CONESTOGA-ROVERS
& ASSOCIATES

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Telephone: 707-935-4850 Facsimile: 707-935-6649
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RECEIVED

12:30 pm, May 25, 2007

Alameda County
Environmental Health

To Whom it May Concern,

We are pleased to announce that effective April 2, 2007, Cambria Environmental Technology, Inc (Cambria) was acquired by Conestoga-Rovers & Associates (CRA) and will be conducting all future work under this new name. Our project managers, business addresses, and telephone contact numbers will remain the same. Our e-mail addresses change to *****@craworld.com. Please contact me if you would like to discuss this transition and CRA.

Sincerely,

Diane M. Lundquist
Vice President

Denis L. Brown

Shell Oil Products US
HSE – Environmental Services
20945 S. Wilmington Avenue
Carson, CA 90810-1039
Tel (707) 865 0251
Fax (707) 865 2542
Email denis.l.brown@shell.com

Mr. Barney Chan
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94205-6577

Re: Former Shell Service Station
461 8th Street
Oakland, California
SAP Code: 129453
Incident No. 97093399
ACHCSA Case No. 0343

Dear Mr. Chan:

The attached document is provided for your review and comment. Upon information and belief, I declare, under penalty of perjury, that the information contained in the attached document is true and correct.

If you have any questions or concerns, please call me at (707) 865-0251.

Sincerely,

Denis L. Brown
Project Manager

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& ASSOCIATES

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Telephone: 707·935·4850 Facsimile: 707·935·6649
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May 25, 2007

Mr. Barney Chan
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Re: **Remedial Alternatives Evaluation, Site Investigation and DPE Pilot Test Work Plan**
Former Shell Service Station
461 8th Street
Oakland, California
SAP Code 129453
Incident No. 97093399
ACHCSA Case No. 0343

Dear Mr. Chan:

Conestoga-Rovers & Associates (CRA) prepared this document on behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell). This work was requested in a March 30, 2007 Alameda County Health Care Services Agency (ACHCSA) letter to Shell following a meeting on March 29, 2007 at the ACHCSA office. The ACHCSA granted an extension to the submittal date in electronic correspondence dated April 27, 2007. Presented below are a site description, an evaluation of remedial alternatives, and a work plan for proposed work.

SITE DESCRIPTION AND BACKGROUND

The site is currently a paved parking lot located at the southwest corner of the intersection of 8th Street and Broadway in Oakland, California (Figures 1 and 2). The property was leased by American Oil Company from at least 1965 until 1972 when the lease was assigned to Shell Oil Products Company (Shell). A Shell service station operated on the property from 1972 to 1980. The underground storage tanks (USTs) associated with the former Shell service station were removed after Shell terminated operations at the site in May 1980. The subject site is used for paid public parking, and as of the date of this document, is up for sale.

A summary of previous work performed at the site is presented in the March 2, 2007 *Site Investigation Report*.

REMEDIAL ALTERNATIVES EVALUATION

ACHCSA requested in their April 27, 2007 email to Shell and CRA that this work plan include an evaluation of remedial alternatives. In this email, ACHCSA stated that they "consider the concentrations of TPHg and BTEX in the groundwater samples as representing a source (potentially free product) which must be removed to the extent possible." This evaluation has been prepared to address this objective prescribed by ACHCSA. However, this evaluation of remedial alternatives should not be interpreted as a corrective action plan (CAP) that is consistent with the California Code of Regulations, Title 23, Division 3, Chapter 16, Underground Storage Tank Regulations.

CRA evaluated several remedial alternatives to achieve site remedial objectives. Subsurface investigation activities and groundwater monitoring indicate that elevated petroleum hydrocarbon levels are present in unsaturated soils near the former dispenser piping, and saturated soils (capillary fringe) on the northeast portion of the site. Groundwater monitoring data from wells S-5 and S-6 indicated the presence of separate phase hydrocarbons (SPH) in the past and currently show elevated dissolved phase TPHg and BTEX concentrations that are indicative of SPH. Remedial alternatives were selected to address the TPHg and BTEX impact to vadose and saturated soils and groundwater. However, implementation of remediation is limited by on-site and off-site site constraints, such as pedestrian and vehicle traffic, buildings, and utilities. Thus, source removal is limited to that which is technically and economically feasible.

The remedial technologies selected for evaluation include soil excavation, soil vapor extraction (SVE) with air sparging (AS), groundwater extraction (GWE), and dual-phase extraction (DPE). Each of these technologies is discussed below, and is evaluated on the basis of source removal technical feasibility.

Soil Excavation

During soil excavation, contaminated soil is removed and transported to permitted off-site treatment and/or disposal facilities. In some cases, pre-treatment (via aeration, aboveground SVE, incineration, etc) of the contaminated media may be required in order to meet land disposal restrictions. Although excavation and off-site disposal alleviates the contaminant problem at the site, it does not treat the contaminant. The type of contaminant and the concentration levels will influence off-site disposal requirements. The disposal of hazardous wastes is governed by the Resource Conservation and Recovery Act (RCRA) (40CFR Parts 261-265), and the U.S. Department of Transportation regulates the transport of hazardous materials (49 CFR Parts 172-179, 49 CFR Part 1387, and DOT-E 8876). Hazardous wastes must be treated to meet either

RCRA or non-RCRA treatment standards prior to land disposal. Transport and disposal of non-hazardous or special wastes are regulated by applicable California regulations.

Standard earth moving equipment (backhoes, bobcats, loaders, etc.) is typically utilized for soil excavation. Depending on available space, this range of equipment can excavate to a depth of approximately 20 feet. Larger earth moving equipment (excavators) can excavate slightly deeper. Entry into excavations deeper than 5 feet requires sidewall shoring per OSHA regulations. Deep excavations may require shoring to prevent collapse of the sidewalls, and to prevent damage or undermining of neighboring structures, utilities, sidewalks, etc. Additionally, dewatering of the excavated area may be required depending on the groundwater elevation and recharge rates. The extent of excavation is typically estimated in advance using available soil boring data, but is ultimately directed by field personnel using field monitoring equipment such as a photo-ionization detector (PID) to screen soils by measurement of soil headspace vapor concentrations. Soil samples are collected for chemical analysis to confirm that the excavation limits are sufficient to meet soil cleanup levels.

Monitoring well data suggests that residual (immobile) non-aqueous phase liquid (NAPL) is present in on-site and off-site soils beneath the former dispensers and along the capillary fringe/smear zone in the downgradient direction (south/southwest). Most of the impacted smear-zone is covered by up to 15 feet of clean over-burden. Given the age of the release at this site, in situ technologies will not remove this NAPL as effectively as excavation. However, excavation would be limited to on-site soils and limited by surrounding structures. Off-site soil excavation is not feasible due to the constraints previously discussed. For on-site soil excavation, the cost to excavate would include engineering, permitting, monitoring well destruction and replacement, dewatering and sidewall shoring, excavating, stockpiling, profiling the soil for disposal, confirmatory sampling and analyses, loading, off-hauling, disposal, backfilling and compaction, site restoration, and project management and reporting. Many of the variables of this remedial alternative cannot be quantified at this time to generate an accurate cost estimate, but enough is known to suggest that the costs of soil excavation would be excessive. Excavation is also impractical due to the volume of clean over-burden soil above the impacted smear zone soils. Therefore, based on limited ability to implement the technique and the excessive associated costs, CRA does not recommend soil excavation.

SVE with AS

SVE is a common remediation technology applied to address gasoline fuel impacts to unsaturated soil at hydrocarbon-impacted sites. SVE is most effective in moderate to high permeability soils and is also more effective on recent releases than on older releases where significant volatilization has already occurred. SVE involves applying a vacuum to wells to extract hydrocarbon-bearing vapors from the vadose zone and capillary fringe area. Extracted hydrocarbons are typically treated by granular activated carbon (GAC), catalytic or thermal oxidizers, or internal combustion engines. Additionally, SVE can improve or protect groundwater quality by removing source area hydrocarbons, by encouraging hydrocarbon diffusion from groundwater, and by delivering oxygen to the subsurface. Increased oxygen concentrations can stimulate naturally occurring hydrocarbon biodegradation in soil and groundwater.

SVE system components would include appropriately constructed SVE wells, vapor conveyance piping, a vapor and liquid separator, a vapor extraction device, and a vapor treatment device. The vapor extraction device (blower) would be sized based on the radius of influence and applied vacuum of the vapor extraction wells observed during pilot testing. The treatment device is determined by the anticipated influent flow rate, hydrocarbon concentration, air quality requirements, and operating duration.

AS (air sparging) is a remedial technology whereby air is injected into the saturated zone to remove volatile contaminants by stripping them from water, transferring them to the vapor phase, and removing the vapors by SVE. The technology is designed to operate at relatively high air flow rates (greater than 2 cubic feet per minute per injection point) in order to cause volatilization. AS is most effective in moderate to high permeability soils. AS is not specifically aimed at stimulating biodegradation, although enhanced biodegradation is often a beneficial secondary effect. Unless operated at low flow rates (biosparging), AS must operate in tandem with an SVE system that captures the volatile contaminants stripped from the saturated zone.

Equipment required to implement AS would include a compressed air source (air compressor/blower), compressed air conveyance piping, and specifically designed AS wells. The air compressor or blower would be sized based on the number of injection points, pressure losses through the delivery system, and minimum pressure and flow delivery at the injection depth.

Vadose and saturated zones soils (silty sand) at this site appear suitable for SVE/AS due to moderate permeability conditions; however, the age of the release makes it less viable. A pilot test would be required to determine the feasibility of SVE/AS at this site. SVE/AS effectiveness is dependant on adequate diffusion of air, volatilization of hydrocarbons from saturated soils/groundwater, and recovery of these vapors. As a result, AS is not typically the most effective technology for addressing saturated soil and groundwater impact. Additionally, if hydrocarbon vapors are not adequately recovered, they may pose a risk to nearby receptors. CRA does not recommend that SVE/AS be implemented at this time, particularly due to the potential to increase vapors beneath nearby commercial structures.

GWE

Groundwater extraction (GWE) has historically been the most common remedial technology applied for groundwater restoration. Groundwater is extracted by down-well pumps and routed to a treatment system, such as activated carbon or an air stripper. The treatment system removes organic constituents of concern (COCs) from the extracted groundwater. The treated groundwater is typically discharged to the sanitary or storm sewer after treatment. GWE can also be used as an interim or temporary remediation measure. This approach can be cost-effective when the majority of the source material has been removed and the extent of treatable groundwater contamination is limited.

In addition to dissolved-phase mass removal, GWE can provide hydraulic containment of the groundwater contaminant plume. Source removal can only be achieved indirectly using GWE, as hydrocarbon contaminants only gradually desorb from soil and trapped NAPL, and enter the dissolved phase. The rate of desorption from soil and residual NAPL is often the limiting factor for hydrocarbon contaminant removal using GWE, especially as concentrations decline over time, and can compromise the cost-effectiveness of GWE. CRA does not recommend GWE based on its poor overall effectiveness.

DPE

DPE is the process of applying high vacuum (upwards of 25-27 inches of Hg) through an airtight well seal to simultaneously extract soil vapors from the vadose zone (and dewatered saturated zone) and groundwater from the saturated zone. The vacuum created by DPE can increase the groundwater yield from wells completed in low permeability formations. In addition, residual TPHg and BTEX in unsaturated and dewatered soils within the influence of the vacuum may be removed in the vapor phase. Groundwater extraction can provide hydraulic control of the hydrocarbon plume and reduce contaminant migration. Furthermore, extended dewatering of the saturated zone combined with vapor extraction can remediate residual hydrocarbons below the water table (via water table depression) within the treated area.

A positive displacement blower or liquid-ring pump may be used to create the higher vacuum needed to extract groundwater and soil vapors simultaneously from low-permeability soils. Alternatively, a submersible groundwater pump can be used to extract groundwater, while a blower or liquid-ring pump is used solely to extract soil vapors. The extraction device is supplemented with a soil vapor treatment (oxidizer or carbon adsorption) system. Typically, extracted groundwater can be treated and discharged to the local sanitary sewer or storm drain with the appropriate permits, or off-hauled to a disposal facility.

As mentioned previously, SVE/AS effectiveness is dependant on adequate diffusion of air, volatilization of hydrocarbons from saturated soils/groundwater, and recovery of these vapors. Thus, DPE is typically a more effective technology for source removal in saturated soils than SVE/AS as it is only dependant on sufficient dewatering. A pilot test would be necessary to prove the feasibility and effectiveness of DPE. CRA recommends implementing DPE at this site, contingent on the results of a pilot test. The following sections detail the pilot testing procedures and required/associated tasks. This work will be conducted following the installation of the wells proposed in the Work Plan that follows.

SITE INVESTIGATION WORK PLAN

Technical Rationale and Objectives

The ACHCSA March 30, 2007 letter provided specific technical comments and requested a work plan to address them. The technical rationale and objectives of the work proposed are presented below:

- Monitoring well S-5 is not safely accessible and needs to be properly decommissioned; an alternate location for a replacement well is proposed on 7th Street.
- To assess potential vapor migration issues at the adjacent commercial building, soil vapor sampling will be performed beneath the adjacent building, if possible. If access is not granted, then on-site soil gas sampling adjacent to the building's northeastern wall will be performed instead. Previous recommendations for onsite soil vapor sampling were based on information that commercial development of the subject site was imminent and were to be used to determine the necessity of onsite remedation. However, the previous plans are on hold, the property is currently for sale, and the ACHCSA has stated that remediation of residual contaminants is required. Thus, given the proposed DPE pilot testing and future remedial efforts at this site, and the unknown nature/schedule of onsite development, the previously proposed on-site soil vapor assessment (with the exception of the potential impact near the offsite commercial building) should be conducted after DPE pilot testing and or other remedial activities have been performed.
- Additional vertical delineation of impacted soil and groundwater is desired to delineate the extent of the residual source area, which could have been dragged beneath the current water table during the de-watering activities associated with the construction of the BART tunnel. Also, the vertical extent of groundwater impact needs to be assessed.
- Based on the current site data, on-site monitoring wells screening the first encountered zone are proposed near B-12, B-13, B-21, B-22, and B-23 (in addition to the offsite well proposed on 7th Street) for monitoring the groundwater plume and performance of the pilot test described above. Proposed intervals of screening are included herein based on the assumption that most of the residual impact is in the vadose zone and within top 10 feet of saturated zone; however, the construction and placement of the wells may be modified following receipt of the data from the vertical delineation work described above.

Proposed Scope of Work

The following describes the scope of work proposed to meet the objectives described above. Proposed sample locations are shown on Figure 2.

- Permit and destroy well S-5;
- Permit and install replacement well in 7th Street (S-11);
- Obtain access agreement and install soil vapor probes in basement of adjacent building; sample vapor probes;
- Install four borings for vertical assessment of lithology, soil and groundwater impact (SB-24 through SB-27);
- After receipt and review of data from SB-24 through SB-27, confirm location and construction of proposed onsite monitoring wells (S-12 through S-16); install and develop new wells;
- Perform DPE pilot test.

Work Tasks

Access: CRA will assist Shell with negotiating access to the adjacent property for installation of vapor probes in the basement and with negotiating access with the current site tenant for performance of the onsite activities.

Permits: CRA will obtain the encroachment permit for work within 7th Street from Oakland Public Works Department, and will obtain the required drilling permits from ACHCSA.

Site Safety Plan: CRA will prepare a comprehensive site-specific safety plan to protect site workers. The plan will be reviewed and signed by each site worker and kept on the site during field activities.

Utility Clearance: CRA will mark proposed drilling locations and will clear the locations through Underground Service Alert prior to drilling. All locations will be cleared using a private utility locating service.

Safety Planning Field Visit: CRA will conduct a site visit to determine appropriate safe access precautions for the decommissioning of well S-5. This well is located within a storm drain vault, and confined space entry may be required to access the well. Additionally, numerous utility corridors exist within both Broadway and 7th Street that may affect the proposed location of the replacement offsite groundwater monitoring well (S-11). Shell's standard safety procedures preclude drilling within 5 feet of any known utility, and require a conductor casing be installed when drilling within 10 feet of a pressurized gas line. CRA will contract a private utility locator to identify utilities near the proposed boring and well locations. Also, if access is granted, the basement will be visited for potential access issues during the same visit, if possible. Following this safety visit, CRA will notify the ACHCSA of any changes to the proposed scope of work.

Well S-5 Destruction: Because well S-5 was installed through an existing storm drain, we recommend destroying this well by grouting the well casing using a thick mixture of neat Portland Type I/II cement. The neat cement will be placed in the well from the bottom up utilizing a tremie pipe. We do not recommend applying pressure, in case there is any connection with the actual storm drain or any other utility in the vicinity. The entire well casing will be filled with grout to complete destruction. We recommend having a representative from the Public Works Department on site during this work.

Basement Sub-Slab Vapor Probe Installation: Assuming access is granted and also assuming the absence of subsurface obstructions, the basement concrete floor will be cored for the installation of three sub-slab soil gas sampling probes (SVP-1, SVP-2, and SVP-3) using a hand auger in the approximate locations shown on Figure 2. Attachment A contains a document titled *Sub-Slab Soil Vapor Standard Operating Procedures*, prepared by H&P Mobile Geochemistry, January 2004. To the extent practical, CRA will follow these procedures for the installation and sampling of the sub-slab soil-vapor points. Following at least two weeks after probe installation, to allow for equilibration of conditions, the soil vapor probes will be purged and sampled in summa canisters, according to standard vapor sampling protocol.

Soil Boring Installation and Soil-Gas Sampling: Assuming the absence of subsurface and overhead obstructions, a direct-push drill rig will be used to drill four soil borings in the approximate locations shown on Figure 2 (SB-24 through SB-27). If access is not granted to the adjacent property for installation of SVP-1 through SVP-3, soil vapor samples will be collected using direct-push sampling equipment at approximately 9 feet below grade (fbg) in the three borings located adjacent to the subject building (SB-25 through SB-27). For each soil-vapor sample, the direct-push equipment will be advanced to the approximate depth, and then a bentonite surface seal will be installed. After the surface seal has set, a soil vapor sample will be collected in a summa canister with flow regulator attached, according to laboratory requirements.

Borings SB-24 through SB-27 will be advanced to approximately 50 fbg for lithologic information, soil sampling, and deeper groundwater sample collection. Soil samples from will be collected continuously between approximately 10 and 50 fbg for soil description, and screening for organic vapors using a photo-ionization detector (PID). Soil samples will be retained for possible chemical analyses at approximately 5-foot intervals and at significant lithological changes. In addition, a hydropunch-type sampler will be advanced from approximately 45 to 50 fbg to collect grab groundwater samples from each boring.

Soil, grab groundwater, and (if collected) soil gas samples designated for chemical analyses will be retained in appropriate sample containers. Soil sample tubes will be covered on both ends with Teflon sheets and plastic end caps. Water samples will be transferred to laboratory supplied containers. Soil gas samples will be collected in Summa canisters. All samples will be labeled, entered onto chain-of-custody records, and placed into an appropriate container for transport to a State of California certified laboratory for analyses. Soil and grab groundwater samples will be stored in a cooler with ice. A standard turn-around time will be requested for laboratory results.

CRA will prepare an exploratory boring log for each boring, and PID measurements will be recorded on the logs. Following collection of soil vapor, soil, and/or grab groundwater samples, all borings will be backfilled with a cement-bentonite grout mixture to within 4 inches below grade and capped with concrete tinted to match the surrounding surface.

Monitoring Well Installation: Assuming the absence of subsurface and overhead obstructions, CRA will use a drill rig equipped with hollow-stem augers to drill six well borings (S-11 through S-16) at the approximate locations shown on Figure 2. The well borings will be advanced to approximately 30 fbg, depending on field conditions during drilling (proposed depth may be revised based on results of borings described above). Soil samples from the well borings will be collected at 5-foot intervals for soil description and screening for organic vapors using a photo-ionization detector (PID). CRA will prepare an exploratory boring log for each well, and PID measurements will be recorded on the log.

Unless other information suggests differently, the wells will be constructed using 4-inch diameter Schedule 40 PVC casing. The well screen intervals will be from approximately 10 to 30 fbg to allow adequate vadose zone exposure for use as DPE wells. A sandpack will be placed from the bottom of each well up to 2 feet above the top of the well screen followed by a 2-foot thick bentonite seal and cement grout to grade. Actual well construction details will be based on field conditions during drilling and results of borings B-24 through B-27. The wells will be secured with a locking cap under a traffic-rated well box.

Following well installation, Blaine Tech Services, Inc. (Blaine) of San Jose, California will develop each well prior to sampling. After well development, Blaine will sample each well and submit the samples to a California-certified laboratory for chemical analyses.

Chemical Analyses: Soil and groundwater samples will be analyzed for total petroleum hydrocarbons as gasoline (TPHg), and benzene, toluene, ethylbenzene, xylenes (BTEX) by EPA Method 8260B. Soil vapor samples will be analyzed for TPHg by EPA Method TO-3, and BTEX by EPA Method TO-15. Additionally, as requested by the ACHCSA, the lead scavengers (EDB and EDC) will be added to the groundwater monitoring program.

PILOT TEST WORK PLAN

Test Procedures: A 5-day DPE pilot test is proposed. CRA will target proposed new wells S-13 through S-16 and existing well S-9 for DPE pilot testing. Once an extraction well has been dewatered to the target elevation (approximately 30 fbg), CRA will incrementally increase the applied vacuum setting to determine the optimal extraction rate (maximum air flow rate). Once determined, CRA will set overnight DPE operation at the optimal extraction rate to determine sustenance of hydrocarbon vapors. CRA will also monitor groundwater drawdown and induced vacuum in proximal wells during DPE. DPE will then be moved to the next extraction well and this protocol will be repeated. The following sections detail the tasks and information for the proposed pilot test:

Health and Safety Plan: Cambria will prepare a comprehensive health and safety plan to protect site workers. The plan will be reviewed and signed by each site worker and kept onsite during field activities.

Notification: Cambria will provide the required notification to the Bay Area Air Quality Management District (BAAQMD).

Test Equipment: Critical components for DPE include an extraction device, water storage, and a vapor treatment device. A trailer-mounted liquid-ring pump and thermal/catalytic oxidizer (trailer) will be used to apply a vacuum to the extraction well and to abate extracted vapors. The trailer requires the use of a generator for powering and possibly propane for supplemental fuel. The trailer will be equipped with a liquid-separator to remove entrained groundwater from the vapor stream. Groundwater will be pumped from the separator into an onsite storage tank.

The trailer will be equipped with controls to manage well flow, dilution air flow, pump vacuum, and well vacuum data. A Thomas Industries model 907CDC18F vacuum pump will be used to collect the vapor samples. A Horiba organic vapor analyzer will be used to field measure hydrocarbon concentrations in the extracted vapor stream. Magnehelic differential pressure gauges will be used to measure induced vacuum in adjacent wells. A water level meter will be used to measure groundwater drawdown in adjacent wells. A Kent C700 flow totalizing meter will continuously measure extracted groundwater.

The trailer will abate the extracted soil vapors to comply with the BAAQMD requirements. The extracted groundwater will be temporarily stored in an onsite storage tank and subsequently transported to Shell's Martinez Refinery located in Martinez, California for recycling. Otherwise, extracted groundwater will be treated and discharged to the sewer under authorization of an East Bay Municipal Utilities District (EBMUD) wastewater discharge permit.

Test Data Collection: CRA will periodically measure/record the following DPE operational and monitoring information: applied vacuum, induced vacuum, well flow, dilution air flow, vapor concentrations, extracted groundwater volume, and groundwater drawdown. This information will be initially collected every 15 to 30 minutes, then in longer intervals after operational data has stabilized. Vapor samples will be collected periodically in one-liter Tedlar bags to confirm field measured concentrations through laboratory analysis. A State-approved analytical laboratory will analyze all samples for TPHg and BTEX using EPA Method 8260.

Report Preparation: Following the completion of the field investigation and DPE pilot testing activities, CRA will prepare a written report, which will describe the field activities, tabulate the field data, calculate the mass of contaminants removed through DPE, and summarize the results and findings. More than one document submittal may be prepared, depending on the actual field schedule and access issues.

Certification: The scope of work described in this work plan will be performed under the supervision of a California Professional Geologist or Professional Engineer.

SCHEDULE

CRA is prepared to begin working as soon as Shell receives written approval from ACHCSA. Because the ACHCSA requested vapor probes in the adjacent building, and approval of that portion of the plan is anticipated, we are proceeding with the access request to the adjacent property owner. The onsite soil borings will need to be completed and data evaluated prior to confirming the construction of the proposed monitoring wells. The DPE test will be permitted/scheduled once the schedule for installation and development of the proposed monitoring wells is known. We will keep the ACHCSA apprised of our status.

CLOSING

If you have any questions regarding the contents of this document, please call Ana Friel at (707) 268-3812.

Sincerely,

Conestoga-Rovers & Associates

Dan Lescure, PE

PROFESSIONAL GEOLOGIST ANA FRIEL No. 6452 exp 9/07 STATE OF CALIFORNIA

Ana Friel, PG

Figures: 1 - Vicinity Map
2 - Site Plan

Attachments: A – Sub-Slab Soil Vapor SOP

cc: Denis Brown, Shell Oil Products US
A.F. Evans Company (Property Owners), c/o Greg Lunkes
R. Casteel & Co.
Leroy Griffin, City of Oakland Fire Prevention Bureau

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12/21/01

Former Shell Service Station

461 8th Street
Oakland, California

Vicinity Map

1/2 Mile Radius

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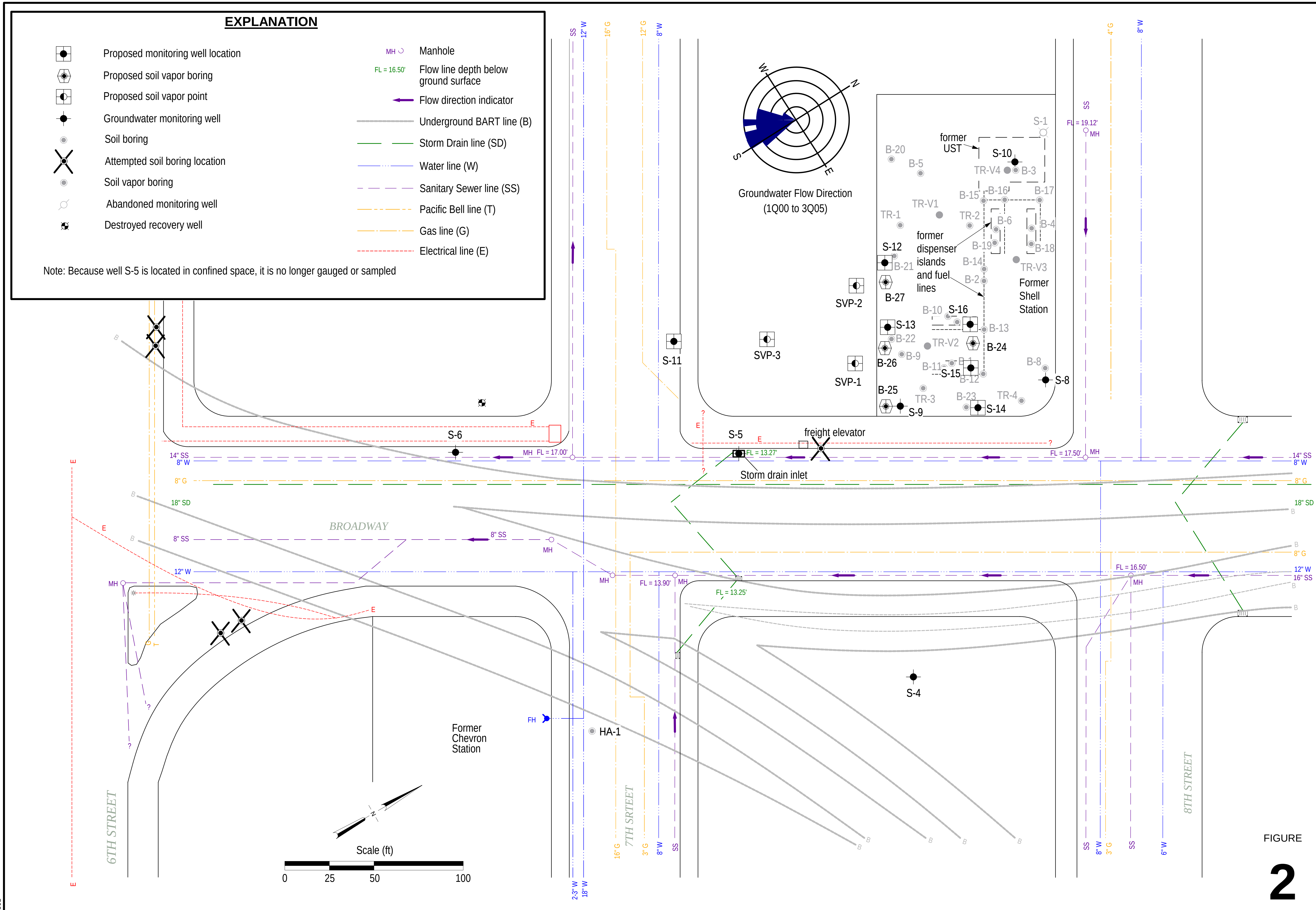
24-May-07



FIGURE

2

Site Plan

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Former Shell Service Station

461 8th Street
Oakland, California

1501

Attachment A

Sub-Slab Soil Vapor SOP

Sub-Slab Soil Vapor
Standard Operating Procedures

(For Vapor Intrusion Applications)

Revised January 2004

Prepared by:

H&P Mobile Geochemistry

Solana Beach, California

Soil Gas Probe Materials/Construction

Materials: stainless steel tubing, nylon tubing, or Teflon tubing

Diameter: nominally 1/8" OD or ¼" OD

Length: Just below base of slab

Tip: SS, Al, ceramic, plastic (typically no tip required for sub-slab).

Surface Termination: Swagelok fittings or valve

Notes:

- Stainless steel and nylon tubing are preferred over Teflon due to lower adsorption. Nylon tubing is more flexible and easier to work with than stainless steel tubing.
- Tips (aluminum, ceramic, SS) can be put on the end if desired to give a longer screen interval, but typically are not used for sub-slab samples.
- Various surface terminations are available and the selection often depends on whether the probes are temporary or permanent.

Probe Installation Protocol

1. Ensure all sub-slab utilities (public and building specific) are marked prior to installation.
2. Drill a ½" to ¾" OD hole through the slab with a drill and spline bit. Do not use water. If dust prevention necessary, cover the location with a towel/cloth and drill through a pre-cut hole in the cloth.
3. Measure slab thickness. Cut probe tubing to appropriate length to reach base of slab and to give required type of surface termination (flush, recessed, protruding). If a flush or recessed surface termination is required, a larger diameter hole in the upper 1 inch of the slab may be required to leave enough room for the fitting on the probe tubing.
4. Insert tubing. Add sand to cover tip with about 1 inch of sand.
5. Grout to the surface using bentonite (if temporary installation) or cement (if permanent installation).
6. Wait 30 to 60 minutes prior to sampling.

Soil Gas Sample Collection

Since sub-slab sampling is from very shallow depths (typically 2" to 6" below surface), minimum purge volumes and low volume samples are preferred to minimize potential breakthrough from the surface. Tracer/leak gas is necessary to ensure breakthrough does not occur.

Materials: 1/8" or ¼" OD nylon or Teflon tubing.

Sample Canister: syringe, tedlar bag, SS canister, gas-tight glass.

Plastic or stainless 3-way valve.

Vacuum gauge and pump as necessary.

Notes: If canisters with flow chokes are used, ensure flow chokes are dedicated to the canister or cleaned before reuse on another canister.

1. Connect fresh tubing to top of probe and to a 60 cc syringe using a 3-way valve (see picture).
2. Purge out 4 tubing dead-volumes (~ 4 cc/ft for 1/8"OD tubing and 15 cc/ft for ¼" OD tubing).
3. Close 3-way valve. Remove syringe and connect soil gas sampling container to valve. If SS canisters are used, check canister vacuum with gauge immediately before use. If flow chokes are used on the canisters, ensure they are clean and all connections are tight.
4. Place tracer/leak compound, typically iso-propanol, butane, or difluoroethane, around the probe at the ground surface and at connections in the sampling system. Liquid tracers are easily emplaced by wetting a paper towel and wrapping around the test locations. Vapor tracers require either multiple canisters for each test location or a device to hold the vapor near the test location (such as a cover at the surface).
5. Once tracer compound in place, open 3-way valve and collect soil gas sample and any duplicate samples.
6. If measurements with a portable meter to be made (e.g. oxygen), conduct measurements after collection of the soil gas sample(s) for VOC analysis.

Notes:

- Sample flow rates are not to exceed 200 ml/min (as specified by CA-EPA) to minimize potential for vacuum extraction of contaminants from the soil phase.
- The presence of the tracer compound in the analysis confirms a leak and another sample is collected until no leak is detected (if on-site analysis exists).
- If large volume canisters used (3 or more liters), a purge volume test may be required to ensure sample dilution from other zones is not occurring.

Field Records

The field technician maintains a log sheet summarizing:

- Sample identification
- Probe location
- Date and time of sample collection
- Sampling depth
- Identity of samplers
- Weather conditions
- Sampling methods and devices
- Soil gas purge volumes
- Volume of soil gas extracted
- Vacuum of canisters before and after samples collected.
- Apparent moisture content (dry, moist or saturated etc.) of the sampling zone
- Chain of custody protocols and records used to track samples from sampling point to analysis.