Mike Bauer
Project Manager
Marketing Business Unit

Chevron Environmental Management Company
145 S. State College Blvd
Brea, CA 92821
Tel (714) 671-3200
Fax (714) 671-3440
mbauer@chevron.com

May 11, 2010

Mr. Jerry Wickham
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Re: Former Signal Oil Marine Storage and Distribution Facility
(Former Chevron Bulk Plant 20-6127)
2301-2311 Blanding Avenue
Alameda, California
LOP Case RO0002466

Dear Mr. Wickham:

The purpose of this letter is to verify that as a representative for Chevron Environmental Management Company (Chevron), I reviewed, and concur with, the comments in the *Work Plan for Further Groundwater Assessment* for the referenced facility, prepared on behalf of Chevron by Conestoga-Rovers & Associates.

Please feel free to contact me at (714) 671-3207 if you have any questions.

Sincerely,

Mike Bauer
Project Manager

CONESTOGA-ROVERS
& ASSOCIATES

10969 Trade Center Drive, Suite 106, Rancho Cordova, CA 95670
Telephone: 916-889-8900 Facsimile: 916-889-8999
www.CRAworld.com

May 11, 2010 Reference No. 631916

Mr. Jerry Wickham
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Re: Work Plan for Further Groundwater Assessment
Former Signal Oil Marine Storage and Distribution Facility
(Chevron Bulk Plant 20-6127)
2301-2311 Blanding Avenue
Alameda, California
SLIC Case RO0002466

Dear Mr. Wickham:

Conestoga-Rovers & Associates (CRA) is submitting this work plan on behalf of Chevron Environmental Management Company (Chevron) for the site referenced above. In a letter dated February 5, 2010 (Attachment A), Alameda County Environmental Health (ACEH) requested further evaluation of shallow groundwater beneath the site near Alameda Canal. To further assess shallow groundwater conditions near Alameda Canal, CRA proposes to drill out and reinstall groundwater monitoring well MW-1, and install a new groundwater monitoring well (MW-6) north of existing well MW-5. Site background, including a site description, site geology and hydrogeology, and our proposed scope of work are presented below.

SITE BACKGROUND

Site Description and Previous Investigation

The approximately 3.5-acre site is located on the northeast side of Blanding Avenue between Oak and Park Streets in Alameda, California (Figures 1 and 2). Land use in the site vicinity is primarily commercial and industrial. The Alameda Canal and a marina are located adjacent to the northeast side of the site. The site is currently occupied by three large commercial buildings, which are used for office, retail, and storage space, and identified as Park Street Landing at 2307-2337 Blanding Avenue. A summary of the site history dating back to 1897 and previous environmental investigation is included as Attachment B.

Site Geology and Hydrogeology

The soils encountered beneath the site generally consist of silty sand and clayey sand from just beneath grade to approximately 5 to 9 feet below grade (fbg). Fill consisting of black sand and

concrete fragments has been reported in several borings at shallow depths. A 4- to 5-foot-thick layer of clay with some sand underlies the silty sand and clayey sand. Below the clay is silty sand and sandy silt to the maximum explored depth of 20.5 fbg. Groundwater is encountered in site borings at approximately 14.5 to 15 fbg within the silty sand and sandy silt, and subsequently rises in the borings/wells to approximately 7 to 10 fbg.

PROPOSED SCOPE OF WORK

Current monitoring well MW-1 is screened from 4 to 19 fbg, likely within the fill material described above. CRA proposes over-drilling groundwater monitoring well MW-1 and reinstalling a well in the resulting borehole with a screen interval that targets the silty sand/sandy silt layer, consistent with the construction of site wells MW-2 through MW-5. Additionally, CRA proposes installing well MW-6 in the vicinity of shallow grab-groundwater samples GWS-8 and GWS-9. The location of well MW-6 was selected generally downgradient of well MW-5 and may change dependent on the materials encountered during drilling. The locations of the proposed wells are shown on Figure 2. Further details regarding the proposed scope of work are presented below.

Site Health and Safety Plan

CRA will prepare a comprehensive site health and safety plan to protect site workers. The plan will be reviewed and signed by each site worker and kept with the field crew during field activities.

Permits

CRA will obtain well installation permits from ACEH. A minimum of 24-hours notice will be given to ACEH prior to beginning drilling activities.

Underground Utility Location

CRA will mark the proposed boring locations and notify Underground Service Alert (USA) of planned drilling activities. USA will be updated at least 48 hours prior to field work. CRA will subcontract a private utility locator to further identify potential subsurface utilities and underground obstructions. As previous attempts to install a well in 2009 in the vicinity of soil boring SB-18 were terminated due to encountered underground obstructions at approximately 4 feet, ground penetrating radar (GPR) will be utilized to determine the final location of the new well (MW-6). Prior to advancing the borings, the proposed locations will be hand augered or vacuum excavated to 8 fbg to confirm utility clearance.

Soil Logging and Sampling

For proposed well MW-6, soil cuttings collected during hand clearing will be logged to 8 fbg. Below 8 fbg, soil will be collected in acetate liners and logged continuously. Soil samples will be screened in the field with a photoionization detector (PID). Soil type will be logged using the Unified Soil Classification System. A minimum of one unsaturated soil sample will be submitted for chemical analysis. The sample container(s) will be labeled, entered onto a chain-of-custody (COC) form, and then packed on ice in coolers and sent to the Lancaster Laboratories (Lancaster) in Lancaster, Pennsylvania for analysis. No soil samples will be collected during the reinstallation of well MW-1. CRA's standard field procedures for monitoring well installation are presented as Attachment C.

Monitoring Well Installation

Well MW-1 will be over-drilled with 10-inch hollow-stem augers to 20 fbg. After the boring for well MW-6 has been hand cleared to 8 fbg, 8-inch hollow-stem augers will be advanced to approximately 20 fbg. Each well will be constructed using 2-inch diameter, schedule 40 polyvinyl chloride (PVC) casing with a 0.020-inch machine slotted screen from approximately 11 to 20 fbg (targeting the silty sand/sandy silt layer encountered at 11 to 14 fbg across the site). The filter pack will consist of #2/12 Monterey sand placed in the annulus from the bottom of the boring to approximately 1 foot above screen interval. The well annulus will have a 3-foot bentonite seal above the filter pack, and the remaining annulus will be filled with neat Portland cement to 1 foot below the surface. The well will be enclosed in a traffic rated well box set in concrete flush with or just above the surface.

Chemical Analyses

Soil samples that are collected for chemical analysis will be submitted under COC to Lancaster and analyzed for the following:

- Total petroleum hydrocarbons as diesel with silica gel cleanup by EPA Method 8015M
- Total petroleum hydrocarbons as gasoline by EPA Method 8015M
- Benzene, toluene, ethylbenzene, and xylenes by EPA Method 8260

Soil and Water Disposal

Soil cuttings and rinse water generated during drilling activities will be stored temporarily onsite in Department of Transportation approved 55-gallon drums until they can be transported to a Chevron-approved facility for disposal.

Well Development

The newly installed wells will be developed using surge-block agitation and bailer or pump evacuation. A maximum of 10 casing volumes will be purged during the well development process. Water quality parameters (temperature, pH, conductivity, and turbidity) will be taken periodically and noted on the well development log.

Groundwater Monitoring and Sampling

Well MW-6 will be added to the current quarterly monitoring and sampling program after installation.

Well Elevation Survey

The top of casing elevation for wells MW-1 and MW-6 will be surveyed by a California licensed land surveyor to mean sea level datum. The surveyor will use a nearby benchmark as a reference datum. Horizontal well coordinates will be measured in compliance with AB2886 (Geotracker), and uploaded to Geotracker.

Reporting

Upon completion of the above well installation activities and review of the analytical results, CRA will prepare a well installation report.

The report will include:

- A summary of well installation activities
- Boring/well logs
- Tabulated analytical results
- Analytical reports and COC forms
- CRA's conclusions and recommendations

Schedule

CRA will begin scheduling the proposed work upon approval of this work plan by the ACEH. CRA will submit the well installation report approximately 8 weeks following the receipt of all final analytical data.

CONESTOGA-ROVERS
& ASSOCIATES

May 11, 2010 Reference No. 631916

We appreciate the opportunity to work with you on this project. Please contact Mr. Brian Silva at (916) 889-8908 if you have any questions or require additional information.

Sincerely,

CONESTOGA-ROVERS & ASSOCIATES

Brian Silva

Greg Barclay, PG 6260

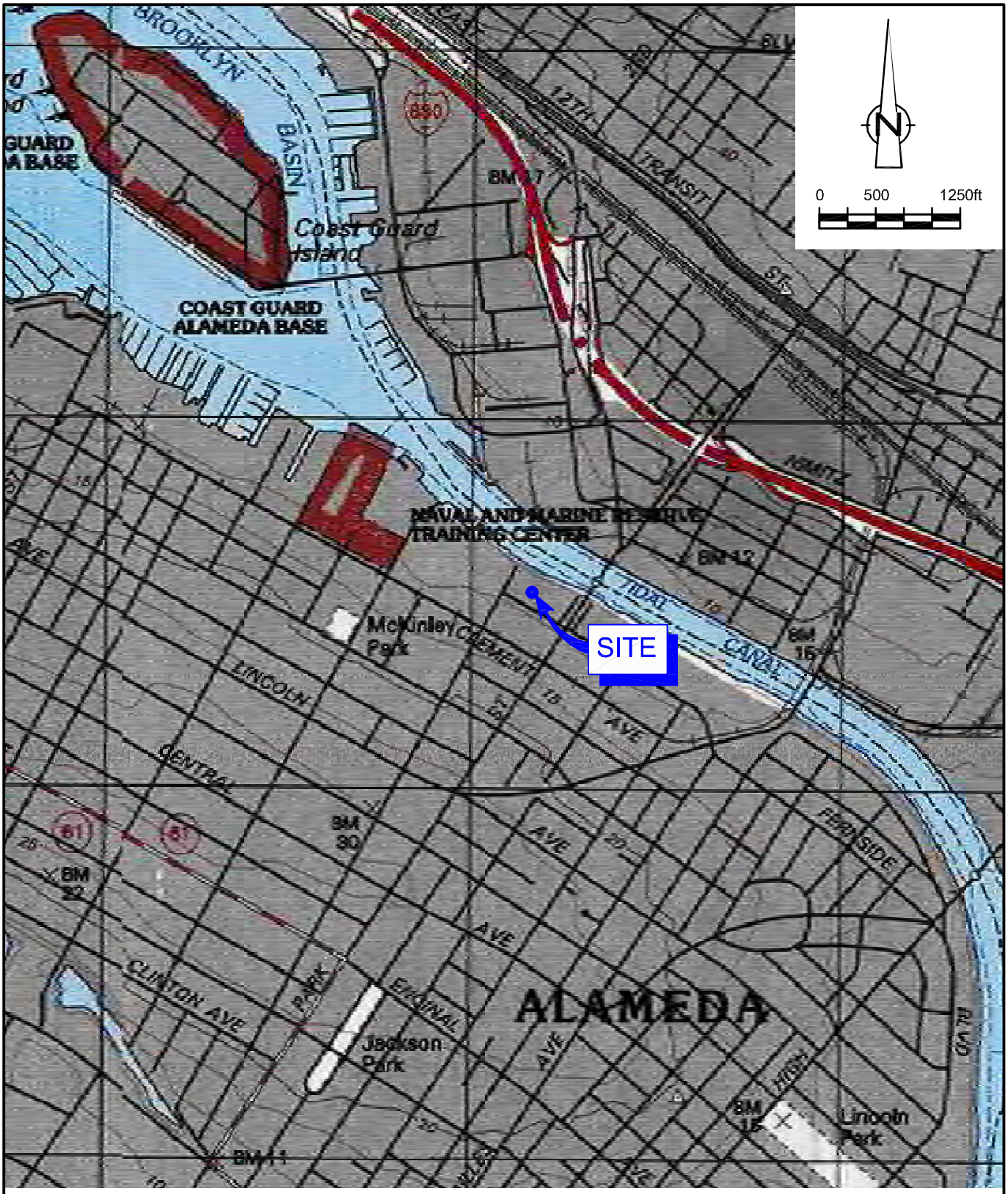
PROFESSIONAL GEOLOGIST
GREG BARCLAY
No. 6260
STATE OF CALIFORNIA

LA/jt/11
Encl.

Figure 1	Vicinity Map
Figure 2	Site Plan
Table 1	Well Construction Specifications
Attachment A	Regulatory Correspondence
Attachment B	Summary of Site History and Previous Environmental Work
Attachment C	Standard Field Procedures for Monitoring Well Installation

cc: Mike Bauer, Chevron (*electronic only*)
Julie Beck Ball
Peter Reinhold Beck
Monroe Wingate
Tom Foley, Gallagher & Miersch

FIGURES

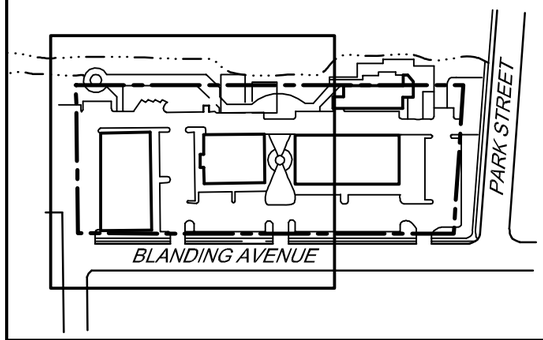


SOURCE: TOPO! MAPS.

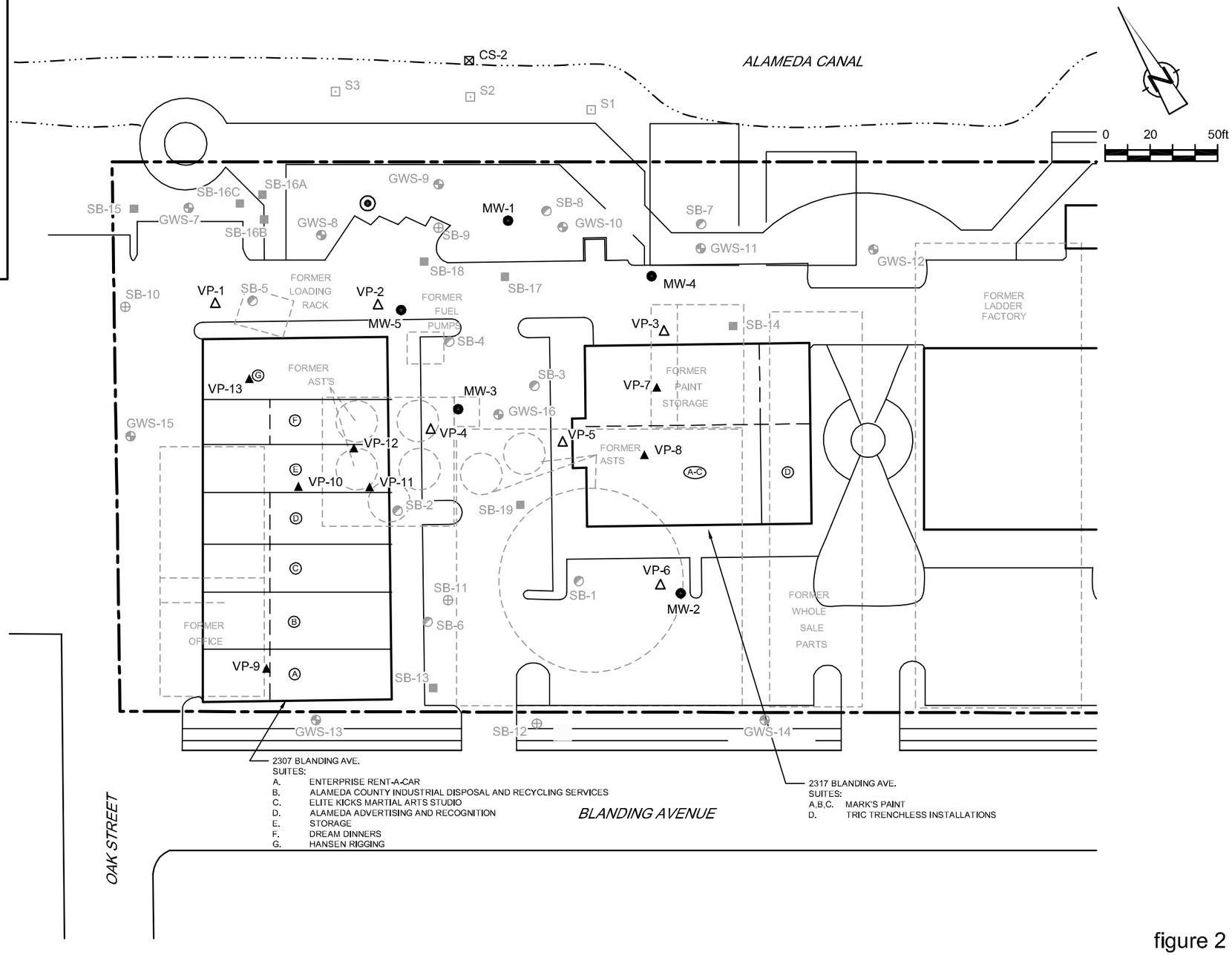
figure 1

VICINITY MAP
FORMER SIGNAL OIL BULK PLANT (CHEVRON FACILITY 20-6127)
2301-2311 BLANDING AVENUE
Alameda, California

631916-2010(012)GN-WA001 MAR 30/2010



KEY PLAN
SCALE: 1"=250'



LEGEND

- ▲ SUB-SLAB VAPOR POINT
- ● MONITORING WELL LOCATION
- △ VAPOR WELL
- ■ SOIL BORING (CRA, AUGUST, 2008)
- ◪ SOIL BORING (GEOMATRIX, FEBRUARY 1995)
- ⊕ SOIL BORING (RRM, OCTOBER 1998)
- ⊕ SHALLOW GROUNDWATER SAMPLE (GEOMATRIX, APRIL 1995)
- ⊠ CANAL GRAB SURFACE WATER SAMPLE (RRM, OCTOBER 1998)
- ⊡ GRAB SOIL SAMPLE (CAMBRIA, JANUARY 2004)
- SITE FEATURES NOTED ON SANBORN FIRE INSURANCE MAP, DATED 1932
- ◉ PROPOSED WELL LOCATION

NOTE:
WELL LOCATIONS ARE BASED ON MAP PROVIDED BY MORROW SURVEYING (DWG NO.0857-149 ct, DATED 7-30-09).
ALL OTHER LOCATIONS ARE APPROXIMATE.

figure 2

SITE PLAN
FORMER SIGNAL OIL BULK PLANT (CHEVRON FACILITY 20-6127)
2301-2311 BLANDING AVENUE
Alameda, California

TABLE

TABLE 1

WELL CONSTRUCTION SPECIFICATIONS
FORMER SIGNAL OIL MARINE STORAGE AND DISTRIBUTION FACILITY
(CHEVRON BULK PLANT 20-6127)
2301-2311 BLANDING AVENUE
ALAMEDA, CALIFORNIA

Well ID	*Date Installed*	*TOC*	*Total Depth (fbg)*	*Casing Diameter* [1] *(inches)*	*Slot Size (inches)*	*Screen Interval (fbg)*	*Filter Pack (fbg)*	*Status*
MW-1	8/15/1990	13.49	19.5	2	0.020	4-19	3-19.5	Active
MW-2	6/19/2009	10.63	18	2	0.020	10.5-15.5	10-16	Active
MW-3	6/19/2009	10.72	18.5	2	0.020	13.5-18.5	12.5-18.5	Active
MW-4	6/19/2009	11.40	20.5	2	0.020	15.5-20.5	14.5-20.5	Active
MW-5	6/23/2009	10.50	18	2	0.020	13-18	12-18	Active
VP-1[2]	7/9/2008	NS	4.25	1	0.020	3.75-4.25	3.5-4.5	Vapor only
VP-2[2]	7/9/2008	NS	4.75	1	0.020	4.25-4.75	4-5	Vapor only
VP-3[2]	7/14/2008	NS	5.75	1	0.020	5.25-5.75	5-6	Vapor only
VP-4[2]	7/14/2008	NS	5.75	1	0.020	5.25-5.75	5-6	Vapor only
VP-5[2]	7/14/2008	NS	5.75	1	0.020	5.25-5.75	5-6	Vapor only
VP-6[2]	7/9/2008	NS	5.75	1	0.020	5.25-5.75	5-6	Vapor only
VP-7[3]	7/17/2009	NS	0.5	0.25	NA	NA	NA	Vapor only
VP-8[3]	7/17/2009	NS	0.5	0.25	NA	NA	NA	Vapor only
VP-9[3]	7/22/2009	NS	0.5	0.25	NA	NA	NA	Vapor only
VP-10[3]	7/22/2009	NS	0.5	0.25	NA	NA	NA	Vapor only
VP-11[3]	7/17/2009	NS	0.5	0.25	NA	NA	NA	Vapor only
VP-12[3]	7/22/2009	NS	0.5	0.25	NA	NA	NA	Vapor only
VP-13[3]	7/22/2009	NS	0.5	0.25	NA	NA	NA	Vapor only

Abbreviations / Notes

TOC = Top of casing elevation (feet above mean sea level)

[1] = Schedule 40 PVC casing material

[2] = Wells VP-1 through VP-6 are vapor wells

[3] = Wells VP-7 through VP-13 are sub-slab vapor points

fbg = Feet below grade

NA = Not applicable

NS = Not surveyed

ATTACHMENT A

REGULATORY CORRESPONDENCE

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
ALEX BRISCOE, Agency Director

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

February 5, 2010

Mr. Mike Bauer
Chevron Environmental Management Company
145 S. State College Blvd.
Brea, CA 92821

Ms. Julie Beck Ball
Mr. Peter Reinhold Beck
2720 Broderick Street
San Francisco, CA 94123

Subject: SLIC Case No. RO0002466 and Geotracker Global ID T06019744728, Park Street Landing 2301-2337 Blanding Avenue, Alameda, CA 94501 – Site Investigation Review

Dear Mr. Bauer and Ms. Ball:

Alameda County Environmental Health (ACEH) staff has reviewed the Spills, Leaks, Investigations, and Cleanups (SLIC) case file for the above referenced site including the recently submitted documents entitled, "*Soil Vapor Sampling Report*," dated December 2, 2009 and "*Fourth Quarter 2009 Groundwater Monitoring Report*," dated November 20, 2009. Both reports were prepared on Chevron's behalf by Conestoga-Rovers & Associates.

The "*Soil Vapor Sampling Report*," presents results from sub-slab vapor probe installation and vapor sampling conducted on October 22, 2009. Sub-slab vapor probes VP-9 through VP-13 were re-installed due to ambient air leaks detected during the initial sampling of the probes on July 24, 2009. Total petroleum hydrocarbons as gasoline (TPHg) and benzene were detected in sub-slab soil vapor samples at concentrations up to 2,100 and 16 micrograms per cubic meter ($\mu g/m^3$), respectively. Based on the sub-slab vapor sampling results obtained, we request additional investigation as discussed in the technical comments below. We request that you address the following technical comments and submit the reports requested below.

TECHNICAL COMMENTS

1. **Sub-Slab Sampling Methods.** Subslab vapor samples VP-9 through VP-13 were collected without purging. We request that future subslab vapor samples be collected following the guidance in the document prepared by the U.S. Environmental Protection Agency entitled, "*Draft Standard Operating Procedures (SOP) for Installation of Sub-Slab Vapor Probes and Sampling Using EPA Method TO-15 to Support Vapor Intrusion Investigations*," which recommends purging two liters from subslab vapor probes using two dedicated 1-liter Tedlar bags. This guidance document was included as Appendix E to the March 11, 2009 Work Plan for the sub-slab vapor probe installation and sampling but apparently was not applied during sub-slab sampling at the site.

2. **Comparison of Sub-slab Vapor Sampling Results to ESLs.** The "*Soil Vapor Sampling Report*," dated December 2, 2009 cites a comparison of the sub-slab sampling results to Environmental Screening Levels (ESLs) in concluding that there appears to be no human health risk due to vapor intrusion to indoor air. We do not concur with this method for evaluating the results. The ESLs cited are for soil vapor samples that are typically collected at a depth of 5 feet and incorporate an attenuation factor for soil based on the distance between the slab of the building and the soil vapor sample. Since, sub-slab samples are collected immediately below the slab, screening levels that incorporate an attenuation factor for a vertical interval of soil are clearly not applicable. The Department of Toxic Substances Control provides a default attenuation factor of 0.01 (Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air, DTSC December 15, 2004) for subslab samples to account for attenuation by the building slab. Therefore, the appropriate approach is to apply an attenuation factor of 0.01 to the subslab sample results and compare the data to indoor air goals. As an example, applying an attenuation factor of 0.01 to the subslab sample results for VP-10 results in an estimated indoor air concentration for TPHg of 21 $\mu g/m^3$ (2,100 $\mu g/m^3$ x 0.01) which exceeds the indoor air goal of 14 $\mu g/m^3$ for noncarcinogenic risk. For benzene, applying an attenuation factor of 0.01 to the subslab sample results for VP-10 results in an estimated indoor air concentration of 0.16 $\mu g/m^3$ (16 $\mu g/m^3$ x 0.01) which exceeds the indoor air goal of 0.14 $\mu g/m^3$ for carcinogenic risk. Although these results do not necessarily indicate that a significant risk of vapor intrusion exists at the site, the results clearly indicate that further investigation is needed. At a minimum, we request that you sample the existing sub-slab and soil vapor probes on a quarterly basis. These data will be used to evaluate temporal variability and the need for further sub-slab and indoor air sampling at the site. We do not concur with the proposal to destroy subslab vapor probes VP-7 through VP-13. Please present the results of quarterly vapor monitoring in the quarterly monitoring reports requested. You may also propose additional investigation of the potential for vapor intrusion that includes actions in addition to quarterly vapor sampling.

3. **Temporal Variability of Soil Vapor Sampling Results.** In some cases, there appears to be significant variability in the analytical results between the 7/24/2009 and 10/22/2009 sampling events. The variability of the sampling results must be considered in evaluating whether there is a potential for vapor intrusion and further supports the need for additional investigation.

4. **Groundwater Monitoring Conclusions.** We concur with the proposal to continue quarterly groundwater monitoring. Please present the results from quarterly groundwater monitoring in the reports requested below. However, it is not clear that the collection of surface water samples at CS-2 provides meaningful information to help assess whether petroleum hydrocarbons from the site discharge to the Alameda Canal. Therefore, sampling of CS-2 may be suspended at this time.

5. **Evaluation of Shallow Groundwater.** In correspondence dated October 17, 2007, we questioned the representativeness of the groundwater monitoring data for well MW-1 and requested additional sampling of shallow groundwater in the area of well MW-1. Two shallow groundwater samples were proposed in the area of well MW-1 (SB-17 and SB-18). TPHg, TPHd, and benzene were detected in the grab groundwater sample from boring SB-18 at concentrations of 3,800, 19,000, and 590 µg/L. The concentrations detected in the grab groundwater sample from SB-18 are significantly higher than the concentrations detected in groundwater from MW-1. This further indicates that the data collected from well MW-1 may not accurately reflect shallow groundwater quality at the site and also indicates

that fuel hydrocarbons are likely discharging to the Alameda Canal. Unfortunately, a groundwater sample was not collected from boring SB-17. The March 11, 2009 "Work Plan for Additional Investigation," proposed the installation of five monitoring wells. One of the proposed wells was downgradient from well MW-1 and would have provided additional data to assess the representativeness of MW-1 results and to help assess potential discharges to the Alameda Canal. The proposed well could not be installed due to subsurface obstructions at approximately 3 to 4 feet bgs. As a result, the evaluation of shallow groundwater and the potential for discharges to Alameda Canal remains incomplete. We request that you make additional attempts to install the proposed well downgradient from MW-1 or propose additional investigation to address this data gap. Please submit a Well Installation Report for the proposed well downgradient from MW-1 or a Work Plan for additional investigation activities to assess potential discharges to Alameda Canal no later than May 12, 2010.

TECHNICAL REPORT REQUEST

Please submit technical reports to Alameda County Environmental Health (Attention: Jerry Wickham), according to the following schedule:

- **30 days after end of each quarter** – Quarterly Soil Vapor and Groundwater Monitoring Report
- **May 12, 2010** – Well Installation Report or Work Plan to Assess Potential Discharges to Alameda Canal

These reports are being requested pursuant to California Health and Safety Code Section 25296.10. 23 CCR Sections 2652 through 2654, and 2721 through 2728 outline the responsibilities of a responsible party in response to an unauthorized release from a petroleum UST system, and require your compliance with this request.

ELECTRONIC SUBMITTAL OF REPORTS

ACEH's Environmental Cleanup Oversight Programs (LOP and SLIC) require submission of reports in electronic form. The electronic copy replaces paper copies and is expected to be used for all public information requests, regulatory review, and compliance/enforcement activities. Instructions for submission of electronic documents to the Alameda County Environmental Cleanup Oversight Program FTP site are provided on the attached "Electronic Report Upload Instructions." Submission of reports to the Alameda County FTP site is an addition to existing requirements for electronic submittal of information to the State Water Resources Control Board (SWRCB) Geotracker website. In September 2004, the SWRCB adopted regulations that require electronic submittal of information for all groundwater cleanup programs. For several years, responsible parties for cleanup of leaks from underground storage tanks (USTs) have been required to submit groundwater analytical data, surveyed locations of monitoring wells, and other data to the Geotracker database over the Internet. Beginning July 1, 2005, these same reporting requirements were added to Spills, Leaks, Investigations, and Cleanup (SLIC) sites. Beginning July 1, 2005, electronic submittal of a complete copy of all reports for all sites is required in Geotracker (in PDF format). Please visit the SWRCB website for more information on these requirements (http://www.swrcb.ca.gov/ust/cleanup/electronic_reporting).

PERJURY STATEMENT

All work plans, technical reports, or technical documents submitted to ACEH must be accompanied by a cover letter from the responsible party that states, at a minimum, the following: "I declare, under penalty of perjury, that the information and/or recommendations contained in the attached document or report is true and correct to the best of my knowledge." This letter must be signed by an officer or legally authorized representative of your company. Please include a cover letter satisfying these requirements with all future reports and technical documents submitted for this fuel leak case.

PROFESSIONAL CERTIFICATION & CONCLUSIONS/RECOMMENDATIONS

The California Business and Professions Code (Sections 6735, 6835, and 7835.1) requires that work plans and technical or implementation reports containing geologic or engineering evaluations and/or judgments be performed under the direction of an appropriately registered or certified professional. For your submittal to be considered a valid technical report, you are to present site specific data, data interpretations, and recommendations prepared by an appropriately licensed professional and include the professional registration stamp, signature, and statement of professional certification. Please ensure all that all technical reports submitted for this fuel leak case meet this requirement.

AGENCY OVERSIGHT

If it appears as though significant delays are occurring or reports are not submitted as requested, we will consider referring your case to the Regional Board or other appropriate agency, including the County District Attorney, for possible enforcement actions. California Health and Safety Code, Section 25299.76 authorizes enforcement including administrative action or monetary penalties of up to $10,000 per day for each day of violation.

If you have any questions, please call me at (510) 567-6791 or send me an electronic mail message at jerry.wickham@acgov.org.

Sincerely,

Jerry Wickham

Digitally signed by Jerry Wickham
DN: cn=Jerry Wickham, o, ou, email=jerry.wickham@acgov.org, c=US
Date: 2010.02.08 15:51:10 -08'00'

Jerry Wickham, California PG 3766, CEG 1177, and CHG 297
Senior Hazardous Materials Specialist

Enclosure: ACEH Electronic Report Upload (ftp) Instructions

cc: Mr. Brian Silva, Conestoga-Rovers & Associates, 10969 Trade Center Drive, Suite 107, Rancho Cordova, CA 95670 (*Sent via E-mail to: bsilva@craworld.com*)

Donna Drogos, ACEH (*Sent via E-mail to: donna.drogos@acgov.org*)
Jerry Wickham, ACEH
Geotracker, File

Alameda County Environmental Cleanup Oversight Programs (LOP and SLIC)	**ISSUE DATE:** July 5, 2005
	REVISION DATE: March 27, 2009
	PREVIOUS REVISIONS: December 16, 2005, October 31, 2005
SECTION: Miscellaneous Administrative Topics & Procedures	**SUBJECT:** Electronic Report Upload (ftp) Instructions

The Alameda County Environmental Cleanup Oversight Programs (LOP and SLIC) require submission of all reports in electronic form to the county's ftp site. Paper copies of reports will no longer be accepted. The electronic copy replaces the paper copy and will be used for all public information requests, regulatory review, and compliance/enforcement activities.

REQUIREMENTS

- Entire report including cover letter must be submitted to the ftp site as **a single portable document format (PDF) with no password protection**. (Please do not submit reports as attachments to electronic mail.)
- It is **preferable** that reports be converted to PDF format from their original format, (e.g., Microsoft Word) rather than scanned.
- Signature pages and perjury statements **must** be included and have either original or electronic signature.
- **Do not password protect the document**. Once indexed and inserted into the correct electronic case file, the document will be secured in compliance with the County's current security standards and a password. **Documents with password protection will not be accepted**.
- Each page in the PDF document should be rotated in the direction that will make it easiest to read on a computer monitor.
- Reports must be named and saved using the following naming convention:
  RO#_Report Name_Year-Month-Date (e.g., RO#5555_WorkPlan_2005-06-14)

Additional Recommendations

- A separate copy of the tables in the document should be submitted by e-mail to your Caseworker in **Excel** format. These are for use by assigned Caseworker only.

Submission Instructions

1) Obtain User Name and Password:
   a) Contact the Alameda County Environmental Health Department to obtain a User Name and Password to upload files to the ftp site.
      i) Send an e-mail to dehloptoxic@acgov.org
         Or
      ii) Send a fax on company letterhead to (510) 337-9335, to the attention of My Le Huynh.
   b) In the subject line of your request, be sure to include **"ftp PASSWORD REQUEST"** and in the body of your request, include the **Contact Information, Site Addresses**, and the **Case Numbers (RO# available in Geotracker) you will be posting for**.

2) Upload Files to the ftp Site
   a) Using Internet Explorer (IE4+), go to ftp://alcoftp1.acgov.org
      (i) Note: Netscape and Firefox browsers will not open the FTP site.
   b) Click on File, then on Login As.
   c) Enter your User Name and Password. (Note: Both are Case Sensitive.)
   d) Open "My Computer" on your computer and navigate to the file(s) you wish to upload to the ftp site.
   e) With both "My Computer" and the ftp site open in separate windows, drag and drop the file(s) from "My Computer" to the ftp window.

3) Send E-mail Notifications to the Environmental Cleanup Oversight Programs
   a) Send email to dehloptoxic@acgov.org notify us that you have placed a report on our ftp site.
   b) Copy your Caseworker on the e-mail. Your Caseworker's e-mail address is the entire first name then a period and entire last name @acgov.org. (e.g., firstname.lastname@acgov.org)
   c) The subject line of the e-mail must start with the RO# followed by **Report Upload**. (e.g., Subject: RO1234 Report Upload) If site is a new case without an RO# use the street address instead.
   d) If your document meets the above requirements and you follow the submission instructions, you will receive a notification by email indicating that your document was successfully uploaded to the ftp site.

ATTACHMENT B

SUMMARY OF SITE HISTORY AND PREVIOUS ENVIRONMENTAL WORK

SUMMARY OF SITE HISTORY AND PREVIOUS ENVIRONMENTAL WORK

Former Signal Oil Bulk Plant 20-6127
2301-2311 Blanding Avenue, Alameda, California

Site History

A Sanborn map dated 1897 showed the site as occupied by several residential structures and outbuildings; the southeast portion of the site was shown as occupied by a laundry facility and a blacksmith. From at least 1930 until approximately 1961, the northwestern portion of the site was occupied by a petroleum bulk plant operated by Signal Oil & Gas Company. Former bulk plant facilities consisted of one large and seven smaller gasoline aboveground storage tanks (ASTs) within concrete secondary containment, underground piping, an office building, a loading rack, and a small structure containing gasoline pumps (Figure 2). The northeast portion of the facility was shown as occupied by a structure identified as an auto garage and also used for paint storage on Sanborn maps dated between 1932 and 1950. A rail spur was shown to service the facilities on Blanding Avenue. The central portion of the site was shown as occupied by two structures identified as wholesale tires and a can warehouse. An additional larger structure was shown in the central portion of the site that was identified as vacant on the 1948 Sanborn map and as a ladder factory on the 1950 Sanborn map. Several structures appeared to be present in the southeast portion of the site in the 1939 aerial photograph. However, only one or two small sheds were shown in this area on the 1948 and 1950 Sanborn maps. In the 1958 aerial photograph, the ladder factory structure no longer appeared present and the southeast portion of the site appeared vacant and used for parking. Between 1957 and 1963, the buildings at the site were reportedly removed; it is assumed that the ASTs and piping were also removed at this time. In the 1965 aerial photograph, all the bulk plant facilities appear to have been removed and the majority of the site appears occupied by a construction materials yard with several small structures. Several additional structures also appear present in the southeast portion of the site. From 1973 to 1983, the northwestern portion of the site reportedly was used as a construction yard and for boat repair activities; and the southeastern portion was occupied by a restaurant, paved parking area, and a possible automobile sales lot. In 1987, the site was redeveloped with the current configuration.

1995 Soil and Groundwater Investigation

In February 1995, Geomatrix Consultants, Inc. (Geomatrix) advanced eight soil borings (SB-1 through SB-8) to approximately 10 feet below grade (fbg) in the northwestern portion of the site to evaluate if previous site uses had impacted soil and groundwater quality. Groundwater was not encountered in the borings. Two to three soil samples were collected at various depths from each boring for laboratory analysis. Nineteen samples were analyzed for total petroleum hydrocarbons as gasoline (TPHg) and diesel (TPHd); and benzene, toluene, ethylbenzene, and xylenes (BTEX). TPHg was detected in six of the samples at concentrations ranging from 4.0 to 2,000 milligrams per kilogram (mg/kg). TPHd was detected in the majority of the samples at concentrations ranging from 10 to 250 mg/kg. BTEX were also detected in several of the

samples (benzene up to 3.7 mg/kg). The highest concentrations of petroleum hydrocarbons generally were detected in borings SB-2 and SB-4 located in the vicinity of the former ASTs and gasoline pump, respectively, between 4 and 7 fbg. One sample from each boring (depths ranging from 0.5 to 3 fbg) was also analyzed for CAM 17 metals. The detected metals concentrations generally appeared to be within the range of natural background levels with the exception of slightly elevated arsenic in a few samples. Arsenic was detected in the samples collected at 1 fbg from borings SB-3, SB-4, and SB-6 at 68 mg/kg, 46 mg/kg, and 130 mg/kg, respectively. As a result, deeper samples collected from borings SB-3 (6.5 fbg) and SB-6 (8 fbg) were also analyzed for arsenic; arsenic was not detected in the sample collected from SB-3, but was detected at 2.5 mg/kg in the sample collected from SB-6. Based on these results, the soil impacted with arsenic appeared to be of limited vertical extent. Three soil samples (SB-4-7', SB-5-6', and SB-8-7') were also analyzed for VOCs, which were not detected. Based on the soil analytical results, a shallow groundwater survey was recommended to evaluate if groundwater had been impacted by petroleum hydrocarbons.

In April 1995, Geomatrix collected grab-groundwater samples from 10 shallow borings (GWS-7 through GWS-16) drilled to depths of 15 to 21.5 fbg at the site. Borings GWS-7 through GWS-12 were located in the northeastern portion of the site adjacent to Alameda Canal to evaluate if impacted groundwater was flowing toward the canal; based on an assumed groundwater flow direction toward the canal. Borings GWS-13 through GWS-15 were located on the southwest and northwest property boundaries in the assumed upgradient and perimeter crossgradient directions to evaluate the quality of groundwater coming onto the site. Boring GWS-16 was located to the northeast of the former ASTs and was drilled approximately 6 feet deeper than the remaining borings to evaluate deeper groundwater quality. The groundwater samples were analyzed for TPHg, BTEX, and TPHd; the samples were filtered by the laboratory to remove turbidity and a silica-gel cleanup was performed to remove non-petroleum organic matter prior to the TPHd analysis. TPHg was detected in the samples collected from borings GWS-8 through GWS-11 and GWS-16 at concentrations ranging from 70 (GWS-16) to 22,000 micrograms per liter (µg/L) (GWS-9). TPHd was detected in the samples collected from borings GWS-8 through GWS-11 at concentrations ranging from 60 (GWS-8) to 1,200 µg/L (GWS-9). Benzene was detected in the samples collected from borings GWS-8 through GWS-10 and GWS-16 at concentrations of 36 µg/L, 6,200 µg/L, and 880 µg/L, respectively. Toluene, ethylbenzene, and xylenes (up to 1,200 µg/L) were also detected in several of the samples. The maximum concentrations were detected in boring GWS-9 located downgradient of the gasoline pump and loading rack. Petroleum hydrocarbons were not detected in the upgradient borings GWS-13 through GWS-15. The deeper sample (GWS-16) contained only low to trace hydrocarbon concentrations.

A black granular material was encountered in boring GWS-7 in the northern corner of the site from approximately 2.5 to 6 fbg. This material appeared similar to a small pile of black granular material observed on the northwestern property boundary that appeared to have originated from the adjacent property (a metal fabrication company). A sample of this material was collected and analyzed for TPHd, VOCs, semi-VOCs, and CAM 17 metals. An elevated concentration of copper (1,700 mg/kg) was detected in the sample. The detected concentration did not exceed the Total Threshold Limit Concentration (TTLC) of 2,500 mg/kg, which is the

concentration above which a waste may be considered hazardous in California. The sample was also analyzed for soluble copper using the Waste Extraction Test (WET) method; which was detected at 0.04 milligrams per liter (mg/L). The detected soluble lead concentration did not exceed the Soluble Threshold Limit Concentration (STLC) of 25 mg/L, which is also the concentration above which a waste may be considered hazardous in California. Details of this investigation were presented in the report titled *Soil Investigation and Shallow Groundwater Survey, Northwestern Portion of the Park Street Landing Site*, prepared by Geomatrix and dated September 1995.

1998 RBCA Tier 1 Evaluation

In July 1998, RRM, Inc. (RRM) performed a Tier 1 Risk-Based Corrective Action (RBCA) assessment to evaluate the potential health risks posed by residual petroleum hydrocarbons in soil and groundwater at the site. Based on the results, RRM recommended the collection of site-specific data to complete a Tier 2 RBCA evaluation; the identification of the beneficial uses of groundwater beneath the site; an evaluation of background water quality in Alameda Canal; and to provide evidence that biodegradation was reducing hydrocarbon concentrations. Details of this investigation were presented in the report entitled *Risk-Based Corrective Action (RBCA) Tier 1 Evaluation, Park Street Landing Site*, prepared by RRM and dated July 24, 1998.

1998 Soil and Groundwater Investigation

In October 1998, RRM performed an additional soil and groundwater investigation at the site. The purpose of the investigation was to: 1) collect site-specific data to complete a Tier 2 RBCA evaluation; 2) identify the beneficial uses of groundwater beneath the site; 3) evaluate the background water quality in Alameda Canal; and 4) evaluate whether biodegradation of petroleum hydrocarbons was occurring beneath the site. Four additional borings (SB-9 through SB-12) were advanced to depths of 15 to 18 fbg during the investigation. A total of eight soil samples were collected at various depths from the borings and analyzed for TPHg, TPHd, BTEX, and methyl tertiary butyl ether (MTBE). TPHg was detected in the soil samples collected at 5 and 13 fbg from boring SB-9 (130 and 900 mg/kg, respectively); and in the sample collected at 6 fbg from boring SB-11 (140 mg/kg). TPHd was detected in the soil samples collected at 5, 13, and 15 fbg from boring SB-9 (3,300 mg/kg, 1,300 mg/kg, and 1.2 mg/kg, respectively); in the sample collected at 5.5 fbg from boring SB-10 (130 mg/kg); and in the sample collected at 6 fbg from boring SB-11 (60 mg/kg). BTEX (up to 3.3 mg/kg) were detected in the soil samples collected from borings SB-9 and SB-11; MTBE (using EPA Method 8020) was only detected in the sample collected at 13 fbg from boring SB-9 (12 mg/kg). Following the initial TPHd analysis, two rounds of silica gel cleanup followed by TPHd analysis were performed on the soil samples from boring SB-9. The detected TPHd concentrations were reduced after each round, indicating that biodegradation was occurring, and natural organic matter was present in the subsurface.

Grab-groundwater samples were collected from each boring and analyzed for TPHg, TPHd, BTEX, and MTBE. TPHg was only detected in the samples collected from borings SB-9 (14,000 µg/L) and SB-11 (310 µg/L). TPHd was detected in the samples collected from borings

SB-9 (83,000 µg/L), SB-10 (97 µg/L), and SB-11 (270 µg/L). Benzene and MTBE (using EPA Method 8020) were only detected in the sample collected from boring SB-9 (1,400 and 260 µg/L, respectively); the sample was re-analyzed for MTBE using EPA Method 8260, and MTBE was not detected. Toluene, ethylbenzene, and xylenes (up to 630 µg/L) were detected in the samples collected from borings SB-9 and SB-11. As with the soil samples, a silica-gel cleanup reduced the detected TPHd concentrations. Based on the depth to water in the borings, and the elevation of the borings, the groundwater flow direction was calculated to be northerly. Based on natural biodegradation indicator parameters in groundwater (dissolved oxygen, oxidation-reduction potential, nitrate, and sulfate), it appeared that petroleum hydrocarbons were being degraded both aerobically and anaerobically; although it appeared that anaerobic processes dominated.

Three grab-water samples (CS-1 through CS-3) were collected from Alameda Canal (Figure 2) and analyzed for TPHg, TPHd, BTEX, and MTBE; which were not detected. Water level measurements were collected from the Alameda Canal and the four temporary wells placed in borings SB-9 through SB-12 to evaluate potential tidal influence on groundwater beneath the site. The fluctuations in borings SB-10 through SB-12 were minimal indicating that groundwater was tidally influenced to a limited degree in these areas. A more significant fluctuation was observed in SB-9; suggesting that groundwater in this area was tidally influenced, and tidal fluctuations would tend to stabilize the petroleum hydrocarbon plume in this area. Two concrete sea walls separated shallow groundwater beneath the site from canal water; likely causing the limited tidal influence. Based on the site data, relevant beneficial uses, and associated water quality parameters, the most applicable beneficial use of groundwater beneath the site was determined to be freshwater replenishment to surface water.

A well survey was performed for a ½-mile radius around the site. Nine wells were identified within the search radius (one recovery well, one irrigation well, five extraction wells, and two industrial wells). All the wells were either located up-gradient of the site or across the Alameda Canal. Based on the results of the Tier 2 RBCA evaluation, soil and groundwater petroleum hydrocarbon concentrations at the site did not exceed the site-specific target levels (SSTLs). Details of this investigation were presented in the report entitled *Soil and Groundwater Investigation Results, Former Signal Oil Marine Terminal*, prepared by RRM and dated May 7, 1999.

2000 Monitoring Well Installation

In December 2000 Gettler-Ryan Inc., under the supervision of Delta Environmental Consultants, Inc. (Delta), installed one groundwater monitoring well (MW-1) along the northeastern portion of the site adjacent to the Alameda Canal. Soil samples were collected at depths of 5, 10, and 15 fbg from the well boring and analyzed for TPHg, TPHd, BTEX, and MTBE. TPHg was only detected in the sample collected at 10 fbg (320 mg/kg). TPHd was only detected in the samples collected at 5 and 10 fbg (30 and 160 mg/kg, respectively). Low concentrations of BTEX were detected in all the samples; MTBE was not detected in any of the samples. The initial groundwater sample collected from the well contained TPHg, TPHd, and benzene at 5,210 µg/L, 1,100 µg/L, and 868 µg/L, respectively. Details of this investigation were presented

in the report entitled *Monitoring Well Installation Report*, prepared by Delta and dated April 10, 2001.

2004 Soil Investigation

In January 2004, Cambria Environmental Technology, Inc. (Cambria) collected three surface soil samples (S1, S2, and S3) from the bank above the western shore of the Alameda Canal. Sample S2 was collected directly down-slope of well MW-1 near a water seep observed on the slope above the canal. Samples S1 and S3 were collected approximately 70 feet east and 90 feet north of well MW-1, respectively, to evaluate background concentrations. The three samples were analyzed for TPHg, TPHd, BTEX, and MTBE. TPHg, BTEX, and MTBE were not detected in any of the samples. TPHd was detected in samples S1, S2, and S3 at 14 mg/kg, 220 mg/kg, and 220 mg/kg, respectively. The laboratory chromatographs indicated that the hydrocarbon pattern observed in these soil samples was not typical of diesel fuel. Therefore, it was concluded the TPHd detections may have represented either highly-degraded diesel fuel from various historical onsite and nearby operations, or residual organic material of unknown origin present in local fill material. Details of this investigation were presented in the report entitled *Soil Sampling Report*, prepared by Cambria and dated February 18, 2004.

Based on generally decreasing petroleum hydrocarbon concentrations in well MW-1 observed during quarterly monitoring, Cambria submitted a case closure request to ACEH dated January 10, 2006. In response to this request, and in a letter dated October 17, 2007, the ACEH requested the collection of additional data to substantiate the conclusion that petroleum hydrocarbons were not migrating and discharging into Alameda Canal. In addition, the potential for vapor intrusion was to be evaluated. Therefore, CRA prepared and submitted *Soil Boring and Vapor Point Installation Work Plan*, dated January 10, 2008. In a letter dated January 30, 2008, the ACEH approved the work plan, with several provisions.

2008 Site Investigation

In July 2008, CRA advanced six soil borings (SB-13 through SB-15 and SB-17 through SB-19) to a maximum depth of 16 fbg, and installed and sampled six permanent soil vapor wells (VP-1 through VP-6) to depths of 4.5 to 6 fbg. Soil boring SB-16 was cleared to 3 fbg but could not be completed due to refusal encountered at three locations (16A, B, and C).
Soil boring SB-16 was cleared to 3 fbg but could not be completed due to refusal encountered at three locations (16A, B, and C).

Soil analytical data indicated that the majority of TPHd and TPHg concentrations in soil are generally located in the area of and downgradient of the former ASTs. The highest concentrations were detected in boring VP-4 at 5 fbg. Relatively low concentrations of TPHd and TPHg were detected in the perimeter borings. Low concentrations of petroleum-related VOCs were also detected in the majority of the soil samples. The BTEX and VOC concentrations generally did not exceed the ESLs, with the exception of a few samples. Concentrations generally appeared to attenuate or were significantly reduced at 10 fbg. Generally, concentrations of metals were consistent with background levels and only exceeded

the ESLs in a few of the samples. Metals in shallow soil across the northwest portion of the site do not appear to be a result of former bulk plant operations. The metals do not appear to have impacted groundwater as only barium was detected in well MW-1.

The highest concentrations of hydrocarbons in groundwater were generally located downgradient of the former ASTs. TPHd, TPHg, and benzene were detected in downgradient boring SB-18 at 19,000 µg/L, 3,800 µg/L, and 590 µg/L, respectively; but only at 1,600 µg/L, 650 µg/L, and 3 µg/L, respectively, in boring SB-19 adjacent to the former large AST. Only relatively low concentrations of TPHd (up to 750 µg/L) were detected in perimeter borings SB-13, SB-14, and SB-15; and as evidenced by the work performed by RRM, some or most of the detected TPHd may be due to natural organic matter. The extent of the impacted groundwater is well-defined by borings GWS-7, GWS-12 through GWS-15, SB-10 (following silica gel cleanup), and SB-12. Chlorinated solvents were not detected in any of the soil samples collected, and generally were not detected in the groundwater samples with the exception of low concentrations of TCE, cis-1,2-DCE, and vinyl chloride in the sample collected from boring SB-15 in the northeast corner of the site.

The highest hydrocarbon concentrations in soil gas were detected in vapor wells VP-4, VP-5, and VP-6 located in the area of the former ASTs. Significantly lower concentrations were detected in vapor wells VP-1 and VP-2 located downgradient of VP-4. Chlorinated solvents were not detected in the soil vapor samples. Additional details of this investigation are presented in CRA's report entitled *Site Investigation Report*, dated October 2008.

2009 Monitoring Well Installation and Sub-Slab Vapor Sampling

In June 2009, CRA installed monitoring wells MW-2 through MW-5 to total depths of 16 to 20.5 fbg in order to further evaluate groundwater quality beneath the site. The new monitoring wells were installed within the former ASTs (MW-3), and north (MW-5), south (MW-2), and east (MW-4) of the former ASTs. Soil analytical data indicated that the majority of TPHd and TPHg concentrations in soil are located north to south through the former ASTs and generally decreases with depth. The highest TPHd concentration detected was from well boring MW-3 at 4 fbg at a concentration of 610 mg/kg. The highest TPHg concentration detected was from well boring MW-2 at 4.5 fbg at 1,100 mg/kg. No petroleum hydrocarbons were detected in perimeter well boring MW-4. No grab-groundwater samples were collected.

CRA also installed sub-slab vapor points beneath the two western buildings at the site in order to further evaluate potential vapor intrusion beneath the buildings. Two sub-slab vapor points (VP-7 and VP-8) were installed inside 2317 Blanding Avenue and five sub-slab vapor points (VP-9 through VP-13) were installed inside 2307 Blanding Avenue. The highest hydrocarbon concentrations in soil gas were detected in vapor points VP-9 and VP-13, located west-southwest of the former ASTs. Lower concentrations were detected in vapor points VP-8, and VP-10 through VP-12. All detected concentrations were below the shallow soil gas ESL of 29,000 micrograms per cubic meter (µg/m^3). Target chlorinated solvents were not detected in the soil vapor samples. Additional details of this investigation are presented in CRA's *Well Installation and Sub-Slab Vapor Sampling Report*, dated September 8, 2009.

2009 Vapor Sampling

In October 2009, CRA re-install and re-sample sub-slab vapor points VP-9 through VP-13 due to ambient air leaks detected during the initial sampling and to further evaluate the elevated soil vapor concentrations detected in vapor wells VP-1 through VP-6. The results of the re-sampling of the vapor wells VP-1 through VP-5 located outside of the buildings were consistent with previous results for vapor wells VP-3 through VP-5. However, results of the re-sampling of vapor wells VP-1 and VP-2 indicated no TPHg or benzene vapor concentrations at each of these locations, which is not consistent with the initial sample results from August 2008. Additional details of this investigation are presented in CRA's *Vapor Sampling Report*, dated December 2, 2009.

ATTACHMENT C

STANDARD FIELD PROCEDURES FOR MONITORING WELL INSTALLATION

Conestoga-Rovers & Associates

STANDARD FIELD PROCEDURES FOR MONITORING WELL INSTALLATION

This document presents standard field methods for drilling and sampling soil borings and installing, developing and sampling groundwater monitoring wells. These procedures are designed to comply with Federal, State and local regulatory guidelines. Specific field procedures are summarized below.

SOIL BORINGS

Objectives

Soil samples are collected to characterize subsurface lithology, assess whether the soils exhibit obvious hydrocarbon or other compound vapor or staining, and to collect samples for analysis at a State-certified laboratory. All borings are logged using the Unified Soil Classification System by a trained geologist working under the supervision of a California Professional Geologist (P.G.) or Professional Engineer (P.E.).

Soil Boring and Sampling

Soil borings are typically drilled using hollow-stem augers or direct-push technologies such as the Geoprobe®. Soil samples are collected at least every five ft to characterize the subsurface sediments and for possible chemical analysis. Additional soil samples are collected near the water table and at lithologic changes. Samples are collected using lined split-barrel or equivalent samplers driven into undisturbed sediments at the bottom of the borehole.

Drilling and sampling equipment is steam-cleaned prior to drilling and between borings to prevent cross-contamination. Sampling equipment is washed between samples with trisodium phosphate or an equivalent EPA-approved detergent.

Sample Analysis

Sampling tubes chosen for analysis are trimmed of excess soil and capped with Teflon tape and plastic end caps. Soil samples are labeled and stored at or below 4^{o} C on either crushed or dry ice, depending upon local regulations. Samples are transported under chain-of-custody to a State-certified analytic laboratory.

Field Screening

One of the remaining tubes is partially emptied leaving about one-third of the soil in the tube. The tube is capped with plastic end caps and set aside to allow hydrocarbons to volatilize from the soil. After ten to fifteen minutes, a portable volatile vapor analyzer measures volatile hydrocarbon vapor concentrations in the tube headspace, extracting the vapor through a slit in the cap. Volatile vapor analyzer measurements are used along with the field observations, odors, stratigraphy and groundwater depth to select soil samples for analysis.

Water Sampling

Water samples, if they are collected from the boring, are either collected using a driven Hydropunch® type sampler or are collected from the open borehole using bailers. The groundwater samples are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4°C, and transported under chain-of-custody to the laboratory. Laboratory-supplied trip blanks accompany the samples and are analyzed to check for cross-contamination. An equipment blank may be analyzed if non-dedicated sampling equipment is used.

Grouting

If the borings are not completed as wells, the borings are filled to the ground surface with cement grout poured or pumped through a tremie pipe.

MONITORING WELL INSTALLATION, DEVELOPMENT AND SAMPLING

Well Construction and Surveying

Groundwater monitoring wells are installed to monitor groundwater quality and determine the groundwater elevation, flow direction and gradient. Well depths and screen lengths are based on groundwater depth, occurrence of hydrocarbons or other compounds in the borehole, stratigraphy and State and local regulatory guidelines. Well screens typically extend 10 to 15 feet below and 5 feet above the static water level at the time of drilling. However, the well screen will generally not extend into or through a clay layer that is at least three feet thick.

Well casing and screen are flush-threaded, Schedule 40 PVC. Screen slot size varies according to the sediments screened, but slots are generally 0.010 or 0.020 inches wide. A rinsed and graded sand occupies the annular space between the boring and the well screen to about one to two feet above the well screen. A two feet thick hydrated bentonite seal separates the sand from the overlying sanitary surface seal composed of Portland type I,II cement.

Well-heads are secured by locking well-caps inside traffic-rated vaults finished flush with the ground surface. A stovepipe may be installed between the well-head and the vault cap for additional security.

The well top-of-casing elevation is surveyed with respect to mean sea level and the well is surveyed for horizontal location with respect to an onsite or nearby offsite landmark.

Well Development

Wells are generally developed using a combination of groundwater surging and extraction. Surging agitates the groundwater and dislodges fine sediments from the sand pack. After about ten minutes of surging, groundwater is extracted from the well using bailing, pumping and/or reverse air-lifting through an eductor pipe to remove the sediments from the well. Surging and extraction continue until at least ten well-casing volumes of groundwater are extracted and the sediment volume in the groundwater is negligible. This process usually occurs prior to installing the sanitary surface seal to ensure sand pack stabilization. If development occurs after surface seal installation, then development occurs 24 to 72 hours after seal installation to ensure that the Portland cement has set up correctly.

All equipment is steam-cleaned prior to use and air used for air-lifting is filtered to prevent oil entrained in the compressed air from entering the well. Wells that are developed using air-lift evacuation are not sampled until at least 24 hours after they are developed.

Groundwater Sampling

Depending on local regulatory guidelines, three to four well-casing volumes of groundwater are purged prior to sampling. Purging continues until groundwater pH, conductivity, and temperature have stabilized. Groundwater samples are collected using bailers or pumps and are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4^{o}C, and transported under chain-of-custody to the laboratory. Laboratory-supplied trip blanks accompany the samples and are analyzed to check for cross-contamination. An equipment blank may be analyzed if non-dedicated sampling equipment is used.

Waste Handling and Disposal

Soil cuttings from drilling activities are usually stockpiled onsite and covered by plastic sheeting. At least three individual soil samples are collected from the stockpiles and composited at the analytic laboratory. The composite sample is analyzed for the same constituents analyzed in the borehole samples in addition to any analytes required by the receiving disposal facility. Soil cuttings are transported by licensed waste haulers and disposed in secure, licensed facilities based on the composite analytic results.

Groundwater removed during development and sampling is typically stored onsite in sealed 55-gallon drums. Each drum is labeled with the drum number, date of generation, suspected contents, generator identification and consultant contact. Upon receipt of analytic results, the water is either pumped out using a vacuum truck for transport to a licensed waste treatment/disposal facility or the individual drums are picked up and transported to the waste facility where the drum contents are removed and appropriately disposed.