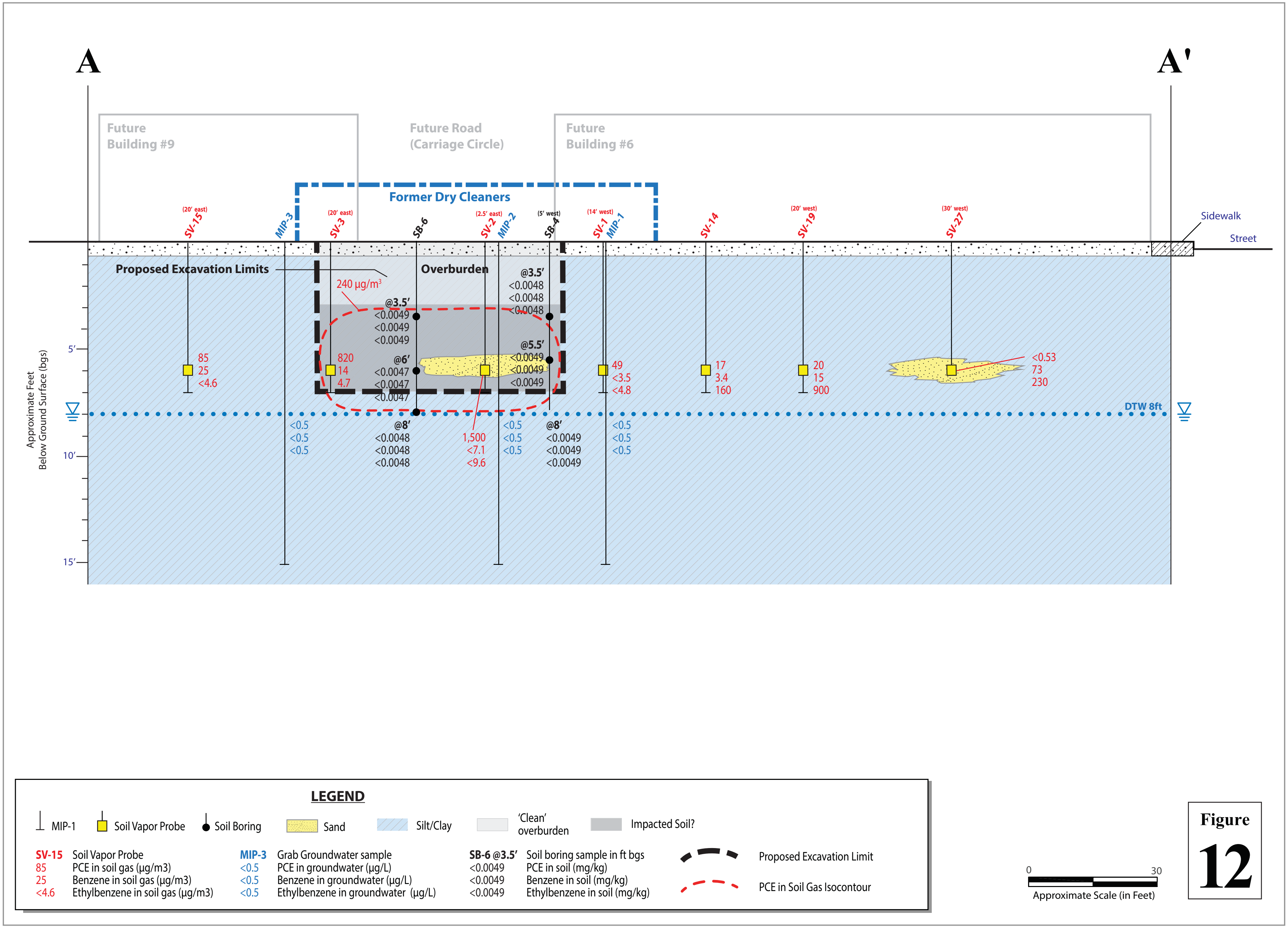
Proposed CAP Excavation Plan



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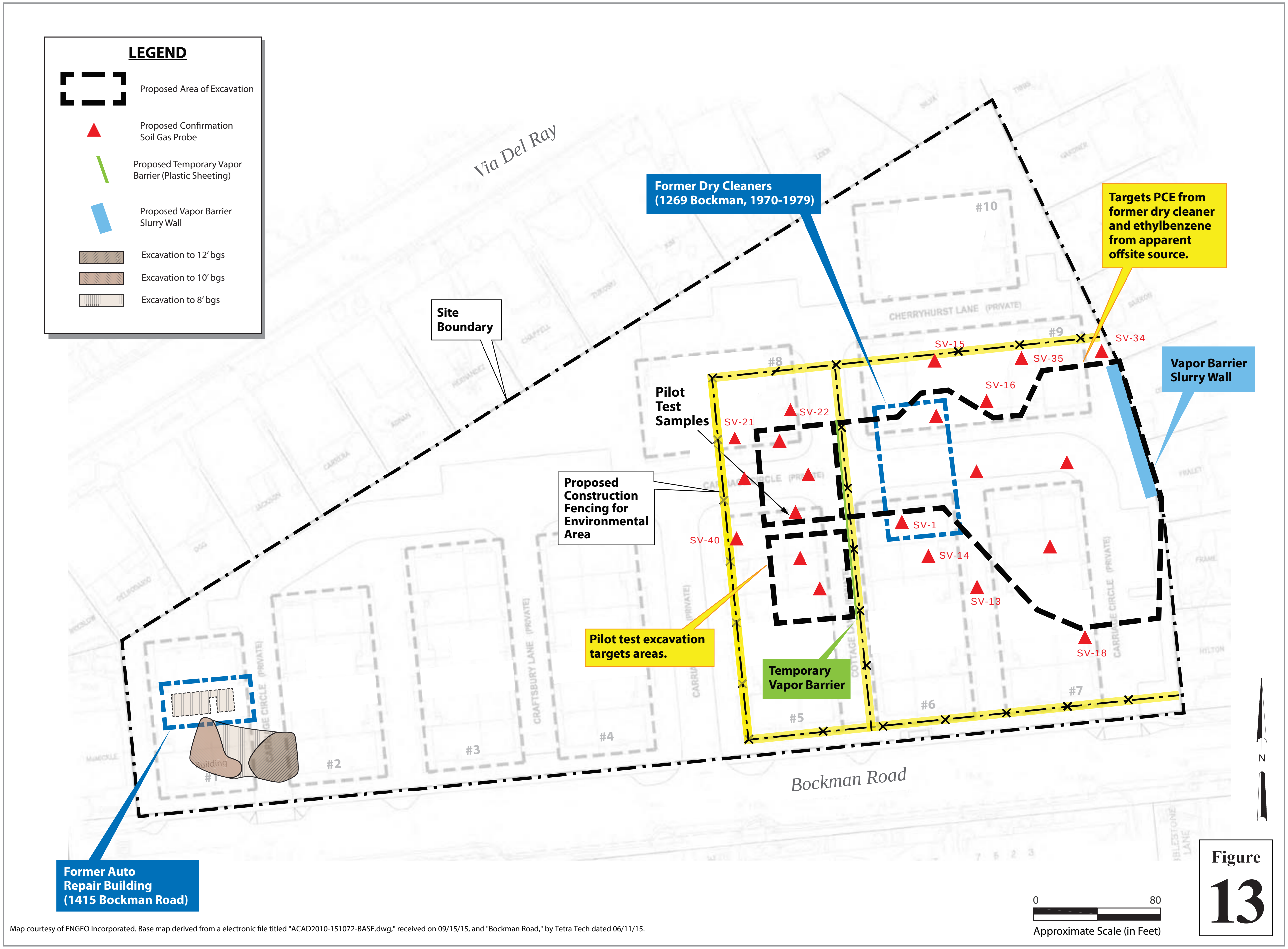
Cross Section of Proposed Excavation



Map courtesy of ENGEO Incorporated. Base map derived from a electronic file titled "ACAD2010-151072-BASE.dwg," received on 09/15/15, and "Bockman Road," by Tetra Tech dated 06/11/15.

1233 Bockman Road
San Lorenzo, California

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Proposed Confirmation Soil Gas Sampling Locations

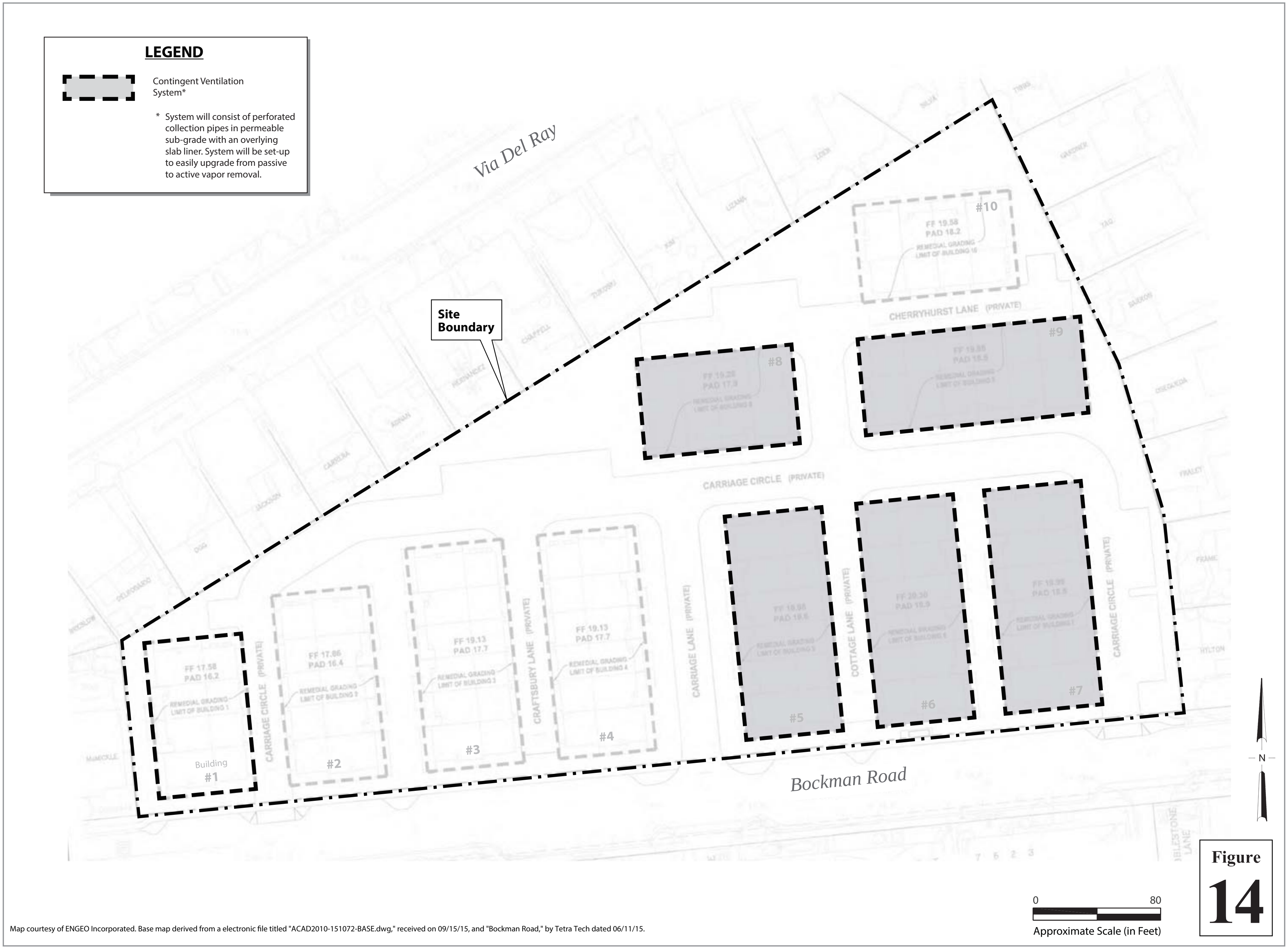

Figure 14

1233 Bockman Road
San Lorenzo, California

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Proposed Subslab Ventilation and Vapor Barrier Locations

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Table 1. Soil Analytical Data - 1233 Bockman Road, San Lorenzo California

Boring / Sample ID	Date Sampled	Sample Depth (ft bgs)	TPHg	TPHd	TPHmo	Lead	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Naphthalene	1,2-DCA	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	Chloroform	Acetone	Other VOC's	PCBs	Notes
Direct Exposure ESL - residential, shallow soil:			740	230	11,000	80	0.23	970	5.1	560	42	3.3	0.37	0.6	1.2	19	160	0.0082	0.30	59,000	varies		
			mg/Kg																				
Soil Borings - ENGEO Site Assessment 2015																							
S-1	6/25/2015	1	<0.1	3.6	32	13	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	<0.021	---	
	6/25/2015	5	<0.1	<2.0	<10	5.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	<0.021	---	
	6/25/2015	10	<0.1	<2.0	<10	5.6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	<0.021	---	
S-2	6/25/2015	1	<0.1	<2.0	<10	7.6	<0.01	<0.01	<0.01	22.6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	<0.021	---	
	6/25/2015	5	<0.1	<2.0	<10	8.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	<0.021	---	
	6/25/2015	10	<0.1	<2.0	<10	4.9	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	<0.021	---	
S-3	6/25/2015	1	<0.1	14	230	1.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	<0.021	---	
	6/25/2015	5	<0.1	<2.0	17	6.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	<0.021	---	
	6/25/2015	10	<0.1	<2.0	<10	5.6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	<0.021	---	
Soil Borings in Dry Cleaner Area - PANGEA 2016																							
SB-1	8/3/2016	3.5	---	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.02	<0.049	---	
		6.5	<0.96	---	---	---	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0087	<0.0043	<0.017	<0.043	---	
		8	---	---	---	---	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0099	<0.005	<0.02	<0.050	---	
SB-2	8/3/2016	1	---	---	---	3.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
		3	---	---	---	8.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
		3.5	---	---	---	---	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0091	<0.0045	<0.018	<0.045	---	
		6	---	---	---	6.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
		6.5	<1.1	---	---	---	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.02	<0.050	---	
		8	---	---	---	---	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0093	<0.0046	<0.019	<0.046	---	
SB-3	8/3/2016	3.5	---	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	0.027	<0.049	---	
		6.5	<0.99	---	---	---	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0091	<0.0045	<0.018	<0.045	---	
		8	---	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.02	<0.049	---	
SB-4	8/3/2016	3.5	---	---	---	---	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0097	<0.0048	<0.019	<0.048	---	
		5.5	<0.99	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0097	<0.0049	<0.019	<0.049	---	
		8	---	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.02	<0.049	---	
SB-5	8/3/2016	3.5	---	---	---	---	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0099	<0.005	<0.02	<0.050	---	
		5.5	<1.1	---	---	---	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0097	<0.0048	<0.019	<0.048	---	
		8	---	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.02	<0.049	---	
SB-6	8/3/2016	1	---	---	---	7.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
		3	---	---	---	5.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
		3.5	---	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0097	<0.0049	<0.019	<0.049	---	
		6	<0.98	---	---	4.1	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0093	<0.0047	<0.019	<0.047	---	
		8	---	---	---	---	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0089	<0.0044	<0.018	<0.044	---	

Table 1. Soil Analytical Data - 1233 Bockman Road, San Lorenzo California

Boring / Sample ID	Date Sampled	Sample Depth (ft bgs)	TPHg	TPHd	TPHmo	Lead	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Naphthalene	1,2-DCA	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	Chloroform	Acetone	Other VOC's	PCBs	Notes
Direct Exposure ESL - residential, shallow soil:			740	230	11,000	80	0.23	970	5.1	560	42	3.3	0.37	0.6	1.2	19	160	0.0082	0.30	59,000	varies		
			mg/Kg																				
Soil Sampling in Auto Repair Area - PANGEA 2016																							
SV-28	8/22/2016	7.5	5.2	**1,400**	2,800	---	<0.0048	<0.0048	<0.0048	<0.0096	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0095	<0.0048	<0.019	<0.048	---	Excavated to 8'
SS-1	9/2/2016	2.5	---	---	---	---	<0.0047	<0.0047	<0.0047	<0.0094	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0094	<0.0047	<0.019	<0.047	---	
SS-2	9/2/2016	2.5	<1.0	43	300	---	<0.0046	<0.0046	<0.0046	<0.0092	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0093	<0.0046	<0.019	<0.046	---	Excavated to 8'
SS-3	9/2/2016	2.5	---	---	---	---	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.020	<0.050	---	
SS-4	9/2/2016	2.5	---	---	---	---	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	0.059	<0.049	---	
SS-5	9/2/2016	2.5	---	---	---	---	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	0.050	<0.050	---	
SS-6	9/2/2016	8	---	---	---	---	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	0.0084	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.020	<0.050	---	Excavated to 12'
	9/2/2016	10	---	---	---	---	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0097	<0.0049	<0.019	<0.049	---	
SS-7	9/2/2016	8	---	---	---	---	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0097	<0.0049	<0.019	<0.049	---	
SS-8	9/2/2016	8	---	---	---	---	<0.0045	<0.0045	<0.0045	<0.0090	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0090	<0.0045	<0.018	<0.045	---	
SS-9	9/2/2016	8	4.0	**650**	3,100	---	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	0.030	<0.049	---	Excavated to 10'
	9/2/2016	10	<0.96	<1.0	<5.0	---	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0099	<0.0049	<0.020	<0.049	---	
Confirmation Samples at Auto Repair Area																							
H-1	8/30/2016	8	---	110	310	---	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0095	<0.0048	<0.019	<0.048	<0.024	bottom of excavation sample
H-2	8/30/2016	8	---	<1.0	<5.0	---	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0095	<0.0048	<0.019	<0.048	<0.024	bottom of excavation sample
H-3	8/30/2016	8	---	1.5	16	---	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0092	<0.0046	<0.018	<0.048	<0.024	bottom of excavation sample
BS-1-12	9/7/2016	12	<1.1	<1.0	<5.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	bottom of excavation sample
BS-2-12	9/7/2016	12	<1.1	<0.99	<5.0	---	<0.0048	<0.0048	<0.0048	<0.0096	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0097	<0.0048	<0.019	<0.048	---	bottom of excavation sample
BS-3-12	9/7/2016	12	<1.0	<1.0	<5.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	bottom of excavation sample
BS-4-8	9/7/2016	8	<1.1	<1.0	<5.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	bottom of excavation sample
BS-5-10	9/7/2016	10	<0.97	<0.99	<5.0	---	<0.0048	<0.0048	<0.0048	<0.0096	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0097	<0.0048	<0.019	<0.048	---	bottom of excavation sample
BS-6-10	9/7/2016	10	<0.94	<1.0	<5.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	bottom of excavation sample
BS-7-10	9/7/2016	10	<0.97	<0.99	<5.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	bottom of excavation sample
SW-1-10	9/7/2016	10	<1.0	<1.0	<5.0	---	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0099	<0.0049	<0.020	<0.049	---	excavation sidewall sample
SW-2-10	9/7/2016	10	<1.0	<0.99	<5.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	excavation sidewall sample

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Table 1. Soil Analytical Data - 1233 Bockman Road, San Lorenzo California

Boring / Sample ID	Date Sampled	Sample Depth (ft bgs)	TPHg	TPHd	TPHmo	Lead	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Naphthalene	1,2-DCA	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	Chloroform	Acetone	Other VOC's	PCBs	Notes
Direct Exposure ESL - residential, shallow soil:			740	230	11,000	80	0.23	970	5.1	560	42	3.3	0.37	0.6	1.2	19	160	0.0082	0.30	59,000	varies		
			mg/Kg																				
SW-3-10	9/8/2016	10	<0.97	1.1	<5.0	---	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0099	<0.0049	<0.020	<0.050	---	excavation sidewall sample
SW-4-8	9/7/2016	8	<0.97	<1.0	<5.0	---	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0099	<0.0050	<0.020	<0.050	---	excavation sidewall sample
SW-5-8	9/7/2016	8	<0.95	<1.0	<5.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	excavation sidewall sample
SW-6-8	9/7/2016	8	<1.0	<1.0	<5.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	excavation sidewall sample

Explanation:

TPHd and TPHmo analyzed by EPA Method 8015, TPHg and VOC's analyzed by EPA Method 8260

Benzene, Toluene, Ethylbenzene and Xylenes by EPA Method 8021.

TPHg = Total Petroleum Hydrocarbons as gasoline

TPHd = Total Petroleum Hydrocarbons as diesel

TPHmo = Total Petroleum Hydrocarbons as motor oil

MTBE = Methyl tert-butyl ether

1,2-DCA = 1,2-Dichloroethane

PCE = Tetrachloroethene

TCE = Trichloroethene

cis-1,2-DCE = cis-1,2-Dichloroethene

PCB = total polychlorinated biphenyls including Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260

mg/Kg = Milligrams per kilogram

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

ESL = Environmental Screening Level, from California Regional Water Quality Control Board - San Francisco Bay Region, Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Interim Revised February 2016 (Revision 3).

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

ND = not detected

contaminant detections highlighted in gray

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Table 2. Groundwater Analytical Data - 1233 Bockman Road, San Lorenzo, California

Boring / Sample ID	Date Sampled	Depth to Water (ft bgs)	TPHg	TPHd	TPHmo	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	1,2-DCA	PCE	TCE	Chloroform	Other VOCs	Notes
			µg/L													
Tier 1 ESL - Groundwater:			100	100	n/a	1.0	40	13	20	0.12	0.5	3.0	5.0	50	varies	
Vapor Intrusion ESL - shallow groundwater, residential:			100	100	n/a	1.1	3,600	13	1,300	20	6.1	3.0	5.6	2.3	varies	
Vapor Intrusion ESL - shallow groundwater, commercial:			5,000	5,000	n/a	9.7	30,000	110	11,000	170	53	26	49	20	varies	
Grab Groundwater Samples - ENGEO Site Assessment																
GW-1	6/25/2015	15-25[a]	51	---	---	0.48	0.42	<0.59	0.26	0.28	<0.17	<0.59	<0.59	<0.59	ND	
	7/15/2016	12-17[b]	<41	---	---	0.41	<0.20	<0.70	<0.55	<1.7	0.15	0.62	<0.70	<0.70	ND	
GW-2	6/25/2015	15-25[a]	<50	---	---	<0.50	<0.50	<0.50	<1.0	<0.16	<0.17	<0.50	<0.50	<0.50	ND	
	7/15/2016	12-17[b]	<41	---	---	<0.22	<0.20	<0.70	<0.55	<1.7	<0.15	<0.33	<0.70	<0.70	ND	
GW-3	6/25/2015	15-25[a]	<50	---	---	<0.50	<0.50	<0.50	<1.0	<0.16	<0.17	<0.50	<0.50	<0.50	ND	
	7/15/2016	12-17[b]	53.2	---	---	<0.22	<0.20	<0.70	<0.55	<1.7	<0.13	<0.33	<0.70	<0.70	ND	
GW-4	7/15/2016	12-17[b]	<41	---	---	<0.22	<0.20	<0.70	<0.55	<1.7	<0.15	<0.33	<0.70	<0.70	ND	
Grab Groundwater Samples - PANGEA																
MIP-1	7/25/2016	8-12	<50	---	---	<0.5	0.70	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	**2.3**	<10	
MIP-2	7/25/2016	8-12	<50	---	---	<0.5	<0.5	<0.5	<1.0	<2.0	<0.5	0.80	<0.5	**3.6**	<10	
MIP-3	7/25/2016	8-12	<50	---	---	<0.5	3.3	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	**8.1**	<10	
MIP-4	7/25/2016	8-12	<50	---	---	<0.5	1.5	<0.5	0.60	<2.0	<0.5	<0.5	<0.5	**13**	<10	
MIP-5	7/25/2016	8-12	<50	---	---	<0.5	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<10	
MIP-6	7/25/2016	8-12	<50	---	---	<0.5	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	**2.6**	<10	
SB-1-W	8/3/2016	8	<50	---	---	<0.5	<0.5	1.0	6.2	<2.0	<0.5	<0.5	<0.5	<0.5	<10	
SB-7	8/22/2016	8	--	---	---	<0.5	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<10	

Pangea

Table 2. Groundwater Analytical Data - 1233 Bockman Road, San Lorenzo, California

Boring / Sample ID	Date Sampled	Depth to Water (ft bgs)	TPHg	TPHd	TPHmo	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	1,2-DCA	PCE	TCE	Chloroform	Other VOCs	Notes
			μg/L													
		Tier 1 ESL - Groundwater:	100	100	n/a	1.0	40	13	20	0.12	0.5	3.0	5.0	50	varies	
		Vapor Intrusion ESL - shallow groundwater, residential:	100	100	n/a	1.1	3,600	13	1,300	20	6.1	3.0	5.6	2.3	varies	
		Vapor Intrusion ESL - shallow groundwater, commercial:	5,000	5,000	n/a	9.7	30,000	110	11,000	170	53	26	49	20	varies	
SB-8-W	9/7/2016	8	<50	**590**	17,000	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	
SB-9-W	9/7/2016	8	<50	**380**	4,300	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	
SB-13-W	9/8/2016	7	<50	<50	<250	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	
Pit	9/7/2016	8	64	73	<250	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10[c]	

Explanation:

TPHg = Gasoline range Total Petroleum Hydrocarbons by EPA Method SW8021B/8015Bm.

TPHd = Diesel Range Total Petroleum Hydrocarbons by EPA Method SW8015B.

TPHmo = Motor Oil Range Total Petroleum Hydrocarbons by EPA Method SW8015B.

VOCs = Volatile Organic Compounds by EPA Methond 8260B.

1,2-DCA = 1,2-Dichloroethane

PCE = Tetrachloroethene

TCE = Trichloroethene

μg/L = micrograms per Liter

ft bgs = feet below grade surface.

ESL = Environmental screening level established by the SFB-RWQCB, Interim Final - November 2007 and amended in February 2016, (Rev. 3)

--- = Not analyzed or not available.

a = ENGEO report dated 07/02/2015 states samples were taken at first encountered groundwater which ranged between 15-25 ft bgs

b = ENGEO report dated 08/02/2016 states samples were taken at first encountered groundwater which ranged between 12-17 ft bgs

c = N-butylbenzene (0.64 ug/L) and 1,2,4-trimethylbenzene (1.6 ug/L)

d7 = strongly aged gasoline or diesel range compounds are significant in the TPH(g) chromatogram

e2 = diesel range compounds are significant; no recognizable pattern

e7 = oil range compounds are significant

e4/e11 = gasoline range compounds are significant; and/or stoddard solvent/mineral spirit?

Bold indicates concentration meets or exceeds Residential Vapor Intrusion ESL

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

Contaminent detections highlighted in gray

Pangea

Table 3. Soil Gas Analytical Data - 1233 Bockman Road, San Lorenzo, California

Boring/ Sample ID	Date Sampled	Sample Depth (ft bgs)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	1,2-DCA	PCE	TCE	Chloroform	Other VOCs	Isopropyl Alcohol (Leak Check Compound)	Oxygen	Notes
			ug/m^3											%	
Residential ESL - Soil/Subslab Gas:			**48**	**160,000**	**560**	**52,000**	**41**	**54**	**240**	**240**	**61**	**Varies**	**NA**	**NA**	
Soil Gas Samples - Engeo 2015 - 2016															
SG-1	06/25/15	5.0	1.34	6.33	<3.2	<6.5	<7.8	<3.1	<5.1	<8.1	4.92	--	<30	--	
SG-2	06/25/15	5.0	2.45	18.3	1.81	14.83	<7.8	<3.1	<5.1	<8.1	<7.4	--	<30	--	
SG-5	06/24/16	10	<19	<26	<27	<44	<140	<55	<24	<150	<130	--	--	--	
SG-6	06/24/16	7.0	<1.6	4.1	143	260	<5.2	<2.1	**256**	<5.4	<4.9	--	--	--	
SG-7	06/24/16	10	21.9	20.9	<4.9	<9.9	<12	<4.7	24.4	<12	<11	--	--	--	
SG-8	06/24/16	7.0	9.18	19.1	232	1,172	<5.2	<2.1	16.7	<5.4	<4.9	--	--	--	
SG-9	06/24/16	7.0	3.84	9.96	<2.2	4.69	<5.2	<2.1	**256**	<5.4	<4.9	--	--	--	
SG-10	06/24/16	10	**61.8**	76.2	<2.0	6.97	<10	<4.1	<1.8	<11	<9.8	--	--	--	
Soil Gas Samples - Pangea 2016															
SV-1	07/27/16	6.0	<3.5	<4.2	<4.8	<4.8	<23	<4.5	49	<5.9	<5.4	--	<11	--	
SV-2	07/27/16	6.0	<7.1	<8.3	<9.6	<9.6	<46	<8.9	**1,500**	<12	<11	--	<22	--	
SV-3	07/27/16	6.0	14	14	4.7	7.7	<22	<4.2	**820**	<5.6	<5.1	--	140	--	
SV-4	07/27/16	6.0	18	7.5	<7.6	<7.6	<36	<7.0	150	<9.4	<8.5	--	<17	--	
	09/01/16	6.0	<6.2	<7.3	<8.4	<16.8	<40	<7.8	190	<10	<9.4	--	<19	--	SV-4 resample
SV-5	07/27/16	6.0	3.8	<3.7	<4.3	<4.3	<21	<4.0	**710**	<5.3	<4.8	--	<9.6	--	
SV-6	07/27/16	6.0	12	<3.8	<4.4	<4.4	<21	<4.1	**430**	<5.4	<4.9	--	<9.9	--	
SV-7	07/27/16	6.0	18	27	<5.1	<5.1	<25	<4.7	15	<6.3	<5.7	--	<12	--	
SV-8	07/28/16	6.0	<4.9*	<11*	<10*	<15*	--	<14*	**640**	<8.7*	<9.4*	--	<22*	--	
Shroud (SV-8)	07/28/16	--	--	--	--	--	--	--	--	--	--	--	130,000	--	
SV-9	09/01/16	6.0	<5.2	<6.1	<7.1	<14.2	<34	<6.6	<11	<8.8	<8.0	--	62	--	
SV-10	07/28/16	6.0	<4.9*	<11*	<10*	<15*	--	<14*	**2,000**	170*	<9.4*	--	<22*	--	
SV-11	07/28/16	6.0	<4.9*	<11*	<10*	<15*	--	<14*	**2,600**	150*	<9.4*	--	<22*	--	
SV-12	07/28/16	6.0	<4.9*	<11*	<10*	110*	--	<14*	**930**	76*	<9.4*	--	<22*	--	
SV-13	07/28/16	6.0	<4.9*	<11*	380	1,470	--	<14*	100*	<8.7*	<9.4*	--	<22*	--	
SV-14	07/27/16	6.0	3.4	3.6	160	980	<20	<3.8	17	<5.1	<4.6	--	64	--	
SV-15	07/27/16	6.0	25	9.2	<4.6	8.6	<22	<4.3	85	6.1	<5.2	--	<10	--	
SV-16	07/27/16	6.0	35	13	<11	<11	<52	<10	<17	<13	<12	--	<24	--	
SV-17	07/28/16	6.0	34	13	28	191	--	<4.1	20	9.7	<5.0	--	150	--	
SV-18	07/28/16	6.0	**54**	59	**1,100**	3,190	--	<4.1	66	<5.5	<5.0	--	7.9*	--	
SV-19	07/28/16	6.0	15	40	**900**	2,490	--	<4.1	20	11	<5.0	--	8.7*	--	
SV-20	08/05/16	6.0	66*	160	**4,300**	18,400	17*	<130	<8.6*	<170	<160	--	<310	--	
SV-21	08/05/16	6.0	5.6*	<11	330	3,090	3.2*	<12	160	<16	<15	--	<29	--	

Table 3. Soil Gas Analytical Data - 1233 Bockman Road, San Lorenzo, California

Boring/ Sample ID	Date Sampled	Sample Depth (ft bgs)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	1,2-DCA	PCE	TCE	Chloroform	Other VOCs	Isopropyl Alcohol (Leak Check Compound)	Oxygen	Notes
			ug/m³											%	
Residential ESL - Soil/Subslab Gas:			**48**	**160,000**	**560**	**52,000**	**41**	**54**	**240**	**240**	**61**	**Varies**	**NA**	**NA**	
	09/01/16	6.0	<3.2	<3.8	<4.3	9.7	<21	<4.0	220	<5.4	<4.9	--	<9.8	--	resample SV-21
SV-22	08/05/16	6.0	21*	<82	340	18,100	10*	<88	24*	<120	<110	--	<210	--	
	09/01/16	6.0	<3.3	<3.9	<4.5	30.7	<21	<4.1	46	<5.5	8.0	--	<10	--	resample SV-22
SV-23	08/05/16	6.0	24*	150	**8,700**	34,000	19*	<130	9.0*	<170	<150	--	<310	--	
SV-24	08/05/16	6.0	42	45	**1,300**	5,500	13*	<35	<2.4*	<47	<43	--	<86	--	
Shroud (SV-24)	08/05/16	--	--	--	--	--	--	--	--	--	--	--	180,000	--	
SV-25	08/05/16	6.0	39	47	270	1,440	<1.2*	<11	1.2*	<14	<13	--	<26	--	
SV-26	08/05/16	6.0	23	28	180	920	2.6*	<4.4	7.6	<5.8	<5.3	--	<11	--	
SV-27	08/05/16	6.0	**73**	48	230	1,250	3.9*	<7.9	<0.53*	<11	<9.6	--	<19	--	
SV-28	08/23/16	6.0	<3.3	<3.9	<4.5	<9.0	<22	<4.2	200	9.6	<5.1	--	1,800	--	auto repair area, well destroyed 08/23/16
SV-29	08/23/16	6.0	7.5	<3.9	<4.5	17.1	<21	<4.1	7.0	<5.5	<5.0	--	83	--	auto repair area, well destroyed 08/23/16
SV-30	09/01/16	6.0	31	42	6.3	33.3	<21	<4.0	<6.7	<5.3	6.6	--	<9.7	--	auto repair area, well destroyed 09/01/16
SV-31	09/01/16	6.0	16	34	6.4	40	<19	<3.7	<6.2	<4.9	<4.5	--	<9.0	--	auto repair area, well destroyed 09/01/16
SV-32	09/01/16	6.0	6.4	3.9	<4.5	<9.0	<21	<4.1	14	<5.5	<5.0	--	<10	--	auto repair area, well destroyed 09/01/16
SV-33	09/01/16	6.0	20	27	<4.2	8.8	<20	<3.9	<6.6	<5.2	<4.7	--	<9.5	--	
SV-34	09/01/16	6.0	17	33	4.7	24.3	<22	<4.3	<7.3	<5.7	<5.2	--	<11	--	
SV-35	09/01/16	6.0	36	100	16	79	<20	<3.8	<6.4	<5.1	5.8	--	<9.3	--	
SV-36	09/01/16	6.0	33	72	11	53	<22	<4.2	<7.1	<5.6	<5.1	--	<10	--	

Pangea

Table 3. Soil Gas Analytical Data - 1233 Bockman Road, San Lorenzo, California

Boring/ Sample ID	Date Sampled	Sample Depth (ft bgs)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	1,2-DCA	PCE	TCE	Chloroform	Other VOCs	Isopropyl Alcohol (Leak Check Compound)	Oxygen	Notes
			ug/m³											%	
Residential ESL - Soil/Subslab Gas:			**48**	**160,000**	**560**	**52,000**	**41**	**54**	**240**	**240**	**61**	**Varies**	**NA**	**NA**	
SV-37	09/01/16	6.0	43	110	17	85	<21	<4.0	<6.6	<5.3	<4.8	--	<9.6	--	
SV-38	09/01/16	6.0	**48**	120	24	120	<20	<3.9	<6.5	<5.2	<4.7	--	<9.4	--	
SV-39	09/01/16	6.0	19	30	<4.1	12	<20	<3.8	<6.4	<5.1	<4.6	--	<9.3	--	
SV-40	09/01/16	6.0	29	51	<4.7	22.2	<23	<4.4	26	<5.9	17	--	<11	--	
SV-41	09/19/16	6.0	**49**	31	<6.1	7.6	<30	<5.7	<9.6	<7.6	<6.9	#	<14	2.9	auto repair area, well destroyed 10/3/16
SV-42	09/19/16	6.0	<20	<24	<27	<54	<130	<25	<43	<34	<31	#	<62	11	auto repair area, well destroyed 10/3/16
SV-43	09/19/16	6.5	7.2	23	6.9	32.2	<20	<3.9	<6.5	<5.2	<4.7	#	<9.5	10	auto repair area, well destroyed 10/3/16
SV-44	09/19/16	6.0	--	--	--	--	--	--	--	--	--	--	--	--	auto repair area, water in well, well destroyed 10/3/16
SV-45	09/19/16	6.0	8.7	33	9.4	43.3	<23	<4.4	20	<5.8	<5.2	#	<11	4.5	auto repair area, well destroyed 10/3/16

Abbreviations:

DCA = 1,2-dichloroethane

PCE = Tetrachloroethene

TCE = Trichloroethene

1,1,1-TCA = 1,1,1-Trichloroethane

VOCs by EPA Method TO-15.

See lab report for trace concentrations of other VOCs

ug/m³ = Micrograms per cubic meter of air.

ft bgs = Feet below ground surface

ESL = Environmental Screening Level for Shallow Soil Gas for Evaluation of Potential Vapor Intrusion (Table E-2). Established by the SFBRWQCB, Interim Final - November 2007; Feb 2016 (Rev. 3)

ND = not detected above laboratory reporting limits.

-- = Not analyzed

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

Bold concentrations exceed residential ESL.

* = Represents an estimated concentration (j-flag value) below the reporting limit, or indicates that there was no detection above the method detection limit.

= other VOCs detected below screening level thresholds. See lab report for details.

contaminant detections highlighted in gray

APPENDIX A

Historical Reports – 1210 Bockman Road

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
ALEX BRISCOE, Agency Director

ENVIRONMENTAL HEALTH SERVICES
ENVIRONMENTAL PROTECTION
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
FAX (510) 337-9335

September 25, 2013

Ms. Katherine Chandler
The Olson Company
3010 Old Ranch Parkway,
Suite 100
Seal Beach, CA 90740
(*Sent via E-mail to:* kchandler@theolsoncompany.com)

Ms. Carol Wallace
Christopher and Carol P. Wallace Trust
509 Ironwood Road
Alameda, CA 94502

Subject: Closure Transmittal; Fuel Leak Case No. RO0002737, (Global ID #T06019771179), Impulse Motors, 1210 Bockman Road, San Lorenzo, CA 94580

Dear Ms. Chandler and Ms. Wallace:

This letter transmits the enclosed underground storage tank (UST) case closure letter in accordance with Chapter 6.75 (Article 4, Section 25299.37[h]). The State Water Resources Control Board adopted this letter on February 20, 1997. As of March 1, 1997, the Alameda County Environmental Health (ACEH) is required to use this case closure letter for all UST leak sites. We are also transmitting to you the enclosed case closure summary. These documents confirm the completion of the investigation and cleanup of the reported release at the subject site. The subject fuel leak case is closed.

SITE INVESTIGATION AND CLEANUP SUMMARY

Please be advised that the following conditions exist at the site:

- Disposal destination of all soil excavated during UST removal not fully reported, "clean" stockpile was redeposited in UST excavation; disposition of "contaminated" stockpile is not reported.

If you have any questions, please call Mark Detterman at (510) 567-6876. Thank you.

Sincerely,

Donna L. Drogos, P.E.
Division Chief

Enclosures: 1. Remedial Action Completion Certificate
2. Case Closure Summary

cc: Ms. Cherie McCaulou (w/enc.), SF- Regional Water Quality Control Board, 1515 Clay Street, Suite 1400, Oakland, CA 94612, (sent via electronic mail to CMacaulou@waterboards.ca.gov)
Dilan Roe, (sent via electronic mail to: dilan.roe@acgov.org)
Donna Drogos, (sent via electronic mail to donna.drogos@acgov.org)
Mark Detterman (sent via electronic mail to mark.detterman@acgov.org)
Electronic File, GeoTracker

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
ALEX BRISCOE, Agency Director

DEPARTMENT OF ENVIRONMENTAL HEALTH
OFFICE OF THE DIRECTOR
1131 HARBOR BAY PARKWAY
ALAMEDA, CA 94502
(510) 567-6777
FAX (510) 337-9135

REMEDIAL ACTION COMPLETION CERTIFICATION

September 25, 2013

Ms. Katherine Chandler
The Olson Company
3010 Old Ranch Parkway,
Suite 100
Seal Beach, CA 90740
(*Sent via E-mail to:* kchandler@theolsoncompany.com)

Ms. Carol Wallace
Christopher and Carol P. Wallace Trust
509 Ironwood Road
Alameda, CA 94502

Subject: Case Closure for Fuel Leak Case Fuel Leak Case No. RO0002737, (Global ID #T06019771179), Impulse Motors, 1210 Bockman Road, San Lorenzo, CA 94580

Dear Ms. Chandler and Ms. Wallace:

This letter confirms the completion of a site investigation and remedial action for the underground storage tanks formerly located at the above-described location. Thank you for your cooperation throughout this investigation. Your willingness and promptness in responding to our inquiries concerning the former underground storage tank(s) are greatly appreciated.

Based on information in the above-referenced file and with the provision that the information provided to this agency was accurate and representative of site conditions, this agency finds that the site investigation and corrective action carried out at your underground storage tank(s) site is in compliance with the requirements of subdivisions (a) and (b) of Section 25299.37 of the Health and Safety Code and with corrective action regulations adopted pursuant to Section 25299.77 of the Health and Safety Code and that no further action related to the petroleum release(s) at the site is required.

Claims for reimbursement of corrective action costs submitted to the Underground Storage Tank Cleanup Fund more than 365 days after the date of this letter or issuance or activation of the Fund's Letter of Commitment, whichever occurs later, will not be reimbursed unless one of the following exceptions applies:

- Claims are submitted pursuant to Section 25299.57, subdivision (k) (reopened UST case); or
- Submission within the timeframe was beyond the claimant's reasonable control, ongoing work is required for closure that will result in the submission of claims beyond that time period, or that under the circumstances of the case, it would be unreasonable or inequitable to impose the 365-day time period.

This notice is issued pursuant to subdivision (h) of Section 25299.37 of the Health and Safety Code. Please contact our office if you have any questions regarding this matter.

Sincerely,

Ariu Levi
Director

CASE CLOSURE SUMMARY
LEAKING UNDERGROUND FUEL STORAGE TANK - LOCAL OVERSIGHT PROGRAM

I. AGENCY INFORMATION

Date: September 25, 2013

Agency Name: Alameda County Environmental Health	Address: 1131 Harbor Bay Parkway
City/State/Zip: Alameda, CA 94502-6577	Phone: (510) 567-6876
Responsible Staff Person: Mark Detterman	Title: Senior Hazardous Materials Specialist

II. CASE INFORMATION

Site Facility Name: Impulse Motors		
Site Facility Address: 1210 Bockman Road, San Lorenzo, CA 94580		
RB Case No.: N/A	STID.: 4769	LOP Case No.: RO0002737
URF Filing Date: 06/11/2004	Geotracker ID: T06019771179	APN: 411-69-2

Responsible Parties	Addresses	Phone Numbers
Carol Wallace Christopher & Carol P Wallace Trust	509 Ironwood Rd Alameda, CA 94502	——
Dale Hines In Town Communities LLC	3130 Crow Canyon Place, Ste 210 San Ramon, CA 94583-4631	(925) 244-9216

Tank I.D. No	Size in Gallons	Contents	Closed In Place/Removed?	Date
----	8,000	Gasoline	Removed	4/14/2004
----	6,000	Gasoline	Removed	4/14/2004
----	6,000	Gasoline	Removed	4/14/2004
Piping			Removed	4/14/2004

III. RELEASE AND SITE CHARACTERIZATION INFORMATION

Cause and Type of Release: Leaking Dispensers	
Site characterization complete? Yes	Date Approved By Oversight Agency: ----

Monitoring wells installed? Yes	Number: 4	Proper screened interval? Yes
Highest GW Depth Below Ground Surface: 7.65	Lowest Depth: 9.14	Flow Direction: Northwest
Most Sensitive Current Use: Potential drinking water source.		

Summary of Production Wells in Vicinity: Sixteen water supply wells are known within a ¼ mile radius of the site. Three wells are classified as domestic water supply wells, and thirteen are classified as irrigation wells. Two domestic wells are over 900 feet cross-gradient from the site. Both do not appear to be receptors for the site due to the direction of groundwater flow and distance. One domestic well is at a distance of 530 feet downgradient, and is 33 feet in depth. It does not appear to be a receptor due to distance from the site, and the lack of significant dissolved-phase contamination in grab groundwater concentrations, and subsequent sampling at a previously unknown offsite irrigation water supply well located approximately 155 downgradient of the site at 17109 Via Chiquita (see below).

Ten of the 13 irrigation wells are in upgradient or cross-gradient positions relative to the site, with the closest at an approximate distance of 425 feet to the southeast (ACPWA Permit No. 88345). This well is 29 feet in depth. Each of these wells do not appear to be a receptor due to the direction of groundwater flow, distance from the site, and the depth of the wells. Three of the 13 irrigation wells can be characterized as cross to downgradient from the site (ACPWA Permit Nos. 77353, 77619 and an un-numbered well permit). The closest well is at a distance of approximately 760 feet. These wells do not appear to be receptors based on distance from the site, and the lack of significant dissolved-phase contamination in grab groundwater, and subsequent sampling at a previously unknown offsite irrigation water supply well located approximately 155 downgradient of the site at 17109 Via Chiquita (see below).

During the Public Participation notification period, ACEH was contacted by a residential well owner not previously known to ACEH or to ACPWA. The well is reported to be primarily used as a residential irrigation well and is located approximately 155 feet downgradient of the release area at the subject site. The well was sampled on September 25, 2012. TPHg and BTEX were not detected at standard limits of reporting; however, TPHd was detected, at a concentration of 68 μg/l. Silica gel cleanup was not preformed on the sample prior to analysis. The concentration of TPHd is less than the San Francisco Regional Water Quality Control Board (RWQCB) Environmental Screening Level (ESL) of 83 parts per billion (ppb) that is considered to be safe under all situations for human health and protection of groundwater. The owner of this well state the well will be utilized for irrigation purposes only and declined to have it decommissioned.

Are drinking water wells affected? No	Aquifer Name: East Bay Plain
Is surface water affected? No	Nearest SW Name: San Francisco Bay (1.75 miles west)
Off-Site Beneficial Use Impacts (Addresses/Locations): None	
Reports on file? Yes	Where are reports filed? Alameda County Environmental Health

TREATMENT AND DISPOSAL OF AFFECTED MATERIAL			
Material	Amount (Include Units)	Action (Treatment or Disposal w/Destination)	Date
Tanks	8,000 gallon 6,000 gallon 6,000 gallon	Disposal/Ecology Control Industries	4/17/2004
Piping	Not Reported	Disposal/Ecology Control Industries	4/17/2004
Free Product	None Reported	----	----
Soil	300 / 500 cubic yards	Disposal / Not Reported	12/2006
Groundwater	Not Reported	----	----

MAXIMUM DOCUMENTED CONTAMINANT CONCENTRATIONS BEFORE AND AFTER CLEANUP
(Please see Attachments 1 – 6 for additional information on contaminant locations and concentrations)

Contaminant	Soil (ppm)		Water (ppb)	
	Before	After	Before	After
TPH (Gas)	5,900	120	2,100	590
TPH (Diesel)	23	23	110,000	66
Oil and Grease	----	----	----	----
Benzene	8.5	<0.5	<0.5	<0.5
Toluene	30	0.021	<0.5	<0.5
Ethylbenzene	37	0.15	<0.5	<0.5
Xylenes	290	0.18	<0.5	<1.0
Heavy Metals (Cd, Cr, Pb, Ni, Zn)	16.5[1]	16.5[1]	Not analyzed	Not analyzed
MTBE	0.003[2]	0.003[2]	9.2[3]	9.2[3]
Other (EPA 8270)	0.017[4]	0.017[4]	21[5]	21[5]

1 Lead only; Cd, Cr, Ni, and Zn not analyzed.

2 0.003 mg/kg MTBE, <0.002 mg/kg EtOH, <0.002 ppm TAME, <0.002 ppm ETBE, <0.002 ppm DIPE, <0.020 ppm TBA, <0.001 ppm EDB, and <0.01 ppm EDC

3 9.2 µg/l MTBE, <1.0 µg/l EtOH, <1.0 µg/l TAME, 5.4 µg/l ETBE, <1.0 µg/l DIPE, <1.0 µg/l TBA, <0.5 µg/l EDB, and <0.5 µg/l EDC

4 0.006 mg/kg n-Butylbenzene, 0.004 mg/kg sec-Butylbenzene, 0.003 mg/kg Isopropylbenzene, 0.017 mg/kg naphthalene, 0.011 mg/kg n-propylbenzene, and 0.011 mg/kg 1,2,4-Trimethylbenzene.

5 1.4 µg/l n-Propylbenzene, 13 µg/l n-Butylbenzene, 10 µg/l sec-Butylbenzene, 6.7 µg/l iso-Propylbenzene, 0.8 µg/l naphthalene, and 21 µg/l n-Propylbenzene.

Site History and Description of Corrective Actions:

The Site is located on the southwest corner of Bockman Road and Via Chiquita Road within a residential area of the City of San Lorenzo. The Site was developed with a gasoline fuel station from the 1950s until 2004. In April 2004, one 8,000 gallon and two 6,000 gallon double-wall steel gasoline fuel tanks were removed from the Site. Upon removal the three USTs were observed to be in good condition and no field indications of hydrocarbon release were observed. Analytical results of soil samples collected from the UST excavation detected 0.018 mg/kg TBA in one of the three samples. Discolored soil with odors was noted beneath the dispenser islands. Soil samples collected from beneath the fuel dispensers and piping run detected concentrations of TPHg ranging from 690 to 5,900 mg/kg, and up to 3.3 mg/kg benzene, 30 mg/kg toluene, 33 mg/kg ethylbenzene, and 180 mg/kg total xylenes.

In November 2004 a pre-purchase Phase 1 Environmental Site Assessment (ESA) was performed for the subject site. The Phase 1 ESA also covered the land parcel north across Bockman Road; however, that parcel was verbally reported not to have been purchased by the Olsen Company for redevelopment. The ESA found evidence of at least one hydraulic lift at the former Impulse Motors site, as well as a sump. The ESA found evidence of previous agricultural use of the land and recommended evaluation of these potential contaminants at the site.

In December 2004 eight soil bores were installed at the site, using Geoprobe, hand augering, and hydropunch technologies. The bores were installed in followup to the ESA recommendations. SP-1 to SP-3 were installed to investigate for potential pesticides in shallow soil; none were detected. SB-2 & SB-7 were installed to evaluate two former hydraulic hoists and the sump previously documented. Hydrocarbons of all C-range groups were not detected between 2 and 8 feet bgs. SB-4 and SB-5 were installed in proximity to the former dispenser island, subsequently overexcavated, detected concentrations up to 4.0 mg/kg TPHg and 0.003 mg/kg benzene at a depth of five feet bgs. Groundwater was evaluated with grab groundwater samples collected from HP-1 to HP-3. Only a concentration of 1.0 µg/l total xylenes was detected at HP-1 in proximity to the former USTs and downgradient of the hydraulic hoists. Groundwater collected from bores HP-1 to HP-3 also was submitted for a full VOC analysis scan to evaluate for the possibility of an unreported dry cleaner to have present at the former strip mall west of the former Impulse Motors site. No chlorinated solvent compounds were detected.

In December 2006 the overexcavation of the area of the former fuel dispensers was performed. Approximately 500 cubic yards of soil was removed from two excavation areas and stockpiled on-site. Verification soil samples were collected from the bottom and sidewalls of each excavation and analytical results up to 120 mg/kg TPHg, 19 mg/kg TPHd, 0.15 mg/kg ethylbenzene, 0.4 mg/kg MTBE, and 0.028 TBA were detected. Benzene, toluene, total xylenes, all other fuel oxygenates, and lead scavengers were non-detectable at standards limits of detection. Lead concentrations ranged up to 16.5 mg/kg. The clean soil stockpile was used as backfill.

In April 2007 seven soil bores were installed, and soil, soil vapor, and groundwater samples were collected from down-gradient of the former fuel dispensers and in the vicinity of the former USTs. In soil up to 0.68 mg/kg TPHg was detected; TPHd, TPHmo, BTEX, all fuel oxygenates, and lead scavengers were non-detectable at standard limits of detection. Lead was detected up to 6.98 mg/kg in soil. In soil vapor, up to 52,000 µg/m^3 TPHg was detected; BTEX and fuel oxygenates were non-detectable at standard limits of detection. Grab groundwater samples detected up to 2,100 µg/l TPHg, 110,000 µg/l TPHd, 9.2 µg/l MTBE and 5.4 µg/l ETBE; BTEX was non-detectable at standard limits of detection.

Three undocumented PVC wells were decommissioned under permit in April 2007. The wells were reported to range in depth between 8 and 18 feet.

In November 2007, four groundwater monitoring wells (MW-1 to MW-4) were installed down-gradient from the former fuel dispensers. Well MW-4 was installed, developed, sampled, and decommissioned due to conflicts with site development activities. Soil samples detected up to 6.1 mg/kg TPHg, <10 mg/kg TPHd, 0.021 toluene, 0.041 ethylbenzene, and 0.18 total xylenes; benzene, all fuel oxygenates, and lead scavengers were non-detectable at standard limits of detection. Concentrations of acetone, n-butylbenzene, sec-butylbenzene, 1,3,5, trimethylbenzene, 1,2,4 trimethylbenzene, and isopropylbenzene (0.40, 0.002, 0.003, 0.001, 0.002, and 0.001 mg/kg, respectively) were also detected. Several additional VOCs were also present at similar trace concentrations. In groundwater up to 0.71 µg/l TPHg was detected; TPHd, BTEX, all fuel oxygenates, and lead scavengers were not detected at standard limits of detection. Naphthalene was present up to 0.8 µg/l in one of the samples.

Quarterly groundwater monitoring was conducted in 2008. Depth to water ranged between 7.65 and 9.14 feet bgs during this period, and generally flows northwest. Concentrations up to 590 µg/l TPHg and 230 µg/l TPHd were detected (MW-2) during this period; BTEX, all fuel oxygenates, and lead scavengers were not detected at standard limits of detection. Concentrations up to 1.1 µg/l n-Butylbenzene, 1.2 µg/l sec-Butylbenzene, and 1.0 µg/l isoproylbenzene were also detected.

In December 2010 soil bores SB-1 and SB-2 were installed offsite and downgradient of the former dispenser locations to evaluate offsite migration of the contaminant plume. In soil concentrations up to 10 mg/kg TPHd were detected; TPHg, TPHmo, BTEX, all fuel oxygenates and lead scavengers, and other VOCs were non-detectable at standards limits of detection. In groundwater concentrations up to 110 µg/l TPHd were detected; TPHg, BTEX, all fuel oxygenates and lead scavengers and other VOCs were non-detectable at standard limits of detection.

IV. CLOSURE

Does completed corrective action protect existing beneficial uses per the Regional Board Basin Plan? Yes		
Does completed corrective action protect potential beneficial uses per the Regional Board Basin Plan? Yes		
Does corrective action protect public health for current land use? Alameda County Environmental Health staff does not make specific determinations concerning public health risk. However, based upon the information available in our files to date, it does not appear that the release would present a risk to human health based upon current land use and conditions.		
Site Management Requirements: This fuel leak case has been evaluated for closure consistent with the State Water Resources Control Board Low-Threat Underground Storage Tank Closure Policy (LTCP). Based on this evaluation, no site management requirements appear to be necessary. However, excavation or construction activities in areas of residual contamination require planning and implementation of appropriate health and safety procedures by the responsible party prior to and during excavation and construction activities.		
Should corrective action be reviewed if land use changes? No		
Was a deed restriction or deed notification filed? No		Date Recorded: --
Monitoring Wells Decommissioned: No	Number Decommissioned: 4	Number Retained: 3
List Enforcement Actions Taken: None		
List Enforcement Actions Rescinded: --		

V. ADDITIONAL COMMENTS, DATA, ETC.

Considerations and/or Variances:

The site meets the general criteria for case closure under the LTCP.

The site does not appear to meet scenarios 1, 2, 3, or 4 of the groundwater media-specific criteria for closure under the LTCP because the closest groundwater supply well is at an approximate distance of 155 feet downgradient of the site.

However, ACEH believes case closure is appropriate based on an analysis of site-specific conditions:

1. The plume is stable or decreasing in size.
2. The plume is less than 250 feet in length.
3. There is no free product.
4. The dissolved concentration of benzene is less than 1,000 ppb.
5. The dissolved concentration of MTBE is less than 1,000 ppb.
6. Based on the age of the plume, site hydrogeology, and apparent stability of the plume, the potential for the plume to pose a threat to the residential use of groundwater for irrigation purposes appears to be low.

The site appears to meet scenario 3 of the numerical media-specific criteria in the LTCP for petroleum vapor intrusion to indoor air (with a bioattenuation zone) for the following reasons:

1. No oxygen data is available, so the site is not considered to have a bioattenuation zone under the LTCP.
2. TPH appears to be less than 100 ppm within the upper five feet of soil.
3. The concentration of benzene detected in soil vapor is less than 100 micrograms per cubic meter ($\mu g/m^3$) which is less than the commercial LTCP soil gas criteria of 280 $\mu g/m^3$ (without a bioattenuation zone), but above the residential LTCP soil gas criteria of 85 $\mu g/m^3$.
4. The concentration of ethylbenzene in soil vapor is less than 8.8 micrograms per cubic meter ($\mu g/m^3$), which is significantly less than the residential and commercial LTCP soil gas criteria of <1,100 $\mu g/m^3$ and 3,600 $\mu g/m^3$ (without a bioattenuation zone).
5. Naphthalene was not an analyte in soil vapor samples. However, since the release at the site consisted primarily of gasoline and benzene and ethylbenzene were not detected at concentrations above commercial ESLs in soil vapor, naphthalene concentrations in soil vapor are not likely to exceed the media-specific criteria in the LTCP.
6. The maximum concentration of benzene in groundwater during the most recent groundwater monitoring event was <0.5 ppb.

The site appears to meet the media-specific criteria for direct contact and outdoor air exposure under the LTCP. The maximum concentrations of benzene and ethylbenzene detected in soil samples collected to date within the upper 10 feet are less than the media-specific criteria in Table 1 of the LTCP for direct contact and outdoor air exposure. Since the release at the site consisted primarily of gasoline, naphthalene concentrations are not likely to exceed the media-specific criteria in Table 1 of the LTCP.

- Disposal destination of all soil excavated during UST removal not fully reported, stockpile identified as clean was redeposited in UST excavation; disposition of contaminated stockpile was not reported.

Conclusion:

Alameda County Environmental Health staff believe that the site meets the conditions for case closure under the State Water Resources Control Board Low-Threat Underground Storage Tank Closure Policy. Based upon the information available in our files to date, no further investigation or cleanup for the fuel leak case is necessary at this time.

VI. LOCAL AGENCY REPRESENTATIVE DATA

Prepared by: Mark Detterman	Title: Senior Hazardous Materials Specialist
Signature:	Date: 9/25/2013
Approved by: Donna L. Drogos, P.E.	Title: Division Chief
Signature:	Date: 09/25/13

This closure approval is based upon the available information and with the provision that the information provided to this agency was accurate and representative of site conditions.

VII. REGIONAL BOARD NOTIFICATION

Regional Board Staff Name: Cherie McCaulou	Title: Engineering Geologist
Notification Date: October 17, 2011	

VIII. MONITORING WELL DECOMMISSIONING

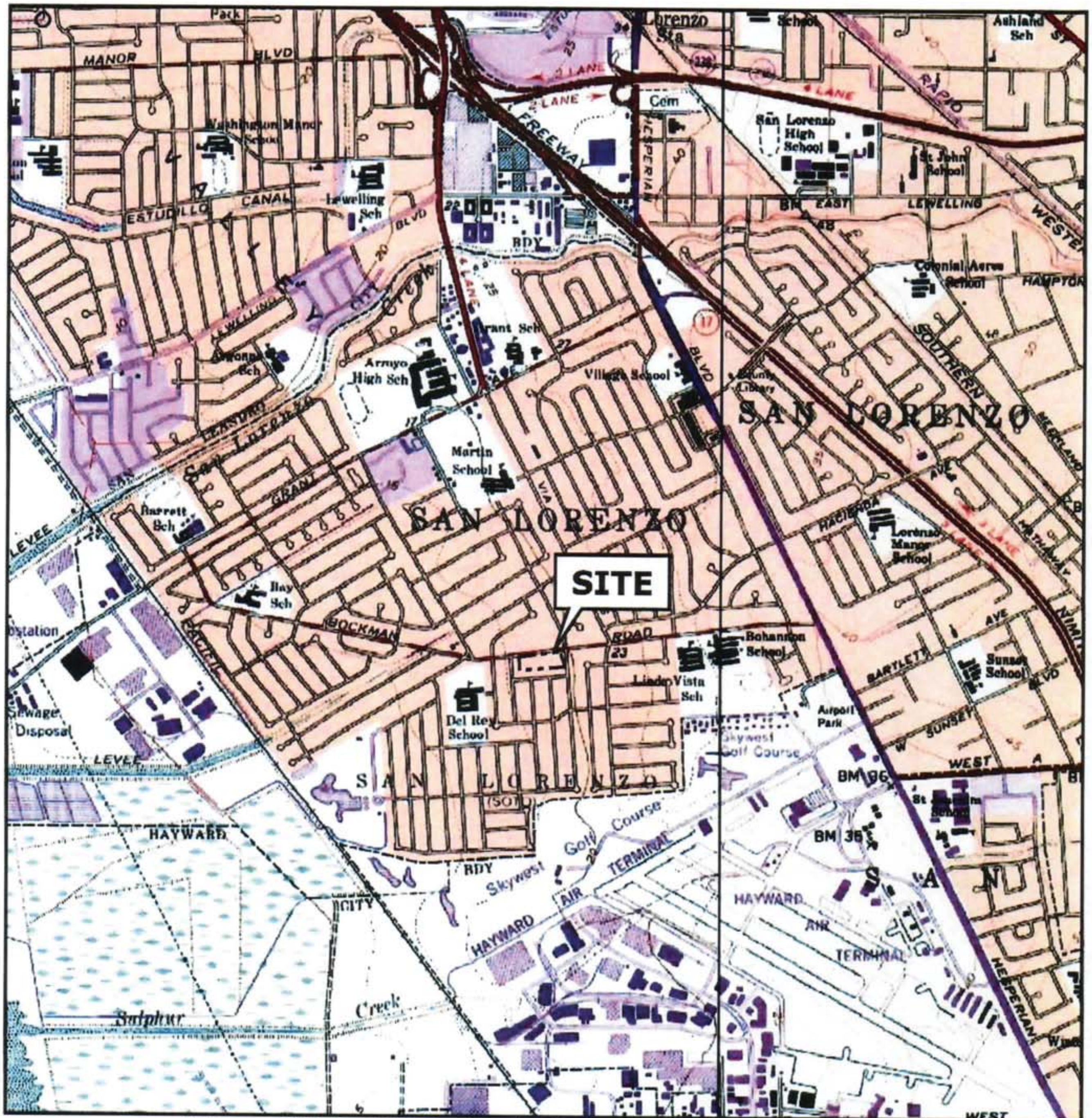
Date Requested by ACEH: December 17, 2012	Date of Well Decommissioning Report: June 3, 2013	
All Monitoring Wells Decommissioned: Yes	Number Decommissioned: 3	Number Retained: 0
Reason Wells Retained: Not Applicable		
Additional requirements for submittal of groundwater data from retained wells: Not Applicable		
ACEH Concurrence - Signature:		Date: 9/25/2013

Attachments:

1. Site Vicinity Map (4 pp)
2. Site Plans (6 pp)
3. Soil Analytical Data (29 pp)
4. Groundwater Analytical Data (11 pp)
5. Soil Vapor Analytical Data (2 pp)
6. Boring Logs (21 pp)

This document and the related CASE CLOSURE LETTER & REMEDIAL ACTION COMPLETION CERTIFICATE shall be retained by the lead agency as part of the official site file.

ATTACHMENT 1



Reference: U.S.G.S., 1959, San Leandro Quadrangle California – Alameda County, 7.5' Series (Topographic). Photorevised 1980.

N

0 2000 4000

APPROXIMATE SCALE (FEET)

QUADRANGLE LOCATION

SECOR 25864-F BUSINESS CENTER DRIVE REDLANDS, CALIFORNIA 92374 PH: (909) 335-6116 / FAX: (909) 335-6120	PREPARED FOR: THE OLSON COMPANY 1210-1366 BOCKMAN ROAD SAN LORENZO, CALIFORNIA		SITE LOCATION MAP	FIGURE: 1
	JOB NUMBER: 04OT.29215.62	DRAWN BY: JMH	CHECKED BY: JH / APPROVED BY: JH	DATE: 12/2004

File Path – Q:\CADD-04\CAD Files\Olson-Co\San Lorenzo\OLS-2921561-PH1_south.dwg – Layout: Figure 1

Impulse Motors
1210 Bockman Road, San Lorenzo, CA 94580

LEGEND:

- APPROXIMATE WELL LOCATION (DOMESTIC OR IRRIGATION ONLY)

0 400 800

APPROXIMATE SCALE (FEET)

Stantec
25864-F BUSINESS CENTER DRIVE
REDLANDS, CALIFORNIA
PH (909) 335-6116 FAX (909) 335-6120

FOR:
THE OLSON COMPANY
FORMER SERVICE STATION
1210 BOCKMAN ROAD
SAN LORENZO, CALIFORNIA

RADIUS MAP WITH WELL LOCATIONS

FIGURE: **1**

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
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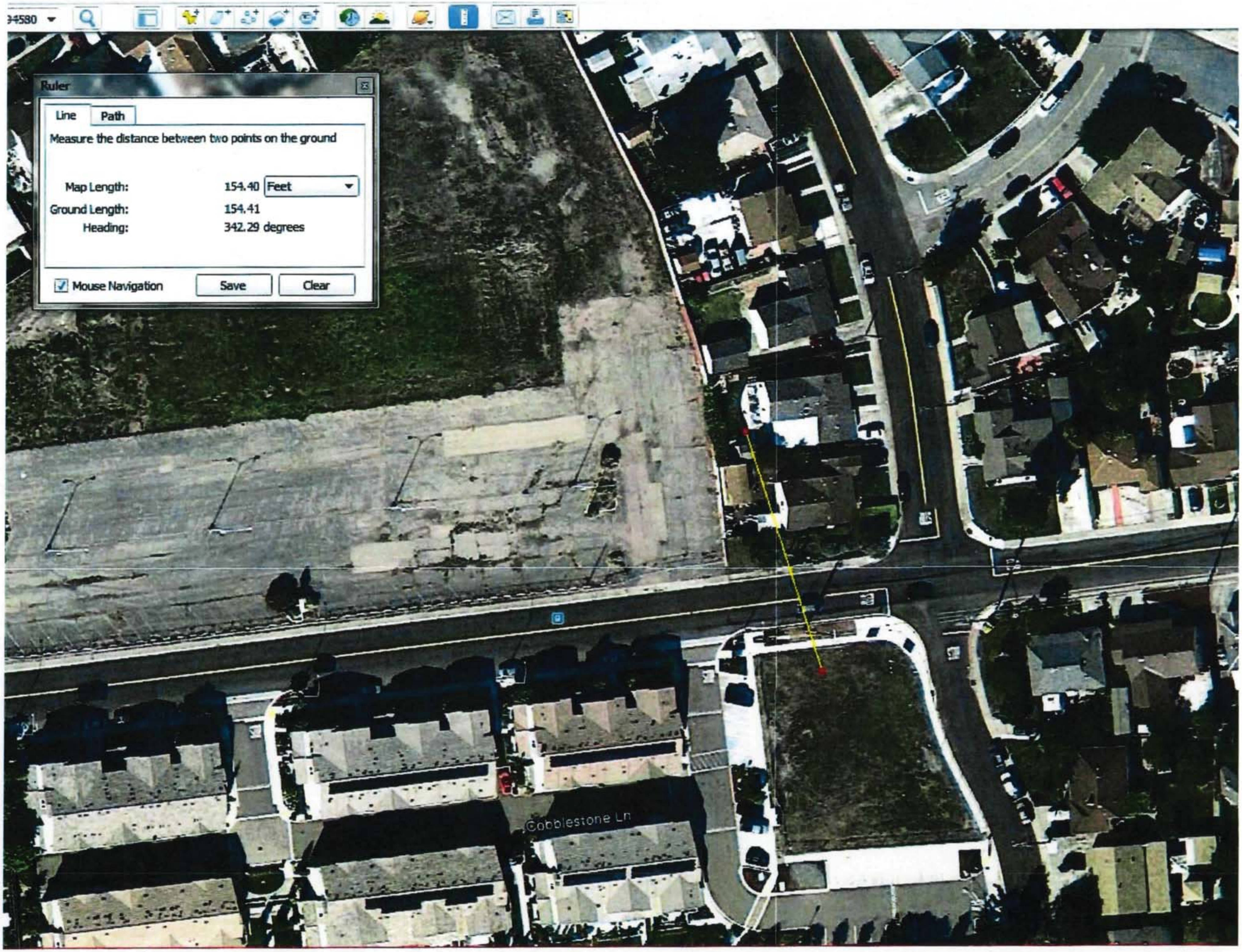

94580
Ruler
Line
Path
Measure the distance between two points on the ground
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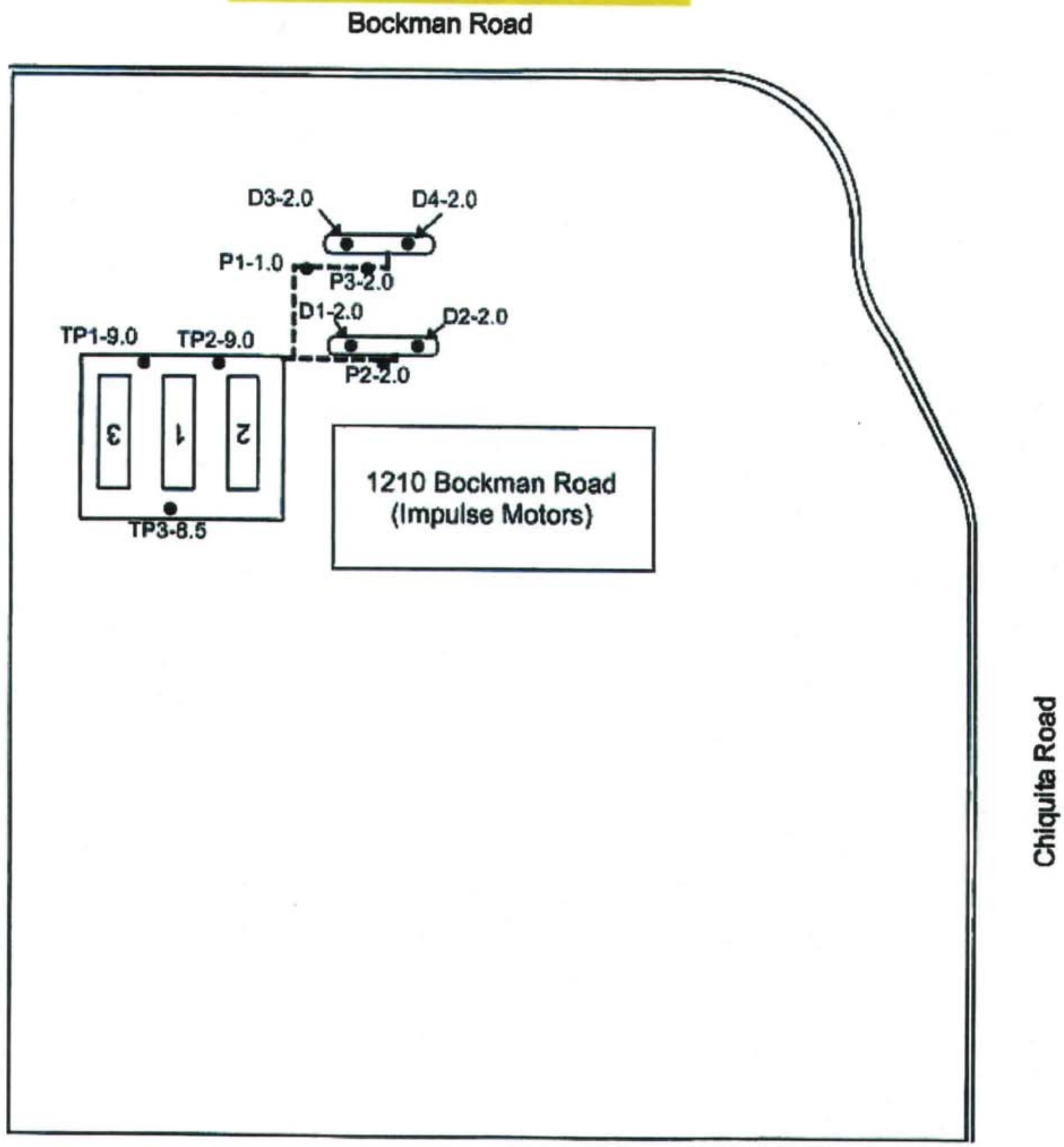
Ground Length: 154.41
Heading: 342.29 degrees
Mouse Navigation
Save
Clear
Cobblestone Ln

ATTACHMENT 2

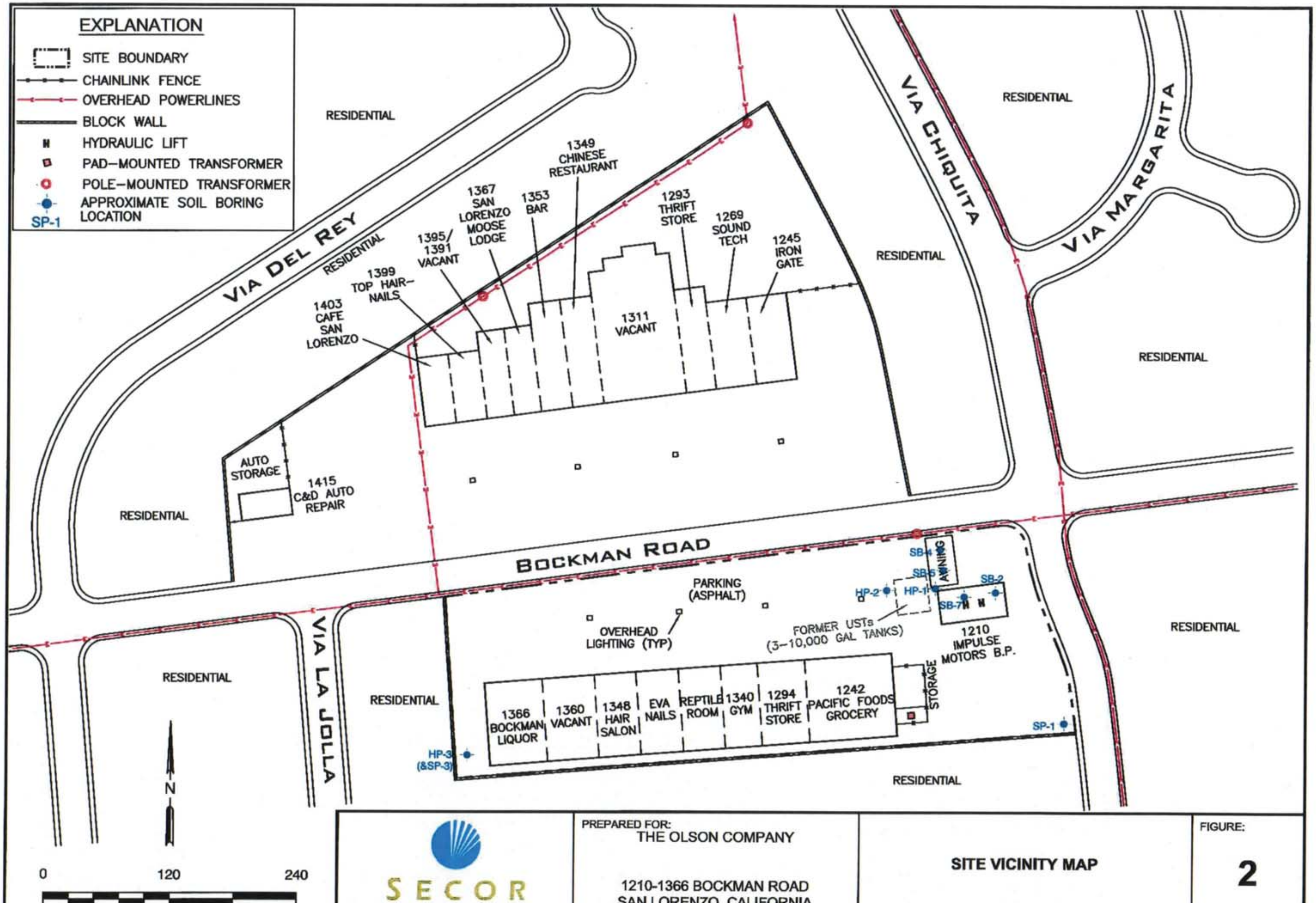


Legend

P1-1.0 ● - Soil Sample Locations

▬ - Piping Locations

Title: ***Site Plan 1210 Bockman Road Hayward, California***	
Figure Number: 2	Scale: 1" = 30'
Project No: 6546-006.00	Drawn By:EJG
A·C·C ENVIRONMENTAL CONSULTANTS 7977 Capwell Drive, Suite 100 Oakland, California 94621 (510) 638-8400 Fax: (510) 638-8404	Date:06/11/04 N W E S

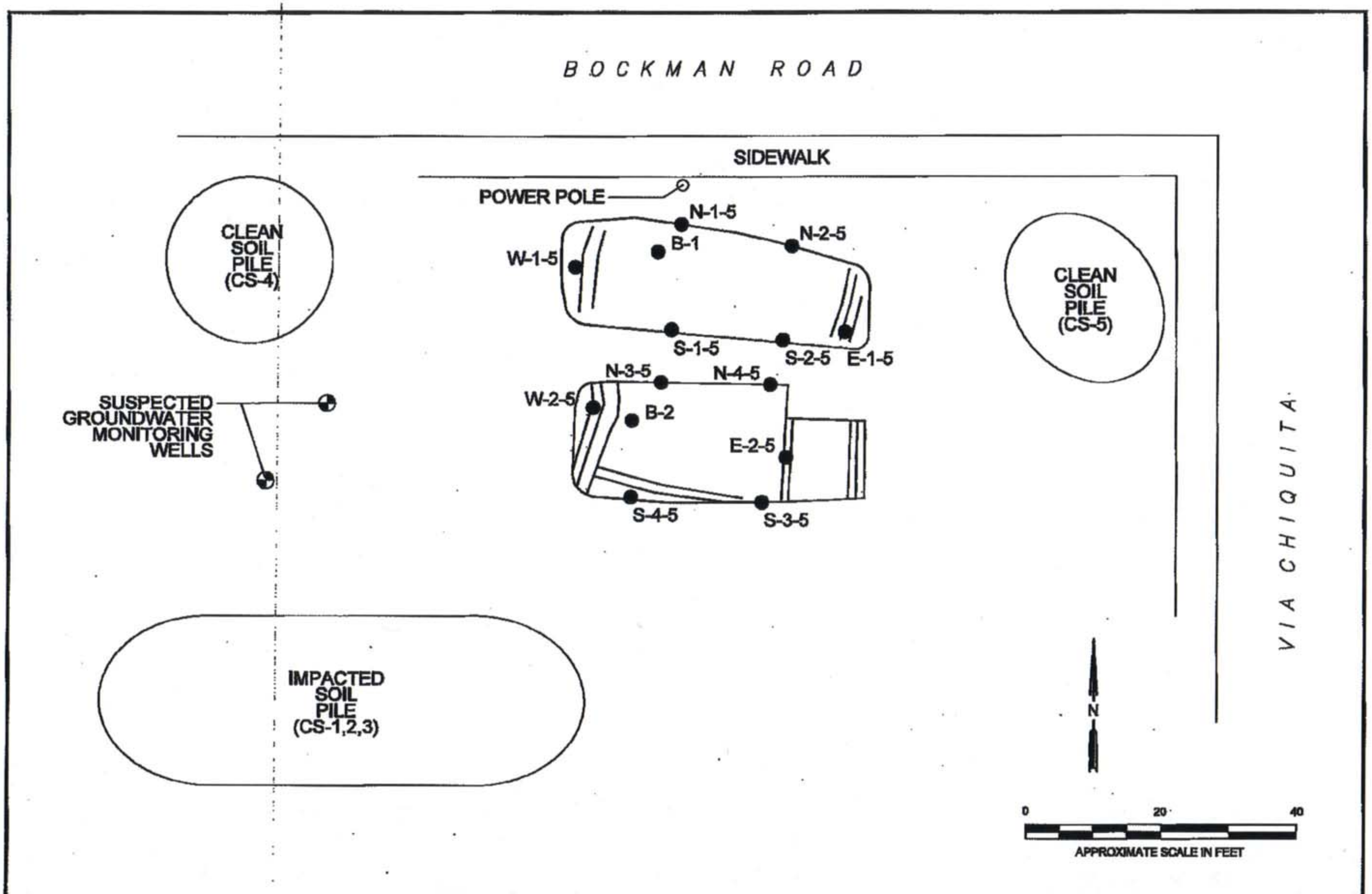


APPROXIMATE SCALE (FEET)

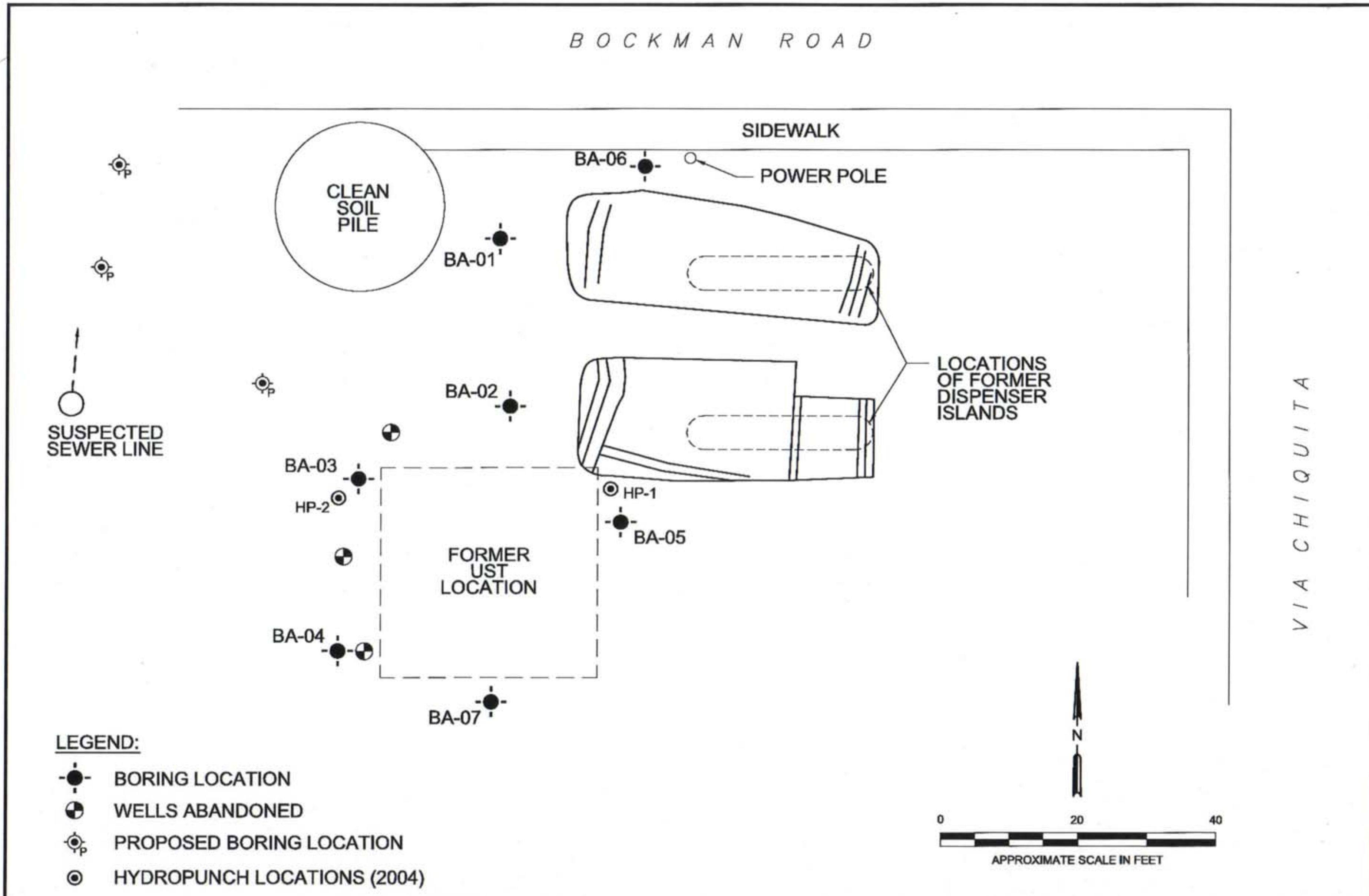
SECOR
25864-F BUSINESS CENTER DRIVE
REDLANDS, CALIFORNIA 92374
PH: (909) 335-6116 / FAX: (909) 335-6120

PREPARED FOR: THE OLSON COMPANY 1210-1366 BOCKMAN ROAD SAN LORENZO, CALIFORNIA		SITE VICINITY MAP		FIGURE: 2
JOB NUMBER: 04OT.29215.62	DRAWN BY: JMH	CHECKED BY: JH	APPROVED BY: JH	DATE: 12/2004

File Path – Q:\CADD-04\CAD Files\Olson-Co\San Lorenzo\OLS-2921561-PH1_south.dwg – Layout: Figure 2



SECOR 25864-F BUSINESS CENTER DRIVE REDLANDS, CA 92374 PHONE (909) 335-6116 FAX:(909) 335-6120	FOR: OLSON - SAN LORENZO 1210-1366 BOCKMAN ROAD SAN LORENZO, CA		SITE PLAN SHOWING SAMPLE LOCATIONS		FIGURE: 2
	JOB NUMBER: 04OT.29215.54	DRAWN BY: GH	CHECKED BY: JA	APPROVED BY:	DATE: 12/21/06



SECOR 25864-F BUSINESS CENTER DRIVE REDLANDS, CA 92374 PHONE: (909) 335-6116 FAX: (909) 335-6120	FOR: OLSON - SAN LORENZO 1210-1366 BOCKMAN ROAD SAN LORENZO, CA		SITE PLAN WITH BORING LOCATIONS		FIGURE: 2
	JOB NUMBER: 04OT.29215.54	DRAWN BY: GH	CHECKED BY: JA	APPROVED BY:	DATE: 5/3/07

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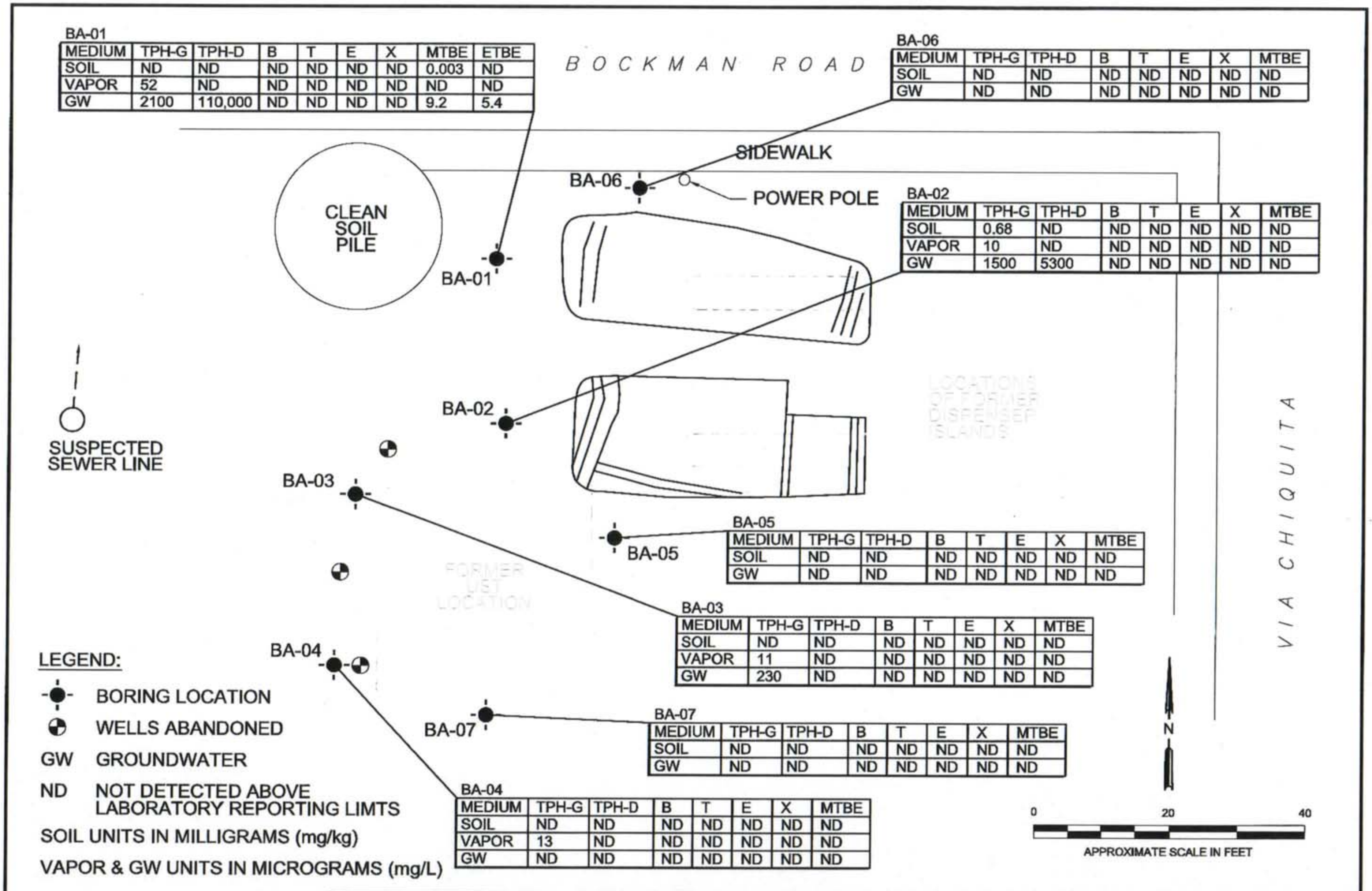


BA-01

MEDIUM	TPH-G	TPH-D	B	T	E	X	MTBE	ETBE
SOIL	ND	ND	ND	ND	ND	ND	0.003	ND
VAPOR	52	ND	ND	ND	ND	ND	ND	ND
GW	2100	110,000	ND	ND	ND	ND	9.2	5.4

BA-06

MEDIUM	TPH-G	TPH-D	B	T	E	X	MTBE
SOIL	ND	ND	ND	ND	ND	ND	ND
GW	ND	ND	ND	ND	ND	ND	ND

BA-02

MEDIUM	TPH-G	TPH-D	B	T	E	X	MTBE
SOIL	0.68	ND	ND	ND	ND	ND	ND
VAPOR	10	ND	ND	ND	ND	ND	ND
GW	1500	5300	ND	ND	ND	ND	ND

BA-05

MEDIUM	TPH-G	TPH-D	B	T	E	X	MTBE
SOIL	ND	ND	ND	ND	ND	ND	ND
GW	ND	ND	ND	ND	ND	ND	ND

BA-03

MEDIUM	TPH-G	TPH-D	B	T	E	X	MTBE
SOIL	ND	ND	ND	ND	ND	ND	ND
VAPOR	11	ND	ND	ND	ND	ND	ND
GW	230	ND	ND	ND	ND	ND	ND

BA-07

MEDIUM	TPH-G	TPH-D	B	T	E	X	MTBE
SOIL	ND	ND	ND	ND	ND	ND	ND
GW	ND	ND	ND	ND	ND	ND	ND

BA-04

MEDIUM	TPH-G	TPH-D	B	T	E	X	MTBE
SOIL	ND	ND	ND	ND	ND	ND	ND
VAPOR	13	ND	ND	ND	ND	ND	ND
GW	ND	ND	ND	ND	ND	ND	ND

LEGEND:

- BORING LOCATION
- WELLS ABANDONED
- GW GROUNDWATER
- ND NOT DETECTED ABOVE LABORATORY REPORTING LIMTS

SOIL UNITS IN MILLIGRAMS (mg/kg)

VAPOR & GW UNITS IN MICROGRAMS (mg/L)

SECOR
25864-F BUSINESS CENTER DRIVE
REDLANDS, CA 92374
PHONE: (909) 335-6116 FAX: (909) 335-6120

FOR:

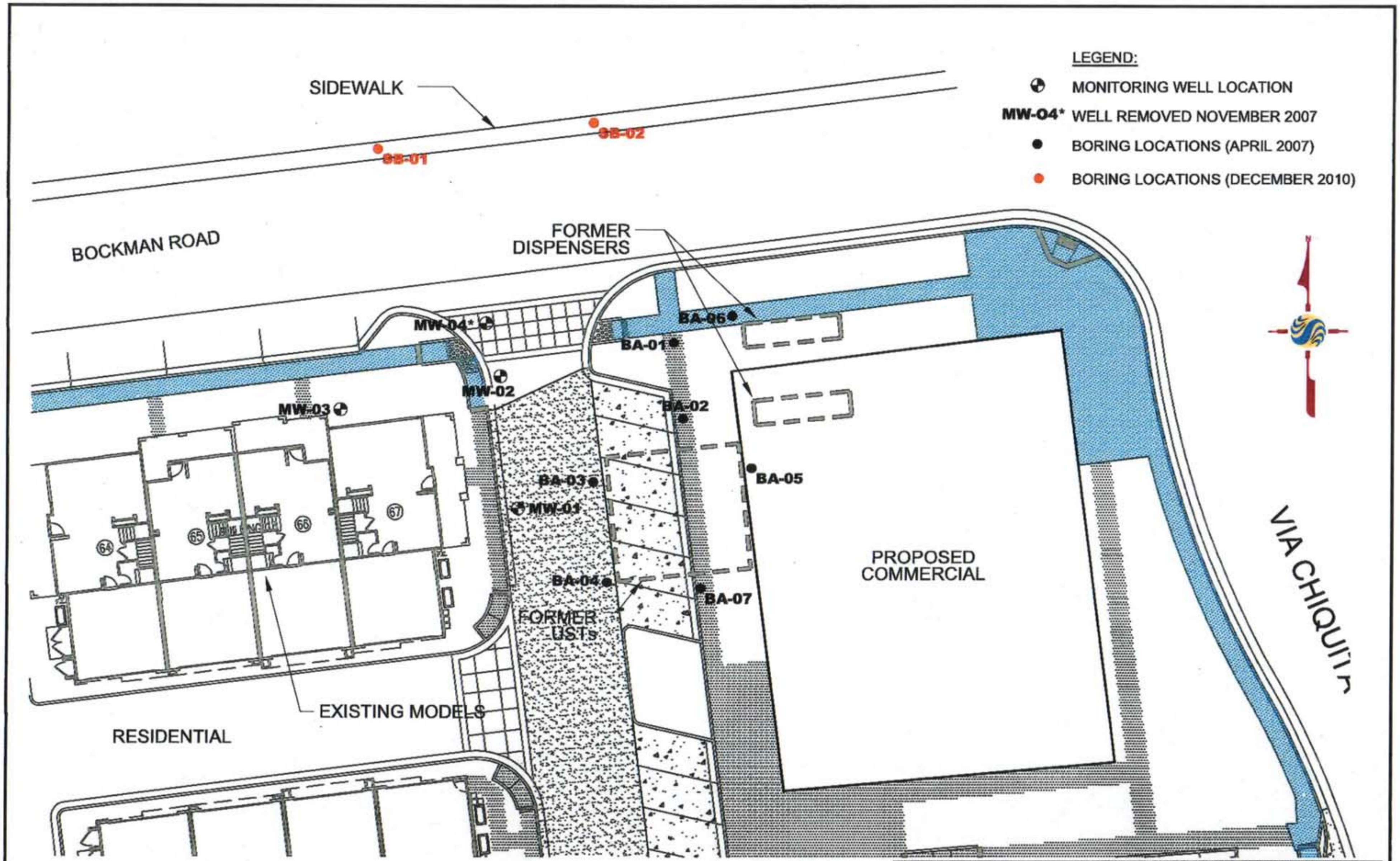
OLSON - SAN LORENZO
1210-1366 BOCKMAN ROAD
SAN LORENZO, CA

SITE PLAN WITH ANALYTICAL DATA

FIGURE: 3

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
04OT.29215.54	GH	JA		5/3/07

FILEPATH:Q:\CADD-61\004 Redlands\OLSON CO\04OT.29215.54\29215 BORING LOCALS.dwg|ghinkle|May 17, 2007 at 9:51|Layout: ANALYTICAL DATA



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0 30 60

APPROXIMATE SCALE IN FEET

Stantec

25864-F BUISNESS CENTER DRIVE
REDLANDS, CALIFORNIA 92374
PHONE: (909) 335-6116 FAX: (909) 335-6120

FOR:
THE OLSON COMPANY
VILLAGE WALK
1210 BOCKMAN ROAD
SAN LORENZO, CALIFORNIA

SITE PLAN WITH
BORING LOCATIONS

FIGURE: 2

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
185802329	JBL	KD	KE	12/21/10

APPENDIX B

Screening-Level Human Health Risk Assessment

SCREENING-LEVEL HUMAN HEALTH RISK ASSESSMENT

1233 BOCKMAN ROAD

SAN LEANDRO, CALIFORNIA

Prepared for:

Pangea Environmental Services, Inc.
1710 Franklin Street, Suite 200
Oakland, California 94612

Prepared by:

GSI Environmental Inc.
155 Grand Avenue, Suite 704
Oakland, CA 94556

GSI Job No. 4480
Issued: 6 September 2016

GSI Job No. 4480
Issued: 06 September 2016

SCREENING LEVEL HUMAN HEALTH RISK ASSESSMENT
1233 Brockman Road, San Leandro, California

TABLE OF CONTENTS

Tables

Appendices

SCREENING LEVEL HUMAN HEALTH RISK ASSESSMENT

1.0 INTRODUCTION

GSI Environmental Inc. (GSI) has prepared this Screening-Level Human Health Risk Assessment (HHRA) for the property located at 1233 Bockman Road in San Lorenzo, California on behalf of Pangea Environmental Services, Inc. (Pangea) and Pangea's client PaulsCorp. GSI relied solely on analytical data provided by Pangea, and did not independently verify the data or assess the data's representativeness.The Site is currently vacant; planned development of the property includes construction of 53 two–story residential units.

The screening-level HHRA involved selection and development of risk-based screening levels (RBSLs) that are protective of human health assuming residential land use. These RBSLs are compared to concentrations of volatile organic compounds (VOCs) detected in soil vapor, soil, and groundwater at the Site. The RBSLs were identified and developed using procedures consistent with United States Environmental Protection Agency (U.S. EPA), California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC) and San Francisco Regional Water Quality Control Board (SF RWQCB) risk assessment guidance. The RBSLs selected for this HHRA are concentrations in soil, soil vapor, or groundwater corresponding to a cancer risk level of one in a million (1×10^{-6}), the level at the more conservative end of the target risk range of one in a million (1×10^{-6}) to 100 in a million (1×10^{-4}) considered by the U.S. EPA and the Cal/EPA to be protective of human health. A target hazard quotient of one is used as the basis for the non-cancer screening levels.

RBSLs may be "generic" screening levels developed and recommended by various regulatory agencies or Site-specific screening levels which consider site-specific conditions. In general, generic screening levels are more stringent (more likely to significantly overstate actual risk) than site-specific screening levels due to the conservative nature of the assumptions used. According to U.S. EPA (2016), when chemical concentrations are below generic screening levels, no further action or study is typically warranted. U.S. EPA (2016) further emphasizes that generic screening levels are not cleanup standards; additional investigation or action is not necessarily warranted if concentrations exceed these screening levels. However, additional evaluation is typically warranted to determine if concentrations exceeding generic screening levels pose a significant health risk. Additional evaluation may include development of site-specific screening levels.

For this screening-level HHRA, GSI selected generic screening levels recommended by U.S.EPA, DTSC, and the SF RWQCB, and developed preliminary Site-specific screening levels. Concentrations of VOCs detected in soil vapor, soil and groundwater at the Site were compared to generic screening levels to identify chemicals of concern (COCs) requiring further evaluation. For purposes of this screening level HHRA, VOCs were identified as COCs when the maximum concentration of the chemical exceeded an applicable generic screening level. COC concentrations were also compared to preliminary Site-specific screening levels to inform remedial activities planned for the Site.

The HHRA will be updated, as appropriate, to reflect Site-specific conditions, using analytical and soil physical parameter data collected from the Site as per GSI's recommendation. A Site-specific HHRA will also be conducted following remedial activities (RA) to confirm RA completion and to support risk management strategies for the 1233 Bockman Road Property.

2.0 SELECTION AND DEVELOPMENT OF RISK-BASED SCREENING LEVELS

Risk-based screening levels selected and developed for use in this screening-level HHRA to evaluate VOCs in soil vapor, groundwater, and soil are described below:

2.1 Soil Vapor Screening Levels

Table 1 presents risk-based soil vapor screening levels for protection of human health from exposure to vapors migrating from soil vapor to indoor air of a residential building. As shown on Table 1, GSI selected generic soil vapor screening levels from the SF RWQCB and DTSC and developed preliminary Site-specific soil vapor screening levels using Site-specific information provided by Pangea. The sources of generic screening levels and methods used by GSI to develop Site-specific soil vapor screening levels are described below:

2.1.1 Generic Soil Vapor Screening Levels

Agency-recommended generic soil vapor screening levels selected for this screening-level HHRA include Environmental Screening Levels (ESLs) developed by the SF RWQCB (2016) and DTSC-recommended screening levels (DTSC-SLs) (DTSC 2016). The soil vapor ESLs are shown on Table 1.

The DTSC-SLs for soil vapor were calculated by GSI using procedures recommended in DTSC *HHRA Note 3* (DTSC 2016) and DTSC (2011) vapor intrusion guidance. Specifically, GSI derived DTSC default soil vapor screening levels using indoor air screening levels recommended by DTSC in HHRA Note 3 (DTSC 2016) and default attenuation factors recommended in DTSC Vapor Intrusion Guidance (2011), as follows:

$$\text{Soil Vapor Screening Level } (\mu\text{g/m}^3) = \frac{SL_{air}}{AF}$$

Where:

SL_{air} = DTSC screening level (SL) for chemical in air (µg/m^3)

AF = Attenuation Factor (unitless)

For purposes of this screening-level HHRA, DTSC soil vapor SLs are calculated using attenuation factors recommended by DTSC for both an existing (0.002) and future (0.001) residential building. However, it should be noted that the 1233 Brockman property is vacant; residential buildings do not currently exist on the property. Therefore, for this property where development of residential building is planned for the future, DTSC-SLs developed using the DTSC default attenuation factor for future residential (0.001) buildings are more applicable than DTSC-SLs for existing residential buildings.

2.1.2 Site-specific Soil Vapor Screening Levels

The Site-specific soil type was identified by Pangea based on boring logs which indicate that the soil type (silty clay loam) at the property is significantly less permeable than the soil type (sand) assumed in the development of the DTSC default attenuation factors. Vapor migration in the vadose zone is impeded by several factors, including high soil moisture and low-permeability (generally, silty clay) soil. Thus, GSI developed preliminary Site-specific soil vapor screening levels using DTSC-recommended residential air screening levels (DTSC 2016) and Site-specific attenuation factors calculated using the DTSC Soil Gas Vapor Intrusion Screening Model (DTSC 2014). The DTSC Soil Gas Vapor Intrusion Screening Model worksheet, showing input parameters used by GSI, is provided in Attachment A. Soil vapor samples were collected by

Pangea at a depth of six feet below ground surface (bgs). However, based on information provided by Pangea, the sampling depth below grade assumed for the model is four feet (or 121.9 centimeters) bgs because the top two feet of soil at the Site will be removed during development of the residential units. As shown in Attachment A, silty clay loam (designated by "SICL") was selected as the soil type for the 1233 Brockman Property based on information provided by Pangea. The DTSC default soil parameters (bulk density, total porosity, water-filled porosity) defined by the model for silty clay loam were used to calculate the attenuation factors. The Site-specific attenuation factors and resultant Site-specific soil vapor screening levels are presented in Table 1.

As noted previously, soil physical parameter data (bulk density, total porosity, water-filled porosity) will be collected at the Site to support future Site-specific updates to this HHRA.

2.2 Sub-slab Soil Vapor Screening Levels

The 1233 Bockman property is a vacant lot and buildings do not currently exist at the Site. However, to support future planning efforts, GSI developed sub-slab soil vapor screening levels using indoor air screening levels recommended by DTSC (2016) and the DTSC default attenuation factor for sub-slab soil vapor (0.05). Sub-slab soil vapor screening levels used in this screening level HHRA are presented in Table 2.

It should be noted that recent draft interim guidance from the SF RWQCB (2014) does not recommend use of the DTSC sub-slab attenuation factor (0.05) because significant concerns have been identified with the U.S. EPA database used to develop this value given the extreme temporal and spatial variability of sub slab soil vapor data. Instead, the current version of the sub-slab ESLs use an attenuation factor of 0.001 (SF RWQCB 2016). Further, SF RWQCB (2014) indicates that "reliance on sub-slab soil vapor data alone is not acceptable because bi-directional flow across the slab is possible such that in some situations sub-slab vapors may originate from indoor air rather than the subsurface." Thus, when VOCs in sub-slab samples exceed screening levels, additional study is typically warranted.

2.3 Soil Screening Levels

The proposed risk-based and groundwater protection screening-levels for the VOCs detected in Site soils are presented in Table 3.

Soil screening levels selected for comparison to VOC concentrations reported in soil samples include SF RWQCB residential and construction worker ESLs for direct contact with soil. Residential soil RSLs (U.S. EPA 2016) and DTSC-SLs (2016) selected in accordance with DTSC HHRA Note 3 (DTSC 2016) were also identified. Direct contact ESLs, RSLs and DTSC-SLs for residential soil are protective of human health assuming direct residential exposure via soil ingestion, dermal contact with soil, and inhalation of volatile chemicals migrating to outdoor air.

ESLs for protection of groundwater (SF RWQCB 2016) were also identified in this screening-level HHRA for use in guiding the proposed RAs at the Site. The SF RWQCB has developed soil ESLs for leaching concerns to address potential migration of chemicals from vadose zone soils to groundwater. Pangea indicated that beneficial uses of the Site groundwater, as designated by the State, include municipal water supply. To protect beneficial uses of Site groundwater as a potential drinking water supply, GSI selected the soil ESLs for leaching concerns protective of a potential drinking water resource were selected as screening criteria for this Site. These ESLs are values that have been back-calculated based on target drinking water quality criteria including maximum contaminant levels (MCLs).

Screening levels for soil are not available to evaluate the inhalation of VOCs migrating from soil to indoor air (i.e., vapor intrusion) pathway. The DTSC (2011) and SF RWQCB (2016) do not recommend use of soil data to evaluate the vapor intrusion exposure pathway because soil data must be converted to vapor concentrations using assumptions about the partitioning of the chemical into the vapor phase. Use of partitioning equations increases the uncertainty in evaluating vapor intrusion. Consistent with recommendations from the DTSC and SF RWQCB, soil vapor and groundwater, rather than soil, are used to evaluate the vapor intrusion pathway in this screening-level HHRA.

The proposed risk-based and groundwater protection screening levels are presented in Table 1 for the VOCs detected in Site soils.

2.4 Groundwater Vapor Intrusion Screening Levels

Table 4 presents risk-based groundwater concentrations for protection of human health from exposure to vapors migrating from groundwater to indoor air of a residential building. GSI developed the risk-based groundwater concentrations for each VOC using the DTSC (2014) Vapor Intrusion Screening Model for Groundwater and the same soil type (SICL) used to develop the Site-specific soil vapor screening levels presented in Table 1. Based on information provided by Pangea, the depth to groundwater was assumed to be 8 feet bgs. The DTSC model worksheets used to develop the risk-based groundwater concentrations are provided in Attachment B. Additional soil data collected at the Site is being analyzed for physical parameters and these data will be considered, where appropriate, in future updates to this HHRA.

To protect beneficial uses of the Site groundwater as a potential drinking water supply, MCLs were selected as criteria to be considered in evaluating the groundwater data collected at the Site. The MCLs for the VOCs detected in Site groundwater are presented in Table 4.

3.0 FINDINGS OF THE SCREENING-LEVEL HHRA

For this screening-level HHRA, concentrations of VOCs detected in soil vapor, soil and groundwater at the Site were compared to risk-based screening levels selected and developed in Section 2.0. Comparison to agency-recommended generic screening levels was used to identify COCs requiring further evaluation. For purposes of this screening level HHRA, VOCs were identified as COCs when the maximum concentration of the chemical exceeded an applicable generic screening level. COC concentrations were also compared to preliminary Site-specific screening levels to inform remedial activities planned for the Site.

The findings of the screening-level HHRA are presented below for soil vapor, soil and groundwater.

Soil Vapor

Table 5 presents a comparison of VOC concentrations detected in Site soil vapor to the soil vapor screening levels selected and developed for the Site (Table 1).

As shown in Table 5, concentrations of benzene, ethylbenzene and tetrachloroethylene (PCE) detected in soil vapor exceed the residential soil vapor ESLs (SF RWQCB 2016) and DTSC-SLs (2016) for soil vapor migration into an existing residential building. However, benzene concentrations in soil vapor are below the DTSC-SLs for vapor migration into a future residential building. Given that the Site is currently vacant and residential buildings do not currently occupy the site, the DTSC-SL for a future residential building is the applicable screening criteria for benzene. Based on this comparison, the COCs identified for soil vapor are limited to ethylbenzene and PCE. Concentrations of all other VOCs reported in soil gas are below these generic screening levels, indicating that additional evaluation of these VOCs is not warranted.

Site-specific soil vapor screening levels were developed considering the silty clay loam soil type present at the Site (Table 1). Ethylbenzene concentrations exceed the Site-specific soil vapor screening level of 1,342 micrograms per cubic meter (µg/m^3) for soil vapor samples collected from two locations (SV-20 and SV-23). PCE exceeds the Site-specific soil vapor screening level of 725 µg/m^3 at five sampling locations (SV-2, SV-3, SV-10, SV-11, and SV-12).

Soil

Table 6 presents a comparison of VOC concentrations detected in Site soil to the soil screening levels selected for this HHRA (Table 3).

For this screening level HHRA, the maximum concentrations reported in Site soil are compared to the soil screening levels. Comparison of the maximum concentrations of chemicals to screening levels can substantially overstate reasonably expected exposures at a site. Thus, consistent with U. S. EPA risk assessment guidance (1989), chemical concentrations used in risk assessment are typically represented by the 95 percent upper confidence limit on the arithmetic mean (95 UCL); 95 UCL concentrations generally provide a more representative basis for estimating potential exposures than maximum concentrations. Where appropriate, the 95 UCL rather than maximum concentration may be used to evaluate Site-specific risks in updates to this HHRA.

As shown in Table 6, concentrations of all VOCs reported in soil samples collected at the Site are all well below generic screening levels identified for the Site including the SF RWQCB residential and construction worker ESLs for direct contact with soil, and residential soil RSLs (U.S. EPA 2016) and DTSC-SLs (2016) selected in accordance with DTSC HHRA Note 3 (Cal/EPA 2016). Thus, direct contact with VOCs in soil is not expected to pose a risk to human health assuming direct residential exposure via soil ingestion, dermal contact with soil, and inhalation of volatile chemicals migrating to outdoor air.

With one exception, VOC concentrations detected in Site soils are also below the ESLs for protection of groundwater, indicating that they are not likely to leach from the vadose zone to underlying groundwater at concentrations that threaten the designated beneficial uses of groundwater, including municipal supply. Xylene was reported in a single soil sample above the ESL for protection of groundwater; xylenes were not detected above the reporting limit in any other soil samples shown on Table 6.

Groundwater

Table 7 presents a comparison of VOC concentrations detected in Site groundwater to the groundwater screening levels selected for this HHRA (Table 4).

As shown in Table 7, all concentrations of VOCs detected in groundwater are below the MCLs and the Site-specific groundwater screening levels for the groundwater to residential indoor air pathway. Therefore, no VOCs in groundwater were identified as COCs, and further evaluation of groundwater is not likely warranted. Based on the findings of our screening-level evaluation of the available data, potential residential exposure to VOCs migrating from groundwater to indoor air of the planned residential buildings at the Site is not expected to pose a significant health risk under residential land use conditions.

4.0 REFERENCES:

Department of Toxic Substances Control (DTSC). 2011. Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance). California Environmental Protection Agency. October.

Department of Toxic Substances Control (DTSC). 2014. Soil Gas Screening Model. March. https://www.dtsc.ca.gov/SiteCleanup/Vapor_Intrusion.cfm

Department of Toxic Substances Control (DTSC). 2016. Human and Ecological Risk Office (HERO). Human Health Risk Assessment (HHRA) Note, HERO HHRA Note 3, DTSC-modified Screening Levels (DTSC-SLs). June.

San Francisco Bay Regional Water Quality Control Board (SF RWQCB). 2014. Interim Framework for Assessment of Vapor Intrusion at TCE-Contaminated Sites in the San Francisco Bay Region. Draft. October 16.

San Francisco Bay Regional Water Quality Control Board (SF RWQCB). 2016. User's Guide: Derivation and Application of Environmental Screening Levels. Interim Final. February.

United States Environmental Protection Agency (U.S. EPA). 1989. Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) Interim Final. EPA/540/1-89/002 December 1989

United States Environmental Protection Agency (U.S. EPA). 2016. Regional Screening Levels (RSLs) User Guide. May.

Tables

GSI ENVIRONMENTAL

TABLE 1
Soil Vapor Screening Levels for Volatile Organic Compounds (VOCs) (µg/m^3)

Soil Vapor Screening Levels		Benzene	Toluene	Ethylbenzene	Xylene	Naphthalene	1,2-Dichloroethane (1,2-DCA)	Tetrachloroethene (PCE)	Trichloroethene (TCE)
Protection of Human Health - Vapor Intrusion									
SF RWQCB Soil Vapor Environmental Screening Levels (ESLs)[1]									
Residential Building	µg/m^3	48	160,000	560	52,000	41	54	240	240
DTSC Soil Vapor Screening Levels (DTSC SLs)[2]									
Residential Air EPA RSLs	µg/m^3	0.36	5,200	1.1	100	0.083	0.11	11	0.48
Residential Air DTSC SLs	µg/m^3	0.097	310	NA	NA	NA	NA	0.48	NA
DTSC Default Attenuation Factor (AF) Existing Residential Building)	unitless	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
DTSC Soil Vapor SLs - Existing Residential Building	µg/m^3	49	155,000	550	50,000	42	55	240	240
DTSC Default Attenuation Factor (AF) (Future Residential Building)	unitless	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
DTSC Soil Vapor SLs - Future Residential Building	µg/m^3	97	310,000	1,100	100,000	83	110	480	480
Site-specific Soil Vapor Screening Levels[3]									
Residential Air EPA RSLs	µg/m^3	0.36	5,200	1.1	100	0.083	0.11	11	0.48
Residential Air DTSC SLs	µg/m^3	0.097	310	NA	NA	NA	NA	0.48	NA
DTSC Model - Site-specific Residential AFs (Assuming Silty Clay Loam [SICL])	unitless	9.7E-04	8.9E-04	8.2E-04	8.2E-04	7.5E-04	9.5E-04	6.6E-04	8.2E-04
Site-specific Residential Soil Vapor Screening Levels (Assuming Silty Clay Loam (SICL))	µg/m^3	100	347,863	1,342	122,092	110	116	725	584

Notes:

µg/L = microgram per liter

NA = Not available

[1] Tier 1 environmental screening levels (ESLs) for subslab and soil gas (SF RWQCB 2016).

[2] The residential soil vapor screening levels (SLs) were calculated using the more conservative (lower) of the DTSC (Cal/EPA 2016)-recommended residential air SL or USEPA (2016) regional screening levels (RSLs) for residential air and the DTSC (Cal/EPA 2011) default attenuation factors (AFs) for an existing (0.002) or a future (0.001) residential building, respectively.

[3] The site-specific residential soil vapor SLs were calculated using site-specific AFs for silty clay loam (SICL) soils.

References:

California Environmental Protection Agency (Cal/EPA). 2011. Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance). DTSC. October.

California Environmental Protection Agency (Cal/EPA). 2016. Department of Toxic Substances Control (DTSC), Human and Ecological Risk Office (HERO). Human Health Risk Assessment (HHRA) Note, HERO HHRA Note 3, DTSC-modified Screening Levels (DTSC-SLs). June.

San Francisco Regional Water Quality Control Board (SF RWQCB). 2016. Environmental Screening Levels. Tier 1 ESLs. February 2016 (Rev.3).

U.S. Environmental Protection Agency (USEPA). 2016. Regional Screening Levels (RSLs). May.

TABLE 2
Subslab Soil Vapor Screening Levels for Volatile Organic Compounds (VOCs) (µg/m^3)

Soil Vapor Screening Levels		Benzene	Toluene	Ethylbenzene	Xylene	Naphthalene	1,2-Dichloroethane (1,2-DCA)	Tetrachloroethene (PCE)	Trichloroethene (TCE)
Protection of Human Health - Vapor Intrusion									
Subslab Soil Vapor Screening Levels									
DTSC Subslab Soil Vapor Screening Levels (DTSC SLs)[1]									
Residential Air EPA RSLs	µg/m^3	0.36	5,200	1.1	100	0.083	0.11	11	0.48
Residential Air DTSC SLs	µg/m^3	0.097	310	NA	NA	NA	NA	0.48	NA
DTSC Default Subslab AFs	unitless	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Residential Building	µg/m^3	1.9	6,200	22	2,000	1.7	2.2	9.6	9.6
SF RWQCB Subslab Soil Vapor Environmental Screening Levels (ESLs)[2]									
Residential Building	µg/m^3	48	160,000	560	52,000	41	54	240	240

Notes:
µg/L = microgram per liter
NA = Not available
[1] The residential soil vapor screening levels (SLs) were calculated using the more conservative (lower) of the DTSC (Cal/EPA 2016)-recommended residential air SL or USEPA (2016) regional screening levels (RSLs) for residential air and the DTSC (Cal/EPA 2011) default attenuation factor (AF) for subslab (0.05) residential building.
[2] Tier 1 environmental screening levels (ESLs) for subslab and soil gas (SF RWQCB 2016).

References:
California Environmental Protection Agency (Cal/EPA). 2011. Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance). DTSC. October.
California Environmental Protection Agency (Cal/EPA). 2016. Department of Toxic Substances Control (DTSC), Human and Ecological Risk Office (HERO). Human Health Risk Assessment (HHRA) Note, HERO HHRA Note 3, DTSC-modified Screening Levels (DTSC-SLs). June.
San Francisco Regional Water Quality Control Board (SF RWQCB). 2016. Environmental Screening Levels. Tier 1 ESLs. February 2016 (Rev.3)
U.S. Environmental Protection Agency (USEPA). 2016. Regional Screening Levels (RSLs). May.

TABLE 3
Screening Levels for Volatile Organic Compounds (VOCs) in Soil (mg/kg)

Screening Levels		Total Petroleum Hydrocarbons Gasoline Range (TPH_g)	Total Petroleum Hydrocarbons Diesel Range (TPH_d)	Total Petroleum Hydrocarbons Motor Oil Range (TPHmo)	Benzene	Toluene	Ethylbenzene	Xylenes	Methyl tert-butyl ether (MTBE)	Naphthalene	1,2-Dichloroethane (1,2-DCA)	Tetrachloroethene (PCE)	Trichloroethene (TCE)	cis-1,2-Dichloroethene (cis-1,2-DCE)	trans-1,2-Dichloroethene (trans-1,2-DCE)	Vinyl Chloride (VC)	Chloroform	Acetone
SF RWQCB Soil Leaching to Groundwater Screening Levels[1]	mg/kg	770	570	NA	0.044	2.9	1.4	2.3	0.023	0.033	0.0045	0.42	0.46	0.19	0.67	0.01	0.068	0.5
Protection of Human Health - Direct Contact with Soil																		
SF RWQCB Environmental Screening Levels (ESLs) for Soil Direct Exposure Human Health Risk Screening Levels[2]																		
Residential Land Use, Shallow Soil	mg/kg	740	230	11,000	0.23	970	5.1	560	42	3	0.37	0.6	1.2	19	160	0.0085	0.3	59,000
Construction Worker, Shallow and Deep Soil	mg/kg	2,800	880	32,000	24	4,100	480	2,400	3,700	350	37	33	23	82	680	3.4	32	260,000
DTSC Screening Level (SL) - Residential Soil																		
USEPA RSL -Residential Soil[3]	mg/kg	NA	NA	NA	1.2	4,900	5.8	580	47	4	0.46	24	0.94	160	1,600	0.059	0.32	62,000
DTSC SL - Residential Soil[4]	mg/kg	NA	NA	NA	0.33	1,100	NA	NA	NA	NA	NA	0.6	NA	19	130	0.0088	NA	NA

Notes:

mg/kg = milligram per kilogram

NA = Not available; DTSC (2016) recommends use of USEPA RSL when a DTSC SL is not available.

[1] San Francisco Regional Water Quality Control Board (SF RWQCB 2016). Soil Environmental Screening Levels (ESLs). Table S-2: Soil Leaching to Groundwater Screening Levels (Organic Compounds Only). Drinking Water Resource. February.

[2] San Francisco Regional Water Quality Control Board (SF RWQCB 2016). Soil Environmental Screening Levels (ESLs). Table S-1: Soil Direct Exposure Human Health Risk Screening Levels (mg/kg). February.

[3] United States Environmental Protection Agency (USEPA). 2016. Regional Screening Levels (RSLs).

[4] California Environmental Protection Agency (Cal/EPA). 2016. Department of Toxic Substances Control (DTSC), Human and Ecological Risk Office (HERO). Human Health Risk Assessment (HHRA) Note, HERO HHRA Note 3, DTSC-modified Screening Levels (DTSC-SLs). June.

References:

Department of Toxic Substances Control (DTSC). 2016. Human and Ecological Risk Office (HERO). Human Health Risk Assessment (HHRA) Note Number: 3, DTSC-modified Screening Levels (DTSC-SLs). June.

San Francisco Regional Water Quality Control Board (SF RWQCB). 2016. Environmental Screening Levels. Tier 1 ESLs. February 2016 (Rev.3).

United States Environmental Protection Agency (USEPA). 2016. Regional Screening Levels (RSLs). May.

TABLE 4
Maximum Contaminant Levels (MCLs) and Screening Levels for Volatile Organic Compounds in Groundwater

Remedial Goals		Total Petroleum Hydrocarbons Gasoline Range (TPH_g)	Benzene	Toluene	Ethylbenzene	Xylene	Napthalene	1,2-Dichloroethane (1,2-DCA)	Tetrachloroethene (PCE)	Trichloroethene (TCE)	Chloroform
Groundwater Protection - Drinking Water Standards[1,2]											
Federal MCL	µg/L	NA	5	1,000	700	10,000	NA	5	5	5	70
California MCL	µg/L	NA	1	150	300	1750	NA	0.5	5	5	80
Protection of Human Health - Vapor Intrusion: Groundwater to Indoor Air											
Site-specific DTSC Risk-based Concentration[3]											
Site-specific DTSC Risk-based Concentration	µg/L	NA	20	62,000	210	29,000	140	78	56	100	40

Notes:

µg/L = microgram per liter

NA = Not available

[1] Federal maximum contaminant levels (MCLs) were obtained from U.S.EPA (2016). California MCLs were obtained from State Water Resources Control Board (SWRCB 2016).

[2] California MCL for chloroform is for Total Trihalomethanes.

[3] Site-specific DTSC risk-based groundwater concentrations for protection of human health - vapor intrusion were calculated using the DTSC (2014) Vapor Intrusion Screening Model for Groundwater and site-soil type of silty clay loam (SICL).

References:

Department of Toxic Substances Control (DTSC). 2014. Vapor Intrusion Screening Model for Groundwater. December.

San Francisco Regional Water Quality Control Board (SF RWQCB). 2016. Environmental Screening Levels. Tier 1 ESLs. February 2016 (Rev.3).

State Water Resources Control Board (SWRCB). 2015. MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants. September.

United States Environmental Protection Agency (USEPA). 2016. Table of Regulated Drinking Water Contaminants. May 3, 2016.

Table 5. Comparison of Soil Vapor Screening Levels to Soil Gas Analytical Data - 1233 Bockman Road, San Lorenzo, California

Boring/ Sample ID	Date Sampled	Sample Depth (ft bgs)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	1,2-DCA	PCE	TCE	Notes
			ug/m^3								
Soil Gas Samples - Engeo 2015 - 2016											
SG-1	06/25/15	5.0	1.34	6.33	<3.2	<6.5	<7.8	<3.1	<5.1	<8.1	
SG-2	06/25/15	5.0	2.45	18.3	1.81	14.83	<7.8	<3.1	<5.1	<8.1	
SG-5	06/24/16	10	<19	<26	<27	<44	<140	<55	<24	<150	
SG-6	06/24/16	7.0	<1.6	4.1	143	260	<5.2	<2.1	**256**	<5.4	
SG-7	06/24/16	10	21.9	20.9	<4.9	<9.9	<12	<4.7	24.4	<12	
SG-8	06/24/16	7.0	9.18	19.1	232	1,172	<5.2	<2.1	16.7	<5.4	
SG-9	06/24/16	7.0	3.84	9.96	<2.2	4.69	<5.2	<2.1	**256**	<5.4	
SG-10	06/24/16	10	**61.8**	76.2	<2.0	6.97	<10	<4.1	<1.8	<11	
Soil Gas Samples - Pangea 2016											
SV-1	07/27/16	6.0	<3.5	<4.2	<4.8	<4.8	<23	<4.5	49	<5.9	
SV-2	07/27/16	6.0	<7.1	<8.3	<9.6	<9.6	<46	<8.9	**1,500**	<12	
SV-3	07/27/16	6.0	14	14	4.7	7.7	<22	<4.2	**820**	<5.6	
SV-4	07/27/16	6.0	18	7.5	<7.6	<7.6	<36	<7.0	150	<9.4	
SV-5	07/27/16	6.0	3.8	<3.7	<4.3	<4.3	<21	<4.0	**710**	<5.3	
SV-6	07/27/16	6.0	12	<3.8	<4.4	<4.4	<21	<4.1	**430**	<5.4	
SV-7	07/27/16	6.0	18	27	<5.1	<5.1	<25	<4.7	15	<6.3	
SV-8	07/28/16	6.0	<4.9*	<11*	<10*	<15*	--	<14*	**640**	<8.7*	
SV-9	--	--	--	--	--	--	--	--	--	--	
SV-10	07/28/16	6.0	<4.9*	<11*	<10*	<15*	--	<14*	**2,000**	170*	
SV-11	07/28/16	6.0	<4.9*	<11*	<10*	<15*	--	<14*	**2,600**	150*	
SV-12	07/28/16	6.0	<4.9*	<11*	<10*	110*	--	<14*	**930**	76*	
SV-13	07/28/16	6.0	<4.9*	<11*	380	1,470	--	<14*	100*	<8.7*	
SV-14	07/27/16	6.0	3.4	3.6	160	980	<20	<3.8	17	<5.1	
SV-15	07/27/16	6.0	25	9.2	<4.6	8.6	<22	<4.3	85	6.1	
SV-16	07/27/16	6.0	35	13	<11	<11	<52	<10	<17	<13	
SV-17	07/28/16	6.0	34	13	28	191	--	<4.1	20	9.7	
SV-18	07/28/16	6.0	**54**	59	**1,100**	3,190	--	<4.1	66	<5.5	
SV-19	07/28/16	6.0	15	40	**900**	2,490	--	<4.1	20	11	
SV-20	08/05/16	6.0	66*	160	**4,300**	18,400	17*	<130	<8.6*	<170	
SV-21	08/05/16	6.0	5.6*	<11	330	3,090	3.2*	<12	160	<16	

Pangea

Table 5. Comparison of Soil Vapor Screening Levels to Soil Gas Analytical Data - 1233 Bockman Road, San Lorenzo, California

Boring/ Sample ID	Date Sampled	Sample Depth (ft bgs)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	1,2-DCA	PCE	TCE	Notes
			ug/m^3								
SV-22	08/05/16	6.0	21*	<82	340	18,100	10*	<88	24*	<120	
SV-23	08/05/16	6.0	24*	150	**8,700**	34,000	19*	<130	9.0*	<170	
SV-24	08/05/16	6.0	42	45	**1,300**	5,500	13*	<35	<2.4*	<47	
SV-25	08/05/16	6.0	39	47	270	1,440	<1.2*	<11	1.2*	<14	
SV-26	08/05/16	6.0	23	28	180	920	2.6*	<4.4	7.6	<5.8	
SV-27	08/05/16	6.0	**73**	48	230	1,250	3.9*	<7.9	<0.53*	<11	
Maximum Concentration (µg/m^3)			**73**	**160**	**8,700**	**34,000**	**17**	**ND**	**2,600**	**170**	
Soil Vapor Screening Levels (µg/m^3)[1]											
SF RWQCB Soil Vapor Environmental Screening Levels (ESLs)			**48**	**160,000**	**560**	**52,000**	**41**	**54**	**240**	**240**	
DTSC Soil Vapor Screening Levels (DTSC SLs)											
DTSC Soil Vapor SLs - Existing Residential Building			**49**	**155,000**	**550**	**50,000**	**42**	**55**	**240**	**240**	
DTSC Soil Vapor SLs - Future Residential Building			**97**	**310,000**	**1,100**	**100,000**	**83**	**110**	**480**	**480**	
Site-specific Residential Soil Vapor Screening Levels (Assuming Silty Clay Loam [SICL])			**100**	**347,863**	**1,342**	**122,092**	**110**	**116**	**725**	**584**	

Abbreviations:

DCA = 1,2-dichloroethane

PCE = Tetrachloroethene

TCE = Trichloroethene

VOCs by EPA Method TO-15.

See lab report for trace concentrations of other VOCs

µg/m^3 = Micrograms per cubic meter of air.

ft bgs = Feet below ground surface

ND = not detected above laboratory reporting limits.

-- = Not analyzed

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

Tetrachloroethene also referred to as Perchloroethene, PCE or Perc.

Bold concentrations exceed most conservative (i.e., lowest) generic screening level.

[green] = Concentration exceeds Site-specific soil vapor screening level.

* = Represents an estimated concentration (j-flag value) below the reporting limit, or indicates that there was no detection above the method detection limit.

contaminant detections highlighted in gray

[1] Soil vapor screening levels obtained from GSI Table 1.

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Table 6. Comparison of Soil Screening Levels to Soil Analytical Data - 1233 Bockman Road, San Lorenzo California

Boring / Sample ID	Date Sampled	Sample Depth (ft bgs)	TPHg	TPHd	TPHmo	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Naphthalene	1,2-DCA	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	Chloroform	Acetone	Other VOC's	Notes
			mg/Kg																		
Soil Data - ENGEO 2015																					
S-1	6/25/2015	1	<0.1	3.6	32	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	---	
	6/25/2015	5	<0.1	<2.0	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	---	
	6/25/2015	10	<0.1	<2.0	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	---	
S-2	6/25/2015	1	<0.1	<2.0	<10	<0.01	<0.01	<0.01	**22.6**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	---	
	6/25/2015	5	<0.1	<2.0	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	---	
	6/25/2015	10	<0.1	<2.0	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	---	
S-3	6/25/2015	1	<0.1	14	230	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	---	
	6/25/2015	5	<0.1	<2.0	17	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	---	
	6/25/2015	10	<0.1	<2.0	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	---	
Soil Data - PANGEA 2016																					
SB-1	8/3/2016	3.5	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.02	---	
		6.5	<0.96	---	---	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0087	<0.0043	<0.017	---	
		8	---	---	---	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0099	<0.005	<0.02	---	
		15	On Hold																		
SB-2	8/3/2016	3.5	---	---	---	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0091	<0.0045	<0.018	---	
		6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
		6.5	<1.1	---	---	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.02	---	
		8	---	---	---	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0093	<0.0046	<0.019	---	
SB-3	8/3/2016	3.5	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	0.027	---	
		6.5	<0.99	---	---	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045	<0.0091	<0.0045	<0.018	---	
		8	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.02	---	
SB-4	8/3/2016	3.5	---	---	---	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0097	<0.0048	<0.019	---	
		5.5	<0.99	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0097	<0.0049	<0.019	---	
		8	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.02	---	
SB-5	8/3/2016	3.5	---	---	---	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0099	<0.005	<0.02	---	
		5.5	<1.1	---	---	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0097	<0.0048	<0.019	---	
		8	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.02	---	
SB-6	8/3/2016	3.5	---	---	---	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0097	<0.0049	<0.019	---	
		6	<0.98	---	---	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0047	<0.0093	<0.0047	<0.019	---	
		8	---	---	---	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0089	<0.0044	<0.018	---	

Table 6. Comparison of Soil Screening Levels to Soil Analytical Data - 1233 Bockman Road, San Lorenzo California

Boring / Sample ID	Date Sampled	Sample Depth (ft bgs)	TPHg	TPHd	TPHmo	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Naphthalene	1,2-DCA	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	Chloroform	Acetone	Other VOC's	Notes
			mg/Kg																		
Maximum Concentration (mg/kg)			ND	14	230	ND	ND	ND	**22.6**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.027	--	
Soil Screening Levels (mg/kg)[1]																					
SF RWQCB Soil Leaching to Groundwater Screening Levels			770	570	NA	0.04	2.9	1.40	2.3	0.02	0.03	0.00	0.42	0.46	0.19	0.67	0.01	0.07	0.50	---	
SF RWQCB Environmental Screening Levels (ESLs) for Soil Direct Exposure Human Health Risk Screening Levels																					
Residential Land Use, Shallow Soil			740	230	11,000	0.23	970	5.10	560	42	3.3	0.37	0.60	1.20	19	160	0.01	0.30	59,000.00	---	
Construction Worker, Shallow and Deep Soil			2,800	880	32,000	24	4,100	480	2,400	3,700	350	37	33	23	82	680	3	32	260,000	---	
DTSC Screening Level (SL) - Residential Soil																					
USEPA RSL -Residential Soil			NA	NA	NA	1.2	4,900	5.8	580	47.0	3.8	0.46	24	0.9	160	1,600	0.1	0.3	62,000	---	
DTSC SL - Residential Soil			NA	NA	NA	0.33	1,100	NA	NA	NA	NA	NA	0.60	NA	19	130	0.01	NA	NA	---	

Explanation:

TPHd and TPHmo analyzed by EPA Method 8015, TPHg and VOC's analyzed by EPA Method 8260

Benzene, Toluene, Ethylbenzene and Xylenes by EPA Method 8021.

TPHg = Total Petroleum Hydrocarbons as gasoline

TPHd = Total Petroleum Hydrocarbons as diesel

TPHmo = Total Petroleum Hydrocarbons as motor oil

MTBE = Methyl tert-butyl ether

1,2-DCA = 1,2-Dichloroethane

PCE = Tetrachloroethene

TCE = Trichloroethene

cis-1,2-DCE = cis-1,2-Dichloroethene

mg/Kg = Milligrams per kilogram

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

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

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

Bold = Concentration exceeds the groundwater protection ESL for a drinking water source.

--- = Not analyzed

contaminant detections highlighted in gray

[1] Soil screening levels obtained from GSI Table 3.

Table 7. Comparison of Groundwater Screening Levels to Groundwater Analytical Data - 1233 Bockman Road, San Lorenzo, California

Boring / Sample ID	Date Sampled	Reference Elevation	Depth to Water (ft bgs)	GWE	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	1,2-DCA	PCE	TCE	Chloroform	Other VOC's	Notes
		(ft amsl)			µg/L											
Grab Groundwater Samples - ENGEO																
GW-1	6/25/2015		15-25[a]		51	0.48	0.42	<0.59	0.26	0.28	<0.17	<0.59	<0.59	<0.59	--	
	7/15/2016		12-17[b]		<41	0.41	<0.20	<0.70	<0.55	<1.7	0.15	0.62	<0.70	<0.70	--	
GW-2	6/25/2015		15-25[a]		<50	<0.50	<0.50	<0.50	<1.0	<0.16	<0.17	<0.50	<0.50	<0.50	--	
	7/15/2016		12-17[b]		<41	<0.22	<0.20	<0.70	<0.55	<1.7	<0.15	<0.33	<0.70	<0.70	--	
GW-3	6/25/2015		15-25[a]		<50	<0.50	<0.50	<0.50	<1.0	<0.16	<0.17	<0.50	<0.50	<0.50	--	
	7/15/2016		12-17[b]		53.2	<0.22	<0.20	<0.70	<0.55	<1.7	<0.13	<0.33	<0.70	<0.70	--	
GW-4	7/15/2016		12-17[b]		<41	<0.22	<0.20	<0.70	<0.55	<1.7	<0.15	<0.33	<0.70	<0.70	--	
Grab Groundwater Samples - PANGEA																
MIP-1	7/25/2016	NA	8-12	NA	<50	<0.50	0.70	<0.50	<0.50	<2.0	<0.5	<0.50	<0.50	2.3	--	
MIP-2	7/25/2016	NA	8-12	NA	<50	<0.50	<0.50	<0.50	<0.50	<2.0	<0.5	0.80	<0.50	3.6	--	
MIP-3	7/25/2016	NA	8-12	NA	<50	<0.50	3.3	<0.50	<0.50	<2.0	<0.5	<0.50	<0.50	8.1	--	
MIP-4	7/25/2016	NA	8-12	NA	<50	<0.50	1.5	<0.50	0.60	<2.0	<0.5	<0.50	<0.50	13	--	
MIP-5	7/25/2016	NA	8-12	NA	<50	<0.50	<0.50	<0.50	<0.50	<2.0	<0.5	<0.50	<0.50	<0.50	--	
MIP-6	7/25/2016	NA	8-12	NA	<50	<0.50	<0.50	<0.50	<0.50	<2.0	<0.5	<0.50	<0.50	2.6	--	
SB-1-W	8/3/2016	NA	8	NA	<50	<0.50	<0.50	1.0	6.2	<2.0	<0.5	<0.50	<0.50	<0.50	--	
Maximum Concentration (µg/L)					53.2	0.5	3.3	1.0	6.2	0.3	0.2	0.8	ND	13	--	
Groundwater Screening Levels (µg/L)[1]																
Groundwater Protection - Drinking Water Standards																
Federal MCL					NA	5	1,000	700	10,000	NA	5	5	5	70	--	
California MCL					NA	1	150	300	1,750	NA	1	5	5	80	--	
Residential Groundwater-to-Indoor Air Vapor Intrusion Screening Levels																
Site-specific DTSC Risk-based Concentration (Assumes soil type of silty clay loam (SICL)					NA	20	62,000	210	29,000	140	78	56	100	40	--	

Explanation:

TPHg = Total Petroleum Hydrocarbons Gasoline by EPA Method 8015.

1,2-DCA = 1,2-Dichloroethane

PCE = Tetrachloroethene

TCE = Trichloroethene

cis-1,2-DCE = cis-1,2 - Dichloroethene by EPA Method 8260.

Vinyl Chloride by EPA Method 8260

Chloroform by EPA Method 8260

VOC's by EPA Method 8260

µg/L = micrograms per Liter

ft amsl = feet above mean sea level.

ft bgs = feet below grade surface.

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

-- = Not analyzed or not available.

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

[a] = ENGEO report dated 07/02/2015 states samples were taken at first encountered groundwater which ranged between 15-25 ft bgs

[b] = ENGEO report dated 08/02/2016 states samples were taken at first encountered groundwater which ranged between 12-17 ft bgs

Attachment A

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

Reset to Defaults

Scenario: Residential   Depth (cm): 121.9   Depth (ft bgs): 4
Soil Type: SICL   Site-Specific

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m³)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
71432	1.00E+02			Benzene
108883	1.00E+02			Toluene
100414	1.00E+02			Ethylbenzene
108383	1.00E+02			m-Xylene
106423	1.00E+02			p-Xylene
95476	1.00E+02			o-Xylene
91203	1.00E+02			Naphthalene
107062	1.00E+02			1,2-Dichloroethane
127184	1.00E+02			Tetrachloroethylene
79016	1.00E+02			Trichloroethylene

Results Summary

Soil Gas Conc. (μg/m³)	Attenuation Factor (unitless)	Indoor Air Conc. (μg/m³)	Cancer Risk	Noncancer Hazard
1.00E+02	9.7E-04	9.7E-02	1.0E-06	3.1E-02
1.00E+02	8.9E-04	8.9E-02	NA	2.8E-04
1.00E+02	8.2E-04	8.2E-02	7.3E-08	7.9E-05
1.00E+02	8.2E-04	8.2E-02	NA	7.9E-04
1.00E+02	8.2E-04	8.2E-02	NA	7.8E-04
1.00E+02	8.2E-04	8.2E-02	NA	7.9E-04
1.00E+02	7.5E-04	7.5E-02	9.1E-07	2.4E-02
1.00E+02	9.5E-04	9.5E-02	8.8E-07	1.3E-02
1.00E+02	6.6E-04	6.6E-02	1.4E-07	1.8E-03
1.00E+02	8.2E-04	8.2E-02	1.2E-07	3.9E-02

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER #N/A 1.66 sampling depth below grade, L_s (cm)	ENTER #N/A 0.375 Average soil temperature, T_S (°C)	ENTER #N/A 5.40E-02 SCS soil type (used to estimate soil vapor permeability)	OR	ENTER 5 vadose zone soil vapor permeability, k_v (cm²)
15	121.9	24	SICL		

MORE ↓

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm³)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm³/cm³)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SICL	1.37	0.482	0.198	5

Lookup Soil Parameters

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH (hour)⁻¹
NEW=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

CAS	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
71432	Benzene	8.95E-02	1.03E-05	5.55E-03	25	7,342	353.24	562.16	2.9E-05	3.0E-03	78.11
108883	Toluene	7.78E-02	9.20E-06	6.64E-03	25	7,930	383.78	591.79	0.0E+00	3.0E-01	92.14
100414	Ethylbenzene	6.85E-02	8.46E-06	7.88E-03	25	8,501	409.34	617.20	2.5E-06	1.0E+00	106.17
108383	m-Xylene	6.84E-02	8.44E-06	7.18E-03	25	8,523	412.27	617.05	0.0E+00	1.0E-01	106.17
106423	p-Xylene	6.82E-02	8.42E-06	6.90E-03	25	8,525	411.52	616.20	0.0E+00	1.0E-01	106.17
95476	o-Xylene	6.89E-02	8.53E-06	5.18E-03	25	8,661	417.60	630.30	0.0E+00	1.0E-01	106.17
91203	Naphthalene	6.05E-02	8.38E-06	4.40E-04	25	10,373	491.14	748.40	3.4E-05	3.0E-03	128.18
107062	1,2-Dichloroethane	8.57E-02	1.10E-05	1.18E-03	25	7,643	356.65	561.00	2.6E-05	7.0E-03	98.96
127184	Tetrachloroethylene	5.05E-02	9.46E-06	1.77E-02	25	8,288	394.40	620.20	5.9E-06	3.5E-02	165.83
79016	Trichloroethylene	6.87E-02	1.02E-05	9.85E-03	25	7,505	360.36	544.20	4.1E-06	2.0E-03	131.39

END

Residential

CAS	Chemical	Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)
71432	Benzene	106.92	0.284	0.276	1.75E-09	0.838	1.46E-09	4,000	1.00E+02	3.39E+04	1.00E+06	5.00E-03	15	7,977	5.30E-03	2.18E-01
108883	Toluene	106.92	0.284	0.276	1.75E-09	0.838	1.46E-09	4,000	1.00E+02	3.39E+04	1.00E+06	5.00E-03	15	9,001	6.31E-03	2.59E-01
100414	Ethylbenzene	106.92	0.284	0.276	1.75E-09	0.838	1.46E-09	4,000	1.00E+02	3.39E+04	1.00E+06	5.00E-03	15	9,994	7.45E-03	3.05E-01
108383	m-Xylene	106.92	0.284	0.276	1.75E-09	0.838	1.46E-09	4,000	1.00E+02	3.39E+04	1.00E+06	5.00E-03	15	10,090	6.78E-03	2.78E-01
106423	p-Xylene	106.92	0.284	0.276	1.75E-09	0.838	1.46E-09	4,000	1.00E+02	3.39E+04	1.00E+06	5.00E-03	15	10,083	6.52E-03	2.67E-01
95476	o-Xylene	106.92	0.284	0.276	1.75E-09	0.838	1.46E-09	4,000	1.00E+02	3.39E+04	1.00E+06	5.00E-03	15	10,245	4.89E-03	2.00E-01
91203	Naphthalene	106.92	0.284	0.276	1.75E-09	0.838	1.46E-09	4,000	1.00E+02	3.39E+04	1.00E+06	5.00E-03	15	12,768	4.09E-04	1.68E-02
107062	1,2-Dichloroethane	106.92	0.284	0.276	1.75E-09	0.838	1.46E-09	4,000	1.00E+02	3.39E+04	1.00E+06	5.00E-03	15	8,368	1.13E-03	4.61E-02
127184	Tetrachloroethylene	106.92	0.284	0.276	1.75E-09	0.838	1.46E-09	4,000	1.00E+02	3.39E+04	1.00E+06	5.00E-03	15	9,410	1.68E-02	6.88E-01
79016	Trichloroethylene	106.92	0.284	0.276	1.75E-09	0.838	1.46E-09	4,000	1.00E+02	3.39E+04	1.00E+06	5.00E-03	15	8,382	9.39E-03	3.85E-01

END

Residential

CAS	Chemical	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)		Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
71432	Benzene	1.80E-04	5.83E-03	106.92	15	1.00E+02	1.25	8.33E+01	5.83E-03	5.00E+03	2.63E+12	**9.72E-04**		9.72E-02	2.9E-05	3.0E-03
108883	Toluene	1.80E-04	5.06E-03	106.92	15	1.00E+02	1.25	8.33E+01	5.06E-03	5.00E+03	1.96E+14	**8.91E-04**		8.91E-02	NA	3.0E-01
100414	Ethylbenzene	1.80E-04	4.46E-03	106.92	15	1.00E+02	1.25	8.33E+01	4.46E-03	5.00E+03	1.75E+16	**8.20E-04**		8.20E-02	2.5E-06	1.0E+00
108383	m-Xylene	1.80E-04	4.45E-03	106.92	15	1.00E+02	1.25	8.33E+01	4.45E-03	5.00E+03	1.84E+16	**8.19E-04**		8.19E-02	NA	1.0E-01
106423	p-Xylene	1.80E-04	4.44E-03	106.92	15	1.00E+02	1.25	8.33E+01	4.44E-03	5.00E+03	1.97E+16	**8.18E-04**		8.18E-02	NA	1.0E-01
95476	o-Xylene	1.80E-04	4.49E-03	106.92	15	1.00E+02	1.25	8.33E+01	4.49E-03	5.00E+03	1.36E+16	**8.23E-04**		8.23E-02	NA	1.0E-01
91203	Naphthalene	1.80E-04	3.95E-03	106.92	15	1.00E+02	1.25	8.33E+01	3.95E-03	5.00E+03	2.18E+18	**7.55E-04**		7.55E-02	3.4E-05	3.0E-03
107062	1,2-Dichloroethane	1.80E-04	5.58E-03	106.92	15	1.00E+02	1.25	8.33E+01	5.58E-03	5.00E+03	9.19E+12	**9.47E-04**		9.47E-02	2.6E-05	7.0E-03
127184	Tetrachloroethylene	1.80E-04	3.28E-03	106.92	15	1.00E+02	1.25	8.33E+01	3.28E-03	5.00E+03	1.09E+22	**6.62E-04**		6.62E-02	5.9E-06	3.5E-02
79016	Trichloroethylene	1.80E-04	4.47E-03	106.92	15	1.00E+02	1.25	8.33E+01	4.47E-03	5.00E+03	1.57E+16	**8.21E-04**		8.21E-02	4.1E-06	2.0E-03

END

RESULTS SHEET

Residential

INCREMENTAL RISK CALCULATIONS:

CAS	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71432	Benzene	1.0E-06	3.1E-02
108883	Toluene	NA	2.8E-04
100414	Ethylbenzene	7.3E-08	7.9E-05
108383	m-Xylene	NA	7.9E-04
106423	p-Xylene	NA	7.8E-04
95476	o-Xylene	NA	7.9E-04
91203	Naphthalene	9.1E-07	2.4E-02
107062	1,2-Dichloroethane	8.8E-07	1.3E-02
127184	Tetrachloroethylene	1.4E-07	1.8E-03
79016	Trichloroethylene	1.2E-07	3.9E-02

MESSAGE SUMMARY:

END

Attachment B

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Scenario: **Residential**
Site-Specific

Depth: **8 ft** **243.8 cm**

Reset to Defaults

DATA ENTRY SHEET

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	243.8	SICL	24	5

↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SICL			SICL	1.37	0.482	0.198

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
71432		**Benzene**
108883		**Toluene**
100414		**Ethylbenzene**
95476		**o-Xylene**
127184		**Tetrachloroethylene**
79016		**Trichloroethylene**
91203		**Naphthalene**
107062		**1,2-Dichloroethane**
67663		**Chloroform**

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for these chemicals.

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} (μg/L)	Noncancer HQ = 1 (μg/L)
2.18E+02	2.3E-05	5.0E-03	NA	NA	2.0E+01	6.3E+02
2.59E+02	2.0E-05	5.1E-03	NA	NA	NA	6.2E+04
3.05E+02	1.7E-05	5.2E-03	NA	NA	2.1E+02	2.0E+05
2.00E+02	1.8E-05	3.6E-03	NA	NA	NA	2.9E+04
6.88E+02	1.2E-05	8.5E-03	NA	NA	5.6E+01	4.3E+03
3.85E+02	1.7E-05	6.6E-03	NA	NA	1.0E+02	3.2E+02
1.68E+01	3.5E-05	5.9E-04	NA	NA	1.4E+02	5.3E+03
4.61E+01	3.0E-05	1.4E-03	NA	NA	7.8E+01	5.3E+03
1.44E+02	2.1E-05	3.0E-03	NA	NA	4.0E+01	3.4E+04

CAS	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
71432	Benzene	8.95E-02	1.03E-05	5.55E-03	25	7,342	353.24	562.16	1.46E+02	1.79E+03	2.9E-05	3.0E-03
108883	Toluene	7.78E-02	9.20E-06	6.64E-03	25	7,930	383.78	591.79	2.34E+02	5.26E+02	0.0E+00	3.0E-01
100414	Ethylbenzene	6.85E-02	8.46E-06	7.88E-03	25	8,501	409.34	617.20	4.46E+02	1.69E+02	2.5E-06	1.0E+00
95476	o-Xylene	6.89E-02	8.53E-06	5.18E-03	25	8,661	417.60	630.30	3.83E+02	1.78E+02	0.0E+00	1.0E-01
127184	Tetrachloroethylene	5.05E-02	9.46E-06	1.77E-02	25	8,288	394.40	620.20	9.49E+01	2.06E+02	5.9E-06	3.5E-02
79016	Trichloroethylene	6.87E-02	1.02E-05	9.85E-03	25	7,505	360.36	544.20	6.07E+01	1.28E+03	4.1E-06	2.0E-03
91203	Naphthalene	6.05E-02	8.38E-06	4.40E-04	25	10,373	491.14	748.40	1.54E+03	3.10E+01	3.4E-05	3.0E-03
107062	1,2-Dichloroethane	8.57E-02	1.10E-05	1.18E-03	25	7,643	356.65	561.00	3.96E+01	8.60E+03	2.6E-05	7.0E-03
67663	Chloroform	7.69E-02	1.09E-05	3.67E-03	25	6,988	334.32	536.40	3.18E+01	7.95E+03	2.3E-05	9.8E-02

END

Residential

CAS	Chemical	Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm³/cm³)	Vadose zone effective total fluid saturation, S_{te} (cm³/cm³)	Vadose zone soil intrinsic permeability, k_i (cm²)	Vadose zone soil relative air permeability, k_{rg} (cm²)	Vadose zone soil effective vapor permeability, k_v (cm²)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm³/cm³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm³/cm³)	Floor-wall seam perimeter, X_{crack} (cm)
71432	Benzene	228.8	0.284	0.276	1.75E-09	0.838	1.46E-09	133.93	0.482	0.083	0.399	4,000
108883	Toluene	228.8	0.284	0.276	1.75E-09	0.838	1.46E-09	133.93	0.482	0.083	0.399	4,000
100414	Ethylbenzene	228.8	0.284	0.276	1.75E-09	0.838	1.46E-09	133.93	0.482	0.083	0.399	4,000
95476	o-Xylene	228.8	0.284	0.276	1.75E-09	0.838	1.46E-09	133.93	0.482	0.083	0.399	4,000
127184	Tetrachloroethylene	228.8	0.284	0.276	1.75E-09	0.838	1.46E-09	133.93	0.482	0.083	0.399	4,000
79016	Trichloroethylene	228.8	0.284	0.276	1.75E-09	0.838	1.46E-09	133.93	0.482	0.083	0.399	4,000
91203	Naphthalene	228.8	0.284	0.276	1.75E-09	0.838	1.46E-09	133.93	0.482	0.083	0.399	4,000
107062	1,2-Dichloroethane	228.8	0.284	0.276	1.75E-09	0.838	1.46E-09	133.93	0.482	0.083	0.399	4,000
67663	Chloroform	228.8	0.284	0.276	1.75E-09	0.838	1.46E-09	133.93	0.482	0.083	0.399	4,000

END

Residential

CAS	Chemical	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy o aporization e. groundwa emperature $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant a e. groundwa emperature H_{TS} (atm-m^3/mo	Henry's law constant at e. groundwa emperature H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
71432	Benzene	3.39E+04	1.00E+06	5.00E-03	15	7,977	5.30E-03	2.18E-01	1.80E-04	5.83E-03	1.06E-04	1.79E-04	228.8	15
108883	Toluene	3.39E+04	1.00E+06	5.00E-03	15	9,001	6.31E-03	2.59E-01	1.80E-04	5.06E-03	9.09E-05	1.53E-04	228.8	15
100414	Ethylbenzene	3.39E+04	1.00E+06	5.00E-03	15	9,994	7.45E-03	3.05E-01	1.80E-04	4.46E-03	7.92E-05	1.34E-04	228.8	15
95476	o-Xylene	3.39E+04	1.00E+06	5.00E-03	15	10,245	4.89E-03	2.00E-01	1.80E-04	4.49E-03	8.27E-05	1.40E-04	228.8	15
127184	Tetrachloroethylene	3.39E+04	1.00E+06	5.00E-03	15	9,410	1.68E-02	6.88E-01	1.80E-04	3.28E-03	5.71E-05	9.63E-05	228.8	15
79016	Trichloroethylene	3.39E+04	1.00E+06	5.00E-03	15	8,382	9.39E-03	3.85E-01	1.80E-04	4.47E-03	7.92E-05	1.34E-04	228.8	15
91203	Naphthalene	3.39E+04	1.00E+06	5.00E-03	15	12,768	4.09E-04	1.68E-02	1.80E-04	3.95E-03	1.66E-04	2.75E-04	228.8	15
107062	1,2-Dichloroethane	3.39E+04	1.00E+06	5.00E-03	15	8,368	1.13E-03	4.61E-02	1.80E-04	5.58E-03	1.40E-04	2.36E-04	228.8	15
67663	Chloroform	3.39E+04	1.00E+06	5.00E-03	15	7,407	3.52E-03	1.44E-01	1.80E-04	5.01E-03	9.80E-05	1.65E-04	228.8	15

END

Residential

CAS	Chemical	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)
71432	Benzene	2.18E+02	1.25	8.33E+01	5.83E-03	5.00E+03	2.63E+12	**2.28E-05**	4.96E-03	2.9E-05	3.0E-03
108883	Toluene	2.59E+02	1.25	8.33E+01	5.06E-03	5.00E+03	1.96E+14	**1.96E-05**	5.07E-03	NA	3.0E-01
100414	Ethylbenzene	3.05E+02	1.25	8.33E+01	4.46E-03	5.00E+03	1.75E+16	**1.71E-05**	5.23E-03	2.5E-06	1.0E+00
95476	o-Xylene	2.00E+02	1.25	8.33E+01	4.49E-03	5.00E+03	1.36E+16	**1.79E-05**	3.58E-03	NA	1.0E-01
127184	Tetrachloroethylene	6.88E+02	1.25	8.33E+01	3.28E-03	5.00E+03	1.09E+22	**1.24E-05**	8.50E-03	5.9E-06	3.5E-02
79016	Trichloroethylene	3.85E+02	1.25	8.33E+01	4.47E-03	5.00E+03	1.57E+16	**1.71E-05**	6.59E-03	4.1E-06	2.0E-03
91203	Naphthalene	1.68E+01	1.25	8.33E+01	3.95E-03	5.00E+03	2.18E+18	**3.50E-05**	5.88E-04	3.4E-05	3.0E-03
107062	1,2-Dichloroethane	4.61E+01	1.25	8.33E+01	5.58E-03	5.00E+03	9.19E+12	**3.00E-05**	1.39E-03	2.6E-05	7.0E-03
67663	Chloroform	1.44E+02	1.25	8.33E+01	5.01E-03	5.00E+03	2.85E+14	**2.11E-05**	3.05E-03	2.3E-05	9.8E-02

END

RESULTS SHEET

Residential

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS: | INCREMENTAL RISK CALCULATIONS:

CAS	Chemical	Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
71432	Benzene	1.95E+01	6.30E+02	1.95E+01	1.79E+06	1.95E+01	NA	NA
108883	Toluene	NA	6.16E+04	6.16E+04	5.26E+05	6.16E+04	NA	NA
100414	Ethylbenzene	2.15E+02	1.99E+05	2.15E+02	1.69E+05	2.15E+02	NA	NA
95476	o-Xylene	NA	2.91E+04	2.91E+04	1.78E+05	2.91E+04	NA	NA
127184	Tetrachloroethylene	5.60E+01	4.29E+03	5.60E+01	2.06E+05	5.60E+01	NA	NA
79016	Trichloroethylene	1.04E+02	3.16E+02	1.04E+02	1.28E+06	1.04E+02	NA	NA
91203	Naphthalene	1.41E+02	5.33E+03	1.41E+02	3.10E+04	1.41E+02	NA	NA
107062	1,2-Dichloroethane	7.80E+01	5.27E+03	7.80E+01	8.60E+06	7.80E+01	NA	NA
67663	Chloroform	4.01E+01	3.35E+04	4.01E+01	7.95E+06	4.01E+01	NA	NA

END