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By Alameda County Environmental Health 2:06 pm, Jul 28, 2016

Mr. Mark Detterman
Alameda County Environmental Health Care Services
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Re: Former Olympic Service Station
1436 Grant Avenue
San Lorenzo, California
ACEHD Case No. RO0000373, GeoTracker No. T0600102256

Dear Mr. Detterman:

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

Sincerely,
George and Frida Jaber 1989 Family Trust

Philip Jaber, Trustee

STRATUS
ENVIRONMENTAL, INC.

3330 Cameron Park Drive, Ste 550
Cameron Park, California 95682
(530) 676-6004 ~ Fax: (530) 676-6005

July 28, 2016
Project No. 2115-1436-01

Mr. Mark Detterman, P.G.
Alameda County Environmental Health Department
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Re: **Work Plan for Additional Site Assessment**
Former Olympic Service Station
1436 Grant Avenue, San Lorenzo, California
LOP Case #RO0000373

Dear Mr. Detterman:

Stratus Environmental, Inc. (Stratus), on behalf of Mr. Philip Jaber and the George and Frida Jaber 1989 Family Trust, has prepared this *Work Plan for Additional Site Assessment (Work Plan)* for the Former Olympic Service Station located at 1436 Grant Avenue in San Lorenzo, California (the site, see Figures 1 and 2). Alameda County Environmental Health Department (ACEHD) currently regulates an environmental case on the subject property relating to a historical release of motor vehicle fuel to the subsurface. ACEHD personnel recently reviewed several reports prepared by Stratus that include data relating to implementation and termination of dual phase extraction (DPE) remediation, groundwater monitoring well sampling, post DPE soil vapor sampling, and a door-to-door reconnaissance intended to locate undocumented water supply wells near the site. After reviewing the reports, ACEHD distributed a letter, dated May 5, 2016, requesting that a scope of work be developed to address issues of concern to the agency. This *Work Plan* has been prepared in order to satisfy the requests of the ACEHD; information regarding the specific requests of agency personnel, and a detailed description and justification for the activities proposed by Stratus, are provided in the following subsections of this document.

SITE DESCRIPTION

The subject site is located on the southern corner of the intersection of Grant Avenue and Channel Street in San Lorenzo, California. The site previously operated as the Olympic Service Station; it is currently operated as San Lorenzo Auto Repair. The current configuration of the property is depicted on Figure 2.

The adjoining property to the southwest and south is developed as the Arroyo Center strip mall. Properties to the north and northwest (across Grant Avenue) are developed as

single family detached residences, and the property to the east and northeast (across Channel Street) has been developed as multi-family housing units (apartments or condominiums). A parking lot and athletic fields for Arroyo High School are situated on property north of Grant Avenue, across the intersection.

SITE BACKGROUND SUMMARY

The following information has been summarized based on information presented in reports prepared by Reese Construction, Aqua Science Engineers, Inc. (ASE), and Conestoga-Rovers & Associates (CRA), and work performed by Stratus.

The former underground storage tanks (USTs) and associated product dispensers were removed in 1998. Eight groundwater monitoring wells (MW-1 through MW-4, MW-5A/B, MW-6A/B), five soil vapor sampling points (SV-1 through SV-5), seven extraction wells (EX-1 through EX-7), two ozone injection wells (IW-1 and IW-2), and nineteen exploratory soil borings (BH-A through BH-C, B-1 through B-13, and B-13A through B-13C) were installed between 1999 and 2014. Locations of the wells, vapor sampling points, and soil borings are shown on Figure 2. Drilling and well construction details are summarized in Table 1.

Chemicals of concern (COCs) at this site include gasoline-range organics (GRO)/total petroleum hydrocarbons as gasoline (TPHG), benzene, toluene, ethylbenzene, and xylenes (BTEX), and the gasoline additive methyl tertiary butyl ether (MTBE). Between 1999 and 2015, groundwater levels beneath the property have ranged between approximately 5.2 and 11.2 feet below ground surface (bgs). The site is currently under a semi-annual groundwater monitoring and sampling program; although ACEHD requested in the May 5, 2016 letter that all wells be sampled quarterly until further notice. A review of Table 1 indicates that five site wells (MW-4, MW-5A, MW-6A, MW-7A, and MW-8A) have been installed to approximately 10 to 12 feet bgs, while the other monitoring / extraction wells have been installed to depths ranging from approximately 20 to 26 feet bgs. In general, fuel contaminant concentrations in the MW-4, MW-5A, and MW-6A samples are higher than contaminant levels in the other wells.

Groundwater samples have historically been analyzed for diesel-range organics (DRO) and the fuel additives di-isopropyl ether (DIPE), tertiary amyl butyl ether (TAME), ethyl tertiary butyl ether (ETBE), tertiary butyl alcohol (TBA), 1,2-dichlorethane (1,2-DCA), 1,2-dibromoethane (EDB), and ethanol. These analytes are not currently included in the groundwater analytical suite.

In general, most soils situated in the upper 15 to 18 feet of the subsurface appear to be predominately fine grained (mixtures of silt/clay, exclusive of fill material). Below this depth, to approximately 25 feet bgs, soil strata have been described as silty sand, clayey sand, and sand.

Soil vapor sampling was performed at the site in 2010; in general, relatively high concentrations of GRO and BTEX were detected in these samples. GRO and benzene were reported at maximum levels of 52,000,000 micrograms per cubic meter ($\mu g/m^3$) and 160,000 $\mu g/m^3$, respectively, at that time.

Most of the petroleum hydrocarbon impact to the subsurface appears to have been situated above approximately 20 feet bgs, and in relatively close proximity to the former USTs and fuel dispenser islands (samples collected prior to DPE remediation are discussed below). In a September 2012 Corrective Action Plan (CAP), Stratus estimated that a mass of 955 pounds of TPHG/GRO were present in soil at the site above 20 feet bgs.

Based on our general understanding of the distribution of contaminants beneath the property, site geologic conditions, and depth to groundwater levels, DPE was selected as a possible remedial alternative for the site. In June 2011, a DPE pilot test was performed at the site, using wells EX-1 through EX-3 for extraction. Based on the findings of this test, DPE was deemed by Stratus to be a viable remedial alternative for the site. Stratus subsequently prepared a CAP for the property, recommending use of DPE at the site, and after receiving approval of this document, installed four additional extraction wells (EX-4 through EX-7).

In July 2014, Stratus initiated full scale DPE at the subject site. As of December 2, 2015, an estimated mass of 983 pounds of GRO have been removed from the subsurface in the vapor phase. Since initiation of DPE, a total of approximately 1,491,520 gallons of groundwater have been extracted from the subsurface, treated onsite using granular activated carbon (GAC), and discharged to the local sewer system. Influent vapor phase concentrations of fuel contaminants have declined appreciably over time, and since the summer of 2015, relatively low concentrations of fuel contaminants were being removed from the subsurface. DPE has been discontinued and the DPE system removed from the site.

In December 2015, Stratus directed the installation of two groundwater monitoring wells (MW-7A and MW-8A), and two additional soil vapor probes (SV-6 and SV-7). After shut down of the DPE system, and allowing approximately one month for equilibration of subsurface conditions, Stratus performed a soil vapor survey on January 28, 2016, (five of the seven wells could be sampled; two of the wells contained moisture and could not be sampled). GRO was detected in one sample (SV-6, 6,900 $\mu g/m^3$); benzene, ethylbenzene, and naphthalene were not detected in any of the samples. Given the findings of the 2016 soil vapor sampling event, DPE appears to have significantly reduced contaminant concentrations in shallow soil vapor.

CRA performed a water well survey using Department of Water Resources (DWR) well completion records obtained in 2008. At this time, no water wells were identified within a

1,000-foot radius of the site. At the request of ACEHD, Stratus conducted a door-to-door field reconnaissance (in December 2015) in order to attempt to locate water wells not documented in the DWR records. At this time, 67 residences were visited, and contact was made with 44 of these owners/tenants. Stratus identified three residences that utilize water wells (at 1408 Via Barrett, 1587 Via Rancho, and 15857 Via Seco). The well at 1408 Barrett is located closest to the site, approximately 200 feet to the north (cross gradient). At each of these three residences, Stratus was verbally informed by the owner/tenant the wells were used exclusively for irrigation (lawn watering and landscaping). No information regarding the construction specifications of the wells is known. It is our understanding that all residences in this area are served by municipal water, and no residences using wells for household consumption were located. Given the use of these wells, we expect that the wells are used intermittently and seasonally, with most groundwater pumping occurring during the late spring, summer, and fall months when precipitation is limited.

PROJECT APPROACH

ACEHD has requested that the three irrigation wells be located and sampled. At the time that this document was issued, permission from one of the three owners (1587 Via Rancho) had been obtained. Stratus sampled this well on July 26, 2016, and analytical results for this sample will be provided in a separate report. Stratus will continue to attempt to obtain access for sampling of the wells located at 1408 Via Barrett and 15857 Via Seco.

Although benzene, ethylbenzene, and naphthalene were not detected in any of the January 2016 soil vapor samples, ACEHD has requested re-sampling of the wells. ACEHD noted that a relatively short equilibration time was allowed following discontinuation of DPE, and that at one well, the practical quantitation limits (but not the method detection limits) for naphthalene could not fully confirm compliance with 'Low Threat Closure Policy' criteria. In addition, two of the seven wells could not be sampled due to moisture in January 2016. Stratus will therefore collect samples from SV-1 through SV-7 during the summer/fall months of 2016, in order to evaluate potential seasonal differences in petroleum hydrocarbon concentrations in shallow soil vapor beneath the site.

Soil analytical data beneath the site is not current, due to operation of the DPE system to remove fuel contaminant mass. ACEHD has thus requested that soil samples be collected in areas of the site where the highest concentrations of petroleum hydrocarbons were historically detected, as another method of evaluating remedial effectiveness. ACEHD also noted that soil samples near a former waste oil tank had not been tested for naphthalene or polynuclear aromatic hydrocarbons (PAHs), which is a requirement of the 'Low Threat Closure Policy'. This *Work Plan* proposes to advance 5 exploratory soil borings (GP-1 through GP-5) and collect soil samples from each boring; two of the

borings (GP-1 and GP-2) will be advanced near historical borings BH-B and EX-3, respectively, one of the borings (GP-3) will be advanced near the former waste oil tank, one of the borings (GP-5) will be advanced within the limits of the former fuel USTs, and one of the borings (GP-4) will be advanced near historical borings MW-4/B-1 (see Figure 2 for proposed locations). This data will allow for an evaluation of current concentrations of petroleum hydrocarbons in soil.

The proposed scope of work has been subdivided into four tasks, as outlined below. All work will be conducted under the direct supervision of a State of California Professional Geologist or Professional Engineer, and will be conducted in accordance with standards established by the *Tri-Regional Board Staff Recommendations of Preliminary Investigation and Evaluation of Underground Tank Sites* (Regional Water Quality Control Board [RWQCB], April 2004).

SCOPE OF WORK

The objectives of the proposed scope of work are to:

- Evaluate current concentrations of petroleum hydrocarbons in shallow soil and soil vapor.
- Assess if offsite irrigation wells located near the site are impacted with fuel contaminants

To accomplish this objective, Stratus is proposing the following work activities:

- Advance five (5) soil borings (GP-1 through GP-5) to approximately 24 feet bgs using direct push methods.
- Collect soil samples during the advancement of borings GP-1 through GP-5 for lithologic comparison and chemical analysis.
- Collect soil vapor samples from SV-1 through SV-7.
- Collect samples from the offsite water wells if permission can be obtained from the property owner.

Task 1: Pre-Field Activities

Following approval of this *Work Plan* by ACEHD, the following activities will be completed:

- Work to obtain access for sampling of irrigation wells at 1408 Via Barrett and 15857 Via Seco.
- Obtain a drilling permit from Alameda County Public Works Agency (ACPWA).

- Retain and schedule a licensed C-57 drilling contractor.
- Update the site specific Health and Safety Plan.
- Mark boring locations and contact Underground Service Alert to locate underground utilities in the vicinity of the work site.
- Notify ACEHD, ACPWA, the Jaber's, and the facility tenant of the proposed work schedule.

Task 2: Field Work

Task 2A: Soil Borings

A Stratus geologist, under the direct supervision of a California Registered Professional Geologist, will oversee a C-57 licensed drilling contractor advance 5 soil sampling exploratory borings (GP-1 through GP-5) using a direct push drilling rig to a depth of approximately 24 feet bgs. The initial 5 feet of each boring will be cleared using hand tools to reduce the possibility of damaging underground utilities. The six soil borings will be continuously cored using a double-walled sampling system equipped with disposable acetate liners. During advancement of the borings, soil samples will be retained in approximately 4-foot intervals. The bottom end of the acrylic lined soil sample section will be lined with Teflon™ sheets, capped, and sealed. Each sample will be labeled, placed in a resealable plastic bag, and stored in an ice-chilled cooler. The samples will remain chilled until relinquished to a state-certified analytical laboratory. Chain-of-custody procedures will be followed from the time the samples are collected until the time the samples are relinquished to the laboratory. Stratus anticipates that approximately 3 to 5 soil samples from each soil boring will be submitted for chemical analysis. The exact number of samples submitted will be determined at the time of the investigation. Photoionization Detector (PID) screening of the samples (described below) will be used to assist in the determination of which samples will be submitted for chemical analysis.

The entire soil core will be classified onsite using the Unified Soil Classification System and recorded, along with other pertinent geologic information, on a boring log. Select sections of the soil core will also be placed and sealed in plastic bags to allow the accumulation of volatile organic compound (VOC) vapors within the airspace in the bags. A PID will be used to measure VOC concentrations from each sample in parts per million (ppm), and will be recorded on the boring log. Soil boring logs will be uploaded to GeoTracker.

Task 2B: Waste Management

Drill cuttings and wastewater generated during the field activities will be contained in DOT-approved 55-gallon steel drums. The drums will be appropriately labeled and

stored at the site pending proper disposal. A licensed contractor will transport the soil and wastewater to an appropriate facility for disposal.

Task 2C: Soil Vapor Sampling

Stratus will return to the site to collect samples from SV-1 through SV-7. Prior to sampling, the approximate air volume situated inside of the Teflon tubing and the filter pack sand surrounding each soil vapor implant will be calculated. Stratus will use expendable Summa Canister(s) to purge this ambient air. Following purging of the ambient air, a separate Summa Canister will be used to collect each soil gas sample. During filling of the canisters, the flowrate will be regulated to fill at a rate between 100 and 200 milliliters per minute (ml/min). A tracer gas leak check using iso-propyl alcohol will be performed in order to assess potential leakage during sampling. Per previous ACEHD requests, soil vapor sampling will be performed inside a containment shroud. Once the samples are collected, the Summa Canisters will be stored at ambient air temperature before delivery to the laboratory for chemical analysis.

Task 2D: Water Well Sampling

Groundwater samples will be collected from the nearby water wells if access is granted from the property owner. Prior to sampling, water will be allowed to run for approximately 10 minutes in order to purge the water lines and force the well to pump fresh water from the surrounding strata. The water samples will be collected in properly preserved glass vials (VOAs). The samples will then be labeled, identified on a chain-of-custody form, and stored on ice pending delivery to a laboratory for chemical analysis.

Task 3: Laboratory Analysis

Groundwater samples will be analyzed by a state-certified laboratory for the same analyte suite already in place for the site's groundwater monitoring and sampling program. The samples will be analyzed for GRO using U.S. Environmental Protection Agency (USEPA) Method 8015B/8260B, and for BTEX and MTBE using USEPA Method 8260. Groundwater analytical data will be uploaded to the State of California's GeoTracker database. Soil samples will also be analyzed for GRO, benzene, and MTBE using USEPA Method 8260. Soil samples collected above 10 feet bgs will be additionally analyzed for naphthalene using USEPA Method 8260 and for PAHs using USEPA Method 8270.

Soil vapor samples will also be forwarded to a California state-certified laboratory for chemical analysis under strict chain-of-custody procedures. The soil gas samples will be analyzed for GRO, BTEX, MTBE, naphthalene, and the leak detection gas iso-propyl alcohol using USEPA Method TO-15.

Soil, soil vapor, and groundwater analytical data will also be uploaded to GeoTracker.

Task 4: Site Assessment Report Preparation

Following completion of the additional site characterization activities, a site assessment report will be prepared. The report will include, but not be limited to, a scaled site plan, soil boring logs, tabulated analytical results, and certified analytical results. The report will be uploaded to GeoTracker upon finalization.

LIMITATIONS

This document was prepared in general accordance with accepted standards of care that existed at the time this work was performed. No other warranty, expressed or implied, is made. Conclusions and recommendations are based on field observations and data obtained from this work and previous investigations. It should be recognized that definition and evaluation of geologic conditions is a difficult and somewhat inexact science. Judgments leading to conclusions and recommendations are generally made with an incomplete knowledge of the subsurface conditions present. More extensive studies may be performed to reduce uncertainties. This document is solely for the use and information of our client unless otherwise noted.

If you have any questions regarding this document, or the project in general, please contact Scott Bittinger at (530) 676-2062 or Gowri Kowtha at (530) 676-6001.

Sincerely,
STRATUS ENVIRONMENTAL, INC.

Scott G. Bittinger, P.G.
Project Geologist

Gowri S. Kowtha, P.E.
Project Manager / Principal

ATTACHMENTS:

Table 1	Well Construction Detail Summary
Figure 1	Site Location Map
Figure 2	Site Plan
Appendix A	Field Practices and Procedures

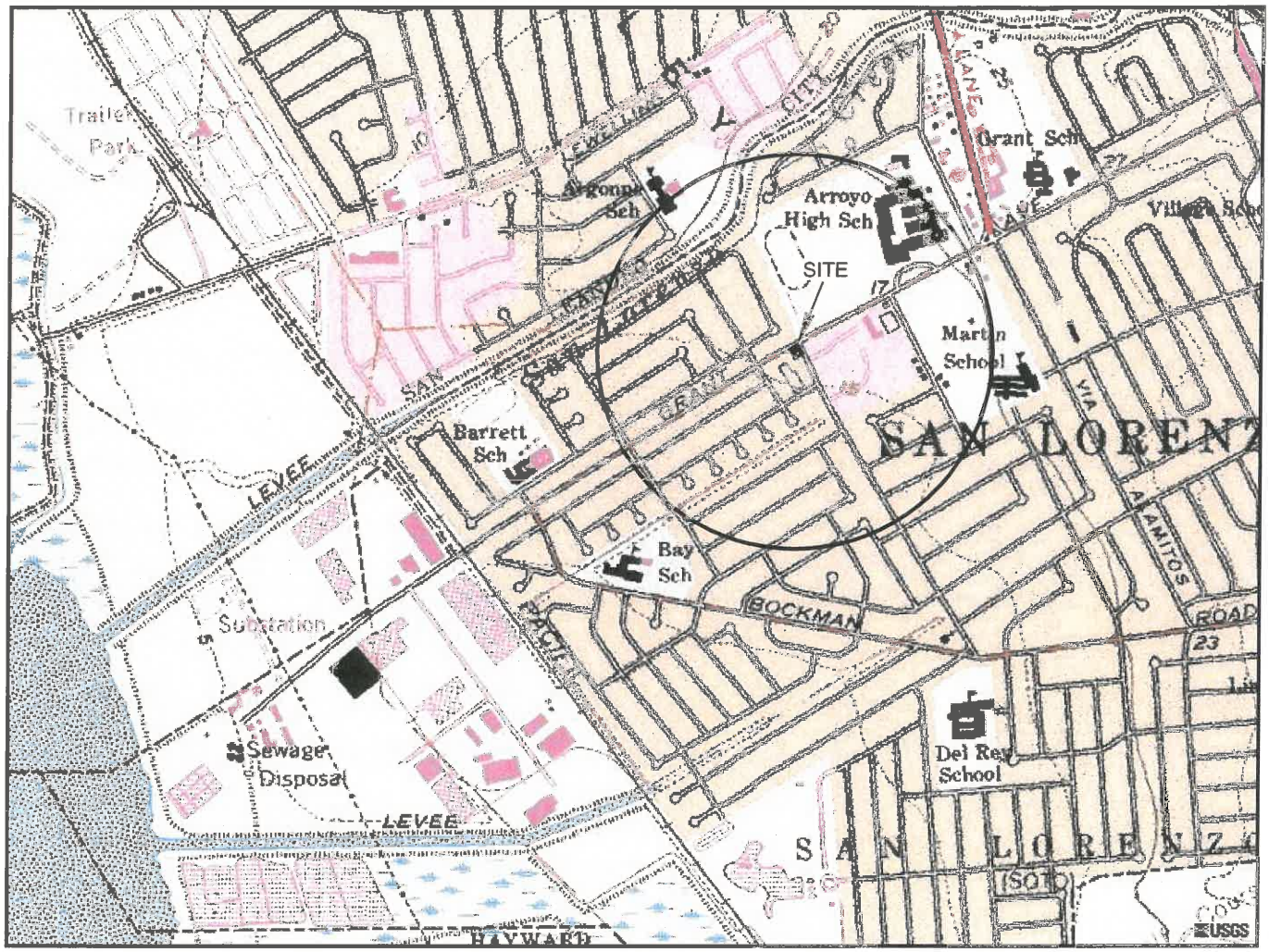
cc: Mr. Philip Jaber
Ms. Cherie McCaulou, RWQCB (via GeoTracker)

TABLE 1
WELL CONSTRUCTION DETAIL SUMMARY
Former Olympic Service Station, 1436 Grant Avenue, San Lorenzo, CA

Boring/Well I.D.	Date	Boring Depth (feet)	Boring Diameter (inches)	Well Diameter (inches)	Screen Interval (feet bgs)	Slot Size (inches)	Drilling Method	Consultant
Groundwater Monitoring Wells								
MW-1	09/24/99	26.5	8	2	5 - 26.5	0.020	HSA	Aqua Science Engineers
MW-2	09/24/99	20	8	2	5-20	0.020	HSA	Aqua Science Engineers
MW-3	09/24/99	21.5	8	2	5-21	0.020	HSA	Aqua Science Engineers
MW-4	02/09/10	10	10	4	5-10	0.020	Air Knife	Conestoga-Rovers & Associates
MW-5A	05/28/14	10	8	2	5-10	0.020	HSA	Stratus Environmental
MW-5B	05/28/14	20	8	2	15-20	0.020	HSA	Stratus Environmental
MW-6A	05/28/14	10	8	2	5-10	0.020	HSA	Stratus Environmental
MW-6B	05/28/14	20	8	2	15-20	0.020	HSA	Stratus Environmental
MW-7A	12/04/15	12	8	2	4-12	0.020	HSA	Stratus Environmental
MW-8A	12/04/15	12	8	2	4-12	0.020	HSA	Stratus Environmental
Extraction Wells								
EX-1	05/19/11	20	10	4	5-20	0.020	HSA	Stratus Environmental
EX-2	05/19/11	20	10	4	5-20	0.020	HSA	Stratus Environmental
EX-3	05/19/11	20	10	4	5-20	0.020	HSA	Stratus Environmental
EX-4	02/20/14	20	10	4	5-20	0.020	HSA	Stratus Environmental
EX-5	02/20/14	20	10	4	5-20	0.020	HSA	Stratus Environmental
EX-6	02/21/14	20	10	4	5-20	0.020	HSA	Stratus Environmental
EX-7	02/20/14	20	10	4	5-20	0.020	HSA	Stratus Environmental
Injection Wells								
IW-1	05/20/11	11.5	8	0.75	9.5-11.5	microporous	HSA	Stratus Environmental
IW-2	05/20/11	16	8	0.75	14-16	microporous	HSA	Stratus Environmental
Soil Vapor Sampling Points								
SV-1	02/12/10	5.5	3.25	0.375	5-5.1	0.002	HA	Conestoga-Rovers & Assoc.
SV-2	02/09/10	5.5	3.25	0.375	5-5.1	0.002	HA	Conestoga-Rovers & Assoc.
SV-3	02/09/10	5.5	3.25	0.375	5-5.1	0.002	HA	Conestoga-Rovers & Assoc.
SV-4	02/09/10	5.5	3.25	0.375	5-5.1	0.002	HA	Conestoga-Rovers & Assoc.
SV-5	05/20/11	5.5	3.25	0.375	5-5.1	0.002	HA	Stratus Environmental, Inc.
SV-6	12/04/15	6	2.5	0.25	5.3-5.5	mesh	HA	Stratus Environmental, Inc.
SV-7	12/04/15	6	2.5	0.25	5.3-5.5	mesh	HA	Stratus Environmental, Inc.

Notes:
HSA = Hollow Stem Auger
HA = Hand Auger
Data regarding the construction of wells MW-1 through MW-4 obtained from groundwater monitoring reports prepared by Conestoga-Rovers & Associates

STRATUS



GENERAL NOTES:
BASE MAP FROM U.S.G.S.
SAN LORENZO, CA.
7.5 MINUTE TOPOGRAPHIC
PHOTOREVISED 1978

QUADRANGLE LOCATION

0 1800 FT

APPROXIMATE SCALE

STRATUS ENVIRONMENTAL, INC.

FORMER OLYMPIC SERVICE STATION
1436 GRANT AVENUE
SAN LORENZO, CALIFORNIA

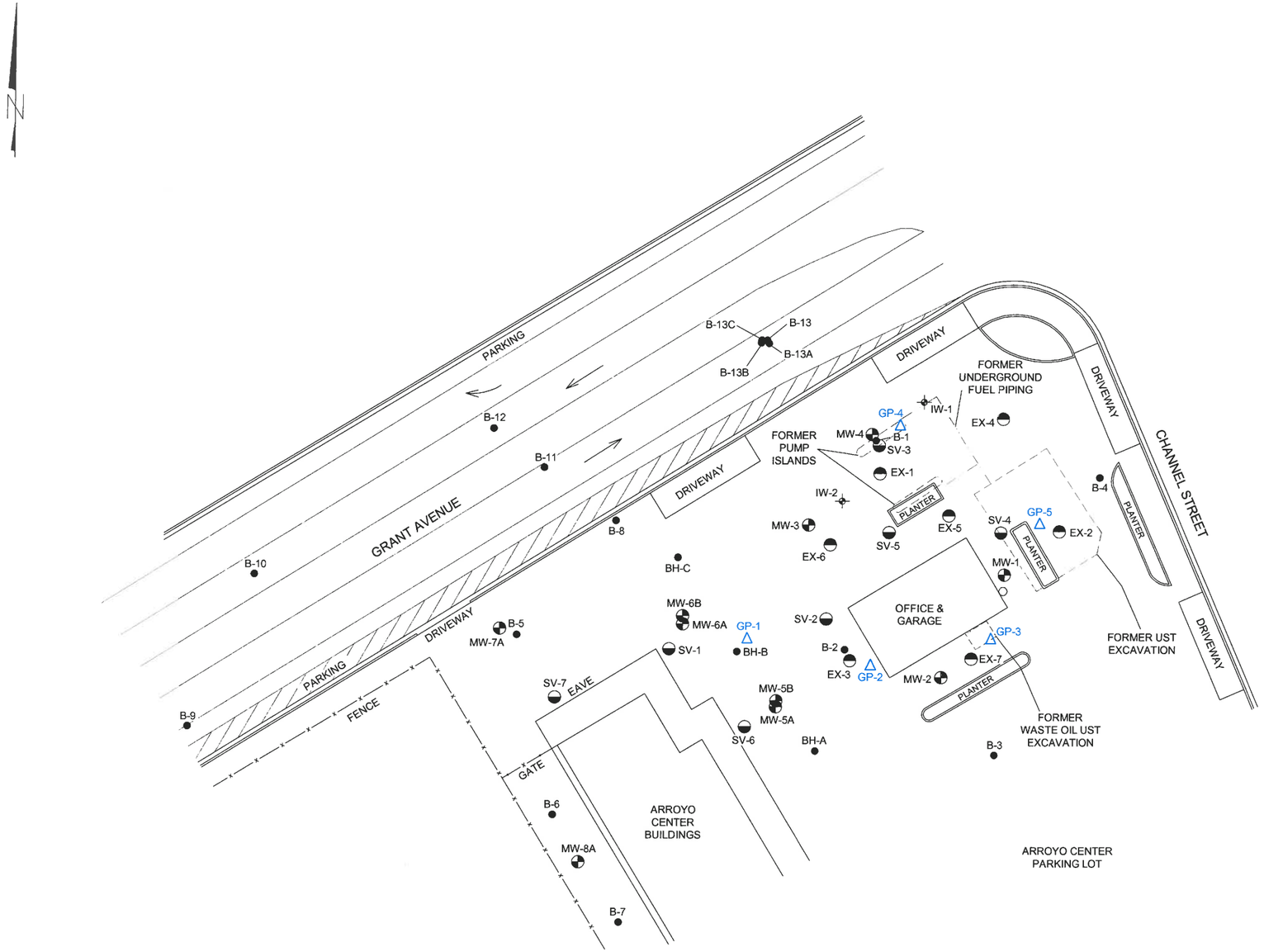
SITE LOCATION MAP

FIGURE
1

PROJECT NO.
2115-1436-01

LEGEND

- MW-1 MONITORING WELL LOCATION
- SV-1 SOIL VAPOR PROBE LOCATION
- EX-1 EXTRACTION WELL LOCATION
- IW-1 OZONE INJECTION WELL LOCATION
- B-1 SOIL BORING LOCATION
- GP-1 PROPOSED SOIL BORING LOCATION



BASED ON SURVEY PREPARED BY MORROW SURVEYING ON 6/15/11 & UPDATED IN JUNE 2014 & DECEMBER 2015.

STRATUS ENVIRONMENTAL, INC.

PATH NAME: Olympic
DRAFTER INITIALS: DMG
DATE LAST REVISED: July 20, 2015
FILENAME: Olympic Siteplan

0 40 FT
SCALE

FORMER OLYMPIC SERVICE STATION
1436 GRANT AVENUE
SAN LORENZO, CALIFORNIA

SITE PLAN

FIGURE
2

PROJECT NO.
2115-1436-01

APPENDIX A

FIELD PRACTICES AND PROCEDURES

FIELD PRACTICES AND PROCEDURES

General procedures used by Stratus in site assessments for drilling exploratory borings, collecting samples, and installing monitoring wells are described herein. These general procedures are used to provide consistent and reproducible results; however, some procedure may be modified based on site conditions. A California state-registered geologist supervises the following procedures.

PRE-FIELD WORK ACTIVITIES

Health and Safety Plan

Field work performed by Stratus at the site is conducted according to guidelines established in a Site Health and Safety Plan (SHSP). The SHSP is a document which describes the hazards that may be encountered in the field and specifies protective equipment, work procedures, and emergency information. A copy of the SHSP is at the site and available for reference by appropriate parties during work at the site.

Locating Underground Utilities

Prior to commencement of any work that is to be below surface grade, the location of the excavation, boring, etc., is marked with white paint as required by law. An underground locating service such as Underground Service Alert (USA) is contacted. The locating company contacts the owners of the various utilities in the vicinity of the site to mark the locations of their underground utilities. Any invasive work is preceded by hand augering to a minimum depth of five feet below surface grade to avoid contact with underground utilities.

FIELD METHODS AND PROCEDURES

Exploratory Soil Borings

Soil borings will be drilled using a truck-mounted, hollow stem auger drill rig. Soil samples for logging will be obtained from auger-return materials and by advancing a modified California split-spoon sampler equipped with brass or stainless steel liners into undisturbed soil beyond the tip of the auger. Soils will be logged by a geologist according to the Unified Soil Classification System and standard geological techniques. Drill cuttings well be screened using a portable photoionization detector (PID) or a flame ionization detector (FID). Exploratory soil borings not used for monitoring well installation will be backfilled to the surface with a bentonite-cement slurry pumped into the boring through a tremie pipe.

Soil sampling equipment will be cleaned with a detergent water solution, rinsed with clean water, and equipped with clean liners between sampling intervals. Augers and

samplers will be steam cleaned between each boring to reduce the possibility of cross contamination. Steam cleaning effluent will be contained in 55-gallon drums and temporarily stored on site. The disposal of the effluent will be the responsibility of the client.

Drill cuttings generated during the drilling procedure will be stockpiled on site. Stockpiled drill cuttings will be placed on and covered with plastic sheeting. The stockpiled soil is typically characterized by collecting and analyzing composite samples from the stockpile. Stratus Environmental will recommend an appropriate method for disposition of the cuttings based on the analytical results. The client will be responsible for disposal of the drill cuttings.

Soil Sample Collection

During drilling, soil samples will be collected in cleaned brass, two by six inch tubes. The tubes will be set in an 18-inch-long split-barrel sampler. The sampler will be conveyed to bottom of the borehole attached to a wire-line hammer device on the drill rig. When possible, the split-barrel sampler will be driven its entire length, either hydraulically or by repeated pounding a 140-pound hammer using a 30-inch drop. The number of drops (blows) used to drive the sampler will be recorded on the boring log. The sampler will be extracted from the borehole, and the tubes containing the soil samples will be removed. Upon removal, the ends of the lowermost tube will be sealed with Teflon sheets and plastic caps. Soil samples for chemical analysis will be labeled, placed on ice, and delivered to a state-certified analytical laboratory, along with the appropriate chain-of-custody documentation.

Soil Classification

As the samples are obtained in the field, they will be classified by the field geologist in accordance with the Unified Soil Classification System. Representative portions of the samples will be retained for further examination and for verification of the field classification. Logs of the borings indicating the depth and identification of the various strata and pertinent information regarding the method of maintaining and advancing the borehole will be prepared.

Soil Sample Screening

Soil samples selected for chemical analysis will be determined from a head-space analysis using a PID or an FID. The soil will be placed in a Ziploc® bag, sealed, and allowed to reach ambient temperature, at which time the PID probe will be inserted into the Ziploc® bag. The total volatile hydrocarbons present are detected by the PID and reported in parts per million by volume (ppmv). The PID will be calibrated to an isobutylene standard.

Generally two soil samples from each soil boring will be submitted for chemical analysis unless otherwise specified in the scope of work. Soil samples selected for analysis typically represent the highest PID reading recorded for each soil boring and the sample just above first-encountered groundwater.

Stockpiled Drill Cuttings and Soil Sampling

Soil generated during drilling operations will be stockpiled on-site. The stockpile will be set on and covered by plastic sheeting in a manner to prevent rain water from coming in contact with the soil. Prior to collecting soil samples, Stratus personnel will calculate the approximate volume of soil in the stockpile. The stockpile will then divided into sections, if warranted, containing the predetermined volume sampling interval. Soil samples will be collected at 0.5 to 2 feet below the surface of the stockpile. Four soil samples will be collected from the stockpile and composited into one sample by the laboratory prior to analysis. The soil samples will be collected in cleaned brass, two by six inch tubes using a hand driven sampling device. To reduce the potential for cross-contan1ination between samples, the sampler will be cleaned between each sampling event. Upon recovery, the sample container will be sealed at each end with Teflon sheeting and plastic caps to minimize the potential of volatilization and cross-contan1ination prior to chemical analysis. The soil sample will be labe1ed, placed on ice, and delivered to a state-certified analytical laboratory, along with the appropriate chain-of-custody documentation.

Direct Push Technology, Soil Sampling

GeoProbe™ is a drilling method of advancing small diameter borings without generating soil cuttings. The GeoProbe™ system consists of a 2-inch diameter, 5-feet long, stainless steel soil sampling tool that is hydraulically advanced into subsurface soils by a small, truck-mounted rig. The sampling tool is designed similar to a California-modified split-spoon sampler, and lined with a 5-foot long, clear acrylic sample tube that enables continuous core sampling.

To collect soil samples, the sampler is advanced to the desired sampling depth. The mouth of the sampling tool is plugged to prevent soil from entering the sampler. Upon reaching the desired sampling depth, the plug at the mouth of the sample tool is disengaged and retracted, the sampler is advanced, and the sampler is filled with soil. The sample tool is then retrieved from the boring, and the acrylic sample tube removed. The sample tool is then cleaned, a new acrylic tube is placed inside and the sampling equipment is advanced back down the borehole to the next sample interval.

The Stratus geologist describes the entire interval of soil visible in the acrylic tube. The bottom-most 6-inch long section is cut off and retained for possible chemical analysis. The ends of the chemical sample are lined with Teflon™ sheets, capped, labeled, and placed in an ice-chilled cooler for transport to California Department of Health Services-certified analytical laboratory under chain-of-custody.

Direct Push Technology, Water Sampling

A well known example of direct push technology for water sampling is the Hydropunch®. For the purpose of this field method the term hydropunch will be used instead of direct push technology for water sampling.

The hydropunch is typically used with a drill rig. A boring is drilled with hollow stem-augers to just above the sampling zone. In some soil conditions the drill rig can push directly from the surface to the sampling interval. The hydropunch is conveyed to the bottom of the boring using drill rods. Once on bottom the hydropunch is driven a maximum of five feet. The tool is then opened by lifting up the drill rod no more than four feet. Once the tool is opened, water enters and a sample can be collected with a bailer or tubing utilizing a peristaltic pump. Soil particles larger than silt are prevented from entering the tool by a screen within the tool. The water sample is collected, labeled, and handled according to the Quality Assurance Plan.

Monitoring Well Installation

Monitoring wells will be completed by installing 2 to 6 inch-diameter Schedule 40 polyvinyl chloride (PVC) casing. The borehole diameter for a monitoring well will be a minimum of four inches larger than the outside diameter of the casing. The 2-inch-diameter flush-threaded casing is generally used for wells dedicated for groundwater monitoring purposes.

A monitoring well is typically cased with threaded, factory-perforated and blank Schedule 40 PVC. The perforated interval consists of slotted casing, generally with 0.01 or 0.02 inch-wide by 1.5-inch-long slots, with 42 slots per foot. The screened sections of casing are factory machine slotted and will be installed approximately 5 feet above and 10 feet below first-encountered water level. The screened interval will allow for seasonal fluctuation in water level and for monitoring floating product. A threaded or slip PVC cap is secured to the bottom of the casing. The slip cap can be secured with stainless steel screws or friction; no solvents or cements are used. Centering devices may be fastened to the casing to ensure even distribution of filter material and grout within the borehole annulus. The well casing is thoroughly washed and/or steam cleaned, or may be purchased as pre-cleaned, prior to completion.

A filter pack of graded sand will be placed in the annular space between the PVC casing and the borehole wall. Sand will be added to the borehole through the hollow stem of the augers to provide a uniform filter pack around the casing and to stabilize the borehole. The sand pack will be placed to a maximum of 2 feet above the screens, followed by a minimum 1-foot seal consisting of bentonite pellets.

Cement grout containing 5 percent bentonite or concrete will be placed above the bentonite seal to the ground surface. A concrete traffic-rated vault box will be installed over the monitoring well(s). A watertight locking cap will be installed over the top of the

well casing. Reference elevations for each monitoring well will be surveyed when more than two wells will be located on site. Monitoring well elevations will be surveyed by a California licensed surveyor to the nearest 0.01-foot relative to mean sea level (MSL). Horizontal coordinates of the wells will be measured at the same time.

Exploratory boring logs and well construction details will be prepared for the final written report.