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Work Plan to Conduct a Groundwater Remediation Pilot Test at the Asphalt Plant and Additional Subsurface Characterization in the Former Diesel Spray Area

Hanson Aggregates Mission Valley Rock Facility
7999 Athenour Way
Sunol, Alameda County, California

August 3, 2007
001-09480-02

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CONTENTS

TABLE

FIGURES

APPENDIX

CERTIFICATIONS

LFR Inc. has prepared this Work Plan, on behalf of Hanson Aggregates Northern California, in a manner consistent with the level of care and skill ordinarily exercised by professional geologists and environmental scientists. This investigation work plan was prepared under the technical direction of the undersigned California Professional Geologists.

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Expires Feb. 28, 2009

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1.0 INTRODUCTION

LFR Inc. (LFR) has prepared this “Work Plan to Conduct a Groundwater Remediation Pilot Test at the Asphalt Plant and Additional Subsurface Characterization in the Former Diesel Spray Area” (“Work Plan”) on behalf of Hanson Aggregates Northern California (“Hanson”). The asphalt plant is located within the Hanson Sunol aggregated facility located at 7999 Athenour Way in Sunol, Alameda County, California (“the Site”; Figure 1). The former diesel spray area is located approximately 300 feet west of the Site. The Site and the former diesel spray area are located within the approximately 588-acre property owned and operated by Hanson since early 2005, and previously by Mission Valley Rock Company (“Mission Valley”) since the 1950s. The Hanson Sunol facility is operated as an aggregate mining quarry with an asphalt manufacturing plant and a ready mix concrete plant. Additionally, various areas throughout the property are leased for industrial, agricultural, and storage purposes.

This Work Plan has been prepared to respond to technical comments provided by Alameda County Environmental Health (ACEH) in a letter to Hanson Aggregates West Region, entitled “Fuel Leak Case No. RO0000207 and GeoTracker Global ID T0600102092, Mission Valley Rock and Asphalt, 7999 Athenour Way, Sunol, CA 94586,” dated April 27, 2007 (“the April 27 letter”). The April 27 letter provided comments to LFR’s report entitled “Site Assessment Report of Additional Lateral and Vertical Characterization and Plan for Interim Remediation at the Asphalt Plant, Hanson Aggregates Mission Valley Rock Facility,” dated April 10, 2007 (“the Site Assessment Report”).

In the April 27 letter, ACEH concurred with the Site Assessment Report conclusion that the Site had been sufficiently characterized. The April 27 letter also concurred with the conclusion that, based on the results of a temporary soil boring advanced near the former diesel spray area, additional characterization would be necessary in this area.

ACEH requested that a Work Plan be submitted describing the scope of work to:

1. conduct a groundwater remediation pilot test for petroleum-affected groundwater beneath the Site, and
2. conduct additional subsurface characterization of the extent of fuel hydrocarbons in soil and/or groundwater in the vicinity of the former diesel spray area.

In addition, the April 27 letter included a request that the Work Plan include the soil boring logs for former temporary soil borings B-1 and B-2 advanced in the asphalt plant area and that additional information regarding existing surface depression features be provided.

This Work Plan is presented in the following sections. Section 2.0 briefly reviews the site history, describes investigations conducted to date and the known extent of fuel hydrocarbons in the subsurface, summarizes the conclusions presented in the Site Assessment Report, and provides an overview of the objectives of the proposed activities described in this Work Plan. Section 3.0 provides a description of the proposed groundwater remediation pilot test in the asphalt plant area. Section 4.0 summarizes the proposed field activities to characterize the extent of petroleum hydrocarbons in the vicinity of the former diesel spray area. Section 5.0 presents the additional information requested by ACEH regarding soil borings B-1 and B-2 and the surface depression features.

2.0 HISTORY OF POTENTIAL ENVIRONMENTAL IMPACTS AND SUMMARY OF PREVIOUS INVESTIGATIONS

2.1 Asphalt Plant Area

The asphalt plant has been in operation since approximately 1980. Operation from 1980 to 1996 included the use of two 10,000-gallon diesel fuel underground storage tanks (USTs) and one 2,000-gallon gasoline UST with fuel dispenser used to fuel company vehicles. These three USTs were removed in June 1996 by Tank Protect Engineering (TPE 1996). At the time they were removed, the USTs were in good condition with no holes evident, although a ¼-inch-diameter hole was observed in one of the fuel lines and an impact to soil and groundwater was discovered.

A fourth, 10,000-gallon diesel tank (designated “D-4”) was located approximately in the southeastern portion of the Site and apparently was a partially buried tank. D-4 reportedly was abandoned and removed and is not believed to have released significant quantities of petroleum hydrocarbons to the environment.

The possible existence of a fifth diesel UST, estimated to be 8,000 to 10,000 gallons in size, is thought to have existed (according to a longtime employee familiar with the Site) in the southern portion of the Site, approximately beneath the two existing 25,000-gallon asphalt cement aboveground storage tanks (ASTs). This fifth diesel UST reportedly was used only for a few years before being abandoned in place (likely filled with cement) during the 1970s and before the asphalt plant was built. The existence and former condition of this UST cannot be confirmed. The two 25,000-gallon ASTs located in the southern portion of the Site contain asphalt cement and therefore are not considered a potential source of fuel hydrocarbons detected in the subsurface.

No other USTs or ASTs are reported to have existed at the Site since approximately 1970. The approximate locations of all known current and former USTs or ASTs are shown on Figure 2. Several subsurface investigations have been completed by LFR and other consultants from 1996 to the present to characterize the extent of petroleum hydrocarbon contamination in the asphalt plant area. These investigations and the known extent of petroleum hydrocarbon impact at the Site are described further below.

2.2 Former Diesel Spray Area

A former diesel spray area was located approximately 300 feet to the west of the asphalt plant (Figure 3). This area reportedly was used to spray down the beds of the trucks with diesel prior to asphalt loading to prevent the materials from sticking in the truck beds. Diesel spray may have reached the ground surface, potentially infiltrating and affecting the subsurface. The area currently is comprised of an elevated platform located approximately in the center of the main north-south road west of the Site, and continues to be used for spraying down the beds of trucks, although soapy water is now used. The former diesel spray area is located approximately upgradient from the Site, based on groundwater flow gradients observed since approximately 1998.

2.3 Summary of Previous Environmental Site Investigations

Several investigations have been completed at, and in the vicinity of, the Site by LFR and other consultants since the three USTs were removed in 1996. In 1998, TPE installed three single-completion groundwater monitoring wells (MW-1 through MW-3) and performed routine quarterly groundwater monitoring at the Site until mid-2000. Tait Environmental Management, Inc. (Tait) assumed the routine quarterly groundwater monitoring and reporting (QMR) activities in June 2000 and, except for a period during 2003 to 2004, has conducted routine, approximately monthly, groundwater monitoring of existing wells at the Site.

Installation of Replacement Well MW-2 and New Wells MW-4 through MW-8 (2005)

In December 2002, Tait conducted a site assessment that included advancing eight temporary soil borings (TB-1 through TB-8) and collecting soil and grab groundwater samples from those borings. In January 2005, Tait advanced eight additional soil borings, six of which were converted to single-, double-, and triple-completion groundwater monitoring wells, for a total of 12 new groundwater monitoring wells. In addition, monitoring well MW-2 was abandoned. The 12 new groundwater monitoring wells were identified as shallow (S), mid (M), and deep (D) completions depending on well screen depths, and included wells MW-2S/M/D, MW-4S/D, MW-5S/D, MW-6S/D, MW-7S/D, and MW-8. Tait resumed routine QMR activities in early 2005; the most recent routine groundwater monitoring and sampling event was conducted during the second quarter of 2007. The most recent and historical water level and analytical results can be found in Tait's second quarter 2007 monitoring and sampling report.

At the request of ACEH, LFR developed an initial site conceptual model (SCM) to better understand the site conditions and the fate and transport of the petroleum hydrocarbons and associated methyl tertiary-butyl ether (MtBE) detected in groundwater beneath the Site. The initial SCM was submitted as part of a work plan submitted by LFR on January 17, 2006 to install additional groundwater monitoring wells at the Site, and was updated, as necessary, to incorporate knowledge gained from subsequent investigations.

Installation of New Well Clusters MW-9 through MW-12 (2006)

In April and May 2006, LFR installed and conducted the initial sampling of 12 new single-completion groundwater monitoring wells located in four well clusters approximately to the north, east, south, and west of the Site (well clusters MW-9 through MW-12, respectively). Each of the four well clusters includes one deeper groundwater monitoring well installed into the top of what is presumed to be the Livermore Formation. These 12 groundwater monitoring wells were completed to depths designated as shallow (“S”, screened approximately from 5 to 10 feet below ground surface [bgs]), deep (“D”, screened approximately from 15 to 20 feet bgs), and Livermore Formation (“LF”, screened approximately from 35 to 40 feet bgs and believed to be approximately within the top 5 to 10 feet of the Livermore Formation). A summary report presenting the work conducted to install groundwater monitoring wells MW-9 through MW-12 and initial sampling results was submitted to ACEH on July 10, 2006 (LFR 2006b).

MIP and Grab Groundwater Investigation (2007)

Based on its review of the July 10, 2006 investigation report, and in agreement with LFR conclusions, ACEH requested that additional characterization be conducted to better characterize the extent of petroleum hydrocarbons laterally to the north and south of the Site, and vertically beneath the Site. Following the approval of LFR’s October 10, 2006 work plan, LFR conducted an additional subsurface investigation during February and March 2007 that included advancing temporary soil borings to the north and south of the Site, and vertically deeper below the areas of highest petroleum hydrocarbon concentrations previously detected in groundwater beneath the Site.

This additional characterization investigation was conducted using cone penetration testing (CPT) drilling methods with a membrane interface probe (MIP) as a field screening tool. A total of six MIP locations (MIP-1 through MIP-6) were advanced to approximately 25 to 47 feet bgs. One MIP location (MIP-4) was advanced in the vicinity of the former diesel spray area, at the request of ACEH, to look for the possible presence of petroleum hydrocarbons in this area. Confirmation soil and/or grab groundwater samples were collected as necessary based on the MIP results evaluated in the field. Sonic drilling technique was used to advance two deeper soil borings to approximately 60 feet bgs (B-1 and B-2) to collect grab groundwater samples for additional vertical characterization. Sonic drilling was used to reach the deeper target depths because the CPT with MIP field screening tool could not be advanced deeper than approximately 47 feet due to field conditions. Results from this characterization investigation were presented in the Site Assessment Report submitted to ACEH on April 10, 2007.

The locations of all former temporary soil borings and all existing or former groundwater monitoring wells installed at the Site are shown on Figure 2.

Remediation Alternative Evaluation (2007)

In addition, groundwater samples were collected from three existing groundwater monitoring wells to evaluate groundwater quality conditions and the potential for naturally occurring biodegradation of petroleum hydrocarbons in groundwater. The three wells selected for this sampling (MW-5D, MW-7D, and MW-12D) represented a range of petroleum hydrocarbon-affected groundwater. These wells were sampled using low-flow purging and sampling techniques, for compounds that are indicators of microbial activity and/or of existing or potential degradation of petroleum hydrocarbons. Analytical results from this groundwater sampling were presented in the Site Assessment Report.

The water quality data obtained from groundwater monitoring wells MW-5D, MW-7D, and MW-12D indicated that natural aerobic biodegradation likely is occurring at the Site. An evaluation of potential remediation alternatives was performed and, as presented in the Site Assessment Report, enhanced biodegradation through the addition of oxygen was proposed as the preferred remedial alternative for the Site.

2.4 Approximate Lateral and Vertical Extent of Petroleum Hydrocarbon Contamination

Results of previous investigations and routine groundwater monitoring conducted at the Site have revealed that groundwater beneath the Site is affected by elevated concentrations of total petroleum hydrocarbons (TPH) as gasoline (TPHg), TPH as diesel (TPHd), the fuel oxygenate MtBE, and benzene.

Occurrence of free product at the Site has been limited to sporadic measurements of limited thicknesses, primarily in former groundwater monitoring well MW-2, in which free product was detected at thicknesses up to 0.9 foot during approximately June 1998 through June 2002. Free product also was noted during the drilling of wells MW-9D and MW-11D in April-May 2006, although free product has not been measured in these wells during routine quarterly groundwater monitoring conducted to date. No other instances of free product have been noted at the Site.

The highest petroleum hydrocarbon concentrations in groundwater historically have been detected in monitoring wells MW-2 (destroyed), MW-7D, MW-9D, and MW-11D. Below is a summary table of the highest TPHg and TPHd concentrations detected in these wells to date.

Well ID	TPHd (μg/L)	Date Detected	TPHg (μg/L)	Date Detected
MW-2 (Destroyed)	610,000	March 2001	24,000	June 1999
MW-7D	150,000	December 2005	1,300,000	December 2005
MW-9D	11,000	June 2007	210,000	February 2007
MW-11D	210,000	September 2006	33,000	September 2006

Note: μg/L = micrograms per liter

With few exceptions, MtBE has been detected primarily in wells MW-2, MW-3, MW-5, MW-6, and MW-11. These wells are located predominantly in the southern portion of the Site. MtBE concentrations. The highest reported MtBE concentration have been in samples from wells MW-6S (410 μg/L in August 2005) and MW-6D (360 μg/L in May 2005).

The CPT/MIP investigation and associated confirmation sampling conducted during February and March 2007 provided lateral characterization to the north of well cluster MW-9 and to the south of well cluster MW-11 where historically elevated concentrations were detected. The grab groundwater samples collected from the two deep soil borings B-1 and B-2 provided vertical characterization into what is presumed to be the Livermore Formation. Based on the results of this most recent investigation, and on results from previous investigations and routine groundwater monitoring, it was determined that the lateral and vertical extent of petroleum hydrocarbon contamination was sufficiently characterized at the Site. ACEH concurred with this conclusion in its April 27, 2007 comment letter.

2.5 Agency Requirements

As lead agency overseeing the site cleanup, ACEH reviewed LFR's Site Assessment Report, which was submitted under Fuel Leak Case No. RO0000207 on April 10, 2007. ACEH provided technical comments in a letter dated April 27, 2007, which stated that no further investigation of the asphalt plan area would be required. In its April 27, 2007 letter, ACEH requested that a work plan be submitted describing the scope of work to design and conduct a pilot test for groundwater remediation at the asphalt plant and to conduct additional site characterization activities at the former diesel spray area.

2.6 Work Plan Objectives

The two primary objectives for the scope of work described in this work plan are:

1. Design and implement a groundwater remediation pilot test to evaluate the effectiveness of injecting air into groundwater beneath the Site and to collect data to

assist in the design of a full-scale remediation system, if deemed appropriate for the Site.

2. Further characterize the extent of petroleum hydrocarbon in the subsurface in the vicinity of the former diesel spray area.

This Work Plan also provides ACEH with the additional information requested, including the soil boring logs for former borings B-1 and B-2 and confirmation of whether the surface depressions are lined.

The scope of work proposed to meet these objectives is described in Sections 3.0 and 4.0 below. The additional information is presented in Section 5.0.

3.0 PROPOSED GROUNDWATER REMEDIATION PILOT TEST

The objectives, methods, and procedures proposed for conducting the proposed oxygen injection pilot test are described in this section.

3.1 Pilot Test Objective and Approach

The overall remedial action objective for the Site is to reduce the concentrations of petroleum hydrocarbons and MtBE in soil and groundwater at the Site to levels that are technically and economically feasible to achieve, with the ultimate objective of meeting applicable ACEH regulatory standards. The remediation approach selected for this Site is enhanced aerobic biodegradation, primarily of MtBE through the addition of oxygen. A flexible approach for remediation is being developed for this Site, which may include the following components:

- air sparging (stripping of hydrocarbon mass and oxygen addition),
- injection of pure (90^{+}%) oxygen (oxygen addition only), and/or
- injection of ozone (oxidation of hydrocarbon mass).

Results from this pilot test will be used, along with the initial performance data from the chosen treatment system, to select which of these components are implemented. The objective of the pilot test proposed in this Work Plan is to assess the feasibility of injecting air into saturated subsurface beneath the Site, and to collect data that will assist with the design of a site-wide injection system, if deemed appropriate for this Site. This objective will be met by injecting air into injection points set at various depths in the saturated interval, and monitoring the effects of that injection using existing groundwater monitoring wells.

Injection points will be installed near existing groundwater monitoring wells MW-9LF, MW-9D, and MW-9S, where relatively elevated petroleum hydrocarbon concentrations have been detected. The injection points are proposed to be installed at the approximate depths of 15, 30, and 45 feet bgs. Injection response will be assessed by collecting data from wells MW-9LF (deepest interval), MW-9D (deep interval), and MW-9S (shallow interval). Injection response will be assessed through collection of hydraulic (pressure transducer) and water quality data in nearby existing monitoring wells, and monitoring of a tracer gas (helium) that will be injected. In addition, shallow soil gas will be monitored to assess for potential increases in hydrocarbon concentrations in the vadose zone.

The pilot test will be conducted and monitored for approximately three to four months, depending on results and performance and monitoring results.

3.2 Pilot Test Location

LFR proposes to conduct the pilot test in the vicinity of monitoring well cluster MW-9, with the installation of three injection wells to be located immediately west of, and approximately between, wells MW-9LF and MW-9D, wells MW-9D and MW-9S, and just northwest of well MW-9S, as shown on Figure 2. Injection response will be monitored using the three wells that comprise well cluster MW-9.

The vicinity of well cluster MW-9 was selected for the pilot testing activities based on the following:

- The relatively elevated concentrations of TPHd and TPHg indicate that well cluster MW-9 is located near a primary source area and/or center of hydrocarbon mass.
- Some of the highest concentrations of TPHd and TPHg have been detected in samples collected from well MW-9D, screened approximately from 19 to 24 feet bgs.
- Well MW-9LF is one of the deepest wells at the Site and one in which TPHg has been detected regularly.
- Well cluster MW-9 offers the possibility of monitoring three different intervals: well MW-9S is screened from approximately 5 to 12 feet bgs, well MW-9D is screened from approximately 19 to 24 feet bgs, and well MW-9LF is screened from approximately 33 to 38 feet bgs.
- Wells MW-1, MW-7S, MW-7D, and MW-8 are located within approximately 40 feet from well cluster MW-9 and, depending on the radius of influence of the injection wells, may offer additional groundwater monitoring locations.
- The area immediately south-southwest of well cluster MW-9 along the ramp wall likely can be used to store the air injection unit during the pilot test.
- The area intended for conducting the pilot test and storing the air injection unit is a somewhat lower-traffic area for vehicles and asphalt plant activities, although extreme caution will be necessary due to nearby heavy truck traffic.

3.3 Scope of Work for the Proposed Pilot Test

The scope of work for the proposed pilot test will include the following activities:

- Collect baseline groundwater data from the following monitoring wells: MW-1, MW-7S, MW-7D, MW-8, MW-9S, MW-9D, and MW-9LF.
- Install three injection wells immediately west of well cluster MW-9, at the locations indicated on Figure 2.
- Install an air compressor and injection unit near the three injection wells and connecting all associated valves and piping.
- Install approximately three shallow (less than 4 feet bgs) single-point soil-gas sample points for monitoring potential off-gassing during the pilot test.
- Inject air at various pressures and flow rates into each of the injection points, for approximately three to four months.
- Collect detailed groundwater level measurements in each of the MW-9 wells and in wells MW-1, MW-7S, MW-7D, and MW-8 using pressure transducers, prior to and during the initial phases of the injection test.
- Collect field dissolved oxygen (DO) data from these wells.
- Collect groundwater samples from wells MW-1, MW-7S, MW-7D, MW-8, MW-9S, MW-9D, and MW-9LF two weeks after start-up, then approximately monthly for four months (depending on location and response), and analyze those samples for petroleum hydrocarbons geochemistry.
- Conduct tracer tests using helium.
- Conduct an evaluation of the groundwater quality data during the pilot test to assess for the effectiveness of air injection to reduce hydrocarbons in groundwater and to assist with the design of a full-scale system, if appropriate.
- Prepare a report summarizing the air injection well and soil-gas sample point installations, the final pilot test design, system start-up, operating injection rates and pressures, tracer test results, groundwater and soil-gas sampling results, and recommendations for design modification and/or alternative remediation technologies, as necessary.

The following text provides details regarding the pilot test activities.

3.4 Pre-Field Activities

3.4.1 Permitting

LFR will apply for the appropriate drilling and well installation permit(s) with the Alameda County Zone 7 Water Agency (Zone 7). LFR will inquire with ACEH and the City of Sunol whether any additional permits would be required specific to conducting the proposed air injection pilot test.

3.4.2 Subsurface Utility Clearance

Potential locations of underground utilities (e.g., pipes, electrical conductors, fuel lines, and/or sewer lines) will be determined before soil intrusive work is performed. The state underground utility notification authority, Underground Service Alert (USA), will be contacted prior to the start of intrusive field activities, in accordance with local notification requirements.

In addition, LFR will subcontract a qualified private underground utility locating contractor to identify possible subsurface obstructions and utilities, using a combination of ground penetrating radar and pipe/cable locating methods. If underground utilities are identified within approximately 5 feet of a proposed drilling location, LFR will revise the proposed location accordingly, and will repeat the underground utility clearance procedures as necessary. As an added precaution, soil borings will be started by hand augering to approximately 5 feet bgs to bypass potentially undetected shallow underground utilities.

LFR will coordinate with facility personnel so that proposed field activities do not significantly interfere with plant operations.

3.4.3 Health and Safety

The Health and Safety Plan (HSP) documents the potential hazards to worker health and safety at the Site during the proposed field activities and specifies the appropriate means to mitigate or control these hazards. The HSP addresses the potential for exposure to hazardous constituents and describes general safety procedures.

An HSP previously was prepared by LFR for the subsurface characterization work conducted by LFR during February and March 2007. The existing HSP will be amended as necessary to incorporate the most recent groundwater monitoring data, and to address health and safety concerns specific to the new field procedures proposed in this Work Plan. Health and safety meetings will be conducted in the field at the start of the project and each day before beginning fieldwork. All fieldwork will be monitored according to the HSP to ensure that appropriate health and safety procedures are followed. A copy of the HSP will be kept on site during scheduled field activities.

In addition, LFR and LFR’s subcontractors also will go through the on-site health and safety training conducted by facility personnel as required by Hanson.

3.5 Baseline Monitoring

Prior to start-up of oxygen injection activities, baseline groundwater samples will be collected from monitoring wells MW-1, MW-7S, MW-7D, MW-8, MW-9S, MW-9D, and MW-9LF. A groundwater sample matrix summarizing the wells selected to be sampled and laboratory analysis methods is presented as Table 1. Collected groundwater samples will be submitted to Curtis & Tompkins, Ltd. (C&T), a California-certified laboratory located in Berkeley, California, and will be analyzed for the following compounds:

- TPHd by Environmental Protection Agency (EPA) Method 8015
- TPHg, benzene, toluene, ethylbenzene, and total xylenes (collectively referred to as BTEX compounds) by EPA Method 8260B
- Fuel oxygenates, including MtBE, ethyl tertiary butyl ether (ETBE), di-isopropyl ether (DIPE), tertiary amyl methyl ether (TAME), and tertiary butyl alcohol (TBA), by EPA Method 8260B

Additionally, samples collected from wells MW-9S, MW-9D, and MW-9LF will be analyzed for the following compounds:

- biological oxygen demand (BOD) by Standard Method 5210B
- chemical oxygen demand (COD) by EPA Method 410.1
- nitrite and nitrate by EPA Method 354.1
- total Kjeldahl nitrogen (TKN) by Standard Method 4500
- orthophosphate by EPA 365.3

Groundwater samples collected from well cluster MW-9 during the baseline sampling event and at the end of the test (approximately week 14) also will be sent to Respirtek, Inc., of Biloxi, Mississippi, for microbial population heterotrophic and specific-degrader plate counts using Standard Method 9215-A.

In addition to the above laboratory analyses, field measurements of groundwater parameters, including DO, pH, electrical conductivity, oxidation reduction potential (ORP), and temperature, will be monitored at each well during the baseline sampling event, during purging and immediately prior to collecting groundwater samples. These field measurements will be recorded on field sheets.

3.6 Installation of Air Injection Well Points

Three injection well (OXY-1, OXY-2, and OXY-3; Figure 2) are proposed to be installed with the following approximate screened intervals:

- 15 to 17 feet bgs (OXY-1)

- 30 to 32 feet bgs (OXY-2)
- 43 to 45 feet bgs (OXY-3)

These depth intervals may be modified in the field, based on the sediments encountered during drilling. These depth intervals were selected to provide increased vertical coverage through the affected saturated interval, which in this area ranges approximately from the top of the water table (4 to 5 feet bgs), to approximately 40 feet bgs (based on monitoring results from well MW-9LF). The new injection wells will be installed using hollow stem auger (HSA) drilling technology, which has successfully been used for the installation of all groundwater monitoring wells at the Site. Lithology near the proposed screened interval for each well will be sampled near-continuously using a continuous-core barrel to help select specific depths for the screened interval for each injection well. Each injection well will be constructed using 2-inch-diameter Schedule 80 polyvinyl chloride (PVC). LFR will subcontract a California-certified drilling contractor to drill and install the proposed sparge points under supervision of LFR field staff working under the direction of an LFR California Professional Geologist.

Filter packs consisting of clean silica sand of an appropriate size for the formation will be placed in the annular space around the well screen from the bottom of the boring to approximately 2 feet above the top of the well screen. A bentonite seal will be placed above the filter pack extending up to approximately 5 to 7 feet bgs, before filling the remaining annular space with cement grout to approximately 2 feet bgs. The extended bentonite seal is proposed to be installed to prevent cement grout from migrating through the coarse-grained material to the adjacent air sparge well location and into the formation, thereby reducing its permeability in the vicinity of the air injection wells.

Flush-mount, traffic-rated wellhead protective covers with be installed in concrete at each of the air injection well points. The surface completions will be constructed similarly to previously installed groundwater monitoring wells, with concrete pads at least 4 or 5 inches thick above ground surface, to reduce the risk of surface water entering the well vaults.

3.7 Air Injection

Pressurized air will be generated using an air compressor located near the injection wells and delivering the air at controlled cycled rates. The air will be injected into oxygen injection wells using a trailer-mounted air compressor, via an air-tight fitting attached directly to the top of the injection wells. The air compressor unit will contain a system control panel, associated pressure gauges, flow meters, and valves for air flow control.

Air flow and pressure will be controlled during the test using a valve and pressure regulator. It is anticipated that the pressure will initially be set at 30 pounds per square inch (psi) and will not exceed a maximum pressure of 100 psi. The flow rate will initially be set at 1 cubic foot per minute. The flow rate and air pressure injected into the injection well points will be recorded in a field notebook approximately biweekly. Air will be injected into each injection well in isolation, and in various combinations during this pilot test.

Air injection flow rates will be dependent upon the formation surrounding the screened interval of the two oxygen injection wells. Flow rates and pressures will be adjusted such that the injected oxygen penetrates the surrounding formation.

3.8 O&M and Pilot Test Performance Monitoring

Operations and maintenance (O&M) will be conducted on a weekly basis during this test. The O&M visits will generally consist of evaluating the pressure gauges, piping, and wellheads, and the security of the injection system.

Groundwater samples that monitor pilot test performance will be collected from monitoring wells MW-1, MW-7S, MW-7D, MW-8, MW-9S, MW-9D, and MW-9LF, as summarized below. Groundwater samples will be collected from these seven wells approximately at two weeks, six weeks, 10 weeks, and 14 weeks after system start-up. However, if a review of analytical data shows that no response is apparent in the groundwater monitoring wells located farthest from the injection wells (MW-7S, MW-7D, and MW-8), then these three wells will be sampled only at 14 weeks after system start-up.

Groundwater samples will be submitted to C&T for analyses of the following compounds:

- TPHd by EPA Method 8015B
- TPHg and BTEX compounds by EPA Method 8260B
- MtBE, ETBE, DIPE, TAME, and TBA by EPA Method 8260B

All groundwater samples collected from well cluster MW-9 also will be analyzed for BOD by Standard Method 5210B and for COD by EPA Method 410.1.

Additionally, groundwater samples collected from well cluster MW-9 at 14 weeks after system start-up will be analyzed for the following:

- Nitrite and nitrate by EPA Method 354.1
- TKN by Standard Method 4500
- orthophosphate by EPA Method 365.3
- heterotrophic and specific-degrader plate counts using Standard Method 9215-A (sample to be sent to Respirtek, Inc.)

In addition to the above laboratory analyses, field measurements of groundwater parameters, including DO, pH, electrical conductivity, ORP, and temperature, will be measured and recorded during purging and immediately prior to sampling at all seven wells during each sampling event.

Sample laboratory analyses and analytical methods are summarized in Table 1.

3.9 Additional Tests and Monitoring Conducted During Pilot Test

3.9.1 Helium Tracer Tests

A helium tracer test will be conducted to collect semi-quantitative data regarding the distribution of injected air. A known mass of helium will be blended into the injected air stream. Helium will be monitored periodically using a detector capable of detecting helium to 100 parts per million by volume (ppmv) in each of the MW-9 well cluster wells and the vadose-zone wells. Helium monitoring will continue until helium is not detected using the monitor.

3.9.2 Soil-Gas Sampling

Three shallow soil-gas sampling points are proposed to be installed in the vicinity of well cluster MW-9 to monitor for potential off-gassing during the pilot test. The soil-gas sample points would be installed using direct-push technology (a 1.5- to 2-inch-diameter drill rod is pushed to the target depth of approximately 3 to 4 feet bgs). The drill rod would be removed and the sample point, consisting of ¼-inch-diameter polyethylene tubing open at the bottom, would be installed in the open hole. The bottom of the sample tubing would be covered by an air filter to prevent sediment from entering the tubing. The annular space around the open bottom end of the tubing would be filled with filter sand to approximately 6 to 12 inches above the bottom of the boring. The rest of the annular space around the tubing would be filled with granular bentonite hydrated as the bentonite is installed to create an air-tight seal.

The top of the tubing would be fitted with compression fittings to allow the tubing to be capped and a pump and/or sample container to be attached to the tubing for sampling purposes. Each soil-gas sample point would be appropriately purged prior to collection of soil-gas samples during the injection test. Soil-gas samples would be collected prior to system start-up and approximately at two weeks, six weeks, 10 weeks, and 14 weeks after system start-up, and would be analyzed for TPHg, TPHd, BTEX compounds, and MtBE, using laboratory analytical method TO-17. The soil-gas samples would be collected in clean laboratory-provided sample containers; a charcoal tube filter would be needed for the TPHd analysis.

3.10 Waste Characterization, Handling, and Disposal

The anticipated investigation-derived waste (IDW) that will be generated during the field activities includes soil cuttings during drilling, well development and purge water, equipment decontamination fluids during drilling, and used personal protective equipment (PPE). Soil cuttings will be containerized in clean Department of Transportation- (DOT-) approved 55-gallon drums or similar. Well development/purge water and decontamination rinse water similarly will be containerized in DOT-approved 55-gallon drums or other appropriate holding tanks with covers. Used PPE and disposable sampling equipment will be placed in double plastic bags in drums or in an industrial disposal bin. An adhesive label will be affixed to each container, noting the following information: container number, waste type, location where the IDW was generated, and date of waste generation.

The containers storing the generated wastes will be temporarily stored at a centralized location at the Site until the waste characterization results are received and disposal is arranged. If necessary for waste disposal, samples of the soil cuttings and fluids will be collected to evaluate appropriate disposal options.

3.11 Field Documentation

The purpose of the standardized field documentation and sampling procedures is to maintain integrity of field documentation and field samples throughout the investigative process.

All relevant field activities will be appropriately documented using the following forms as appropriate: field logs of soil borings, well development forms, groundwater sampling forms, sample labels, chain-of-custody forms, waste management and hazardous waste labels, and pilot test injection start-up details and ongoing O&M monitoring. All field forms will be kept on file at LFR and will be available upon request. Copies of relevant field forms will be included in the summary report.

4.0 PROPOSED SUBSURFACE CHARACTERIZATION ACTIVITIES

4.1 Pre-Field Activities

4.1.1 Permitting

LFR will apply for the appropriate soil boring drilling permits with Zone 7.

4.1.2 Subsurface Utility Clearance

Similarly to the subsurface utility clearance activities described in Section 3.4.2, all proposed temporary soil boring locations will be cleared by first contacting USA, then by a qualified private underground utility locating contractor. If underground utilities are identified within approximately 5 feet of a proposed drilling location, LFR will revise the proposed location accordingly, and will repeat the underground utility clearance procedures as necessary. As an added precaution, soil borings will be started by hand augering to approximately 5 feet bgs to bypass potentially undetected shallow underground utilities.

LFR will coordinate with facility personnel so that proposed field activities do not significantly interfere with plant operations.

4.1.3 Health and Safety Plan

As described in Section 3.4.3, the existing HSP will be amended as necessary to address health and safety concerns specific to the new field procedures proposed in this Work Plan. Health and safety meetings will be conducted in the field at the start of the project and at the beginning of each day of fieldwork. All fieldwork will be monitored according to the HSP to ensure that appropriate health and safety procedures are followed. A copy of the HSP will be kept on site during scheduled field activities.

LFR and LFR's subcontractors also will go through the on-site health and safety training conducted by facility personnel as required by Hanson.

4.2 Proposed Soil Borings for Lateral and Vertical Characterization

4.2.1 Proposed Locations and Target Depths

The proposed soil boring locations were selected to further characterize the lateral and vertical extent of petroleum hydrocarbons in the former diesel spray area (Figure 3).

As described further below, drilling and field screening methods chosen will, where possible, provide real-time preliminary results that will be evaluated to select successive sample locations in a step-out fashion. As such, the total number of soil boring locations and depths cannot be precisely specified in this Work Plan, but instead will be determined based on field conditions and preliminary analytical results. A total of approximately 12 temporary soil borings are proposed to better characterize the lateral and vertical extent of petroleum hydrocarbon contamination in the subsurface beneath the former diesel spray area.

For the lateral characterization, LFR proposes to advance at least six shallow soil borings to approximately 30 feet bgs, located approximately 100 feet to the northwest, north, northeast, east, southeast, and south of the former diesel spray area, as shown on Figure 3. The shallow soil borings may be advanced deeper if field conditions allow it and if preliminary results indicate the need for deeper soil borings. Based on preliminary field results, an additional four to six temporary soil borings are proposed to be advanced in step-out (or step-in) locations, depending on field conditions.

To characterize the vertical extent of contamination, LFR proposes to advance two deep soil borings to approximately 60 feet bgs located approximately 50 feet to the west and to the east of the former diesel spray area. The initial and step-out proposed soil boring locations are shown on Figure 3.

Based on LFR's knowledge of the subsurface, target depths will be controlled largely by subsurface conditions and limitation of the drilling methods. As discussed in the following section, LFR proposes to use two different drilling methods to offer greater flexibility while drilling through the predominantly coarse gravel, unconsolidated sediments.

4.2.2 Soil Boring Advancement and Grab Groundwater Sampling

The proposed soil and grab groundwater investigation will involve the simultaneous collection of MIP data and electrical conductivity (EC) or CPT data. These drilling technologies allow for the real-time collection of lithologic data as well as indicators for hydrocarbon-affected sediments. For boring locations where target depths cannot be achieved using direct-push drilling, a sonic drill rig will be implemented to achieve the target depths. LFR will contract with California-licensed drilling subcontractors to advance the proposed MIP/CPT and sonic temporary soil borings to target depths ranging from approximately 30 to 60 feet bgs, depending upon their purpose, location, and achievable depths.

Grab groundwater samples will be analyzed by C&T for concentrations of TPHd, TPHg, BTEX compounds, and MtBE (Table 2).

4.2.2.1 MIP Technology and Grab Groundwater Sampling

The MIP/CPT investigation proposed for lateral characterization will involve the simultaneous collection of both lithologic identification (CPT) and indicator of petroleum hydrocarbon concentration by gas chromatograph detector (MIP). The proposed soil borings will be advanced using a 30-ton direct-push (CPT-type) drill rig with an MIP probe attached to a standard string of 1.25- or 1.5-inch steel drill rods and a direct-push probing unit. The tubing that houses the carrier gas and conductivity cable is connected to the MIP tool and is strung through the probe rod. The drill rods are then loaded on a rod cart or fixed tool rack for easy dispensing and storage. As the probe is driven to depth, the advancement is stopped at desired intervals (typically 6 inches) to heat the permeable membrane interface on the wall of the probe and gather volatile organic compound (VOC) data. Conductivity logging data are gathered on a continuous basis. VOCs that are exposed to the membrane are volatilized and picked up by the carrier gas behind the membrane, which in turn delivers the gas to the gas chromatograph detector at the surface (typically an electron capture detector [ECD], photoionization detector [PID], and/or flame ionization detector [FID]). A stringpot, which is mounted on the probe, senses movement of the probe and measures depth and speed. The data are stored in spreadsheet-compatible format for later graphing and analysis.

Based on a preliminary evaluation of the MIP data, a Hydropunch sampler will be advanced in a new soil boring located adjacent to the MIP boring, to collect depth-discrete grab groundwater samples at target depths. The groundwater samples will be collected using a hydraulically driven temporary piezometer consisting of a hollow-rod assembly with a 3-foot-long stainless steel screen attached at the leading end of the assembly (Hydropunch). The temporary piezometer will be advanced to the desired depth interval based upon the CPT-derived lithology and the MIP's PID results. At the selected depths, the rod assembly will then be retracted to raise the outer piezometer sleeve, exposing the screen and allowing groundwater to pass through the screen into the piezometer. Grab groundwater samples will be collected using a disposable or clean stainless steel bailer lowered through the hollow-push rods into the piezometer screen. The groundwater will be transferred into clean laboratory-provided sample containers, stored in an ice-chilled cooler, and transported under chain-of-custody protocol to the laboratory for analysis.

The proposed target depth for the shallow borings is approximately 30 feet bgs, although the total depth may change depending upon preliminary results and achievable depths.

4.2.2.2 Sonic Drilling Technology and Grab Groundwater Sampling

For soil boring locations where target depths cannot be attained using direct-push drilling with the MIP, a sonic drill rig will be used to achieve the target depths. Depth-discrete grab groundwater samples will be collected at a minimum from the bottom of each soil boring and, if field conditions permit, at one to two shallower depths during drilling.

A sonic drill rig uses high-frequency, resonant energy to advance a core barrel or casing into subsurface formations. The drill rig uses a combination of the mechanically generated vibrations and limited rotary power to penetrate the soil. Resonance occurs when the frequency of the vibrations equals the natural frequency of the drill pipe. The frequency of vibration (generally between 50 and 120 cycles per second) of the drill bit or core barrel can be varied to attain maximum drilling productivity. The sonic drilling technique has proven an effective technology to advance to depths deeper than approximately 45 feet through the coarse-grained, unsaturated sediments encountered at the Site.

A dual-string assembly allows advancement of a continuous soil sampler casing within the outer casing drill pipe. Small amounts of air and water can be used to remove the material between the inner and outer casing. When a drill bit is used, most of the cuttings are forced into the borehole wall, reducing the amount of cuttings requiring disposal. The outer casing also serves as a conductor to minimize cross contamination and to hold the borehole open for the collection of grab groundwater sampling.

Continuous soil cores will be collected, field screened using a PID or similar, and logged. Grab groundwater samples will be collected from target depths using a disposable, clean stainless steel bailer lowered through the hollow-push rods into the piezometer screen. The groundwater will be transferred into clean, laboratory-provided bottles, stored in an ice-chilled cooler, and transported under chain-of-custody protocol to the laboratory for analysis.

4.2.3 Lithologic Logging Procedures

The MIP probe will be equipped with a CPT and/or an EC detector to collect data while drilling, from which lithology will be inferred. Continuous MIP and CPT/EC measurements will be made at each of the shallow soil boring locations for lateral characterization.

Conventional visual lithologic logging will be conducted of the continuous cores collected from the two deep soil boring locations advanced using sonic drilling techniques. An LFR field geologist will classify the soil samples using American Society for Testing and Materials (ASTM) D 2488-93, which is based on the Unified Soil Classification System. Lithologic descriptions will be recorded on field boring logs that will be reviewed, edited, and signed by a California Professional Geologist.

After field screening, soil logging, and grab groundwater samples are collected, as appropriate, soil borings will be abandoned by filling the borings from the bottom to ground surface with neat cement grout.

4.3 Equipment Decontamination Procedures

Drilling and sampling equipment will be properly decontaminated before each use and between each location. Down-hole drilling equipment, including drill rods and bits, will be decontaminated by steam cleaning at a designated wash pad or within a portable containment unit. Soil sampling equipment and down well development equipment will be decontaminated by washing in nonphosphate detergent solution, deionized water rinse, and final deionized water rinse before each use. Groundwater samples will be collected using either dedicated or single-use, disposable sampling devices such as bailers or tubing.

4.4 Waste Characterization, Handling, and Disposal

As described in Section 3.10, IDW generated during the field activities, including soil cutting, decontamination or rinse water, and PPE, will be stored temporarily at the Site in clean, labeled, DOT-approved 55-gallon drums or similar, until waste disposal is arranged.

4.5 Field Documentation

As described in Section 3.11, all relevant field activities will be appropriately documented using field forms, including field logs of soil borings, well development forms, groundwater sampling forms, sample labels, chain-of-custody forms, and waste management and hazardous waste labels. Field forms will be kept on file at LFR and will be available upon request. Copies of relevant field forms will be included in the summary report.

5.0 ADDITIONAL INFORMATION REQUESTED BY ACEH

5.1 Soil Boring Logs for B-1 and B-2

Temporary soil borings B-1 and B-2 were advanced as part of the additional vertical characterization activities completed at the Site during February and March 2007. These two soil borings were drilled using sonic drilling technology to reach the target depths of 60 and 65 feet bgs, deeper than was possible using HSA or direct-push methods. Grab groundwater samples were collected at the target depths for laboratory analyses. A description of the drilling and a summary of analytical results was presented in the Site Assessment Report. Due to an oversight by LFR, the soil boring logs for these two locations were not included in the appendix of the Site Assessment Report. At the request of ACEH, copies of the soil boring logs for former soil borings B-1 and B-2 are included in Appendix A of this Work Plan.

5.2 Surface Depressions at the Site

ACEH requested that additional detail about the surface depressions previously identified at the Site be provided in this Work Plan. In particular, ACEH requested that it be confirmed whether the surface features have an impermeable lining and whether water may be discharged to the subsurface from these features. The location and purpose of these surface features were discussed in the Site Assessment Report, and a figure showing their location and how they are connected was presented in Appendix E of that report. According to Hanson, these depressions are connected by a gravity line, allowing water to flow from the depression located north of the Site to the two depressions located approximately at the northeastern and southeastern corners of the Site. The water then is pumped via a pressure line up to Reclaim Pond #1.

According to Hanson, the construction of the surface depressions, and whether they are lined with concrete or other material, is unknown. Additional investigation will be conducted by Hanson to determine the state and construction of these surface depressions. The additional investigation may include probing the bottom and sides of the depressions and identifying the nature and condition of the openings leading into and out of the depressions and of the piping joining the surface depressions and routing surface water to Reclaim Pond #1. These investigations have not been completed.

The results of the surface depression inspections conducted by Hanson will be reported in the summary report to be submitted to ACEH with the results of the proposed pilot test and the former diesel spray area subsurface investigation.

6.0 PREPARATION OF SUMMARY REPORT

LFR will prepare a summary report for submittal to ACEH, presenting the results of the pilot test and the additional characterization investigation conducted at the former diesel spray area. The report will include site background and environmental setting information, a description of the pilot test design, implementation, and monitoring, and field procedures for the subsurface investigation. All analytical results will be presented and discussed. The report also will include soil boring logs, construction details of the new injection wells and soil-gas sample points, and copies of drilling permits, field sheets, and certified analytical laboratory reports.

The results of the investigation will be used to refine the existing SCM, as necessary, potentially to address the petroleum hydrocarbon detected in the former diesel spray area. The report will include an evaluation of the results of the pilot test and determine whether the selected groundwater remediation alternative of injecting oxygen (air, pure oxygen, or ozone) is an appropriate alternate for this Site. Based on the results of the pilot test evaluation, a full-scale remediation plan may be proposed for the Site.

The report will be uploaded to the GeoTracker system and ACEH file transfer protocol (FTP) site in accordance with Regional Water Quality Control Board and ACEH requirements.

7.0 REFERENCES

Alameda County Environmental Health (ACEH). 2005. Letter to Mr. W.M. Calvert, Mission Valley Rock Company from Jerry Wickham, re: Fuel Leak Case No. RO0000207, Mission Valley Rock and Asphalt, 7999 Athenour Way, Sunol, California. November 3.

———. 2006a. Letter to Mr. W.M. Calvert of Mission Valley Rock Company from Jerry Wickham, re: Fuel Leak Case No. RO0000207, Mission Valley Rock and Asphalt, 7999 Athenour Way, Sunol, California – Work Plan Approval. February 3.

———. 2006b. Letter to Mr. Steven Zacks of Hanson Aggregates Mid-Pacific, Inc., and to Mr. W.M. Calvert of Mission Valley Rock Company from Jerry Wickham, re: Fuel Leak Case No. RO0000207, Mission Valley Rock and Asphalt, 7999 Athenour Way, Sunol, California. August 3.

———. 2007. Letter to Mr. Lee Cover of Hanson Aggregates West Region from Jerry Wickham, re: Fuel Leak Case No. RO0000207 and GeoTracker Global ID T0600102092, Mission Valley Rock and Asphalt, 7999 Athenour Way, Sunol, California, 94586. April 27.

LFR Inc. (LFR). 2006a. Work Plan for Additional Investigation at the Asphalt Plant, Hanson Aggregates Mission Valley Rock Facility, 7999 Athenour Way, Sunol, Alameda County, California. January 17.

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Tait Environmental Management, Inc. (Tait). 2003. Site Assessment and Fourth Quarter 2002 Groundwater Monitoring Report, Mission Valley Rock Company, 7999 Athenour Way, Sunol, California. March 23.

———. 2005. Site Assessment and First Quarter 2005 Groundwater Monitoring and Sampling Report, Mission Valley Rock Company, 7999 Athenour Way, Sunol, California. April 1.

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Tank Protect Engineering (TPE). 1996. Tank Closure Report, Mission Valley Rock. August 12.

———. 1998. Preliminary Site Assessment Report, Mission Valley Rock, 7999 Athenour Way, Sunol, California. October 30.

United States Environmental Protection Agency. 2004. Technologies for Treating MTBE and Other Fuel Oxygenates. May.

Table 1
Pilot Study Sample Matrix
Mission Valley Rock and Asphalt
7999 Athenour Way, Sunol, California

Groundwater Monitoring Wells	Matrix	Analyses [1]: TPHd, TPHg, BTEX, MTBE, BOD, COD, nitrate/nitrite, total Kjeldahl nitrogen, orthophosphate				
		(Sampling Intervals) [2]				
		Baseline	**2 weeks**	**6 weeks**	**10 weeks**	**14 weeks**
MW-1	water	X	X	X (if response)	X (if response)	X
MW-7S	water	X	X	X (if response)	X (if response)	X
MW-7D	water	X	X	X (if response)	X (if response)	X
MW-8	water	X	X	X (if response)	X (if response)	X
MW-9S	water	X [3]	X	X	X	X [3]
MW-9D	water	X [3]	X	X	X	X [3]
MW-9LF	water	X [3]	X	X	X	X [3]

Soil Gas Sample Points	Matrix	Analyses [4]: TPHd, TPHg, BTEX, MTBE				
		(Sampling Intervals) [2]				
		Baseline	**2 weeks**	**6 weeks**	**10 weeks**	**14 weeks**
SG-1	soil gas	X	X	X	X	X
SG-2	soil gas	X	X	X	X	X
SG-3	soil gas	X	X	X	X	X

Notes:

(1) Periodic analyses for groundwater samples:
TPHd = total petroleum hydrocarbons as diesel by EPA Method 8015
TPHg = total petroleum hydrocarbons as gasoline by EPA Method 8260B
BTEX = benzene, toluene, ethylbenzene, and total xylenes by EPA Method 8260B
MTBE = methyl tertiary-butyl ether by EPA Method 8260B
BOC = biological oxygen demand by EPA Method 5210B
COC = chemical oxygen demand by EPA Method 410.1
nitrate and nitrite by EPA Method 354.1
total Kjeldahl nitrogen by EPA Method 4500
orthophosphate by EPA Method 365.3

(2) Sampling Intervals:
Baseline = before air injection system start-up
2 weeks, 6 weeks, 10 weeks, and 14 weeks = 2, 6, 10, and 14 weeks after system start-up

(3) Groundwater samples collected from well cluster MW-9 before and after the pilot test also will be analyzed for microbial population heterotrophic and specific-degrader plate counts using EPA Standard Method 9215-A.

(4) Periodic analyses for soil-gas samples:
TPHd , TPHg, BTEX, and MTBE by EPA Method TO-17

Table 2
Former Diesel Spray Area Grab Groundwater Sample Matrix
Mission Valley Rock and Asphalt
7999 Athenour Way, Sunol, California

Proposed Sample Location	Matrix	TPH as Diesel	TPH as Gasoline	BTEX	MTBE
Lateral Characterization Investigation					
Locations are approximately 100 to 200 feet from the former diesel spray area					
Borings to approximately 30 feet bgs	water	X	X	X	X
Vertical Characterization Investigation					
Locations are approximately adjacent to the former diesel spray area					
Borings to approximately 60 feet bgs	water	X	X	X	X

Notes:

TPH = total petroleum hydrocarbons
BTEX = benzene, toluene, ethylbenzene, and total xylenes
MTBE = methyl tertiary-butyl ether
bgs = below ground surface

Site Location Map

Hanson Aggregates, 7999 Athenour Way, Sunol, CA

LFR

Figure 1

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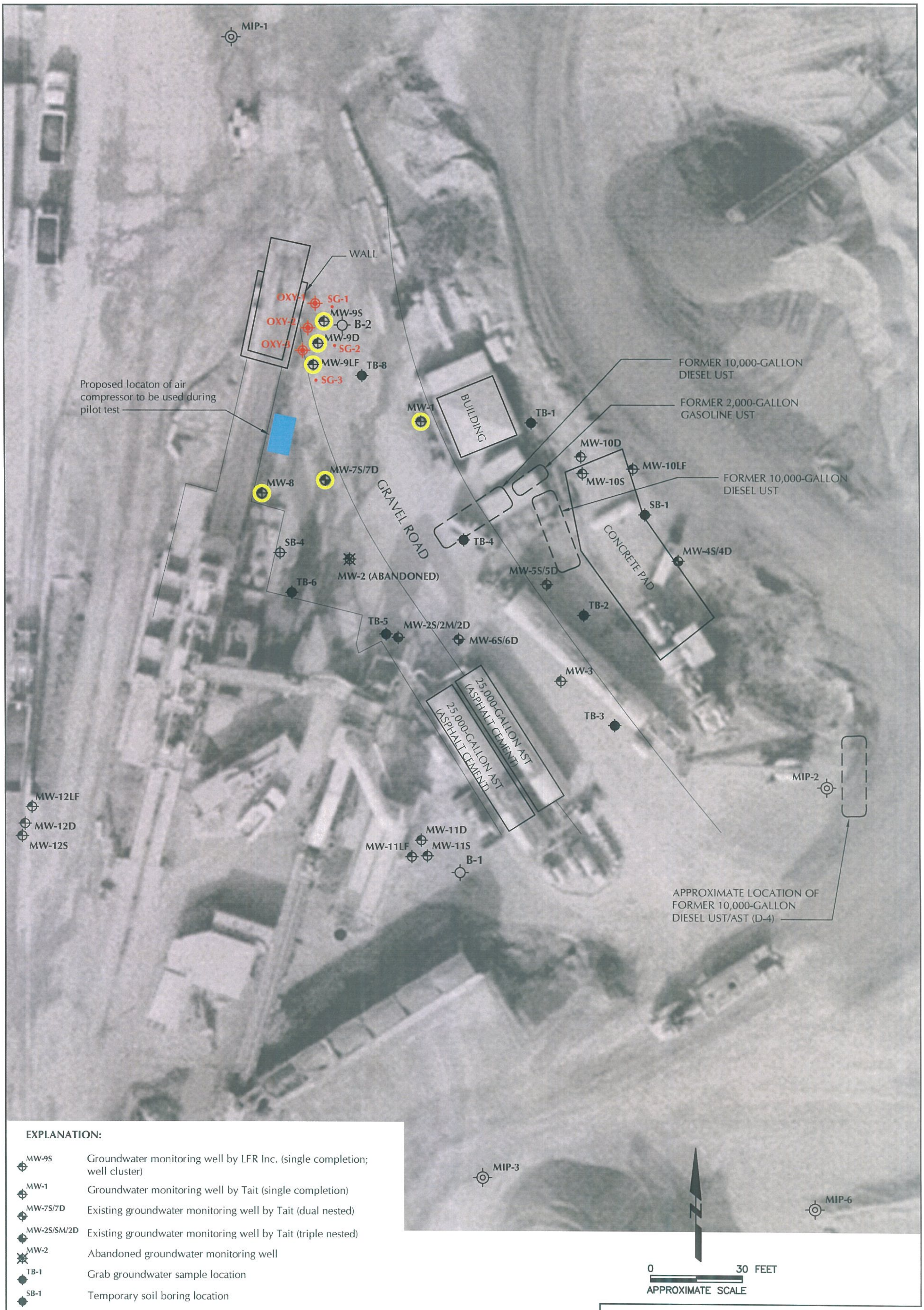

EXPLANATION:

MW-9S	Groundwater monitoring well by LFR Inc. (single completion; well cluster)
MW-1	Groundwater monitoring well by Tait (single completion)
MW-7S/7D	Existing groundwater monitoring well by Tait (dual nested)
MW-2S/SM/2D	Existing groundwater monitoring well by Tait (triple nested)
MW-2	Abandoned groundwater monitoring well
TB-1	Grab groundwater sample location
SB-1	Temporary soil boring location
B-2	Sonic boring / grab groundwater
MIP 3	MIP boring / grab groundwater
OXY-1	Proposed pilot test air injection well
SG-1	Proposed soil gas sample point
MW-9S	Groundwater monitoring well by LFR Inc. Proposed to be used for groundwater monitoring during pilot test.

AST = Aboveground storage tank
UST = Underground storage tank
MIP = Membrane Interface Probe

Proposed Air Injection Pilot Test Wells and Sample Locations

Hanson Aggregates, Sunol, California

LFR

Figure 2

I:\Design\001\09480\02\000\DWG\Air Injection Pilot Test Wells.dwg Aug 03,2007-4:17pm

EXPLANATION:

MW-9	Groundwater monitoring well (Single completion; nested and well cluster)
MIP-3	MIP boring / grab groundwater
B-1	Sonic boring / grab groundwater
MIP-1	Proposed MIP boring location / grab groundwater
◉	Proposed step-out boring / grab groundwater
B-4	Proposed sonic boring / grab groundwater

Proposed Soil Boring Locations in the Former Diesel Spray Area

Hanson Aggregates, Sunol, California

LFR

Figure 3

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APPENDIX A

Soil Boring Logs for B-1 and B-2

Lithology and Sample Data

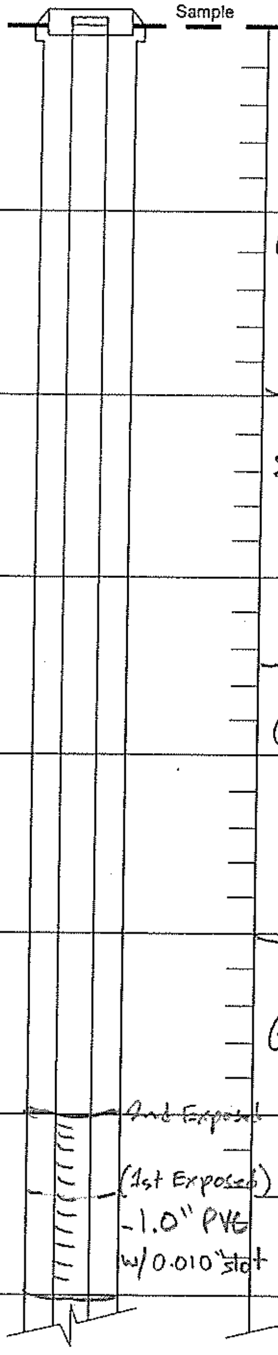
Project Number: 001-09480-02

Project Name: Hanson, Sunol

Page 1 **of** 1

Date: 3/1/07 start=11:00 stop=3:00

WELL CONSTRUCTION — LITHOLOGY — SAMPLE DATA



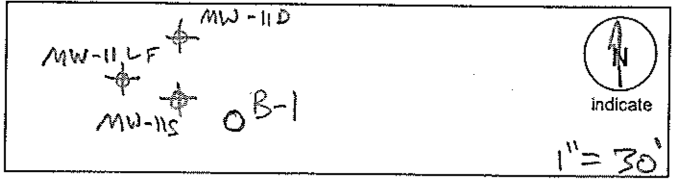
Depth, feet	Time of Sample	Graphic Log	Description	Sample Number	Interval	Penetration Rate (blows/ft.)	PID/FID (ppm)
Ø			*Interval from Ø to 35' bgs was not logged because of boring log information from MW-11 LF -See MW-11 LF for Lithologic description.		(*) Slight odors from 10-20' bgs.		
35'		GM	>Silty Gravel (7.5 YR 3/0) F-Crs Subrounded Gravel, Med. subR. sand, silt, wet. (75,15,10,0)				0.6ppmv
40'			@ 40' = (5,80,15,0)		100% (Recovery)		1.0ppmv
		SM	@ 42' = SAND (7.5 YR 3/0) F-Crs Subrounded Gravel, Med subrounded sand, silt, firm moist (15,60,25,0)				
45'					100%		1.0ppmv
		GM	(Approx.) @ 47.5' = SAND w/ Gravel (7.5 YR 3/0) F-Crs Subangular River Rock gravel, F-Med subA. sand, silt, v. soft. (40,10,50,0)		0%		
50'							
55'					50%		0.2ppmv
		GM	@ 55' = Gravel (7.5 YR 3/0) F-Crs SubA. gravel F subA. sand, silt, firm, most. (50,15,35,0)				
60'			@ 60' = (50,10,40,0)		75%		0.2ppmv
		ML	@ 62' = Gravelly Silt (7.5 YR 3/0) F-Crs SubA. gravel F. SubA. sand, silt, hard, dry. (20,10,70,0) (*) Matrix seemed cemented B-1 (60-65) @ 1400 —> GW Sample epervesent				
65'					75%		0.0ppmv

TD=67.0'

Boring/Well No.: B-1
Date drilled: 3/1/07
Drilling company: RSI
LFR Staff: NJ

Drilling method: Sonic
Sampling Method: Grab
Hammer weight and size: NA

Boring/Well Location Schematic



Reviewed by:______ **Signed:**______ **Date:**______

Lithology and Sample Data

LFR

Project Number: 001-09480-02

Project Name: Hanson Sunol

Page 1 of 1

Date: 3/2/07

Strt 0815

Stop 0930

WELL CONSTRUCTION — LITHOLOGY — SAMPLE DATA

Sht 0815

Depth, feet	Time of Sample	Graphic Log	Description	Sample Number	Interval	Penetration Rate (blows/ft.)	PID/FID (ppm)
0			Interval 0'→35' bgs not logged b/c have boring log information from well MW-9LF				
35			—Poor Recovery —Sluff —Very Saturated, gravel & fine coarse Sand		20%		
40		ML	Very dark bluish gray (Gley 2 3/1) Fine subrounded gravel, Fine Subangular-subrounded Sand, Clay moist, med. firm (25, 15, 10, 50) increasing Sand w/ depth		100%		PID=12.9
45		GM	Very dark bluish gray (Gley 2 3/1), wet fine subrounded gravel, trace very dark bluish gray coarse gravel, Fine - Coarse Sand subrounded-subangular, increasing (65, 20, 15, 0) silt content increase w/depth		100%		PID=0.9 PID=0.5
50		GM	Gley 2 4/1 (Dark bluish gray) wet, med. firm fine-coarse gravel, max dia. size 5 cm fine-coarse sand (45, 20, 35, 0)		80%		PID=1.1
		GM	(45, 40, 15, 0) increase of Sand, very soft "Soupy", silt decreased from above				
55			Notes: 55'-60' ~~Hydropunched~~ drilled but not logged TD=60', Sample No. B-2 (55-60) @0945 Using 0.75" plastic/disposable bailer				
60							
65		~~Stop 0945~~					

Boring/Well No.: B-2

Drilling method: Sonic

Date drilled: 3/2/07

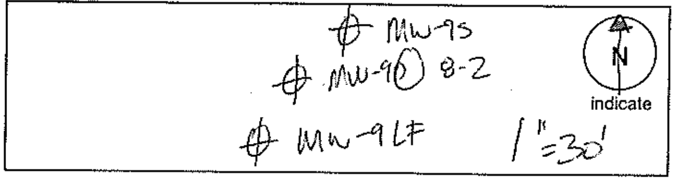
Sampling Method: Sonic Sampling

Drilling company: RSI

Hammer weight and size: n/a

LFR Staff: James Gonzalez

Boring/Well Location Schematic



Reviewed by:

Signed:

Date:

Key: (25, 15, 10, 50) = 25% gravel, 15% sand, 10% silt, 50% clay