CONESTOGA-ROVERS & ASSOCIATES

5900 Hollis Street, Suite A
Emeryville, California 94608
Telephone: (510) 420-0700 Fax: (510) 420-9170
www.CRAworld.com

TRANSMITTAL

DATE: July 28, 2010

REFERENCE NO.: 240612

PROJECT NAME: 1784 150th Avenue, San Leandro

TO: Jerry Wickham
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

RECEIVED
1:40 pm, Jul 30, 2010
Alameda County
Environmental Health

Please find enclosed:
- ☐ Draft
- ☐ Originals
- ☐ Prints
- ☒ Final
- ☐ Other

Sent via:
- ☐ Mail
- ☐ Overnight Courier
- ☐ Same Day Courier
- ☒ Other GeoTracker and Alameda County FTP

QUANTITY	DESCRIPTION
1	Revised Air Sparge/Soil Vapor Extraction Pilot Test Work Plan

- ☐ As Requested
- ☐ For Your Use
- ☒ For Review and Comment
- ☐
- ☐

COMMENTS:
If you have any questions regarding the content of this document, please contact Peter Schaefer at (510) 420-3319.

Copy to: Denis Brown, Shell Oil Products US *(electronic copy)*
SF Data Room *(electronic copy)*

Completed by: Peter Schaefer Signed: Peter Schaefer

Filing: **Correspondence File**

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

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

Re: Shell-branded Service Station
1784 150th Avenue
San Leandro, California
SAP Code 136019
Incident No. 98996068
ACEH Case No. RO0000367

Dear Mr. Wickham:

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

REVISED AIR SPARGE/SOIL VAPOR EXTRACTION PILOT TEST WORK PLAN

SHELL-BRANDED SERVICE STATION
1784 150TH AVENUE
SAN LEANDRO, CALIFORNIA

SAP CODE 136019
INCIDENT NO. 98996068
AGENCY NO. RO0000367

Prepared by:
Conestoga-Rovers & Associates

5900 Hollis Street, Suite A
Emeryville, California
U.S.A. 94608

Office: (510) 420-0700
Fax: (510) 420-9170

web: http://www.CRAworld.com

JULY 28, 2010
REF. NO. 240612 (17)
This report is printed on recycled paper.

TABLE OF CONTENTS

LIST OF FIGURES
(Following Text)

1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA) prepared this *Revised Air Sparge/Soil Vapor Extraction Pilot Test Work Plan* on behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell) to incorporate the changes in the pilot test protocol requested in Alameda County Department of Environmental Health's (ACEH's) December 30, 2009 letter and to propose installation of a soil vapor extraction well (SVE-1) to mitigate shallow soil vapors detected during our previous attempt to complete this pilot test in March 2010. The initial test was suspended because shallow soil vapor samples from soil vapor probe SVP-1 exceeded the 30 parts per million (ppm) limit specified in ACEH's letter. CRA also proposes to install a soil vapor probe (SVP-6) adjacent to the southwest property boundary to further assess the potential for shallow soil vapor intrusion during the pilot test. A work plan detailing the proposed soil vapor probe installation will be provided under separate cover. The purpose of conducting the AS/SVE pilot test is to evaluate if AS/SVE is a viable remedial technology for the site. This document supersedes our November 16, 2009 *Air Sparge/Soil Vapor Extraction Pilot Test Work Plan.*

2.0 SITE BACKGROUND

The site is an operating Shell-branded service station located at the southern corner of 150th Avenue and Freedom Avenue in San Leandro, California (Figure 1). The area surrounding the site is mixed commercial and residential. The site layout (Figure 2) includes a station building, two dispenser islands, and three fuel underground storage tanks (USTs). One waste oil UST was removed from the site on May 25, 2006.

A summary of previous work performed at the site is provided in CRA's July 28, 2010 Soil Vapor Probe Installation and Soil Vapor Sampling Work Plan and is not repeated herein.

2.1 SITE GEOLOGY AND HYDROGEOLOGY

2.1.1 LOCAL GEOLOGY

The site is located at the base of the Berkeley Hills on the eastern edge of the East Bay Plain Groundwater Basin. Sediments beneath the site are Quaternary alluvial deposits derived from sedimentary and igneous rocks of the Diablo Range. The site is intersected by the Hayward Fault Zone. The site is underlain by low estimated permeability

sediments (clay) with interspersed sediments of moderate permeability. During recent investigations, soil consisted of silty clay, clayey silts, and clayey sandy silt interlayed with sands and gravels to the total explored depth of 40 feet below grade (fbg).

2.1.2 SOIL TYPES

Generalized observations of soil samples from hollow-stem auger and geoprobe borings have shown that the site is underlain by a layer of sandy silt, silt, silty clay with gravel or silty clay to an approximate depth of 5 fbg. Beneath lays silty clay or clay to approximately 15 fbg. Interbedded silty sand, sandy silt and silt is present to the total explored depth of 45 fbg, with increasing amounts of gravel and sand interbedded below 20 fbg.

Soil types encountered in cone penetration testing borings consisted predominantly of silt, clayey silt, and sandy silt with increasing interbedded silty sand, and cemented sand and sand below 25 fbg to the total depth explored of 75 fbg.

2.1.3 GROUNDWATER ELEVATION AND GRADIENT

Groundwater depths have ranged between 16 and 30 fbg on site and between approximately 4 and 14 fbg in off-site well MW-4. Water level measurements have not shown a consistent or reliable groundwater flow direction, although the most frequent groundwater flow direction since 1999 has been to the north-northwest. Groundwater gradients have ranged from 0.0008 feet per foot (ft/ft) to 0.017 ft/ft. The high level of variability in groundwater levels and gradient is likely partially due to the sloping local topography. In addition, an underpass of the MacArthur Freeway (I-580) located directly across Freedom Avenue (up groundwater gradient) from the site likely intercepts high groundwater levels and causes additional variation.

3.0 AS/SVE PILOT TEST WORK PLAN

The objective of the AS/SVE pilot test is to determine if AS/SVE is a viable remedial alternative to mitigate the residual concentrations of petroleum hydrocarbons observed at the site and to obtain design information for a potential future AS/SVE system. The specific goals of the AS/SVE pilot test are to:

1. Determine if sufficient air can be delivered and properly distributed through the impacted area,
2. Determine the maximum air injection flow rate, and
3. Determine the magnitude and sustenance of hydrocarbon vapor concentrations in vapor extraction wells during sparging.

The pilot test target area is in the western corner of the site west of the USTs.

3.1 PILOT TEST EQUIPMENT

3.1.1 INJECTION AND EXTRACTION EQUIPMENT

CRA will use a Mako Industries, Ltd AS trailer (AS unit) with a rotary screw air compressor capable of 28 cubic feet per minute (cfm) and 125 pounds per square inch (psi) to conduct the AS test. We will use a trailer-mounted electric catalytic oxidizer (SVE unit) with a 10-horsepower positive displacement blower for SVE and abatement and a trailer-mounted portable diesel generator to power the AS and SVE units. An on-site helium tank will be used to introduce helium into the injection well through a pre-constructed manifold.

3.1.2 DATA COLLECTION EQUIPMENT

CRA will measure field vapor concentrations with a Horiba Model MEXA554J organic vapor analyzer. We will collect vapor samples in 1-liter Tedlar® bags using a Gast rotary-vane sample pump. Helium concentrations will be assessed using a Marks product inline helium detector. Air rotameters will be mounted on the manifold for measuring the flow of air. We will measure induced vacuum in adjacent wells with a Dwyer digital manometer and groundwater depth with a Solinst water level meter. An YSI 600 XLM pressure transducer and data logger will be installed in wells P-4A and EW-2 to measure pH, dissolved oxygen (DO), oxygen reduction potential (ORP), conductivity, temperature, and depth.

3.2 PILOT TEST WELLS

Well AS-1, installed during March 2010, will be used as the air sparge well, and existing well P-3A and proposed well SVE-1 will be used as vapor extraction wells. P-3A will be

the primary vapor extraction well for the pilot test, with the vacuum on SVE-1 set to mitigate shallow soil vapors migrating toward the southwest property boundary. Existing wells EW-2, MW-11, P-3B, P-4A, and P-4B, and soil vapor probes SVP-1, SVP-2, and SVP-6 will be used as observation points (Figure 2). The sparge, extraction, and observation well and soil vapor probe screen diameters, screen intervals, and estimated distance from AS-1 are presented in the table below.

Well ID	*Screen Diameter (inches)*	*Screen Interval (fbg)*	*Estimated Distance from AS-1 (feet)*
AS-1	2	29-31	0
EW-2	4	18-33	11
MW-11	4	15-25	7
P-3A	4	8-23	5
P-3B	4	23-33	8
P-4A	4	8-23	11
P-4B	4	17-27	10
SVE-1	4	8-23	18
SVP-1	1/4	4.6-4.9	12
SVP-2	1/4	4.6-4.9	51
SVP-6	1/4	5-5.1	22

3.3 SITE HEALTH AND SAFETY PLAN

Pursuant to Shell and CRA requirements, CRA will prepare a comprehensive site health and safety plan to protect site workers during the pilot test activities. The plan will be kept onsite during field activities and will be reviewed and signed by each site worker.

3.4 AIR DISCHARGE PERMIT

As required, CRA will notify the Bay Area Air Quality Management District (BAAQMD) regarding the proposed AS/SVE test. The SVE unit will abate the extracted soil vapors to comply with the BAAQMD requirements. In compliance with BAAQMD pilot-test regulations, this pilot test will be limited to five days in duration.

3.5 AS/SVE TEST PROCEDURE

Prior to testing, CRA will collect vapor samples from wells MW-11, P-3A, P-4A, EW-2, SVP-1, SVP-2, and SVP-6 to establish the background hydrocarbon vapor concentrations.

We will also collect static depth-to-groundwater measurements from the test wells prior to testing.

The test will begin with SVE from wells P-3A and SVE-1. After stabilizing the SVE system for an hour, AS will begin in AS-1. SVE will be continued from well P-3A throughout the test and will be continued in SVE-1 as needed to mitigate shallow soil vapors. Air will be injected into well AS-1 using an air compressor with injection pressure and air flow monitoring at the manifold. Helium gas, used as a study tracer, will also be injected into AS-1 at a constant rate after air sparge flow patterns have been established.

The test will begin with an approximate injection pressure of 5 pounds per square inch (psi), and be incrementally increased to the maximum injection pressure of 25 psi, which was established as 75 percent of the overburden pressure. The over burden pressure was calculated as follows:

The hydrostatic pressure (P_H) was determined using the following equation:

P_H = (Water column above top of screen)(Specific Weight $_{WATER}$)

The static depth-to-water in well AS-1 is estimated to be 17 fbg. The top of the screened interval for well AS-1 is at 29 fbg. Therefore, the water column above the top of screen is 12 feet. The specific weight of water is 62.4 pounds per cubic foot. Therefore, the hydrostatic pressure equates to:

P_H = (12 feet) (62.4 pounds/cu ft)(1 square foot/144 square inches) = 5.2 psi

The overburden pressure (P_{OB}) is determined using the following equation:

$P_{OB} = P_H + P_{SOIL}$ where;
P_{SOIL} = (Soil column above top of screen)(Specific Gravity$_{SOIL}$)(1-porosity)(weight of soil)

As stated above, the top of the screened interval for well AS-1 is at 29 fbg. The specific gravity and porosity of soil are estimated at 2.7 and 0.40. The unit weight of soil is taken as 90 pounds per cubic foot. Using this data, the soil pressure equates to:

P_{SOIL} = (29 feet)(2.7)(1 - 0.40)(90)(1 square foot/144 square inches) = 29.4 psi

Using the equation above, the overburden pressure equates to:

$P_{OB} = P_H + P_{SOIL} = 5.2$ psi + 29.4 psi = 34.6 psi

The maximum injection pressure was taken as 75 percent of the overburden pressure, which equates to 25 psi. Therefore, the injection pressure range for this test will be established as 5 to 25 psi. Air flow will be monitored at each applied pressure interval.

Hydrocarbon vapor concentrations will be periodically field-measured from extraction well P-3A, observation wells EW-2, MW-11, and P-4A, and soil vapor probes SVP-1, SVP-2, and SVP-6. Vapor samples will be collected from extraction well P-3A and observation wells MW-11 and P-4A for laboratory analysis to assess volatilization of hydrocarbons from groundwater and soils. Vapor samples will also be collected from the SVE effluent to confirm required destruction efficiencies are met throughout the test. Pressure transducers will log depth to groundwater in observation wells EW-2, MW-11, P-3B, and P-4B. If vapor concentrations exceed 30 ppm in SVP-2 or SVP-6 at any time, the pilot test will be suspended, and we will increase vapor extraction from well SVE-1. If increased vapor extraction from well SVE-1 does not mitigate the shallow soil vapor concentrations detected in soil vapor probes SVP-2 and SVP-6, the pilot test will be terminated.

Helium concentrations will be monitored in extraction well P-3A, EW-2, and MW-11 using the helium detector to assess the distribution of injected air in the formation and determine the recovery rate of the SVE system. A recovery rate of >80 percent is considered a successful rate of an SVE system, and vapor migration risks are assumed to be low. The recovery rate will be calculated using the following equation:

%Recovery = (SVE flowrate/helium injection rate)(% helium in extraction well)(100)

3.6 DATA COLLECTION

Data will be collected on standard forms. Prior to pilot-test activities, CRA will measure and record the water level in all wells. During the test, CRA will periodically measure and record the following AS/SVE operational and monitoring information: injection pressures and flows, the YSI multi-parameter (depth-to-groundwater, DO, ORP, etc.), manifold vacuum, vacuum applied to the extraction well, induced vacuum at observation wells, extraction well soil-vapor flow, dilution air flow, hydrocarbon-vapor concentrations, helium concentrations, and extracted entrained groundwater volume.

Vapor samples will be collected periodically in 1-liter Tedlar® bags to confirm field-measured concentrations through laboratory analysis.

3.7 CHEMICAL ANALYSES FOR PILOT TEST SAMPLES

All laboratory samples will be analyzed by Calscience Environmental Laboratories, Inc., a State-of-California-certified laboratory. Samples will be analyzed for total petroleum hydrocarbons as gasoline, benzene, toluene, ethylbenzene, xylenes, and methyl tertiary butyl ether by EPA Method 8260B.

3.8 REPORT PREPARATION

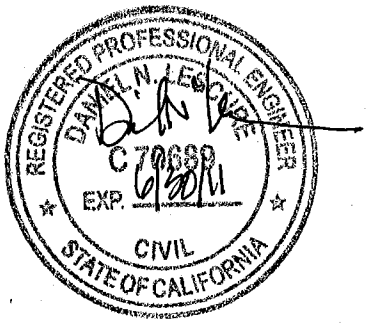
After completion of the well and soil vapor probe installations and pilot-test activities, CRA will prepare a written AS/SVE pilot test report presenting the field procedures, field test data, and laboratory results. Based on all these data collected, it will include an evaluation of the feasibility of AS/SVE at the site.

4.0 SCHEDULE

Prior to conducting the test, CRA will submit a notification to the BAAQMD. CRA will begin work upon receiving ACEH's written approval of this revised work plan and the appropriate drilling permits. We anticipate that the well and soil vapor probe installations will be completed during September 2010 and completing the pilot test in November 2010. We propose to provide ACEH with a report detailing the results of the pilot test by January 31, 2011.

All of Which is Respectfully Submitted,
CONESTOGA-ROVERS & ASSOCIATES

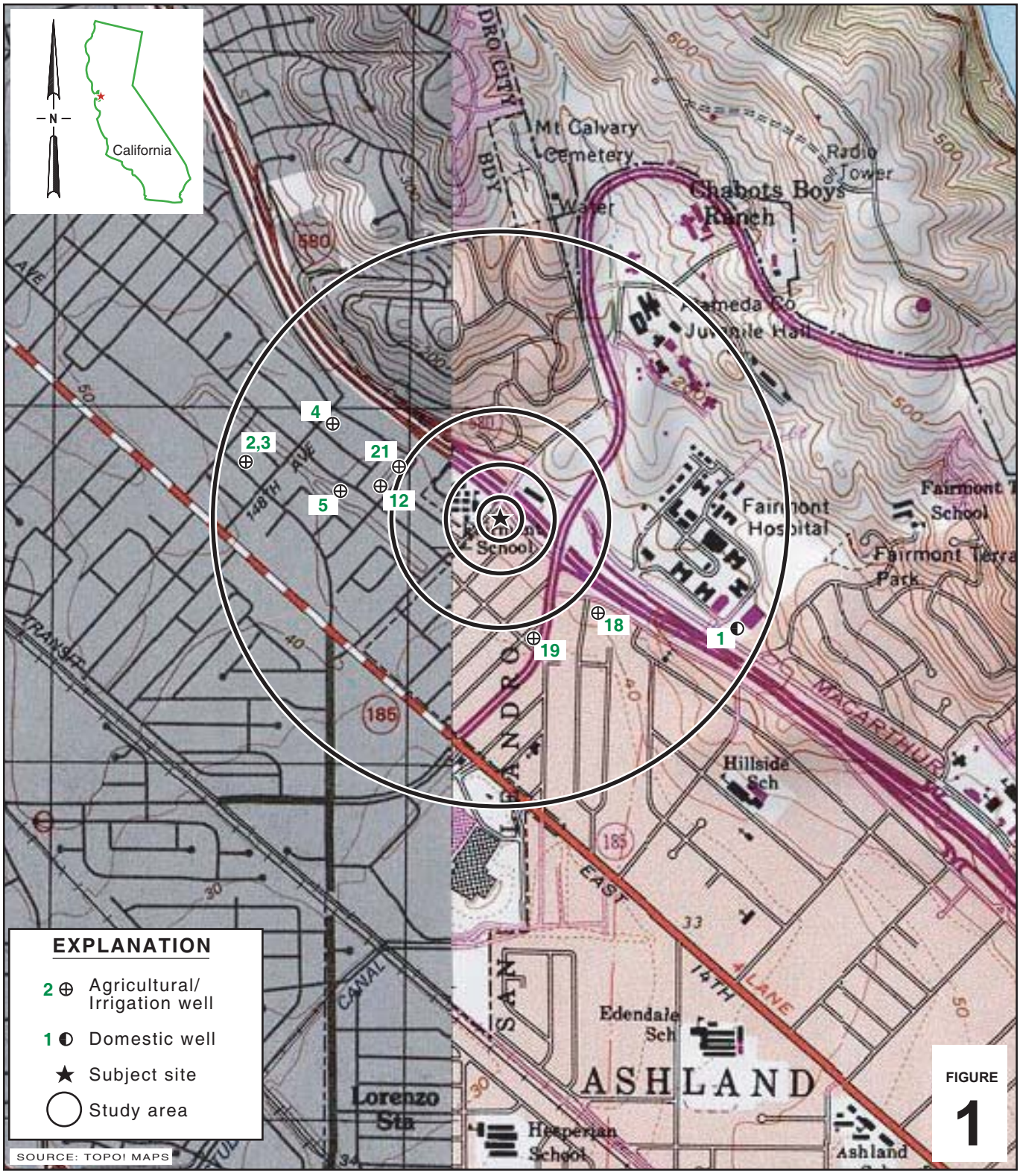
Peter Schaefer, CEG, CHG



Dan Lescure, PE

FIGURES

11/03/08



I:\Shell\6-chars\2406--\240612-San Leandro 1784 150th\240612-FIGURES\240612 VICINITY.AI

FIGURE 1

0 1/8 1/4 1/2 1

SCALE : 1" = 1/4 MILE

Shell-branded Service Station

1784 150th Avenue

San Leandro, California

CONESTOGA-ROVERS & ASSOCIATES

Vicinity Map

07/20/10

Site Plan

EXPLANATION

- SVE-1 — Proposed soil vapor extraction well location
- SVP-6 — Proposed soil vapor probe location
- AS-1 — Air sparge well location
- P-1A — Piezometer location
- P-1B — Deeper piezometer location
- EW-1 — Extraction well location
- MW-3 — Monitoring well location
- MW-1B — Deeper monitoring well location
- MW-1 — Destroyed well location
- B-1 — Soil boring location (CRA, 9/14/07)
- CPT-1 — CPT location (CRA, 8/29-30/07)
- SVP-1 — Soil vapor probe location (CRA, 8/28/07)
- 1 — Dispenser number
- Product piping (P)
- Water line (W)

PORTOFINO CIRCLE
PORTOFINO DRIVE
150TH AVENUE
FREEDOM AVENUE
I-580
Brick Sound Wall
Residential
Residential
Residential
Residential
Residential
(Townhouses)
Residential
(Townhouses)
Residential
(Townhouses)
Private (Gated Driveway)
Storm Drain
Manhole (MH, typ.)
Shell Station
1784 150th Ave.
Former Dispenser Island
Dispenser Islands
Station Building
USTs
Former W/O UST
Air Comp.
Storage
Parking Lot
Denny's Restaurant
15015 Freedom Ave.
MW-9
SB-25/ MW-13
MW-4
MW-7
SVP-5
SB-24/MW-12
MW-8
MW-10
CPT-3
MW-2B
P-4B
P-4A
MW-2
AS-1
P-3A
CPT-2
P-3B
MW-11
EW-2
SVP-1
SVE-1
SVP-6
B-1
SVP-4
EW-1
CPT-1
SVP-2
P-1B
P-1A
MW-1
P-2B
SVP-3
P-2A
MW-1B
MW-1A
MW-3
MW-5
CPT-5
CPT-6
MW-6

N

0 20 40 80
Scale (ft)

FIGURE
2

Shell-branded Service Station
1784 150th Avenue
San Leandro, California

CONESTOGA-ROVERS & ASSOCIATES

I:\Shell\6-chars\2406--\240612-San Leandro 1784 150th\240612-FIGURES\240612 SITE PLAN.DWG