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BIOVENTING SYSTEM INSTALLATION AND STARTUP REPORT

REDWOOD REGIONAL PARK
SERVICE YARD
OAKLAND, CALIFORNIA

Prepared for:

EAST BAY REGIONAL PARK DISTRICT
OAKLAND, CALIFORNIA

February 2006

STELLAR
ENVIRONMENTAL SOLUTIONS, INC.
GEOSCIENCE & ENGINEERING CONSULTING

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February 21, 2006

Mr. Jerry Wickham, P.G.
Hazardous Materials Specialist
Alameda County Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Subject: Bioventing Installation and Startup Report
Redwood Regional Park Service Yard Site – Oakland, California

Dear Mr. Wickham:

This report discusses the installation and startup of a bioventing corrective action system at the Redwood Regional Park Service Yard, located at 7867 Redwood Road, Oakland, California. This project is being conducted for the East Bay Regional Park District, and follows previous site investigation and remediation activities (conducted since 1993). The key regulatory agencies for this investigation are the Alameda County Department of Environmental Health, the Regional Water Quality Control Board, and the California Department of Fish and Game. I declare, under penalty of perjury, that the information and/or recommendations contained in the attached document or report is true and correct to the best of my knowledge.

If you have any questions regarding this report, please contact Mr. Neal Fujita of the East Bay Regional Park District, or contact us directly at (510) 644-3123.

Sincerely,

Bruce M. Rucker, R.G., R.E.A.
Project Manager

Richard S. Makdisi, R.G., R.E.A.
Principal Geochemist

cc: Carl Wilcox (California Department of Fish and Game); Cherie McCalou (Regional Water Quality Control Board); Neal Fujita (East Bay Regional Park District)

BIOVENTING SYSTEM INSTALLATION AND STARTUP REPORT

REDWOOD REGIONAL PARK
SERVICE YARD
OAKLAND, CALIFORNIA

Prepared for:

EAST BAY REGIONAL PARK DISTRICT
P.O. BOX 5381
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February 21, 2006

Project No. 2005-66

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1.0 PROJECT DESCRIPTION AND SITE HISTORY

PROJECT DESCRIPTION

The subject property is the East Bay Regional Park District (EBRPD) Redwood Regional Park Service Yard, located at 7867 Redwood Road in Oakland, Alameda County, California. The site has undergone site investigations and remediation since 1993 to address subsurface contamination caused by leakage from one or both of two former underground fuel storage tanks (UFSTs) that contained gasoline and diesel fuel. The Alameda County Health Care Services Agency, Department of Environmental Health (Alameda County Health) has provided regulatory oversight of the investigation since its inception. Other regulatory agencies with historical involvement in site review include the Regional Water Quality Control Board – San Francisco Bay Region (Water Board) and the California Department of Fish and Game (CDFG).

This report documents the installation and startup of a soil bioventing system at the site. Bioventing was selected as an appropriate corrective action to mitigate residual petroleum contamination, based on site conditions, residual contaminant distribution, and results from a previously conducted bioventing pilot test in 2004. The bioventing system installation and startup activities were conducted in December 2005 and January 2006, and consisted of: installing two additional vent wells (VW) and one additional vapor monitoring point (VMP); installing a bioventing blower; installing air distribution piping to convey air from the blower to the vent wells; conducting baseline soil vapor sampling from unsaturated bioventing well screens; and a 1-month period of air flow optimization. These activities are described in detail in Sections 2.0 through 4.0.

This work follows a bioventing pilot test conducted in 2004. The pilot test consisted of: installing one VW and three VMPs; conducting an in situ respiration (ISR) test; and evaluating soil air permeability and the likely radius of influence for a full-scale bioventing system (SES, 2004b). The evaluation report recommended the installation of operation of a full-scale bioventing system, which was approved by Alameda County Health (Alameda County Health, 2005b).

SITE DESCRIPTION

Figure 1 shows the location of the project site. A site plan showing the full-scale bioventing system is presented on Figure 2.

The site slopes to the west, from an elevation of approximately 564 feet above mean sea level (amsl) at the eastern edge of the service yard to approximately 545 feet amsl at Redwood Creek, which defines the approximate western edge of the project site with regard to this investigation. From east to west, the study area consists of:

- Flat, paved EBRPD service yard with several permanent and temporary buildings/sheds (former UFST excavation area);
- Steep slope (approximately 45 degrees) between the western edge of the service yard and the park entrance road (immediately west of MW-2);
- Hummocky terrain with low vegetation (between MW-8 and MW-11), including a large EBRPD-designated sycamore tree (adjacent to MW-8 and VMP-2);
- Flat, unpaved parking lot (between MW-11 and MW-7); and
- Steep slope (approximately 45 degrees) to Redwood Creek (immediately west of MW-12, MW-7, and MW-9).

SITE HISTORY AND CONTAMINATION

Contaminant corrective actions and investigations have been conducted at the site since 1993. General phases of work previously included:

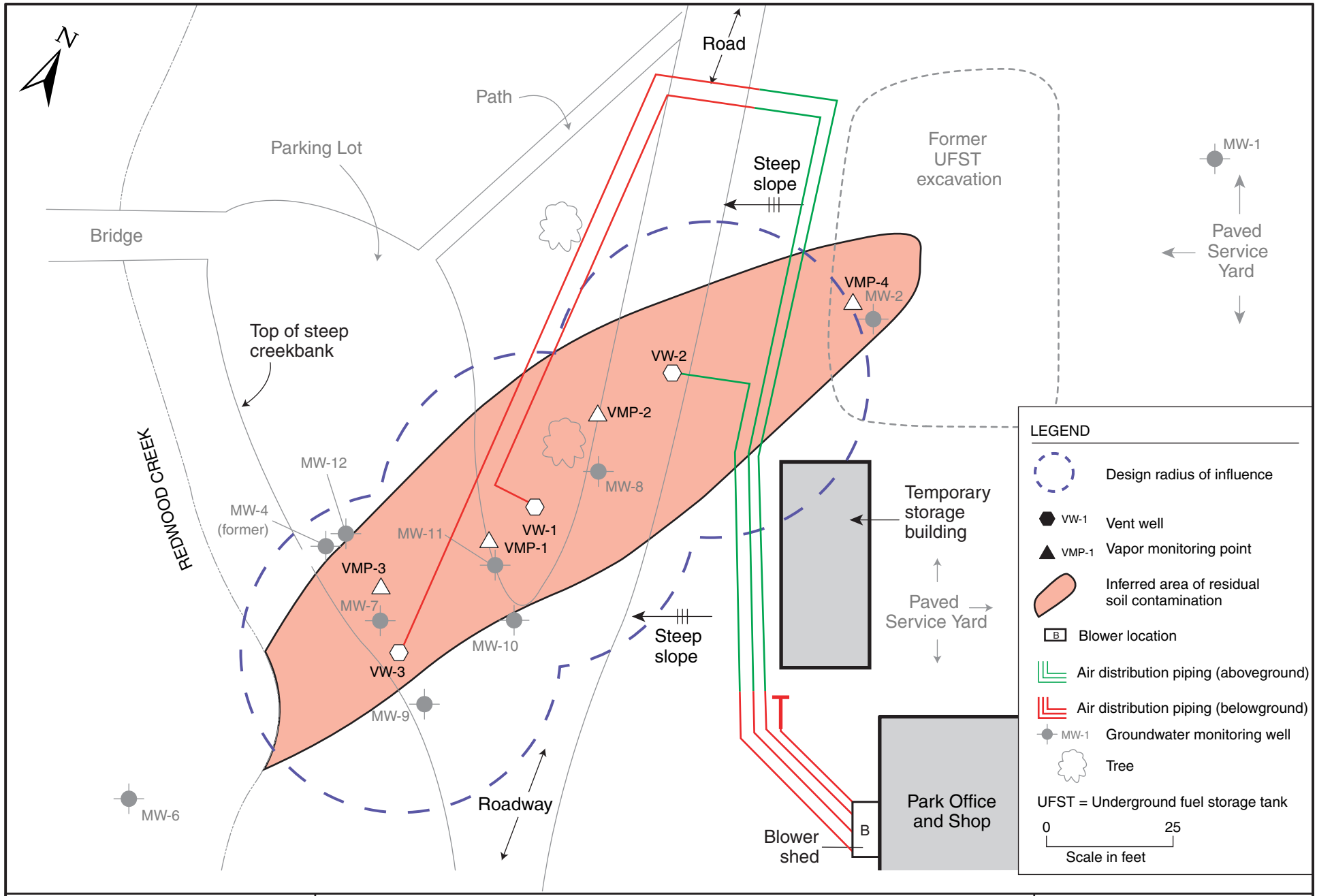
- Removal of UFSTs and contaminated soil;
- Installation and quarterly monitoring of groundwater monitoring wells;
- Several phases of remedial investigation-oriented exploratory borehole drilling and sampling;
- A correction action feasibility study;
- Two phases of ORC™ injection; and
- An evaluation of bioventing feasibility as a corrective action, which included a bioventing pilot test.

N

SITE LOCATION ON U.S.G.S. TOPOGRAPHIC MAP

Redwood Reg. Park Service Yard Oakland, CA	By: MJC	APRIL 2004	★ Stellar Environmental Solutions, Inc. Geoscience & Engineering Consulting
	Figure 1		

2004-02-01



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FULL-SCALE BIOVENTING SYSTEM

7867 Redwood Rd, Oakland, CA

Figure 2

by: MJC | DECEMBER 2005

2005-66--08

As discussed in detail in previous SES reports, the available data support the following conclusions:

- The saturated zone overlies laterally-extensive bedrock, which limits downward migration of groundwater contamination.
- The unsaturated zone varies in thickness due to seasonal water level fluctuations of several feet.
- Site chemicals of concern include total petroleum hydrocarbons (TPH)—specifically as gasoline (TPHg) and diesel (TPHd); benzene, toluene, ethylbenzene, and xylenes (BTEX); and methyl *tertiary*-butyl ether (MTBE).
- Residual soil contaminant mass in the unsaturated zone is acting as a long-term source of groundwater contamination; the maximum thickness of the residual soil contamination (during lowest water level periods) is approximately 10 feet.
- Previous ORC™ injection programs resulted in apparent permanent reductions at the peripheral plume margins, but was followed by rebound to pre-injection conditions within the central portions of the plume, corroborating the conceptual model that remaining unsaturated zone soil contamination is continuing to impact groundwater.
- Site conditions appear favorable for bioventing as a corrective action to reduce unsaturated zone soil contamination, especially in the near-source area that is inaccessible to other methods due to the hilly topography.

SITE GEOLOGY AND HYDROGEOLOGY

Previous reports by SES (SES, 2004a; SES, 2004b) have detailed site subsurface lithology through a series of constructed cross sections. Shallow soil stratigraphy consists of a surficial 3- to 10-foot-thick clayey silt unit underlain by a 5- to 15-foot-thick silty clay unit. In the majority of boreholes, a 5- to 10-foot-thick clayey coarse-grained sand and clayey gravel unit that laterally grades to a clay or silty clay was encountered. This unit overlies a weathered siltstone at the base of the observed soil profile. The top of this bedrock varies in elevation by several feet in the area of contamination, and likely is a fundamental control on local groundwater flow (on the order of several feet). The soils beneath Redwood Creek appear to be a thin clayey unit with large cobbles in the creek bed, underlain by sandy and gravelly soils to an unknown depth. Soils in the vicinity of MW-1 are inferred to be landslide debris (loose matrix of poorly-sorted material and steep groundwater gradient).

Groundwater at the site occurs under unconfined and semi-confined conditions, generally within the clayey, silty, sand-gravel zone. The top of this zone varies between approximately 12 and 19

feet below ground surface (bgs), and the bottom of the water-bearing zone (approximately 25 to 28 feet bgs) corresponds to the top of the siltstone bedrock unit. Seasonal fluctuations in groundwater depth create a capillary fringe of several feet that is saturated in the rainy period (late fall through early spring) and unsaturated during the remainder of the year. The thickness of the saturated zone plus the capillary fringe varies between approximately 10 and 15 feet in the area of contamination. Local perched water zones have been observed well above the top of the capillary fringe, generally in the rainy high-water conditions in the winter and spring. Water level data for the bioventing wells are presented in Section 4.0.

SITE CONCEPTUAL MODEL AND CONTAMINANT MASS ESTIMATE

A large mass of residual TPH contamination in the unsaturated zone overlies the contaminant plume, primarily in the area between the former UFSTs and the park entrance roadway, with the contaminated zone thinning toward Redwood Creek. Seasonal desorption of contamination in this unsaturated zone occurs during the rainy season and during high-water periods, acting as a long-term source of dissolved contamination. Previous ORC™ injection programs, which resulted in apparent permanent reductions at the peripheral plume margins, but were followed by rebound (to pre-injection conditions) within the central portions of the plume, indicate that site conditions support aerobic biodegradation; however, biodegradation is limited by oxygen deficiency in the unsaturated zone.

Based on this conceptual model—and using conservative assumptions for equilibrium partitioning, contaminant geometry, soil moisture, and previous laboratory analytical results for TPH in soil—estimates of TPH mass in soil were calculated (SES, 2004b). Residual TPH in vadose zone soil is estimated at 1,400 to 7,000 pounds (100 to 600 gallons of gasoline), compared to a mass of TPH in groundwater estimated at 1 to 10 pounds (0.1 to 1.0 gallon of gasoline).

REGULATORY STATUS AND DATA REPORTING

The lead regulatory agency for the site investigation and remediation is Alameda County Health, with oversight provided by the Water Board. The CDFG is also involved with regard to water quality impacts to Redwood Creek. The most recent regulatory agency input was Alameda County Health's approval to install and implement the full-scale bioventing system (Alameda County Health, 2005b).

Hard copies of all technical workplans and reports have been and will continue to be submitted to these agencies. In addition, since 2001, electronic data and reports have been uploaded by SES to the State Water Resources Control Board's "GeoTracker" online system. Bioventing-related GeoTracker uploads completed to date include:

- "Field Point IDs" – names of bioventing wells
- "GeoMap" – site plan showing bioventing wells and air distribution piping
- "GeoBore" – borehole geologic logs for bioventing wells
- "Geo Report" – electronic format of the Bioventing Pilot Test Results Report (SES, 2004f) and this report.
- Electronic Data Deliverable (EDD) – analytical laboratory report for the December 2005 soil vapor sampling event.

The site is also subject to Alameda County Environmental Health's separate file transfer protocol (ftp) electronic system, which also requires the uploading of site technical reports. Uploads to the ftp system have been made for both the Bioventing Pilot Test Results Report (SES, 2004b) and this current report, and Alameda County Health has been notified of the uploads via email.

2.0 BIOVENTING SYSTEM INSTALLATION

This section discusses the installation of the full-scale bioventing system, which includes: two additional VWs; one additional VMP; air distribution piping; and a blower. Photos of the bioventing system installation are included in Appendix A. Figure 2 shows the full-scale bioventing system site plan.

RATIONALE FOR WELL LOCATION AND CONSTRUCTION

Bioventing typically has an effective radius of influence between 10 and 50 feet, depending on soil type. As part of the October 2004 pilot test, a single vent well (VW-1) was installed in the central portion of the contaminated area, and three VMPs (VMP-1, VMP-2, and VMP-3) were installed at distances of approximately 10, 20, and 35 feet from the vent well to allow for an evaluation of the radius of influence due to air injection at VW-1. The pilot test data indicated a likely radius of influence of 30 feet.

Two additional VWs (VW-2 and VW-3) and one additional VMP (VMP-4) were installed in November/December 2005 to supplement the existing bioventing well network. As shown on Figure 2, the design radii of the three VWs encompass the entire area of residual unsaturated zone soil contamination. The VWs were screened from 6 to 16 feet bgs (VW-1) and 8 to 18 feet bgs (VW-2 and VW-3) to incorporate the full thickness of the residual soil contamination zone.

Two "nested" casings/screens were installed in each of the four VMP boreholes (total of eight VMP screens available for monitoring). The VMP screened intervals in each borehole correspond to the top of unsaturated zone soil contamination at each location, and at depths coincident with VW screened intervals, and provide two separate monitoring depths.

Table 1 summarizes bioventing VW and VMP construction data.

Table 1
Bioventing Well Construction Data
Redwood Regional Park Service Yard, Oakland, California

Well	Screen Interval Depth (feet)	Filter Pack Sand Depth Interval (feet)
VW-1	6-16	4-16
VW-2	8-18	6-18
VW-3	8-18	6-18
VMP-1	10-11.5	9.5-12
	14-15.5	13.5-16
VMP-2	10-11.5	9.5-12
	14-15.5	13.5-16
VMP-3	10-11.5	9.5-12
	12.5-14	12-14.5
VMP-4	15.5-17	15-17.5
	20.5-22	20-20.5

Note:

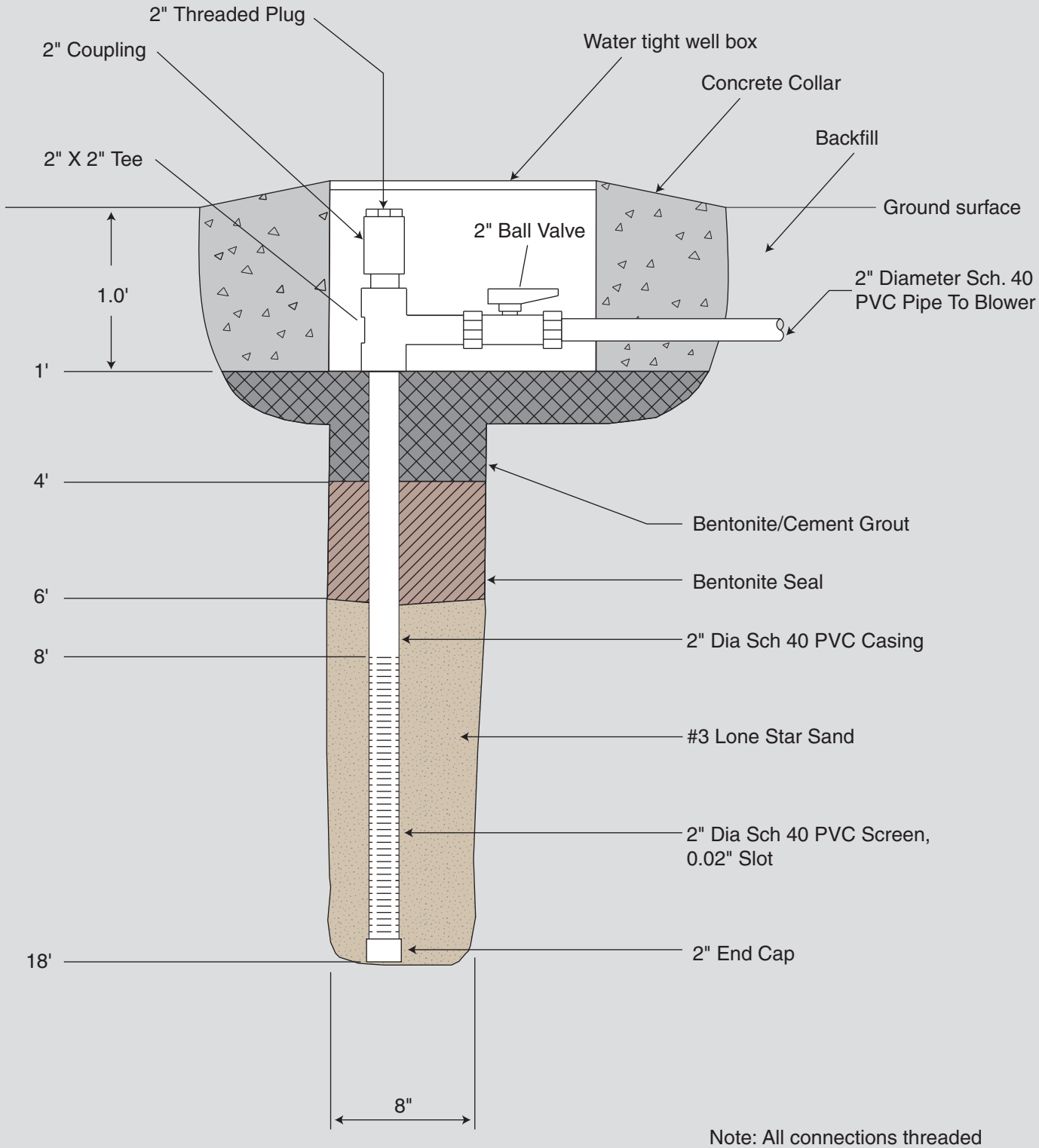
All depths are in feet below top of well box (approximately ground surface).

VENT WELL INSTALLATION ACTIVITIES

The wells were installed on November 28-30, 2005 by HEW Drilling (East Palo Alto, CA) under the direct supervision of Bruce Rucker, the SES California Registered Geologist. Prior to installation, well installation permits were obtained from Alameda County Public Works Agency (ACPWA). Well boreholes were drilled with 8-inch-diameter truck-mounted, hollow-stem augers. Appendix B contains copies of the well installation permits and geologic logs.

Figure 3 shows the as-built construction details for VW-2 and VW-3. The total depth of both boreholes was 18 feet bgs. Both VWs were constructed of 2.0-inch inner diameter (ID), Schedule 40 PVC casing, and screened from 8 to 18 feet bgs (0.020-inch slot size). Flush-threaded PVC casing and screen was used, with no organic solvents or glues. Annular filter pack material was placed across and 2 feet above the well screen.

The well specification called for 8x16 (“8 Mesh) filter pack sand; however, a field oversight resulted in using 8x20 (#3) sand, which is a slightly finer-grained sand. In our professional opinion, this variance should not result in a significant adverse impact to the operation of the



NOT TO SCALE
(well casing is actually centered in borehole)

Note: All connections threaded with gasket or teflon tape. No glues used.

AS-BUILT VENT WELL CONSTRUCTION DETAILS FOR VW-2 & VW-3

Redwood Regional Park **Oakland, CA**	**By: MJC**	**DECEMBER 2005**
	Figure 3	

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system because: 1) the grain size of the sand used is appropriate for (larger than) the well screen size (i.e., the sand grains will not enter the well through the screen); and 2) the small difference in grain size will not appreciably reduce effective porosity (for air transmission).

A 3-foot-thick layer of hydrated bentonite pellets was then placed above the filter pack, followed by a bentonite/cement grout annular pollution seal to surface. A metal well box was installed at the surface to protect the well, with cut openings in the east side (VW-2) and north side (VW-3) to accommodate air distribution piping.

VAPOR MONITORING POINT INSTALLATION ACTIVITIES

Figure 4 shows the as-built construction details for VMP-4. The total depth of the VMP-4 borehole was 22 feet bgs. Two isolated, nested screened intervals were installed in each VMP; each screened interval was constructed with a 1.5-foot-long, 1.0-inch ID Schedule 80 PVC slotted well screen (0.020-inch slot size). The upper screened interval was from 15.5 to 17.0 feet bgs. The lower screened interval was from 20.5 to 22.0 feet bgs. Riser casing (from top of screened interval to surface) was 0.5-inch ID Schedule 80 PVC.

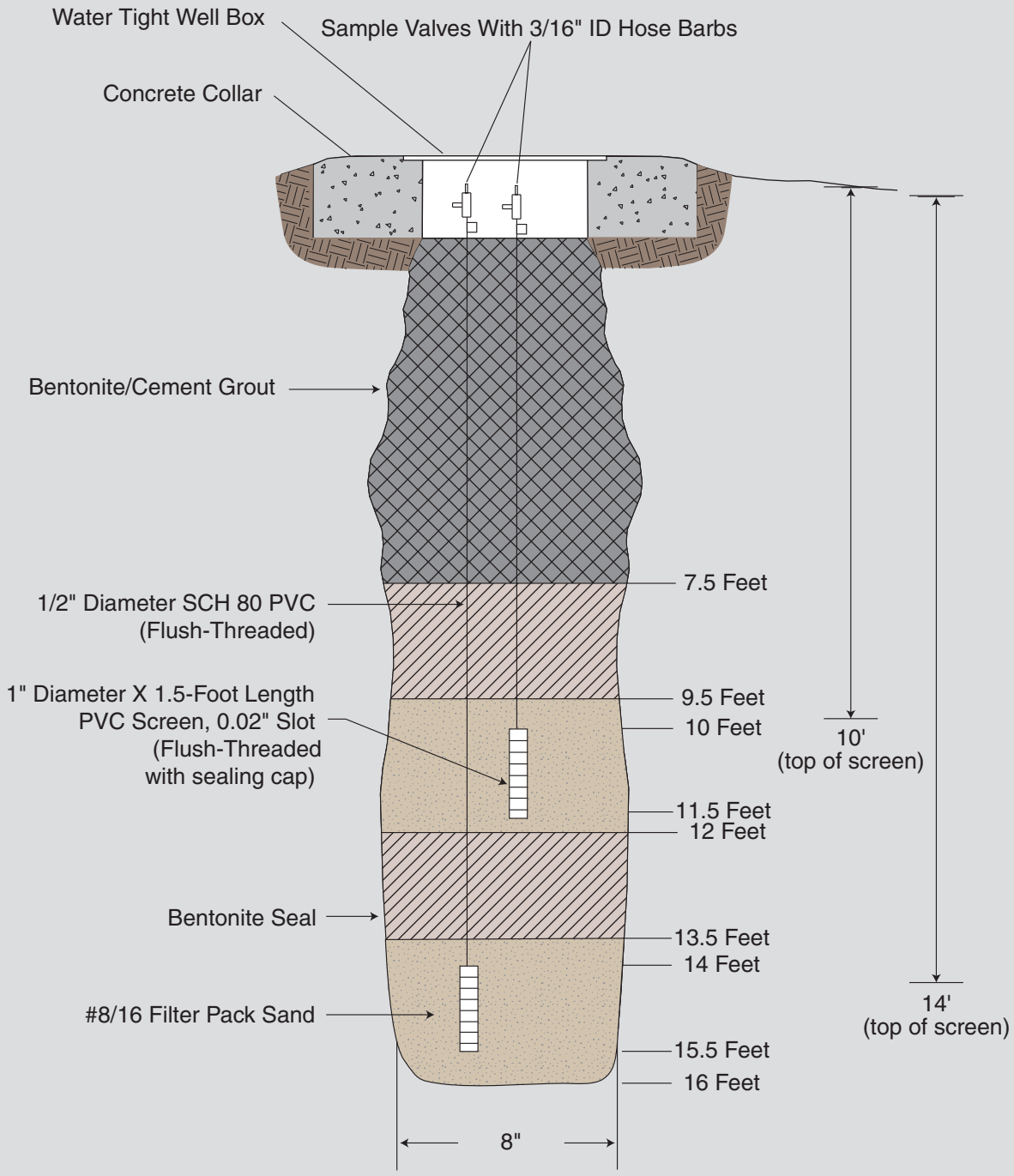
Annular filter pack (#8/16) sand was placed across and 0.5 feet above and below the well screen. A bentonite seal (2 to 3 feet thick) was placed between each filter pack to isolate the individual well screens/filter packs within the borehole. Above the shallowest filter pack, a cement grout annular pollution seal was installed to ground surface. The two nested casings are contained in the same traffic-rated, Christy-type well box. Individual air sampling valves were installed on each VMP casing at the ground surface for purging and sampling.

Each nested VMP screened interval was assigned a unique name, corresponding to the top of the 1.5-foot-long screened interval (e.g., VMP-4-15.5 refers to the screened interval between 15.5 and 17.0 feet in VMP-4).

In accordance with ACPWA requirements, SES submitted Well Completion Forms for the wells, including one form for each of the nested VMP-4 casings and one for each of VW-2 and VW-3. Copies of the Well Completion Forms are included in Appendix B.

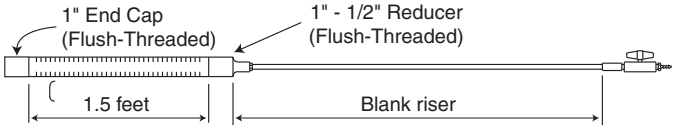
Waste Soil Disposal

Waste soil from drilling activities was placed in seven labeled, 55-gallon steel drums temporarily stored onsite with four drums of waste soil from the installation of the pilot test wells in September 2004. Following all drilling, a composite sample ("Soil Drum Comp.") from the



Not To Scale

Note: Depts shown are applicable to VMP-1 and VMP-2. Deptsh in VMP-3 and VMP-4 vary.



VMP SCREEN DETAIL
Not To Scale

AS-BUILT VAPOR MONITORING POINT CONSTRUCTION DETAILS

Redwood Regional Park **Oakland, CA**	**By: MJC**	**JUNE 2005**	STELLAR ENVIRONMENTAL SOLUTIONS, INC GEOSCIENCE & ENGINEERING CONSULTING
	Figure 4		

2005-66-10

drums was collected for laboratory analysis, to profile the soil for disposal. Appendix C contains the certified analytical laboratory report and chain-of-custody record for that sample. The analytical results demonstrated that the soil is non-hazardous, and amenable for disposal at a permitted Class III or II landfill. All 11 drums of waste soil were profiled and hauled offsite as non-hazardous waste on December 12, 2005 by Morgan Environmental (U.S. Environmental Protection Agency [EPA] ID No. CAT080013428) and disposed of at D/K Environmental in Vernon, California. A copy of the waste transport documentation is included in Appendix D.

Air Distribution Piping Installation

All air distribution piping was Schedule 80, 2-inch outside diameter PVC.

On December 2, 2005, SES began the installation of the aboveground component of the air distribution piping. Aboveground piping was installed in areas of minimal foot/vehicle traffic, as shown on Figure 2: up the hill from the service road, and along the western side of the service yard. Aboveground piping was secured in place by driving U-shaped pieces of iron rebar into the ground. Piping lengths were connected with either Schedule 80 PVC slip couplings or with rubber screw-tight Fernco ™ couplings.

On December 5, 2005, the belowground portion of the air distribution piping was installed. The belowground portions of the distribution piping were installed in areas of potential foot/vehicle traffic, as shown on Figure 2, and included all piping to the west of and across the service road, as well as the approximately 25 feet adjacent to the blower shed. This piping was laid in a trench approximately 1 foot deep; the fittings were secured with glued Schedule 80 slip-type couplings; and the trenches were backfilled with the excavated soil.

While only three VWs were installed, a fourth air distribution line was installed from the blower manifold to the edge of the temporary storage container. This fourth line was installed in anticipation of possible future use with a fourth vent well (which would be designated VW-4); this piping is currently capped and is accessible from the ground surface.

Blower System

For ease of setup and operation, the blower system consists of a new, pre-packaged blower system constructed by Environmental Instruments (Concord, CA), and contains the following components and specifications:

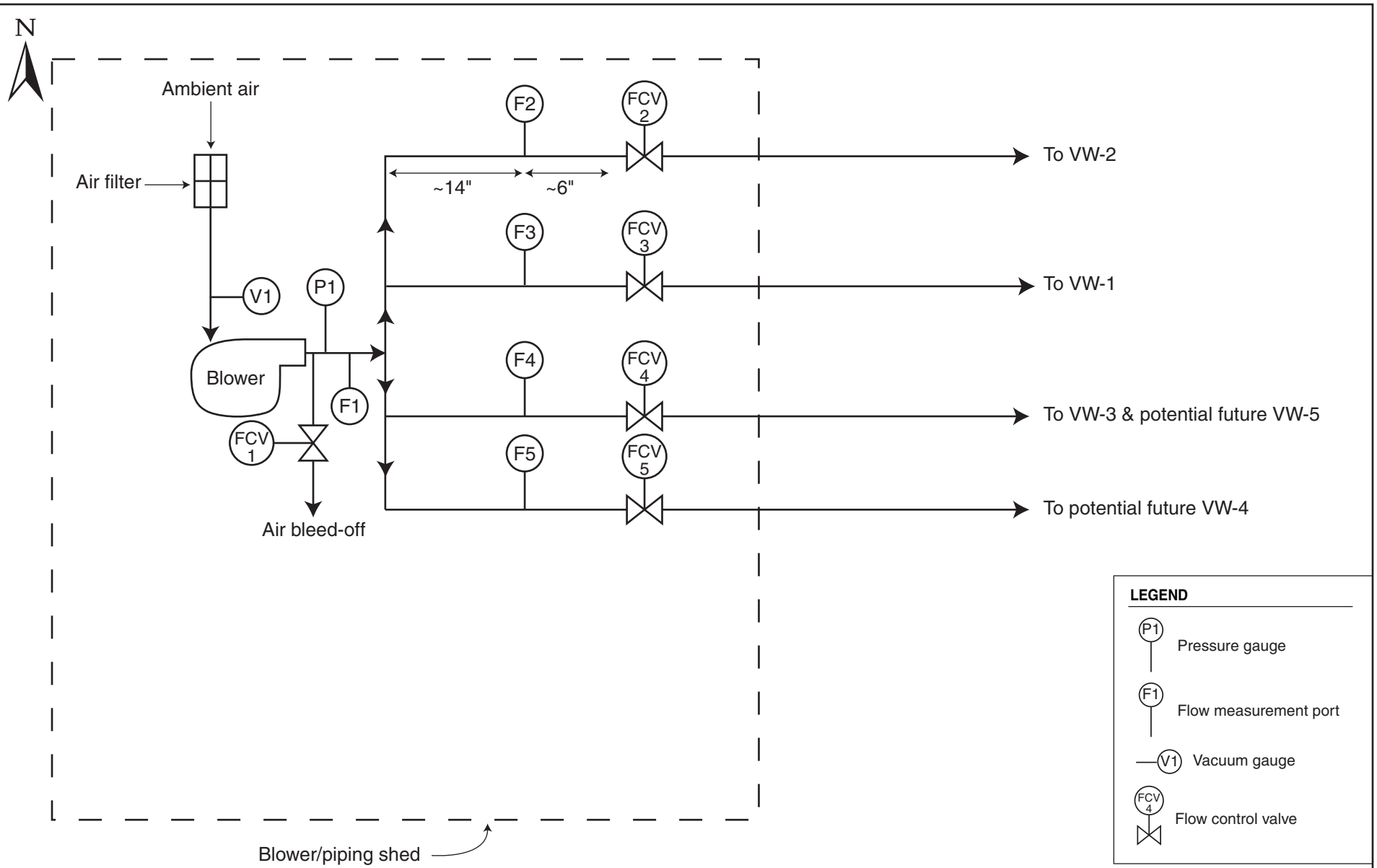
- 2.0-horsepower Rotron EN 505M regenerative-type blower
- 230-volt starter
- Outlet air bleed valve (for controlling air flow)

- Integral vacuum gauge (inlet) and pressure gauge (outlet)
- In-line particulate air filter
- Maximum free air flow: 160 standard cubic feet per minute (scfm)
- Maximum operating pressure: 62 inches water (H_2O)
- Air flow at 20 inches H_2O: 140 scfm
- Explosion-proof motor and internal circuit breaker

Figure 5 is a flow instrumentation diagram for the blower and associated manifold. The blower is installed in a small shed on the west side of the service yard garage building. This blower system was selected based on the pilot test design specifications; namely, achieving a potential 30-foot radius of influence and a 40-scfm flow rate to individual vent wells under induced pressure conditions.

An air distribution piping manifold was constructed to connect the blower discharge to the vent well air distribution piping. The manifold was constructed wholly of Schedule 80 PVC, 2-inch-diameter piping with glued slip-type couplings. The blower discharge pipe was manifolded into four separate pipes (one to each existing VW and one to a potential fourth VW) that exit the blower shed and extend directly underground. Threaded metal flow measurement ports were installed at the following locations: in the blower discharge pipe (to measure total blower discharge); and in each of the four VW-specific manifold pipes (to measure individual air flows to each VW). A ball-type flow control valve was installed immediately downstream of each of the four VW-specific flow measurement ports, to allow for flow adjustment to individual VWs.

An air inlet pipe (1.5-inch-diameter Schedule 40 PVC) was run from the blower inlet to the exterior of the blower shed to draw in ambient air. A similar pipe was run from the blower bleed valve to the exterior of the shed. A small wooden enclosure was constructed adjacent to the blower shed to house the ends of the air inlet and blower bleed valve outlet pipes. This enclosure was constructed to minimize blower noise, and also to minimize intake of debris and moisture.



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BIOVENTING PROCESS FLOW AND INSTRUMENTATION DIAGRAM

7867 Redwood Rd, Oakland, CA

Figure 5

by: MJC | **DECEMBER 2005**

2005-66-07

3.0 SOIL VAPOR SAMPLING ACTIVITIES

This section discusses the soil vapor sampling and analysis methods used to conduct the baseline sampling prior to bioventing system startup.

SOIL VAPOR SAMPLING AND ANALYSIS

The soil vapor sampling was conducted December 9, 2005 to establish baseline conditions for future evaluation of the impact of bioventing on residual soil contamination. At that time, all four VMPs showed shallow screens and all three VWs showed partially exposed (unsaturated) screens (see Section 4.0 for a discussion of water level depths relative to screened intervals). However, the shallow screen at VMP-4 could not be purged (or sampled), suggesting either that the annular filter pack around this screen was saturated during hydration of the bentonite seal during installation or that soils surrounding the screen are very tight and/or moderately-saturated due to the shallow water level.

Soil vapor samples were collected with a sample collection system that consisted of a small, portable vacuum pump, Tygon® tubing, and a vacuum chamber. The vacuum pump was used to purge the well and tubing. The purge times for each of the VMP depths was approximately 1 minute, and the purge time for VWs was approximately 5 minutes. These purge times were based on well construction and the flow rate of the pump to ensure that a representative sample was collected.

Once the wells were purged, soil vapor samples were collected in Tedlar® bags within the vacuum chamber for field analysis. All soil vapor samples were analyzed in the field using portable meters: a GasTech Model GT-408 for oxygen/carbon dioxide and a photoionization detector (PID) (*Mini*-RAE Plus Classic) for organic compounds. Meters were calibrated prior to field use according to manufacturer's specifications. Soil vapor samples were collected for laboratory analysis subsequent to purging and field screening by attaching an evacuated Summa® canister directly to the well.

All samples collected for laboratory analysis were analyzed for BTEX, MTBE, and total volatile hydrocarbons as gasoline (TVHg) using EPA Method TO-3. Laboratory analyses were conducted by Columbia Analytical Services (Simi Valley, CA). Sample results are discussed below, and certified analytical results and chain-of-custody forms are provided in Appendix C.

SOIL VAPOR SAMPLING RESULTS

Fuel Hydrocarbons

Table 2 summarizes the baseline soil vapor sample analytical results, as well as field PID readings. Gasoline concentrations ranged from non-detect (VMP-1 and VMP-3) to 5,100 parts per million by volume (ppmv) (VMP-2). Note that the oxygen and carbon dioxide readings in VW-2 (discussed below) suggest that ambient air leakage may have occurred, and the contaminant concentrations in VW-2 likely is at a higher concentration than recorded. Sampling points with elevated gasoline concentrations also showed elevated BTEX concentrations. The only well with detected MTBE was VMP-2.

Maximum concentrations for all hydrocarbon compounds were measured at VMP-2. This result is consistent with previous findings that indicated the center of mass of groundwater and residual soil contamination is located in the area surrounding VMP-2. There was relatively good correlation between PID field readings and TVHg laboratory measurements, with higher PID readings associated with higher TVH readings.

Oxygen/Carbon Dioxide

Oxygen concentrations below background concentration (usually 18 to 21 percent), and carbon dioxide concentrations above background (usually 0.05 percent) indicate that petroleum hydrocarbon contamination has induced native microbiological activity in soils. However, aerobic microbial activity is substantially limited below approximately 5 percent oxygen.

During baseline sampling, oxygen concentrations were depleted and carbon dioxide concentrations were elevated (as compared to ambient conditions) in all monitored points, with the exception of VW-2 (likely due to ambient air leakage). These results are consistent with the previous findings of residual soil contamination at these locations. At VW-2 (location of inferred maximum contamination), oxygen was not detected and carbon dioxide was at 19 percent, indicating a strong contaminant impact and significantly limiting conditions for aerobic microbial activity.

Table 2
Baseline Soil Vapor Sampling Results, December 2005
Redwood Regional Park Service Yard, Oakland, California [a]

Location	Depth (feet)	TVHg	Benzene	Toluene	Ethyl Benzene	Xylenes	MTBE	O_2 (%)	CO_2 (%)	PID
December 9, 2005 Baseline Sampling										
VW-1	6-16	**45**	*< 0.058*	*< 0.058*	*< 0.058*	0.058	*< 0.058*	**9.1**	**9.3**	**24.5**
VW-2 [b]	8-18	**2,500**	**2.8**	**3.3**	**2.5**	**1.5**	*< 0.065*	**20.5** [c]	**0.4**	**420**
VW-3	8-18	**4,100**	**1.9**	**8.5**	*< 0.073*	**7.9**	*< 0.073*	**15.4**	**2.0**	**675**
VMP-1-shallow	10-11.5	*< 6.9*	*< 0.068*	*< 0.068*	*< 0.068*	*< 0.136*	*< 0.068*	**10.0**	**9.5**	*< 0.1*
VMP-2-shallow	10-11.5	**5,100**	**61**	**28**	**80**	**316**	**21**	**0.0**	**19.0**	**1,890**
VMP-3-shallow	10-11.5	*< 7.1*	*< 0.070*	*< 0.070*	*< 0.070*	*< 0.070*	*< 0.140*	**10.9**	**8.6**	*< 0.1*

Notes:

[a] All concentrations are in parts per million by volume (ppmv) unless otherwise indicated.
[b] Contaminant and carbon dioxide results may be biased (low) due to ambient air leakage.
[c] Results may be biased (high) due to ambient air leakage.

CO_2 = carbon dioxide
MTBE = methyl tertiary-butyl ether
O_2 = oxygen
PID = photoionization detector
TVHg = total volatile hydrocarbons as gasoline

4.0 SYSTEM STARTUP AND AIR FLOW OPTIMIZATION

The purpose of the expanded full-scale bioventing system is to provide oxygen to stimulate aerobic biodegradation of the remaining soil contamination present at the site. Because at least several feet of exposed (unsaturated) VW screens was measured immediately following the VW installations (see Table 3), startup of the system was initiated on December 20, 2005. It is expected that the effectiveness of the bioventing system will be reduced as water levels rise during the rainy period, and then increase as water levels fall. The system will be shut down in the event that all VW screens become fully saturated, or if no flow is measured in any of the wells.

SYSTEM OPERATION AND MAINTENANCE

System Testing and Start-Up

The final electrical service for the blower was installed on December 19, 2005. On December 20, 2005 (after the baseline soil vapor sampling event), the blower was started (with the bleed valve fully open and the VW flow control valves fully closed at the manifold) and total air flow was measured. The VW flow control valves at the manifold and at the well head were then opened (one VW at a time) to ensure that air was moving through the manifold piping to each wellhead. SES confirmed that air was moving from the blower and through each VW pipe and exiting at each wellhead, with flow rates of approximately 30 to 50 standard cubic feet per minute (scfm) per VW. Total blower airflow could not be measured as the limit of meter range was 100 scfm. The valve at each VW wellhead was then closed so that air flow was introduced into the subsurface at each VW. Airflow was measured using a thermal anemometer (TSI model 8345).

Air Flow Optimization

Initial system measurements were taken on December 21 and 22, 2005. Total and VW-specific air injection rates were optimized to ensure uniform flow rates to VWs and proper operation of the blower system. Total blower airflow was determined to be approximately 50 to 55 scfm, with all air flow going to VW-1. No air was being injected into either newly installed VW-2 or VW-3. In our opinion, the filter pack (sand) material in those two wells was saturated (as a result of well installation and/or high water level conditions). The blower bleed valve was therefore adjusted to maintain the design outlet pressure of 40 inches of water.

Table 3
Bioventing System Measurements - Blower and Vent Wells
Redwood Regional Park Service Yard, Oakland, California

Location	Blower Total Air Flow – before adjustment (scfm)	Blower Total Air Flow – after adjustment (scfm)	Blower Inlet Vacuum (inches H_20) [(a)]	Blower Pressure (inches H_20) [(a)]	Airflow to VW – before adjustment (scfm)	Airflow to VW – after adjustment (scfm)	Screened Interval Depth (feet)	Water Level (feet)
December 9, 2005 (before bioventing system startup)								
Blower	---	---	---	---				
VW-1					*NM*	*NM*	5.6 – 15.6	12.15
VW-2					*NM*	*NM*	8.4 – 18.4	10.27
VW-3					*NM*	*NM*	8.8 –18.8	11.94
December 23, 2005 (first event following bioventing system startup)								
Blower	53	*NM*	16	42				
VW-1					51	*NM*	5.6 – 15.6	11.0
VW-2					*< 1*	*NM*	8.4 – 18.4	10.9
VW-3					*< 1*	*NM*	8.8 –18.8	14.1
December 29, 2005								
Blower	29	28	14	49				
VW-1					34	30	5.6 – 15.6	11.1
VW-2					*< 1*	*< 1*	8.4 – 18.4	7.2
VW-3					*< 1*	*< 1*	8.8 –18.8	14.5
January 3, 2006 [(b)]								
Blower	*NM*	*NM*	17	45				
VW-1					*NM*	*NM*	5.6 – 15.6	6.0

Table 3 continued

Location	Blower Total Air Flow – before adjustment (scfm)	Blower Total Air Flow – after adjustment (scfm)	Blower Inlet Vacuum (inches H_20) [a]	Blower Pressure (inches H_20) [a]	Airflow to VW – before adjustment (scfm)	Airflow to VW – after adjustment (scfm)	Screened Interval Depth (feet)	Water Level (feet)
January 6, 2006								
Blower	8.5	7.5	18	38				
VW-1					8.0	*NM*	5.6 – 15.6	6.7
VW-2					*< 1*	*< 1*	8.4 – 18.4	3.4
VW-3					*< 1*	*< 1*	8.8 –18.8	10.1
January 12, 2006								
Blower	*NM*	10.1	13	58				
VW-1					*NM*	9.8	5.6 – 15.6	8.5
VW-2					*NM*	*< 1*	8.4 – 18.4	6.5
VW-3					*NM*	*< 1*	8.8 –18.8	11.8
January 24, 2006								
Blower	NM	NM	18	38				
VW-1					*NM*	*NM*	5.6 – 15.6	9.9
VW-2					*NM*	*< 1* [c]	8.4 – 18.4	5.98
VW-3					*NM*	*< 1* [c]	8.8 –18.8	12.90

Notes:

[a] Reading is prior to adjustment back to design operating parameters
[b] Supplemental event to check on blower system after heavy precipitation event.
[c] Qualitatively assessed by closing the VW-specific manifold valve and noting no change in blower outlet pressure.

H_2O = water
NM = not measured
scfm = standard cubic feet per minute

Depths are in feet below top of well casing (TOC).

Water levels measured in this period confirmed that all deep VMP screens were fully saturated (such that purging and vapor sampling could not be conducted).

Following startup, four weekly system monitoring events were conducted designed to measure system operation and optimize air flows. The objective of the monitoring events was to ensure that the required flow rates are achieved and that oxygen concentrations increase in the VMPs as a result of air injection. As shown in Table 3 (Bioventing System Measurements – Blower and Vent Wells) and Table 4 (Bioventing Vapor Monitoring Points Data), the following measurements were made during each event (when conditions allowed):

- Water levels in VWs and VMPs.
- Blower inlet vacuum and outlet pressure.
- Airflow rates to each VW (including temperature during the air flow reading).
- Induced pressure in each non-saturated VMP well screen, using Dwyer magnehelic gauges (0- to 1-inch water range).
- Oxygen and carbon dioxide concentrations in each non-saturated VMP well screen (by puring and Tedlar bag sampling).

The following general sequence of procedures were followed for the weekly events.

- Initial ("before adjustments") system measurements (blower inlet vacuum and outlet pressure) were made.
- The system was turned off and water level measurements were made.
- Induced pressures were measured.
- Well purging and Tedlar bag was conducted.
- The air flow system was returned to operating conditions, and air flows/blower outlet pressure were adjusted, and final ("after adjustment") readings were made.

As discussed below, unfavorable bioventing conditions (high water levels) precluded collecting some of the desired measurements. Summaries of each of the weekly monitoring activities follow.

On December 29, 2005 (approximately 1 week after startup), total air flow to the VWs had declined to approximately 30 scfm, again with all the air flow going to VW-1 and no air flow into VW-2 or VW-3. Induced air pressure was measured at the shallow well screens of VMP-1, VMP-2, and VMP-3. Because vacuum conditions had previously been demonstrated in the shallow screen of VMP-4, neither induced pressure readings nor purging were conducted.

Table 4
Bioventing Vapor Monitoring Points Data
Redwood Regional Park Service Yard, Oakland, California

Location	Induced Pressure at VMP (inches H_20)	O_2 (%)	CO_2 (%)	PID	Screened Interval Depth (feet)	Water Level (feet)
December 9, 2005 (before bioventing system startup)						
VMP-1-10	NA	10.0	9.5	< 0.1	9.3 – 10.8	dry (>10.8)
VMP-1-14	NA	(a)	(a)	(a)	13.4 – 14.9	10.8
VMP-2-10	NA	0.0	19.0	1,890	9.5 – 11.0	dry (>11.0)
VMP-2-14	NA	(a)	(a)	(a)	13.9 – 15.4	12.5
VMP-3-10	NA	10.9	8.6	< 0.1	9.8 – 11.3	11.0
VMP-3-12.5	NA	(a)	(a)	(a)	12.0 – 13.5	10.8
VMP-4-15.5	NA	(a)	(a)	(a)	15.1 – 16.6	dry (>16.6)
VMP-4-20.5	NA	(a)	(a)	(a)	20.8 – 22.3	19.3
December 23, 2005 (first event bioventing system startup)						
VMP-1-10	0.50	16.9	6.6	*NM*	9.3 – 10.8	10.9
VMP-1-14	(a)	(a)	(a)	(a)	13.4 – 14.9	*NM*
VMP-2-10	0.12	1.3	16.6	*NM*	9.5 – 11.0	dry (>11.0)
VMP-2-14	(a)	(a)	(a)	(a)	13.9 – 15.4	*NM*
VMP-3-10	0.18	(a)	(a)	*NM*	9.8 – 11.3	10.2
VMP-3-12.5	(a)	(a)	(a)	(a)	12.0 – 13.5	*NM*
VMP-4-15.5	-0.13	(a)	(a)	*NM*	15.1 – 16.6	dry (>16.6)
VMP-4-20.5	(a)	(a)	(a)	(a)	20.8 – 22.3	*NM*
December 29, 2005						
VMP-1-10	0.34	(a)	(a)	*NM*	9.3 – 10.8	10.14
VMP-1-14	(a)	(a)	(a)	(a)	13.4 – 14.9	*NM*
VMP-2-10	0.33	(a)	(a)	*NM*	9.5 – 11.0	10.39
VMP-2-14	(a)	(a)	(a)	(a)	13.9 – 15.4	*NM*
VMP-3-10	0.50	(a)	(a)	*NM*	9.8 – 11.3	10.12
VMP-3-12.5	(a)	(a)	(a)	(a)	12.0 – 13.5	*NM*
VMP-4-15.5	(a)	(a)	(a)	*NM*	15.1 – 16.6	dry (>16.6)
VMP-4-20.5	(a)	(a)	(a)	(a)	20.8 – 22.3	*NM*

Table 4 continued

Location	Induced Pressure at VMP (inches H_20)	O_2 (%)	CO_2 (%)	PID	Screened Interval Depth (feet)	Water Level (feet)
January 6, 2006						
VMP-1-10	(a)	(a)	(a)	*NM*	9.3 – 10.8	9.9
VMP-1-14	(a)	(a)	(a)	(a)	13.4 – 14.9	7.9
VMP-2-10	(a)	(a)	(a)	*NM*	9.5 – 11.0	9.9
VMP-2-14	(a)	(a)	(a)	(a)	13.9 – 15.4	6.4
VMP-3-10	(a)	(a)	(a)	*NM*	9.8 – 11.3	9.2
VMP-3-12.5	(a)	(a)	(a)	(a)	12.0 – 13.5	5.9
VMP-4-15.5	(a)	(a)	(a)	*NM*	15.1 – 16.6	dry (>16.6)
VMP-4-20.5	(a)	(a)	(a)	(a)	20.8 – 22.3	15.6
January 12, 2006						
VMP-1-10	-0.12	(a)	(a)	*NM*	9.3 – 10.8	9.8
VMP-1-14	(a)	(a)	(a)	(a)	13.4 – 14.9	8.4
VMP-2-10	-0.20	(a)	(a)	*NM*	9.5 – 11.0	7.5
VMP-2-14	(a)	(a)	(a)	(a)	13.9 – 15.4	7.2
VMP-3-10	-0.22	(a)	(a)	*NM*	9.8 – 11.3	9.6
VMP-3-12.5	(a)	(a)	(a)	(a)	12.0 – 13.5	9.2
VMP-4-15.5	0.0	(a)	(a)	*NM*	15.1 – 16.6	dry (>16.6)
VMP-4-20.5	(a)	(a)	(a)	(a)	20.8 – 22.3	15.8
January 24, 2006						
VMP-1-10	NM	(a)	(a)	*NM*	9.3 – 10.8	8.5
VMP-1-14	NM	(a)	(a)	(a)	13.4 – 14.9	8.7
VMP-2-10	NM	(a)	(a)	*NM*	9.5 – 11.0	7.4
VMP-2-14	NM	(a)	(a)	(a)	13.9 – 15.4	7.5
VMP-3-10	NM	(a)	(a)	*NM*	9.8 – 11.3	9.8
VMP-3-12.5	NM	(a)	(a)	(a)	12.0 – 13.5	9.4
VMP-4-15.5	NM	(a)	(a)	*NM*	15.1 – 16.6	dry (>16.6)
VMP-4-20.5	NM	(a)	(a)	(a)	20.8 – 22.3	15.8

Notes:

(a) Well screen saturated and/or tight soils exhibited high vacuum condition during (purging; sample could not be collected).

CO_2 = carbon dioxide
H2O = water
NA = not applicable
NM = not measured
O_2 = oxygen
PID = photoionization detector

Depths are in feet below top of well casing (TOC).

This event demonstrated that oxygen concentrations increased and carbon dioxide decreased measurably at VMP-1-10 and VMP-2-10. Also, the induced pressure numbers are somewhat higher than what was seen during the pilot test. Both of these results indicate that the blower injection and flow was having the desired effect, but that it was short-lived.

On January 3, 2006, it was observed that the blower had shut down. The blower was left off until the cause of the shut-down was confirmed. The EBRPD subsequently confirmed that the entire facility lost electrical power during the severe storms earlier in the week.

On January 6, 2006, the water level in VW-1 (as well as other VWs) had risen several additional feet in response to heavy rainfall earlier in the week. The blower (which had been off since January 3, 2006) was restarted. Total blower airflow had decreased to approximately 8 scfm, again with all of the air flow going to VW-1 and no air flow to VW-2 or VW-3. Water levels in the shallow screens of the VMPs were either above or nearly coincident with the top of the well screens. Induced air pressure was measured at the shallow well screens of all VMPs. Induced air pressures were either zero (VMP-3 and VMP-4) or negative (VMP-1 and VMP-2), indicating vacuum conditions in the well (typical of saturated conditions). No well purging, PID readings, or oxygen/carbon dioxide measurements were done because of the saturated well screen conditions.

On January 12, 2006, the water level in VW-1 (and in the other VWs) had dropped slightly, and a slight increase in airflow was observed. As with previous events, all airflow was to VW-1 and none to VW-2 or VW-3. Water levels in the shallow screens of the VMPs were either above or nearly coincident with the top of the well screens. Induced air pressure was measured at the shallow well screens of all VMPs. Induced air pressures were either zero (VMP-3 and VMP-4) or negative (VMP-1 and VMP-2), indicating saturated conditions. No well purging, PID readings, or oxygen/carbon dioxide measurements were done because of the saturated well screen conditions.

On January 24, 2006, the water level had risen in VW-2 (0.5 feet), and had dropped in VW-1 (1.4 feet) and VW-3 (1.1 feet). As with previous events, all airflow was to VW-1 and none to VW-2 or VW-3 (this was evaluated qualitatively by turning off the VW-specific manifold valves (for VW-2 and VW-3) and noting no change in blower outlet pressure. No well purging, PID readings, or oxygen/carbon dioxide measurements were done because of the saturated well screen conditions.

Following the January 24, 2006 (final) weekly event, all manifold valves were closed except VW-3. The objective of this was to concentrate all air flow into VW-3, in an attempt to dehydrate the annular pack material in that well. Planned monthly operation and maintenance events will include a qualitative evaluation of air flow into VW-3 (by closing the VW-3 manifold valve and looking for an increase in blower outlet pressure).

5.0 EVALUATION OF RESULTS

This section discusses the findings of the full-scale bioventing system startup and first month of system monitoring.

BLOWER OPERATION AND AIR FLOW IN DISTRIBUTION PIPING

The blower system is fully functional and operating within design parameters. The blower system has two safety mechanisms for automatic shut-off. First, for safety reasons, there is no automatic re-start of the blower. The first shut-off mechanism consists of 60-amp fuses in the external circuit breaker box. The second shut-off mechanism is an internal, time-delay variable amp shut-off (currently set at 22 amps); the shutdown occurs when the motor operates at unsafe amperage due to increased blower outlet pressure.

During the approximately 1-month startup period, the blower shut down twice. One shutdown occurred due to sitewide electrical service outage. The second shutdown was due to blower outlet pressure causing an exceedance of the internal shut-off amperage. These events demonstrate that the blower's automatic shut-off mechanisms are working and there is minimal risk associated with automatic operation.

Air flow is moving through the air distribution piping and reaching wellheads (when wellheads are open) at expected flow rates. No significant air leaks have been observed in the system.

HYDROGEOLOGIC CONDITIONS AFFECTING AIR INJECTION

Water level monitoring has confirmed that water levels fluctuate in wells up to several feet over the year and can change rapidly over short periods of time following individual precipitation events, which will affect both total system flow rate and possibly the ratio between individual VWs.

Vent Wells

Water levels rose between 6 and 7 feet in VW-1 and VW-2 between December 9, 2005 and January 6, 2006, in response to two heavy precipitation events. Water levels subsequently dropped 2 to 3 feet in these wells within the next week. Slightly less variable water level changes were observed in downgradient VW-3.

Initial conditions showed several feet of exposed screen (relative to water level measurements in the well) in newly-installed VW-2 and VW-3. However, no air could be injected into these two new wells. Water level measurements have demonstrated that the well screens are open to groundwater entry; thus, there is no possibility that the wells screens were sealed during well installation. It is likely that the filter pack material in these wells was saturated as a result of installation activities (or possibly capillary action that filled pore spaces in the filter pack). Because the 3 weeks of blower operation did not result in any measurable air flow to these VWs, it appears likely that no appreciable air flow into VW-2 and VW-3 will occur until water levels drop and the filter pack material dehydrates.

Vapor Monitoring Points

All deep screens at all VMPs were fully saturated from the time of the initial measurement through the final weekly event, and it is highly unlikely that the bioventing system has any positive effect on residual contamination at these depths, during the current high-water conditions.

Initial (system startup and first weekly monitoring event) induced pressures at the shallow screens of VMPs indicated that air injection at VW-1 did have a positive pressure effect on VMPs (except for VMP-4). Another indication that the blower system had a positive effect were the increase in oxygen and decrease in carbon dioxide in the shallow screens of VMP-1 and VMP-2. By the second week, induced pressures were either zero or negative (indicating a vacuum) at the VMPs. This suggests that pore spaces in the soil are filled with water (due to rising water levels) and that air is not flowing at these depths.

BASELINE CONDITIONS

Baseline soil vapor sampling results confirm the general conditions observed in the 2004 bioventing pilot test. High petroleum concentrations were detected in soil vapor in the area of groundwater contamination, and depressed oxygen/elevated carbon dioxide levels demonstrate that aerobic microbial activity is occurring but is limited by oxygen supply. Baseline oxygen levels at VMP-2 (area of inferred maximum contamination) are below the level necessary to support sustained aerobic microbial activity.

Minimal air injection is occurring (and only at VW-1) due to high-water level conditions and/or filter pack saturation from well installation. As water levels drop (following the rainy season), it is likely that air injection rates and increases in oxygen concentrations will improve and potentially exceed those seen during the pilot test due to the expanded well network. This expectation will be confirmed by continued measurement of water levels, air injection rates, oxygen concentrations, and the proposed ISR test.

6.0 SUMMARY, CONCLUSIONS, AND PROPOSED ACTIONS

This section presents the conclusions and proposed actions with regard to the installation and implementation of the full-scale bioventing remedial system at the Redwood Regional Park Service Yard.

SUMMARY AND CONCLUSIONS

- The 2005 bioventing pilot test demonstrated a radius of bioventing influence of approximately 30 feet, greater than the minimum design criteria needed for cost-effective operations.
- The full-scale bioventing system was installed in November and December 2005. The full-scale system consists of: four vapor monitoring points, each with two nested screens; three vent wells; air distribution piping from the blower to the VWs; a blower and manifold system; and appurtenant gauges and sampling ports.
- Pre-startup (baseline) soil vapor sampling confirmed elevated petroleum concentrations in the majority of the VMPs (shallow screens) and VWs.
- Pre-startup (baseline) soil vapor sampling also confirmed depressed oxygen/elevated carbon dioxide levels, indicating that aerobic microbial activity is occurring but is limited by oxygen supply.
- Current high-water level conditions as a result of seasonal rains are currently impeding significant air flow into the VWs, and are resulting in tight soil conditions that preclude the sampling of all VMP screens (both deep and shallow).
- Current conditions (little to no air injection) will likely continue through the rainy season. Falling water levels should improve air injection rates and response at the VMPs.

PROPOSED ACTIONS

EBRPD proposes to implement the following actions with regard to the bioventing program:

- Operate and maintain the full-scale bioventing system until in situ respiration testing data (i.e., oxygen utilization rates) and soil vapor sampling data at the VMPs indicate that residual soil contamination has been significantly reduced and that biodegradation is no longer oxygen-limited.

- Conduct monthly operation and maintenance of the bioventing system, including air flow optimization when water level changes and/or air injection rates warrant.
- Conduct an ISR test, including air permeability and system radius of influence, at such time as water levels drop sufficiently to evaluate at least the shallow VMP screens.
- Report on bioventing system progress/activities in quarterly progress reports, and prepare an annual summary report (approximately 1 year after the system begins operation).

6.0 REFERENCES

Alameda County Health, 2005a. Letter regarding Alameda County Health's review of SES Bioventing Pilot Test Report. May 25.

Alameda County Health, 2005b. Letter approving installation and implementation of bioventing full-scale system. June 24.

Stellar Environmental Solutions, Inc. (SES), 2004a. Bioventing Feasibility Letter Report – Redwood Regional Park Service Yard, Oakland, California. February 6.

Stellar Environmental Solutions, Inc. (SES), 2004b. Bioventing Pilot Tests Result Report, Redwood Regional Park Service Yard, Oakland, California. October 29.

Stellar Environmental Solutions, Inc. (SES), 2003. Letter to Alameda County Health Care Services Agency proposing bioventing as a corrective action remedy at Redwood Regional Park Service Yard, Oakland, California. November 6.

APPENDIX A

Photodocumentation

Subject: Drilling borehole for vent well VW-3, looking to the northwest from the park service road.	
Site: 7867 Redwood Road, Oakland, Alameda County, California	
Date Taken: November 28, 2005	Project No.: SES 2005-66
Photographer: Bruce Rucker	Photo No.: 01

Subject: Drilling borehole for vent well VW-2, looking to the south, down the park entrance road.	
Site: 7867 Redwood Road, Oakland, Alameda County, California	
Date Taken: November 28, 2005	Project No.: SES 2005-66
Photographer: Bruce Rucker	Photo No.: 02

Subject: Drilling borehole for vapor monitoring point VMP-4, looking to the west from the service yard parking lot.	
Site: 7867 Redwood Road, Oakland, Alameda County, California	
Date Taken: November 29, 2005	Project No.: SES 2005-66
Photographer: Bruce Rucker	Photo No.: 03

Subject: Trenching for bioventing underground piping, looking to the north from VW-3.	
Site: 7867 Redwood Road, Oakland, Alameda County, California	
Date Taken: December 5, 2005	Project No.: SES 2005-66
Photographer: Bruce Rucker	Photo No.: 04

Subject: Below-grade piping connected to VW-3 (before backfilling), looking to the north.	
Site: 7867 Redwood Road, Oakland, Alameda County, California	
Date Taken: December 5, 2005	Project No.: SES 2005-66
Photographer: Bruce Rucker	Photo No.: 05

Subject: Surface completion at vent well VW-3 showing ball valve (red handle) and sampling port (top of well).	
Site: 7867 Redwood Road, Oakland, Alameda County, California	
Date Taken: December 5, 2005	Project No.: SES 2005-66
Photographer: Bruce Rucker	Photo No.: 06

Subject: Bioventing piping going underground (before backfilling), looking to the north.	
Site: 7867 Redwood Road, Oakland, Alameda County, California	
Date Taken: December 5, 2005	Project No.: SES 2005-66
Photographer: Bruce Rucker	Photo No.: 07

Subject: Bioventing piping going underground (before backfilling), looking to the south.	
Site: 7867 Redwood Road, Oakland, Alameda County, California	
Date Taken: December 5, 2005	Project No.: SES 2005-66
Photographer: Bruce Rucker	Photo No.: 08

Subject: Bioventing piping coming from blower shed (before backfilling), looking to the southeast.	
Site: 7867 Redwood Road, Oakland, Alameda County, California	
Date Taken: December 5, 2005	Project No.: SES 2005-66
Photographer: Bruce Rucker	Photo No.: 09

Subject: Bioventing blower (left) and piping manifold (right) in the blower shed (before installing flow measurement ports on the manifold).	
Site: 7867 Redwood Road, Oakland, Alameda County, California	
Date Taken: December 5, 2005	Project No.: SES 2005-66
Photographer: Bruce Rucker	Photo No.: 10

APPENDIX B

Well Permits, Geologic Logs, and DWR Well Completion Forms

Alameda County Public Works Agency - Water Resources Well Permit

399 Elmhurst Street
Hayward, CA 94544-1395
Telephone: (510)670-6633 Fax:(510)782-1939

Application Approved on: 10/31/2005 By jamesy **Receipt Number: WR2005-2171**
Permits Issued: W2005-1069 to W2005-1073 **Permits Valid from 11/28/2005 to 11/30/2005**

Application Id: 1130791965828 **City of Project Site:** Oakland
Site Location: 7867 Redwood Road, Oakland, 94546
(Redwood Park Service Yard)
Project Start Date: 11/28/2005 **Completion Date:** 11/30/2005

Applicant: Stellar Environmental Solutions - Bruce Rucker **Phone:** 510-644-3123
2198 6th St, Berkeley, CA 94710
Property Owner: East Bay Regional Park District **Phone:** 510-649-3313
PO Box 5382, Oakland, CA 94605
Client: ** same as Property Owner **

Total Due: $1200.00
Total Amount Paid: $1200.00
Paid By: CHECK **PAID IN FULL**

Works Requesting Permits:

Well Construction-Monitoring-Monitoring - 1 Wells
Driller: HEW Drilling - Lic #: 604987 - Method: auger **Work Total: $300.00**

Specifications

Permit #	Issued Date	Expire Date	Owner Well Id	Hole Diam.	Casing Diam.	Seal Depth	Max. Depth
W2005-1069	10/31/2005	02/26/2006	MW-12	8.00 in.	0.00 in.	0.00 ft	26.00 ft

Specific Work Permit Conditions

1. Permittee shall assume entire responsibility for all activities and uses under this permit and shall indemnify, defend and save the Alameda County Public Works Agency, its officers, agents, and employees free and harmless from any and all expense, cost, liability in connection with or resulting from the exercise of this Permit including, but not limited to, properly damage, personal injury and wrongful death.

2. Permitte, permittee's contractors, consultants or agents shall be responsible to assure that all material or waters generated during drilling, boring destruction, and/or other activities associated with this Permit will be safely handled, properly managed, and disposed of according to all applicable federal, state, and local statutes regulating such. In no case shall these materials and/or waters be allowed to enter, or potentially enter, on or off-site storm sewers, dry wells, or waterways or be allowed to move off the property where work is being completed.

3. Prior to any drilling activities, it shall be the applicant's responsibility to contact and coordinate an Underground Service Alert (USA), obtain encroachment permit(s), excavation permit(s) or any other permits or agreements required for that Federal, State, County or City, and follow all City or County Ordinances. No work shall begin until all the permits and requirements have been approved or obtained.

4. Compliance with the well-sealing specifications shall not exempt the well-sealing contractor from complying with appropriate State reporting-requirements related to well destruction (Sections 13750 through 13755 (Division 7, Chapter 10, Article 3) of the California Water Code). Contractor must complete State DWR Form 188 and mail original to the Alameda County Public Works Agency, Water Resources Section, within 60 days. Including permit number and site map.

5. Applicant shall contact James Yoo for an inspection time at 510-670-6633 at least five (5) working days prior to starting, once the permit has been approved. Confirm the scheduled date(s) at least 24 hours prior to drilling.

6. Wells shall have a Christy box or similar structure with a locking cap or cover. Well(s) shall be kept locked at all times. Well(s) that become damaged by traffic or construction shall be repaired in a timely manner or destroyed immediately (through permit process). No well(s) shall be left in a manner to act as a conduit at any time.

7. Minimum surface seal thickness is two inches of cement grout placed by tremie

8. Minimum seal depth for monitoring wells is 5 feet below ground surface(BGS) or the maximum depth practicable or 20 feet.

9. Copy of approved drilling permit must be on site at all times. Failure to present or show proof of the approved permit application on site shall result in a fine of $500.00.

Well Destruction-Monitoring - 1 Wells
Driller: HEW Drilling - Lic #: 604987 - Method: auger **Work Total: $300.00**

Specifications

Permit #	Issued Date	Expire Date	Owner Well Id	Hole Diam.	Casing Diam.	Seal Depth	Max. Depth	State Well #	Orig. Permit #	DWR #
W2005-1070	10/31/2005	02/26/2006	MW-4	8.00 in.	0.00 in.	0.00 ft	26.00 ft			

Specific Work Permit Conditions

1. Drilling Permit(s) can be voided/ cancelled only in writing. It is the applicant's responsibility to notify Alameda County Public Works Agency, Water Resources Section in writing for an extension or to cancel the drilling permit application. No drilling permit application(s) shall be extended beyond ninety (90) days from the original start date. Applicants may not cancel a drilling permit application after the completion date of the permit issued has passed.

2. Compliance with the well-sealing specifications shall not exempt the well-sealing contractor from complying with appropriate State reporting-requirements related to well destruction (Sections 13750 through 13755 (Division 7, Chapter 10, Article 3) of the California Water Code). Contractor must complete State DWR Form 188 and mail original to the Alameda County Public Works Agency, Water Resources Section, within 60 days. Including permit number and site map.

3. Permittee shall assume entire responsibility for all activities and uses under this permit and shall indemnify, defend and save the Alameda County Public Works Agency, its officers, agents, and employees free and harmless from any and all expense, cost and liability in connection with or resulting from the exercise of this Permit including, but not limited to, property damage, personal injury and wrongful death.

4. Applicant shall contact James Yoo for an inspection time at 510-670-6633 at least five (5) working days prior to starting, once the permit has been approved. Confirm the scheduled date(s) at least 24 hours prior to drilling.

5. Permitte, permittee's contractors, consultants or agents shall be responsible to assure that all material or waters generated during drilling, boring destruction, and/or other activities associated with this Permit will be safely handled, properly managed, and disposed of according to all applicable federal, state, and local statutes regulating such. In no case shall these materials and/or waters be allowed to enter, or potentially enter, on or off-site storm sewers, dry wells, or waterways or be allowed to move off the property where work is being completed.

6. Copy of approved drilling permit must be on site at all times. Failure to present or show proof of the approved permit application on site shall result in a fine of $500.00.

7. Drill out & Replace with New Well

Remedian Well Construction-Injection - 1 Wells
Driller: HEW Drilling - Lic #: 604987 - Method: auger **Work Total: $200.00**

Specifications

Permit #	Issued Date	Expire Date	Owner Well Id	Hole Diam.	Casing Diam.	Seal Depth	Max. Depth
W2005-1071	10/31/2005	02/26/2006	VMP-4	8.00 in.	0.00 in.	0.00 ft	22.00 ft

Specific Work Permit Conditions

1. Applicant shall contact James Yoo for an inspection time at 510-670-6633 at least five (5) working days prior to starting, once the permit has been approved. Confirm the scheduled date(s) at least 24 hours prior to drilling.

2. Minimum seal depth is 2 feet below ground surface (BGS).

3. Minimum surface seal thickness is two inches of cement grout placed by tremie

4. Copy of approved drilling permit must be on site at all times. Failure to present or show proof of the approved permit application on site shall result in a fine of $500.00.

5. Compliance with the above well-sealing specifications shall not exempt the well-sealing contractor from complying with appropriate state reporting-requirements related to well destruction (Sections 13750 through 13755 (Division 7, Chapter 10, Article 3) of the California Water Code). Contractor must complete State DWR Form 188 and mail original to the Alameda County Public Works Agency, Water Resources Section, within 60 days. Including permit number and site map.

6. Permittee shall assume entire responsibility for all activities and uses under this permit and shall indemnify, defend and save the Alameda County Public Works Agency, its officers, agents, and employees free and harmless from any and all expense, cost, liability in connection with or resulting from the exercise of this Permit including, but not limited to, properly damage, personal injury and wrongful death.

7. Prior to any drilling activities, it shall be the applicant's responsibility to contact and coordinate an Underground Service Alert (USA), obtain encroachment permit(s), excavation permit(s) or any other permits or agreements required for that Federal, State, County or City, and follow all City or County Ordinances. No work shall begin until all the permits and requirements have been approved or obtained.

8. Permitte, permittee's contractors, consultants or agents shall be responsible to assure that all material or waters generated during drilling, boring destruction, and/or other activities associated with this Permit will be safely handled, properly managed, and disposed of according to all applicable federal, state, and local statutes regulating such. In no case shall these materials and/or waters be allowed to enter, or potentially enter, on or off-site storm sewers, dry wells, or waterways or be allowed to move off the property where work is being completed.

Remedian Well Construction-Extraction - 1 Wells
Driller: HEW Drilling - Lic #: 604987 - Method: auger **Work Total: $200.00**

Alameda County Public Works Agency - Water Resources Well Permit

Specifications

Permit #	Issued Date	Expire Date	Owner Well Id	Hole Diam.	Casing Diam.	Seal Depth	Max. Depth
W2005-1072	10/31/2005	02/26/2006	VW-2	8.00 in.	0.00 in.	0.00 ft	18.00 ft

Specific Work Permit Conditions

1. Permittee shall assume entire responsibility for all activities and uses under this permit and shall indemnify, defend and save the Alameda County Public Works Agency, its officers, agents, and employees free and harmless from any and all expense, cost, liability in connection with or resulting from the exercise of this Permit including, but not limited to, properly damage, personal injury and wrongful death.

2. Permitte, permittee's contractors, consultants or agents shall be responsible to assure that all material or waters generated during drilling, boring destruction, and/or other activities associated with this Permit will be safely handled, properly managed, and disposed of according to all applicable federal, state, and local statutes regulating such. In no case shall these materials and/or waters be allowed to enter, or potentially enter, on or off-site storm sewers, dry wells, or waterways or be allowed to move off the property where work is being completed.

3. Compliance with the well-sealing specifications shall not exempt the well-sealing contractor from complying with appropriate State reporting-requirements related to well destruction (Sections 13750 through 13755 (Division 7, Chapter 10, Article 3) of the California Water Code). Contractor must complete State DWR Form 188 and mail original to the Alameda County Public Works Agency, Water Resources Section, within 60 days. Including permit number and site map.

4. Applicant shall contact James Yoo for an inspection time at 510-670-6633 at least five (5) working days prior to starting, once the permit has been approved. Confirm the scheduled date(s) at least 24 hours prior to drilling.

5. Minimum seal depth is 2 feet below ground surface (BGS).

6. Minimum surface seal thickness is two inches of cement grout placed by tremie

7. Copy of approved drilling permit must be on site at all times. Failure to present or show proof of the approved permit application on site shall result in a fine of $500.00.

Remedian Well Construction-Extraction - 1 Wells
Driller: HEW Drilling - Lic #: 604987 - Method: auger **Work Total: $200.00**

Specifications

Permit #	Issued Date	Expire Date	Owner Well Id	Hole Diam.	Casing Diam.	Seal Depth	Max. Depth
W2005-1073	10/31/2005	02/26/2006	VW-3	8.00 in.	0.00 in.	0.00 ft	18.00 ft

Specific Work Permit Conditions

1. Permittee shall assume entire responsibility for all activities and uses under this permit and shall indemnify, defend and save the Alameda County Public Works Agency, its officers, agents, and employees free and harmless from any and all expense, cost, liability in connection with or resulting from the exercise of this Permit including, but not limited to, properly damage, personal injury and wrongful death.

2. Permitte, permittee's contractors, consultants or agents shall be responsible to assure that all material or waters generated during drilling, boring destruction, and/or other activities associated with this Permit will be safely handled,

properly managed, and disposed of according to all applicable federal, state, and local statutes regulating such. In no case shall these materials and/or waters be allowed to enter, or potentially enter, on or off-site storm sewers, dry wells, or waterways or be allowed to move off the property where work is being completed.

3. Compliance with the well-sealing specifications shall not exempt the well-sealing contractor from complying with appropriate State reporting-requirements related to well destruction (Sections 13750 through 13755 (Division 7, Chapter 10, Article 3) of the California Water Code). Contractor must complete State DWR Form 188 and mail original to the Alameda County Public Works Agency, Water Resources Section, within 60 days. Including permit number and site map.

4. Applicant shall contact James Yoo for an inspection time at 510-670-6633 at least five (5) working days prior to starting, once the permit has been approved. Confirm the scheduled date(s) at least 24 hours prior to drilling.

5. Minimum seal depth is 2 feet below ground surface (BGS).

6. Minimum surface seal thickness is two inches of cement grout placed by tremie

7. Copy of approved drilling permit must be on site at all times. Failure to present or show proof of the approved permit application on site shall result in a fine of $500.00.

STELLAR ENVIRONMENTAL SOLUTIONS, INC
GEOSCIENCE & ENGINEERING CONSULTING

Soil Boring Log

BORING NUMBER VW-2 Page 1 of 1

PROJECT Redwood Park Service Yard
OWNER East Bay Regional Park District
LOCATION 7867 Redwood Road, Oakland, CA
PROJECT NUMBER 2005-66
TOTAL DEPTH 18 feet bgs
BOREHOLE DIA. 8 inch
SURFACE ELEV. ~550' amsl
WATER FIRST ENCOUNTERED 17'
DRILLING COMPANY HEW Drilling
DRILLING METHOD Hollow Stem Auger
DRILLER Manuel
GEOLOGIST B. Rucker
DATE DRILLED 11/28/2005

DEPTH (feet)	GRAPHIC LOG	DESCRIPTION/SOIL CLASSIFICATION	REMARKS
0		Dark brown clayey silt (ML), moist, sl. stiff, cohesive, friable	
2			
4		4.5' Iron staining and organics	
6		6' Becomes mod. stiff, friable, mod. cohesive, sl. moist	
8			Petroleum odor begins at 8.5'
10		Dark brown silty clay (CL), mod. stiff, cohesive, sl. friable, sl. moist 10' Blue-grey discoloration, sl. stiff, moist	
12			
14		13' Mod. stiff, minor fine-medium sand, mostly dark brown with some blue-grey mottling 13.5' Sl. stiff, no visible sand, sticky, moist 14.5' Minor fine sand	Petroleum odor slight at 13.5' Petroleum odor absent at 14.5'
16			
18		17' Sl.-mod. stiff, v. moist 17'.5 Minor small gravel	
20		Bottom of borehole = 18'	

2005-66-02

STELLAR ENVIRONMENTAL SOLUTIONS, INC
GEOSCIENCE & ENGINEERING CONSULTING

Soil Boring Log

BORING NUMBER VW-3 Page 1 of 1

PROJECT Redwood Park Service Yard
OWNER East Bay Regional Park District
LOCATION 7867 Redwood Road, Oakland, CA
PROJECT NUMBER 2005-66
TOTAL DEPTH 19 feet bgs
BOREHOLE DIA. 8 inch
SURFACE ELEV. ~547' amsl
WATER FIRST ENCOUNTERED 17'
DRILLING COMPANY HEW Drilling
DRILLING METHOD Hollow Stem Auger
DRILLER Manuel
GEOLOGIST B. Rucker
DATE DRILLED 11/28/2005

DEPTH (feet)	GRAPHIC LOG	DESCRIPTION/SOIL CLASSIFICATION	REMARKS
0		Dark brown clayey silt (ML), friable, no cohesion, stiff, dense	
2			
4		4' Mod. cohesive, sl. stiff, sl. moist	
		5' No cohesion, mod. stiff	
6			
		7.5' Very stiff	
8		9' Mod. cohesion, friable	
10		10.5' Minor fine sand, occasional cobbles	
12		Light brown sandy, gravelly clay (CL), sand is fine, gravel is small, mod. stiff, friable, sl. cohesive, sl. moist	
		13.5' Gravel very minor, sand absent, v. stiff, friable	
14		14' Blue-grey silty clay (CL), sl. stiff, v. cohesive, moist	Petroleum odor at 14'
		15' Very moist	
16		16' Gravelly (~30%), small-medium size	
		17' Blue-grey, no gravel, sl. sandy, sl. stiff, v. cohesive, v. moist	Petroleum odor ends at 17.5'
18		Light brown clayey silty (ML), med. stiff, v. moist	
20		Bottom of borehole = 19'	

2005-66-03

STELLAR ENVIRONMENTAL SOLUTIONS, INC
GEOSCIENCE & ENGINEERING CONSULTING

Soil Boring Log

BORING NUMBER VWP-4 Page 1 of 1

PROJECT Redwood Park Service Yard
OWNER East Bay Regional Park District
LOCATION 7867 Redwood Road, Oakland, CA
PROJECT NUMBER 2005-66
TOTAL DEPTH 21 feet bgs
BOREHOLE DIA. 8 inch
SURFACE ELEV. ~564' amsl
WATER FIRST ENCOUNTERED ~20'
DRILLING COMPANY HEW Drilling
DRILLING METHOD Hollow Stem Auger
DRILLER Manuel
GEOLOGIST B. Rucker
DATE DRILLED 11/29/2005

DEPTH (feet)	GRAPHIC LOG	DESCRIPTION/SOIL CLASSIFICATION	REMARKS
0		Brown gravelly silty clay (UFST backfill material) dry, fully friable, sl. cohesive	
2			
4			
6			
8			
10			
12			
14		Dark brown silty clay (CL), sl. moist, sl. plastic, slight petroleum odor, cohesive	
16			
18			
20		Red-brown clayey silty (ML), minor small gravel, sl. moist, mod. stiff, mod. cohesive	
		Bottom of borehole = 21'	

2005-66-04

ORIGINAL
File with DWR

Page 1 of 3

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. e033611

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. VMP-4-15.5'
Date Work Began November 29, 2005, Ended November 29, 2005
Local Permit Agency Alameda County Public Works Agency
Permit No. W2005-1071 Permit Date October 31, 2005

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Hollow Stem FLUID ___

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
	Please see attached geologic log and well construction diagram.
	This is a nested Vapor Monitoring Point (VMP) with two screens in the same borehole (other screen is VMP-4-15.5')
	Well Completion Report No. e033612

TOTAL DEPTH OF BORING 22.5 (Feet)
TOTAL DEPTH OF COMPLETED WELL 17.5 (Feet)

WELL OWNER

Name East Bay Regional Parks District
Mailing Address P.O. Box 5381
Oakland, California 94605
CITY STATE ZIP

WELL LOCATION

Address 7867 Redwood Road
City Oakland
County Alameda County
APN Book ___ Page ___ Parcel ___
Township ___ Range ___ Section ___
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH
Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH

NORTH
WEST — Please See Attached Site Plan — EAST
SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)
WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
Air MONITORING X
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 to 15.5	8-inch	X				PVC	0.5-inch	Schedule 80	
15.5 to 17	8-inch		X			PVC	1-inch	Schedule 80	0.020 inch

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	TYPE CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 to 13	X			
13 to 15		X		
15 to 17.5				# 8/16 sand

ATTACHMENTS (✓)

X Geologic Log
X Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
X Other Site Plan

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Bruce Rucker of Stellar Environmental Solutions, Inc. California R.G. #6814
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

2198 Sixth Street, Suite 201 Berkeley, California 94710
ADDRESS CITY STATE

Signed Bruce M. Rucker
WELL DRILLER/AUTHORIZED REPRESENTATIVE

December 14, 2005
DATE SIGNED

HEW Drilling Co.
604987
C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR
Page 1 of 3
Owner's Well No. VMP-4-20.5'

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. e033612

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Date Work Began November 29, 2005, Ended November 29, 2005
Local Permit Agency Alameda County Public Works Agency
Permit No. W2005-1071 Permit Date October 31, 2005

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Hollow Stem FLUID ___

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
	Please see attached geologic log and well construction diagram.
	This is a nested Vapor Monitoring Point (VMP) with two screens in the same borehole (other screen is VMP-4-15.5')
	Well Completion Report No. e033611

TOTAL DEPTH OF BORING 22.5 (Feet)
TOTAL DEPTH OF COMPLETED WELL 22.5 (Feet)

WELL OWNER

Name East Bay Regional Parks District
Mailing Address P.O. Box 5381
Oakland, California 94605
CITY STATE ZIP

WELL LOCATION

Address 7867 Redwood Road
City Oakland
County Alameda County
APN Book ___ Page ___ Parcel ___
Township ___ Range ___ Section ___
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH
Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH

NORTH
WEST — Please See Attached Site Plan — EAST
SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)
WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
Air MONITORING X
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 to 20.5	8-inch	X				PVC	0.5-inch	Schedule 80	
20.5 to 22	8-inch		X			PVC	1-inch	Schedule 80	0.020 inch

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 to 18	X			
18 to 20		X		
20 to 22.5				# 8/16 sand

ATTACHMENTS (✓)

X Geologic Log
X Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
X Other Site Plan

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Bruce Rucker of Stellar Environmental Solutions, Inc. California R.G. #6814
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

2198 Sixth Street, Suite 201 Berkeley, California 94710
ADDRESS CITY STATE

Signed Bruce M. Rucker
WELL DRILLER/AUTHORIZED REPRESENTATIVE

HEW Drilling Co.
December 14, 2005 DATE SIGNED
604987 C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR
Page 1 of 3

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. e033613

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. VW-2
Date Work Began November 30, 2005, Ended November 30, 2005
Local Permit Agency Alameda County Public Works Agency
Permit No. W2005-1072 Permit Date October 31, 2005

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Hollow Stem FLUID ___

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
	This is a bioventing Vent Well (VW).
	Please see attached geologic log and well construction diagram.

TOTAL DEPTH OF BORING 18 (Feet)
TOTAL DEPTH OF COMPLETED WELL 18 (Feet)

WELL OWNER

Name East Bay Regional Parks District
Mailing Address P.O. Box 5381
Oakland, California 94605
CITY STATE ZIP

WELL LOCATION

Address 7867 Redwood Road
City Oakland
County Alameda County
APN Book ___ Page ___ Parcel ___
Township ___ Range ___ Section ___
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH
Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH

NORTH
WEST — Please See Attached Site Plan — EAST
SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)
WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
Air INJECTION X
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 to 8	8-inch	X				PVC	2-inch	Schedule 40	
8 to 18	8-inch		X			PVC	2-inch	Schedule 40	0.020 inch

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	TYPE CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 to 4	X			
4 to 6		X		
6 to 18				# 8/16 sand

ATTACHMENTS (✓)

X Geologic Log
X Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
X Other Site Plan

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Bruce Rucker of Stellar Environmental Solutions, Inc. California R.G. #6814
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

2198 Sixth Street, Suite 201 Berkeley, California 94710
ADDRESS CITY STATE

HEW Drilling Co.

Signed Bruce M. Rucker
WELL DRILLER/AUTHORIZED REPRESENTATIVE

December 14, 2005
DATE SIGNED

604987
C-57 LICENSE NUMBER

ORIGINAL
File with DWR

Page 1 of 3

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. e033614

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. VW-3

Date Work Began November 28, 2005, Ended November 28, 2005

Local Permit Agency Alameda County Public Works Agency

Permit No. W2005-1073 Permit Date October 31, 2005

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD Hollow Stem FLUID ___

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
	This is a bioventing Vent Well (VW).
	Please see attached geologic log and well construction diagram.

TOTAL DEPTH OF BORING 18 (Feet)

TOTAL DEPTH OF COMPLETED WELL 18 (Feet)

WELL OWNER

Name East Bay Regional Parks District

Mailing Address P.O. Box 5381

Oakland, California 94605

CITY STATE ZIP

WELL LOCATION

Address 7867 Redwood Road

City Oakland

County Alameda County

APN Book ___ Page ___ Parcel ___

Township ___ Range ___ Section ___

Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH

NORTH

WEST — Please See Attached Site Plan — EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
Air INJECTION X
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	8	8-inch	X				PVC	2-inch	Schedule 40	
8	18	8-inch		X			PVC	2-inch	Schedule 40	0.020 inch

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	4	X			
4	6		X		
6	18				# 8/16 sand

ATTACHMENTS (✓)

X Geologic Log
X Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
X Other Site Plan

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Bruce Rucker of Stellar Environmental Solutions, Inc. California R.G. #6814
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

2198 Sixth Street, Suite 201 Berkeley, California 94710
ADDRESS CITY STATE

Signed Bruce M. Rucker
WELL DRILLER/AUTHORIZED REPRESENTATIVE

HEW Drilling Co.

December 14, 2005
DATE SIGNED

604987
C-57 LICENSE NUMBER

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

APPENDIX C

Certified Analytical Laboratory Reports and Chain-of-Custody Records

Waste Soil Disposal Profile Sample

Curtis & Tompkins, Ltd.
Analytical Laboratory Since 1878
2323 Fifth Street
Berkeley, CA 94710
(510) 486-0900 Phone
(510) 486-0532 Fax

CHAIN OF CUSTODY

C & T LOGIN #: 183495

Sampler: B.M. Flinn

Project No.:

Report To: Bruce Rucker

Project Name: Redwood Park

Company: Stellar Environmental Solutions

Project P.O.:

Telephone: 510-674-3123

Turnaround Time: 5 day

Fax:

Lab No.	Sample ID.	Sampling Date Time	Matrix: Soil	Matrix: Water	Matrix: Waste	# of Containers	Preservative: HCL	Preservative: H_2SO_4	Preservative: HNO_3	Preservative: ICE	Analysis: TVH gas + BTEX + MTBE	Analysis: TEH diesel
-1	Soil Drum Comp.	11/30/05 1215	X			1				✓	✓	✓

Notes:
Sample is a composite of 11 55-gal drums of soil (drill cuttings)

SAMPLE RECEIPT
☒ Intact ☒ Cold
☐ On ice ☐ Ambient
Preservative Correct?
☐ Yes ☐ No ☒ N/A

RELINQUISHED BY:
B.M. Flinn 11/30/05 1410 DATE / TIME
DATE / TIME
DATE / TIME

RECEIVED BY:
Lawanna Curtis 11/30/05 2:10 p.m. DATE / TIME
DATE / TIME
DATE / TIME

SIGNATURE

Curtis & Tompkins, Ltd.
Analytical Laboratories, Since 1878

Curtis & Tompkins Laboratories Analytical Report

Lab #:	183495	Location:	Redwood Park
Client:	Stellar Environmental Solutions	Prep:	EPA 5030B
Project#:	STANDARD		
Field ID:	SOIL DRUM COMP	Batch#:	108288
Matrix:	Soil	Sampled:	11/30/05
Basis:	as received	Received:	11/30/05
Diln Fac:	1.000	Analyzed:	12/01/05

Type: SAMPLE Lab ID: 183495-001

Analyte	Result	RL	Units	Analysis
Gasoline C7-C12	2.6	0.95	mg/Kg	EPA 8015B
MTBE	ND	19	ug/Kg	EPA 8021B
Benzene	ND	4.8	ug/Kg	EPA 8021B
Toluene	ND	4.8	ug/Kg	EPA 8021B
Ethylbenzene	28	4.8	ug/Kg	EPA 8021B
m,p-Xylenes	58	4.8	ug/Kg	EPA 8021B
o-Xylene	ND	4.8	ug/Kg	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	105	59-140	EPA 8015B
Bromofluorobenzene (FID)	115	62-149	EPA 8015B
Trifluorotoluene (PID)	99	63-125	EPA 8021B
Bromofluorobenzene (PID)	114	71-129	EPA 8021B

Type: BLANK Lab ID: QC319347

Analyte	Result	RL	Units	Analysis
Gasoline C7-C12	ND	0.20	mg/Kg	EPA 8015B
MTBE	ND	4.0	ug/Kg	EPA 8021B
Benzene	ND	1.0	ug/Kg	EPA 8021B
Toluene	ND	1.0	ug/Kg	EPA 8021B
Ethylbenzene	ND	1.0	ug/Kg	EPA 8021B
m,p-Xylenes	ND	1.0	ug/Kg	EPA 8021B
o-Xylene	ND	1.0	ug/Kg	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	99	59-140	EPA 8015B
Bromofluorobenzene (FID)	104	62-149	EPA 8015B
Trifluorotoluene (PID)	101	63-125	EPA 8021B
Bromofluorobenzene (PID)	107	71-129	EPA 8021B

ND= Not Detected
RL= Reporting Limit

Curtis & Tompkins, Ltd.
Analytical Laboratories, Since 1878

Batch QC Report

Curtis & Tompkins Laboratories Analytical Report

Lab #:	183495	Location:	Redwood Park
Client:	Stellar Environmental Solutions	Prep:	EPA 5030B
Project#:	STANDARD	Analysis:	EPA 8021B
Type:	LCS	Basis:	as received
Lab ID:	QC319348	Diln Fac:	1.000
Matrix:	Soil	Batch#:	108288
Units:	ug/Kg	Analyzed:	12/01/05

Analyte	Spiked	Result	%REC	Limits
MTBE	100.0	109.9	110	71-130
Benzene	100.0	107.4	107	80-120
Toluene	100.0	100.6	101	80-120
Ethylbenzene	100.0	103.6	104	80-120
m,p-Xylenes	100.0	103.2	103	80-120
o-Xylene	100.0	105.0	105	80-120

Surrogate	%REC	Limits
Trifluorotoluene (PID)	98	63-125
Bromofluorobenzene (PID)	110	71-129

Curtis & Tompkins, Ltd.
Analytical Laboratories, Since 1878

Batch QC Report

Curtis & Tompkins Laboratories Analytical Report

Lab #:	183495	Location:	Redwood Park
Client:	Stellar Environmental Solutions	Prep:	EPA 5030B
Project#:	STANDARD	Analysis:	EPA 8015B
Type:	LCS	Basis:	as received
Lab ID:	QC319349	Diln Fac:	1.000
Matrix:	Soil	Batch#:	108288
Units:	mg/Kg	Analyzed:	12/01/05

Analyte	Spiked	Result	%REC	Limits
Gasoline C7-C12	10.00	10.66	107	80-120

Surrogate	%REC	Limits
Trifluorotoluene (FID)	123	59-140
Bromofluorobenzene (FID)	118	62-149

Curtis & Tompkins, Ltd.
Analytical Laboratories, Since 1878

Batch QC Report

Curtis & Tompkins Laboratories Analytical Report

Lab #:	183495	Location:	Redwood Park
Client:	Stellar Environmental Solutions	Prep:	EPA 5030B
Project#:	STANDARD	Analysis:	EPA 8015B
Field ID:	SOIL DRUM COMP	Diln Fac:	1.000
MSS Lab ID:	183495-001	Batch#:	108288
Matrix:	Soil	Sampled:	11/30/05
Units:	mg/Kg	Received:	11/30/05
Basis:	as received	Analyzed:	12/02/05

Type: MS Lab ID: QC319350

Analyte	MSS Result	Spiked	Result	%REC	Limits
Gasoline C7-C12	2.570	10.53	13.06	100	44-120

Surrogate	%REC	Limits
Trifluorotoluene (FID)	118	59-140
Bromofluorobenzene (FID)	115	62-149

Type: MSD Lab ID: QC319351

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Gasoline C7-C12	10.99	11.60	82	44-120	15	23

Surrogate	%REC	Limits
Trifluorotoluene (FID)	113	59-140
Bromofluorobenzene (FID)	111	62-149

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.
Analytical Laboratories, Since 1878

Total Extractable Hydrocarbons

Lab #:	183495	Location:	Redwood Park
Client:	Stellar Environmental Solutions	Prep:	SHAKER TABLE
Project#:	STANDARD	Analysis:	EPA 8015B
Field ID:	SOIL DRUM COMP	Batch#:	108295
Matrix:	Soil	Sampled:	11/30/05
Units:	mg/Kg	Received:	11/30/05
Basis:	as received	Prepared:	12/01/05
Diln Fac:	1.000	Analyzed:	12/02/05

Type: SAMPLE Lab ID: 183495-001

Analyte	Result	RL
Diesel C10-C24	17 H L Y	1.0

Surrogate	%REC	Limits
Hexacosane	108	48-132

Type: BLANK Cleanup Method: EPA 3630C
Lab ID: QC319372

Analyte	Result	RL
Diesel C10-C24	ND	1.0

Surrogate	%REC	Limits
Hexacosane	93	48-132

H= Heavier hydrocarbons contributed to the quantitation
L= Lighter hydrocarbons contributed to the quantitation
Y= Sample exhibits chromatographic pattern which does not resemble standard
ND= Not Detected
RL= Reporting Limit

Curtis & Tompkins, Ltd.
Analytical Laboratories, Since 1878

Batch QC Report

Total Extractable Hydrocarbons

Lab #:	183495	Location:	Redwood Park
Client:	Stellar Environmental Solutions	Prep:	SHAKER TABLE
Project#:	STANDARD	Analysis:	EPA 8015B
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC319373	Batch#:	108295
Matrix:	Soil	Prepared:	12/01/05
Units:	mg/Kg	Analyzed:	12/02/05
Basis:	as received		

Cleanup Method: EPA 3630C

Analyte	Spiked	Result	%REC	Limits
Diesel C10-C24	49.58	46.64	94	54-137

Surrogate	%REC	Limits
Hexacosane	96	48-132

Curtis & Tompkins, Ltd.
Analytical Laboratories, Since 1878

Batch QC Report

Total Extractable Hydrocarbons

Lab #:	183495	Location:	Redwood Park
Client:	Stellar Environmental Solutions	Prep:	SHAKER TABLE
Project#:	STANDARD	Analysis:	EPA 8015B
Field ID:	ZZZZZZZZZZ	Batch#:	108295
MSS Lab ID:	183505-003	Sampled:	11/30/05
Matrix:	Soil	Received:	11/30/05
Units:	mg/Kg	Prepared:	12/01/05
Basis:	as received	Analyzed:	12/02/05
Diln Fac:	1.000		

Type: MS Lab ID: QC319374

Analyte	MSS Result	Spiked	Result	%REC	Limits
Diesel C10-C24	0.4536	50.13	47.46	94	28-163

Surrogate	%REC	Limits
Hexacosane	92	48-132

Type: MSD Lab ID: QC319375

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Diesel C10-C24	50.42	50.67	100	28-163	6	46

Surrogate	%REC	Limits
Hexacosane	97	48-132

RPD= Relative Percent Difference

December 2005 Soil Vapor Samples

2665 Park Center Drive, Suite D Simi Valley, California 93065 (805) 526-7161 ph (805) 526-7270 fax

Columbia Analytical Services INC.
An Employee - Owned Company

December 28, 2005

Mr. Bruce Rucker
Stellar Environmental Solutions, Inc.
2198 Sixth Street #201
Berkeley, CA 94710

RE: P2503094
Redwood Bioventing/2005-02

Dear Mr. Rucker:

Enclosed are the results of the sample(s) submitted to our laboratory on December 12, 2005. For your reference, these analyses have been assigned our service request number P2503094.

All analyses were performed in accordance with our laboratory's quality assurance program. Results are intended to be considered in their entirety and apply only to the samples analyzed. Columbia Analytical Services is not responsible for use of less than the complete report. Your report contains 13 pages.

Columbia Analytical Services is certified by the California Department of Health Services, Certificate No. 2380; Arizona Department of Health Services, Certificate No. AZ0550; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA20007; The American Industrial Hygiene Association, Laboratory #101661. Please contact me for specific method(s) and analyte(s) corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

Columbia Analytical Services, Inc.

Kate Aguilera
Project Manager

2665 Park Center Drive, Suite D Simi Valley, California 93065 (805) 526-7161 ph (805) 526-7270 fax

Columbia Analytical Services INC.
An Employee - Owned Company

LABORATORY REPORT

Client:	Stellar Environmental Solutions, Inc.	Date of Report:	12/28/05
Address:	2198 Sixth Street #201	Date Received:	12/12/05
	Berkeley, CA 94710	CAS Project No:	P2503094
Contact:	Mr. Bruce Rucker	Purchase Order:	2005-02

Client Project ID: Redwood Bioventing/2005-02

Six (6) Stainless Steel Summa Canisters labeled:

"VMP-1-Shallow" "VMP-2-Shallow" "VMP-3-Shallow"
"VW-1" "VW-3" "VW-2"

The samples were received at the laboratory under chain of custody on December 12, 2005. The samples were received intact. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time that they were received at the laboratory.

Total Petroleum Hydrocarbons as Gasoline Analysis

The samples were analyzed for total petroleum hydrocarbons as gasoline per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

Reviewed and Approved:

Regan Lau
Analytical Chemist
Air Quality Laboratory

Reviewed and Approved:

Wade Henton
GC-VOA Team Leader
Air Quality Laboratory

2665 Park Center Drive, Suite D Simi Valley, California 93065 (805) 526-7161 ph (805) 526-7270 fax

Columbia Analytical Services INC.
An Employee - Owned Company

CAS Project No: P2503094

BTEX/MTBE Analysis

The samples were also analyzed for methyl tert-butyl ether, benzene, toluene, ethylbenzene, and xylenes according to modified CARB Method 410. This method is based on the separation of a gas mixture using dual column high resolution gas chromatographic column followed by measurement of the separated components with dual photoionization detectors (PID). One of the columns serves as the quantitation column and the other the confirmation column. The retention times of each separated component are compared with those of known compounds under identical conditions on the respective column. Only components that contain a peak on both the quantitation column and the confirmation column in the proper retention time window are positively confirmed.

The concentration for each analyte is calculated from each column and compared by relative percent difference. If the RPD is within acceptable limits the lower of the two concentrations is reported; however if the result exceeds the criteria, the lower value is reported with a matrix interference qualifier.

The results of analyses are given on the attached data sheets. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Client: **Stellar Environmental Solutions, Inc.**
Client Project ID: **Redwood Bioventing/2005-02** CAS Project ID: P2503094

Total Petroleum Hydrocarbons (TPH) as Gasoline

Test Code: EPA TO-3 Modified
Instrument ID: HP5890 II/GC11/FID
Analyst: Regan Lau
Sampling Media: Summa Canister(s)
Test Notes:

Date Collected: 12/9/05
Date Received: 12/12/05
Date Analyzed: 12/16/05
Volume(s) Analyzed: 1.00 ml
0.50 ml
0.10 ml

Client Sample ID	CAS Sample ID	D. F.	Total Petroleum Hydrocarbons (TPH) as Gasoline				Data Qualifier
			Result mg/m³	MRL mg/m³	Result ppmV	MRL ppmV	
VMP-1-Shallow	P2503094-001	1.36	ND	24	ND	6.9	
VMP-2-Shallow	P2503094-002	1.26	**18,000**	230	**5,100**	64	
VMP-3-Shallow	P2503094-003	1.39	ND	25	ND	7.1	
VW-1	P2503094-004	1.15	**160**	21	**45**	5.9	**G**
VW-3	P2503094-005	1.46	**8,700**	26	**2,500**	7.5	**G**
VW-2	P2503094-006	1.31	**14,000**	47	**4,100**	13	**G**
Method Blank	P051216-MB	1.00	ND	18	ND	5.1	

Parts Per Million Results Are Based on a Molecular Weight of 86.18
ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.
G = Quantitated using fuel calibration, but pattern does not match current gasoline standard.

Verified By: RC Date: 12/27/05

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Client: **Stellar Environmental Solutions, Inc.**
Client Sample ID: **VMP-1-Shallow** CAS Project ID: P2503094
Client Project ID: **Redwood Bioventing/2005-02** CAS Sample ID: P2503094-001

Test Code: CARB 410 Modified Date Collected: 12/9/05
Instrument ID: HP5890A/GC2/PID Date Received: 12/12/05
Analyst: Regan Lau Date Analyzed: 12/16/05
Sampling Media: Summa Canister Volume(s) Analyzed: 1.00 ml
Test Notes:
Container ID : 1SC00087

Pi 1 = -2.6 Pf 1 = 1.8
D.F. = 1.36

CAS #	Compound	Result mg/m³	MRL mg/m³	Result ppmV	MRL ppmV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.25	ND	0.068	
71-43-2	Benzene	ND	0.22	ND	0.068	
108-88-3	Toluene	ND	0.26	ND	0.068	
100-41-4	Ethylbenzene	ND	0.30	ND	0.068	
136777-61-2	*m,p* -Xylenes	ND	0.30	ND	0.068	
95-47-6	*o* -Xylene	ND	0.30	ND	0.068	

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit.**
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: Rc Date: 12/27/05

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Client: **Stellar Environmental Solutions, Inc.**
Client Sample ID: **VMP-2-Shallow** CAS Project ID: P2503094
Client Project ID: **Redwood Bioventing/2005-02** CAS Sample ID: P2503094-002

Test Code: CARB 410 Modified Date Collected: 12/9/05
Instrument ID: HP5890A/GC2/PID Date Received: 12/12/05
Analyst: Regan Lau Date Analyzed: 12/16/05
Sampling Media: Summa Canister Volume(s) Analyzed: 1.00 ml
Test Notes:
Container ID : 1SC00037

Pi 1 = -1.5 Pf 1 = 1.9
D.F. = 1.26

CAS #	Compound	Result mg/m³	MRL mg/m³	Result ppmV	MRL ppmV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	**77**	0.23	**21**	0.063	**PI**
71-43-2	Benzene	**190**	0.20	**61**	0.063	**PI**
108-88-3	Toluene	**110**	0.24	**28**	0.063	
100-41-4	Ethylbenzene	**350**	0.27	**80**	0.063	
136777-61-2	*m,p* -Xylenes	**1,200**	0.27	**280**	0.063	
95-47-6	*o* -Xylene	**160**	0.27	**36**	0.063	**PI**

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit.**
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.
PI = Possible/Probable Interference and/or Analyte whose concentration has a greater than 25% difference for detected concentrations between the GC primary and confirmation columns.

Verified By: RC Date: 12/27/05

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Client: **Stellar Environmental Solutions, Inc.**
Client Sample ID: **VMP-3-Shallow** CAS Project ID: P2503094
Client Project ID: **Redwood Bioventing/2005-02** CAS Sample ID: P2503094-003

Test Code: CARB 410 Modified Date Collected: 12/9/05
Instrument ID: HP5890A/GC2/PID Date Received: 12/12/05
Analyst: Regan Lau Date Analyzed: 12/16/05
Sampling Media: Summa Canister Volume(s) Analyzed: 1.00 ml
Test Notes:
Container ID : 1SC00027

Pi 1 = -3.2 Pf 1 = 1.3
D.F. = 1.39

CAS #	Compound	Result mg/m³	MRL mg/m³	Result ppmV	MRL ppmV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.25	ND	0.070	
71-43-2	Benzene	ND	0.22	ND	0.070	
108-88-3	Toluene	ND	0.26	ND	0.070	
100-41-4	Ethylbenzene	ND	0.30	ND	0.070	
136777-61-2	*m,p* -Xylenes	ND	0.30	ND	0.070	
95-47-6	*o* -Xylene	ND	0.30	ND	0.070	

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit.**
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: RC Date: 12/27/05

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Client: **Stellar Environmental Solutions, Inc.**
Client Sample ID: **VW-1**
Client Project ID: **Redwood Bioventing/2005-02**

CAS Project ID: P2503094
CAS Sample ID: P2503094-004

Test Code: CARB 410 Modified
Instrument ID: HP5890A/GC2/PID
Analyst: Regan Lau
Sampling Media: Summa Canister
Test Notes:
Container ID : 1SC00048

Date Collected: 12/9/05
Date Received: 12/12/05
Date Analyzed: 12/16/05
Volume(s) Analyzed: 1.00 ml

Pi 1 = -1.0 Pf 1 = 1.1

D.F. = 1.15

CAS #	Compound	Result mg/m³	MRL mg/m³	Result ppmV	MRL ppmV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.21	ND	0.058	
71-43-2	Benzene	ND	0.18	ND	0.058	
108-88-3	Toluene	ND	0.22	ND	0.058	
100-41-4	Ethylbenzene	ND	0.25	ND	0.058	
136777-61-2	*m,p* -Xylenes	**0.25**	0.25	**0.058**	0.058	**NX, PI**
95-47-6	*o* -Xylene	ND	0.25	ND	0.058	

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.
PI = Possible/Probable Interference and/or Analyte whose concentration has a greater than 25% difference for detected concentrations between the GC primary and confirmation columns.
NX = Chromatogram does not resemble Xylene

Verified By: RC Date: 12/27/05

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Client: **Stellar Environmental Solutions, Inc.**
Client Sample ID: **VW-3**
Client Project ID: **Redwood Bioventing/2005-02**

CAS Project ID: P2503094
CAS Sample ID: P2503094-005

Test Code: CARB 410 Modified
Instrument ID: HP5890A/GC2/PID
Analyst: Regan Lau
Sampling Media: Summa Canister
Test Notes:
Container ID : 1SC00089

Date Collected: 12/9/05
Date Received: 12/12/05
Date Analyzed: 12/16/05
Volume(s) Analyzed: 1.00 ml

Pi 1 = -3.7 Pf 1 = 1.4

D.F. = 1.46

CAS #	Compound	Result mg/m³	MRL mg/m³	Result ppmV	MRL ppmV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.26	ND	0.073	
71-43-2	Benzene	**6.1**	0.23	**1.9**	0.073	**NX, PI**
108-88-3	Toluene	**32**	0.28	**8.5**	0.073	
100-41-4	Ethylbenzene	ND	0.32	ND	0.073	
136777-61-2	*m,p* -Xylenes	**34**	0.32	**7.9**	0.073	**NX**
95-47-6	*o* -Xylene	ND	0.32	ND	0.073	

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.
PI = Possible/Probable Interference and/or Analyte whose concentration has a greater than 25% difference for detected concentrations between the GC primary and confirmation columns.
NX = Chromatogram does not resemble benzene and xylene

Verified By: RC Date: 12/27/05

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Client: **Stellar Environmental Solutions, Inc.**
Client Sample ID: **VW-2** CAS Project ID: P2503094
Client Project ID: **Redwood Bioventing/2005-02** CAS Sample ID: P2503094-006

Test Code: CARB 410 Modified
Instrument ID: HP5890A/GC2/PID
Analyst: Regan Lau
Sampling Media: Summa Canister
Test Notes:
Container ID : 1SC00034

Date Collected: 12/9/05
Date Received: 12/12/05
Date Analyzed: 12/16/05
Volume(s) Analyzed: 1.00 ml

Pi 1 = -2.7 Pf 1 = 1.0

D.F. = 1.31

CAS #	Compound	Result mg/m³	MRL mg/m³	Result ppmV	MRL ppmV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.24	ND	0.065	
71-43-2	Benzene	**9.1**	0.21	**2.8**	0.065	**NX, PI**
108-88-3	Toluene	**12**	0.25	**3.3**	0.065	
100-41-4	Ethylbenzene	**11**	0.28	**2.5**	0.065	**PI**
136777-61-2	*m,p* -Xylenes	**6.6**	0.28	**1.5**	0.065	**NX, PI**
95-47-6	*o* -Xylene	ND	0.28	ND	0.065	

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit.**
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.
PI = Possible/Probable Interference and/or Analyte whose concentration has a greater than 25% difference for detected concentrations between the GC primary and confirmation columns.
NX = Chromatogram does not resemble benzene and xylene

Verified By: RC Date: 12/27/05

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Client: **Stellar Environmental Solutions, Inc.**
Client Sample ID: **Method Blank** CAS Project ID: P2503094
Client Project ID: **Redwood Bioventing/2005-02** CAS Sample ID: P051216-MB

Test Code: CARB 410 Modified Date Collected: NA
Instrument ID: HP5890A/GC2/PID Date Received: NA
Analyst: Regan Lau Date Analyzed: 12/16/05
Sampling Media: Summa Canister Volume(s) Analyzed: 1.00 ml
Test Notes:

D.F. = 1.00

CAS #	Compound	Result mg/m³	MRL mg/m³	Result ppmV	MRL ppmV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.18	ND	0.050	
71-43-2	Benzene	ND	0.16	ND	0.050	
108-88-3	Toluene	ND	0.19	ND	0.050	
100-41-4	Ethylbenzene	ND	0.22	ND	0.050	
136777-61-2	*m,p* -Xylenes	ND	0.22	ND	0.050	
95-47-6	*o* -Xylene	ND	0.22	ND	0.050	

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: RC Date: 12/27/05

Columbia Analytical Services, Inc.
Sample Acceptance Check Form

Client: Stellar Environmental Solutions, Inc. Work order: P2503094

Project: Redwood Bioventing/2005-02

Sample(s) received on: 12/12/05 Date opened: 12/12/05 by: MZ

Note: This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client or as required by the method/SOP.

			Yes	No	N/A
1	Were **custody seals** on outside of cooler/Box?		☐	☒	☐
	Location of seal(s)? _____	Sealing Lid?	☐	☐	☒
	Were signature and date included?		☐	☐	☒
	Were seals intact?		☐	☐	☒
	Were custody seals on outside of sample container?		☐	☒	☐
	Location of seal(s)? _____	Sealing Lid?	☐	☐	☒
	Were signature and date included?		☐	☐	☒
	Were seals intact?		☐	☐	☒
2	Were **sample containers** properly marked with client sample ID?		☒	☐	☐
3	Did **sample containers** arrive in good condition?		☒	☐	☐
4	Were **chain-of-custody** papers used and filled out?		☒	☐	☐
5	Did **sample container labels** and/or tags agree with custody papers?		☒	☐	☐
6	Was **sample volume** received adequate for analysis?		☒	☐	☐
7	Are samples within specified holding times?		☒	☐	☐
8	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?		☐	☐	☒
	Cooler Temperature NA °C				
	Blank Temperature NA °C				
9	Is pH (acid) **preservation** necessary, according to method/SOP or Client specified information?		☐	☐	☒
	Is there a client indication that the submitted samples are **pH** (acid) preserved?		☐	☐	☒
	Were **VOA vials** checked for presence/absence of air bubbles?		☐	☐	☒
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?		☐	☐	☒
10	**Tubes:** Are the tubes capped and intact?		☐	☐	☒
	Do they contain moisture?		☐	☐	☒
11	**Badges:** Are the badges properly capped and intact?		☐	☐	☒
	Are dual bed badges separated and individually capped and intact?		☐	☐	☒

Lab Sample ID	Required pH (as received, if required)	pH (as received, if required)	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P2503094-001			NA	
P2503094-002			NA	
P2503094-003			NA	
P2503094-004			NA	
P2503094-005			NA	
P2503094-006			NA	

Explain any discrepancies: (include lab sample ID numbers):

Page 1 of 1

Chain of Custody Record & Analytical Service Request

Columbia Analytical Services, Inc.
An Employee - Owned Company

Air Quality Laboratory
2665 Park Center Drive, Suite D
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Requested Turnaround Time by Close of Business Day (Surcharges) Please Circle:
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (15%) (10 Day-Standard)

CAS Project No. P2503094

CAS Contact: Kate Aguilera

Reporting Information (Company Name & Address)
Stellar Environmental Solutions, Inc
2198 Sixth St #201
Berkeley CA 94710

Attention: BRUCE RUCKER

Phone 510/644-3123 Fax 510/644-3859

Email Address for Result Reporting: brucker@stellar-environmental.com

P.O. # / Billing Information: 2005-02

Project Name: REDWOOD BLANKETING

Project Number: 2005-02

Sampler (Print & Sign): JOSEPH DUNAN

Analysis Method and/or Analytes

Client Sample ID	Date Collected	Time Collected	Lab Sample No.	Sample Type (Air/Liquid /Solid/Tube)	Canister ID (Bar Code#)	Flow Controller (Bar Code #)	Sample Volume	TO-3	TO-3	Comments e.g. Preservative or specific instructions
VMP-1-Shallow	12/9/05	1250	(1)	AIR	ISC00087	NA	1L	TO-3	-5.2	
VMP-2-Shallow		1305	(2)		ISC00037			TO-3	-3.1	
VMP-3-Shallow		1230	(3)		ISC00027			TO-3	-6.5	Sample Not Collected
~~VMP-4-Shallow~~					~~ISC00034~~			~~TO-3~~		
VW-1		1455	(4)		ISC00048			TO-3	-2.1	
~~VW-2~~					~~ISC00090~~			~~TO-3~~		Do Not Analyze
VW-3		1430	(5)		ISC00080			TO-3	-7.5	
VW-2	12/9/05	1600	(6)	AIR	ISC00034	NA	1L	TO-3	-5.8	

Report Tier Levels - please select
Tier I - (default if not specified) ✓
Tier II (QC forms) ____
Tier III (QC, Raw Data, Spectra) 10% Surcharge ____
Other ____

EDD required (Yes) / No
Type: ____

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date: 12/9/05	Time: 1700	Received by: (Signature) TO FED EX	Date: 12/9/05	Time: 1700
Relinquished by: (Signature) Fedex	Date:	Time:	Received by: (Signature)	Date: 12/10/05	Time: 0900
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank Temperature ____ °C

APPENDIX D

Waste Soil Disposal Documentation

Morgan Environmental Services, Inc.-P.M. Sheet

PH# (510)-267-0134 FX# (510)-267-0140

DATE:	12/12/05	**Start Time:**	1300	☐	**Emergency Response**
ME#	4380	**Meal:**	0	☐	**Special**
Customer:	Stellar Environmental	**Stop Time:**	1630	☒	**NON-ER**
Site Address:	7867 Redwood Rd. Oakland, Ca.	**P.M. Signature:**		☐	**Bill Per Quote**

Code	Title	Name / Item	Unit#	Leave Yard	Arrive Site	Leave Site	Arrive Yard	Restock Start	Restock Stop	Total Hours
5635459	PM									
5635460	PM-OT									
5635465	Super									
5635466	Sup-OT									
5635486	Tech	W. Young								3.5
5635487	Tech-ot									
5635486	Tech									
5635487	Tech-ot									
5635486	Tech									
5635487	Tech-ot									
		ERV	26							3.5
5630498	Pick-Up	¾ Ton Pickup W/ O Operator								
5630498	Pick-Up	¾ Ton Pickup W/ O Operator								

COMMENTS: Manifest# N/A
Non-Haz. Waste Man. #4380A
Pkd Drums of Non-Haz Dirt

Contact Name:	
Contact Phone#:	
Contact Fax#:	
Job Site:	Redwood Park
Site Contact:	Joseph Phan
Site Contact Phone#:	510-644-3123

Please print or type
(Form designed for use on elite (12-pitch) typewriter.)

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. NON Applicable | Manifest Doc. No. 43804 | 2. Page 1 of 1

GENERATOR

3. Generator's Name and Mailing Address
East Bay Regional Park District
P.O. Box 5381 — Oakland, Ca. 94605-0381

4. Generator's Phone (510) 649 - 3313

5. Transporter 1 Company Name: Morgan Environmental, Inc.

6. US EPA ID Number: CAT 080013428

A. Transporter's Phone: 510-267-0134

7. Transporter 2 Company Name

8. US EPA ID Number

B. Transporter's Phone

9. Designated Facility Name and Site Address
~~ALTAMONT LANDFILL~~ D/K Environmental
~~10840 ALTAMONT PASS RD.~~ 3650 East 26th St
~~LIVERMORE, CA 94550~~ Vernon, Ca. 90023

10. US EPA ID Number: CAT 080033681
~~CAD981382732~~

C. Facility's Phone: 323-268-5056
~~(925) 449-6349~~

11. Waste Shipping Name and Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
a. Non-Hazardous Waste Solid	21	DM	87.00	P
b.				
c.				
d.				

D. Additional Descriptions for Materials Listed Above
a) Soil Cuttings

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
MFst 4380
Site: 7867 Redwood Rd.
Oakland, Ca.

PROFILE # _____

CUSTOMER NAME _____

16. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name: ~~BCPH~~ Dwayne - Stellar Environmental | Signature | Month 12 | Day 12 | Year 05

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Warren A. Young | Signature | Month | Day | Year

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month | Day | Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name | Signature | Month | Day | Year

Printed by JOHN KELLER & ASSOCIATES, INC.
Neenah, WI 54957-0368

TRANSPORTER #1