Preliminary Phase II Environmental Site Assessment Work Plan

Former Fairway Dry Cleaners and Laundry
1600 Capitola Road
Santa Cruz, California

Prepared for:
Chang Family Trust

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Sign-off and Certification Sheets

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Abbreviations

Abbreviations	Meaning
APN	Assessor's Parcel Number
CCRWQCB	Central Coast Regional Water Quality Control Board
CH	High plasticity clay
CL	Low plasticity clay
COC	Chain-of-custody
COPCs	Chemicals of potential concern
DOT	Department of Transportation
ELAP	Environmental Laboratory Accreditation Program
ESAWP	Environmental Site Assessment Work Plan
ESLs	Environmental Screening Levels
ft	feet
ft/ft	Feet per foot
HASP	Health and Safety Plan
ML	Silt
mls	mean sea level
PCE	tetrachloroethene
PHC	petroleum hydrocarbon compound
PID	photoionization detector
Qcl	Colluvium (Holocene)—Loose to firm, unsorted sand, silt, clay, gravel, rock debris, and organic material, in varying proportions
SAP	Site Assessment Plan
SCAP	State Cleanup Subaccount Program
SP	Sand
USA	Underground Service Alert
USCS	Unified Soil Classification System
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
µg/m3	micrograms per cubic meter (µg/m3)

Contents

1 INTRODUCTION ... 1

1.1 Investigation Purpose and Objectives ... 1

2 Background ... 2

2.1 Site Location and Description ... 2

2.2 Site History ... 2

2.3 Environmental Setting ... 2

2.3.1 Site Vicinity ... 2

2.3.2 Geology and Hydrogeology ... 2

2.4 Previous Environmental Investigations ... 3

2.5 Nearby Environmental Investigations ... 3

2.5.1 1412-1514 Capitola Road Site ... 3

2.5.2 Live Oaks Texaco ... 4

3 Scope of Work ... 5

3.1 Step 1: Pre-Field Activities and Utility Survey ... 5

3.1.1 Health and Safety - HASP Preparation ... 5

3.1.2 USA-Alert and Utility Locating ... 5

3.1.3 Site Access, Permitting, and Notifications ... 5

3.1.4 Subsurface Utility Survey ... 6

3.2 Step 2: Preliminary Passive Soil Gas Survey ... 6

3.3 Step 3: Soil and Groundwater Assessment ... 7

3.4 Step 4: Preliminary Active Soil Gas Survey ... 7

4 Field Investigation ... 8

4.1 Passive Soil Gas Sampling ... 8

4.2 Sub-Slab Soil Gas Sampling ... 8

4.3 Soil and Grab Groundwater Assessment ... 9

4.3.1 Soil Borings ... 9

4.4 Investigation-Derived Waste Handling and Disposal ... 10

5 Reporting and Schedule ... 11

5.1 Reporting ... 11

5.2 Schedule ... 11

6 REFERENCES 12

Figures

Figure 1 Site Location Map

Figure 2 Proposed Phase II Site Assessment Work Scope Map

Figure 3 Proposed Phase II Site Assessment Work Scope Map with Underground Utilities

Tables

Table 1 Preliminary Phase II Environmental Site Assessment Sampling and Analysis Plan

Appendix A: Historical Neighborhood Property Environmental Data

Appendix B: Field Procedures

Appendix C: Field Procedures for Installation of Beacon Passive Soil Gas Samplers

Appendix D: Field Procedures for Installation of Sub-slab Vapor Pins

Appendix E: Field Procedures for Terra Core Sampler

1 INTRODUCTION

This Preliminary Phase II Environmental Site Assessment Work Plan (ESAWP) has been prepared by Trinity Source Group, Inc. (Trinity), on behalf of the Chang Family Trust (the Client), and outlines sub-surface investigation procedures to delineated the extent of contamination at the Former Fairway Dry Cleaners and Landry (the Site) located at 1600 Capitola Road, in Santa Cruz (Figure 1). The work is being performed under the regulatory oversight and guidance from the Central Coast Regional Water Quality Control Board (CCRWQCB). This ESAWP was developed following a teleconference between the Client, CCRWQCB and Trinity on November 12, 2020 to determine a path forward in the process for evaluating the degree and extent of contamination at the Site. The Site is listed on the State of California GeoTracker® environmental database as Fairway Dry Cleaners and Laundry, case number T1000015553.

1.1 Investigation Purpose and Objectives

Recent environmental investigations performed by others in the neighborhood of the Site have revealed the presence of Volatile Organic Compounds (VOCs) in soil, soil vapor and groundwater. These investigations and the Site's use as a dry cleaning facility imply that a release of the dry cleaning solvent, tetrachloroethene (PCE) may have occurred to the environment. The purpose of the proposed investigations is to test soil, soil vapor and groundwater for chemicals of potential concern (COPCs) to evaluate whether a release of PCE has potentially occurred from the subject property with the objectives of obtaining sufficient Site-specific information such that the Site may qualify for enrolment in the State Cleanup Subaccount Program (SCAP).

2 Background

2.1 Site Location and Description

The Site is located at 1600 Capitola Road in Santa Cruz, California, and identified by Santa Cruz County Tax Assessor's Parcel Number (APN) 026-741-016 (Figure 2). The rectangular shaped parcel of land has dimensions of 137-feet by 370-feet and occupies an area of 1.16-acres. The property slopes gently from an elevation of approximately 83 feet above mean sea level (msl) at the northern boundary of the property (adjacent to Capitola Road) to 79 feet msl at the southern boundary.

The Site is occupied by one-single storied building located in the northwest corner of the parcel, the former dry cleaner facility, which now operates as a laundry mat. The building is approximately 42-feet by 48-feet, with an attached 8-foot by 12-foot utility/storage room located at the rear of the building. Services utilities from the building run north to Capitola Road.

2.2 Site History

The Site reportedly operated as a dry-cleaning facility from approximately 1966 to at least 1984. An environmental due diligence investigation recently performed at neighboring properties revealed the presence of PCE (Weber Hayes, 2020a, b) in the neighborhood. The former operators of the dry cleaning business are no longer available to provide information on the chemical use, operational practices, storage and waste management practices as related to PCE and the dry cleaning operations.

2.3 Environmental Setting

2.3.1 Site Vicinity

The Site is located in a predominantly commercial/retail district along Capitola Road (Figure 2), within the local Live Oaks residential neighborhood. The on-Site building no longer performs dry cleaning activities and now operates as a coin operated laundry mat. The Site is located approximately 0.85-miles due west of Highway 1 and 1.1-mile due east to the Pacific Ocean.

2.3.2 Geology and Hydrogeology

The Site is located within the west facing coastal hillside of the Monterey Bay, within the California Coastal Range Geomorphic Province (Coast Range). The Coast Range extends from California's northern border to the Transverse Range in the south and is generally subparallel to the San Andreas Fault. The Coast Range is bounded on the west by the Pacific Ocean and on the east by the Great Valley Geomorphic Province (CGS, 2002). The Coast Range rocks consist primarily of the Franciscan Complex, a diverse collection of sedimentary and metamorphic rocks accreted during the Late Mesozoic subduction of the Farallon Plate beneath the North American Plate.

The U.S. Geological Survey Santa Cruz, California 7.5 Minute Quadrangle Map, the subject property lies at approximately 80 feet (ft) above mean sea level (msl). The topographic slope of the subject property and surrounding area is generally to the south-southeast towards Monterey Bay (Figure 1). Regional and Site Geology as depicted on the Geologic Map of Santa Cruz County, the site lies upon Pleistocene coastal terrace deposits (Qcl). The deposits are described as semi-consolidated, generally well-sorted sand with a few thin, relatively continuous layers of gravel deposited in a nearshore high-energy environment (Brabb, 1989).

The following is a geological description from the adjacent 1671 Capitola Road former Live Oaks Texaco site, and geological conditions are expected to be similar at the subject property: shallow soil was identified as primarily consisting of fine grained interbedded silts, fine sands, and clays (ML to CL to CH), from the ground surface to depths of between 7 and 13 feet below ground surface (bgs). Below which a well-graded sand (SW) generally extends to a depth of approximately 20 feet bgs. A poorly graded sand (SP) is then encountered from 20 feet bgs to at least 45 feet bgs, which is the maximum depth explored at the site (AES, 2012).

2.4 Previous Environmental Investigations

No previous environmental investigations have been completed at the Site.

2.5 Nearby Environmental Investigations

A review of the GeoTracker database reveals that there are two properties that neighbor the Site with reported environmental concerns. Information from neighboring properties' environmental condition provide local data to inform this Work Plan, as described below.

2.5.1 1412-1514 Capitola Road Site

The 1412 to 1514 Capitola Road parcels lie immediately east and adjacent to the Site. Weber-Hayes in April 2020 completed an expedited site characterization investigation at the 1412-1514 Capitola Road parcels and encountered PCE and petroleum hydrocarbon compounds (PHCs) across the property (WHA, 2020b); however, PCE and PHC concentrations in soil gas and groundwater decline across the property from east to west, suggesting that chemicals of potential concern (COPCs) may have originated to the east of this property. In particular, soil gas data revealed elevated PCE concentrations in the area immediately adjacent to the Site's former dry cleaning building. A copy of relevant soil gas and groundwater data are provided in Appendix A.

2.5.2 Live Oaks Texaco

A former gas station (the former Live Oaks Texaco service station) is located at 1671 Capitola Road, which is northeast of the Site across Capitola Road at the intersection of Capitola Road and 17th Street. The former Texaco underground service tank (UST) site was closed in 2012; however, data collected over the years from the property provides relevant information with regard to local soil conditions, groundwater flow direction, and groundwater chemistry. During the period of active groundwater monitoring between 1998 and 2012, the depth to groundwater varied from about 18.5 to 25.5 feet below ground surface, with groundwater flow at an average gradient of 0.006 feet per foot (ft/ft) in a predominantly south-southwest direction towards the Pacific Ocean. A copy of relevant conceptual site model and groundwater data are provided in Appendix A.

3 Scope of Work

Trinity proposes the following Scope of Work be performed in a phased, four-step approach to evaluate Site conditions and the extent of VOC contamination in Site media. The Steps are listed below and presented in Table 1, Summary of Multi-Media Sampling and Laboratory Analyses:

- Step 1 – Pre-Field Activities and Utility Survey
- Step 2 – Perform Passive Soil Gas Survey on-Site and surrounding areas.
- Step 3 – Preliminary Active Soil Gas, and Sub-Slab Soil Gas Sampling.
- Step 4 – Soil and Groundwater Assessment.

A site assessment sampling and analysis plan (SAP) for the work described in the following sections is provided as Table 1. The following sections outline the work scope. Field investigation activities associated with Steps 2 through 4 are described in Section 4. A reporting and project schedule outline are discussed in Section 5.

3.1 Step 1: Pre-Field Activities and Utility Survey

Trinity will complete the following pre-field activities prior to conducting the proposed phased field activities.

3.1.1 Health and Safety - HASP Preparation

A Site-specific Health and Safety Plan (HASP) will be prepared and utilized in accordance with 29 CFR 1910.120 and Title 8 California Code of Regulations Section 5192, to address potential hazards at the Site during the proposed field activities. The HASP will be reviewed, signed, and adhered to by all onsite personnel including field staff, subcontractors, and Site visitors during the performance of the fieldwork.

The HASP will include objectives, hazard assessments for potential hazards that may be encountered at the Site including chemicals of potential concern, personal protective equipment and monitoring, Site organization, and emergency contacts. The HASP will remain onsite during all fieldwork.

3.1.2 USA-Alert and Utility Locating

Trinity will contact Underground Service Alert (USA) at least 72-hours prior to the start of fieldwork to notify local utilities of the planned work. Additionally, a private utility locator will perform an independent survey of onsite subsurface utilities and/or obstructions that may be encountered during drilling.

3.1.3 Site Access, Permitting, and Notifications

The following access and permits will be obtained:

- Site access with nearby private property owners will be coordinated, as needed.
- Encroachment permits will be acquired from City of Santa Cruz Department of Public Works prior to any work that encroaches upon any City's Right-of-Ways.
- Borehole permits will be acquired from the Santa Cruz County Environmental Health Services.

The following notifications will be made:

- Property owners and/or their tenants will be notified at least five (5) days in advance of select fieldwork in accordance with the site access agreement(s).
- Local businesses will be notified of work that may interrupt business activities.
- CCRWQCB will be notified at least five (5) days in advance of all field investigations.
- City and/or County inspectors will also be notified in advance of select fieldwork in accordance with the permit requirements.

3.1.4 Subsurface Utility Survey

Trinity will conduct an underground utility survey and prepare a detailed utility map. Available building plans, historical documents, and utility maps gathered from City or County Public Works and/or utility companies will be reviewed. Additionally, Trinity will contract with Coast Wide Utility Locators, LLC of Felton, California to conduct subsurface utility locating at the Site. The resulting utility map will provide guidance for siting passive soil gas sampling locations, and identify possible preferential pathways for vapor migration.

3.2 Step 2: Preliminary Passive Soil Gas Survey

Step 2 includes the performance of a passive soil gas survey, with the locations of passive soil gas samplers shown in Figures 2 and 3. Tasks involved with Step 2 are as follows:

- To evaluate the general distribution of VOCs in the Site vicinity, passive soil gas sampling will be conducted by:
  - Installing up to thirty-nine (39) passive soil gas samplers at exterior locations to evaluate the extent of the PCE vapor plume in the Site vicinity.
  - Analyzing samples for VOCs using U.S. EPA Method 8260C, with numerical conversions such that sample results are presented in micrograms per cubic meter ($\mu g/m^3$).

All passive soil gas samplers will be shipped to Beacon Environmental Services, Inc. (Beacon) (Department of Defense ELAP Accreditation #72690) located in Forest Hill, Maryland for analysis.

3.3 Step 3: Soil and Groundwater Assessment

Step 3 was designed to evaluate subsurface conditions (i.e., lithology, soil, and groundwater quality) for the evaluation of VOC distribution onSite.

Soil quality on and in the vicinity of the Site will be evaluated by:

- Advancing up to five (5) borings to depths of approximately 20 to 25 feet bgs using the direct-push method.
- Collecting up to three (3) soil samples per borehole for VOC analyses by U.S. EPA Method 8260B.

Groundwater quality in the vicinity of the Site will be evaluated by:

- Collecting up to five (5) grab-groundwater samples for VOC analyses by U.S. EPA Method 8260B.

All soil and groundwater samples will be delivered to Torrent Laboratory, Inc. (Torrent), a State-certified laboratory (ELAP #1991) for analysis.

3.4 Step 4: Preliminary Active Soil Gas Survey

Step4 involves the conversion of select boreholes into temporary nested soil vapor wells, the collection of the active soil gas, and sub-slab soil gas, as follows:

- To evaluate the flux of PCE vapors emanating from soil and groundwater impacts, install and sample five (5) nested soil vapor locations. The nested probes will have screens set at approximately 5 and 15 feet bgs.
  - Sampling the Vapor Wells using 1-liter Summa™ canisters.
  - Collecting one (1) duplicate sample for quality control purposes.
  - Analyzing the samples for VOCs using U.S. EPA Method TO-15 or equivalent.
- Sub-slab soil gas will be evaluated during two seasonal events in the three selected buildings using active sampling methods by:
  - Installing up to four (4) sub-slab Vapor Pins™.
  - Sampling the Vapor Pins™ using 1-liter Summa™ canisters.
  - Collecting one (1) duplicate sample for quality control purposes.
  - Analyzing the samples for VOCs using U.S. EPA Method TO-15 or equivalent.

All soil vapor samples will be sent to Torrent for analysis of VOCs using EPA Method TO-15.

4 Field Investigation

The following sections briefly describe field investigation activities associated with Steps 2 through 4 of the proposed investigation. Additional information on field protocols is provided in Appendices B through E.

4.1 Passive Soil Gas Sampling

An exterior screening-level survey of passive soil gas will be conducted using Beacon passive soil gas samplers. The survey will consist of installing up to 39 passive samplers installed to 1 to 2 feet bgs.

The survey includes 15 on-Site sample locations (as shown on Figure 2) to evaluate the downgradient vapor plume with respect to anticipated ground water flow direction, and 24 on-Site and off-Site locations designed to evaluate if the sanitary sewer laterals may have been a conveyance and release pathway. Collectively, the locations of passive soil gas samplers should allow a semi-quantitative comparison of relative soil gas concentrations and assist delineate the extent of VOCs in soil gas. Actual sample locations will be determined on the basis of potential obstructions or hazards encountered in the field.

Once installed, the samplers will remain in place for approximately 14 days and will later be retrieved for analysis. Following removal of the samplers, each borehole will be grouted with Portland cement and capped with concrete or asphalt to match existing grade. Passive soil gas samples will be submitted to Beacon under chain-of-custody (COC) protocols. Beacon will analyze the passive soil gas sampling media for VOCs using U.S. EPA Method 8260c. The data quality objectives will include laboratory reporting limits not exceeding residential and commercial environmental screening levels (ESLs) for soil gas, for this phase of work.

For quality assurance/quality control (QA/QC) purposes, Trinity will submit one trip blank per sample kit and up to five (2) duplicate passive soil gas samples (or a minimum of 5 percent of the total amount of samples collected) for analyses (Table 1).

Field procedures for installing and retrieving the passive soil gas samplers are provided in Appendix B and Appendix C.

4.2 Sub-Slab Soil Gas Sampling

Up to four (4) sub-slab soil gas probes will be installed across the building's concrete slab for evaluation of potential indoor air pathways (Figure 3). Trinity will install the probes in a manner consistent with DTSC guidance (DTSC, 2011). Trinity will use Vapor Pin™ technology for the sub-slab soil gas probe. The Vapor Pin™ installation procedures are presented in Appendix B and Appendix D.

Sub-slab soil gas sample will be collect the samples using 1-liter Summa canisters for analyses of VOCs using U.S. EPA Method TO-15. For QA/QC purposes, Trinity will collect one duplicate sub-slab vapor sample for analysis (Table 1).

Samples will be analyzed by Torrent. Data quality objectives for the sub-slab soil gas samples will include the minimum reporting limits to meet residential and commercial land use soil gas ESLs.

4.3 Soil and Grab Groundwater Assessment

Up to five (5) soil borings will be advanced to groundwater for the purposes of collecting soil and grab groundwater samples, and installing a nested soil vapor probes. The depth to groundwater is anticipated to occur between 22 to 26 feet bgs. The sample locations have been situated to capture the anticipated downgradient groundwater flow direction (Figure 2), with one sample location (Figure 3) is within the "backdoor area" of the utility room.

4.3.1 Soil Borings

Soil borings will be installed using a Geoprobe direct push rig equipped with nominal 2.25-inch diameter core barrel lined with acetate liners for retaining soil core. The retrieve soil core will be screened for VOCs using a photoionizing detector (PID) and select depth intervals of soil core will be retained for laboratory analysis based of field screening with a PID meter. Soil core will be logged by a Trinity geologist for lithology using the Unified Soil Classification System (USCS). Soil boring logs will be generated for each borehole installed.

Soil core selected for analysis, will be collected from the acetate liner and preserved using the Terra Core® method utilizing a single-use plunger which removes a predetermined volume of soil. The sub-sample will then be extruded into laboratory-supplied Terra Core® preservation vials following U.S. EPA Method 5035A sampling protocols, properly labeled and then placed in an ice-filled cooler for transport to the laboratory under COC documentation.

Samples for VOC analyses will be analyzed by Torrent. Field procedures for collecting soil samples using the Terra Core® sampling method are presented in Appendix B and the recommended use of the Terra Core® sampling device is presented in Appendix E.

The soil borings will be advanced up to three feet into groundwater and a temporary well casing with a 5-foot screen at the bottom will be inserted into the borehole to allow for the collection of a grab groundwater sample. Grab groundwater samples will be collected using a peristaltic pump with new clean tubing or a single use disposable bailer. Grab-groundwater samples will be analyzed for VOCs using U.S. EPA Method 8260B.

The groundwater samples will be poured directly into laboratory-supplied containers appropriate for the desired analyses. The samples will be properly labeled and placed in an ice-filled cooler for transport to Torrent under COC documentation for laboratory analyses.

For QA/QC purposes, Trinity will submit one trip blank and up to two duplicate grab-groundwater samples for analyses (Table 1).

Field procedures for collecting grab groundwater samples are presented in Appendix B.

4.4 Investigation-Derived Waste Handling and Disposal

Soil cuttings, decontamination water, and purged groundwater from the site assessment will be stored onsite in properly labeled Department of Transportation (DOT) 55-gallon drums pending waste characterization. Site investigation results are used for waste profiling where possible; otherwise, the drums will be sampled to determine waste profile. The waste will then be off-hauled by a licensed contractor and properly disposed offsite at a licensed disposal facility within 90 days after completion of the field activities.

5 Reporting and Schedule

5.1 Reporting

Upon completion of field activities and the receipt of analytical results from the laboratory, Trinity will prepare a Report of Findings from this Preliminary Site Investigation. The Report of Findings will include:

- A description of field procedures, including soil boring logs.
- Maps of sample locations (soil, grab groundwater, soil gas and sub-slab soil gas).
- Summary Tables of chemical analytical results.
- Maps posting chemical analytical results.
- Laboratory certified analytical data sheets.
- Discussion of deviations, if any, from the scope of work described in this Work Plan.
- Waste disposal documentation
- Conclusions and Recommendations

5.2 Schedule

Trinity proposes to initiate the proposed scope of work promptly after approval of this *Work Plan* by the CCRWQCB. Trinity anticipates that pre-field work, including obtaining permits and procuring vendors will take approximately four weeks, three weeks to complete field activities, three weeks for submittal and receiving laboratory analytical results and four weeks to prepare and submit the Report of Findings to the CCRWQCB.

6 REFERENCES

AES, 2012: *Groundwater Monitoring Report and Request for Case Closure*, Former Live Oak Service Station. May18.

California Geological Survey (CGS), 2002: *California Geomorphic Provinces*. Note 36

DTSC, 2011: *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance)*. October.

DTSC 2020: *HHRA Note 3*. July.

SFBRWQCB, 2020: *Environmental Screening Levels*.

USEPA, 2020: Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=1) November 2020, https://semspub.epa.gov/work/HQ/400431.pdf

Weber-Hayes, 2020a: *Expedited Site Characterization for an Imminent Multi-Use Development, County of Santa Cruz Redevelopment Parcels*, 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz. February 17.

Weber-Hayes, 2020b: *Data Submittal Package: Soil Vapor, Groundwater and Soil Sample Results*, County of Santa Cruz Redevelopment Parcels, 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz. April 16.

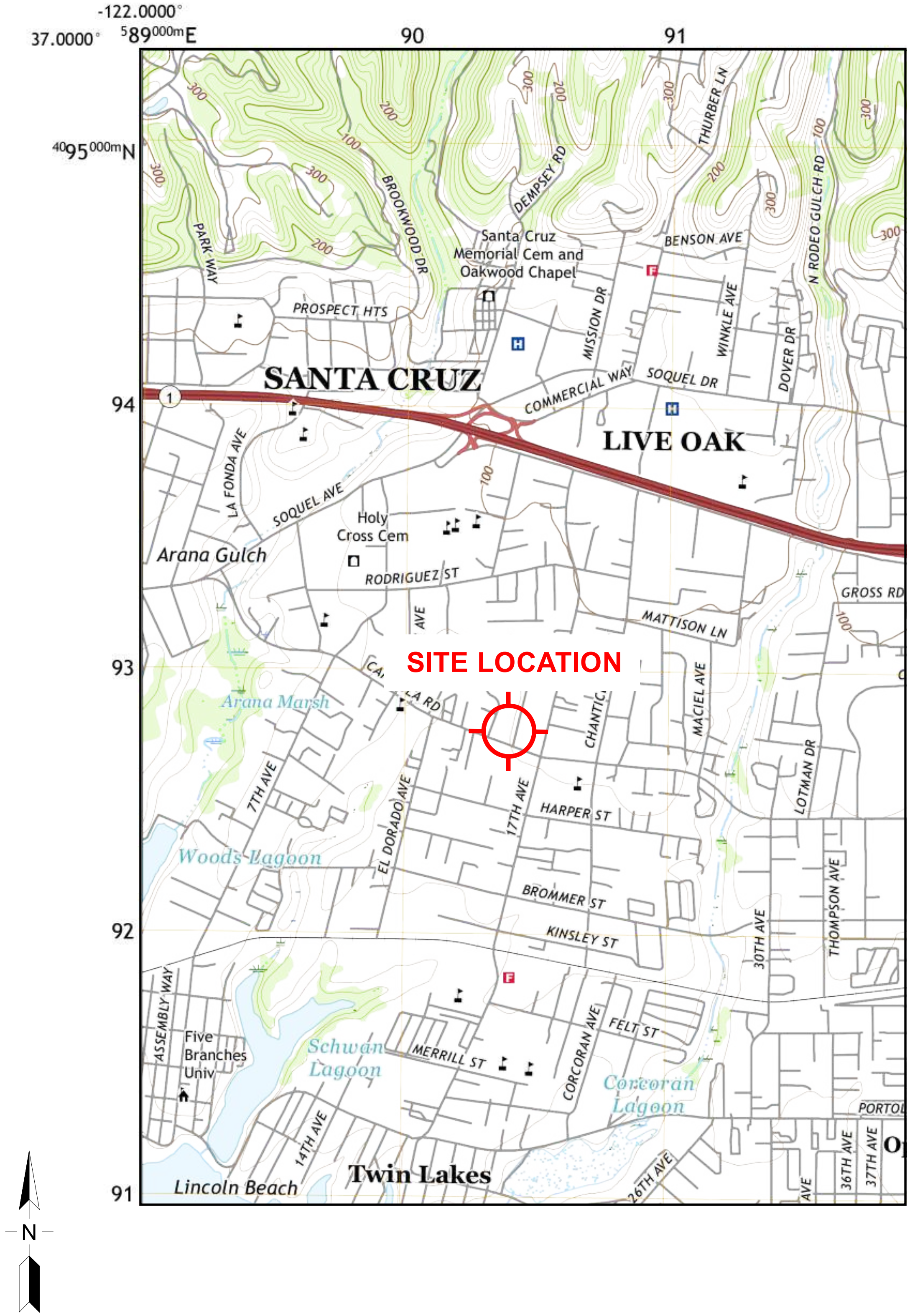
Figures

Figures supporting this report are listed below and presented on the following pages.

Figure 1 Site Location Map

Figure 2 Proposed Phase II Site Assessment Work Scope Map

Figure 3 Proposed Phase II Site Assessment Work Scope Map with Underground Utilities



Source: USGS 7.5-Minute Quadrangle, Soquel

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SITE LOCATION MAP

1600 Capitola Road
Santa Cruz, California

PROJECT: 575.001.001

FIGURE: 1

N

Legend

- Proposed Passive Soil Vapor Sampling Location
- Proposed Soil Boring with Grab-Groundwater Sample and 5'/15' Permanent Soil Vapor Probes

SCALE IN FEET

0 100

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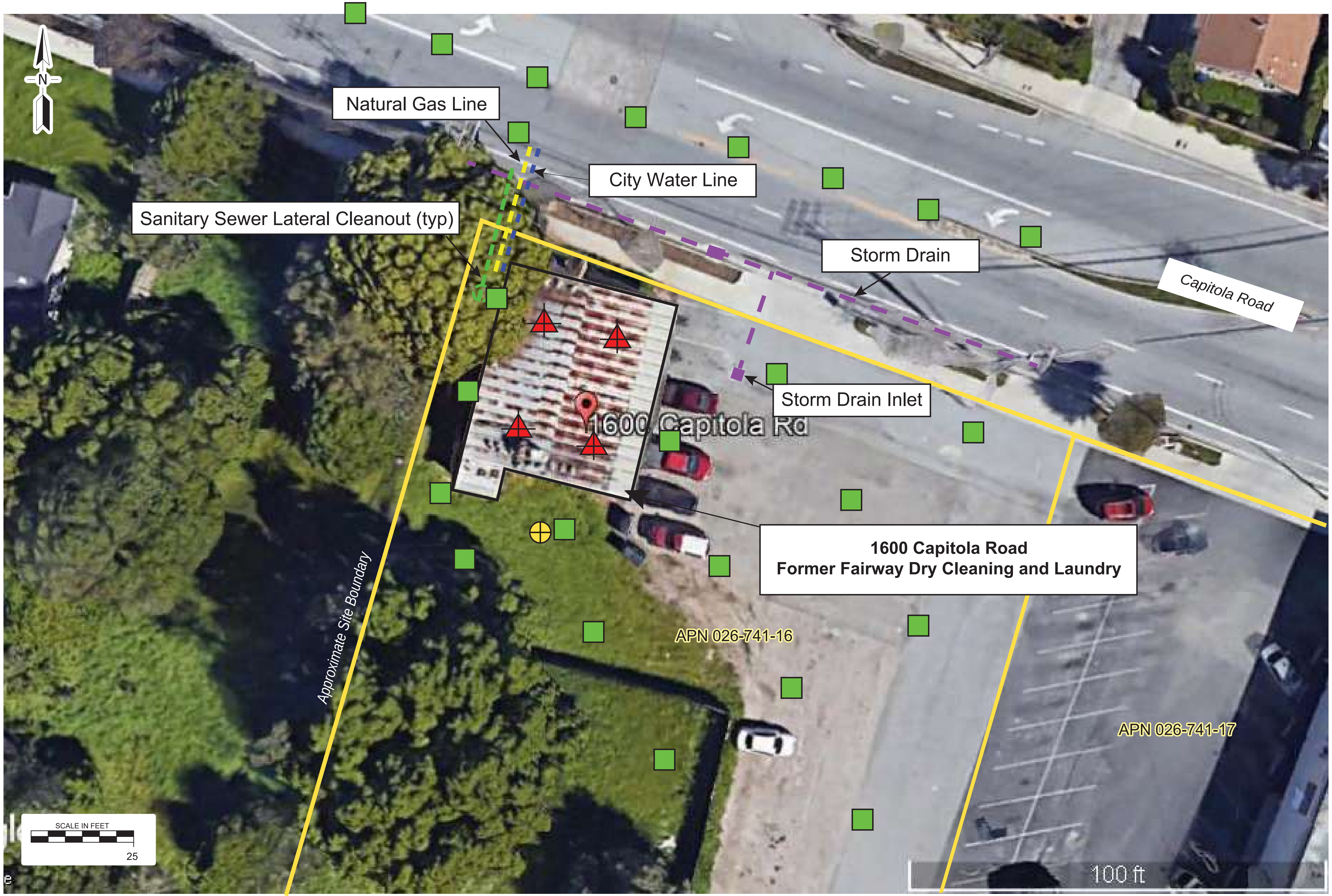
PROPOSED PHASE II SITE ASSESSMENT WORK SCOPE MAP

Former Fairway Dry Cleaning and Laundry
1600 Capitola Road
Santa Cruz, California

PROJECT: 575.001.001

FIGURE: 2



Legend

- Proposed Passive Soil Vapor Sampling Location
- Proposed Soil Boring with Grab-Groundwater Sample and 5'/15' Permanent Soil Vapor Probes
- Proposed Sub-Slab Vapor Probe

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PROPOSED PHASE II SITE ASSESSMENT WORK SCOPE DETAIL MAP WITH UNDERGROUND UTILITIES

Former Fairway Dry Cleaning and Laundry
1600 Capitola Road
Santa Cruz, California

PROJECT: 575.001.001

FIGURE: 3

Tables

Tables supporting this report are listed below and presented on the following pages.

Table 1 Preliminary Phase II Environmental Site Assessment Sampling and Analysis Plan

Table 1: **1600 Capitola Road, Sampling and Analysis Plan**			
Sample Location Id	Analysis	Installed	Comments
Beacon Passive Soil Gas samplers			
SGP-1	8260C		
SGP-2	8260C		
SGP-3	8260C		
SGP-4	8260C		
SGP-5	8260C		
SGP-7	8260C		
SGP-8	8260C		
SGP-9	8260C		
SGP-10	8260C		
SGP-11	8260C		
SGP-12	8260C		
SGP-13	8260C		
SGP-14	8260C		
SGP-15	8260C		
SGP-16	8260C		
SGP-17	8260C		
SGP-18	8260C		
SGP-19	8260C		
SGP-20	8260C		
SGP-21	8260C		
SGP-22	8260C		
SGP-23	8260C		
SGP-24	8260C		
SGP-25	8260C		
SGP-26	8260C		
SGP-27	8260C		
SGP-28	8260C		
SGP-29	8260C		
SGP-30	8260C		
SGP-31	8260C		
SGP-32	8260C		
SGP-33	8260C		
SGP-34	8260C		
SGP-35	8260C		
SGP-36	8260C		
SGP-37	8260C		
SGP-38	8260C		
SGP-39	8260C		

Table 1: 1600 Capitola Road, Sampling and Analysis Plan			
Sample Location Id	Analysis	Installed	Comments
Soil Borings and Grab-Groundwater			
B-1	8260B		Up to 3 soil and one grab-groundwater
B-2	8260B		Up to 3 soil and one grab-groundwater
B-3	8260B		Up to 3 soil and one grab-groundwater
B-4	8260B		Up to 3 soil and one grab-groundwater
B-5	8260B		Up to 3 soil and one grab-groundwater
Nested Soil Vapor Probes			
B-1S (5-foot)	TO-15		
B-1D (15-foot)	TO-15		
B-2S (5-foot)	TO-15		
B-2D (15-foot)	TO-15		
B-3S (5-foot)	TO-15		
B-3D (15-foot)	TO-15		
B-4S (5-foot)	TO-15		
B-4D (15-foot)	TO-15		
B-5S (5-foot)	TO-15		
B-5D (15-foot)	TO-15		
Sub-slab Vapor Pins			
SS-1	TO-15		
SS-2	TO-15		
SS-3	TO-15		
SS-4	TO-15		

Appendix A: Historical Neighborhood Property Environmental Data

ENVIRONMENTAL DATA (FIGURES AND TABLES) FROM 1412-1514 CAPITOLA ROAD
PRELIMINARY SITE CHARACTERIZATION INVESTIGATIONS
DATA FROM WHA, 2020

Figures

Figure 1: Location Map (topographic)

Figure 2: Vicinity Map (aerial)

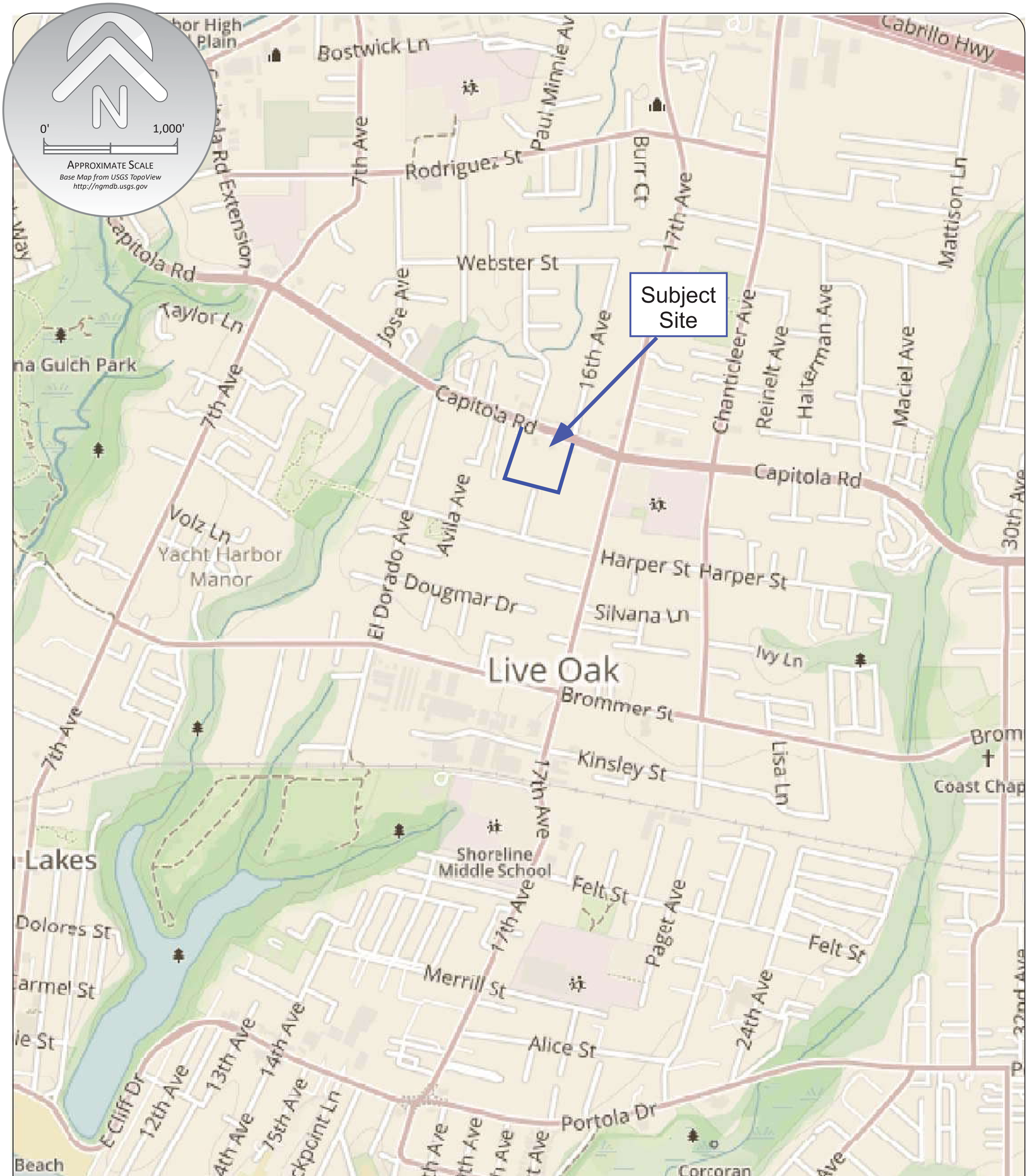
Figure 3: Site Map

Figure 4: Groundwater Sample Results (w/ dissolved PCE plume)

Figure 5: Passive Soil Vapor Survey Results

Figure 6: Active Soil Vapor Results

Figure 7: a) Isocontour Map of 5-ft Soil Vapor Detections
b) Isocontour Map of 15-ft Soil Vapor Detections



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Location Map

Supplemental Property Screening Assessment

Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz

Date: April 2020

Revisions/Notes:

FIGURE 1
Project 2t009

Figure 2
Project 2t009

Vicinity Map
Supplemental Property Screening Assessment

Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz

Date: April 2020

Revisions/Notes:

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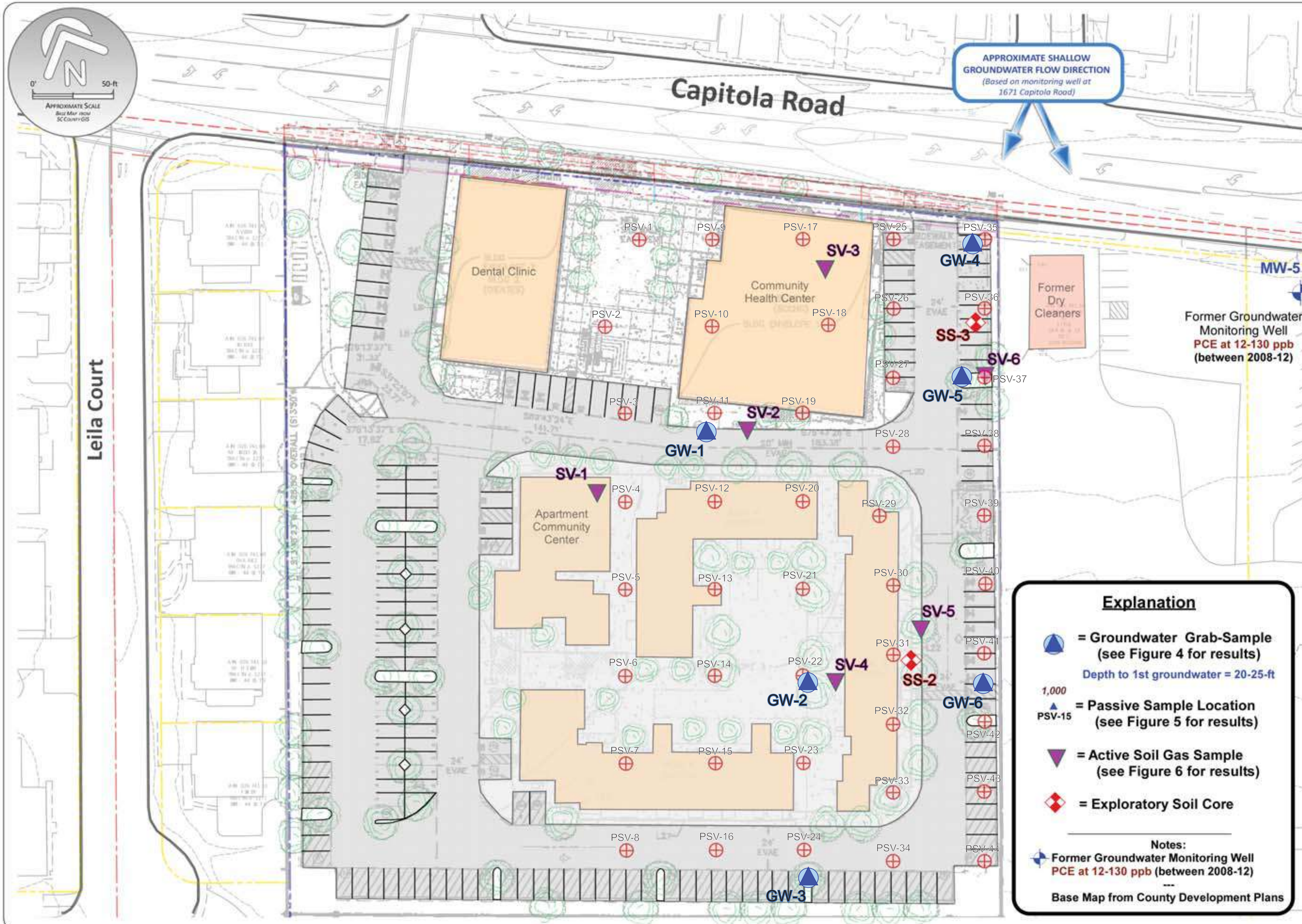

Figure 3

Project 2t009

Site Map

Supplemental Property Screening Assessment

Site: County of Santa Cruz Redevelopment Parcels

Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz

Date: April 2020

Revisions/Notes:

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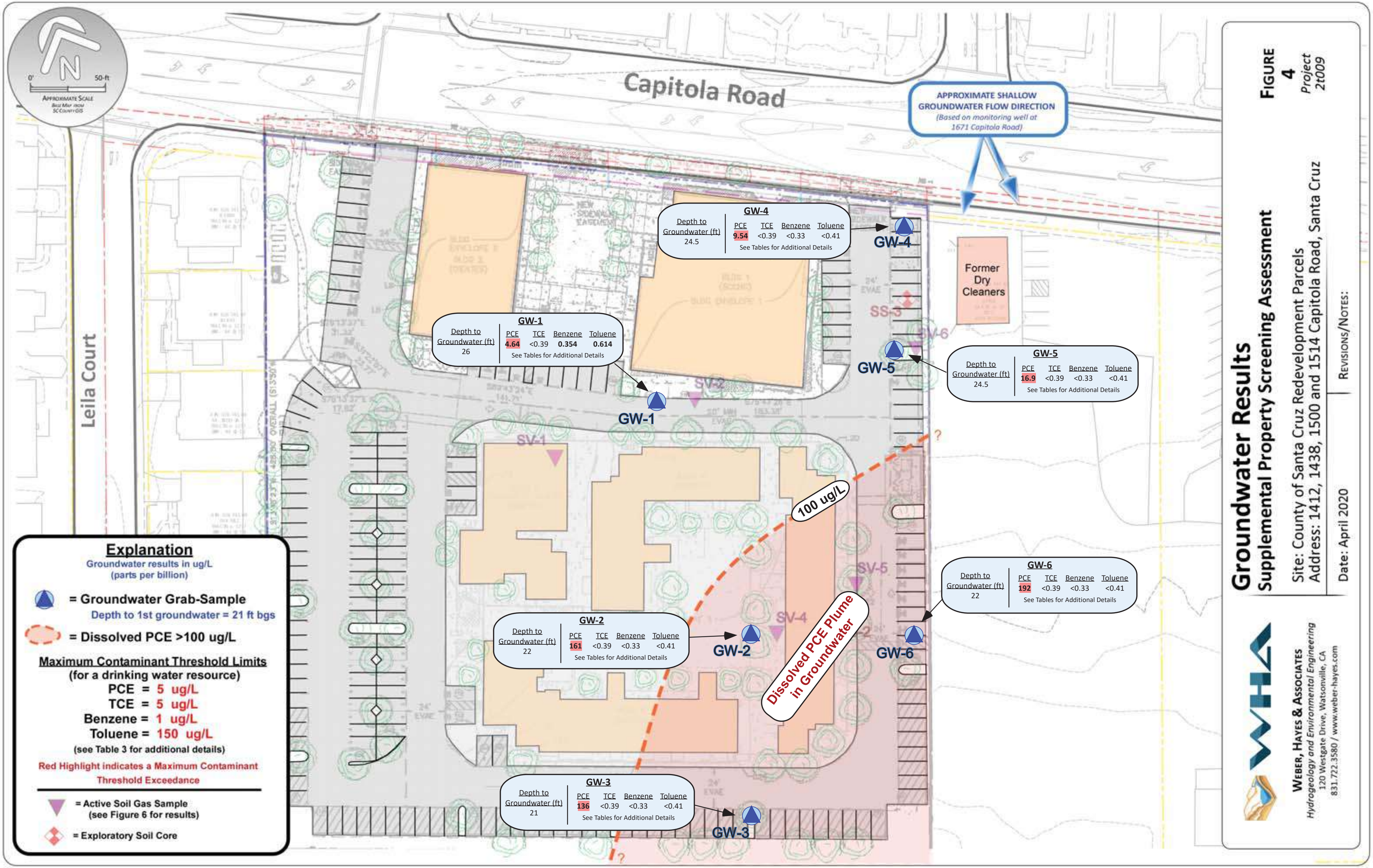

0'
50-ft
Approximate Scale
Base Map from SC County GIS
Capitola Road
Leila Court
APPROXIMATE SHALLOW GROUNDWATER FLOW DIRECTION
(Based on monitoring well at 1671 Capitola Road)
Former Dry Cleaners
GW-4
Depth to Groundwater (ft) 24.5
PCE 9.54 | TCE <0.39 | Benzene <0.33 | Toluene <0.41
See Tables for Additional Details
GW-1
Depth to Groundwater (ft) 26
PCE 4.64 | TCE <0.39 | Benzene 0.354 | Toluene 0.614
See Tables for Additional Details
GW-5
Depth to Groundwater (ft) 24.5
PCE 16.9 | TCE <0.39 | Benzene <0.33 | Toluene <0.41
See Tables for Additional Details
GW-6
Depth to Groundwater (ft) 22
PCE 192 | TCE <0.39 | Benzene <0.33 | Toluene <0.41
See Tables for Additional Details
GW-2
Depth to Groundwater (ft) 22
PCE 161 | TCE <0.39 | Benzene <0.33 | Toluene <0.41
See Tables for Additional Details
GW-3
Depth to Groundwater (ft) 21
PCE 136 | TCE <0.39 | Benzene <0.33 | Toluene <0.41
See Tables for Additional Details
SS-3
SV-1
SV-2
SV-4
SV-5
SV-6
100 ug/L
Dissolved PCE Plume in Groundwater
?
Explanation
Groundwater results in ug/L (parts per billion)
= Groundwater Grab-Sample
Depth to 1st groundwater = 21 ft bgs
= Dissolved PCE >100 ug/L
Maximum Contaminant Threshold Limits
(for a drinking water resource)
PCE = 5 ug/L
TCE = 5 ug/L
Benzene = 1 ug/L
Toluene = 150 ug/L
(see Table 3 for additional details)
Red Highlight indicates a Maximum Contaminant Threshold Exceedance
= Active Soil Gas Sample (see Figure 6 for results)
= Exploratory Soil Core
Figure 4
Project 2t009
Groundwater Results
Supplemental Property Screening Assessment
Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz
Date: April 2020
Revisions/Notes:
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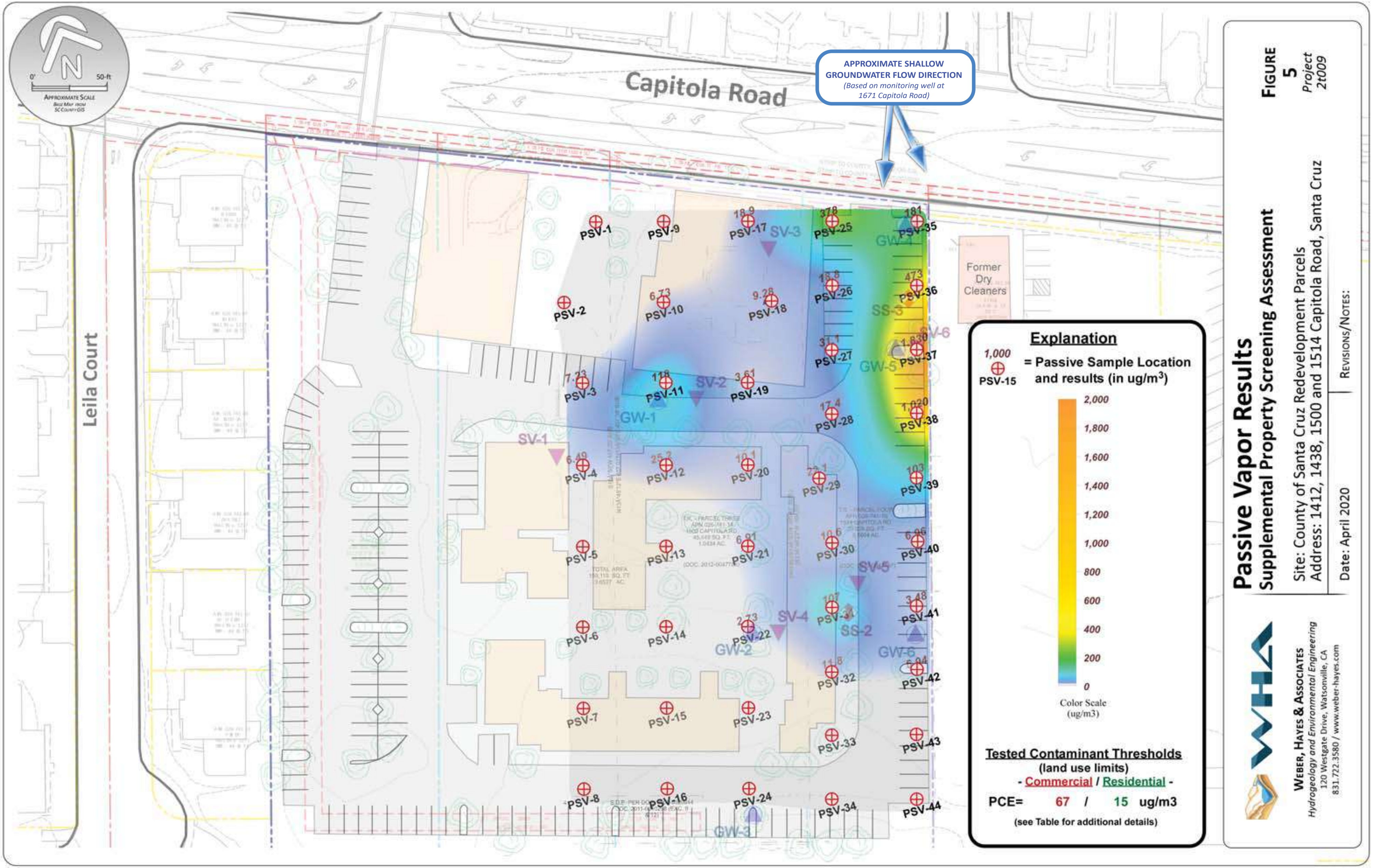

Approximate Scale
0'
50-ft
Base Map from SC County GIS
Capitola Road
Leila Court
APPROXIMATE SHALLOW GROUNDWATER FLOW DIRECTION
(Based on monitoring well at 1671 Capitola Road)
Former Dry Cleaners
PSV-1
PSV-9
18.9 PSV-17
378 PSV-25
181 PSV-35
PSV-2
6.73 PSV-10
9.28 PSV-18
18.8 PSV-26
473 PSV-36
31.1 PSV-27
1,830 PSV-37
7.23 PSV-3
118 PSV-11
3.61 PSV-19
17.4 PSV-28
1,020 PSV-38
6.49 PSV-4
25.2 PSV-12
10.1 PSV-20
72.1 PSV-29
103 PSV-39
PSV-5
PSV-13
6.91 PSV-21
10.6 PSV-30
6.96 PSV-40
PSV-6
PSV-14
2.73 PSV-22
107 PSV-31
3.48 PSV-41
11.8 PSV-32
6.04 PSV-42
PSV-7
PSV-15
PSV-23
PSV-33
PSV-43
PSV-8
PSV-16
PSV-24
PSV-34
PSV-44
SV-1
SV-2
SV-3
SV-4
SV-5
SV-6
SS-2
SS-3
GW-1
GW-2
GW-3
GW-4
GW-5
GW-6
Explanation
1,000 PSV-15 = Passive Sample Location and results (in ug/m3)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Color Scale (ug/m3)
Tested Contaminant Thresholds
(land use limits)
- Commercial / Residential -
PCE= 67 / 15 ug/m3
(see Table for additional details)
FIGURE 5
Project 2t009
Passive Vapor Results
Supplemental Property Screening Assessment
Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz
Date: April 2020
Revisions/Notes:
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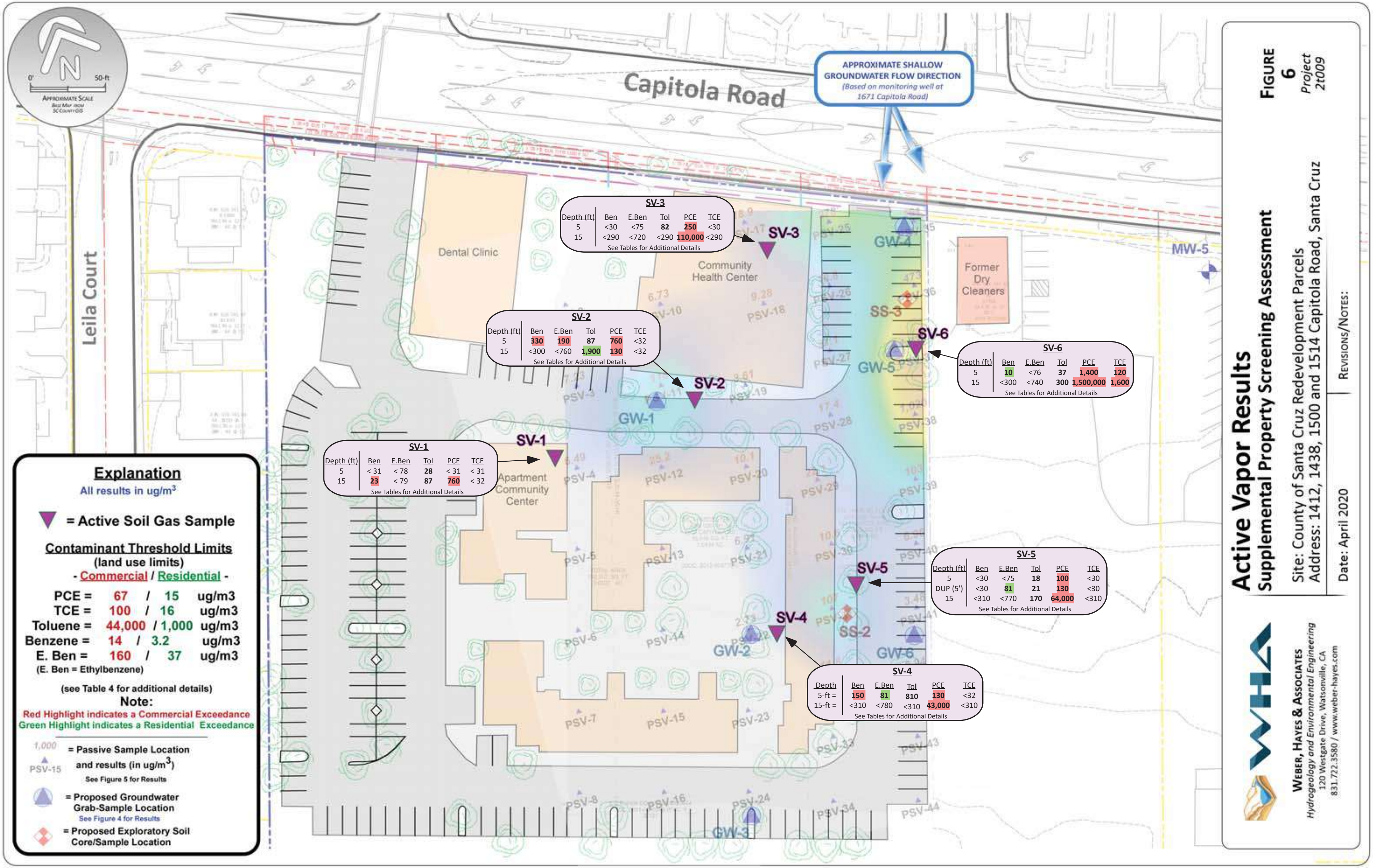

Approximate Scale
0'
50-ft
Base Map from SC County GIS
Capitola Road
APPROXIMATE SHALLOW GROUNDWATER FLOW DIRECTION
(Based on monitoring well at 1671 Capitola Road)
Leila Court
Dental Clinic
Community Health Center
Former Dry Cleaners
Apartment Community Center
MW-5
GW-1
GW-2
GW-3
GW-4
GW-5
GW-6
SS-2
SS-3
SV-1
SV-2
SV-3
SV-4
SV-5
SV-6
SV-3
Depth (ft) | Ben | E.Ben | Tol | PCE | TCE
5 | <30 | <75 | 82 | 250 | <30
15 | <290 | <720 | <290 | 110,000 | <290
See Tables for Additional Details
SV-2
Depth (ft) | Ben | E.Ben | Tol | PCE | TCE
5 | 330 | 190 | 87 | 760 | <32
15 | <300 | <760 | 1,900 | 130 | <32
See Tables for Additional Details
SV-6
Depth (ft) | Ben | E.Ben | Tol | PCE | TCE
5 | 10 | <76 | 37 | 1,400 | 120
15 | <300 | <740 | 300 | 1,500,000 | 1,600
See Tables for Additional Details
SV-1
Depth (ft) | Ben | E.Ben | Tol | PCE | TCE
5 | < 31 | < 78 | 28 | < 31 | < 31
15 | 23 | < 79 | 87 | 760 | < 32
See Tables for Additional Details
SV-5
Depth (ft) | Ben | E.Ben | Tol | PCE | TCE
5 | <30 | <75 | 18 | 100 | <30
DUP (5') | <30 | 81 | 21 | 130 | <30
15 | <310 | <770 | 170 | 64,000 | <310
See Tables for Additional Details
SV-4
Depth | Ben | E.Ben | Tol | PCE | TCE
5-ft = | 150 | 81 | 810 | 130 | <32
15-ft = | <310 | <780 | <310 | 43,000 | <310
See Tables for Additional Details
Explanation
All results in ug/m3
= Active Soil Gas Sample
Contaminant Threshold Limits
(land use limits)
- Commercial / Residential -
PCE = 67 / 15 ug/m3
TCE = 100 / 16 ug/m3
Toluene = 44,000 / 1,000 ug/m3
Benzene = 14 / 3.2 ug/m3
E. Ben = 160 / 37 ug/m3
(E. Ben = Ethylbenzene)
(see Table 4 for additional details)
Note:
Red Highlight indicates a Commercial Exceedance
Green Highlight indicates a Residential Exceedance
1,000 PSV-15 = Passive Sample Location and results (in ug/m3)
See Figure 5 for Results
= Proposed Groundwater Grab-Sample Location
See Figure 4 for Results
= Proposed Exploratory Soil Core/Sample Location
Figure 6
Project 2t009
Active Vapor Results
Supplemental Property Screening Assessment
Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz
Date: April 2020
Revisions/Notes:
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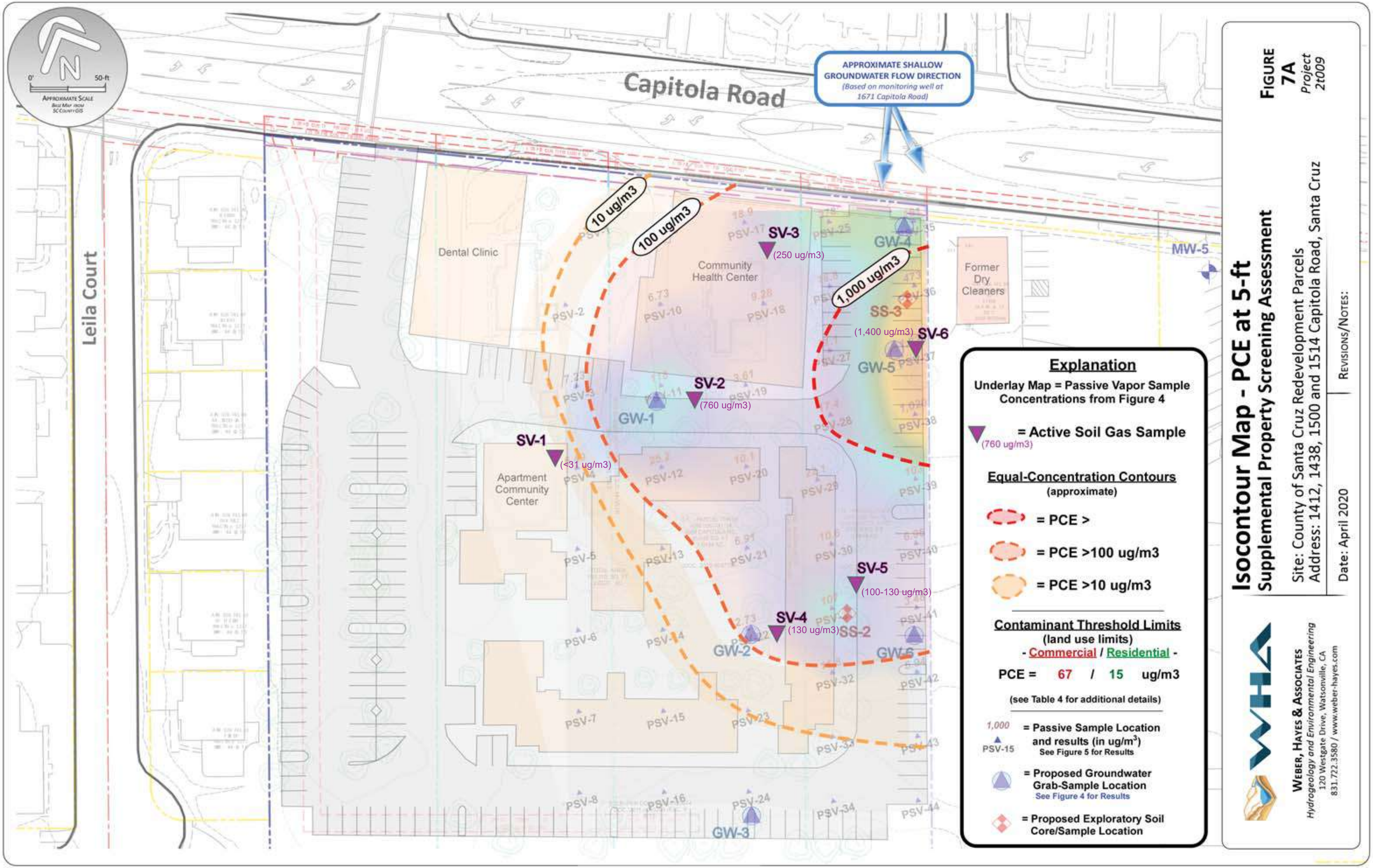

Figure 7A
Project 2t009
Isocontour Map - PCE at 5-ft
Supplemental Property Screening Assessment
Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz
Date: April 2020
Revisions/Notes:
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0' 50-ft
Approximate Scale
Base Map from SC County GIS
Capitola Road
Leila Court
APPROXIMATE SHALLOW GROUNDWATER FLOW DIRECTION
(Based on monitoring well at 1671 Capitola Road)
Dental Clinic
Community Health Center
Apartment Community Center
Former Dry Cleaners
10 ug/m3
100 ug/m3
1,000 ug/m3
SV-1 (<31 ug/m3)
SV-2 (760 ug/m3)
SV-3 (250 ug/m3)
SV-4 (130 ug/m3)
SV-5 (100-130 ug/m3)
SV-6 (1,400 ug/m3)
GW-1
GW-2
GW-3
GW-4
GW-5
GW-6
MW-5
SS-2
SS-3
PSV-1
PSV-2
PSV-3
PSV-4
PSV-5
PSV-6
PSV-7
PSV-8
PSV-10
PSV-11
PSV-12
PSV-13
PSV-14
PSV-15
PSV-16
PSV-17
PSV-18
PSV-19
PSV-20
PSV-21
PSV-23
PSV-24
PSV-25
PSV-27
PSV-28
PSV-29
PSV-30
PSV-32
PSV-33
PSV-34
PSV-36
PSV-37
PSV-38
PSV-39
PSV-40
PSV-41
PSV-42
PSV-43
PSV-44
Explanation
Underlay Map = Passive Vapor Sample Concentrations from Figure 4
(760 ug/m3) = Active Soil Gas Sample
Equal-Concentration Contours (approximate)
= PCE >
= PCE >100 ug/m3
= PCE >10 ug/m3
Contaminant Threshold Limits (land use limits)
- Commercial / Residential -
PCE = 67 / 15 ug/m3
(see Table 4 for additional details)
1,000 PSV-15 = Passive Sample Location and results (in ug/m3) See Figure 5 for Results
= Proposed Groundwater Grab-Sample Location See Figure 4 for Results
= Proposed Exploratory Soil Core/Sample Location

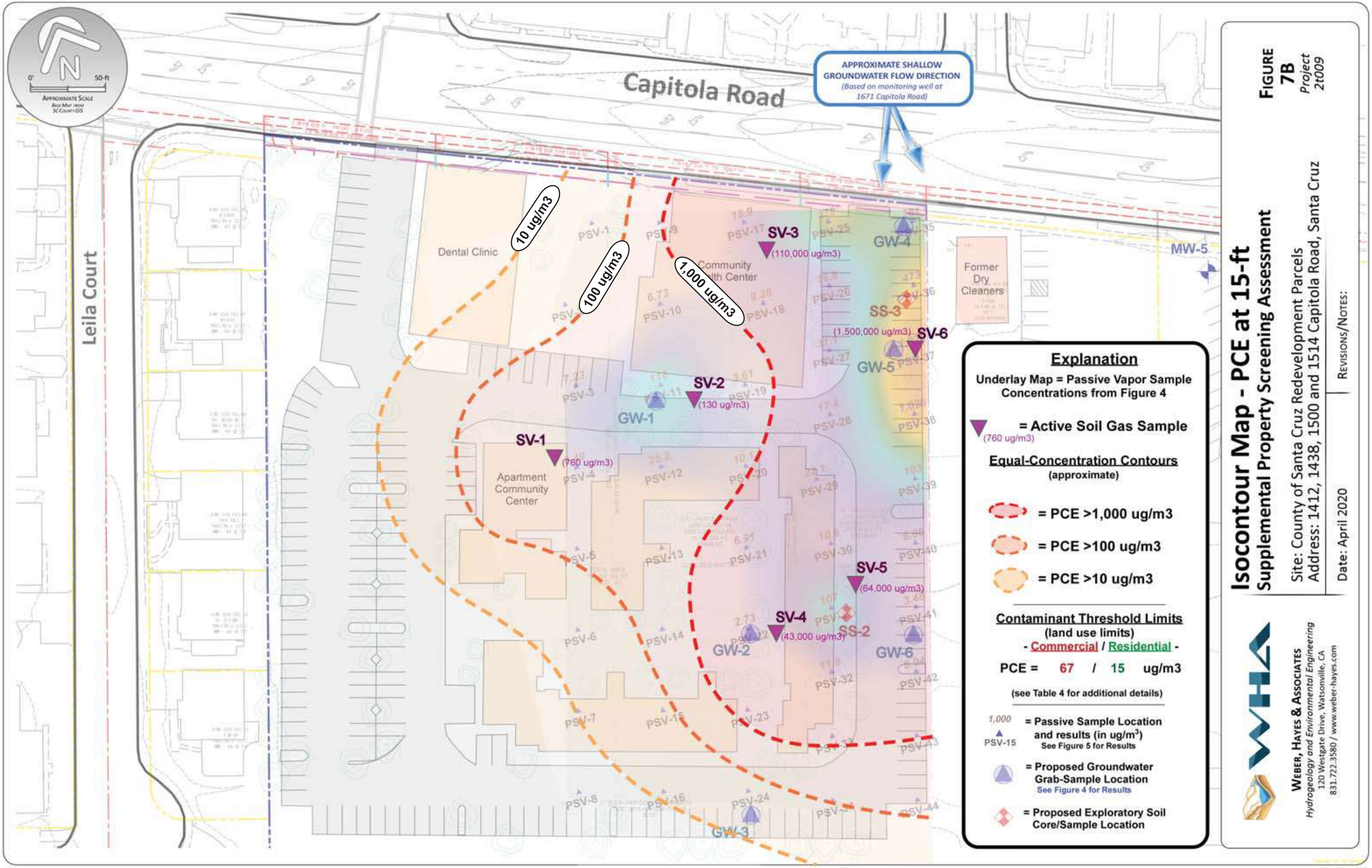


FIGURE 7B
Project 2t009
Isocontour Map - PCE at 15-ft
Supplemental Property Screening Assessment
Site: County of Santa Cruz Redevelopment Parcels
Address: 1412, 1438, 1500 and 1514 Capitola Road, Santa Cruz
Date: April 2020
Revisions/Notes:
Weber, Hayes & Associates
Hydrogeology and Environmental Engineering
120 Westgate Drive, Watsonville, CA
831.722.3580 / www.weber-hayes.com
0' 50-ft
Approximate Scale
Base Map from SC County GIS
N
Capitola Road
Leila Court
APPROXIMATE SHALLOW GROUNDWATER FLOW DIRECTION
(Based on monitoring well at 1671 Capitola Road)
Dental Clinic
Community Health Center
Former Dry Cleaners
Apartment Community Center
10 ug/m3
100 ug/m3
1,000 ug/m3
SV-1 (760 ug/m3)
SV-2 (130 ug/m3)
SV-3 (110,000 ug/m3)
SV-4 (43,000 ug/m3)
SV-5 (64,000 ug/m3)
SV-6 (1,500,000 ug/m3)
GW-1
GW-2
GW-3
GW-4
GW-5
GW-6
MW-5
SS-2
SS-3
Explanation
Underlay Map = Passive Vapor Sample Concentrations from Figure 4
(760 ug/m3) = Active Soil Gas Sample
Equal-Concentration Contours
(approximate)
= PCE >1,000 ug/m3
= PCE >100 ug/m3
= PCE >10 ug/m3
Contaminant Threshold Limits
(land use limits)
- Commercial / Residential -
PCE = 67 / 15 ug/m3
(see Table 4 for additional details)
1,000 PSV-15 = Passive Sample Location and results (in ug/m3)
See Figure 5 for Results
= Proposed Groundwater Grab-Sample Location
See Figure 4 for Results
= Proposed Exploratory Soil Core/Sample Location

Tables

Table 1: Passive Soil Vapor Sample Results

Table 2: Active Soil Vapor Sample Results

Table 3: Groundwater Sample Results

Table 4: Discrete Soil Sample Results

Table 1

Passive Soil Gas Sampling

Volatile Dry Cleaning Solvent Compound Testing Results

Seven Day Sampling Event (February 25-March 3, 2020)

1412-1514 Capitola Road
Santa Cruz

Sample Information		*Laboratory Analytical Results* *All soil vapor results are in ug/m^3*								
Sample ID	*Sample Depth (feet below ground surface)*	*PCE (Tetrachloroethene)*	*TCE (Trichloroethene)*	*Dichloroethene (DCE)*		*Vinyl Chloride*	*Benzene*	*Toluene*	*Ethylbenzene*	*Xylenes*
				cis-1,2-DCE	*trans-1,2-DCE*					
PSV-1	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	**4.76**	<6.05	<2.99	<2.88
PSV-2	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	**2.56 J**	**26.6**	<2.99	<2.88
PSV-3	3 ft	**7.23**	<2.92	<1.84	<2.25	<1.29	**6.74**	**17.3**	<2.99	<2.88
PSV-4	3 ft	**6.49**	<2.92	<1.84	<2.25	<1.29	**3.62 J**	<6.05	<2.99	<2.88
PSV-5	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	**4.58 J**	<6.05	<2.99	**8.38**
PSV-6	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	**4.31 J**	<6.05	<2.99	**12.68**
PSV-7	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	**3.08 J**	<6.05	<2.99	<2.88
PSV-8	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	**2.98 J**	<6.05	<2.99	<2.88
PSV-9	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-10	3 ft	**6.73**	<2.92	<1.84	<2.25	<1.29	**3.37 J**	<6.05	<2.99	<2.88
PSV-11	3 ft	**118**	**5.58**	<1.84	<2.25	<1.29	**7.26**	**10.9**	<2.99	<2.88
PSV-12	3 ft	**25.2**	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-13	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-14	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	<1.84	**11**	<2.99	<2.88
PSV-15	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-16	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	**3.61 J**	<6.05	<2.99	<2.88
PSV-17	3 ft	**18.9**	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-18	3 ft	**9.28**	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-19	3 ft	**3.61**	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-20	3 ft	**10.1**	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-20-dup	3 ft	**10.8**	<2.92	<1.84	<2.25	<1.29	**1.91 J**	<6.05	<2.99	<2.88
PSV-21	3 ft	**6.91**	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-22	3 ft	**2.73**	<2.92	<1.84	<2.25	<1.29	**1.90 J**	<6.05	<2.99	<2.88
PSV-23	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	**3.16 J**	<6.05	<2.99	<2.88
PSV-24	3 ft	<2.42	<2.92	<1.84	<2.25	<1.29	**3.54 J**	<6.05	<2.99	<2.88
PSV-25	3 ft	**378**	**19.7**	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-26	3 ft	**18.8**	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-27	3 ft	**31.1**	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-28	3 ft	**17.4**	<2.92	<1.84	<2.25	<1.29	**1.95 J**	<6.05	<2.99	<2.88
California DTSC-Modified Soil Gas Levels (2) Residential / Commercial Land Use		15 / 67	16 / 100	280 / 1,200	2,800 / 12,000	0.32 / 5.2	3.2 / 14	10,333 / 43,333	N E	N E
Environmental Screening Levels (1) Residential / Commercial		15 / 67	16 / 100	280 / 1,200	2,800 / 12,000	0.32 / 5.2	3.2 / 14	10,000 / 44,000	37 / 160	3,500 / 15,000

Table 1

Passive Soil Gas Sampling

Volatile Dry Cleaning Solvent Compound Testing Results

Seven Day Sampling Event (February 25-March 3, 2020)

1412-1514 Capitola Road
Santa Cruz

Sample Information		*Laboratory Analytical Results* *All soil vapor results are in ug/m³*									
Sample ID	*Sample Depth* *(feet below ground surface)*	*PCE* *(Tetrachloroethene)*	*TCE* *(Trichloroethene)*	*Dichloroethene (DCE)* *cis-1,2-DCE*	*trans-1,2-DCE*	*Vinyl Chloride*	*Benzene*	*Toluene*	*Ethylbenzene*	*Xylenes*
PSV-29	**3 ft**	**22.1**	<2.92	<1.84	<2.25	<1.29	<1.84	**8.86**	<2.99	<2.88
PSV-30	**3 ft**	**10.6**	<2.92	<1.84	<2.25	<1.29	**4.26 J**	<6.05	<2.99	<2.88
PSV-31	**3 ft**	**107**	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-32	**3 ft**	**11.8**	<2.92	<1.84	<2.25	<1.29	**3.73 J**	**42.8**	<2.99	<2.88
PSV-33	**3 ft**	<2.42	<2.92	<1.84	<2.26	<1.29	**2.03 J**	<6.05	<2.99	<2.88
PSV-34	**3 ft**	<2.42	<2.92	<1.84	<2.25	<1.29	<1.84	**7.94**	<2.99	<2.88
PSV-35	**3 ft**	**181**	<2.92	<1.84	<2.25	<1.29	**2.28 J**	<6.05	<2.99	<2.88
PSV-35-dup	**3 ft**	**240**	**5.26**	<1.84	<2.25	<1.29	**2.56 J**	<6.05	<2.99	<2.88
PSV-36	**3 ft**	**473**	**9.74**	<1.84	<2.25	<1.29	**1.98 J**	<6.05	<2.99	<2.88
PSV-37	**3 ft**	**1,830**	**16.1**	**2.38**	<2.25	<1.29	<1.84	**24.5**	<2.99	<2.88
PSV-38	**3 ft**	**1,020**	**18.5**	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-39	**3 ft**	**103**	<2.92	<1.84	<2.25	<1.29	**3.16 J**	<6.05	<2.99	<2.88
PSV-39-dup	**3 ft**	**80.7**	<2.92	<1.84	<2.25	<1.29	**2.95 J**	<6.05	<2.99	<2.88
PSV-40	**3 ft**	**6.96**	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-41	**3 ft**	**3.48**	<2.92	<1.84	<2.25	<1.29	**2.75 J**	**11.6**	<2.99	<2.88
PSV-42	**3 ft**	**6.94**	<2.92	<1.84	<2.25	<1.29	**2.10 J**	<6.05	<2.99	<2.88
PSV-43	**3 ft**	<2.42	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-44	**3 ft**	<2.42	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
PSV-44-dup	**3 ft**	<2.42	<2.92	<1.84	<2.25	<1.29	<1.84	<6.05	<2.99	<2.88
California DTSC-Modified Soil Gas Levels (2) Residential / Commercial Land Use		**15 / 67**	**16 / 100**	**280 / 1,200**	**2,800 / 12,000**	**0.32 / 5.2**	**3.2 / 14**	**10,333 / 43,333**	**N E**	**N E**
Environmental Screening Levels (1) Residential / Commercial		**15 / 67**	**16 / 100**	**280 / 1,200**	**2,800 / 12,000**	**0.32 / 5.2**	**3.2 / 14**	**10,000 / 44,000**	**37 / 160**	**3,500 / 15,000**

Notes:

1 = **CA DTSC Modified Air Screening Levels:** Human health risk thresholds established by the California Department of Toxic Substances Control (DTSC), Office of Human and Ecological Risk (HERO), Human Health Risk Assessment (HHRA) Note Number 3, Table 3, **April 2019.**
- < **https://www.dtsc.ca.gov/AssessingRisk/upload/HHRA-Note-3-June-2018.pdf** >

2 = **Environmental Screening Levels (ESLs):** Human health risk thresholds established by the San Francisco Bay Regional Water Quality Control Board. Source: the *User's Guide: Screening for Environmental Concerns at Sites With Contaminated Soil and Groundwater* (Interim Final, Jan 2019)
- <https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/ESL/ESLs.html >.
- Note: The ESLs for all media (soil, soil vapor, groundwater were generated to to provide quantitative risk-based guidance on whether further assessment or remediation of contamination is warranted based on chemical transport and their effect on receptors (i.e. human health, groundwater resources, ecological). The ESLs listed in this summary table are the most conservative, "Tier 1 ESLs", and are based on shallow soils (<3m), groundwater is a current or potential source of drinking water.

BOLD = Indicates the compound was detected.

< X = Constituent not detected above laboratory's Method Detection Limit (MDL), X.

BOLD = Analytical result exceeds **Commercial** US EPA RSL, CA DTSC or ESL threshold.

BOLD = Analytical result exceeds **Residential** US EPA RSL, CA DTSC or ESL threshold.

PCE = Tetrachloroethene

TCE= Trichloroethene

DCE = Dichloroethene

Note: TCE and DCE are degradation (daughter products) of PCE

NE = Not Established

Table 2

Active Soil Vapor Analytical Results

Volatile Organic Compounds

1412-1514 Capitola Road

All soil vapor results are in micrograms per meter cubed (ug/m³)

Sample Information			*Volatile Organic Compounds (VOCs)* (by Laboratory Analysis by EPA Method TO-15)										**Field Leak Check Monitoring (Isopropyl Alcohol)**		
			PCE (Tetrachloroethene)	*TCE (Trichloroethene)*	*Dichloroethene (DCE)*		*Vinyl chloride*	*Benzene*	*Toluene*	*Ethylbenzene*	*Xylenes*	*Other VOCs*	**Field Shroud Concentration (avg., in ppm)**	**Laboratory Results (in ug/m³)**	**Calculated Leakage (percent, %)**
Sample Date	*Sample ID*	*Depth (feet below ground surface)*			*cis-1,2-DCE*	*trans-1,2-DCE*									
April 1st, 2020	**SV-1**	***5 ft***	<5.3^	<5.9^	<31	<31	**<4.5^***	<2.5^	**28**	<5.6^	<160	Acetone = 91 Propylene = 2,000' Carbon Disulfide = 11 n-Heptane = 19 Hexane = 48 All Other VOC's =ND	133.33	< 7.3	0%
		15 ft	**760**	<6^	<32	<32	**<4.6^***	**23**	**87**	<5.7^	**42**	Acetone = 36 Cyclohexane = 95 n-Heptane = 32 Hexane = 61 All Other VOC's =ND	100	< 7.4	0%
	SV-2	***5 ft***	**130**	<6.1^	<32	<32	**<4.6^***	**330**	**1,900**	**190**	**870**	Acetone = 62 Propylene = 360 Cyclohexane = 99 Ethanol = 810 n-Heptane = 490 Hexane = 150 1-Ethyl-4-methylbenzene = 72 1,2,4-Trimethylbenzene = 71 1,3,5-Trimethylbenzene = 34 All Other VOC's =ND	100	< 7.5	0%
		15 ft	**38,000**	**<57^***	<35^	<300	**<44^***	**<24^***	**170**	**<54^***	<1,500	All Other VOC's = ND	88.33	< 71	3%
	SV-3	***5 ft***	**250**	<5.7^	**21**	<30	**<4.4^***	<2.4^	**82**	<5.4^	<150	Acetone = 120 Propylene = 400 carbon disulfide = 21 n-Heptane = 15 All Other VOC's =ND	125	< 7	0%
		15 ft	**110,000**	**<55^***	<33^	<290	**<42^***	**<23^***	<290	**<52^***	<1,400	Propylene =150 Hexane = 470 All Other VOC's =ND	95	< 68	3%
	SV-4	***5 ft***	**130**	<6^	<32	<32	**<4.6^***	**150**	**810**	**81**	**370**	Acetone = 150 Propylene = 2,800 Ethanol = 63 1 -Ethyl-4-methylbenzene = 28 n-Heptane = 180 Hexane = 79 1,2,4-Triethylbenzene = 26 All Other VOC's =ND	136.66	< 7.5	0%
		15 ft	**43,000**	**<60^***	<36^	<310	**<46^***	**<25^***	<310	**<57^***	<1,600	Hexane = 770 All Other VOC's =ND	175	< 74	2%
	SV-5	***5-ft***	**100**	<5.7^	<30	<30	**<4.4^***	<2.4^	**18**	<5.4^	<150	Propylene = 230 n-Heptane = 16 Hexane = 46 All Other VOC's =ND	68.3	< 30	2%
		Duplicate A (5-ft)	**130**	<5.7^	<30	<30	**<4.4^***	<2.4^	**21**	**81**	**310**	Acetone = 79 Propylene = 270 1,2,4-Trimethylbenzene = 210 Ethanol = 14 1-Ethyl-4-methylbenzene = 170 n-Heptane = 18 Hexane = 53 1,2,4-Trimethylbenzene = 210 1,3,5-Trimethylbenzene = 56 All Other VOC's =ND	68.3	**220**	13%
		15 ft	**64,000**	**<59^***	<35^	<310	**<45^***	**<25^***	**170**	**<55^***	<1,500	Hexane = 910 All Other VOC's =ND	53.33	< 72	5%
	SV-6	***5 ft***	**1,400**	**120**	**170**	<31	**<4.4^***	**10**	**37**	<5.5^	<150	Propylene = 220 Hexane = 41 All Other VOC's =ND	162.5	< 7.2	0%
		15 ft	**1,500,000**	**1,600**	<34^	<300	**<43^***	**<24^***	**300**	**<53^***	<1,500	All Other VOC's = ND	212.5	< 70	1%
Environmental Screening Levels [1] **Residential / Commercial Land Use** **(ATTENUATION FACTOR: 0.03)**			**15 / 67**	**16 / 100**	**280 / 1,200**	**2,800 / 12,000**	**0.32 / 5.2**	**3.2 / 14**	**1,000 / 44,000**	**37 / 160**	**3,500 / 15,000**	Acetone = 1,100,000 / 4,500,000 All Other Detected VOC's = NE			
California DTSC-Modified Soil Gas Levels [2] **Residential / Commercial Land Use** **(ATTENUATION FACTOR: 0.03)**			**15 / 67**	**16 / 100**	**280 / 1,200**	**2,800 / 12,000**	**0.32 / 5.2**	**3.2 / 14**	**1,033 / 43,333**	**NE**	**NE**	All Other Detected VOC's = NE			

Notes

1 = **Environmental Screening Levels (ESLs):** from *User's Guide: Screening for Environmental Concerns at Sites With Contaminated Soil and Groundwater,* set by the San Francisco Bay Regional Water Quality Control Board (Interim Final, Jan 2019) <https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/ESL/ESLs.html >. The ESLs are intended to provide quantitative risk-based guidance on whether further assessment or remediation of contamination is warranted. The ESLs used in this table were obtained from the above referenced document,"Tier 1 ESLs", based on shallow soils (<3m), groundwater is a current or potential source of drinking water.

2 = CA DTSC Modified Air Screening Levels: From the California Department of Toxic Substances Control (DTSC), Office of Human and Ecological Risk (HERO), Human Health Risk Assessment (HHRA) Note Number 3, Table 3, **April 2019**. < https://www.dtsc.ca.gov/AssessingRisk/upload/HHRA-Note-3-June-2018.pdf >

< X = Constituent not detected above laboratory's Practical Quantiation Limit (PQL), X.

^ = Laboratory Method Detection Limit (MDL) was used due to the PQL being higher than an established screening level

< X^* = Constituent was non-detected however the Method Detction Limit (MDL) was above the ESL or DTSC threshold.

BOLD = Analytical result exceeds **Commercial** US EPA RSL, CA DTSC or ESL threshold.

BOLD = Analytical result exceeds **Residential** US EPA RSL, CA DTSC or ESL threshold.

BOLD = Compound detected.

J = Laboratory note: Estimated value between the laboratory method detection limit and PQL

ND = Not Detected

-- = Sample was not analyzed for this constituent

NE = Not Established

Table 3

Groundwater Analytical Results

Volatile Organic Compounds (VOCs)

1412-1514 Capitola Road, Santa Cruz

All water results are in micrograms per liter (ug/L)

Sample Information			*Volatile Organic Compounds* by EPA Method 8260B						
			Solvents		Fuel Constituents				
Location ID	Depth To Water (in feet, below goround surface)	Screen Interval (in feet, below ground surface)	PCE	TCE	Benzene	Toluene	Ethyl-benzene	Xylenes	Other VOC's
GW-1	26-ft	23-28 ft	4.64	<1.00	0.354 J	0.614 J	<1.00	<3.00	Acetone = 14 J Chloromethane = 0.428 J All Other VOC'S = ND
GW-2	22-ft	19-24 ft	161	<1.00	<1.00	<1.00	<1.00	<3.00	Di-Isopropyl Ether = 0.417 J All Other VOC's = ND
GW-3	21-ft	19-24 ft	136	<1.00	<1.00	<1.00	<1.00	<3.00	All Other VOC's = ND
GW-4	24.5-ft	23-28 ft	9.54	<1.00	<1.00	<1.00	<1.00	<3.00	All Other VOC's = ND
GW-5	24.5-ft	27-32 ft	16.9	<1.00	<1.00	<1.00	<1.00	<3.00	All Other VOC's = ND
GW-6	22-ft	23-28 ft	192	0.403 J	<1.00	<1.00	<1.00	<3.00	All Other VOC's = ND
Laboratory Reported Detection Limit (RDL)			1.0	1.0	1.0	1.0	1.0	3.0	Varies
Maximum Contamination Limit (MCL) [(1)] *(+ Human Health ESL if no MCL established)*			5	5	1	150	300	1,750	Acetone = 14,000 Chloromethane = 190
Environmental Screening Levels (ESLs) [(2)]			0.64 (Vapor Intrusion)	1.2 (Vapor Intrusion)	0.42 (vapor intrusion)	40 (odor nuisance)	3.5 (vapor intrusion)	20 (odor nuisance)	Acetone = 1,500 Chloromethane = 190

Notes

1 = ***Water Quality Goals*** **(WQGs):** The listed ***Water Quality Goals*** listed are based on ***Maximum Contaminant Levels (MCLs)*** - see note below. However, if a MCL does not exist for a constituent, the listed WQG is based on ***Environmental Screening Levels (ESLs)*** - constituents with a WQG based on an ESLs are identified with an asterisk ("(*)", see note below.

Maximum Contaminant Levels (MCLs): < https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chemicalcontaminants.html >. **MCL's** are drinking water standards established in Title 22 of the California Code of Regulations for safe water coming from a tap or a drinking water aquifer. If no MCL is available the corresponding ***Environmental Screening Level (ESL, below)*** **health based pathway** will be used in its place.

2 = ***Environmental Screening Levels*** **(ESLs):** < https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/esl.html> The ESLs are agency-stablished threshold concentrations intended to provide quantitative risk-based guidance on whether further assessment or remediation of contamination is warranted based on risk pathways (protection of human heath, groundwater and/or ecological). Source: The Regional Water Quality Control Board (San Francisco Bay Region) guideline document: Screening for Environmental Concerns at Sites With Contaminated Soil and Groundwater (Final version, 2019).

BOLD **= Red highlight indictates the laboratory-detected concentration is equal to or greater than the corresponding MCL or ESL**

< X = Constituent *not detected* above the laboratory-*Reported Detection Limit (RDL* , X). Refer to laboratory reports for detection limits.

bgs= below ground surface

RDL = Reported Detection Limit = is the laboratory-determined value that is 2 to 5 times above the Method Detection Limit (MDL) that can be reproduced in a manner that results in a 99% confidence level and is both accurate and precise (based on Laboratory's Blank (QA/QC).

NE= Not Established

MDL = Method Detection Limit - The minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero.

J = This **"J-Flag"** is a lab-reported value that is detected at a concentration that is below the laboratory's RDL but above the MDL - the detection is considered an accurate detection of the compound, but it is an estimated value.

Table 4
Summary of Soil Analytical Results
Volatile Organic Compounds
1412-1514 Capitola Road, Santa Cruz
All soil results are in milligrams per Kilogram (mg/Kg)

Sample Information			*Volatile Organic Compounds (VOCs)* *by EPA Method 8260B*								
Sample Date	*Sample ID*	*Depth (feet bgs)*	*PCE (Tetrachloroethene)*	*TCE (Trichloroethene)*	*Benzene*	*Toluene*	*Ethylbenzene*	*Xylenes*	*MTBE*	*Naphthalene*	*Other Compounds*
April 1st & 2nd, 2020	**SS-2**	3	**0.00162 J**	<0.00114	<0.00114	<0.00569	<0.00285	<0.00740	<0.00114	<0.0142	2-Butanone (MEK) = 0.0223 J All Other VOC's = ND
		4.5	**0.00132 J**	<0.00119	<0.00119	<0.00594	<0.00297	<0.00773	<0.00119	<0.0149	2-Butanone (MEK) = 0.0308 All Other VOC's = ND
		12	**0.0871**	<0.00107	<0.00107	<0.00537	<0.00268	<0.00698	<0.00107	<0.0134	2-Butanone (MEK) = 0.0160 J All Other VOC's = ND
	SS-3	3	**0.02**	**0.00423**	<0.00126	<0.00629	<0.00315	<0.00818	<0.00126	<0.0157	2-Butanone (MEK) = 0.0488 All Other VOC's = ND
		6	**0.484**	**0.00253**	<0.00117	<0.00585	<0.00292	<0.00760	<0.00117	<0.0146	2-Butanone (MEK) = 0.0475 All Other VOC's = ND
		12	**0.103**	<0.00109	<0.00109	<0.00546	<0.00273	<0.00710	<0.00109	<0.0137	2-Butanone (MEK) = 0.0247 J All Other VOC's = ND
	GW-1	3	**0.00213 J**	<0.00124	<0.00124	<0.00618	<0.00309	<0.00803	<0.00124	<0.0155	2-Butanone (MEK) = 0.0607 All Other VOC's = ND
		7	**0.005**	<0.00118	<0.00118	<0.00590	<0.00295	<0.00767	<0.00118	<0.0147	2-Butanone (MEK) = 0.0438 All Other VOC's = ND
		12	**0.00137 J**	<0.00110	<0.00110	**0.00375 J**	<0.00274	<0.00713	<0.00110	<0.0137	2-Butanone (MEK) = 0.0386 All Other VOC's = ND
		24	<0.00308	<0.00123	<0.00123	**0.00258 J**	<0.00308	<0.00801	<0.00123	<0.0154	2-Butanone (MEK) = 0.0175 J All Other VOC's = ND
	GW-3	3	<0.00306	<0.00122	<0.00122	**0.0176**	**0.000929 J**	<0.00795	<0.00122	<0.0153	2-Butanone (MEK) = 0.0322 All Other VOC's = ND
		6	<0.00303	<0.00121	<0.00121	**0.00192 J**	<0.00303	<0.00788	<0.00121	<0.0152	2-Butanone (MEK) = 0.0198 J All Other VOC's = ND
		12	<0.00287	<0.00115	<0.00115	<0.00573	<0.00287	<0.00745	<0.00115	<0.0143	2-Butanone (MEK) = 0.0368 All Other VOC's = ND
		19	**0.00698**	<0.00119	<0.00119	<0.00595	<0.00297	<0.00773	<0.00119	<0.0149	2-Butanone (MEK) = 0.0429 All Other VOC's = ND
	GW-4	3	**0.0196**	<0.00126	<0.00126	<0.00628	<0.00314	<0.00817	<0.00126	<0.0157	2-Butanone (MEK) = 0.0584 All Other VOC's = ND
		6	**0.00922**	<0.00147	<0.00147	<0.00734	<0.00367	<0.00955	<0.00147	<0.0184	2-Butanone (MEK) = 0.05 All Other VOC's = ND
		12	**0.0259**	<0.00107	<0.00107	**0.00908**	<0.00268	<0.00696	<0.00107	<0.0134	2-Butanone (MEK) = 0.0255 J Acetone = 0.0206 J All Other VOC's = ND
		23	**0.0934**	<0.00106	<0.00106	<0.00532	<0.00266	<0.00691	<0.00106	<0.0133	2-Butanone (MEK) = 0.0165 J All Other VOC's = ND
	GW-5	3	**0.0179**	**0.00309**	<0.00128	<0.00639	<0.00319	<0.00830	<0.00128	<0.0160	2-Butanone (MEK) = 0.0487 All Other VOC's = ND
		6	**0.164**	**0.000665 J**	<0.00117	<0.00587	<0.00294	<0.00764	<0.00117	<0.0147	2-Butanone (MEK) = 0.0204 J All Other VOC's = ND
		12	**0.0338**	<0.00112	<0.00112	<0.00560	<0.00280	<0.00727	<0.00112	<0.0140	2-Butanone (MEK) = 0.0489 All Other VOC's = ND
		27	**0.22**	<0.00116	<0.00116	<0.00580	<0.00290	<0.00754	<0.00116	<0.0145	2-Butanone (MEK) = 0.0303 All Other VOC's = ND
DTSC **Human Healt, Risk-Based Screening Levels** Residential / Commercial Land Uses (2)			0.59 / 22.7	NE	0.33 / 1.4	1,100 / 5,300	5.8 / 25	580 / 2,500	47 / 210	3.3 / 14	2-Butanone (MEK) = NE
Environmental Screening Levels (ESLs) (1) Residential / Commercial Land Uses (Construction Worker)			0.59 / 2.7 (33)	0.95 / 6.1 (130)	0.33 / 1.4 (33)	1,100 / 5,300 (4,700)	5.9 / 26 (540)	580 / 2,500 (2,400)	47 / 210 (4,100)	3.8 / 17 (400)	2-Butanone (MEK) = 27,000 / 200,000
"Tier 1 ESL" (lowest of all possible pathways & land uses) Basis = Human Health **(HH)**, Leachability **(L)**, Ecologic **(Eco)**, or Odor **(O)**			**0.08** (L)	**0.085** (L)	**0.025** (L)	**3.2** (L)	**0.43** (L)	**2.1** (L)	**0.028** (L)	**0.033** (L)	2-Butanone (MEK) = 6.1 (L)

See Notes on Next Page

Table 4
Summary of Soil Analytical Results
Volatile Organic Compounds
1412-1514 Capitola Road, Santa Cruz
All soil results are in milligrams per Kilogram (mg/Kg)

Notes

1 = **CA DTSC Soil Screening Levels:** From the California Department of Toxic Substances Control (DTSC), Office of Human and Ecological Risk (HERO), Human Health Risk Assessment (HHRA) Note Number 3, Table 1, April 2019. **If no DTSC screening level is established then the corresponding US EPA RSL is provided.**

2 = **Environmental Screening Levels (ESLs):** Regional Water Quality Control Board (San Francisco Bay Region) guideline document: *Screening for Environmental Concerns at Sites With Contaminated Soil and Groundwater* (Final version, 2019). The ESLs are intended to provide quantitative risk-based guidance on whether further assessment or remediation of contamination is warranted <**https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/ESL/new/ESL_Summary_Tables_24Jan19_Rev1.pdf** >

TIER 1 ESL = The most conservative Environmental Screening Level (ESL) across all potential pathways for all land uses (residential & commerical). Pathways include leaching (groundwater protection) , human health, ecologic ("Terrestrial Habitat"), & volatilization (inhalation).

L = Indicates the lowest ESL is based on a **potential Leaching pathway** (for groundwater protection).

HH = Indicates the lowest ESL is based on a **potential Human Health & Safety Pathway** (ingestion, inhalation, dermal).

ECO = Indicates the lowest ESL is based on a **potential Terrestrial Habitat pathway.**

O = Indicates the lowest ESL is based on a **potential "odor nuisance"** (i.e. 100 mg/kg for gasoline).

RDL = **Reported Detection Limit** = is the laboratory-determined value that is 2 to 5 times above the Method Detection Limit (MDL) that can be reproduced in a manner that results in a 99% confidence level and is both accurate and precise.

J = Laboratory reports that the detection value is between MDL and RDL, and should be considered an estimate.

^ = Detection and Quantitation Limits are raised due to sample dilution

-- = Not Analyzed

ND = Non Detection

< = A "less than" symbol indicates no detectable concentrations (i.e., the laboratory **did not** detect the contaminant at the concentration shown).

BOLD =	A **bold** concentration indicates the laboratory detected the contaminant at the concentration shown.
BOLD =	Orange highlight indicates the analytical result is detected at a concentration that is ***above the Commercial land use ESL.***
BOLD =	Green highlight indicates the analytical result is detected at a concentration that is ***above the Residential land use ESL.***
BOLD =	Blue highlight indicates the analytical result is detected at a concentration that is ***above the most conservative ESL*** (Tier I)

A+ Environmental Solutions, LLC
1671 Capitola Road, Santa Cruz, California 95062

ENVIRONMENTAL DATA (FIGURES, CSM AND SENSISTIVE RECEPTORS) FROM AES, 2012 REPORT FOR SITE CLOSURE

FIGURES

SOURCE: USGS 7.5 MINUTE SOQUEL QUAD

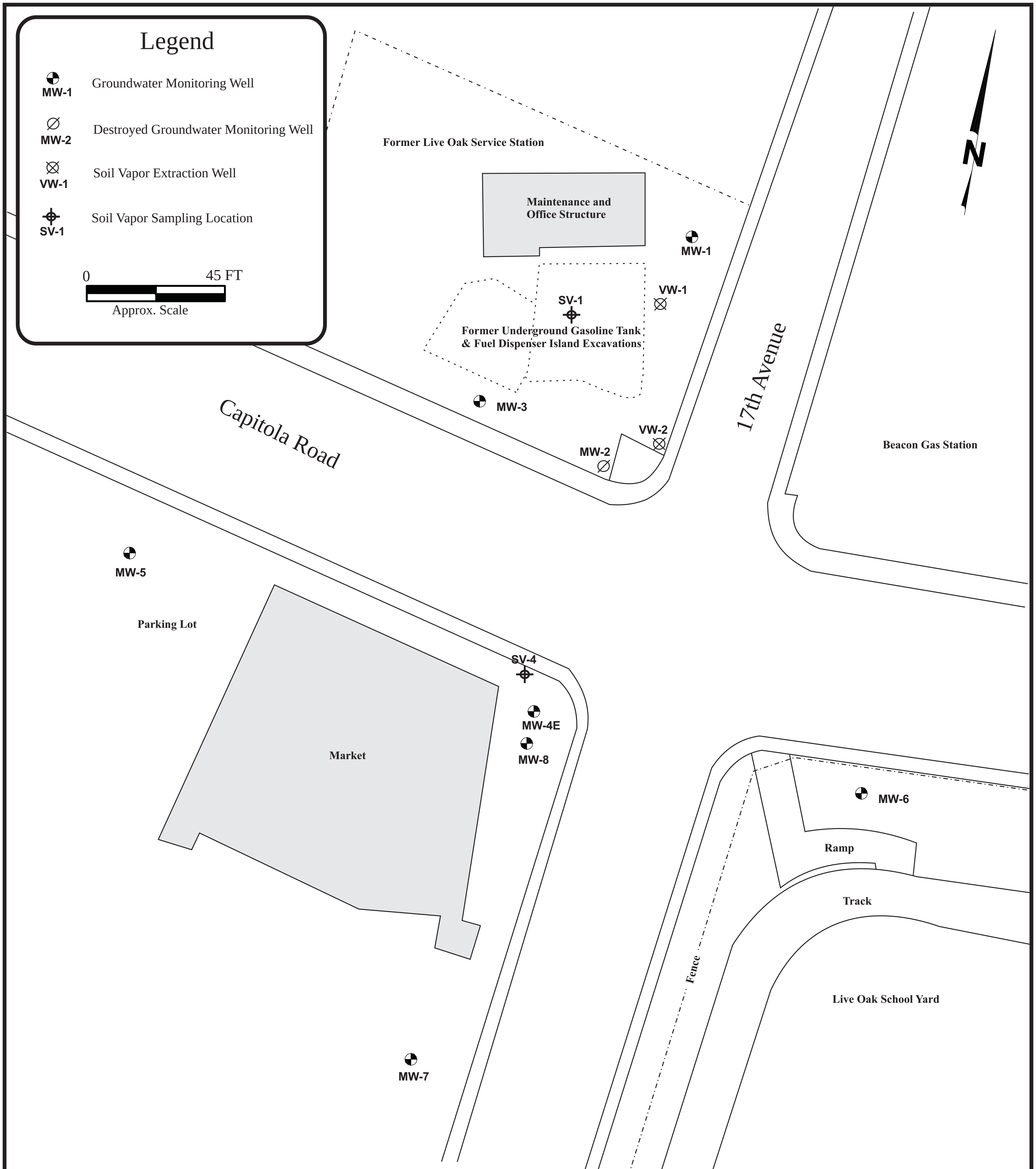
A+ Environmental Solutions, LLC

FORMER LIVE OAK SERVICE STATION
1671 CAPITOLA ROAD
SANTA CRUZ, CALIFORNIA

SITE VICINITY MAP

FIGURE

1



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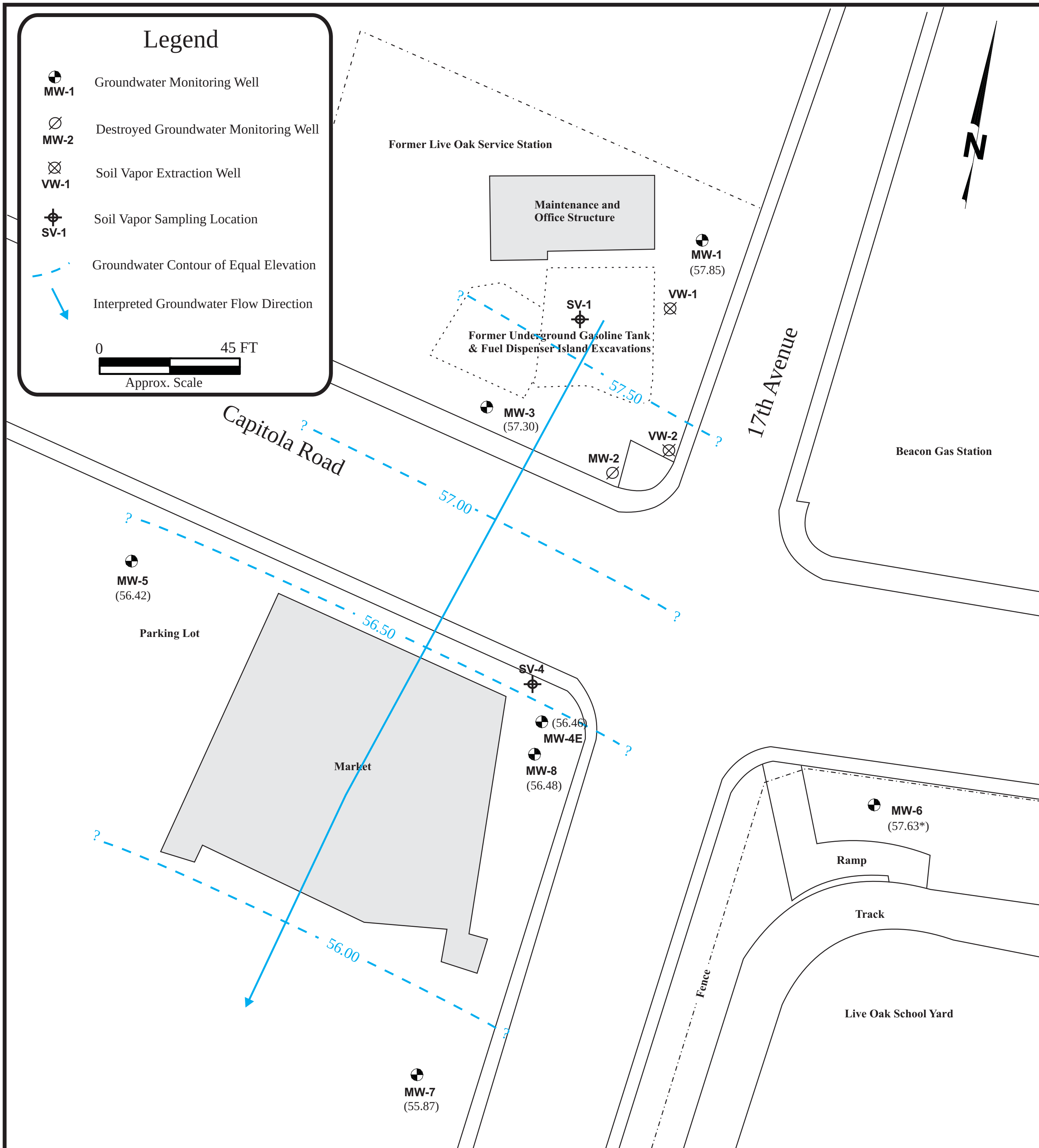
Former Live Oak Service Station
1671 Capitola Rd.
Santa Cruz, California

Site Map

Figure

2



NOTE: Estimated Groundwater Gradient = 0.007 ft/ft
*** = Groundwater elevation not included as part of potentiometric map due to anomalous reading.**

AES
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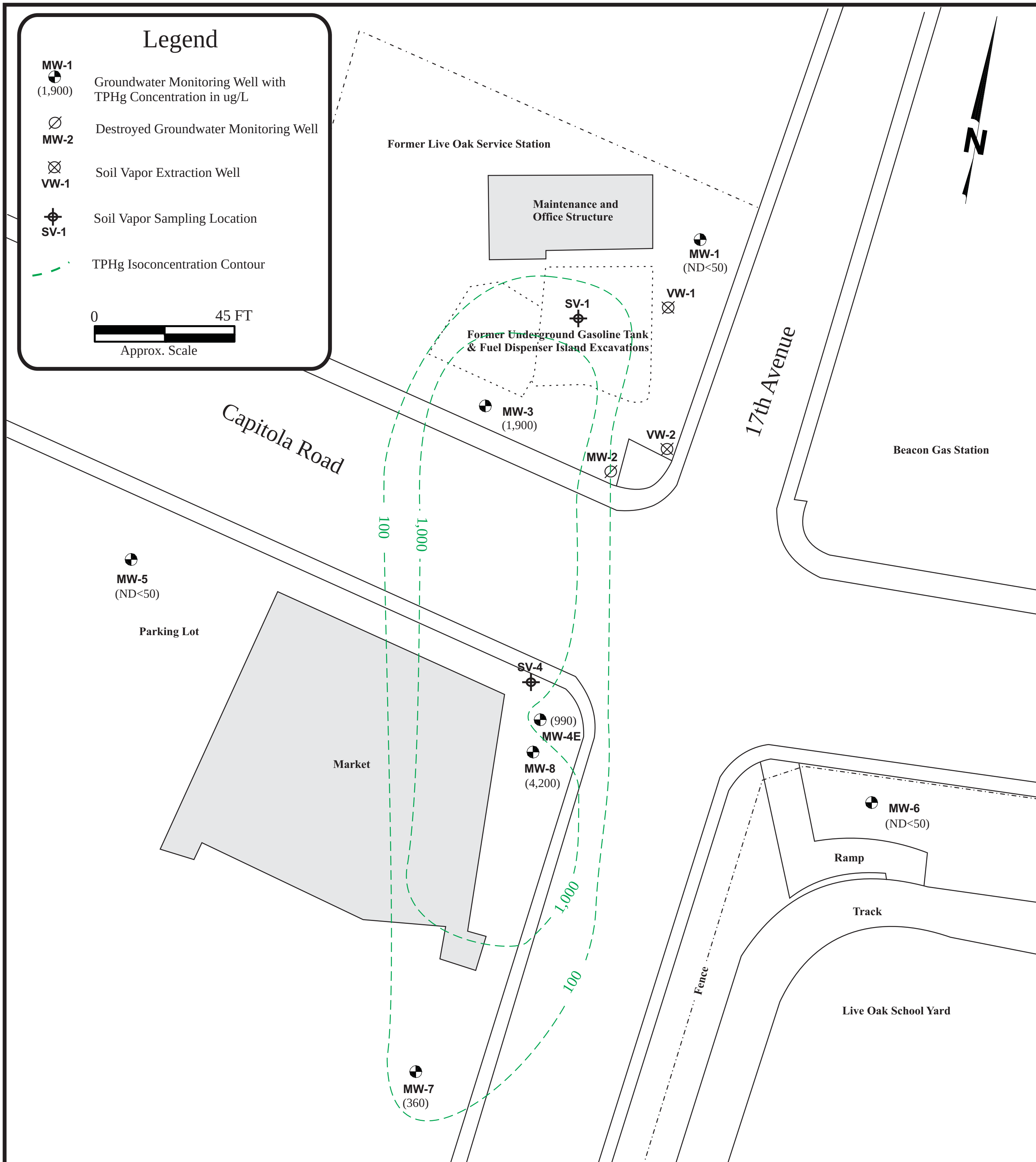
Former Live Oak Service Station
1671 Capitola Rd.
Santa Cruz, California

March 27, 2012
Groundwater Gradient Map

Figure

3



NOTE: All concentrations measured in ug/L (ppb)

AES
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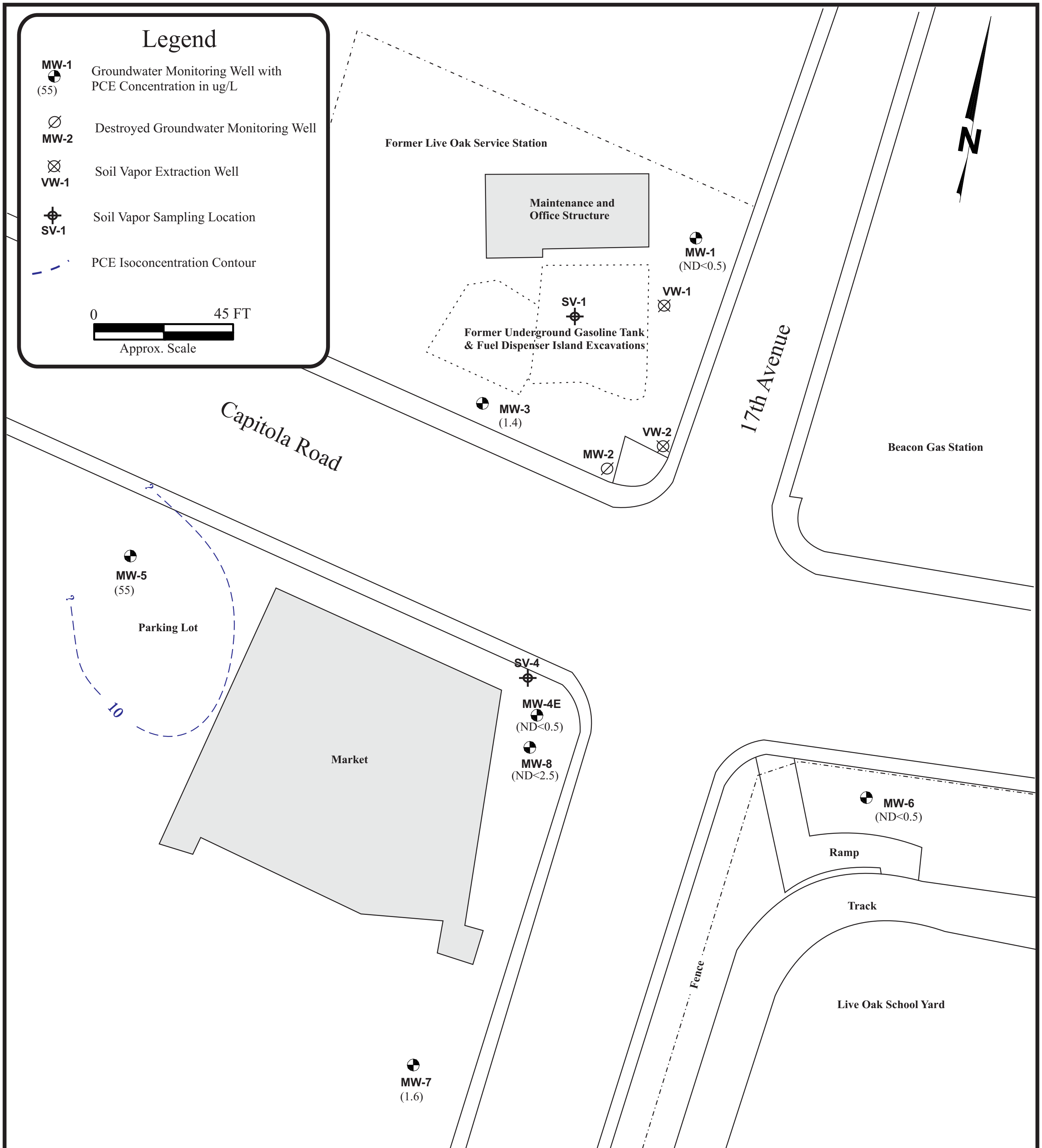
Former Live Oak Service Station
1671 Capitola Rd.
Santa Cruz, California

March 27, 2012
TPHg Isoconcentration Map

Figure

4



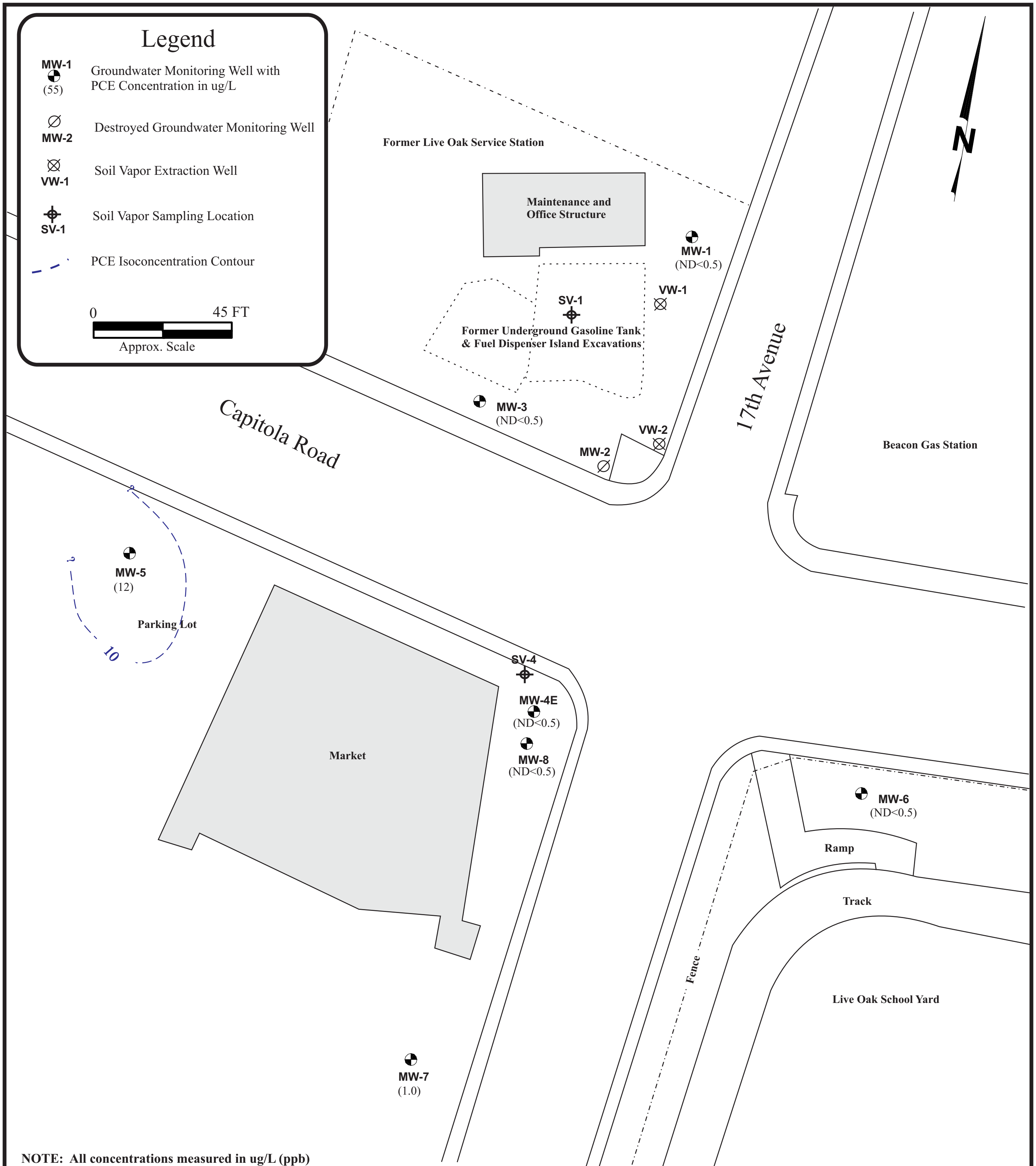
NOTE: All concentrations measured in ug/L (ppb)

A+ Environmental Solutions, LLC

Former Live Oak Service Station
1671 Capitola Rd.
Santa Cruz, California

March 27, 2012
PCE Isoconcentration Map

Figure 5A



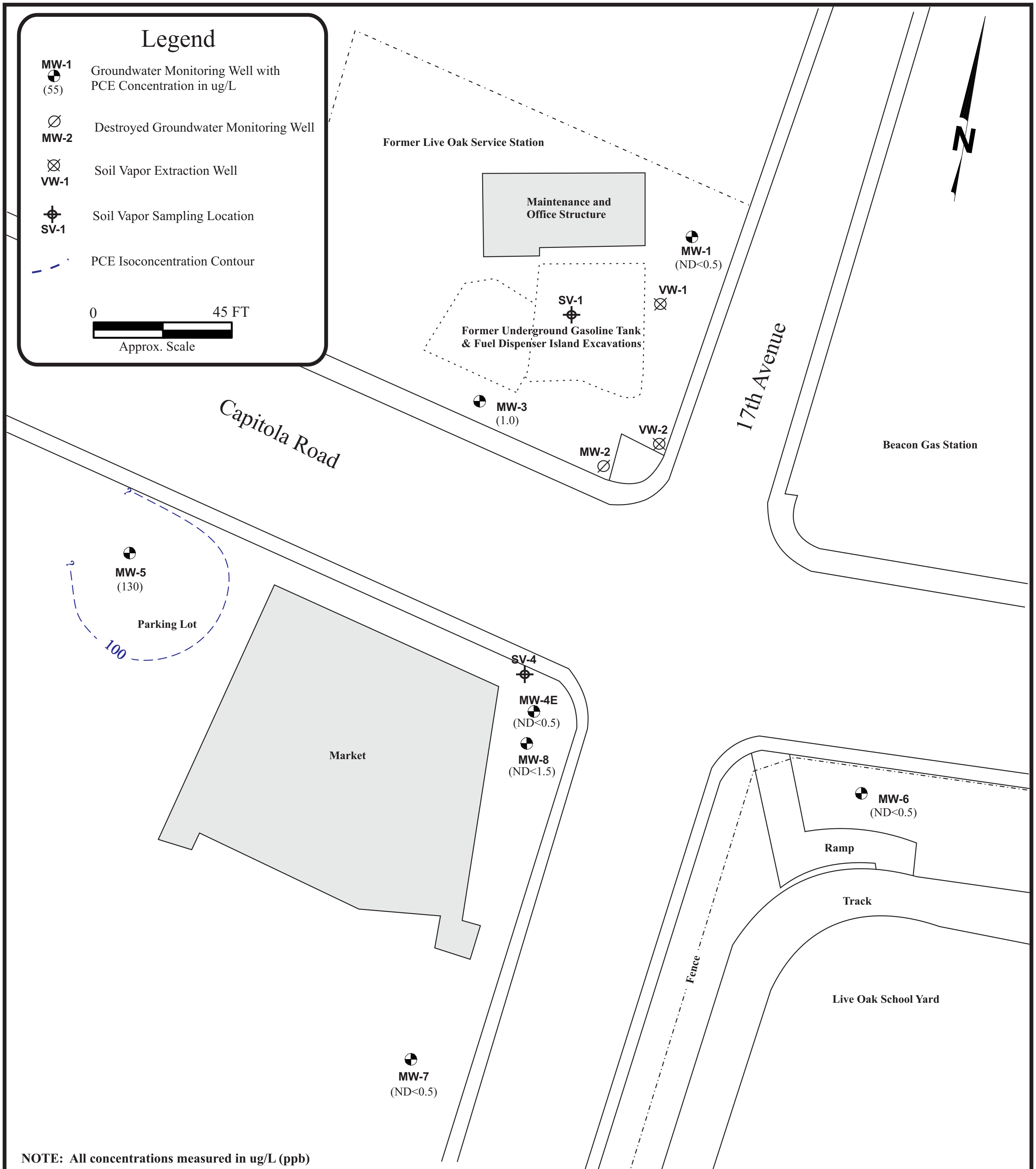
A+ Environmental Solutions, LLC

Former Live Oak Service Station
1671 Capitola Rd.
Santa Cruz, California

December 10, 2010
PCE Isoconcentration Map

Figure

5B



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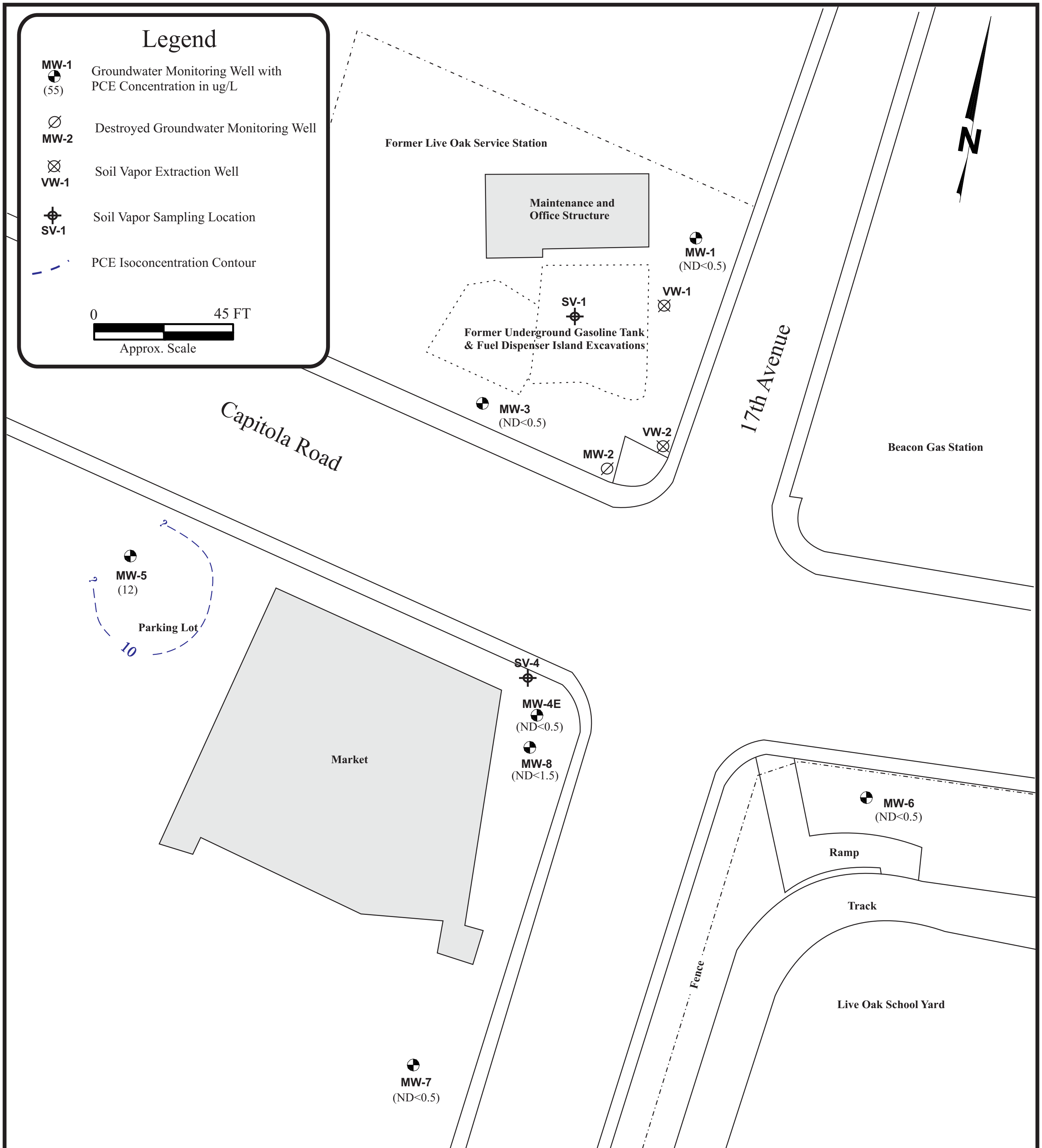
Former Live Oak Service Station
1671 Capitola Rd.
Santa Cruz, California

March 18, 2009
PCE Isoconcentration Map

Figure

5C



NOTE: All concentrations measured in ug/L (ppb)

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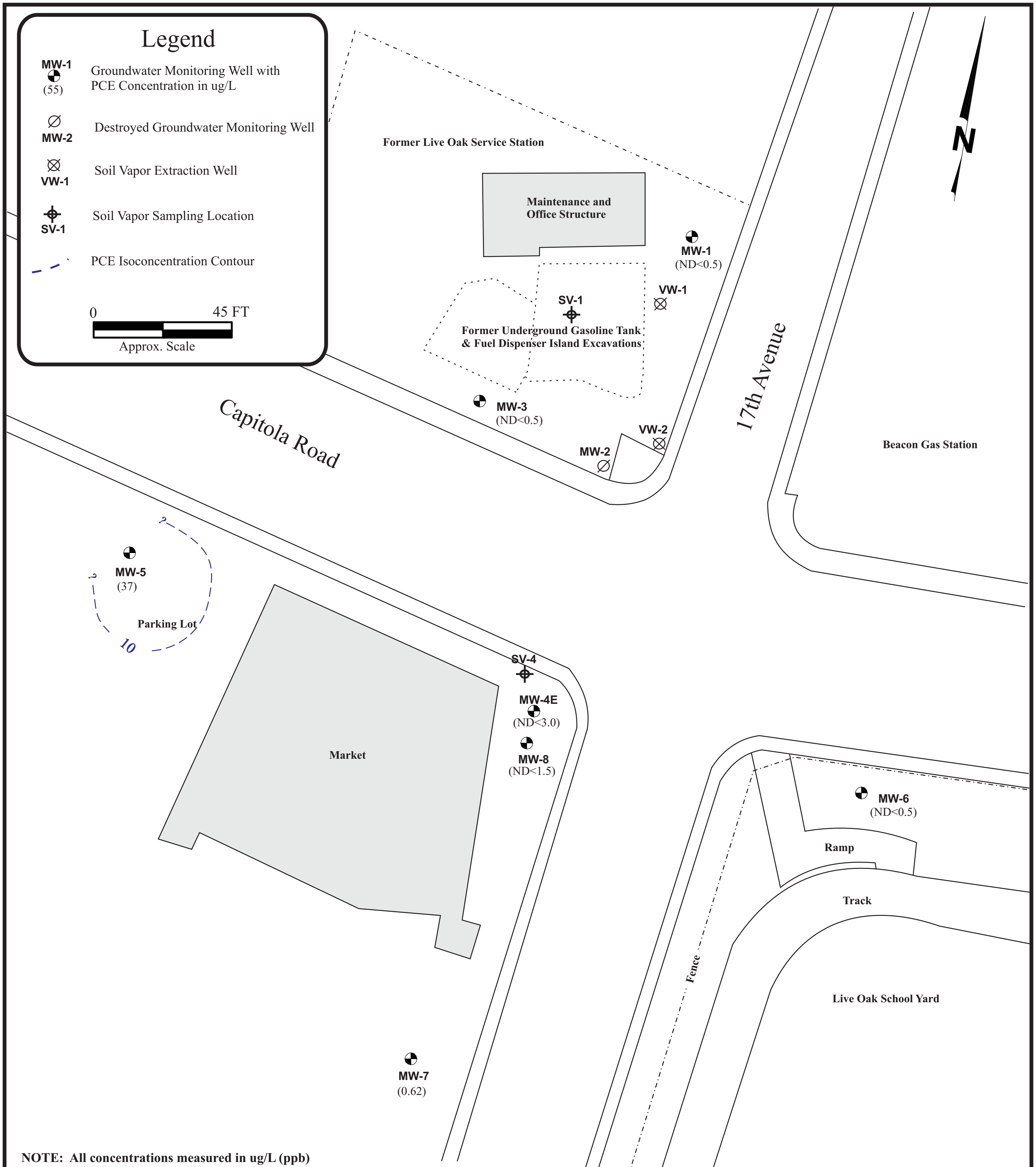
Former Live Oak Service Station
1671 Capitola Rd.
Santa Cruz, California

December 15, 2009
PCE Isoconcentration Map

Figure 5D



A+ Environmental Solutions, LLC

Former Live Oak Service Station
1671 Capitola Rd.
Santa Cruz, California

October 22, 2008
PCE Isoconcentration Map

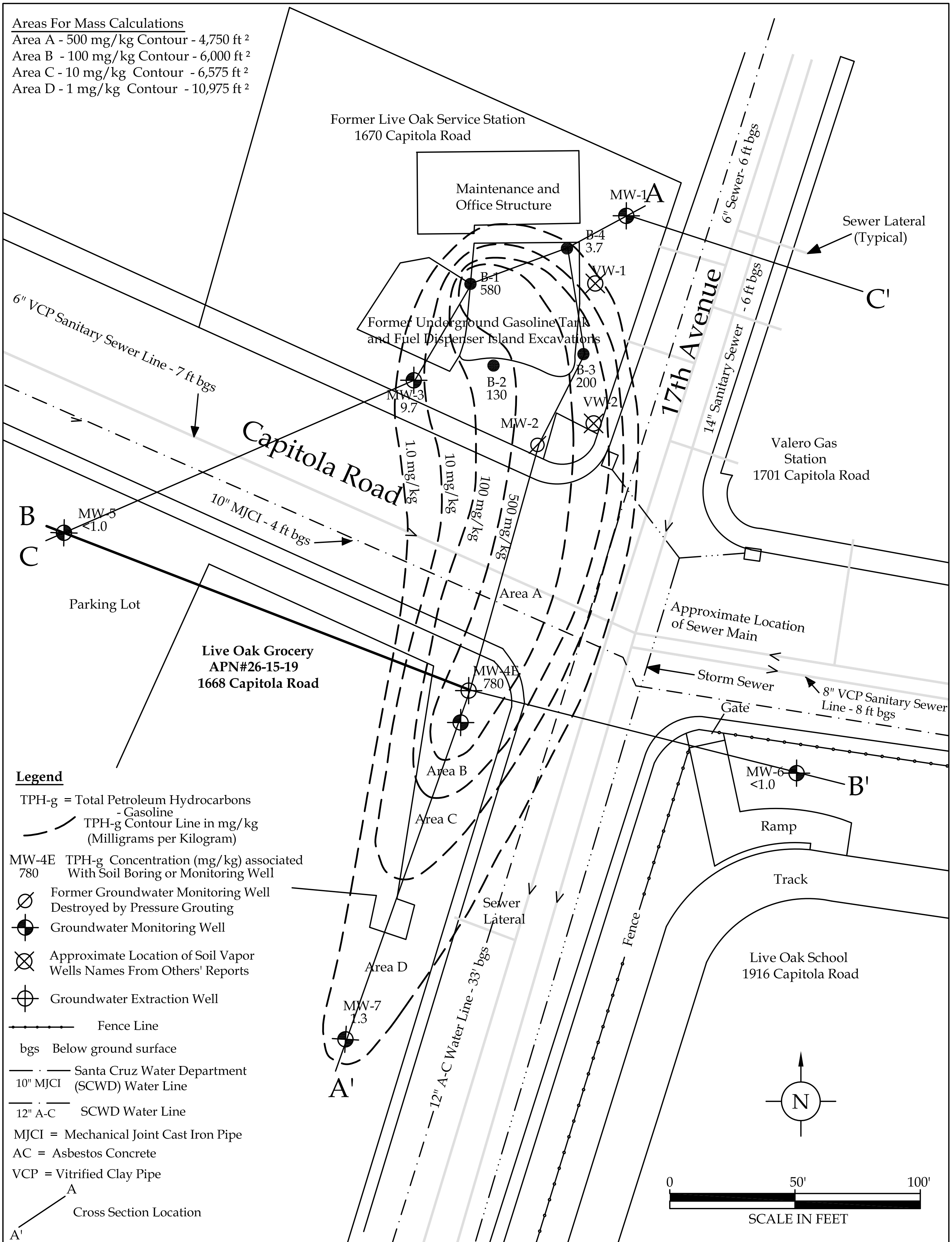
Figure

5E

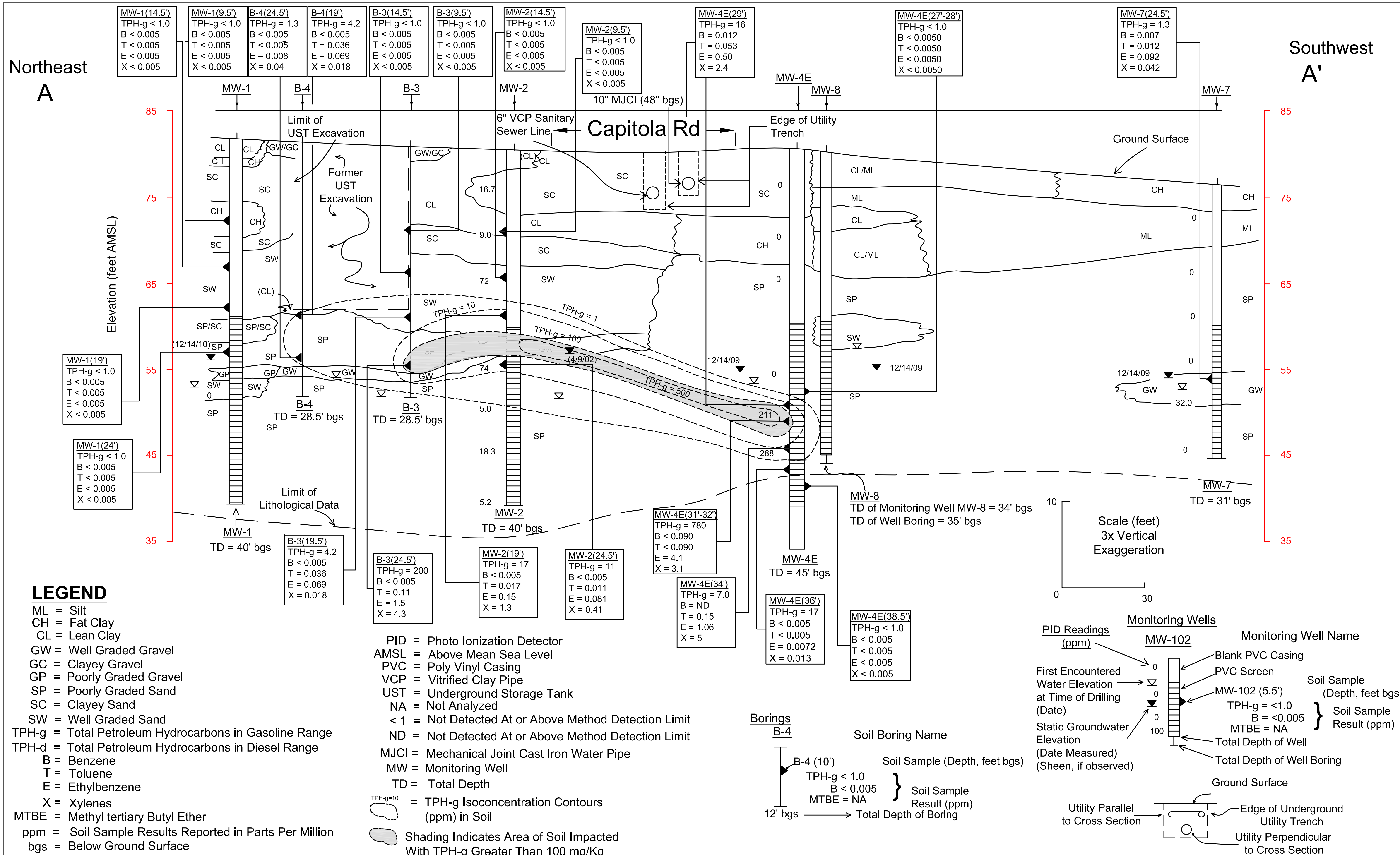
APPENDIX E

CROSS SECTIONS

A+ Environmental Solutions, LLC
Phone: 831-476-9200 ● Fax: 831-475-5322 ● 6898 Soquel Avenue, Santa Cruz, CA 95062
www.envir-solutions.com



Sorbed-Phase Hydrocarbon Distribution in Soil and Cross Section Location and TPH-g Contour Map Former Live Oak Service Station 1671 Capitola Road Santa Cruz, CA	**CLEARWATER GROUP**		
	Project No. **GP011**	Figure Date **6/11**	Figure **9**



Note:

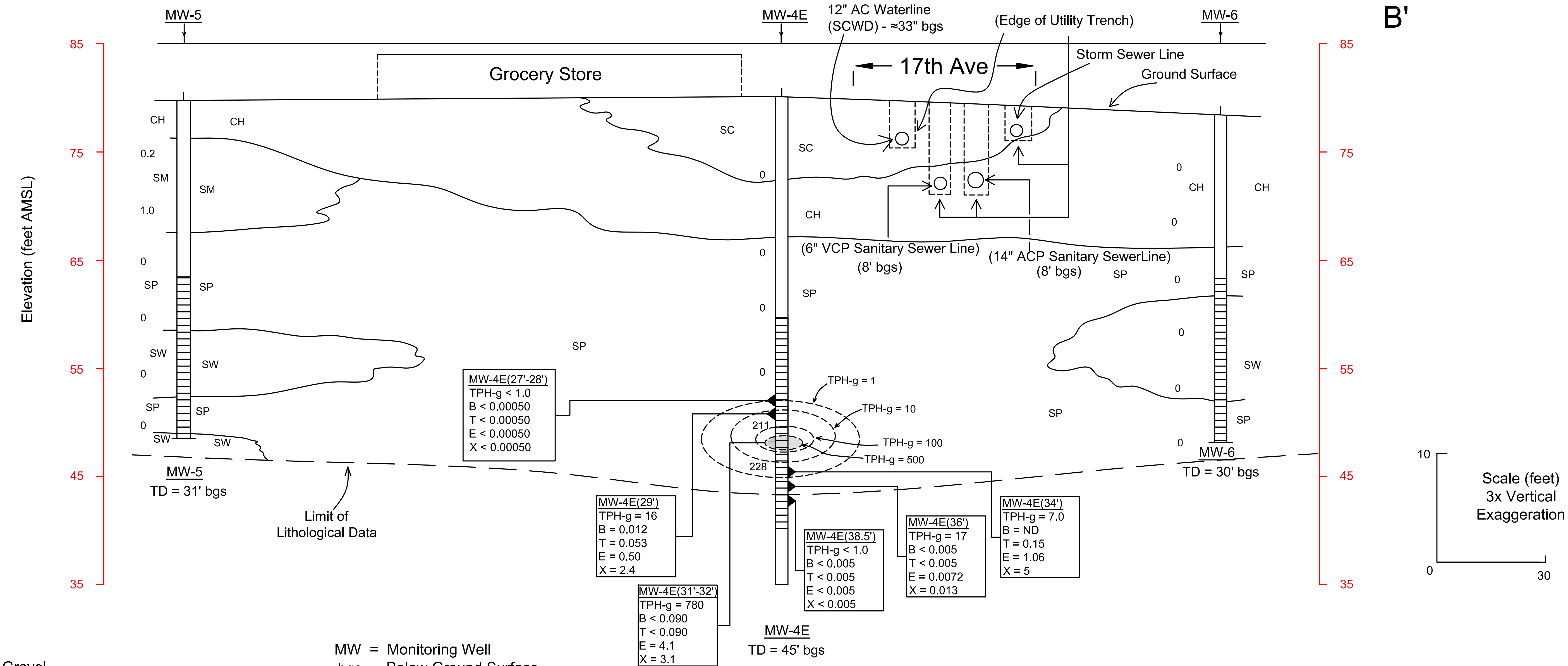
MW-4 converted from 2" Well to 4" Well on 8/12/2010, and depth extended to 45' bgs on 1/20/2011 with blank casing from 40' to 45' bgs. Well now referenced as MW-4E.

Cross Section A-A' Looking Southeast

Former Live Oak Service
1671 Capitola Road, Santa Cruz, CA

CLEARWATER GROUP

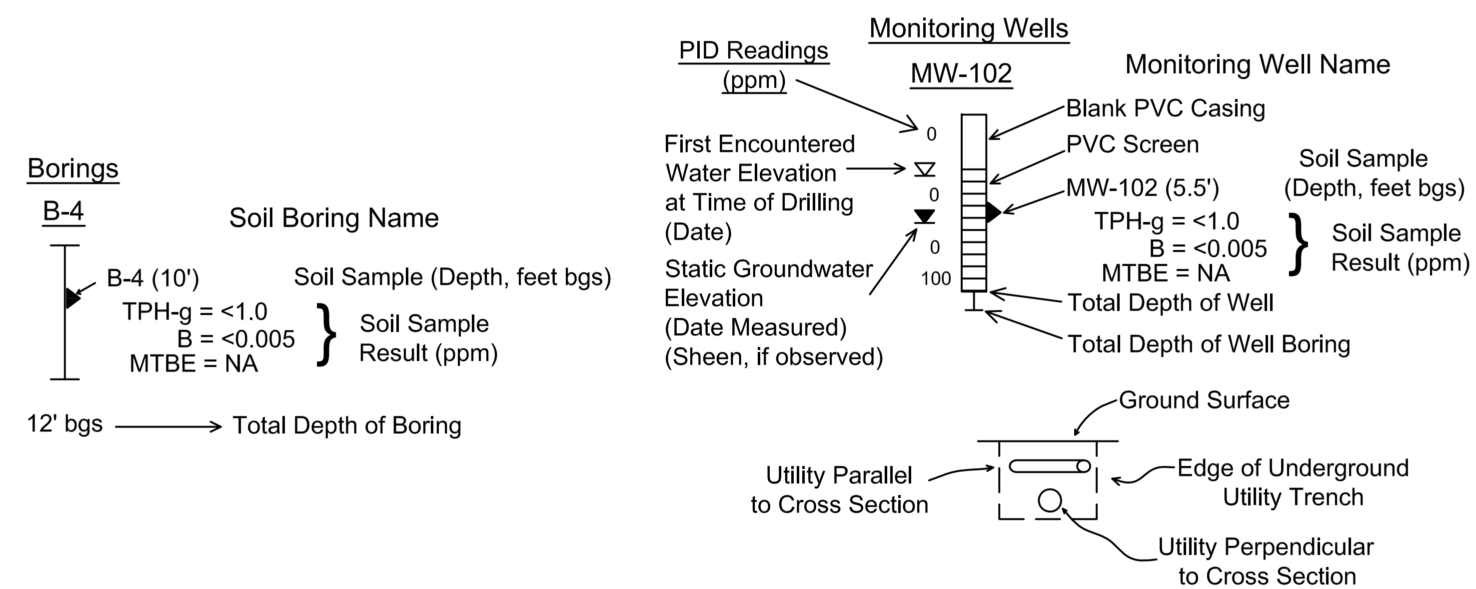
Project No.	Figure Date	Figure
GP011	6/11	10



LEGEND

ML = Silt
CH = Fat Clay
CL = Lean Clay
GW = Well Graded Gravel
GC = Clayey Gravel
GP = Poorly Graded Gravel
SP = Poorly Graded Sand
SC = Clayey Sand
SW = Well Graded Sand
TPH-g = Total Petroleum Hydrocarbons in Gasoline Range
TPH-d = Total Petroleum Hydrocarbons in Diesel Range
B = Benzene
T = Toluene
E = Ethylbenzene
X = Xylenes
MTBE = Methyl tertiary Butyl Ether
ppm = Soil Sample Results Reported in Parts Per Million

MW = Monitoring Well
bgs = Below Ground Surface
TD = Total Depth
PID = Photo Ionization Detector
AMSL = Above Mean Sea Level
PVC = Poly Vinyl Casing
AC = Asbestos Concrete Pipe
VCP = Vitrified Clay Pipe
UST = Underground Storage Tank
NA = Not Analyzed
< 1 = Not Detected At or Above Method Detection Limit
ND = Not Detected At or Above Method Detection Limit
TPH-g=10 = TPH-g Isoconcentration Contours (ppm) in Soil
Shading Indicates Area of Soil Impacted With TPH-g Greater Than 100 mg/Kg



Note:

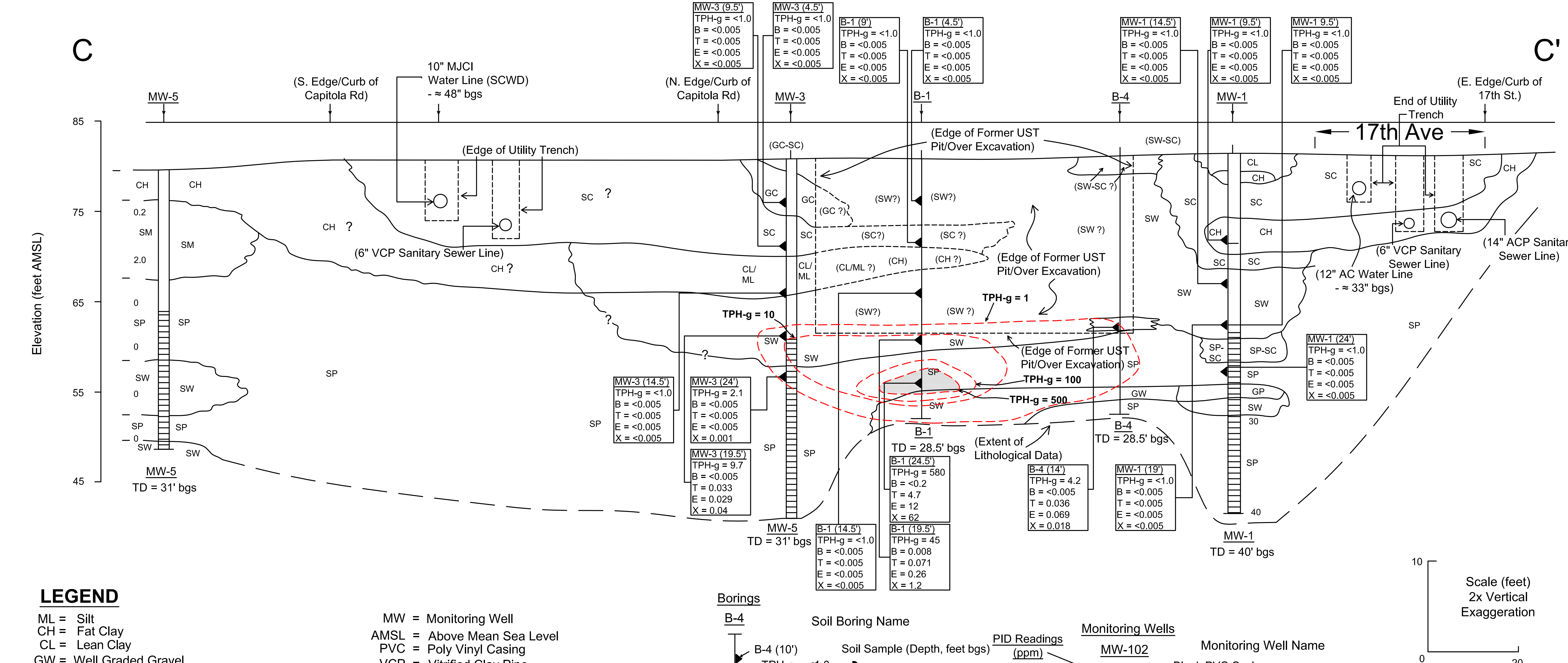
MW-4 converted from 2" Well to 4" Well on 8/12/2010, and depth extended to 45' bgs on 1/20/2011 with blank casing from 40' to 45' bgs. Well now referenced as MW-4E.

NOTE:
Subsurface utilities beneath the 17th St. are approximate from reading available sources researched.

Cross Section B-B' Looking Northeast

Former Live Oak Service
1671 Capitola Road, Santa Cruz, CA

CLEARWATER GROUP		
Project No. GP011	Figure Date 6/11	Figure 11



LEGEND

ML = Silt
CH = Fat Clay
CL = Lean Clay
GW = Well Graded Gravel
GC = Clayey Gravel
GP = Poorly Graded Gravel
SP = Poorly Graded Sand
SC = Clayey Sand
SW = Well Graded Sand
TPH-g = Total Petroleum Hydrocarbons in Gasoline Range
TPH-d = Total Petroleum Hydrocarbons in Diesel Range
B = Benzene
T = Toluene
E = Ethylbenzene
X = Xylenes
MTBE = Methyl tertiary Butyl Ether

MW = Monitoring Well
AMSL = Above Mean Sea Level
PVC = Poly Vinyl Casing
VCP = Vitrified Clay Pipe
AC = Asbestos Cement Pipe
MJCI = Mechanical Joint Cast Iron Pipe
UST = Underground Storage Tank
NA = Not Analyzed
< 1 = Not Detected At or Above Method Detection Limit
ND = Not Detected At or Above Method Detection Limit
bgs = Below Ground Surface
TD = Total Depth
PID = Photo Ionization Detector
ppm = Soil Sample Results Reported in Parts Per Million

TPH-g=10 TPH-g Iso-concentration Contours (ppm) in Soil

Shading Indicates Area of Soil Impacted With TPH-g Greater Than 100 mg/Kg

Borings

B-4 — Soil Boring Name
B-4 (10') — Soil Sample (Depth, feet bgs)
TPH-g = <1.0
B = <0.005
MTBE = NA
} Soil Sample Result (ppm)
12' bgs → Total Depth of Boring

Monitoring Wells

PID Readings (ppm)
MW-102 — Monitoring Well Name
Blank PVC Casing
PVC Screen
First Encountered Water Elevation at Time of Drilling (Date)
Static Groundwater Elevation (Date Measured) (Sheen, if observed)
MW-102 (5.5') — Soil Sample (Depth, feet bgs)
TPH-g = <1.0
B = <0.005
MTBE = NA
} Soil Sample Result (ppm)
Total Depth of Well
Total Depth of Well Boring

Ground Surface
Utility Parallel to Cross Section
Edge of Underground Utility Trench
Utility Perpendicular to Cross Section

Note:

MW-4 converted from 2" Well to 4" Well on 8/12/2010, and depth extended to 45' bgs on 1/20/2011 with blank casing from 40' to 45' bgs. Well now referenced as MW-4E.

NOTE:
Subsurface utilities beneath the Capitola Road and 17th Avenue are approximate from reading available sources researched.

Cross Section C - C'
Former Live Oak Service
1671 Capitola Road, Santa Cruz, CA

CLEARWATER GROUP		
Project No. GP011	Figure Date 06/11	Figure 12

APPENDIX F

SENSITIVE RECEPTOR SURVEY

1.) Private Well at 1390 Harper Street
2.) Live Oak Senior Center at 1777 Capitola Road
3.) Live Oak Elementary School at 1916 Capitola Road
4.) Private Water Wells at 2545 Capitola Road
5.) Private Water Well at 1045 17th Ave
6.) Private Water Well at 1965 Chanticleer Ave

2,000 Ft Radius Sensitive Receptor Survey Map Former Live Oak Service Station 1671 Capitola Road Santa Cruz, CA	**CLEARWATER GROUP**		
	Project No. **GP011**	Figure Date **6/11**	Figure **5**

Appendix B: Field Procedures

Appendix B: Field Procedures

Pre-Field Activities

All borings advanced during this investigation will be permitted and installed in accordance with state and local guidelines.

Prior to drilling, standard boring clearance procedures are followed to minimize the potential for encountering structures in the subsurface. Standard borehole clearance procedures include: (1) marking boring locations at the site and visually identifying, where possible, existing utilities; (2) notifying Underground Service Alert (USA) before any digging occurs at the Site; (3) reviewing boring locations with former Site operators, and/or obtaining and reviewing of any available site, as-built plans/drawings; (4) performing field review of USA Underground markings; (5) contract and conduct an underground utility survey, utilizing a reputable private underground utility locator to identify any utilities that are not cleared and/or marked by USA and if in question all borings will be carefully hand cleared using hand auger equipment and hand tools to approximately 5 feet below ground surface (bgs) the entire diameter of the drilling equipment to be used.

Sampling Overview

Soil, groundwater, and 'active' soil gas samples collected during the site investigation will be transported to Torrent Laboratory, Inc. (ELAP #1991) a California-licensed laboratory for analytical testing. Selected soil samples will be submitted to a geotechnical laboratory to conduct tests on the physical parameters of soil. The tables below summarize sample containers, preservation methods, holding times (Table C-1), and quality control/quality assurance (QA/QC) parameters for each quantity of proposed sample media (Table C-2).

Table C-1: Summary of Sample Containers, Preservation, and Holding Times

Analyte	Method	Container	Preservation	Maximum Holding Time
Soil Samples				
VOCs	8260B	Terra Core® Samplers	Cool to 4 ± 2° C	14 days
Groundwater Samples				
VOCs	8260B	4 x 40 mL Glass Vials, Teflon™ Cap	HCL, Cool to 4 ± 2° C	14 days

Analyte	Method	Container	Preservation	Maximum Holding Time
Passive Soil Gas Samples				
VOCs	8260C	Glass Vials with Sorbent Cartridges	None	30 days
Sub-Slab Soil Gas Samples				
VOCs	TO-15	1-L SUMMA® Canisters	None	30 days

Table C-2: Quality Assurance/Quality Control

Sample Category	Number of Locations	Total No. of Samples Analyzed	Media Type	QA/QC Samples		
				Duplicates[1]	Trip Blanks[2]	Equip. Blanks[3]
Confirmation Soil Borings	5	15	Soil	0	0	---
Grab-Groundwater	5	5	Water	0	1	---
Passive Soil Gas	30	30	Sorbent Cartridge	2	1	--
Active Sub-Slab Soil Gas[4]	4	4	Gas	1	0	---
Active Soil Gas	10	10	Gas	1	0	--

Notes:
1. Field duplicate numbers determined by number of primary samples selected for analysis, on basis of 1 duplicate per 10 samples. Field duplicates will only be collected for grab-groundwater, soil gas and sub-slab gas samples. Soil duplicates are not required to meet the data quality objectives of the proposed scope of work.
2. Trip blank numbers determined by number of days that samples will be collected and shipped for analysis of VOCs, on basis of 1 trip blank per day. Trip blanks are not required to meet the data quality objectives of the proposed scope of work.
3. Equipment blank numbers are determined by number of days that reusable downhole sampling equipment is expected to be used. This includes submersible sampling pumps, hand trowels, depth to water meters, and split-barrel samplers. There is no reusable downhole equipment used for any sample media during this site assessment. Equipment blanks are not required to meet the data quality objectives of the proposed scope of work.
4. All sub-slab gas probes will be installed as implants to below the building slab thickness of approximately 6 inches.

Passive Soil Gas Sampling

Passive soil gas (PSG) samplers will be deployed and collected during the site investigation and shipped to Beacon Environmental Services, Inc. (Department of Defense ELAP Accreditation #72690, Certificates L18-338 and L18-339) for analytical testing. The PSG samplers consist of a borosilicate vial containing two hydrophobic adsorbent cartridges, which is suspended within an aluminum tube at an approximate depth of 1 to 2 feet below ground surface (bgs). The vials have a mesh cap which allows soil gas to diffuse into the vial.

The cartridges adsorb volatile organic compounds present in the soil gas. The laboratory detection limit for each compound is determined by the length of time the sampler remains in the ground. Longer sampling times produce lower laboratory detection limits. For this investigation, a sampling time of 14 days is sufficient to achieve the required laboratory detection limit for comparing the results to the applicable environmental screening levels.

Trinity follows the field procedures prescribed by Beacon Environmental Service's document, Passive Soil Gas Testing: Standard for Site Characterization, which is included at as Appendix C.

Sub-Slab Soil Gas Probe Installation and Sampling

Trinity follows the Cox-Colvin & Associates, Inc., Vapor Pin™ Standard Operating Procedures for installation of sub-slab soil gas probes, which are included in Appendix D.

Soil gas samples from the sub-slab soil gas probes are collected in 1-liter SUMMA® canisters following the procedure outlined below. In accordance with the July 2015 Advisory *Active Soil Gas Investigations*, the sub-slab soil gas probes are allowed to equilibrate for at least 2 hours after installation prior to sampling, and three times the total volume of air within the sampling train and probe is purged from each sampling point prior to collecting a sample.

Sampling Set-up

Prior to sampling, the sampling technician dons a new pair of clean nitrile gloves.

Purge and sample SUMMA® canisters are connected in tandem to a sampling train that connects to the sub-slab gas probe with 1 to 2 feet of ¼-inch diameter Teflon™ tubing. The sub-slab soil gas sampling train is equipped with a 100- to 200 milliliter per minute (ml/min) flow regulator and a laboratory-supplied particulate filter.

A diagram of the soil gas sampling equipment schematic is included as Figure D-1.

Shut-In Testing

A shut-in test is conducted with the sampling train fully assembled and connected to the sampling probe/sampling location. The sampling train valve is closed, (to the sampling location) and the dedicated purge canister is used to evacuate air from the sampling train to a measured vacuum of about 30 ”Hg.[1] A laboratory-supplied calibrated vacuum gauge, sensitive to measure 0.5’’ Hg, is used to observe the vacuum within the sampling train for 10 minutes. If there is any observable loss of vacuum, the fittings and tubing are adjusted and the shut-in test process continues until the vacuum in the sample train does not

[1] Note that while the initial applied vacuum will decrease with each subsequent sample as long as the same canister is used to purge air from the probes, the principle and effectiveness of the shut-in test remains the same.

noticeably dissipate within the 10-minute timeframe. After a successful shut-in test, the sampling train remains in its current configuration and is not altered.

Purging

Purging is conducted after the shut-in test shows that there are no leaks in the sampling train. The purge canister valve and the valve on the downhole side of the particulate filter are opened and the time is recorded. The purge canister valve is closed after three volumes of air are purged from the sample apparatus and the probe. The purge volume is calculated based on the internal volume of the tubing and probe. The amount of air purged is measured based on the time that the flow-control orifice is opened, with a flow rate of 200 ml/min, and based on a discernable vacuum drop on the purge canister pressure gauge. The time at which purging is terminated is recorded. The flow rate is kept at greater than 10 ml/min, and the sample vacuum is maintained at less than 10" Hg if possible; otherwise low-flow conditions are noted and sampling at that probe is terminated.

Sub-Slab Soil Gas Sampling

Following the purging, the sample SUMMA® canister valve is opened to begin the sample collection. The time at which the sample collection begins and the initial vacuum in the sample canister is recorded.

Secondary leak testing is initiated at this point during the soil gas sampling by placing isopropyl alcohol wipes near each joint and connection in the sampling assembly, as well as at the top of the soil gas probe. Soil gas samples are analyzed for isopropyl alcohol by the laboratory to indicate whether any leaks occurred during sampling. Once the isopropyl alcohol wipes have been placed, the sampling technician carefully removes their gloves and dons new clean nitrile gloves in order to prevent cross-contamination which may result in a false positive detection of isopropyl alcohol in the sample.

The flow is maintained at 200-ml/min, and the sample canister is kept open until the canister pressure gauge indicates approximately -5" Hg remains inside the sample canister. The sample canister valve is closed and the time and final sample canister vacuum are recorded. The fitting on the sample canister is replaced with a laboratory-supplied brass cap.

The sample canisters are labeled and chain-of-custody maintained by recording the sample name, sample date, sample time, final vacuum, canister and flow controller serial numbers, initials of sample collector, and the compounds to be analyzed by a California state-certified laboratory. The sample canisters are stored in a container that blocks sunlight to the stainless steel canister and does not subject the air-tight canister to excessive changes in pressure and temperature. The sample canisters are delivered to the analytical laboratory via ground transportation under chain-of-custody protocol.

Passive Sub-Slab Soil Gas Sampling

Passive soil gas (PSG) samplers used for sub-slab soil gas sampling will be deployed and collected during the site investigation and shipped to Beacon Environmental Services, Inc. (Department of Defense ELAP Accreditation #72690, Certificates L18-338 and L18-339) for analytical testing. The PSG samplers consist of a borosilicate vial containing two hydrophobic adsorbent cartridges, which is installed below the building sub-slab at an approximate depth of 6-inches below bgs. The vials have a mesh cap which allows soil gas to diffuse into the vial. The cartridges adsorb volatile organic compounds present in the soil gas. The laboratory detection limit for each compound is determined by the length of time the sampler remains in the ground. Longer sampling times produce lower laboratory detection limits. For this investigation, a sampling time of 14 days is sufficient to achieve the required laboratory detection limit for comparing the results to the applicable environmental screening levels.

Trinity follows the field procedures prescribed by Beacon Environmental Service's document, Passive Soil Gas Testing: Standard for Site Characterization, which is included at as Appendix C.

Soil Boring - Soil Logging and Sampling

Boreholes will be advanced using the direct-push drill rig. The boring is drilled using Geoprobe® or similar direct-push drilling equipment. A pre-cleaned sampler with a clear acetate liner and drive rods (typically 2 ¼-inch diameter) is advanced for the purpose of collecting samples and evaluating subsurface conditions, the soil is typically continuously sampled as drilling tooling is advanced to depth. The sampler is advanced in intervals of 3 to 5 feet, then the rods and sampler are retracted and the acetate liner is removed from the sampler head for evaluation and sample collection by the onsite Trinity geologist. The sampler head is then cleaned, filled with a new acetate liner, inserted into the borehole, and advanced over the next sampling interval where the sample retrieval process is repeated.

After retrieval, each filled acetate liner is split open for examination and potential sampling of soils. The onsite Trinity geologist logs the soils including a physical description of observed soil characteristics (i.e. moisture content, consistency, obvious odor, color, photoionization detector [PID] readings, etc.), drilling difficulty, and soil type as a function of depth, in accordance with the Unified Soil Classification System (USCS).

Soils samples collected at 2-foot intervals are screened in the field for volatile organic compounds (VOCs) using a PID. The PID screening is conducted by placing approximately 30 grams from an undisturbed soil sample into a clean plastic zip-lock bag. The bag is sealed and left undisturbed for approximately 20 minutes to allow VOCs to off-gas into the headspace within the bag. The headspace within the bag is sampled with the PID probe tip, and the total VOC content within the headspace is measured in parts per million as isobutylene (ppm; volume/volume). The PID readings represent relative levels of organic vapors for the site conditions at the time of drilling. The PID readings are noted on the field logs.

In general, soil samples are preserved where changes in soil type or elevated PID readings are observed, or at a minimum of every 5 feet. Selected soil intervals are sampled directly from the acetate liner with a single-use plunger which removes a predetermined volume of soil. This sub-sample is extruded into laboratory-supplied Terra Core™ preservation vials following U.S. EPA Test Method 5035A sampling protocols (Appendix E), properly labeled, and then placed in an ice-filled cooler for transport to the laboratory under chain-of-custody documentation. The Terra Core™ vials are prepared with preservatives consisting of either sodium bisulfate solution or methanol. These samples are analyzed for volatile organic compounds.

Soil samples for dry weight analysis are taken from the soil core and placed into 4-ounce glass jars or plastic bags as directed by the analytical laboratory, labeled, and transported to the laboratory under chain-of-custody documentation. Soil samples for other analyses than VOCs and dry weight are collected by cutting the acetate liners into 1-foot or 0.5-foot sections and capping each end with Teflon™ sheets and plastic caps. The samples are labeled, preserved (if applicable), and transported to the laboratory under chain-of-custody documentation.

Grab-Groundwater Sampling

Once the total depth is achieved for the soil boring locations intended for grab-groundwater sample collection, a ¾-inch diameter polyvinyl chloride (PVC) pipe with approximately 5 feet of 0.010-inch factory-slotted screen is lowered into the open borehole. When static groundwater is reached, a groundwater sample is collected from within the temporary well casing using a peristaltic pump or check valve with new tubing at depths greater than 25 feet bgs. The samples will be pumped directly into laboratory-supplied containers appropriate for the desired analyses. The samples will be labelled and placed in an ice-filled cooler for transport to the laboratory under chain-of-custody documentation.

Borehole Abandonment

Following completion of the direct-push drilling, soil, and/or grab-groundwater sampling, each borehole is backfilled with neat cement grout, on and as needed basis boreholes will be abandoned by backfilling from the bottom up using tremie pipe or drill rods, and finished at the surface to match surrounding grade.

Investigation-Derived Waste

Investigation-derived waste (IDW) materials (soil and groundwater) are placed into properly labeled DOT 55-gallon drums or appropriate soil bins and sampled to determine the waste profile. A separate contractor transports the wastes to an approved disposal facility.

Appendix C: Field Procedures for Installation of Beacon Passive Soil Gas Samplers

PASSIVE SOIL GAS TESTING:

STANDARD FOR SITE CHARACTERIZATION

Beacon Environmental Services, Inc.
2203A Commerce Road
Suite 1
Forest Hill, MD 21050 USA

Beacon is the recognized leader in passive soil gas and air sampling

DoD ELAP, NELAP, and ISO/IEC 17025 Accredited Laboratory
NEFAP Accredited Field Sampling Organization
Accreditation No. 72690

PASSIVE SOIL GAS TESTING:
STANDARD FOR SITE CHARACTERIZATION

Background and Introduction

Passive soil gas surveys utilize adsorbent samplers that are emplaced subsurface to adsorb volatile and semivolatile organic compounds (VOCs and SVOCs) in soil gas without forcing the flow rate of gas, that can yield a more representative sample than active soil gas methods. Samplers are typically placed in a grid pattern to simultaneously sample trace levels of compounds in soil gas that originate from contamination in soil or groundwater. By sampling all locations at the same time, the temporal variations in soil-gas concentrations that are known to occur daily and even hourly are normalized. In addition, the spatial variability of contamination is better defined with a passive soil gas survey because the lower sampling and analytical costs of the method allow for more locations to be sampled than normally would be with a fixed budget. Passive soil gas (PSG) methods have been demonstrated to be more sensitive and reproducible than active soil gas methods and are able to target a broad range of organic compounds from vinyl chloride to polynuclear aromatic hydrocarbons (PAHs) and other SVOCs.

The analytical results for a passive soil gas method are presented in units of mass (e.g., nanograms of each individual compound) for comparison between sample locations to identify source areas, identify the potential for vapor intrusion, to delineate the lateral extent of contamination, including migration pathways, and to monitor remediation programs. When requested, the mass measured (ng) can be converted to a concentration by dividing the mass (ng) by the sampler uptake rate (ml/min) and the sampling period (min), which is then multiplied by a value of 1,000 to convert ng/ml to ug/m^3. The Beacon PSG Sampler has verified uptake rates when sampling in air for a suite of chlorinated and BTEX compounds. For soil gas sampling, the concentrations reported represent the concentration of the identified compounds under steady state (natural) conditions by passive sampling, as opposed to active sampling with a pump or evacuated canister that may create a momentary vacuum in the soil during the time of sampling. If the soils at the site have low porosity, the formation itself could limit transport of soil gas to the samplers resulting in the reported concentration being biased low. However, the Beacon sampler has a low and controlled uptake rate to limit this bias from occurring.

Passive soil gas (PSG) results are based on a higher level of QA/QC than can be achieved with other field screening methods. Measurements are based on a five-point initial calibration with the lowest point on the calibration curve at or below the practical quantitation limit of each compound. Internal standards and surrogates are included with each analysis – per EPA Method 8260C – to provide proof of performance that the system was operating properly for each sample and to provide consistent reference points for each analysis, which enables an accurate comparison of measured quantities. Trip blanks are analyzed with each batch of samples and because two sets of hydrophobic adsorbent cartridges are provided in each Sampler, duplicate or confirmatory analyses can be performed for any of the sample locations. A representative list of compounds that can be targeted with passive soil gas surveys is provided in **Table 1**.

Table 1
Passive Soil-Gas Survey
Representative List of Target Compounds

TPH C_4-C_9	Chlorobenzene
TPH C_{10}-C_{15}	Ethylbenzene
Vinyl Chloride	p & m-Xylene
1,1-Dichloroethene	Bromoform
Methylene Chloride	1,1,2,2-Tetrachloroethane
1,1,2-Trichlorotrifluoroethane (Freon 113)	o-Xylene
trans-1,2-Dichloroethene	1,2,3-Trichloropropane
Methyl-t-butyl ether (MTBE)	Isopropylbenzene
1,1-Dichloroethane	1,3,5-Trimethylbenzene
cis-1,2-Dichloroethene	1,2,4-Trimethylbenzene
Chloroform	1,3-Dichlorobenzene
2,2-Dichloropropane	1,4-Dichlorobenzene
1,2-Dichloroethane	1,2-Dichlorobenzene
1,1,1-Trichloroethane	n-Butylbenzene
1,1-Dichloropropene	1,2,4-Trichlorobenzene
Carbon Tetrachloride	Naphthalene
Benzene	Hexachlorobutadiene
1,2-Dichloropropane	Trichlorobenzenes
Trichloroethene	2-Methylnaphthalene
1,4-Dioxane	Tetrachlorobenzenes
1,1,2-Trichloroethane	Acenaphthylene
Toluene	Acenaphthene
1,3-Dichloropropane	Pentachlorobenzene
1,2-Dibromoethane (EDB)	Hexachlorobenzene
Tetrachloroethene	Phenanthrene
1,1,1,2-Tetrachloroethane	Anthracene

Note: Additional compounds may be targeted to meet project specific requirements.
The reporting quantitation level (RQL) for each compound is 25 nanograms (ng) and the RQL for TPH is 5,000 ng; however, the demonstrated limit of quantitation (LOQ) for each compound is typically 10 ng.

2203A Commerce Road, Suite 1, Forest Hill, MD 21050 USA ph: 1-410-838-8780 www.beacon-usa.com

The following document is broken into two separate parts:

1. General Overview of Passive Soil Gas Investigation for Site Characterization
2. Step-by-Step Passive Soil Gas Sampler Installation and Retrieval

For the complete site characterization, Beacon Environmental recommends a passive soil gas survey be performed followed by a limited and focused soil and/or groundwater sampling program to measure the concentrations of identified compounds. The primary purpose of this document is to describe the methods and procedures used to perform a passive soil gas investigation.

Part 1: General Overview of Passive Soil Gas Investigation for Site Characterization

1.0 Survey Design

The survey design varies depending on the amount of historical and other site information that is available prior to initiating the passive soil gas (PSG) survey. Typically an unbiased grid is established across the site with additional biased sample locations to target specific features. The spacing between sample locations is dependent upon the expected depth of the chemicals of concern (CoC), the soil types, and the size of the area to be investigated. Generally, a grid with 25-foot spacing between sample locations is used to identify source areas, but the actual spacing will be dependent additionally on the size of the area of investigation and the project budget. Wider grids and transects are used to track groundwater contamination. Global positioning system (GPS) equipment can be used to collect the sample location coordinate data.

Beacon Environmental provides a BESURE Sample Collection Kit™ with detailed instructions to allow samples to be collected by an environmental field technician. Following collection in the field, the samplers are returned to Beacon Environmental's laboratory for analysis using thermal desorption-gas chromatography/mass spectrometry (TD-GC/MS) instrumentation following EPA Method 8260C. A comprehensive survey report is provided by Beacon Environmental that includes results in tabular form as well as on color isopleth maps showing the distribution of compounds identified in the investigation (see **Figure 1** below).

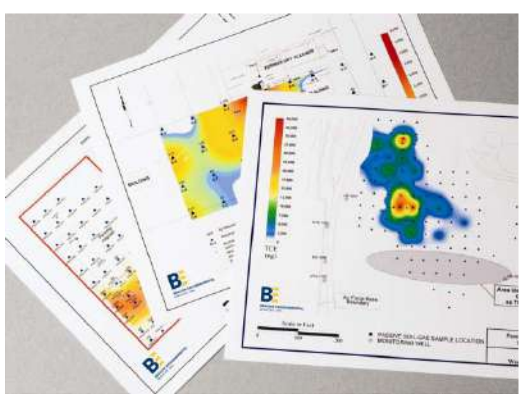


Figure 1 – Example Color Isopleth Maps

2.0 Soil-Gas Sampling Procedures

To perform the soil-gas investigation, Beacon Environmental provides a BESURE Sample Collection Kit™ with all the materials necessary to collect the requested number of soil-gas samples. To collect soil-gas samples, an approximately one-inch diameter hole is advanced to the appropriate depth to meet the objectives of the survey (e.g., one to three feet). The PSG Sampler (which contains two sets of ***hydrophobic adsorbent*** cartridges) is installed in the hole and covered with an aluminum foil plug and soil to seal the sampler in the ground. The adsorbent cartridges used by Beacon Environmental are hydrophobic, which allows the samplers to be effective even in water-saturated conditions. Extensive empirical evidence, which is supported by a government study, has proven that hydrophobic adsorbents work perfectly well in high moisture conditions and should not be encased by a hydrophobic membrane.

For locations covered by asphalt or concrete surfacing, an approximately 1 ½-inch diameter hole is drilled through the surfacing to the underlying soils. A ½" to 1" diameter drill bit can then be used to advance the hole to a three foot depth to increase the sensitivity of the method. The upper 12 inches of the hole is sleeved with a sanitized metal pipe provided in the Kit. After the Sampler is installed inside the metal pipe, the hole is patched with an aluminum foil plug and a thin concrete patch to effectively protect the sampler.

The samplers are exposed to subsurface gas for approximately three to 14 days, with the exact length of time appropriate to meet the objectives of the survey. The sampler is shipped to the site with a length of wire wrapped around the vial and twisted around the shoulder of the vial to expedite retrieval from the ground. Following the exposure period, the Samplers are retrieved and shipped to Beacon Environmental's laboratory for analysis. It is not necessary to use ice or preservatives during shipment; however, the samplers are sealed and shipped under established chain-of-custody procedures. Trip blanks, which remain with the other samples during preparation, shipment, and storage, are included at a typical rate of five percent of the total number of field samples. **Figure 2** shows a PSG Sampler as it looks when received in the BESURE Kit™.

Figure 2 – Beacon PSG Sampler

A two-person team can install approximately 50 to 100 samplers per day depending on the number of sample locations that are covered with asphalt, concrete, or gravel surfacing. For retrieval of the Samplers, one person can retrieve approximately 50 samplers per day and patch the holes through the surfacing. **Figure 3** shows installation through asphalt and grass surfaces, respectively.

Figure 3 — Installation of Samplers with Beacon Environmental's BESURE Kit™

The amount of days required to complete the installation and retrieval procedures is dependent upon the number of personnel deployed for the execution of the fieldwork, weather conditions, and health and safety considerations.

3.0 Analytical Procedures

A chain-of-custody accompanies the field samples at all times from the time the samples are collected until final analysis. BESURE Kits™ are shipped with tug-tight custody seals to ensure that samplers are not tampered with during transport (see **Figure 4**). Once samples are received at the laboratory, the sample custodian receives the samples and logs the samples into the laboratory's Sample Receipt Log.

Figure 4 – BESURE Sample Collection Kit™

Beacon Environmental's laboratory is maintained in a safe and secure manner at all times. The facility is locked when not occupied and is monitored for fire and unauthorized access. Beacon Environmental personnel escort all visitors at all times while inside the facility. Neither soil nor water analyses are performed at Beacon Environmental, so no solvents are stored or used that can create background contamination problems as experienced by wet labs. This ensures that a clean laboratory environment is maintained for trace analyses.

Soil gas samples are analyzed by Beacon Environmental using thermal desorption-gas chromatography/mass spectrometry (TD-GC/MS) instrumentation, following EPA Method 8260C procedures. Samples are routinely analyzed for a list of approximately 40 compounds, which can additionally include total petroleum hydrocarbons (TPH). Results are based on an ***initial five-point calibration***. In addition, a BFB tune is performed daily and a method blank is run following the daily calibration verifications. ***Internal standards and surrogates*** are included with each sample analysis. The laboratory's reported quantitation level (RQL) for each of the targeted compounds is 10 or 25 nanograms (ng); however, the limit of quantitation (LOQ) is 10 ng and the limit of detection (LOD) is 5 ng. MDL studies are performed, as well. As an option, tentatively identified compounds (TICs) can be reported for each sample, with the results based on the closest internal standard to the TIC.

Beacon Environmental is known for providing the highest level of accuracy and quality assurance and quality control (QA/QC) procedures for the analysis of soil gas samples in the industry. The table below summarizes these analytical procedures.

Description	**Included**
Analysis by thermal desorption-gas chromatography/mass spectrometry (TD-GC/MS) following EPA Method 8260C - Accredited	√
Analytical results based on 5-point initial calibration	√
MDLs are based on a seven replicate study with contiguous analyses	√
Limit of Detection (LOD) and Limit of Quantitation (LOQ) studies performed quarterly	√
Internal standards and surrogates included with each run	√
BFB tunes (5 to 50 nanograms through GC, per method)	√
Continuing calibration checks and method blanks	√

Analyses of the samples are performed at Beacon Environmental's laboratory using state-of-the-art instruments that are listed below. The Markes thermal desorption instruments outperform other older thermal desorption equipment, which cannot target as broad a range of compounds with as much sensitivity or accuracy.

- Agilent 7890 Gas Chromatograph / 5975 Mass Spectrometer,
- Markes UltrA autosampler and Unity thermal desorber,
- Markes TD100 and TD100xr, and
- Markes Mass Flow Controller Module.

4.0 Reporting

Following analysis and a thorough data review, a comprehensive survey report is provided that contains:

- project objectives,
- the investigation plan,
- the QA/QC program and findings,
- laboratory data,
- color isopleth maps showing the distribution of detected compounds,
- field procedures,
- laboratory procedures,
- Field Deployment Reports, and
- Chain-of-Custody documentation.

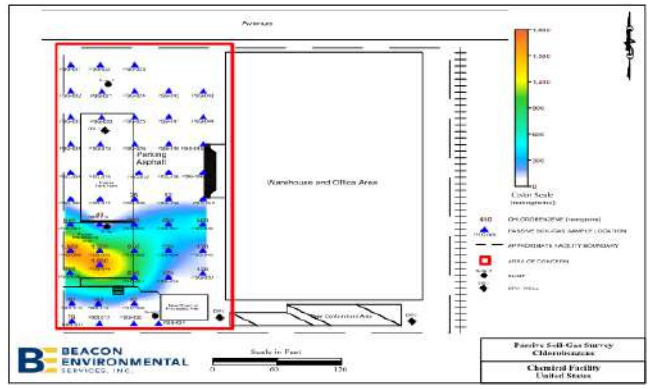


Figure 5 – Example Color Isopleth Map

Beacon Environmental requests a CAD drawing of the site is provided with coordinate data for each location to facilitate creation of color isopleth maps. BEACON can provide the color isopleth maps as layers for use with CAD software or provide data files of the contours for use with GIS software. Beacon Environmental provides post survey support to assist in interpreting the data, when requested.

Biography of Author

Harry O'Neill is the President of Beacon Environmental Services and has managed soil gas and vapor intrusion investigations for more than 25 years, working on federal, state, and commercial projects throughout the United States, as well as internationally across six continents. Under his direction since 1999, Beacon Environmental has achieved DoD ELAP, NELAP, and ISO/IEC 17025 accreditation for the analysis of soil gas and air samples to target trace concentrations of organics using sorbent samplers. In addition, Mr. O'Neill oversaw the implementation of the quality program that enabled Beacon to become the first National Environmental Field Activities Program (NEFAP) accredited field sampling and measurement organization (FSMO) in the United States, and the company's accreditation is for the collection of soil gas and air samples. Mr. O'Neill has been on the forefront of the acceptance of passive sampling technologies at the national and international level and has managed the implementation of thousands of soil gas and air sampling surveys. He is a member of AWMA, ITRC, and ASTM, and is the lead author of ASTM Standard D7758: *Standard Practice for Passive Soil Gas Sampling in the Vadose Zone* and has published and presented findings throughout the United States, as well as internationally across four continents as an invited speaker. Mr. O'Neill can be contacted at Harry.ONeill@Beacon-usa.com or by phone at 1-410-838-8780.

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Part 2: PSG Sampler Step-by-Step Installation and Retrieval Procedures

PSG Sampler Installation

1. At each survey point, clear vegetation as necessary and, using a hammer drill and drill bit (or comparable equipment), create a 1”- to 1½”-diameter hole approximately 12 inches deep, but can be as shallow as 6 inches. When appropriate, use a ½” to 1” diameter drill bit to extend the hole to a three foot depth. Note: In areas of very organic topsoil or landscaped areas (*i.e.*, mulched areas, gardens, etc.) it is important to get beneath the organic soil layer to the underlying soil below. For locations covered with asphalt or concrete, an approximately 1½”-diameter hole is drilled through the surfacing to the underlying soils and the hole is sleeved with a 12” long pre-cleaned, aluminum pipe provided in the BeSure Sample Collection Kit. The pipe is then pushed or tapped ½” to 1” into the base of the hole using a hammer and tapping dowel also provided in the Kit.

2. After the hole is created, remove a Beacon PSG Sampler (a rugged, borosilicate glass vial containing two sets of ***hydrophobic adsorbent cartridges***) and unwind the retrieval wire wrapped around it. Holding the capped end of the vial in one hand, pull the wire tight (to straighten it) with the other hand. Remove the solid cap on the Sampler Vial and replace it with a Sampling Cap (a one-hole cap with a screen meshing insert). Store the solid cap in the Cap Storage Container.

3. Lower the Sampler with the screened-capped-end pointing down into the hole. If the hole was created to a greater depth it is only necessary to suspend the sampler in the upper portion of the hole because compounds in soil gas that enter the hole will migrate up to the sampler. With the retrieval wire extending from the hole, plug the top of the hole with aluminum foil and use a hammer to collapse the soils above the foil plug. Coil the wire and lay it flat on the ground surface. For those locations through concrete or asphalt, lower the Sampler into the aluminum pipe and bend the end of the wire over the top of the pipe so that the coil of wire hangs over the top and outside the pipe. Next, plug the top of the hole with a wad of aluminum foil and a thin concrete patch (approximately ¼” thick) to effectively seal the Sampler in the ground. **Figure 6** depicts sampler installation options.

4. Close the Kit, and on the Chain of Custody record: (a) sample-point number; (b) date and time of emplacement; and (c) other relevant information (*e.g.*, soil type, vegetation, proximity to potential source areas). Be sure to mark the sample location and take detailed notes (*i.e.*, compass bearings and distances from fixed reference points or GPS coordinates).

5. Move to next location.

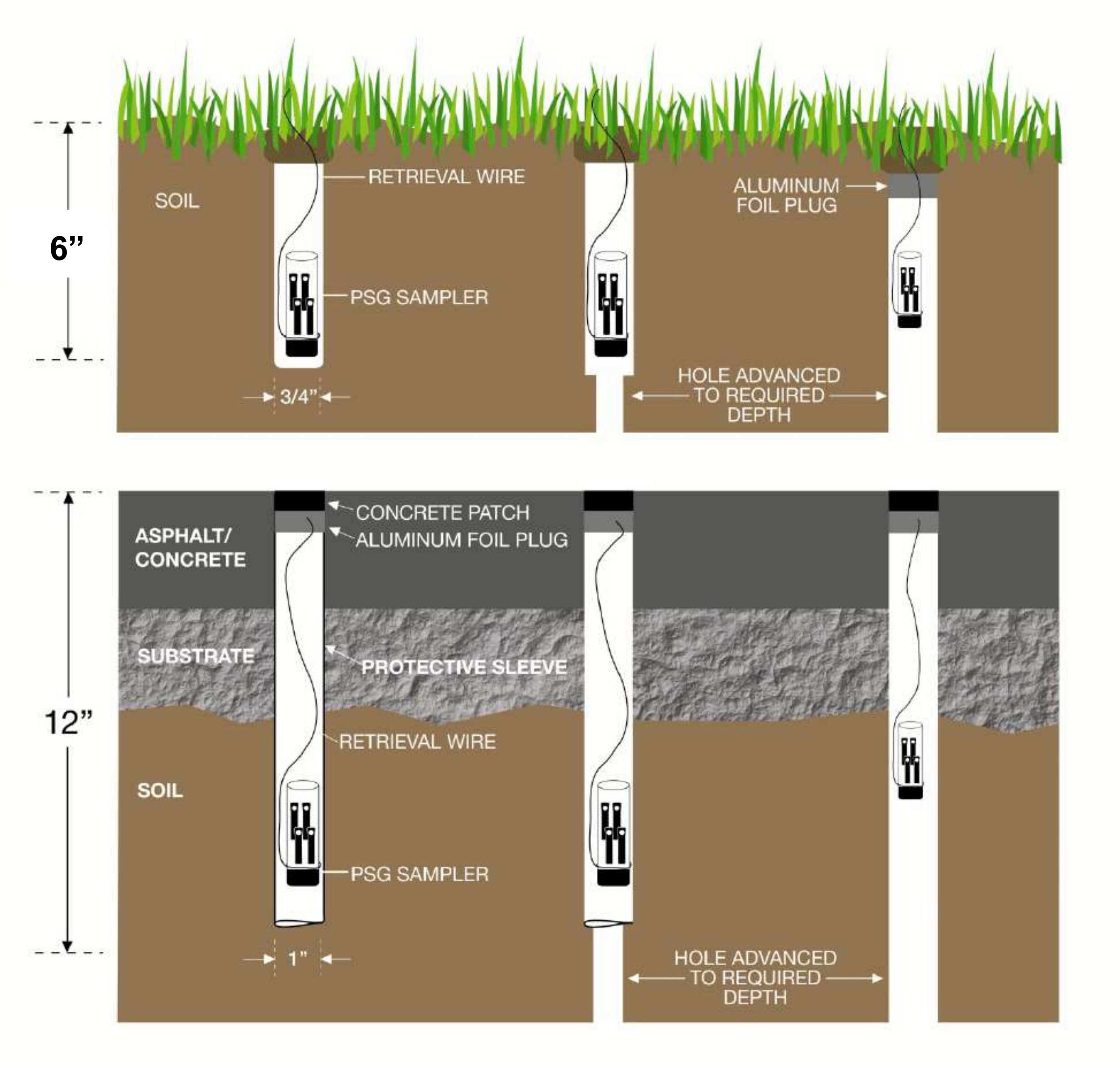


Figure 6 – Sampler Installation Options

PSG Sampler Retrieval

1. At each sample location open the BeSure Sample Collection Kit and place it and the wire cutters within easy reach. Remove a square of gauze cloth and place it and a clean towel on the open Kit. Remove a solid cap from the Cap Storage Container and place it on the Kit, also.

2. Expose the Sampler by pulling on the wire when in soils or using a small chisel and hammer to chip the thin concrete patch away when in asphalt/concrete. Retrieve the Sampler from its hole by pulling on the retrieval wire. Holding the Sampler upright, clean the sides of the vial with the clean towel (especially close to the Sampling Cap). Remove the Sampling Cap, cut the wire from the vial with the wire cutters, and clean the vial threads completely with the gauze cloth.

3. Firmly screw the solid cap on the Sampler Vial and with a ballpoint pen record the sample number, corresponding to the sample location, on the cap's label.

4. On the Field Deployment Report, record: (a) date and time of retrieval (to nearest minute); and (b) any other relevant information.

5. Return the sampling cap to the Sampling Cap container. Place the sealed and labeled Sampler Vial in a 3" x 4" re-sealable Sampler Bag. Then place the individually bagged and labeled sampler into the larger bag labeled "Return Shipment Bag." Each sampler is to be individually bagged and placed in a Return Shipment Bag, with at least one trip blank per Return Shipment Bag included with the PSG Samplers.

6. On the Chain of Custody, record: (a) date and time of retrieval; and (b) any other relevant information. After all samples have been retrieved, verify that the caps on each Sampler are sealed tightly and that the seals on the Sampler Bags are closed. Verify that all Samplers are stored in the Return Shipment Bag, which contains an adsorbent pack. Seal the Return Shipment Bag and place it in the upper tray of the Kit, and place the provided tools and materials in the lower compartment of the Kit.

7. Complete the chain-of-custody for shipment of Samplers. Seal the BESURE Sample Collection Kit with the provided tug tight custody seal, provided in the Kit, which has a unique identification number that is documented on the chain-of-custody. Place the Kit and paperwork in a cardboard box and ship via overnight delivery to Beacon Environmental Services for analysis of the samples.

Appendix D: Field Procedures for Installation of Sub-slab Vapor Pins

Standard Operating Procedure
Installation and Extraction of the Vapor Pin™

Updated February 27, 2015

Scope:

This standard operating procedure describes the installation and extraction of the Vapor Pin™ for use in sub-slab soil-gas sampling.

Purpose:

The purpose of this procedure is to assure good quality control in field operations and uniformity between field personnel in the use of the Vapor Pin™ for the collection of sub-slab soil-gas samples or pressure readings.

Equipment Needed:

- Assembled Vapor Pin™ [Vapor Pin™ and silicone sleeve(Figure 1)]; Because of sharp edges, gloves are recommended for sleeve installation;
- Hammer drill;
- 5/8-inch (16mm) diameter hammer bit (Hilti™ TE-YX 5/8" x 22" (400 mm) #00206514 or equivalent);
- 1½-inch (38mm) diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent) for flush mount applications;
- ¾-inch (19mm) diameter bottle brush;
- Wet/Dry vacuum with HEPA filter (optional);
- Vapor Pin™ installation/extraction tool;
- Dead blow hammer;
- Vapor Pin™ flush mount cover, if desired;
- Vapor Pin™ drilling guide, if desired;
- Vapor Pin™ protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel for repairing the hole following the extraction of the Vapor Pin™.

Figure 1. Assembled Vapor Pin™

Installation Procedure:

1) Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.

2) Set up wet/dry vacuum to collect drill cuttings.

3) If a flush mount installation is required, drill a 1½-inch (38mm) diameter hole at least 1¾-inches (45mm) into the slab. Use of a Vapor Pin™ drilling guide is recommended.

4) Drill a 5/8-inch (16mm) diameter hole through the slab and approximately 1-inch (25mm) into the underlying soil to form a void.

5) Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.

6) Place the lower end of Vapor Pin™ assembly into the drilled hole. Place the small hole located in the handle of the installation/extraction tool over the Vapor Pin™ to protect the barb fitting, and tap the Vapor Pin™ into place using a dead blow hammer (Figure 2). Make sure the installation/extraction tool is aligned parallel to the Vapor Pin™ to avoid damaging the barb fitting.

Figure 2. Installing the Vapor Pin™.

During installation, the silicone sleeve will form a slight bulge between the slab and the Vapor Pin™ shoulder. Place the protective cap on Vapor Pin™ to prevent vapor loss prior to sampling (Figure 3).

Figure 3. Installed Vapor Pin™

7) For flush mount installations, cover the Vapor Pin™ with a flush mount cover, using either the plastic cover or the optional stainless-steel Secure Cover (Figure 4).

Figure 4. Secure Cover Installed

8) Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to re-equilibrate prior to sampling.

9) Remove protective cap and connect sample tubing to the barb fitting of the Vapor Pin™. This connection can be made using a short piece of Tygon™ tubing to join the Vapor Pin™ with the Nylaflow tubing (Figure 5). Put the Nylaflow tubing as close to the Vapor Pin as possible to minimize contact between soil gas and Tygon™ tubing.

Figure 5. Vapor Pin™ sample connection.

10) Conduct leak tests in accordance with applicable guidance. If the method of leak testing is not specified, an alternative can be the use of a water dam and vacuum pump, as described in SOP Leak Testing the Vapor Pin™ via Mechanical Means (Figure 6). For flush-mount installations, distilled water can be poured directly into the 1 1/2 inch (38mm) hole.

Figure 6. Water dam used for leak detection

11) Collect sub-slab soil gas sample or pressure reading. When finished, replace the protective cap and flush mount cover until the next event. If the sampling is complete, extract the Vapor Pin™.

Extraction Procedure:

1) Remove the protective cap, and thread the installation/extraction tool onto the barrel of the Vapor Pin™ (Figure 7). Continue turning the tool clockwise to pull the Vapor Pin™ from the hole into the installation/extraction tool.

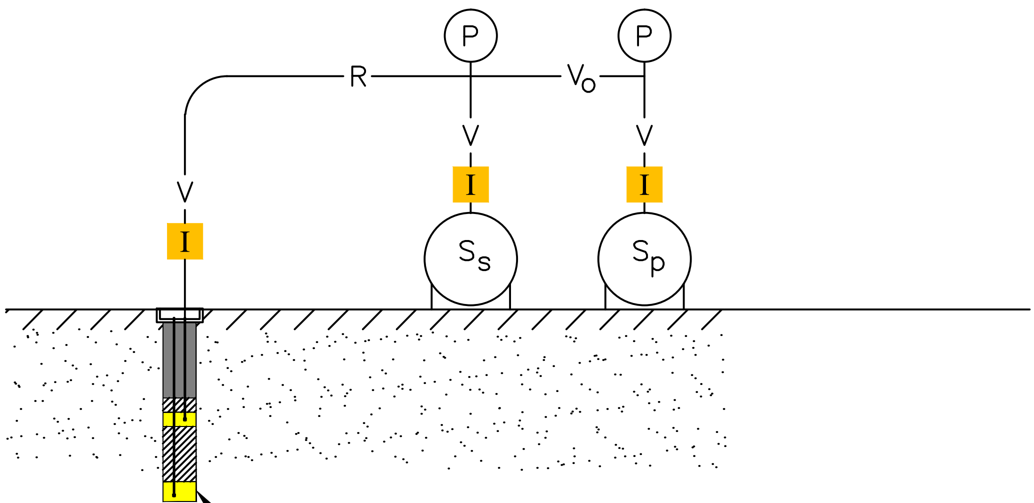
2) Fill the void with hydraulic cement and smooth with a trowel or putty knife.

Figure 7. Removing the Vapor Pin™.

3) Prior to reuse, remove the silicone sleeve and protective cap and discard. Decontaminate the Vapor Pin™ in a hot water and Alconox® wash, then heat in an oven to a temperature of 265° F (130° C) for 15 to 30 minutes.

The Vapor Pin™ to designed be used repeatedly, however, replacement parts and supplies will be required periodically. These parts are available on-line at VaporPin.CoxColvin.com.

V = VALVE
I = ISOPROPYL ALCOHOL (LEAK CHECK COMPOUND)
Vo = OPTIONAL VALVE
P = PRESSURE GAUGE
Ss = SAMPLE SUMMA CANISTER
Sp = PURGE SUMMA CANISTER
R = FLOW REGULATOR



SEMI-PERMANENT SOIL GAS PROBE
OR SUB-SLAB VAPOR PROBE

* USE SWAGELOK FITTINGS
ON ALL CONNECTIONS

** ASSEMBLE SAMPLE APPARATUS
AND LEAK TEST PRIOR TO
MOBILIZING TO FIELD

PREPARED BY
TRINITY
source group, inc.
Environmental Consultants
119 Encinal Street
Santa Cruz, California 95060
v: 831.426.5600
f: 831.426.5602

SOIL GAS SAMPLING EQUIPMENT SCHEMATIC

Former Fairway Dry Cleaners and Laundry
1600 Capitola Road
Santa Cruz, California

PROJECT: 575.001.001

FIGURE: D-1

Appendix E: Field Procedures for Terra Core® Sampler

En Novative Technologies

Terra Core® Sampler

The Cost Effective, Time Saving, Disposable Transfer Tool

- Uniquely designed to be the easiest and most rugged sampler on the market.
- Built-in handle allows samples to be easily taken from hard packed soils.
- Eliminates the need for a field balance.
- No additional handles or tools needed.
- Available in a 5 gram or 10 gram sample size.

Available Online At
www.ennovativetech.com

En Novative Technologies

En Novative Technologies
2355 Bishop Circle West
Dexter, MI 48130
PHONE (920) 465-3960
FAX (920) 465-3963
TOLLFREE (888) 411-0757

En Novative Technologies

Recommended Use Of The Terra Core®

NOTE: ***The Terra Core® Sampler is a single use device. It cannot be cleaned and/or reused.***

Step 1

Have ready a 40ml glass VOA vial containing the appropriate preservative. With the plunger seated in the handle, push the Terra Core® into freshly exposed soil until the sample chamber is filled. A filled chamber will deliver approximately 5 or 10 grams of soil.

Step 2

Wipe all soil or debris from the outside of the Terra Core® sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.

Step 3

Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40ml VOA vial containing the appropriate preservative and extrude the sample by pushing the plunger down. Quickly place the lid back on the 40ml VOA vial. **Note:** When capping the 40ml VOA vial, be sure to remove any soil or debris from the top and/or threads of the vial.

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