FOCUSED FEASIBILITY STUDY
Rainier Avenue Facility Remediation
Prepared for: Darigold, Inc.

Project No. 090066-003-05 • February 18, 2011

Aspect CONSULTING

earth + water

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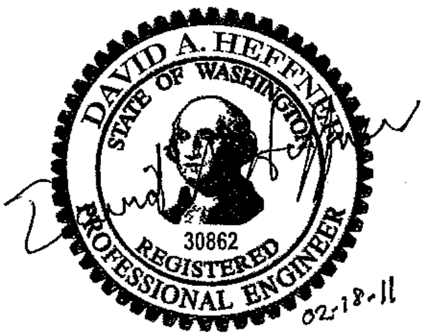

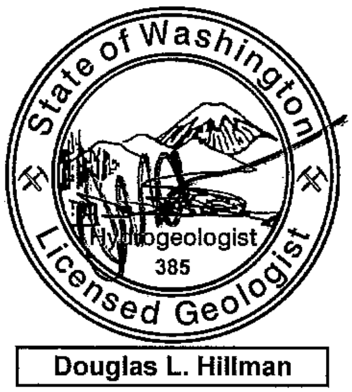

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Contents

List of Tables

List of Figures

List of Appendices

ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
ARARs	applicable or relevant and appropriate requirements
AS	air sparge
AST	above-ground storage tank
Aspect	Aspect Consulting, LLC
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
COCs	chemicals of concern
DO	dissolved oxygen
DPE	dual-phase extraction
DRPH	diesel-range petroleum hydrocarbons
Ecology	Washington State Department of Ecology
EPA	United State Environmental Protection Agency
FFS	Focused Feasibility Study
GRPH	gasoline-range petroleum hydrocarbons
iow	inches of water
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MTBE	methyl tertiary-butyl ether
MTCA	Washington State Model Toxics Control Act
O&M	operation and maintenance
ORPH	oil-range petroleum hydrocarbons
psig	pounds per square inch gauge
the Property	4058 Rainier Avenue South, Seattle, Washington

RAOs	Remedial Action Objectives
RCW	Revised Code of Washington
RI	remedial investigation
ROI	radius of influence
ROW	right-of-way
scfm	standard cubic feet per minute
SES	Sound Environmental Strategies Corporation
SPH	separate-phase hydrocarbon
SVE	soil vapor extraction
UST	underground storage tank
WAC	Washington Administrative Code

1 Introduction

This focused feasibility study (FFS) evaluates alternatives for environmental cleanup at Darigold's Rainier Avenue Facility located at 4058 Rainier Avenue South in Seattle (the Property). Releases from former underground storage tank (UST) systems have impacted soil and groundwater in the North Yard of the facility with petroleum hydrocarbons in the gasoline and diesel ranges, as well as the gasoline additive methyl tertiary-butyl ether (MTBE). SoundEarth Strategies Inc. (previously known as Sound Environmental Strategies Corporation [SES]) and others have conducted multiple site investigations over the past 20 years. In addition, SES pilot-tested several remedial technologies in June 2008. It also designed and oversaw installation of an air sparge/soil vapor extraction (AS/SVE) system in August 2008. That system has yet to be operated.

Aspect Consulting, LLC (Aspect), on behalf of Darigold, Inc. (Darigold), prepared this report. It represents a compilation of site investigation, pilot testing, and cleanup alternative assessment information prepared by SES and Aspect's technical memorandum dated October 8, 2010 (Aspect, 2010).

1.1 Document Purpose and Organization

The Washington Model Toxics Control Act (MTCA) specifies that a feasibility study be conducted in accordance with Washington Administrative Code (WAC) sections 173-340-350 through 173-340-390. The feasibility study serves as the mechanism to develop remedial action alternatives, comparatively evaluate them against criteria specified under MTCA, and recommend the alternative that best satisfies the evaluation criteria. This FFS is organized into the following sections:

Section 2.0, Background. This section discusses the Property location and description, its geologic and hydrogeologic setting, environmental investigations conducted at the Property, chemicals of concern (COCs), impacted media, exposure pathways, and the Site definition.

Section 3.0, Pilot Testing. This section summarizes the remedial technologies tested at the Property, the testing procedures for each technology, and the results of the pilot tests.

Section 4.0, Remedial Alternatives Assessment. This section discusses applicable or relevant and appropriate requirements (ARARs), proposes appropriate Site cleanup levels, and develops remedial action objectives (RAOs). Potentially-applicable remedial components are then identified and screened. Components retained by the screening process are combined into several remedial alternatives representing a broad range of possible responses, and those alternatives are evaluated with respect to the MTCA criteria.

Section 5.0, Recommendations. This section recommends for implementation the remedial alternative that best satisfies the evaluation criteria. It also provides recommendations for additional investigation and pilot testing.

2 Background

2.1 Property Location and Description

The Property consists of a single trapezoidal tax parcel (King County parcel number 7950301240) encompassing approximately 296,097 square feet (6.80 acres) of land situated southeast of the intersection of Rainier Avenue South and South Andover Street in Seattle, Washington (Figure 1). The Property is developed with a dairy-processing facility, which was originally built during the 1920s (ENVIRON International Corporation [Environ], 2004). Darigold completed a series of plant upgrades and expansions between 1952 and 1988 resulting in the existing configuration of the 150,000-square foot facility. The main building at the Property occupies most of the western half of the Property. Employee parking occupies the eastern third of the Property. The truck delivery and storage yard occupies the north end and central portion of the Property (Figure 2). A few small out-buildings are also present.

The perimeter of the Property is fenced. Vehicle and pedestrian access to the Property is gained through monitored, remote-controlled service gates situated at the north and south property boundaries. The North Yard of the dairy-processing facility consists of a truck loading dock constructed over a basement. Approximately 40 to 50 tractor-trailer trucks pass through the Property each day, 24 hours per day, seven days per week. The tractor-trailer trucks drive through the North Yard to access the northwestern-most loading docks, where inventory exits the building continuously.

A 40-foot wide concrete apron surfaces the truck delivery yard next to the north loading dock. The concrete apron is 9 to 18 inches thick and reinforced with welded-wire mesh. Refrigerated trailers used for product cold-storage are parked permanently on the concrete apron at the north end of the facility. They extend the cold-storage capacity of the facility. Zipper drains mark the transition between the concrete apron and surrounding asphalt-paved surfaces of the truck delivery and storage yard. The basement of the dairy-processing facility extends approximately 10 feet below the surrounding surface, and is constructed on the grade-beams of a pile-supported foundation system. The perimeter foundation drains and a basement slab drainage system discharge north into a manhole located 80 feet west of the northeast corner of the facility. The manhole discharges northeast into a storm sewer main located in the Andover right-of-way (ROW). A network of storm sewer and sanitary sewer utilities pass between the north end of the dairy-processing facility and South Andover Street (Figure 2). The facility is serviced by underground sanitary sewer, water, storm sewer, natural gas, and overhead power utilities. Setbacks for overhead power lines in the Andover ROW encroach onto the north end of the Property.

Consolidated Dairy Products Company, Darigold's corporate predecessor, purchased the lots now comprising the Site at various times from 1952 to 1966 (SES, 2004a). From 1952 onward, several USTs were installed on the property as part of a fuel supply system (SES, 2004a). The USTs were removed in 1990, 1998, and 2004 (SES, 2004a).

The Property is bordered by public right-of-ways on four sides: Rainier Avenue South to the west, South Andover Street to the north, Courtland Place South to the east, and South

Dakota Street to the south. Additionally, a strip mall and supermarket are located to the north across South Andover Street. The areas to the east, west and south contain a mix of residential housing and commercial buildings. The proposed interim remediation activities would be visible and audible from neighboring residences and businesses.

2.2 Geologic and Hydrogeologic Setting

The geology and hydrogeology influence the mobility and distribution of contaminants, the stability of open excavations, and the effectiveness of individual remedial technologies. Subsurface conditions at the Property are characterized by urban fill placed over inter-bedded clay and sand to the depths explored, up to 30 feet below ground surface (bgs). The first water-bearing zone occurs within approximately 10 feet of the ground surface in the North Yard.

2.2.1 Physiographic Setting and Geology

The Property and surrounding area comprise a gently rolling upland deposited during the Vashon Stade of the last episode of continental glaciation, which ended approximately 13,500 years ago. Review of geologic maps indicates that the Property has been re-graded using artificial fill of unspecified thickness, and that native soils beneath the artificial fill layer consist of Vashon recessional lacustrine deposits (Troost, et. al, 2005).

The Property is located within the Rainier Valley between Beacon Hill to the west and an unnamed ridge to the east. The valley formed in soft to medium stiff, glacial recessional silts and clay. Artificial fill was placed in the bottom of the valley during the first half of the 20th Century. The land surface of the North Yard of the Property has been filled to an elevation of approximately 40 feet above mean sea level and graded flat to shed storm runoff towards the north and east. The natural drainage pattern within the Rainier Valley is towards the south into Lake Washington via the Wetmore Slough (USGS, 1895), now known as Genesee Park (Figure 1). Data developed at the Property indicate that the overall direction of groundwater flow beneath the North Yard of the Property is towards the west-southwest.

2.2.2 Subsurface Soil Conditions

The results of investigations performed at the Property between 1990 and 2009 are consistent with the above-referenced geologic mapping. The North Yard is underlain by loose, artificial fill to depths ranging from 1 to 8.5 or more feet. The artificial fill is mixed with construction debris including wood, concrete, brick, and metal. Subsurface investigations have encountered construction debris less frequently with increasing distance from the former UST excavation (SD&C, 1998; Integral, 2003). Therefore, the character of the fill material is variable based on texture, permeability, organic content, and debris content.

Beneath the artificial layer, investigations performed by SES and others encountered stiff, high plasticity clay to fine sandy clay beneath the Andover ROW and the northern and eastern portions of the North Yard. Boring SB-3 encountered clay and sandy clay soils to depths of at least 29 feet bgs approximately 5 feet west of the former 2004 UST excavation. West of the former fueling facility the clay grades into silt, sandy clay, clayey sand, and gravelly sand. Subsurface investigations encountered sand and gravelly sand beneath the north end of the existing basement in monitoring wells MW14 through MW17. This granular soil deposit extends at least 10 feet north of the building footprint past monitoring wells MW08, MW10, MW11, air-sparging wells AS01, AS02, AS03, and pilot well PE01.

The former 2004 UST excavation was backfilled with pea gravel. The contrasting permeability between the pea gravel backfill and the surrounding native silts and clays allows groundwater to accumulate in the former UST cavity and results in radial groundwater flow directions and contaminant distribution patterns. Soil sample locations and cross-section locations are presented on Figure 2. Generalized cross-sections that depict the subsurface soil conditions beneath the North Yard are presented on Figures 3 through 5.

2.2.3 Groundwater Conditions

Soil borings advanced between May 2004 and October 2009 encountered water-bearing conditions in native soils at depths ranging from 1 to 13 feet bgs. Groundwater levels generally range from approximately 6 to 11 feet bgs beneath the North Yard and from approximately 0.9 to 2.2 feet beneath the basement floor. The 2009 Semi-Annual Groundwater Monitoring Report by SES, dated January 7, 2010, describes estimated directions of groundwater flow and groundwater gradients beneath the North Yard and the Andover ROW. Based on water level measurements collected on October 27, 2009, at the Property, the overall direction of groundwater beneath the North Yard is towards the west-southwest at a gradient of approximately 0.036 vertical feet per horizontal foot (ft/ft). Historical groundwater analytical results are summarized in Table 1.

2.3 Environmental Investigations

This section presents a chronology and overview of environmental investigations at the Property. Sample locations are shown on Figure 2. Historical groundwater and soil analytical results are presented in Tables 1 and 2, respectively. The compiled results of these investigations contributed to the development of a Conceptual Site Model that guided the selection of remedial technologies for implementation in the North Yard. Site characterization activities, in chronological order, have included:

- **Enviros. October 1990.** During the summer of 1990, Darigold had a gasoline UST removed from the west side of the former fueling facility and replaced with a diesel UST. Darigold’s UST contractor also removed a lubricating oil UST located south of the former fueling facility. During removal of the two USTs, the contractor removed approximately 450 cubic yards of petroleum contaminated soil. Subsequently, in October 1990, Enviros conducted a soil vapor survey at the facility to assess “the possibility of hydrocarbon migration” in the vicinity of the former fueling facility. Enviros quantified concentrations of petroleum hydrocarbons in soil vapor samples using EPA Method 8015 Modified, which does not differentiate between gasoline- and diesel-range constituents and does not quantify individual components such as benzene. Enviros’ letter-report, dated November 21, 1990, indicates that petroleum hydrocarbons were detected in soil gas samples collected within at least 50 feet of the footprint of the former fueling facility. The highest concentration of petroleum hydrocarbon detected in soil vapor was 290 parts per million by volume in sample SG-7, which was collected between the location of the former gasoline UST and the northeast corner of the existing building (Figure 2).

- **SD&C. August 1998.** In August 1998, Slotta Design & Construction (SD&C) removed one 10,000-gallon diesel UST and one 8,000-gallon diesel UST from the northeastern and eastern side of the former pump island and advanced twelve soil borings (B-1 through B-12) in the North Yard (Figure 2). The results of soil sampling and analysis indicated that concentrations of GRPH, DRPH, ORPH, and/or total xylenes exceeded the respective MTCA cleanup level in north sidewall sample EW-N, west sidewall sample EW-W and in borings B-5, B-8, B-9, and B-10, generally between depths of 7 and at least 11 feet bgs. The results of sampling and analysis completed in 1998 by S&DC are consistent with the findings of more recent investigations.

- **Integral Consulting, Inc. (Integral) January and February 2003.** Integral advanced 19 soil borings (SB-1 through SB-19) around the former UST locations to depths ranging from 5 to 30 feet bgs. Integral documented releases of GRPH and DRPH from the former USTs and associated impacts to groundwater. GRPH was detected in 16 of the 29 soil samples (12 of 18 borings) at concentrations up to 2,240 milligrams per kilogram (mg/kg). DRPH and heavy oil-range petroleum hydrocarbons (ORPH) were detected in 12 of 16 samples (11 of 18 borings) at concentrations up to 2,120 mg/kg. Concentrations of DRPH, GRPH, and or one or more BTEX constituent exceeded their respective MTCA cleanup level in soil samples collected from depths between 5 feet and at least 13 feet bgs.

- **SES. January through June 2004.** SES installed eight monitoring wells (MW01 through MW08) in the North Yard following the January 2004 removal of the 10,000-gallon diesel UST. SES did not submit soil samples for laboratory analysis because data developed during earlier studies was deemed sufficient to characterize the extent of contaminated soils and, with the exception of monitoring well MW07, each well was installed in close proximity to a previous soil sampling location. SES collected groundwater samples from each of the eight monitoring wells and from a pre-existing monitoring well (MW09) installed by others on the west, downgradient side of the Property. The results of groundwater sampling and analysis confirmed a release of GRPH, DRPH and BTEX to the groundwater media beneath the North Yard.

- **SES. July 2004 through August 2005.** The groundwater monitoring wells at the site were monitored and sampled in November 2004 and June 2005, and bi-weekly separate-phase hydrocarbon (SPH) removal was conducted at monitoring well MW07 between May 13 and June 21, 2005. SES prepared a *Remedial Alternatives Analysis*, dated July 8, 2005, which evaluated and compared various remedial technology alternatives for potential implementation at the Property.

- **SES. January 2008 through June 2008.** A supplemental remedial investigation, including installation of eight additional wells (MW10 through MW17), was conducted in January 2008. SES installed one pilot test well (PE01) just outside the northeast corner of the existing building in May 2008. It conducted engineering pilot tests in June 2008. The results of the pilot testing are described in greater detail below in Section 3.0.

- **SES. October 2009.** SES performed a supplemental subsurface investigation of conditions beneath the Andover ROW to investigate the lateral extent of soil and groundwater contamination northwest of the former fueling facility in the southern portion of the Andover ROW. No petroleum hydrocarbons were detected in soil or groundwater samples collected from boring/wells MW19, MW20 and MW21, which are located in the northern portion of the Andover ROW.

- **SES. December 2006 through the Present.** SES has performed quarterly groundwater monitoring at the Site since December 2006. The quarterly monitoring program has included monthly SPH removal since March 2008. The results of quarterly groundwater monitoring indicate that:

  - Groundwater elevations fluctuate approximately 1 to 2 feet between summer and winter. The deepest groundwater table generally occurs during the summer months and the shallowest groundwater table occurs during the winter months.

  - The overall direction of groundwater flow through the North Yard is towards the west-southwest. A northwest component of groundwater flow is apparent between monitoring wells MW03 and MW12 on an irregular basis, most recently during October 2009.

  - Concentrations of petroleum hydrocarbons in groundwater have migrated northwest, west, and southwest of the former fueling facility to monitoring wells MW03, MW04, MW07, MW10 through MW12, and PE01. The Site boundary also encompasses monitoring wells MW01 and MW05, where MTBE-impacted groundwater has migrated northwest and east of the former 2004 UST excavation.

  - The aqueous solubility of MTBE (4.3 percent) is higher than that of gasoline- and diesel-range petroleum hydrocarbons, including benzene (0.18 percent). This likely explains why MTBE is detected in groundwater outside the perimeter of the petroleum hydrocarbon plume (Garrett, et. al., 1986).

  - The lateral extents of benzene and MTBE in groundwater are similar, despite the higher solubility of MTBE. The incongruity of MTBE's higher solubility in comparison with the similar lateral extent suggests that MTBE was released more recently than benzene.

  - For clay soil conditions, concentrations of benzene in groundwater commonly exceed concentrations of benzene in soil at corresponding sample locations. For example, the concentrations of benzene in soil in monitoring well MW12 range from 0.18 to 0.56 milligrams per kilogram (180 to 560 parts per billion) while concentrations of benzene in groundwater in monitoring well MW12 historically ranged from 1,300 to 4,800 parts per billion. The inverse contaminant transport relationship between the two media is due to the combination of two important physical characteristics of clay deposits: high porosity in conjunction with the hydration of clay particles at the molecular level.

- Concentrations of petroleum hydrocarbons above MTCA cleanup levels do not appear to have migrated beneath the existing building, the northeast corner of which is located 30 feet southwest and downgradient from the former fueling facility.
- SPH conditions have been present in monitoring well MW07 southwest of the former fueling facility since at least November 2004. SES removed approximately 25 gallons of mixed water and SPH from monitoring well MW07 between March 2008 and December 2010.

2.4 Chemicals of Concern

Based on the findings of the investigations conducted on and adjacent to the Property, the COCs for the Site include the chemicals that were detected in soil and/or groundwater at concentrations exceeding the applicable cleanup levels. These COCs include DRPH, GRPH, BTEX, and MTBE.

2.5 Impacted Media

Based on the findings of remedial investigations (RI), groundwater, soil, and soil vapor are the affected media at the Site (SES 2008a, SES 2010).

2.6 Exposure Pathways

An exposure pathway is the mechanism through which an individual or population comes into contact with a hazardous substance. For a given pathway to be considered “complete,” the following must exist at a site:

- A release of hazardous substance to the environment;
- A point at which a receptor can be exposed to the hazardous substance; and
- A route by which chemical intake can occur (i.e., ingestion, inhalation, or dermal contact).

Complete exposure pathways are the “risk drivers” behind a cleanup action.

2.6.1 Direct Contact Pathway

Direct contact with soil and groundwater exhibiting concentrations of petroleum hydrocarbons in excess of the cleanup levels is limited to human receptors that come into close contact with the media via direct exposure, including dermal contact or ingestion of excavated soil or groundwater. In Washington, the standard point of compliance for soil contamination beneath a site is within the upper 15 feet bgs, which represents a reasonable estimate of the depth that could be accessed during normal site redevelopment activities (WAC 173-340-740[6][d]). Although petroleum-contaminated soil and groundwater are present within 15 feet of the ground surface, due to the current land use at the Property and the historical presence of asphalt and/or concrete pavement at the

Property, contaminated soil and groundwater at the Property are not easily accessed. This situation minimizes the potential for exposure via the direct-contact pathway. However, until such time as the contaminated soil and groundwater are removed from the Site or an environmental covenant limiting direct contact with soil is recorded for the Property, the direct-contact pathway must be considered to be potentially complete.

2.6.2 Groundwater/Drinking Water Pathway

Leaching of vadose zone contaminants to groundwater via surface water infiltration is mitigated somewhat by the asphalt and concrete, which have historically covered the Property and adjacent ROWs. Nonetheless, analytical testing of groundwater samples indicates that Site groundwater has been significantly impacted. The municipal water supply for the City of Seattle consists of open reservoirs located within Cascade Mountain watersheds. Under MTCA, however, drinking water is considered the highest beneficial use of groundwater at most sites irrespective of water supply. It is unlikely that this site would qualify for an exemption from drinking water beneficial use under MTCA [WAC 173-340-720(2)]. Therefore, drinking water use of groundwater must be considered a potentially complete exposure pathway.

2.6.3 Surface Water Pathway

There are no surface water bodies currently on or adjacent to the Property. As noted in Section 2.1, the building has a perimeter and basement slab drain system that discharges to a storm sewer main located in the South Andover Street right-of-way. Information from the *Interim Corrective Action Plan* (SES, 2008b) and the 1986 building design drawings were used to develop Cross Section D-D', presented on Figure 6. (Figure 2 shows the cross section location.) The building's north wall is supported by pairs of auger cast piles. Spaced along the wall span at intervals of approximately 22 feet on-center, the pile pairs each have individual pile caps on which the wall rests. A 6-inch-diameter perforated perimeter drain pipe runs along the upper outside corners of the pile caps, and parallel 6-inch-diameter perforated pipes located just beneath the basement floor slab are manifolded together to provide sub-slab drainage. The two drain systems discharge through a common 6-inch-diameter pipe to manhole CB#8968 in the North Yard (see Figure 2 for manhole location). From there, drainage water is routed to the storm sewer main under South Andover Street.

MW7 and MW14 are shown on the cross section, along with the ranges of liquid levels measured in those wells during periodic groundwater monitoring. SPH has been consistently detected floating on the groundwater in MW7 since November 2004. MW14, on the other hand, has not only been SPH-free, but also has had no detectable concentrations of contaminants dissolved in groundwater. The top of the range measured in MW7 is at approximately the same elevation as the nearby perimeter drain pipe. This suggests that, when the water table is high, SPH and impacted groundwater along the north wall have the potential to enter the perimeter drain pipe. (It may also help explain why groundwater contamination has not been detected beneath the building.)

Unless further investigation demonstrates otherwise, storm sewer discharge from CB#8968 must be considered a potential route of offsite contaminant migration.

2.6.4 Soil Vapor Intrusion Pathway

Volatile COCs, including benzene, have been identified in shallow groundwater at the Site. The building's HVAC system does not maintain positive pressurization in the basement, which would preclude vapor intrusion (VI) as a potentially complete exposure pathway. Ecology's draft *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action* (Ecology, 2009) establishes a "Tier I" process in which shallow groundwater concentration data are compared to groundwater screening levels to evaluate the need for further assessment or action to address the VI pathway. The screening level for benzene is 2.4 micrograms per liter (µg/L). A benzene concentration of 1,700 µg/L was measured in a groundwater sample collected from well PE-01 (located within several feet of the building's north wall) in May 2010. Therefore, application of Ecology's Tier I process indicates that VI is a potentially complete exposure pathway. (See Section 5.2 for VI assessment status.)

2.7 Site Definition

Based on the findings from the investigations conducted by SES and others between October 1990 and October 2009, and the historical research presented in this report, the Site includes petroleum-contaminated soil and groundwater that extends from the former fueling facility:

- North into the Andover ROW past the locations of monitoring well MW12 and soil sample EW-N;
- West past the location of soil boring SB-16;
- Southwest towards the existing building past monitoring wells MW07, MW10, MW11, and PE01;
- South past the location of soil boring SB-7, and
- East past the location of monitoring well MW05 (MTBE only).

Petroleum-contaminated soil has been encountered at a maximum depth of approximately 14 feet bgs.

3 Pilot Testing

Based on the findings of RIs performed to date, additional remedial action appeared warranted in order to achieve regulatory closure for the Site. Factors that were considered during the evaluation of potential remedial alternatives for the pilot testing included the COCs and their distribution in the subsurface, the affected media, potential exposure pathways, schedule, cost, and accessibility. In cases where a potential remedial alternative posed impacts to facility operations, those impacts were noted as part of the evaluation. Based on these factors, soil vapor extraction (SVE), air sparging (AS), and groundwater recirculation technologies were selected for pilot testing.

Due to conflicts with concurrent facility operations, installation of monitoring wells and pilot wells was scheduled on Sundays whenever possible, beginning with monitoring well MW10 in January 2008. Pilot testing activities were initiated during weekends and/or scheduled as early during the workweek as possible to minimize conflicts with facility operations.

3.1 Soil Vapor Extraction Test

On June 3, 2008, SES conducted an SVE pilot test at the Property to evaluate the effectiveness of SVE technology to remediate petroleum-contaminated soil and groundwater in areas of the Site with relatively permeable soils. The test also was conducted to generate sufficient information to design and implement a full-scale SVE system.

3.1.1 Soil Vapor Extraction Pilot Test Procedures

SES performed the SVE pilot test on existing monitoring wells MW07 and MW10. A vacuum truck applied a vacuum to each test well through a piping assembly that was equipped with an instrument train and a bleed-air assembly. SES fitted the instrument train and bleed-air assemblies with air velocity measurement devices (averaging pitot tubes). It modified nearby wellheads MW01, MW02, MW07, MW08, MW10, MW11, and/or PE01 with vacuum-tight seals and sample ports to measure the vacuum influence from the SVE test well at varying distances. SES documented the data collected during the SVE pilot tests on field data sheets, which are presented on Tables 1 through 4 in Appendix B. Depth-to-water measurements were measured prior to commencing the test and at the termination of each test (Appendix B, Table 3.0).

SES collected a vapor sample from each of the test wells at the conclusion of the pilot test. It collected each sample from a sample port located on the instrument train assembly between the test well and the vacuum truck. A portable vacuum pump with dedicated tubing was used to collect the vapor samples in Tedlar bags. SES submitted the vapor samples for GRPH analysis by Northwest Total Petroleum Hydrocarbon (NWTPH) Method NWTPH-Gx and for BTEX analysis by EPA Method 8021B. Laboratory analytical results and chain-of-custody documentation are included in Appendix A.

3.1.2 Soil Vapor Extraction Pilot Test Results

The following is a summary of the SVE pilot test results as they relate to individual pilot test wells.

Soil Vapor Extraction Pilot Test Results (MW07)

SES conducted a 2-hour SVE test on monitoring well MW07. The vacuum applied to monitoring well MW07 during the test ranged from 5.5 to 60 inches of water (iow) (Appendix B, Table 1.1). The measured air flow rate during the test ranged from 8.3 to 25.5 standard cubic feet per minute (scfm), with the maximum air flow rate occurring at 60 iow (Appendix B, Table 1.1).

Adjacent monitoring wells MW01, MW02, MW10, MW11, and PE01 were used as observation points during the SVE test to measure the effects of the applied vacuum at varying distances from the test well. SES used the vacuum data from the observation wells to estimate the average radius of influence (ROI) of 41 feet for monitoring well MW07 (Appendix B, Table 1.2).

The concentrations of GRPH in the vapor sample collected from monitoring well MW07 was 19,000 milligrams per cubic meter (mg/m^3). The concentration of benzene in the vapor sample collected from monitoring well MW07 was 44 mg/m^3 (Appendix B, Table 4.0). The elevated concentrations of GRPH and benzene in the vapor sample collected from MW07 are attributed to the presence of SPH in the test well.

Soil Vapor Extraction Pilot Test Results (MW10)

SES conducted a 1-hour SVE test on monitoring well MW10. SES applied a vacuum of 6.0 to 88.0 iow to monitoring well MW07 (Appendix B, Table 2.1). The measured air flow rate during the test ranged from 0.0 to 8.3 standard cubic feet per minute (scfm), with the maximum air flow rate occurring at 6.0 iow (Appendix B, Table 2.1).

Adjacent monitoring wells MW01, MW02, MW07, MW10, MW11, and PE01 were used as observation points during the SVE test to measure the effects of the applied vacuum at varying distances from the test well. SES used the vacuum data from the observation wells to estimate the ROI of 33 feet for monitoring well MW10 (Appendix B, Table 2.2).

The concentrations of GRPH in the vapor sample collected from monitoring well MW10 was 1,600 mg/m^3. The concentration of benzene in the vapor sample collected from monitoring well MW7 was 0.8 mg/m^3 (Appendix B, Table 4.0).

3.1.3 Soil Vapor Extraction Pilot Test Conclusions

Based on the results of the two SVE pilot tests, SVE was identified as a feasible technology for remediation of the unsaturated soil (vadose zone) and groundwater smear zone in areas of the Site with relatively permeable soils.

3.2 Air Sparge Pilot Test

On June 3, 2008, SES conducted an AS pilot test at the Property. The purposes of the pilot test were to evaluate the effectiveness of AS technology to remediate petroleum-contaminated soil and groundwater in areas of the Site with relatively permeable soils, and to generate sufficient information to design and implement a full-scale AS system.

3.2.1 Air Sparge Pilot Test Procedures

SES selected pilot well PE01 as the location for the AS pilot test due to its double screen interval. In order to perform the AS pilot test, SES utilized a packer to isolate the lower screen interval from the upper screen interval for the pilot test. A compressed air tank was utilized to provide compressed air for the AS pilot test. Access to AS pilot well PE01 was limited during pilot test activities due to conflicts with concurrent facility operations. Operational conflicts required that the air compressor used for the AS pilot test be staged approximately 70 feet from the wellhead. SES used an air-flow regulator to control the delivery of compressed air to the test well and an inline flow meter to measure and control the air flow rate. The regulator measured air pressure in pound-force per square inch gauge (psig) and the inline flow meter measured the air flow rate in units of standard cubic feet per minute (scfm). The concentration of dissolved oxygen (DO) was measured in nearby monitoring wells (MW02, MW03, MW08, MW10, and MW11) using a down-well DO meter to evaluate the ROI of the test well. Initial and final depth-to-water was measured for the test well and monitoring wells (Appendix C, Table 2.0). No media samples were collected as part of the AS pilot test.

3.2.2 Air Sparge Pilot Test Results

During the AS test on monitoring well PE01, SES applied an air pressure of approximately 18 psig and an inline air flow rate of 2.6 scfm for the duration of the test (Appendix C, Table 1.1). SES estimated a friction loss of approximately 7.3 psig between the compressor and the wellhead (SES, 2008c), due to the remote staging of the air compressor. Initial and final DO measurements were collected from monitoring wells, MW02, MW03, MW08, MW10, MW11 and pilot well PE01 (Appendix C, Table 1.2). Monitoring well MW08 and test well PE01 displayed slight increases in DO concentrations over the duration of the test. Based on the observed increase in DO concentrations in monitoring well MW08 and its distance from pilot well PE01, SES estimated a conservative ROI of 20 feet.

3.2.3 Air Sparge Pilot Test Conclusions

Based on the AS pilot test results, AS was identified as a feasible technology for remediation of the saturated zone in areas of the Site with relatively permeable soils.

3.3 Groundwater Recirculation Pilot Test

SES performed a groundwater recirculation test at the Property to evaluate the viability of this *in situ* technology as a remedial alternative for the Site. SES performed the groundwater recirculation pilot test on June 1, 2 and 3, 2008, using pilot test well PE01.

Groundwater recirculation technology eliminates the need for above-ground treatment of extracted groundwater. Extracted vapors may require treatment based on the recovered vapor concentrations of the COCs.

3.3.1 Groundwater Recirculation Pilot Test Procedures

SES performed the 48-hour groundwater recirculation pilot test in well PE01, a dual-screened well with the upper screen between 5 and 13 feet bgs and the lower screen between 17 and 19 feet bgs. A groundwater recirculation apparatus known as a Plume Eater® pulls groundwater towards the well through the upper screen, where pressurized air is applied to the water through internal tubing, essentially stripping out the volatile constituents from the groundwater. The oxygen-rich groundwater is then reintroduced to the formation through the lower screen and provides dissolved oxygen to microorganisms in the subsurface, promoting bioremediation. In a full-scale design, a vacuum is applied to the wellhead to capture the vapor extracted from the groundwater. A vacuum was not applied to the wellhead for this pilot test.

The recommended air-flow rate for the Plume Eater® is 1 to 2 scfm at a pressure of 15 to 20 psig. SES used a trailer equipped with a compressed air tank to supply air to the pilot well for the 48-hour test. In addition to monitoring DO levels in nearby wells, SES injected a non-hazardous dye, Rhodamine Red, through the lower screen interval to evaluate the ROI of the groundwater recirculation system.

Upon conclusion of the pilot test, SES collected a vapor sample from the top of the well casing to quantify the volatile organic compounds stripped from the water column. SES also collected a groundwater sample from test well PE01 for comparison to the groundwater sample collected during a scheduled quarterly groundwater monitoring event, which was performed three weeks prior to the test. Both samples were analyzed for GRPH by Method NWTPH-Gx and for BTEX by EPA Method 8021B by Friedman & Bruya, Inc. of Seattle, Washington. Laboratory analytical results and chain-of-custody documentation are included in Appendix D.

3.3.2 Groundwater Recirculation Pilot Test Results

The results of the Plume Eater® test were inconclusive. GRPH and BTEX constituents were not detected in the vapor sample that SES collected upon conclusion of the pilot test. Although DO readings fluctuated during the 48-hour test, SES did not observe a significant increase in groundwater DO levels (Appendix D, Table 1.0). Rhodamine Red dye was not detected in the nearby observation wells. Copies of the data collection sheets are included in Appendix D, Table 1.0.

Concentrations of COCs were not detected in pre- or post-pilot test vapor samples. The groundwater performance sample collected upon completion of the pilot test was compared to the baseline groundwater sample collected from pilot test well PE01 three weeks prior to the test. The comparison indicated a decline in COCs in the aqueous phase. The results of the vapor and groundwater samples collected during the groundwater recirculation pilot test are included in Appendix D, Tables 3.0 and 4.0 respectively.

3.3.3 Groundwater Recirculation Pilot Test Conclusions

The test data were inconclusive and indicated that groundwater recirculation would not necessarily be an effective remedial technology for the Site. Each groundwater recirculation well assembly costs approximately $1,000 to $3,000 more than a comparable sparging well. Therefore, under the circumstances of inconclusive pilot test results, groundwater recirculation was not carried forward for further consideration under the feasibility study.

3.4 Aquifer Tests

SES conducted a pump test and two slug tests to estimate hydraulic conductivities for the shallow water-bearing zone beneath the Property. The pump test was performed by pumping groundwater from monitoring well MW11. SES also performed rising head slug tests on monitoring wells MW04 and MW11 to confirm the calculated hydraulic conductivity values for the shallow water-bearing zone. SES used the data obtained from the aquifer tests to evaluate the viability of groundwater extraction technologies, such as dual-phase extraction (DPE).

3.4.1 Aquifer Test Procedures

On May 29, 2008, SES performed a pump test on monitoring well MW11 using a Grundfos RediFlo2® pump. The water level change in the pumping well and nearby observation wells was measured using a PT2X SmartSensor pressure transducer inside the pumping well connected to an Aqua4Plus datalogger. Due to low recharge rate of the shallow water-bearing zone and sensitivity of the submersible pump controls, the shallow water bearing zone was drawn down at a variable pumping rate. The variable pumping rates ranged from 250 to 690 milliliters per minute (mL/min). Each drawdown pump test lasted approximately 120 minutes. On August 5, 2008, SES performed rising head slug tests on monitoring wells MW04 and MW11. The purpose of the slug tests was to determine the hydraulic conductivity value for the shallow water-bearing zone. Prior to measuring water levels, the monitoring wells were opened to allow groundwater levels to equilibrate with atmospheric pressure for a minimum of 30 minutes. SES measured initial and final water levels in each monitoring well manually using an electric water level meter. Automatic water level measurements were recorded in each well during the slug tests using a PT2X SmartSensor pressure transducer and Aqua4Plus data logger. SES programmed the data logger to record data at one second intervals. It cleaned all field equipment prior to installation in each well and upon completion of each test.

3.4.2 Aquifer Test Results

SES plotted groundwater displacement versus time using aquifer testing analysis software Aquifer^{win32} to fit type-curves to the displacement data. The hydraulic conductivity results calculated for each well using Aquifer^{win32} are summarized on Table 1.1 in Appendix E. Data analysis plots for the pump test and slug tests are provided in Appendix E.

Results from the aquifer testing analysis for monitoring well MW11 using the Theis solution indicates that the transmissivity of the shallow water-bearing zone is 69.6 gallons per day per foot (Theis, 1935). Assuming a saturated thickness of 9 feet for the shallow water-bearing zone (approximate saturated well screen length), SES calculated a hydraulic conductivity of 1.03 feet per day or 3.65×10^{-4} centimeters per second for monitoring well MW11 (Appendix E, Table 1.1).

SES chose the Bouwer-Rice Method (Bouwer, H. and Rice, R.C. 1976) analytical solution for the slug test data, based on the assumption that monitoring wells MW04 and MW11 are screened within the shallow water-bearing zone under unconfined conditions. SES calculated hydraulic conductivities of 0.717 feet per day or 2.53×10^{-4} centimeters per second for monitoring well MW04 and 0.283 feet per day or 9.99×10^{-5} centimeters per second for monitoring well MW11 (Appendix E, Table 1.1).

3.4.3 Aquifer Test Conclusions

The hydraulic conductivity calculated values from the pump test and slug tests are consistent with the typical range for silt and silty sand deposits (Freeze and Cherry, 1979). SES encountered silt and clay soils in monitoring wells MW04 and MW13 and silty sand in monitoring well MW11.

Based on the aquifer test results, subsurface geology, and COCs, DPE was identified as a technically feasible remedial technology for saturated and unsaturated granular soil formations beneath the Site. A DPE pilot test has not been performed at the Site. In order to implement DPE technology at the Site, DPE pilot tests would be required to predict site-specific ROIs in varying subsurface conditions (both the granular and silt/clay formations encountered at the property).

4 Remedial Alternatives Assessment

In this section, remedial action alternatives are developed and evaluated in accordance with WAC 173-340-350(8). Site-specific applicable or relevant and appropriate requirements (ARARs) are briefly discussed and cleanup levels proposed. Remedial action objectives (RAOs) are then established. Next, remedial components are screened for their potential effectiveness in achieving the RAOs. Remedial components retained by the screening process are combined into several remedial alternatives that are both implementable and capable of achieving the RAOs. Those alternatives are described in detail and comparatively evaluated against MTCA criteria.

4.1 Applicable or Relevant and Appropriate Requirements

Under WAC 173-340-350 and 173-340-710, applicable requirements include regulatory cleanup standards, standards of control, and other environmental requirements, criteria, or limitations established under state or federal law that specifically address a contaminant, remedial action, location, or other circumstances at a site.

MTCA and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) define relevant and appropriate requirements as:

> *those cleanup standards, standards of control, and other human health and environmental requirements, criteria, or limitations established under state or federal law that, while not applicable to the hazardous substance, cleanup action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to a particular site.*

The criteria used to make this determination are presented in WAC 173-340-710(4)(a)-(i).

Remedial actions conducted under MTCA must comply with the substantive requirements of the ARARs but are exempt from their procedural requirements (WAC 173-340-710[9]). Specifically, this exemption applies to state and local permitting requirements under the Washington Water Pollution Control Act, Solid Waste Management Act, Hazardous Waste Management Act, Clean Air Act, State Fisheries Code, and Shoreline Management Act.

ARARs were screened in order to assess their applicability to the Site. The following list identifies ARARs that may be applicable to the Site:

- State Environmental Policy Act (Chapter 43.21C of the Revised Code of Washington [RCW 43.21C]);
- Washington Shoreline Management Act (RCW 90.58; WAC 173-18, 173-22, and 173-27);
- The Clean Water Act (33 United States Code [USC] 1251 et seq.);
- CERCLA of 1980 (42 USC 9601 et seq. and Part 300 of Title 40 of the Code of Federal Regulations [40 CFR 300]);
- The Fish and Wildlife Coordination Act;
- Endangered Species Act (16 USC 1531 et seq.; 50 CFR 17, 225, and 402);
- Native American Graves Protection and Repatriation Act (25 USC 3001 through 3013; 43 CFR 10) and Washington's Indian Graves and Records Law (RCW 27.44);
- Archaeological Resources Protection Act (16 USC 470aa et seq.; 43 CFR 7);
- Washington Dangerous Waste Regulations (WAC 173-303);
- Solid Waste Management Act (RCW 70.95; WAC 173-304 and 173-351);
- Water Quality Standards for Surface Waters of the State of Washington (RCW 90.48 and 90.54; WAC 173-201A);
- Department of Transportation Hazardous Materials Regulations (40 CFR Parts 100 through 185);
- Water well construction (RCW 18.104) and Minimum standards for construction and maintenance of wells (WAC 173-160); and
- City of Seattle and King County regulations, codes, and standards.

4.2 Proposed Cleanup Levels

The cleanup levels proposed for Site soil and groundwater are the MTCA Method A cleanup levels for unrestricted land use. The levels proposed for indoor air are the MTCA Method B air cleanup levels, applicable to a residential use scenario. Proposed cleanup levels are summarized in the following table:

MTCA Cleanup Levels

	Method A		Method B
Analyte	**Soil**	**Groundwater**	**Indoor Air**
GRPH	30 mg/kg	800 µg/L	-
DRPH	2,000 mg/kg	500 µg/L	-
Benzene	0.03 mg/kg	5 µg/L	0.32 µg/m^3
Toluene	7.0 mg/kg	1,000 µg/L	2,200 µg/m^3
Ethylbenzene	6.0 mg/kg	700 µg/L	460 µg/m^3
Total Xylenes	9.0 mg/kg	1,000 µg/L	46 µg/m^3
MTBE	-	20 µg/L	9.6 µg/m^3

<u>NOTES</u>
µg/L = micrograms per liter
µg/m^3 = micrograms per cubic meter
DRPH = diesel-range petroleum hydrocarbons
GRPH = gasoline-range petroleum hydrocarbons
mg/kg = milligrams per kilogram
MTBE = methyl tertiary-butyl ether
MTCA = Washington Model Toxics Control Act

4.3 Remedial Action Objectives

RAOs are media-specific cleanup goals that are considered to be protective of human health and the environment. Each RAO addresses a specific exposure route and provides an acceptable concentration or range of concentrations for chemicals of concern.

The following RAOs are proposed for the Site:

- Conduct SPH removal to the maximum extent practicable, in accordance with WAC 173-340-450(4).
- Ensure that contamination does not migrate offsite via the storm sewer utility between manhole CB#8968 and the sewer main under South Andover Street.
- Ensure that VI does not cause air concentrations in the building basement to exceed MTCA Method B cleanup levels for indoor air.
- Remediate site soils and groundwater to achieve MTCA Method A cleanup levels throughout the site.
- Implement institutional controls (i.e., a deed restriction prohibiting well installation) to prevent exposure to impacted groundwater in the North Yard, until groundwater cleanup levels are achieved.
- Implement institutional controls (i.e., a deed restriction addressing invasive work) to prevent exposure to impacted soils and groundwater in the North Yard, until cleanup levels are achieved.

4.4 Screening of Remedial Components

Remedial components that are potentially applicable to site cleanup were screened for their potential effectiveness in achieving the RAOs. Table 3 presents the results of the remedial component screening process in matrix format. Remedial components that passed the screening process and which are compatible with facility operations, building structure (loading dock widths, concrete panel reinforcement and dimensions, integrity of drainage and pavement systems, etc.), and construction and operational traffic logistics include the following:

- Excavation using shoring and/or structurally sloped sidewalls (with offsite treatment/disposal of petroleum-contaminated soil);
- Soil vapor extraction;
- Air sparging;
- Dual-phase extraction;

- Monitored natural attenuation;
- *In situ* aerobic bio-stimulation; and
- *In situ* bioremediation using Oxygen-Release Compound® (ORC®).

Excavation with offsite treatment/disposal is commonly employed for source removal at petroleum-contaminated sites in situations where impacted soils are relatively shallow and accessible. Soil vapor extraction and air sparging are *in situ* physical treatment technologies that have been determined to be feasible at the Site based on pilot test results (discussed in Sections 3.1 and 3.2, respectively). Based on the aquifer test results discussed in Section 3.4, DPE is another *in situ* physical treatment technology that would likely be feasible. However, pilot testing would be required to predict site-specific ROIs in varying subsurface conditions.

Natural attenuation depends on intrinsic environmental factors to reduce contaminant concentrations over time, through such processes as biodegradation, abiotic chemical transformation, adsorption, and dispersion. Per WAC 173-340-370(7), Ecology expects that natural attenuation may be appropriate at sites where:

a) Source control has been conducted to the maximum extent practicable;

b) Leaving contaminants on-site during the restoration time frame does not pose an unacceptable threat to human health or the environment;

c) There is evidence that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate at the site; and

d) Appropriate monitoring requirements are conducted to ensure that the natural attenuation process is taking place and that human health and the environment are protected.

Groundwater monitoring results provide evidence that natural attenuation is ongoing at the Site (as is almost always the case for sites in the Puget Sound region impacted by gasoline- and diesel-range petroleum hydrocarbons). Figure 7 presents concentration trends over the period May 2007 through May 2010 for the primary constituents of concern [benzene, MTBE, and petroleum hydrocarbons in the gasoline and diesel ranges] in five of the Site's most highly impacted groundwater monitoring wells (MW3, MW4, MW11, MWE12, and PE01). (Well MW7 is also presumed to be highly impacted, but that well typically contains SPH and is not sampled.) The MTCA Method A groundwater cleanup levels are also indicated for comparison. Concentrations measured in groundwater are highly variable over time, due in part to fluctuations caused by the annual rise and fall of the groundwater table. In addition, MTBE was not included on the analyte list until recently, making it especially difficult to evaluate a concentration trend for that constituent. For the other three constituents, however, an overall downward trend in concentrations is apparent. The trend is clearest in MW3, the well with the highest constituent concentrations at the start of the 3-year period. This is consistent with the fact that MW3 is located closest to the presumed UST source area. That is, whereas concentrations may trend higher further from the source as contaminants are transported in groundwater, concentrations in the immediate source area should not increase once the source has been removed. The fact that they appear to have decreased substantially during the 3-year period evaluated suggests that significant natural attenuation is occurring.

Based on experience at similar sites, aerobic biodegradation is likely the dominant natural attenuation process, and biodegradation rates are likely limited by the rate at which oxygen is supplied to the subsurface. The last two remedial components retained in the screening process are *in situ* technologies that enhance biodegradation rates by increasing oxygen delivery to the subsurface. Aerobic bio-stimulation can potentially be implemented by injecting air in a manner similar to air sparging. Alternatively, oxygen can be delivered to the subsurface by introducing peroxides such as ORC®, a proprietary magnesium peroxide. Effective delivery of the chemical to the subsurface is key to the success of this technology.

4.5 Development of Remedial Alternatives

Using the remedial components retained in the screening process, the following remedial alternatives were developed, representing a broad range of possible responses from "no action" to extensive removal via excavation, for evaluation in this FFS:

- Alternative 1 – No Action;
- Alternative 2 – Operate Existing AS/SVE System with MNA;
- Alternative 3 – *In Situ* Technologies Only;
- Alternative 4 – Targeted Excavation; and
- Alternative 5 – Extensive Excavation.

The remedial alternatives are described in this section, and comparatively evaluated with respect to MTCA criteria in Section 4.6. Table 4 provides a summary of how the remedial components that passed the screening process (Section 4.4) are apportioned among the remedial alternatives. Note that *in situ* aerobic bio-stimulation is not called out explicitly, but is represented in Alternatives 2 and 3 by the air sparging component. In addition, DPE is not included in any alternative. AS/SVE (included in Alternatives 2 and 3) has similar limitations to DPE with regard to effectiveness in lower-permeability soils, and it has been successfully pilot-tested at the Site. Without pilot test information, it would be difficult to evaluate DPE in a remedial alternative. However, if Alternative 2 or Alternative 3 is recommended for implementation, DPE should be reassessed as a potential alternative to AS/SVE for *in situ* physical treatment of contaminants in soil and groundwater.

Note that, for purposes of remedial alternative development and evaluation, it is assumed that contaminants are not migrating offsite via the storm sewer utility and VI is not impacting indoor air. These potential exposure pathways should be further investigated (see Recommendations section below) and, if they are found to be pathways of concern, incorporated into the remedial alternative evaluation process.

4.5.1 Alternative 1 – No Action

Under this alternative, the site would remain in its present condition. The existing AS/SVE system would not be operated and periodic monitoring would not be conducted.

This alternative is retained as a baseline for comparison of other alternatives, and to help ensure that remedial actions are not taken unless they are warranted.

4.5.2 Alternative 2 – Operate Existing AS/SVE System with MNA

The primary objective of operating the existing AS/SVE system under this alternative would be to remove SPH in the vicinity of monitoring well MW07, to satisfy the MTCA requirement for free product removal. AS/SVE is not generally considered to be a particularly effective technology for SPH removal, but it may prove successful for the limited extent of SPH observed. Contamination associated with the balance of the site (outside the influence of the existing AS/SVE system) would be allowed to attenuate naturally over time.

This alternative would include implementing property deed restrictions prohibiting the installation of drinking water wells and addressing conditions under which invasive work may be carried out in the North Yard. Periodic monitoring would be conducted to assess attenuation of contaminants. The deed restrictions would remain in effect until soil and groundwater cleanup levels are achieved throughout the site.

Components of the existing AS/SVE system are shown in green on Figure 2. The system includes three air sparge wells (AS-01 through AS-03) and five soil vapor extraction wells (MW07, MW10, MW11, MW18, and PE01). The AS wells are designed to inject air beneath the water table, thereby facilitating volatilization of contaminants dissolved in groundwater and adsorbed to soil, as well as SPH. The SVE wells extract soil vapor from the vadose zone (above the water table). They are designed for higher flow rates than the AS wells so that, in addition to capturing air injected by those wells, the SVE wells depressurize the vadose zone, causing atmospheric air to be drawn in. The increased oxygen made available by operation of the AS/SVE system stimulates aerobic biodegradation activity both above and below the water table. Thus, contaminant removal is achieved through both volatilization and biodegradation. Removal of SPH would depend almost exclusively on volatilization since indigenous microbes are not active in SPH.

If further investigation determines that VI is a potential exposure pathway of concern at the north end of the building under ambient conditions, the SVE wells of the existing system could likely be operated (with air sparging turned off) to address that concern. On the other hand, it is also possible that operation of the AS/SVE system for the purpose of contaminant removal from the subsurface could inadvertently induce VI in the building, even though VI may not be a concern when the system is off. This is because the SVE wells may not effectively capture all the sparge air injected by the AS wells. If a portion of the contaminant-laden sparge air migrates under the building rather than toward an SVE well, VI may result. If this is the case, it may be possible to alleviate the problem by adjusting system operation (e.g., by decreasing sparge rates and increasing extraction rates). Prior to implementation, this alternative (and Alternative 3) would warrant testing of the existing AS/SVE system to determine operating characteristics and influence.

4.5.3 Alternative 3 – In Situ Technologies Only

Under this alternative, *in situ* remediation technologies would be applied over the entire North Yard area where petroleum-impacted soils exceeding MTCA Method A cleanup levels have been detected. In addition to operating the existing AS/SVE system, AS/SVE technology would be applied in the former UST area northeast of the building (see Figure 8), where relatively permeable soils should facilitate AS/SVE effectiveness. A grid of AS and SVE wells would be installed in this area and, similar to the existing system along the building's north wall, sub-grade piping would supply sparge air to the AS wells and convey extracted soil vapors away from the SVE wells. Equipment, instrumentation, and piping in the existing AS/SVE enclosure could likely be modified/supplemented to handle the expanded well network, so that the above-grade footprint of the expanded system would not increase appreciably over that of the current system.

In the remaining areas of impact, where less permeable soils would likely impede AS/SVE effectiveness, injection of ORC® is proposed. Figure 8 shows the estimated area to be addressed by this technology. ORC® slowly releases (time releases) oxygen into groundwater to stimulate aerobic biodegradation of contaminants.

If a remedial alternative incorporating ORC® injection is selected, pilot testing would be warranted prior to full-scale implementation. The goals of pilot-testing injection of ORC® would include the following:

- confirm its effectiveness in the site's less permeable soils;
- confirm its effectiveness in treating not just petroleum hydrocarbons, but also MTBE (testing in the vicinity of monitoring well MW04 is recommended); and
- develop design information for full-scale application of the technology.

Assuming pilot testing is successful, multiple injection events would likely be required during full-scale application (3 aggressive injection events are assumed in the cost estimate for Alternative 3), with periodic monitoring of subsurface conditions to assess remediation progress. Once contaminant concentrations are substantially reduced, MNA would likely be relied on to ultimately achieve cleanup levels.

Applying *in situ* remediation technologies as proposed in this alternative is expected to substantially reduce the remediation time frame compared to reliance on MNA alone. As an order-of-magnitude estimate, it is expected that MNA alone would require over 30 years to achieve cleanup levels throughout the site, whereas 10 years is a reasonable expectation if the *in situ* remediation technologies proposed in this alternative are aggressively applied.

4.5.4 Alternative 4 – Targeted Excavation

Under this alternative, soil excavation with off-site treatment/disposal would be used to address the most highly impacted areas of the site, and injection of ORC® would be applied to the remainder of the impacted area. Areas proposed for targeted excavation under this alternative are shown on Figure 9. Excavation boundaries were determined by evaluating soil quality data for benzene and TPH in the gasoline and diesel ranges against the corresponding MTCA Method A cleanup levels. Areas where concentrations detected in soil exceed 20 times the benzene cleanup level, 10 times the gasoline-range

TPH cleanup level, and/or 3 times the diesel-range TPH cleanup level are proposed for excavation in this alternative. These exceedence factors were selected to account for the relative susceptibility of the constituents to biodegradation. That is, since benzene is much more susceptible to biodegradation than diesel-range TPH, injection of oxygen-releasing compound can generally be relied on to affect larger reductions in benzene concentrations over a given period of time. Therefore, remediation time frame can be reduced more effectively by focusing excavation efforts on soils with large diesel-range TPH exceedences rather than large benzene exceedences.

The vertical extent of excavation is assumed to be limited in this alternative to approximately 10 feet, so that shoring systems are not required. The volume of soils requiring excavation is estimated at roughly 2,300 cubic yards (cy). Characterization trenches would be completed to verify the current applicability of historical soil analytical results and to estimate mid-summer groundwater seepage rates. The characterization trenches would be backfilled with controlled density fill (CDF) to: 1) serve as shoring for construction traffic; 2) retard lateral sources of seepage into excavation cells; and 3) prevent recontamination of backfill between adjoining excavation cells.

In areas where soil impacts extend below the excavation depth, ORC® would be spread on the excavation bottom prior to backfilling with clean imported soil to promote biodegradation of residual contamination. One exception is excavation in the vicinity of monitoring well MW07, where thorough SPH removal would be an important objective. The Figure 6 cross section shows the approximate configuration of relevant features in this area, including the range of depths at which SPH has been observed in MW07. Excavation would likely be conducted in the summer, when the water table tends to be low. It appears that excavation depth would need to extend to approximately the base of the pile cap (i.e., roughly 11-foot depth) to remove SPH floating on the water table. Aspect's preliminary geotechnical review of this scenario indicates that soil can likely be safely excavated down to the base of the pile cap and southward to the north wall of the building without compromising the building foundation. (Modified soil backfilling and compaction requirements would be specified in the immediate vicinity of the building.) Therefore, thorough SPH removal via excavation is expected to be achievable in this alternative.

Note that ORC® injection is proposed in this alternative to remediate areas with relatively permeable soils that are not excavated, whereas AS/SVE was applied to these areas in Alternative 3. Retaining AS/SVE in these areas as a component of Alternative 4 was evaluated on a preliminary basis, but was not carried forward because it was not judged to be cost-effective. That is, since the majority of impacted permeable soils will be excavated in Alternative 4, those remaining can be most cost-effectively addressed by applying the same *in situ* technology (ORC® injection) as is applied to the less permeable soils. However, if VI is found to be an exposure pathway of concern, incorporation of the existing AS/SVE system should be reconsidered during detailed design of this alternative. Removing the most highly-impacted soils from the site should result in a significantly faster cleanup compared to Alternative 3. The cost estimate for this alternative assumes that only 2 aggressive ORC® injection events are needed, versus 3 in Alternative 3. A remediation time frame of 5 to 7 years is a reasonable expectation under this alternative, again assuming that the *in situ* remediation technology (injection of ORC®) is aggressively applied.

4.5.5 Alternative 5 – Extensive Excavation

Under this alternative, it is assumed that all soils with MTCA Method A cleanup level exceedences are excavated and treated/disposed of offsite. The approximate area requiring excavation, based on Aspect's evaluation of soil cleanup level exceedences, is shown on Figure 10. Where necessary, shoring systems would be used to allow access to deeper impacted soils (maximum excavation depth of 14 feet assumed) that would be left in place in Alternative 4. All excavated areas would be backfilled with clean imported soil.

The volume of soil requiring excavation in this alternative is estimated at roughly 6,000 cy. The actual extent of impacted soils requiring excavation would be determined by completing characterization trenches (as described above for Alternative 4) and by monitoring during excavation.

Once impacted soils are removed from the site, residual groundwater exceedences are expected to naturally attenuate to below MTCA Method A cleanup levels within a couple years. Therefore, a remediation time frame of 1 to 3 years is a reasonable expectation under this alternative.

4.5.6 Present Worth Cost Estimates

Present worth cost estimates for the 5 remedial alternatives are summarized in Table 5. These FS-level estimates, which have an intended accuracy of -30/+50 percent, include "sunk costs" that have already been incurred (primarily for pilot testing and for design and construction of the existing AS/SVE system), as well as estimated future costs. Future costs include those related to future remedial action pilot testing, design, and implementation, and costs associated with long-term monitoring and reporting. Itemization of estimated costs is provided in Appendix A. Present worth estimates are based on 2011 dollars and assume a real discount rate of 2 percent for both past and future expenditures. Major construction expenditures, including the AS/SVE system expansion in Alternative 3 and soil excavation in Alternatives 4 and 5, are assumed to occur in 2011.

The estimated present worth costs (rounded to three significant figures) range from $292,000 for Alternative 1, which represents the present worth of costs incurred to date, up to $3,780,000 for Alternative 5. Appendix A contains additional notes and assumptions regarding the remedial alternative cost estimates.

4.6 Comparative Evaluation of Remedial Alternatives

In this section, we perform a comparative evaluation of the remedial alternatives, in accordance with WAC 173-340-350, "Remedial Investigation and Feasibility Study." The alternatives are evaluated against criteria stated in WAC 173-340-360, "Selection of Cleanup Actions." The following criteria are considered in this comparative evaluation:

Threshold Criteria

- Protection of human health and the environment;

- Compliance with cleanup standards and applicable state and federal laws; and
- Provision for compliance monitoring.

Other Criteria

- Use of permanent solutions to the maximum extent practicable;
- Provision for a reasonable restoration time frame; and
- Consideration of public concerns.

All cleanup actions must meet the requirements of the threshold criteria. The other criteria are considered in selecting from among the alternatives that fulfill the threshold requirements.

In the following subsections, the revised remedial alternatives are comparatively evaluated with respect to each of the criteria listed above. Evaluation results are summarized in Table 5.

4.6.1 Protection of Human Health and the Environment

This threshold criterion considers the overall protectiveness of the alternatives, including the degree to which existing risks are reduced, the time required to reduce risk and attain cleanup levels, on- and off-site risks resulting from implementing the alternative, and improvement of the overall environmental quality.

Assuming that contaminants are not migrating offsite via the storm sewer utility and that VI is not impacting indoor air, all 5 alternatives are equally protective of human health and the environment under current exposure conditions. Under future conditions, however, Alternative 1 is not adequately protective because deed restrictions would not be implemented to prevent potential future exposures to impacted media.

4.6.2 Compliance with Cleanup Standards and Applicable Laws

Alternatives 2 through 5 are expected to comply with applicable laws and, given sufficient time, to achieve cleanup standards. Alternative 1 would not comply with WAC 173-340-440(4)(a), which states that institutional controls (such as deed restrictions) are required when cleanup levels are established using Method A or B and hazardous substances remain at the site at concentrations that exceed the applicable cleanup level.

4.6.3 Provision for Compliance Monitoring

This threshold criterion requires that the alternatives provide for compliance monitoring. Under MTCA, compliance monitoring encompasses the following types of monitoring:

- **Protection monitoring** confirms that human health and the environment are adequately protected during construction and the operation and maintenance (O&M) period of a cleanup action;
- **Performance monitoring** confirms that the cleanup action has attained cleanup levels and/or other performance standards such as, construction quality control

measurements or monitoring necessary to demonstrate compliance with a permit; and

- **Confirmation monitoring** confirms the long-term effectiveness of the cleanup action once cleanup levels and/or other performance standards have been attained.

Alternatives 2 through 5 are judged to provide adequate provision for compliance monitoring. These alternatives include long-term monitoring to assure that cleanup levels are ultimately achieved throughout the impacted aquifer. Protection monitoring will be conducted in accordance with site-specific safety and health plans during the construction and O&M periods associated with application of the AS/SVE, injection, and soil excavation technologies, and in the event that invasive work is performed in impacted areas of the North Yard. Performance monitoring of contaminant concentrations will be conducted to evaluate remediation progress and to ultimately confirm that cleanup levels have been achieved.

Alternative 1 does not include any future compliance monitoring. Therefore, it is judged to be deficient relative to this criterion.

Since Alternative 1 does not fully meet the requirements of the threshold criteria discussed above, it is eliminated from further consideration in this comparative evaluation.

4.6.4 Use of Permanent Solutions to Maximum Extent Practicable

The permanence of a solution considers the extent to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances. This includes the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment processes, and the characteristics and quantity of treatment residuals generated.

Alternatives 3 through 5 are all judged to provide a high degree of permanence because the active remedial technologies they employ have been demonstrated to permanently reduce contaminant concentrations at sites impacted by petroleum hydrocarbons in the gasoline and diesel ranges. AS/SVE removes contaminants via volatilization and also increases aerobic biodegradation activity in the subsurface. Volatilized contaminants would be adsorbed onto activated carbon (SVE exhaust treatment) and ultimately destroyed during thermal regeneration of the carbon. Aerobic biodegradation, which is also the principal removal mechanism for injection of oxygen-releasing compound, provides contaminant destruction via microbial metabolism. Although soil excavation with offsite treatment/disposal does not necessarily result in contaminant destruction (i.e., if disposal without treatment is implemented), it is considered to provide a high degree of permanence because contaminants are physically removed from the site.

MNA reduces contaminant concentrations through such processes as biodegradation, abiotic chemical transformation, adsorption, and dispersion. Given sufficient time, MNA will likely achieve the MTCA Method A soil and groundwater cleanup levels. However, employing MNA as the principal remedial technology is generally not considered to provide as high a degree of permanence as the active technologies discussed above, due to uncertainties associated with MNA. For example, it is unclear in the end what portion of the contaminant mass may be destroyed (e.g., via biodegradation and abiotic chemical transformation), and what portion may remain at the site (e.g., adsorbed onto soil or dispersed). For this reason, Alternative 2 is judged to only partially meet this criterion.

4.6.5 Provision for a Reasonable Restoration Time Frame

Restoration time frame refers to the time it will take to achieve cleanup standards. To assess the degree to which an alternative provides for a reasonable restoration time frame, the following factors are considered:

- Potential risks posed by the Site to human health and the environment;
- Practicability of achieving a shorter restoration time frame;
- Current use of the Site, surrounding areas, and associated resources that are, or may be, affected by releases from the Site;
- Potential future use of the Site, surrounding areas, and associated resources that are, or may be, affected by releases from the Site;
- Availability of alternative water supplies;
- Likely effectiveness and reliability of institutional controls;
- Ability to control and monitor migration of hazardous substances from the Site;
- Toxicity of the hazardous substances at the Site; and
- Natural processes that reduce concentrations of hazardous substances and have been documented to occur at the Site or under similar Site conditions.

As summarized in Table 5, restoration time frame estimates range from just 1 to 3 years for Alternative 5, to 30 years or more for Alternative 2. Since Alternatives 4 and 5 both achieve large contaminant reductions (via soil excavation) within a short time period, and are expected to achieve soil and groundwater cleanup levels in 7 years or less, they are judged to generally meet this criterion. The restoration time frame for Alternative 2 is highly uncertain and likely to be at least several decades. Thus, it is not considered to meet this criterion. Alternative 3, which employs *in situ* technologies expected to significantly accelerate the restoration rate over Alternative 2, is judged to partially meet this criterion.

4.6.6 Consideration of Public Concerns

Public concerns are most likely to arise from construction aspects of the soil excavation alternatives (Alternatives 4 and 5). Both private residences and retail businesses are situated in close proximity to the site. Excavating and hauling offsite several thousand tons of soil and importing clean backfill soil will create traffic congestion, noise, and possibly odors during construction. While these nuisance conditions can be somewhat mitigated through careful planning, engineering, and implementation of construction methods and traffic control, they cannot be completely eliminated. For this reason, Alternatives 4 and 5 are judged to only partially meet this criterion.

Implementation of the *in situ* technologies in Alternatives 2 and 3 is not expected to cause the above-noted nuisance conditions for Darigold's neighbors to any significant extent. As discussed above, these two alternatives result in much longer restoration time frames, which could potentially raise exposure concerns for some neighbors. However, since contamination is currently contained within the fenced Darigold property and monitoring will ensure that offsite migration does not occur, this is not considered to be a significant concern. Therefore, Alternatives 2 and 3 are judged to generally meet this criterion.

5 Recommendations

5.1 Preferred Remedial Alternative

As shown in Table 5 and discussed above, Alternative 1 (No Action) does not fully meet the requirements of the threshold criteria. Therefore, it may not be selected as the preferred remedy. Alternative 2, which relies solely on monitored natural attenuation of contamination in all but a small portion of the Site, is expected to require more than 30 years to achieve cleanup levels. Therefore, Alternative 2 is judged to not generally meet the criterion to provide for a reasonable restoration time frame.

Alternatives 3 through 5 are similarly ranked with respect to the evaluation criteria. However, an important distinction can be made among these alternatives regarding the certainty of outcome. Soil excavation with off-site treatment/disposal clearly provides a higher degree of certainty that contamination has been addressed versus reliance on *in situ* treatment technologies. Therefore, Alternative 5 (Extensive Excavation) is judged to have a more certain outcome than Alternative 4 (Targeted Excavation), and Alternative 4 is more certain than Alternative 3 (*In Situ* Technologies Only).

Since Alternatives 3 through 5 are similarly ranked, it is appropriate to consider their relative costs. Alternative 3 and Alternative 4 are estimated to be similar in cost, at just over $2.1 million. Alternative 4 relies on conventional excavation techniques targeted to remove the most highly-impacted soils from the Site, which is expected to shorten the remediation time frame by roughly 4 years relative to Alternative 3. Although public concerns may arise from construction aspects of the soil excavation, careful planning, engineering, and implementation of construction methods and traffic control should largely address those concerns. Thus, due to its shorter remediation time frame and greater certainty associated with hot-spot soil removal, Alternative 4 is judged to be preferable over Alternative 3.

Alternative 5 is estimated to be considerably more expensive than Alternative 4, at nearly $3.8 million. By removing all impacted soils via excavation, the outcome of Alternative 5 is highly certain and presents the lowest risk in terms of reaching regulatory endpoints. Since it relies on *in situ* methods to remediate a portion of the impacted soils, Alternative 4 carries with it certain inherent risks, including:

- The risk that the time required to achieve cleanup levels throughout the Site may be longer than the 5 to 7 years estimated in this evaluation; and
- The risk that changing environmental standards or attitudes may, in the course of the extended restoration time frame, require more costly remedial actions than anticipated.

Deed restrictions would be required in Alternative 4, and the presence of residual contamination would impact property value until cleanup levels are achieved. Alternative 5 would likely not require deed restrictions, and is expected to yield a fully unencumbered property within 3 years.

The potential costs of assuming additional risk with Alternative 4 are difficult to quantify, and have not been considered in the cleanup cost estimates. However, the estimated incremental cost of Alternative 5 over Alternative 4 (roughly $1.7 million) is judged to be disproportionate relative to potential benefits derived from a faster, more certain cleanup. Therefore, it is recommended that Alternative 4 be carried forward as the preferred remedial alternative.

5.2 Other Recommendations

It is also recommended that:

1. storm sewer discharge from CB#8968 be further investigated as a potential route of offsite contaminant migration (see Section 2.6.3 discussion);
2. vapor intrusion be investigated at the north end of the building in the vicinity of monitoring wells MW07 and PE01 (see Section 2.6.4 discussion); and
3. ORC® injection be pilot-tested (see Section 4.5.3 discussion).

Sub-slab soil vapor sampling in the vicinity of wells MW07 and PE01 is currently underway. If sub-slab sampling results indicate the potential for unacceptable indoor air impacts due to VI, direct sampling of indoor air in the building's basement is recommended. If indoor air sampling indicates unacceptable impacts due to VI, startup of the SVE component of the existing AS/SVE system should be considered for near-term VI mitigation. In addition, the merits of retaining the existing system (or some portion of it) for post-construction VI mitigation (in the event that it is still required) should be considered during detailed remedial design.

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7 Limitations

Work for this project was performed and this report prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Darigold, Inc., for specific application to the referenced property. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

TABLES

Table 1
Summary of Groundwater Analytical Results
Darigold, Inc. Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Well ID	Sample Date	Groundwater Elevation (feet)[1]	Analytical Results (micrograms per liter)							
			DRPH[2]	ORPH[2]	GRPH[3]	Benzene[4]	Toluene[4]	Ethyl-benzene[4]	Total Xylenes[4]	MTBE[4]
MW01	05/08/04	81.37	**520**	--	**6,100**	**1,300**	3	2	<3	--
	11/24/04	81.48	360	--	**3,000**	**520**	<1	6	7	--
	04/12/05	82.04	--	--	--	--	--	--	--	--
	06/21/05	NM	270	70 [6]	<100	<1	<1	<1	<3	--
	12/07/06	82.73	350	<250	460	**120**	<1	<1	<3	--
	02/26/07	82.31	430	<250	150	**33**	<1	<1	<3	--
	05/15/07	82.20	420	<250	150	**46**	<1	<1	<3	--
	08/28/07	81.93	<50	<250	600	**190**	<1	10	14	--
	11/14/07	82.43	<50	<250	170	**66**	<1	<1	<3	--
	02/11/08	82.14	<50	<250	<100	<1	<1	<1	<3	--
	05/19/08	81.87	<50	<250	<100	2	<1	<1	<3	--
	08/20/08	81.47	<50	<250	<100	**7**	<1	<1	<3	--
	11/24/08	81.78	310[x]	<250	<100	2	<1	<1	<3	--
	02/24/09	82.00	330[x]	<250	<100	<1	<1	<1	<3	--
	05/19/09	82.13	69[x]	**550** [6]	<100	<1	<1	<1	<3	--
	08/25/09	81.46	<50	<250	<100	<1	<1	<1	<3	--
	10/28/09	81.63	<50	<250	<100	<1	<1	<1	<2	**140**
	02/22/10	82.15	<50	<250	<100	<1	<1	<1	<2	**92**
	05/24/10	82.05	<50	<250	<100	<0.35	<1	<1	<3	**87**
	08/23/10	81.51	<50	<250	<100	<0.35	<1	<1	<3	**100**
	12/14/10	82.45	<50	<250	<100	<0.35	<1	<1	<3	**96**
MW02	05/08/04	79.26	**700**	--	**980**	**160**	<1	6	80	--
	11/24/04	81.14	**1,500**	--	**2,000**	**230**	2	6	140	--
	04/12/05	79.93	--	--	--	--	--	--	--	--
	06/21/05	NM	410	90 [6]	110	**15.0**	<1	<1	4	--
	12/07/06	79.76	360	<250	110	2	<1	<1	<3	--
	02/26/07	80.32	480	<250	150	<1	<1	<1	<3	--
	05/15/07	80.23	340	<250	<100	<1	<1	<1	<3	--
	08/28/07	79.98	<50	<250	<100	<1	<1	<1	<3	--
	11/14/07	80.92	<50	<250	<100	<1	<1	<1	<3	--
	02/11/08	80.21	<50	<250	<100	<1	<1	<1	<3	--
	05/19/08	79.82	53[x]	<250	<100	<1	<1	<1	<3	--
	08/20/08	81.70	<50	<250	<100	<1	<1	<1	<3	--
	11/24/08	80.97	220[x]	<250	<100	<1	<1	<1	<3	8.0
	02/24/09	82.18	340[x]	<250	<100	<1	<1	<1	<3	--
	05/19/09	82.47	130[x]	**530** [6]	<100	<1	<1	<1	<3	--
	08/25/09	81.61	<50	<250	140	<1	<1	<1	18	--
	10/28/09	81.98	<50	<250	<100	<1	<1	<1	<2	5.4
	02/23/10	82.40	<50	<250	<100	<1	<1	<1	<2	9.6
	05/25/10	82.33	<50	<250	<100	<0.35	<1	<1	<3	7.2
	08/23/10	81.67	<50	<250	<100	<0.35	<1	<1	<3	4.5
	12/14/10	83.90	<50	<250	<100	<0.35	<1	<1	<3	5.8
MW03	05/08/04	83.12	**1,000**	--	**2,100**	**360**	110	55	190	--
	11/24/04	82.33	**8,900**	--	**36,000**	**9,700**	600	**1,200**	**3,200**	--
	04/12/05	82.89	--	--	--	--	--	--	--	--
	06/21/05	NM	**12,000**	<250	**100,000**	**7,500**	**5,200**	**3,500**	**17,000**	--
	12/07/06	82.22	**SPH** (sheen)							
	02/26/07	82.85	**SPH** (sheen)							
	05/15/07	82.86	**10,000**[x]	310[y,6]	**92,000**	**10,000**	86	**2,100**	**3,300**	--
	08/28/07	82.55	**3,200**[x]	<250	**60,000**	**6,400**	160	**1,800**	**8,800**	--
	11/14/07	82.64	**4,600**[x]	<250	**28,000**	**1,100**	42	**1,300**	**6,500**	--
	02/11/08	83.81	500[x]	<250	**1,600**	**9**	2	28	170	--
	05/19/08	82.97	**2,400**[x]	<250	**7,900**	**1,000**	7	310	**1,100**	--
	08/20/08	84.19	**2,300**[x]	<250	**18,000**	**2,100**	15	**800**	**2,700**	--
	11/24/08	83.31	**3,100**[x]	480 [6]	**15,000**	**1,400**	13	660	**2,700**	--
	02/24/09	84.20	**2,700**[x]	410 [6]	**12,000**	**880**	<40	530	**2,100**	--
	05/19/09	84.11	**1,500**	**1000** [6]	**4,600**	**360**	<1	240	699	--
	08/25/09	82.81	**2,000**[x]	<250	**19,000**	**2,800**	<40	690	**2,100**	--
	10/28/09	82.97	**1,500**[x]	<250	**22,000**	**2,800**	4.9	**890**	**2,910**	**1,600**
	02/22/10	83.93	**1,400**[x]	<250	**10,000**	**1,100**	<100	510	**<1,500**	**520**
	05/24/10	83.98	450[x]	<250	**3,100**	**160**	<10	99	260	**75**
	08/23/10	83.03	**590**[x]	<250	**6,000**	**950**	<10	360	900	**260**
	12/14/10	84.22	330[x]	**570**	**1,100**	**67**	<1	47	<111	20
MTCA Method A Cleanup Levels[5]			500	500	800	5	1,000	700	1,000	20

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4058 Rainier Avenue South
Seattle, Washington

Well ID	Sample Date	Groundwater Elevation (feet)[1]	Analytical Results (micrograms per liter)							
			DRPH[2]	ORPH[2]	GRPH[3]	Benzene[4]	Toluene[4]	Ethyl-benzene[4]	Total Xylenes[4]	MTBE[4]
MW04	05/08/04	84.01	160	--	670	**8**	<5	45	150	--
	11/24/04	83.78	**2,500**	--	**3,500**	**330**	<50	190	92	--
	04/12/05	84.31	--	--	--	--	--	--	--	--
	06/21/05	NM	**5,800**	300 [6]	**11,000**	**1,800**	27	700	**1,200**	--
	12/07/06	83.99	**3,500**	360 [6]	**13,000**	**1,700**	<10	**610**	610	--
	02/26/07	84.13	**3,800**[x]	430[y,6]	**14,000**	**1,700**	<40	**810**	850	--
	05/15/07	83.96	**3,200**[x]	400[y,6]	**9,100**	**1,100**	<100	440	590	--
	08/28/07	83.58	**1,100**[x]	<250	**15,000**	**2,700**	<40	**1,000**	**1,400**	--
	11/14/07	83.63	**1,600**[x]	<250	**12,000**	**1,800**	<40	**970**	**1,400**	--
	02/11/08	84.16	**950**[x]	<250	**7,000**	**1,000**	<10	540	440	--
	05/19/08	81.00	**730**[x]	<250	**5,600**	**1,300**	3	520	440	--
	08/20/08	82.71	**1,000**[x]	<250	**6,000**	**870**	2	430	510	--
	11/24/08	83.07	**3,200**[x]	480 [6]	**5,000**	**1,600**	4	120	200	**6,100**
	02/24/09	83.39	**3,200**[x]	410 [6]	**3,900**	**670**	<10	140	200	--
	05/19/09	83.91	**3,200**[x]	**1100** [6]	**4,400**	**770**	1.3	160	180	--
	08/25/09	82.60	**980**[x]	<250	**6,900**	**1,700**	<10	97	240	--
	10/28/09	83.12	**850**[x]	<250	**4,000**	**920**	<1	94	<210	**2,700**
	02/22/10	83.68	**870**[x]	<250	**2,800**	**550**	<100	<100	<300	**2,600**
	05/24/10	83.76	**1,300**[x]	<250	**5,500**	**1,200**	<10	30	44	**3,600**
	08/23/10	82.73	**570**[x]	<250	**5000**[lp]	**1,300**	<50	63	110	**4,200**
	12/14/10	84.15	**940**[x]	<250	**3000**[lp]	**400**	<50	<50	<150	**1,900**
MW05	05/08/04	84.29	**730**	--	<50	<1	<1	<1	<3	--
	11/24/04	83.90	350	--	<50	<1	<1	<1	<3	--
	04/12/05	84.36	--	--	--	--	--	--	--	--
	06/21/05	NM	400	110 [6]	<100	<1	<1	<1	<3	--
	12/07/06	84.15	310	<250	<100	<1	<1	<1	<3	--
	02/26/07	84.48	300	<250	<100	<1	<1	<1	<3	--
	05/15/07	84.16	260	<250	<100	<1	<1	<1	<3	--
	08/28/07	84.03	<50	<250	<100	<1	<1	<1	<3	--
	11/14/07	84.04	<50	<250	<100	<1	<1	<1	<3	--
	02/11/08	84.49	<50	<250	<100	<1	<1	<1	<3	--
	05/19/08	84.08	<50	<250	<100	<1	<1	<1	<3	--
	08/20/08	83.30	<50	<250	<100	2	<1	2	6	--
	11/24/08	83.70	190[x]	<250	<100	<1	<1	<1	<3	--
	02/24/09	84.28	190[x]	<250	<100	<1	<1	<1	<3	--
	05/19/09	84.47	<50	450 [6]	<100	<1	<1	<1	<3	--
	08/25/09	83.38	<50	<250	<100	<1	<1	<1	<3	--
	10/28/09	84.05	<50	<250	<100	<1	<1	<1	<2	**63**
	02/23/10	84.53	<50	<250	<100	<1	<1	<1	<2	**56**
	05/25/10	84.45	<50	<100	<100	<0.35	<1	<1	<3	**62**
	08/23/10	83.65	<50	<250	<100	<0.35	<1	<1	<3	**63**
	12/14/10	85.51	<50	<250	<100	<0.35	<1	<1	<3	**58**
MW06	05/08/04	79.75	**520**	--	<50	<1	<1	<1	<3	--
	11/24/04	79.97	**510**	--	<50	<1	<1	<1	<3	--
	04/12/05	80.47	--	--	--	--	--	--	--	--
	06/21/05	NM	410	110 [6]	<100	<1	<1	<1	<3	--
	12/07/06	80.64	**550**	270 [6]	<100	<1	<1	<1	<3	--
	02/26/07	80.95	**740**	390 [6]	<100	<1	<1	<1	<3	--
	05/15/07	80.96	**630**	250[y,6]	<100	<1	<1	<1	<3	--
	08/28/07	80.51	<50	<250	<100	<1	<1	<1	<3	--
	11/14/07	80.69	<50	<250	<100	<1	<1	<1	<3	--
	02/11/08	80.72	<50	<250	<100	<1	<1	<1	<3	--
	05/19/08	80.58	<50	<250	<100	<1	<1	<1	<3	--
	08/20/08	82.02	<50	<250	<100	<1	<1	<1	<3	--
	11/24/08	82.13	**520**[x]	300 [6]	<100	<1	<1	<1	<3	--
	02/24/09	82.58	**540**[x]	290 [6]	<100	<1	<1	<1	<3	--
	05/19/09	82.96	210	**840** [6]	<100	<1	<1	<1	<3	--
	08/25/09	82.10	<50	<250	<100	<1	<1	<1	<3	--
	10/28/09	82.30	<50	<250	<100	<1	<1	<1	<2	4.6
	02/22/10	83.05	<50	<250	<100	<1	<1	<1	<2	6.0
	05/25/10	83.04	<50	<250	<100	<0.35	<1	<1	<3	5.7
	08/23/10	82.28	<50	<250	<100	<0.35	<1	<1	<3	4.9
	12/14/10	83.40	<50	<250	<100	<0.35	<1	<1	<3	5.8
MTCA Method A Cleanup Levels[5]			**500**	**500**	**800**	**5**	**1,000**	**700**	**1,000**	**20**

SoundEarth Strategies

Table 1
Summary of Groundwater Analytical Results
Darigold, Inc. Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

			Analytical Results (micrograms per liter)							
Well ID	**Sample Date**	**Groundwater Elevation (feet)[1]**	**DRPH[2]**	**ORPH[2]**	**GRPH[3]**	**Benzene[4]**	**Toluene[4]**	**Ethyl-benzene[4]**	**Total Xylenes[4]**	**MTBE[4]**
MW07	05/08/04	79.75	**8,600**	--	**62,000**	**6,900**	**4,600**	**2,400**	**9,300**	--
	11/24/04	NM	**SPH** (thickness not measured)							
	04/12/05	80.42	--	--	--	--	--	--	--	--
	05/23/05	80.70	--	--	--	--	--	--	--	--
	06/21/05	NM	**SPH** (thickness not measured)							
	12/07/06	NM	**SPH** (approximately 0.1 feet)							
	02/26/07	NM	**SPH** (approximately 0.1 feet)							
	05/17/07	80.59	**SPH** (0.66 feet)							
	08/28/07	80.31	**SPH** (0.33 feet)							
	11/14/07	80.94	**SPH** (0.17 feet)							
	02/11/08	80.44	**SPH** (0.44 feet)							
	05/19/08	80.29	**SPH** (0.06 feet)							
	08/20/08	81.55	**SPH** (0.02 feet)							
	11/24/08	81.81	**SPH** (sheen)							
	02/24/09	82.10	**SPH** (sheen)							
	05/19/09	82.03	**SPH** (0.1 feet)							
	08/25/09	81.56	**SPH** (0.4 feet)							
	10/27/09	81.70	**SPH** (sheen)							
	02/22/10	82.06	**SPH** (0.05 feet)							
	05/24/10	82.10	**SPH** (0.04 feet)							
	08/23/10	81.91	**SPH** (0.01 feet)							
	12/14/10	82.41	**SPH** (0.01 feet)							
MW08	05/08/04	79.13	270	--	<250	<5	<5	<5	<15	--
	11/24/04	79.57	<250	--	<50.0	3	<1	<1	<3	--
	04/12/05	80.03	--	--	--	--	--	--	--	--
	06/21/05	NM	64	<250	<100	2	<1	<1	<3	--
	12/07/06	79.99	230	<250	<100	<1	<1	<1	<3	--
	02/26/07	80.61	<50	<250	<100	<1	<1	<1	<3	--
	05/17/07	80.34	<50	<250	<100	<1	<1	<1	<3	--
	08/28/07	79.94	<50	<250	<100	<1	<1	<1	<3	--
	11/14/07	80.78	<50	<250	<100	<1	<1	<1	<3	--
	02/11/08	79.85	<50	<250	<100	<1	<1	<1	<3	--
	05/19/08	79.84	<50	<250	<100	<1	<1	<1	<3	--
	08/20/08	81.36	<50	<250	<100	<1	<1	<1	<3	--
	11/24/08	81.59	<50	<250	<100	<1	<1	<1	<3	--
	02/24/09	81.89	<50	<250	<100	<1	<1	<1	<3	--
	05/19/09	82.01	<50	290[6]	<100	<1	<1	<1	<3	--
	08/25/09	81.39	<50	<250	<100	<1	<1	<1	<3	--
	10/28/09	82.47	<50	<250	<100	<1	<1	<1	<2	<1
	02/22/10	82.01	<50	<250	<100	<1	<1	<1	<2	1.4
	05/25/10	81.88	<50	<250	<100	<0.35	<1	<1	<3	2.0
	08/23/10	81.38	<50	<250	<100	<0.35	<1	<1	<3	1.0
	12/14/10	83.38	<50	<250	<100	<0.35	<1	<1	<3	1.3
MW09	05/08/04	NM	270	--	<50.0	<1	<1	<1	<3	--
	11/24/04	84.75	**700**	--	<50.0	<1	<1	<1	<3	--
	06/21/05	NM	100	<250	<100	<1	<1	<1	<3	--
	12/07/06	87.18	**740**	320[6]	<100	<1	<1	<1	<3	--
	02/26/07	86.38	<50	<250	<100	<1	<1	<1	<3	--
	05/17/07	86.07	<50	<250	<100	<1	<1	<1	<3	--
	08/28/07	85.84	<50	<250	<100	2	<1	<1	5	--
	11/14/07	NM	<50	<250	<100	<1	<1	<1	<3	--
	02/11/08	86.18	<50	<250	<100	<1	<1	<1	<3	--
	05/19/08	85.95	<50	<250	<100	<1	<1	<1	<3	--
	08/20/08	82.90	<50	<250	<100	<1	<1	<1	4	--
	11/24/08	83.70	170[x]	<250	<100	<1	<1	<1	<3	--
	02/24/09	84.06	<50	<250	<100	<1	<1	<1	<3	--
	05/19/09	84.29	<50	<250	<100	<1	<1	<1	<3	--
	08/25/09	81.47	<50	<250	<100	<1	<1	<1	<3	--
	10/27/09	82.23	<50	<250	<100	<1	<1	<1	<2	<1
	02/23/10	84.41	<50	<250	<100	<1	<1	<1	<2	<1
	05/24/10	84.17	<50	<250	<100	<0.35	<1	<1	<3	<1
	08/23/10	82.87	<50	<250	<100	<0.35	<1	<1	<3	<1
	12/14/10	84.58	<50	<250	<100	<0.35	<1	<1	<3	<1
MTCA Method A Cleanup Levels[5]			**500**	**500**	**800**	**5**	**1,000**	**700**	**1,000**	**20**

Table 1
Summary of Groundwater Analytical Results
Darigold, Inc. Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Well ID	Sample Date	Groundwater Elevation (feet)[1]	Analytical Results (micrograms per liter)							
			DRPH[2]	ORPH[2]	GRPH[3]	Benzene[4]	Toluene[4]	Ethyl-benzene[4]	Total Xylenes[4]	MTBE[4]
MW10	02/11/08	82.14	**1,100[x]**	<250	**1,200**	**83**	2	140	59	--
	05/19/08	81.92	**840[x]**	<250	**1,100**	**86**	2	140[ve]	38	--
	08/20/08	81.36	**710[x]**	<250	**1,100**	**75**	3	90	26	--
	11/24/08	81.45	**2,200[x]**	480[6]	**1,100[ip,7]**	**93[ip,7]**	2[ip,7]	51[ip,7]	14[ip,7]	**140**
	02/24/09	81.88	**2,200[x]**	470[6]	**810**	**60**	1	45	4	--
	05/19/09	82.01	**1,900[x]**	**880[6]**	800	**59**	<1	36	<3	--
	08/25/09	81.38	**870[x]**	<250	440	**20**	<1	9	<3	--
	10/28/09	81.47	**660**	<250	450	**15**	<1	4.7	<2	**64**
	02/23/10	81.84	**750[x]**	<250	530	**25**	<1	11	<2	**28**
	05/24/10	81.90	**730[x]**	<250	**810**	**12**	<1	8.7	<3	**24**
	08/23/10	81.52	**470[x]**	<250	540	0.53	<1	2.0	<3	**29**
	12/14/10	82.33	**630[x]**	<250	740	1.50	<1	2.7	<3	**23**
MW11	02/11/08	82.28	**3,100[x]**	<250	**21,000**	**680**	120	**1,200**	**4,500**	--
	05/19/08	81.98	**2,100[x]**	<250	**10,000**	**880**	5	**1,100**	**1,600**	--
	08/20/08	81.56	**1,300[x]**	<250	**15,000**	**1,400**	13	**1,800**	**1,700**	--
	11/24/08	81.93	**2,300[x]**	<250	**6,500**	**420**	3	560	800	--
	02/24/09	82.16	**1,000[x]**	<250	**2,700**	**150**	<10	330	320	--
	05/19/09	82.41	**1,600[x]**	**690[6]**	**5,500**	**180**	22	700	**1,420**	--
	08/25/09	81.61	**1,400[x]**	<250	**8,500**	**280**	<10	**960**	960	--
	10/28/09	81.80	**1,200[x]**	<250	**7,600**	**230**	2.0	**950**	**1,486**	**27**
	02/23/10	82.37	**2,500[x]**	<250	**14,000**	**290**	<10	**1,000**	**2,247**	**27**
	05/24/10	82.18	**1,400[x]**	<250	**13,000**	**280**	<10	**860**	**2,024**	**29**
	08/23/10	81.69	**490[x]**	<250	**3,800**	**98**	<10	230	520	15
	12/14/10	82.74	**1,000[x]**	<250	**3,300**	**56**	<1	50	<141	13
MW12	02/11/08	82.95	**2,400[x]**	<250	**26,000**	**2,300**	7	**1,600**	**5,300**	--
	05/19/08	82.67	**4,800[x]**	<250	**60,000**	**4,800**	14	**4,100**	**15,000**	--
	08/20/08	83.13	**2,600[x]**	<250	**42,000**	**3,700**	8	**3,300**	**7,800**	--
	11/24/08	83.74	**4,300[x]**	<250	**28,000**	**2,600**	7	**2,500**	**5,400**	--
	02/24/09	83.75	**3,100[x]**	<270	**29,000**	**2,000**	<40	**2,500**	**5,500**	--
	05/19/09	84.53	**3,800[x]**	**590[6]**	**28,000**	**2,400**	1.5	**2,700**	**5,756**	--
	08/25/09	83.10	**2,000[x]**	<250	**27,000**	**2,200**	<40	**2,200**	**3,700**	--
	10/28/09	83.84	**2,800[x]**	<250	**17,000**	**1,300**	<1	**1,800**	**2,510**	**110**
	02/23/10	84.20	**2,100[x]**	<250	**17,000**	**1,600**	<100	**1,800**	**<2,200**	**240**
	05/24/10	84.17	**1,800[x]**	<250	**21,000**	**1,800**	<100	**2,100**	**2,400**	**150**
	08/23/10	83.06	**1,400[x]**	<250	**18,000**	**1,600**	<50	**1,600**	**1,700**	**110**
	12/14/10	84.67	**1,800[x]**	<250	**11,000**	**940**	<50	**1,100**	**<1,250**	**74**
MW13	02/11/08	83.36	<50	<250	<100	<1	<1	<1	<3	--
	05/19/08	82.94	310[x]	<250	**4,300**	**410**	1	300	**1,100**	--
	08/20/08	81.31	<50	<250	<100	1	<1	<1	3	--
	11/24/08	81.88	55[x]	<250	<100	<1	<1	<1	<3	--
	02/24/09	82.26	<50	<250	<100	<1	<1	<1	<3	--
	05/19/09	82.66	<50	<250	<100	<1	<1	<1	<3	--
	08/25/09	81.27	<50	<250	<100	<1	<1	<1	<3	--
	10/28/09	82.79	<50	<250	<100	<1	<1	<1	<2	20
	02/23/10	83.77	<50	<250	<100	<1	<1	<1	<2	3.4
	05/24/10	83.49	<50	<250	<100	0.51	<1	2.8	3.5	3.2
	08/23/10	82.50	<50	<250	<100	<0.35	<1	<1	<3	5.5
	12/14/10	83.97	<50	<250	<100	<0.35	<1	<1	<3	**25**
MW14	01/27/08	80.28	<50	<250	<100	2	<1	3	<3	--
	05/19/08	80.08	<50	<250	<100	<1	<1	<1	<3	--
	08/20/08	79.62	<50	<250	<100	<1	<1	2	5	--
	11/24/08	80.03	220[x]	<250	<100	<1	<1	<1	<3	--
	02/24/09	80.14	340[x]	<250	<100	<1	<1	<1	<3	--
	05/19/09	80.05	200[x]	360	<100	<1	<1	<1	<3	--
	08/26/09	79.63	<50	<250	<100	<1	<1	<1	<3	--
	10/27/09	79.85	<50	<250	<100	<1	<1	<1	<2	<1
	02/23/10	80.43	<50	<250	<100	<1	<1	<1	<2	<1
	05/25/10	80.23	<50	<250	<100	<0.35	<1	<1	<3	<1
	08/23/10	79.74	<50	<250	<100	<0.35	<1	<1	<3	<1
	12/14/10	80.89	<50	<250	<100	<0.35	<1	<1	<3	<1
MW15	01/27/08	80.38	<50	<250	<100	<1	<1	<1	<3	--
	05/19/08	79.79	<50	<250	<100	<1	<1	<1	<3	--
	08/20/08	79.68	<50	<250	<100	<1	<1	<1	<3	--
	11/24/08	79.95	210[x]	<250	<100	<1	<1	<1	<3	--
	02/24/09	80.18	130[x]	<250	<100	<1	<1	<1	<3	--
	05/19/09	80.40	<50	350	<100	<1	<1	<1	<3	--
	08/26/09	79.67	<50	<250	<100	<1	<1	<1	<3	--
	10/27/09	79.95	<50	<250	<100	<1	<1	<1	<2	<1
	02/23/10	80.40	<50	<250	<100	<1	<1	<1	<2	<1
	05/25/10	80.27	<50	<250	<100	<0.35	<1	<1	<3	<1
	08/23/10	79.77	<50	<250	<100	<0.35	<1	<1	<3	<1
	12/14/10	81.79	<50	<250	<100	<0.35	<1	<1	<3	<1
MTCA Method A Cleanup Levels[5]			**500**	**500**	**800**	**5**	**1,000**	**700**	**1,000**	**20**

SoundEarth Strategies

Table 1
Summary of Groundwater Analytical Results
Darigold, Inc. Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Well ID	Sample Date	Groundwater Elevation (feet)[1]	Analytical Results (micrograms per liter) DRPH[2]	ORPH[2]	GRPH[3]	Benzene[4]	Toluene[4]	Ethyl-benzene[4]	Total Xylenes[4]	MTBE[4]
MW16	01/27/08	81.00	<50	<250	<100	<1	<1	<1	<3	--
	05/19/08	81.88	<50	<250	<100	<1	<1	<1	<3	--
	08/20/08	79.67	<50	<250	<100	<1	<1	<1	<3	--
	11/24/08	79.91	<50	<250	<100	<1	<1	<1	<3	--
	02/24/09	80.34	<50	<250	<100	<1	<1	<1	<3	--
	05/19/09	81.01	<50	<250	<100	<1	<1	<1	<3	--
	08/26/09	79.67	<50	<250	<100	<1	<1	<1	8	--
	10/27/09	79.78	<50	<250	<100	<1	<1	<1	<2	<1
	02/23/10	81.18	<50	<250	<100	<1	<1	<1	<2	<1
	05/25/10	80.96	<50	<250	<100	<0.35	<1	<1	<3	<1
	08/23/10	79.83	<50	<250	<100	<0.35	<1	<1	<3	<1
	12/14/10	81.18	<50	<250	<100	<0.35	<1	<1	<3	<1
MW17	01/27/08	80.60	<50	<250	<100	<1	<1	<1	<3	--
	05/19/08	80.06	<50	<250	<100	<1	<1	<1	<3	--
	08/20/08	79.63	<50	<250	<100	<1	<1	<1	<3	--
	11/24/08	79.84	<50	<250	<100	<1	<1	<1	<3	<1
	02/24/09	80.09	<50	<250	<100	<1	<1	<1	<3	--
	05/19/09	80.42	<50	<250	<100	<1	<1	<1	<3	--
	08/26/09	79.62	<50	<250	<100	<1	<1	<1	<3	--
	10/27/09	79.73	<50	<250	<100	<1	<1	<1	<2	<1
	02/23/10	80.43	<50	<250	<100	<1	<1	<1	<2	<1
	05/25/10	80.23	<50	<250	<100	<0.35	<1	<1	<3	<1
	08/23/10	79.68	<50	<250	<100	<0.35	<1	<1	<3	<1
	12/14/10	81.06	<50	<250	<100	<0.35	<1	<1	<3	<1
MW18	08/20/08	80.56	<50	<250	<100	<1	<1	<1	<3	--
	11/24/08	80.84	330[x]	<250	<100	3	<1	<1	<3	--
	02/24/09	81.09	310[x]	<250	<100	<1	<1	<1	<3	--
	05/19/09	81.20	84[x]	280 [6]	<100	<1	<1	<1	<3	--
	08/26/09	80.53	<50	<250	<100	<1	<1	<1	<3	--
	10/27/09	80.50	84[x]	<250	<100	<1	<1	<1	<2	<1
	02/23/10	81.01	<50	<250	<100	<1	<1	<1	<2	<1
	05/24/10	81.11	<50	<250	<100	<0.35	<1	<1	<3	<1
	08/23/10	83.97	<50	<250	<100	<0.35	<1	<1	<3	<1
	12/14/10	81.73	<50	<250	<100	<0.35	<1	<1	<3	<1
MW19	10/27/09	81.81	<50	<250	<100	<1	<1	<1	<2	<1
	02/23/10	83.33	<50	<250	<100	<1	<1	<1	<3	<1
	05/24/10	82.23	<50	<250	<100	<0.35	<1	<1	<3	<1
	08/23/10	80.95	<50	<250	<100	<0.35	<1	<1	<3	<1
	12/14/10	85.13	<50	<250	<100	<0.35	<1	<1	<3	<1
MW20	10/27/09	81.29	<50	<250	<100	<1	<1	<1	<2	<1
	02/23/10	83.02	<50	<250	<100	<1	<1	<1	<2	<1
	05/24/10	81.82	<50	<250	<100	<0.35	<1	<1	<3	<1
	08/23/10	81.02	<50	<250	<100	<0.35	<1	<1	<3	<1
	12/14/10	85.72	<50	<250	<100	<0.35	<1	<1	<3	<1
MW21	10/27/09	84.55	<50	<250	<100	<1	<1	<1	<2	<1
	02/23/10	83.95	<50	<250	<100	<1	<1	<1	<2	<1
	05/24/10	83.76	<50	<250	<100	<0.35	<1	<1	<3	<1
	08/23/10	83.32	<50	<250	<100	<0.35	<1	<1	<3	<1
	12/14/10	84.66	<50	<250	<100	<0.35	<1	<1	<3	<1
PE01	05/19/08	80.86	**6,100[x]**	<250	**15,000**	**590**	17	**920**	**3,400**	--
	08/20/08	81.49	**2,100[x]**	<250	**6,200**	**550**	17	350	670	--
	11/24/08	81.76	**3,400[x]**	300 [6]	**17,000**	**1,300**	**1,100**	690	**2,400**	--
	02/24/09	82.07	**2,200[x]**	310 [6]	**6,600**	**1,100**	87	340	940	--
	05/19/09	82.19	**2,700[x]**	**980 [6]**	**9,400**	**1,800**	50	630	**1,270**	--
	08/25/09	81.56	**670[x]**	<260	**3,800**	**580**	14	270	280	--
	10/28/09	81.64	**650[x]**	<250	**5,500**	**700**	73	370	600	9.9
	02/23/10	82.13	**1,200[x]**	<250	**14,000**	**1,400**	540	580	**1,810**	10
	05/24/10	82.06	**930[x]**	<250	**13,000**	**1,700**	170	680	**1,660**	10
	08/23/10	81.89	**530[x]**	<250	**2,600**	**450[ve]**	6	180	186[ve]	8.4
	12/14/10	82.46	71[x]	<250	410	**32**	<1	14	51	<1
MTCA Method A Cleanup Levels[5]			**500**	**500**	**800**	**5**	**1,000**	**700**	**1,000**	**20**

NOTES:
Red indicates concentration exceeding MTCA Method A cleanup levels for groundwater.
[1]Relative to an arbitrary site datum designated 100.00 feet.
[2]Analyzed by NWTPH Method NWTPH-Dx.
[3]Analyzed by NWTPH Method NWTPH-Gx.
[4]Analyzed by EPA Method 8021B or 8260C.
[5]MTCA Method A cleanup levels, Table 720-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, revised November 2007.
[6]Sample contains non-petroleum hydrocarbons attributed to organic soil conditions (silica gel cleanup procedure not specified).
[7]Originally tabulated with laboratory data qualifier 'j'.

LABORATORY DATA QUALIFIERS:
[ip] Recovery fell outside of normal control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.
[j] The result is below normal reporting limits. The value reported is an estimate.
[x] The pattern of peaks present is not indicative of diesel.
[y] The pattern of peaks present is not indicative of motor oil.
[ve] The value reported exceeded the calibration range established for the analyte and should be considered an estimate.

< = not detected at concentration exceeding the laboratory reporting limit
-- = not analyzed
DRPH = diesel-range petroleum hydrocarbons
EPA = United States Environmental Protection Agency
GRPH = gasoline-range petroleum hydrocarbons
MTCA = Model Toxics Control Act
NM = not measured
NWTPH = Northwest Total Petroleum Hydrocarbon
ORPH = oil-range petroleum hydrocarbons
SPH = separate-phase hydrocarbons

Table 2
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Darigold Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Soil Sample ID	Well ID	Location	Use/Purpose	Date Sampled	Depth (feet)	PID	GRPH[1]	DRPH[2]	ORPH[2]	Benzene[3]	Toluene[3]	Ethyl-benzene[3]	Total Xylenes[3]
Slotta Design & Construction, 1998 UST Removal (Closure Samples Only)													
EW-N	NA	UST Excavation	Sidewall Sample	08/28/98	--	--	**36**	<20	<50	<0.050	<0.050	<0.050	0.130
EW-NW	NA	UST Excavation	Sidewall Sample	08/28/98	--	--	<5.0	<20	<50	<0.050	<0.050	<0.050	<0.050
EW-NE	NA	UST Excavation	Sidewall Sample	08/28/98	--	--	<5.0	290	<50	<0.050	<0.050	<0.050	<0.050
EW-NE(2)	NA	UST Excavation	Sidewall Sample	08/28/98	--	--	<5.0	<20	<50	<0.050	<0.050	<0.050	<0.050
EW-W	NA	UST Excavation	Sidewall Sample	08/28/98	--	--	**2,200**	**38,000**	<50	<0.050	**19.000**	**17.000**	**97.000**
EB-N	NA	UST Excavation	Bottom Sample	08/28/98	--	--	<5.0	<20	<50	<0.050	<0.050	<0.050	0.140
EB-S	NA	UST Excavation	Bottom Sample	08/28/98	--	--	<5.0	<20	<50	<0.050	<0.050	<0.050	<0.050
EW-S	NA	UST Excavation	Sidewall Sample	08/28/98	--	--	<5.0	<20	<50	<0.050	<0.050	<0.050	<0.050
EW-SE	NA	UST Excavation	Sidewall Sample	08/28/98	--	--	<5.0	<20	<50	<0.050	<0.050	<0.050	<0.050
Slotta Design & Construction, 1998 Subsurface Investigation													
B-1	NA	North Yard	Investigation	08/21/98	6	--	<10	<20	<50	--	--	--	--
B-2	NA	North Yard	Investigation	08/21/98	6	--	<10	<20	<50	--	--	--	--
B-3	NA	North Yard	Investigation	08/21/98	6	--	<10	<20	<50	--	--	--	--
B-4	NA	North Yard	Investigation	08/21/98	4	--	<10	<20	<50	--	--	--	--
B-5	NA	North Yard	Investigation	08/21/98	4	--	<10	68	410	--	--	--	--
B-6	NA	North Yard	Investigation	08/21/98	5	--	<10	<20	<50	--	--	--	--
B-7	NA	North Yard	Investigation	08/21/98	7	--	<10	<20	54	--	--	--	--
B-8	NA	North Yard	Investigation	08/21/98	7	--	**45**	<20	<50	--	--	--	--
B-8	NA	North Yard	Investigation	08/21/98	11	--	25	<20	<50	--	--	--	--
B-9	NA	North Yard	Investigation	08/21/98	8	--	**500**	<20	<50	--	--	--	--
B-9	NA	North Yard	Investigation	08/21/98	11	--	**140**	<20	<50	--	--	--	--
B-10	NA	North Yard	Investigation	08/21/98	7	--	**100**	<20.0	<50.0	--	--	--	--
B-10	NA	North Yard	Investigation	08/21/98	11	--	<10	<20	<50	--	--	--	--
B-11	NA	North Yard	Investigation	08/21/98	3	--	12	<20	100	--	--	--	--
B-12	NA	North Yard	Investigation	08/21/98	7	--	<10	<20	<50	--	--	--	--

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Soil Sample ID	Well ID	Location	Use/Purpose	Date Sampled	Depth (feet)	PID	GRPH[1]	DRPH[2]	ORPH[2]	Benzene[3]	Toluene[3]	Ethyl-benzene[3]	Total Xylenes[3]
Integral, 2003 Subsurface Investigation													
SB-1	NA	North Yard	Investigation	01/08/03	5	0	<5.00	17.9	52.9	<0.0300	<0.0500	<0.0500	<0.100
SB-2	NA	North Yard	Investigation	01/08/03	3	2,000	<5.00	<10.0	<25.0	<0.0300	<0.0500	<0.0500	<0.100
SB-2	NA	North Yard	Investigation	01/08/03	10	1,000	--	--	--	--	--	--	--
SB-2	NA	North Yard	Investigation	01/08/03	15	--	<5.00	<10.0	<25.0	<0.0300	<0.0500	<0.0500	<0.100
SB-3	NA	North Yard	Investigation	01/08/03	6	0	**157**	561	<25.0	**0.139**	<0.100	0.849	3.40
SB-4	NA	North Yard	Investigation	01/08/03	6	300	**2,240**	1,060	92.7	**7.09**	<0.500	**51.5**	**190**
SB-4	NA	North Yard	Investigation	01/08/03	15	30	--	--	--	--	--	--	--
SB-5	NA	North Yard	Investigation	01/09/03	6	--	**1,240**	**2,120**	<250	**1.90**	<0.500	**26.2**	**35.4**
SB-5	NA	North Yard	Investigation	01/09/03	10	400	--	--	--	--	--	--	--
SB-6	NA	North Yard	Investigation	01/09/03	8	150	**50.8**	157	302	**0.0359**	0.114	0.156	0.275
SB-7	NA	North Yard	Investigation	01/09/03	9	--	**99.6**	114	<25.0	**0.0642**	<0.0500	0.528	1.39
SB-7	NA	North Yard	Investigation	01/09/03	13	300	**88.3**	204	<25.0	**0.0726**	<0.0500	0.535	1.38
SB-7	NA	North Yard	Investigation	01/09/03	17	400[c]	--	--	--	--	--	--	--
SB-8	NA	North Yard	Investigation	01/09/03	12	--	<5.00	<10.0	<25.0	<0.0300	<0.0500	<0.0500	<0.100
SB-9	NA	North Yard	Investigation	01/09/03	5	2,000	**148**	743	1,530	**2.71**	<0.0500	0.819	1.32
SB-9	NA	North Yard	Investigation	01/09/03	10	800	--	--	--	--	--	--	--
SB-10	NA	North Yard	Investigation	01/09/03	6	400	**766**	**3,520**	265	**8.21**	<0.0500	**28.9**	**37.8**
SB-11	NA	North Yard	Investigation	02/06/03	5	0	<5.00	67.7	313	<0.0300	<0.0500	<0.0500	<0.100
SB-12	NA	North Yard	Investigation	02/06/03	8	0	5.62	<10.0	<25.0	<0.0300	<0.0500	<0.0500	<0.100
SB-13	NA	North Yard	Investigation	02/06/03	5	--	**70.3**	--	--	**0.31**	0.0726	0.757	1.70
SB-14	NA	North Yard	Investigation	02/06/03	5	20	13.0	--	--	**0.394**	<0.0500	0.346	0.690
SB-14	NA	North Yard	Investigation	02/06/03	10	0.10	**43.4**	--	--	**0.114**	0.275	0.316	1.73
Integral, 2003 Subsurface Investigation (cont'd)													
SB-15	NA	North Yard	Investigation	02/06/03	5	0	14.7	--	--	**0.140**	<0.0500	0.124	0.553
SB-15	NA	North Yard	Investigation	02/06/03	10	300	**64.1**	22.7	<25.0	**0.929**	3.62	1.48	**9.05**
SB-16	NA	North Yard	Investigation	02/06/03	8	--	25.4	--	--	**0.418**	0.0650	0.212	0.783
SB-16	NA	North Yard	Investigation	02/06/03	10	--	**767**	71.3	<25.0	**1.82**	**18.1**	**14.7**	**82.1**
SB-17	NA	North Yard	Investigation	02/06/03	5	0	<5.00	--	--	<0.0300	<0.0500	<0.0500	<0.100
SB-17	NA	North Yard	Investigation	02/06/03	10	0	<5.00	--	--	<0.0300	<0.0500	<0.0500	<0.100
SB-17	NA	North Yard	Investigation	02/06/03	13	0	21.5	--	--	<0.129	<0.215	<0.215	<0.430
SB-18	NA	North Yard	Investigation	02/06/03	5	12	<5.00	--	--	<0.0300	<0.0500	<0.0500	<0.100
SB-18	NA	North Yard	Investigation	02/06/03	10	0	<5.00	--	--	<0.0300	<0.0500	<0.0500	<0.100
SB-19	NA	North Yard	Investigation	02/06/03	5	--	<5.00	--	--	<0.0300	<0.0500	<0.0500	<0.100
SB-19	NA	North Yard	Investigation	02/06/03	10	--	<5.00	--	--	<0.0300	<0.0500	<0.0500	<0.100

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Soil Sample ID	Well ID	Location	Use/Purpose	Date Sampled	Depth (feet)	PID	GRPH[1]	DRPH[2]	ORPH[2]	Benzene[3]	Toluene[3]	Ethyl-benzene[3]	Total Xylenes[3]
SES, 2004 UST Removal													
E-1	NA	UST Excavation	Sidewall Sample	01/15/04	6.5	>2,000	**190**	**2,900**	<50	**0.6**	0.8	2.4	3.8
E-2	NA	UST Excavation	Sidewall Sample	01/15/04	6.5	>2,000	**42**	**3,800**	<50	**0.03**	<0.02	0.16	0.46
E-3	NA	UST Excavation	Sidewall Sample	01/15/04	6.5	>2,000	**86**	**4,900**	64	**2.8**	0.06	0.83	0.38
E-4	NA	UST Excavation	Sidewall Sample	01/15/04	6.5	>2,000	**420**	**2,100**	<50	**2.1**	0.6	**14**	**32**
E-5	NA	UST Excavation	Bottom Sample	01/15/04	10	>2,000	3	<10	<50	**0.43**	<0.02	0.18	0.67
E-7	NA	UST Excavation	Sidewall Sample	01/15/04	6.5	400	<1	<10	<50	**0.06**	<0.02	0.04	0.07
E-8	NA	UST Excavation	Sidewall Sample	01/15/04	6.5	>2,000	**400**	770	280	**2.8**	0.6	**14**	6.3
E-9	NA	UST Excavation	Sidewall Sample	01/15/04	6.5	>2,000	**110**	55	<50	**0.27**	0.05	0.38	0.64
E-10	NA	UST Excavation	Bottom Sample	01/15/04	10	1,000	**520**	1,200	<50	**2.9**	1.0	**15**	**13**
E-11	NA	UST Excavation	Bottom Sample	01/15/04	10	1,200	**470**	280	<50	**2.9**	1.0	**13**	6.6
SES, 2008 Supplemental Remedial Investigation - North Yard													
B13-05	MW-10	North Yard	Monitoring Well	01/13/08	5	20.2	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B13-08	MW-10	North Yard	Monitoring Well	01/13/08	8	12.1	3	<50	<250	<0.02	<0.02	<0.02	<0.06
B13-13	MW-10	North Yard	Monitoring Well	01/13/08	13	21.4	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B14-09	MW-11	North Yard	Monitoring Well	01/13/08	9	92.2	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B14-11	MW-11	North Yard	Monitoring Well	01/13/08	11	67.2	<2	<50	<250	<0.02	<0.02	<0.02	0.07
PE01-03	PE-01	North Yard	Pilot Well	05/18/08	3.0	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
PE01-08.5	PE-01	North Yard	Pilot Well	05/18/08	8.5	8.4	15	800	<250	**0.05**	0.02	1.3	15
PE01-13	PE-01	North Yard	Pilot Well	05/18/08	13.0	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
PE01-19	PE-01	North Yard	Pilot Well	05/18/08	19.0	0.0	<2	<50	<250	<0.02	<0.02	0.03	0.10
SES, 2008 Remediation Wells - North Yard													
B15-08.5	AS01	North Yard	Remediation Well	08/03/08	8.5	>2000	16	<50	<250	<0.02	<0.02	0.19	1.6
B15-14	AS01	North Yard	Remediation Well	08/03/08	14	>2000	**55**	73[x]	<250	**0.24**	0.32	1.3	6.4[ve]
B16-13.5	AS02	North Yard	Remediation Well	08/03/08	13.5	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B17-03	AS03	North Yard	Remediation Well	08/03/08	3	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B17-13	AS03	North Yard	Remediation Well	08/03/08	13	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B18-02.5	MW18	North Yard	Remediation Well	08/03/08	2.5	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B18-17.5	MW18	North Yard	Remediation Well	08/03/08	17.5	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
SES, 2008 Supplemental Remedial Investigation - South Andover Street Right-of-Way													
B15-04	MW-12	Andover Street	Monitoring Well	01/13/08	4	5.1	7	<50	<250	**0.18**	0.03	0.09	0.32
B15-06	MW-12	Andover Street	Monitoring Well	01/13/08	6	66.1	**43**	<50	<250	**0.56**	0.05	2.0	0.37
B15-10	MW-12	Andover Street	Monitoring Well	01/13/08	10	26.4	5	<50	<250	**0.31**	<0.02	0.38	0.47
B16-06	MW-13	Andover Street	Monitoring Well	01/14/08	6	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B16-09	MW-13	Andover Street	Monitoring Well	01/14/08	9	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B16-11	MW-13	Andover Street	Monitoring Well	01/14/08	11	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06

SOUND ENVIRONMENTAL STRATEGIES
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Darigold Rainier Avenue Facility
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Soil Sample ID	Well ID	Location	Use/Purpose	Date Sampled	Depth (feet)	PID	GRPH[1]	DRPH[2]	ORPH[2]	Benzene[3]	Toluene[3]	Ethyl-benzene[3]	Total Xylenes[3]
SES, 2008 Supplemental Remedial Investigation - Basement of Dairy-Processing Facility													
HA01-01.5	MW14	Basement	Monitoring Well	01/27/08	1.5	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
HA01-03.5	MW14	Basement	Monitoring Well	01/27/08	3.5	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
HA02-01.5	MW15	Basement	Monitoring Well	01/27/08	1.5	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
HA02-05	MW15	Basement	Monitoring Well	01/27/08	5	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
HA03-01.5	NA	Basement	Investigation 01/	27/08	1.5	0.0	Organic peat soil sample was not submitted for analysis						
HA04-01.5	NA	Basement	Investigation	01/27/08	1.5	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
HA05-01.5	MW16	Basement	Monitoring Well	01/27/08	1.5	0.3	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
HA06-01.5	MW17	Basement	Monitoring Well	01/27/08	1.5	0.0	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
SES, 2009 Supplemental Remedial Investigation - South Andover Street Right-of-Way													
B17-05.5	MW19	Andover Street	Monitoring Well	10/20/09	5.5	17.9[c]	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B17-11	MW19	Andover Street	Monitoring Well	10/20/09	11	26.2[c]	<2	--	--	<0.02	<0.02	<0.02	<0.06
B18-08	MW20	Andover Street	Monitoring Well	10/20/09	8	11.5[c]	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B18-11	MW20	Andover Street	Monitoring Well	10/20/09	11	15[c]	<2	--	--	<0.02	<0.02	<0.02	<0.06
B19-08	MW21	Andover Street	Monitoring Well	10/20/09	8	6.7[c]	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B19-13	MW21	Andover Street	Monitoring Well	10/20/09	13	3.2[c]	<2	--	--	<0.02	<0.02	<0.02	<0.06
MTCA Method A Cleanup Levels for Soil[4]							100/30[b]	2,000	2,000	0.03	7	6	9

NOTES:

Red denotes concentration exceeds MTCA Method A Cleanup Levels.

Results reported in mg/kg.

Chemical analyses conducted by Friedman & Bruya, Inc. of Seattle, Washington.

[1] Analyzed by Northwest Method NWTPH-Gx.

[2] Analyzed by Northwest Method NWTPH-Dx.

[3] Analyzed by EPA Method 8021 or EPA Method 8260B.

[4] MTCA Method A Cleanup Levels for Soil, Table 740-1 of Chapter 173-340-900 of the Washington Adminsitrative Code.

[a] 100 mg/kg when benzene is not present and 30 mg/kg when benzene is present.

[c] PID malfunctioning due to humidity.

LABORATORY DATA QUALIFIERS:

x = The pattern of peaks present is not indicative of diesel.

ve = The value reported exceeded the calibration range estblished for the analyte. The reported concentration should be considered an estimate.

-- = not analyzed

< = not detected at concentration exceeding the laboratory reporting limit

mg/kg = milligrams per kilogram

DRPH = diesel-range petroleum hydrocarbons

EPA = United States Environmental Protection Agency

GRPH = gasoline-range petroleum hydrocarbons

MTCA = Model Toxics Control Act

NA = Not applicable

ORPH = oil-range petroleum hydrocarbons

PID = photoionization detector

SES = Sound Environmental Strategies Corporation

UST = underground storage tank

SOUND ENVIRONMENTAL STRATEGIES
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Table 3
Remedial Component Screening Matrix
Darigold Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Component Group	Component Options	Protects Human Health and the Environment	Complies with Cleanup Standards	Complies with Applicable Local, State and Federal Laws	Provides for Compliance Monitoring	Uses Permanent Solutions to the Maximum Extent Practicable	Provides Reasonable Restoration Time Frame	Considers Public Concerns	Retained Alternative for Further Evaluation	Comments
		Threshold Criteria (WAC 173-340-360 [2][a])				Modifying Criteria (WAC 173-340-360 [2][b])				
Passive Remediation										
	No Further Action	×	×	×	×	×	×	×	No	Not protective of human health and the environment.
	Monitored Natural Attenuation	✓	✓	✓	✓	×	×	✓	Yes	Retained as part of the alternatives for final polishing.
	Containment Cap	✓	×	✓	✓	×	×	✓	Yes	Retained as an engineering control to reduce/minimize leachate generation.
	Deed Restriction	✓	×	✓	×	×	×	✓	No	Does not address groundwater contamination at the Site.
	Passive Treatment Wall (Activated Carbon/PRB)	×	×	✓	✓	×	×	✓	No	Technology is demonstrated to be effective for COCs; however, it does not address the source of contamination.
In Situ Physical Treatment										
	SVE	✓	✓	✓	✓	✓	✓	✓	Yes	SVE is a demonstrated technology for remediation of COCs in soil (vadose zone).
	Air Sparge	✓	✓	✓	✓	✓	✓	✓	Yes	AS is a demonstrated technology for remediation of COCs in groundwater and delivers oxygen to saturated soils to promote biodegradation.
	Air Sparge with SVE	✓	✓	✓	✓	✓	✓	✓	Yes	Air sparge with SVE are demonstrated technologies for remediation of COCs in soil and groundwater.
	Surfactant Washing	×	×	✓	×	×	×	✓	No	Technology eliminated due to the potential to mobilize COCs off Property.
	Cosolvent Washing	×	×	✓	×	×	×	✓	No	Technology eliminated due to the potential to mobilize COCs off Property.
	Pump and Treat	✓	×	✓	✓	×	×	✓	No	Does not address the source material and prolongs the restoration time frame.
	Dual-Phase Extraction	✓	✓	✓	✓	✓	✓	✓	Yes	Technology is proven for the remediation of COCs in soil and groundwater.
Thermal										
	Resistive Thermal with SVE	✓	✓	✓	✓	✓	✓	✓	No	Technology is demonstrated to be effective for COCs; however, the cost to implement is disproportionately higher than other technology options.
	Conductive Thermal with SVE	✓	✓	✓	✓	✓	✓	✓	No	Technology is demonstrated to be effective for COCs; however, the cost to implement is disproportionately higher than other technology options.
	Radio Frequency/Electromagnetic Thermal with SVE	✓	✓	✓	✓	✓	✓	✓	No	Technology is demonstrated to be effective for COCs; however, the cost to implement is disproportionately higher than other technology options.
	Steam Injection with SVE and Groundwater Extraction	×	×	✓	✓	✓	✓	✓	No	Technology is not implementable due to Site-specific subsurface characteristics and the cost to implement is disproportionately higher than other technology options.
	Hot Air Injection with SVE	×	×	✓	✓	✓	✓	✓	No	Technology is not implementable due to Site-specific subsurface characteristics and the cost to implement is disproportionately higher than other technology options.
	Hot Water Injection with SVE and Groundwater Extraction	×	×	✓	✓	✓	✓	✓	No	Technology is not implementable due to Site-specific subsurface characteristics and the cost to implement is disproportionately higher than other technology options.
Source Removal										
	Excavation without Shoring	×	×	×	✓	×	×	×	No	Shoring (sheet piles or CDF berms) is necessary to reach depth of contamination; however utilities make installation difficult and disproportionately higher than other technology options.
	Conventional Excavation with Structurally Sloped Sidewalls	✓	✓	✓	✓	✓	✓	✓	Yes	Technology is cost-effective and is commonly employed when practical. Maximum allowable slopes of 1.5:1 (2:1 when groundwater is encountered) conflict with space limitations and involve the removal and replacement of excessive volumes of overburden; therefore, shoring will likely be required to access contamination deeper areas of soil contamination. This technology is retained for potential implementation in combination with other technology options.
	Excavation with Shoring									
	Secant Wall - Impervious Wall	✓	✓	✓	✓	×	✓	✓	No	Technology is effective for source removal; however, the cost to implement is disproportionately higher than other technology options.
	Sheet Pile Wall (Sealed) - Impervious Wall	✓	✓	✓	✓	×	✓	✓	No	Technology is effective for source removal; however, the cost to implement is disproportionately higher than other technology options.
	Soldier Pile Wall - Non-Impervious Wall	✓	✓	✓	✓	✓	✓	✓	Yes	Technology is effective for source removal; however, there are limitations due to the building footprint and utilities in the right-of-way.
	Controlled Density Fill Berms	✓	✓	✓	✓	✓	✓	✓	Yes	Technology is effective for source removal and adaptable with utility conflicts, but is potentially limited by groundwater seepage.

SOUND ENVIRONMENTAL STRATEGIES
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Table 3
Remedial Component Screening Matrix
Darigold Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Component Group	Component Options	Protects Human Health and the Environment	Complies with Cleanup Standards	Complies with Applicable Local, State and Federal Laws	Provides for Compliance Monitoring	Uses Permanent Solutions to the Maximum Extent Practicable	Provides Reasonable Restoration Time Frame	Considers Public Concerns	Retained Alternative for Further Evaluation	Comments
		Threshold Criteria (WAC 173-340-360 [2][a])				Modifying Criteria (WAC 173-340-360 [2][b])				
In Situ Chemical Oxidation										
	Heated Sodium Persulfate	×	×	✓	✓	✓	✓	✓	No	In situ technology method not effective for remediation of COCs in soil.
	Hydrogen Peroxide	×	×	✓	✓	✓	✓	✓	No	In situ technology method not effective for remediation of COCs in soil.
	Permanganate	×	×	✓	✓	✓	✓	✓	No	In situ technology method not effective for remediation of COCs in soil.
	RegenOx™ (Catalyzed Sodium Percarbonate)	×	×	✓	✓	✓	✓	✓	No	In situ technology method not effective for remediation of COCs in soil.
Containment/Immobilization										
	Bituminization	✓	×	✓	✓	×	×	×	No	In situ technology method for soil is not cost competitive with other technologies, leaves source material in place, and requires long term monitoring.
	Emulsified Asphalt	✓	×	✓	✓	×	×	×	No	In situ technology method for soil is not cost competitive with other technologies, leaves source material in place, and requires long term monitoring.
	Modified Sulfur Cement	✓	×	✓	✓	×	×	×	No	In situ technology method for soil is not cost competitive with other technologies, leaves source material in place, and requires long term monitoring.
	Polyethylene Extrusion	✓	×	✓	✓	×	×	×	No	In situ technology method for soil is not cost competitive with other technologies, leaves source material in place, and requires long term monitoring.
	Pozzolan/Portland Cement	✓	×	✓	✓	×	×	×	No	In situ technology method for soil is not cost competitive with other technologies, leaves source material in place, and requires long term monitoring.
	Vitrification/Molten Glass	✓	×	✓	✓	✓	×	×	No	In situ technology method for soil is not cost competitive with other technologies, leaves source material in place, and requires long term monitoring.
	Slurry Wall Containment	✓	×	✓	✓	×	×	×	No	In situ technology method for soil is not cost competitive with other technologies, leaves source material in place, and requires long term monitoring.
	Sheet Pile Wall Containment	✓	×	✓	✓	×	×	×	No	In situ technology method for soil is not cost competitive with other technologies, leaves source material in place, and requires long term monitoring.
	Pump and Treat for Hydraulic Containment	✓	×	✓	✓	×	×	×	No	Technology is effective in containment of COCs dissolved in groundwater but does not remediate COCs in soil.
Phytoremediation										
	Hydraulic Control	×	×	×	×	×	×	✓	No	Hydraulic control is limited to root zone, does not address COCs in soil, and unreasonable restoration time frame.
	Phyto-Degradation	×	×	×	✓	✓	×	✓	No	Technology not compatible with future Property use.
	Phyto-Volatilization	×	×	×	✓	✓	×	✓	No	Technology not compatible with future Property use.
	Phyto-Accumulation	×	×	×	✓	✓	×	✓	No	Technology not compatible with future Property use.
	Phyto-Stabilization	×	×	×	✓	✓	×	✓	No	Technology not compatible with future Property use.
	Enhanced Rhizosphere Biodegradation	×	×	×	✓	✓	×	✓	No	Technology not compatible with future Property use.
In Situ Bioremediation										
	Aerobic Bio-Stimulation	✓	✓	✓	✓	✓	✓	✓	Yes	Retained as a companion of air sparge, SVE, or dual-phase extraction technology.
	ORC-Advanced®	✓	✓	✓	✓	✓	✓	✓	Yes	In situ technology that releases oxygen to promote aerobic bioremediation; effective technology for COCs.
	Anaerobic Bio-Augmentation	×	×	×	✓	✓	×	✓	No	Not appropriate for Site-specific COCs.
	Anaerobic Bio-Stimulation	×	×	×	✓	✓	×	✓	No	Not appropriate for Site-specific COCs.
	Nitrate-Enhanced Bioremediation	×	×	×	✓	✓	×	✓	No	Not implementable due to high COC concentration in soil.
	Sulfate-Enhanced Bioremediation	×	×	×	✓	✓	×	✓	No	Not implementable due to high COC concentration in soil.

NOTES:

× Does not meet criterion
✓ Meets criterion

COCs = chemicals of concern
PRB = permeable reactive barrier
SVE = soil vapor extraction
WAC = Washington Administrative Code

Table 4 - Components of Revised Remedial Alternatives

FFS, Darigold Rainier Avenue Facility

Components of Revised Remedial Alternatives	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Permitting, design, & infrastructure already invested[(1)]	X	X	X	X	X
Deed restrictions (e.g., prohibiting installation of drinking water wells and addressing invasive work) until cleanup levels are achieved.		X	X	X	
Operation of existing AS/SVE system.		X	X		
Construction and operation of AS/SVE system expansion.			X		
ORC® injection.			X	X	
Excavation of soils to 10-foot depth with contaminant concentrations that exceed MTCA Method A cleanup levels by more than 20X for benzene, 10X for gasoline-range TPH, and 3X for diesel-range TPH.				X	
Excavation of all soils with contaminant concentrations exceeding MTCA Method A cleanup levels.					X
Monitored natural attenuation of residual contaminants via periodic groundwater sampling, until cleanup levels are achieved.		X	X	X	X

Notes:

(1) This line item accounts primarily for pilot testing, design, and construction of the existing AS/SVE system.

Table 5 - Comparison of Revised Remedial Alternatives

FFS, Darigold Rainier Avenue Facility

	Threshold Criteria			Other Criteria[1]			
	Protection of Human Health and the Environment	Compliance with Cleanup Standards and Applicable Laws	Provision for Compliance Monitoring	Use of Permanent Solutions to the Maximum Extent Practicable	Provision for a Reasonable Restoration Time Frame	Consideration of Public Concerns	Estimated Present Worth Cost[1]
Alternative 1– No Action	▒	▒	□	(Note 2)	[30+ yrs] (Note 2)	(Note 2)	$292,000
Alternative 2– Operation of Existing AS/SVE System, Monitored Natural Attenuation, and Deed Restrictions	■	■	■	▒	[30+ yrs] □	■	$1,200,000
Alternative 3– Construction/Operation of Expanded AS/SVE System, ORC® Injection, Monitored Natural Attenuation, and Deed Restrictions	■	■	■	■	[10 yrs] ▒	■	$2,150,000
Alternative 4– Targeted Soil Excavation, ORC® Injection, Monitored Natural Attenuation, and Deed Restrictions	■	■	■	■	[5 - 7 yrs] ■	▒	$2,120,000
Alternative 5– Excavation of All Soils Exceeding MTCA Method A Cleanup Levels and Monitored Natural Attenuation	■	■	■	■	[1 - 3 yrs] ■	▒	$3,780,000

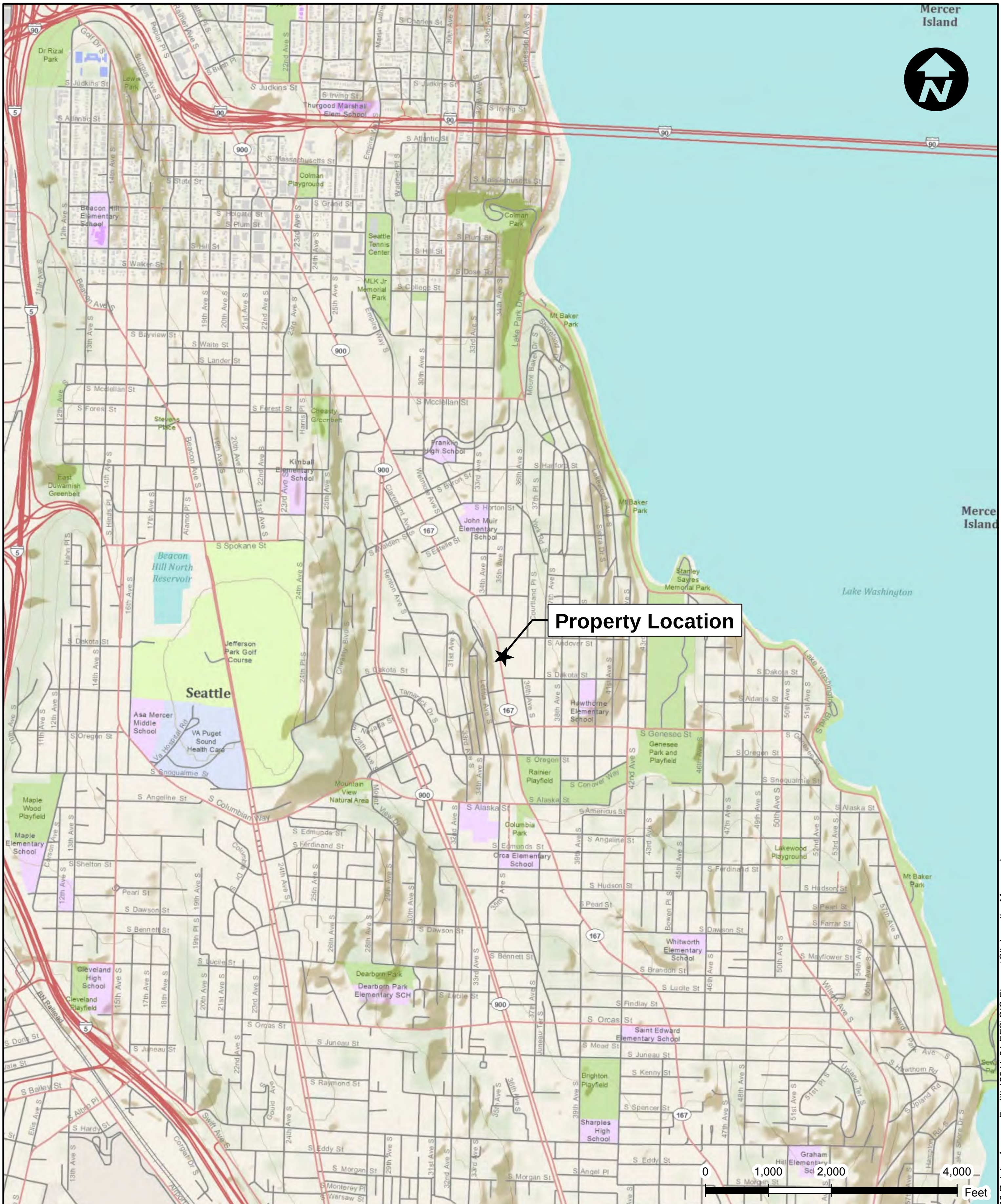
Notes:

[1] Estimated present worth costs are in 2011 dollars, and were calculated using a real discount rate of 2 percent. The itemized estimates are provided in Appendix A.

[2] Since Alternative 1 does not satisfy the threshold criteria, it is not evaluated with respect to the other criteria.

□ Does Not Generally Meet Criterion
▒ Criterion Partially Met
■ Criterion Generally Met

FIGURES



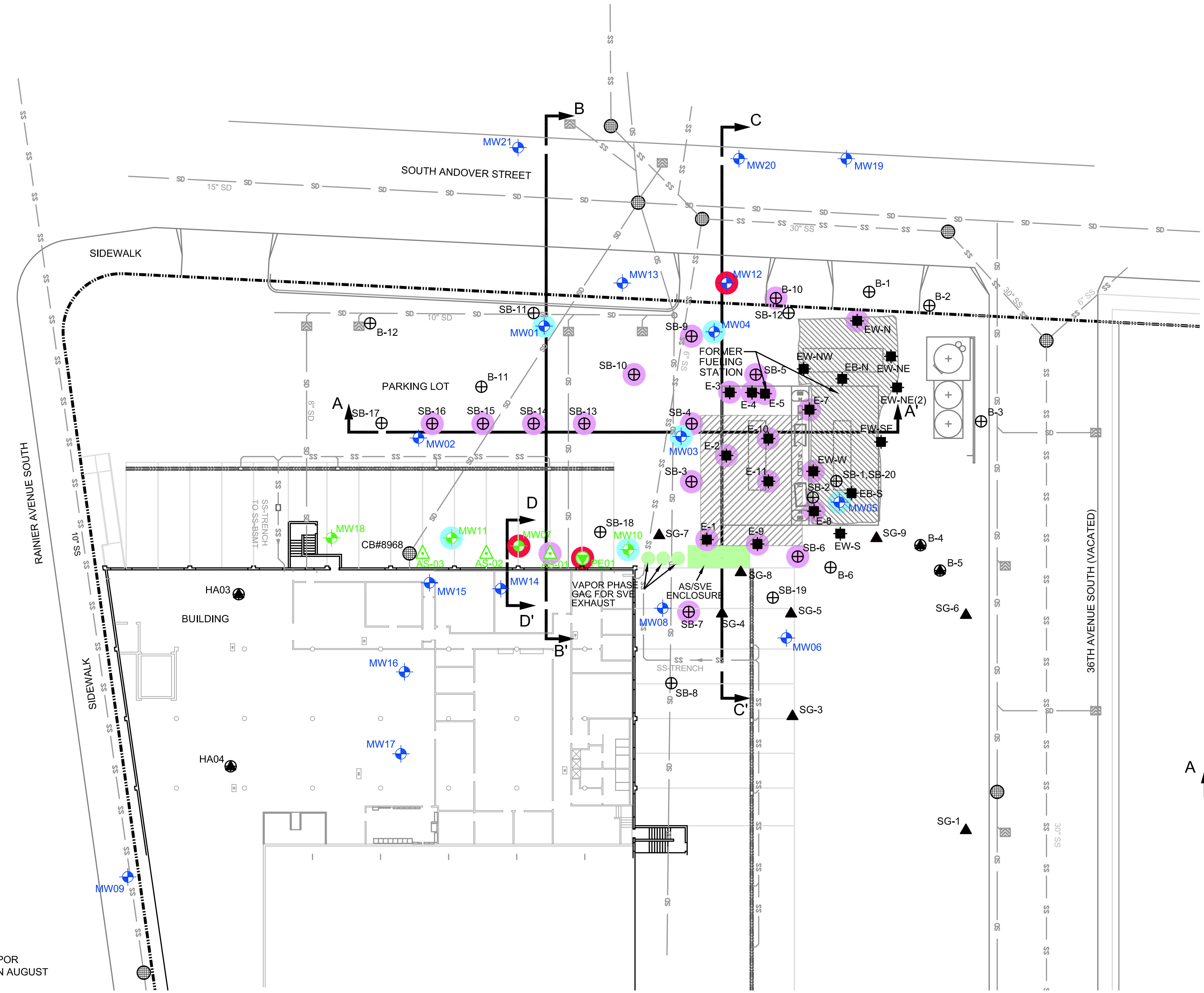
Site Location Map

Darigold - Rainier Avenue Facility
Seattle, Washington

Aspect CONSULTING

DATE: January 2011	PROJECT NO. 090066
DESIGNED BY: SCC	
DRAWN BY: SCC	FIGURE NO. 1
REVISED BY: - - -	

Path: Q:\Darigold\090066 Rainier Avenue Facility\2011-01 FFS\GIS Figures\SiteLocationMap.mxd



N

LEGEND

- B-1 SOIL BORING
- E-1 SOIL EXCAVATION BASE OR SIDEWALL SAMPLE
- SG-1 SOIL GAS SAMPLE
- MW01 GROUNDWATER MONITORING WELL
- PE01 PILOT TEST WELL

NOTE:
Green wells have been incorporated into the soil vapor extraction (SVE) system.

- AS-01 AIR SPARGING WELL
- CATCH BASIN OR CURB INLET
- MANHOLE
- PROPERTY BOUNDARY
- APPROXIMATE PARCEL BOUNDARY
- SS SANITARY SEWER
- SD STORM SEWER
- ZIPPER DRAIN
- FORMER UST
- APPROXIMATE FORMER UST EXCAVATION (SES, 2004)
- APPROXIMATE FORMER UST EXCAVATION (SD&C, 1998)
- A A' ALIGNMENT OF GENERALIZED CROSS SECTION (REFER TO FIGURES 3 THROUGH 6)
- UST UNDERGROUND STORAGE TANK

DETECTION OF MTCA METHOD A CLEANUP LEVEL EXCEEDENCES

- SOIL ONLY
- GROUNDWATER ONLY
- SOIL AND GROUNDWATER

Note:
– Among the explorations, only the monitoring wells (MWs) and Well PE01 have groundwater sampling results.
– Groundwater cleanup level exceedences are based on the four monitoring rounds between August 2009 and May 2010.

NOTES:

1.) COMPONENTS OF THE AIR SPARGE/SOIL VAPOR EXTRACTION (AS/SVE) SYSTEM INSTALLED IN AUGUST 2008 ARE COLORED GREEN ON THIS FIGURE

REFERENCES: SES, FIELD MEASUREMENTS, 2004-2009
DARIGOLD, INC, FACILITY DRAWINGS, 2005.
CITY OF SEATTLE, SEWER CARD NOS. 1442, 1443, AND 5412, 2001.
SD&C, UNDERGROUND STORAGE TANK SITE ASSESSMENT REPORT, 1998.

N
0 40 80
Feet

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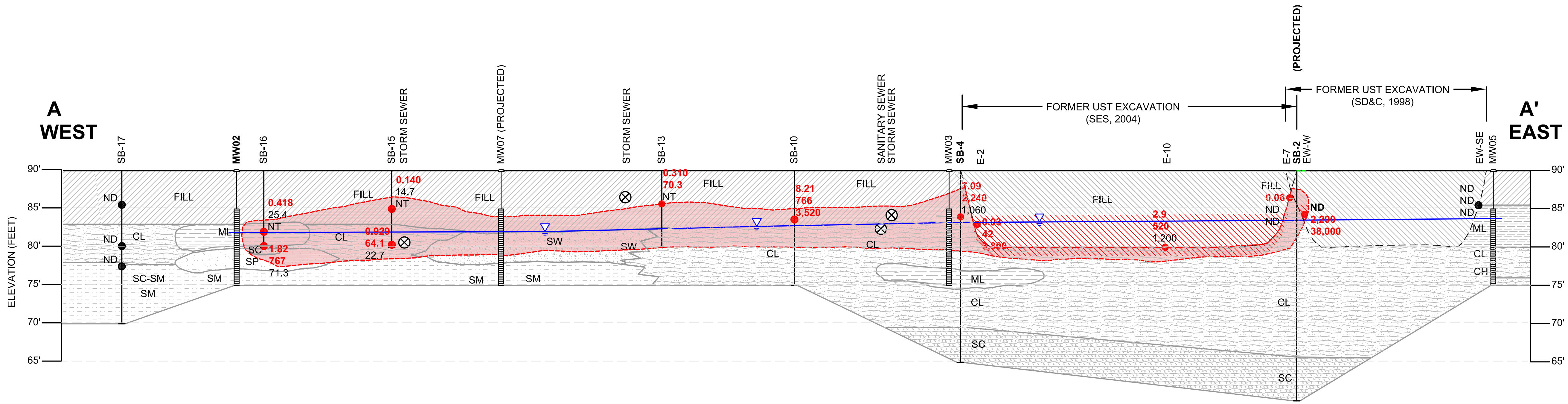
Site Plan Showing Cleanup Level Exceedences and Cross Section Alignments

Darigold - Rainier Avenue Facility
Seattle, Washington

DATE: January 2011	PROJECT NO. 090066
DESIGNED BY: DAH	
DRAWN BY: PMB	FIGURE NO. 2
REVISED BY: SCC	

Q:\Darigold\090066 Rainier Avenue Facility\2011-01 FFS\090066-02.dwg Figure 1 (11 x 17)
Jan 13, 2011 1:18pm scudd

1/11/2011



LEGEND

CL
INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS. HIGH PLASTICITY CLAYS (CH) WHERE INDICATED

ML
INORGANIC SILTS AND VERY FINE SANDS

FILL
VARIABLE. GRAVELLY SAND TO SANDY CLAY. RED GRAPHICS INDICATE POTENTIAL FOR RECONTAMINATED BACKFILL

SM
SILTY SANDS

SW
WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES

SP
POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES

SC
CLAYEY SANDS, SAND - CLAY MIXTURES

ESTIMATED EXTENT OF PETROLEUM-CONTAMINATED SOIL

MONITORING WELL CONSTRUCTION:

BLANK CASING
SCREENED INTERVAL

GROUNDWATER LEVEL
EXCAVATION EXTENTS
GROUNDWATER TABLE (OCTOBER 27, 2009)
SEWER LINE (STORM OR SANITARY)
BLACK DENOTES SAMPLE LOCATION WITH CONCENTRATION(S) BELOW MTCA METHOD A CLEANUP LEVEL(S) IN SOIL
RED DENOTES SAMPLE LOCATION WITH CONCENTRATION(S) EXCEEDING MTCA METHOD A CLEANUP LEVEL(S) IN SOIL

8.21	BENZENE
766	GRPH
3,520	DRPH

* ALL ELEVATIONS SHOWN ARE RELATIVE TO AN ARBITRARY ON-SITE DATUM OF 100 FEET.

SOIL CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM

DRPH	DIESEL-RANGE PETROLEUM HYDROCARBONS
E-10	EXCAVATION SOIL SAMPLE IDENTIFICATION NUMBER
GRPH	GASOLINE-RANGE PETROLEUM HYDROCARBONS
MTCA	WASHINGTON STATE MODEL TOXICS CONTROL ACT
MW13	MONITORING WELL IDENTIFICATION NUMBER
ND	NOT DETECTED ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT
NT	NOT TESTED
SD&C	SLOTTA DESIGN AND CONSTRUCTION
SES	SOUND ENVIRONMENTAL STRATEGIES
SB17	SOIL BORING IDENTIFICATION NUMBER
UST	UNDERGROUND STORAGE TANK
<	NOT DETECTED AT CONCENTRATION EXCEEDING LABORATORY REPORTING LIMIT

SOUND ENVIRONMENTAL STRATEGIES
SOUNDENVIRONMENTAL.COM

DATE: 12/10/09
DRAWN BY: BLR
CHECKED BY: SER/DHG
CAD FILE: 0396-001_2010FFS_XAA

PROJECT NAME: DGI RAINIER AVENUE FACILITY
SES PROJECT NUMBER: 0396-001
STREET ADDRESS: 4058 RAINIER AVENUE SOUTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:

0 15 30
APPROXIMATE SCALE IN FEET

FIGURE 3
GENERALIZED CROSS SECTION A-A'

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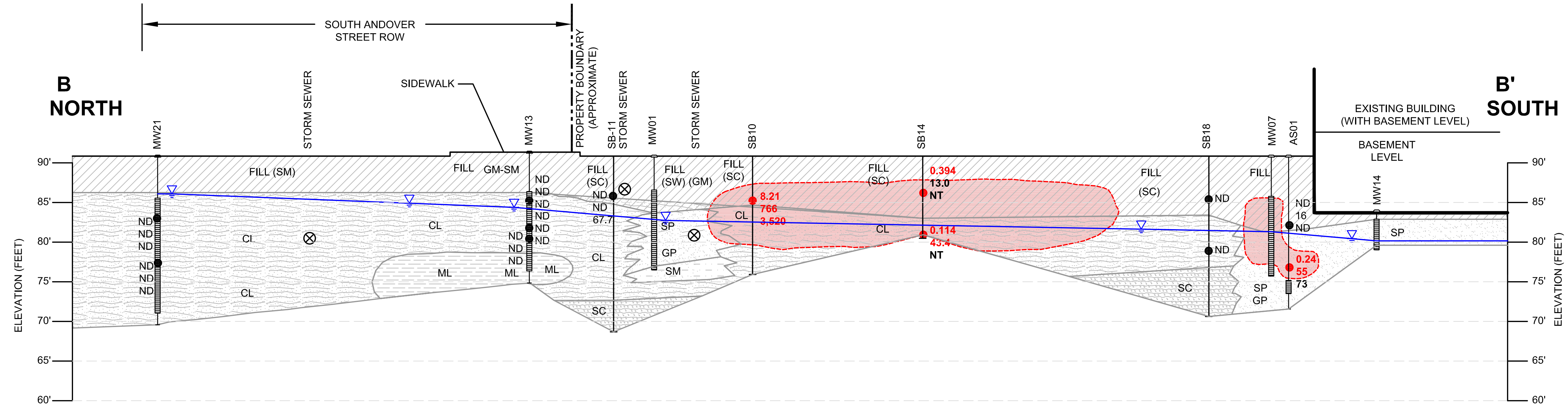


LEGEND

CL INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS. HIGH PLASTICITY CLAYS (CH) WHERE INDICATED

ML INORGANIC SILTS AND VERY FINE SANDS

FILL VARIABLE. GRAVELLY SAND TO SANDY CLAY

SM SILTY SANDS, SAND - CLAY MIXTURES

SP POORLY GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES

GP POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES

SC CLAYEY SANDS, SAND - CLAY MIXTURES

ESTIMATED EXTENT OF PETROLEUM-CONTAMINATED SOIL

MONITORING WELL CONSTRUCTION:

BLANK CASING

SCREENED INTERVAL

GROUNDWATER LEVEL

EXCAVATION EXTENTS

GROUNDWATER TABLE (OCTOBER 27, 2009)

SEWER LINE (STORM OR SANITARY)

BLACK DENOTES SAMPLE LOCATION WITH CONCENTRATION(S) BELOW MTCA METHOD A CLEANUP LEVEL(S) IN SOIL

RED DENOTES SAMPLE LOCATION WITH CONCENTRATION(S) EXCEEDING MTCA METHOD A CLEANUP LEVEL(S) IN SOIL

7.09	BENZENE
2,240	GRPH
1,060	DRPH

* ALL ELEVATIONS SHOWN ARE RELATIVE TO AN ARBITRARY ON-SITE DATUM OF 100 FEET.

SOIL CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM

DRPH	DIESEL-RANGE PETROLEUM HYDROCARBONS
GRPH	GASOLINE-RANGE PETROLEUM HYDROCARBONS
MTCA	WASHINGTON STATE MODEL TOXICS CONTROL ACT
MW13	MONITORING WELL IDENTIFICATION NUMBER
ND	NOT DETECTED ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT
NT	NOT TESTED
ROW	RIGHT-OF-WAY
SB17	SOIL BORING IDENTIFICATION NUMBER
<	NOT DETECTED AT CONCENTRATION EXCEEDING LABORATORY REPORTING LIMIT

SOUND ENVIRONMENTAL STRATEGIES
SOUNDENVIRONMENTAL.COM

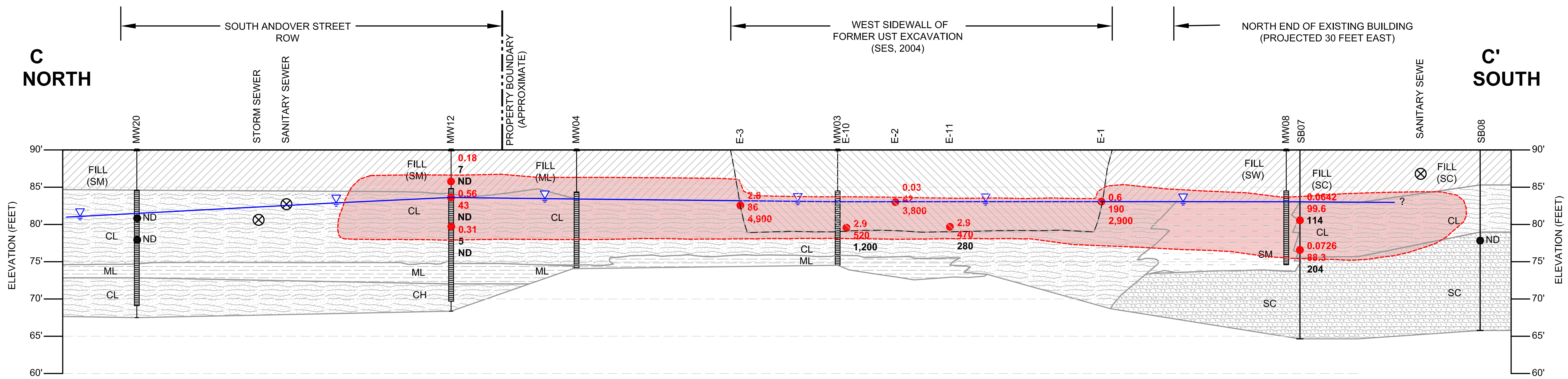
DATE: 12/10/09
DRAWN BY: BLR
CHECKED BY: SER/DHG
CAD FILE: 0396-001_2010FFS_XBB

PROJECT NAME: DGI RAINIER AVENUE FACILITY
SES PROJECT NUMBER: 0396-001
STREET ADDRESS: 4058 RAINIER AVENUE SOUTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:

0 15 30
APPROXIMATE SCALE IN FEET

FIGURE 4
GENERALIZED CROSS SECTION B-B'



LEGEND

CL INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS. HIGH PLASTICITY CLAYS (CH) WHERE INDICATED

ML INORGANIC SILTS AND VERY FINE SANDS

FILL VARIABLE. GRAVELLY SAND TO SANDY CLAY.

SM SILTY SANDS, SAND - CLAY MIXTURES

SC CLAYEY SANDS, SAND - CLAY MIXTURES

ESTIMATED HISTORICAL EXTENT OF PETROLEUM-CONTAMINATED SOIL

MONITORING WELL CONSTRUCTION:

BLANK CASING

SCREENED INTERVAL

GROUNDWATER LEVEL

APPROXIMATE LIMITS OF 2004 UST EXCAVATION

GROUNDWATER TABLE (OCTOBER 27, 2009)

SEWER LINE (STORM OR SANITARY)

BLACK DENOTES SAMPLE LOCATION WITH CONCENTRATION(S) BELOW MTCA METHOD A CLEANUP LEVEL(S) IN SOIL

RED DENOTES SAMPLE LOCATION WITH CONCENTRATION(S) EXCEEDING MTCA METHOD A CLEANUP LEVEL(S) IN SOIL

7.09	BENZENE
2,240	GRPH
1,060	DRPH

* ALL ELEVATIONS SHOWN ARE RELATIVE TO AN ARBITRARY ON-SITE DATUM OF 100 FEET.

SOIL CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM

DRPH	DIESEL-RANGE PETROLEUM HYDROCARBONS
E-11	EXCAVATION SOIL SAMPLE IDENTIFICATION NUMBER
GRPH	GASOLINE-RANGE PETROLEUM HYDROCARBONS
MTCA	WASHINGTON STATE MODEL TOXICS CONTROL ACT
MW13	MONITORING WELL IDENTIFICATION NUMBER
ND	NOT DETECTED ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT
ROW	RIGHT-OF-WAY
SB17	SOIL BORING IDENTIFICATION NUMBER
UST	UNDERGROUND STORAGE TANK
<	NOT DETECTED AT CONCENTRATION EXCEEDING LABORATORY REPORTING LIMIT

SOUND ENVIRONMENTAL STRATEGIES
SOUNDENVIRONMENTAL.COM

DATE: 01/14/10
DRAWN BY: BLR
CHECKED BY: SER/DHG
CAD FILE: 0396-001_2010FFS_XCC

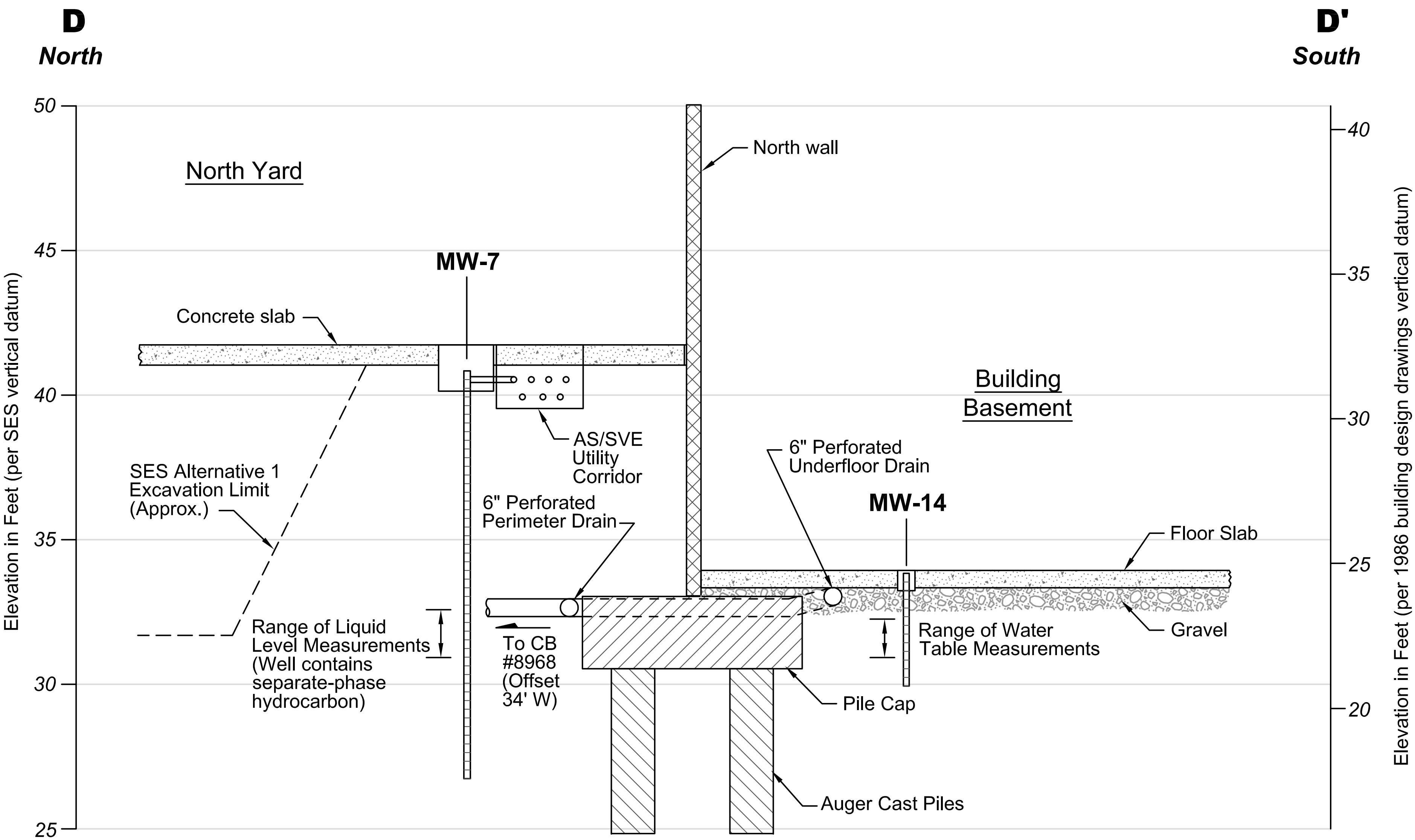
PROJECT NAME: DGI RAINIER AVENUE FACILITY
SES PROJECT NUMBER: 0396-001
STREET ADDRESS: 4058 RAINIER AVENUE SOUTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:

0 15 30
APPROXIMATE SCALE IN FEET

FIGURE 5
GENERALIZED CROSS SECTION C-C'

1/11/2011
Q:\DARIGOLD\090066 RAINIER AVENUE FACILITY\2011-01 FFS\0396-001_2010FFS_F07_XCC.DWG



Note: All dimensions, elevations and orientations are approximate.

0 5 10
Feet

Aspect CONSULTING

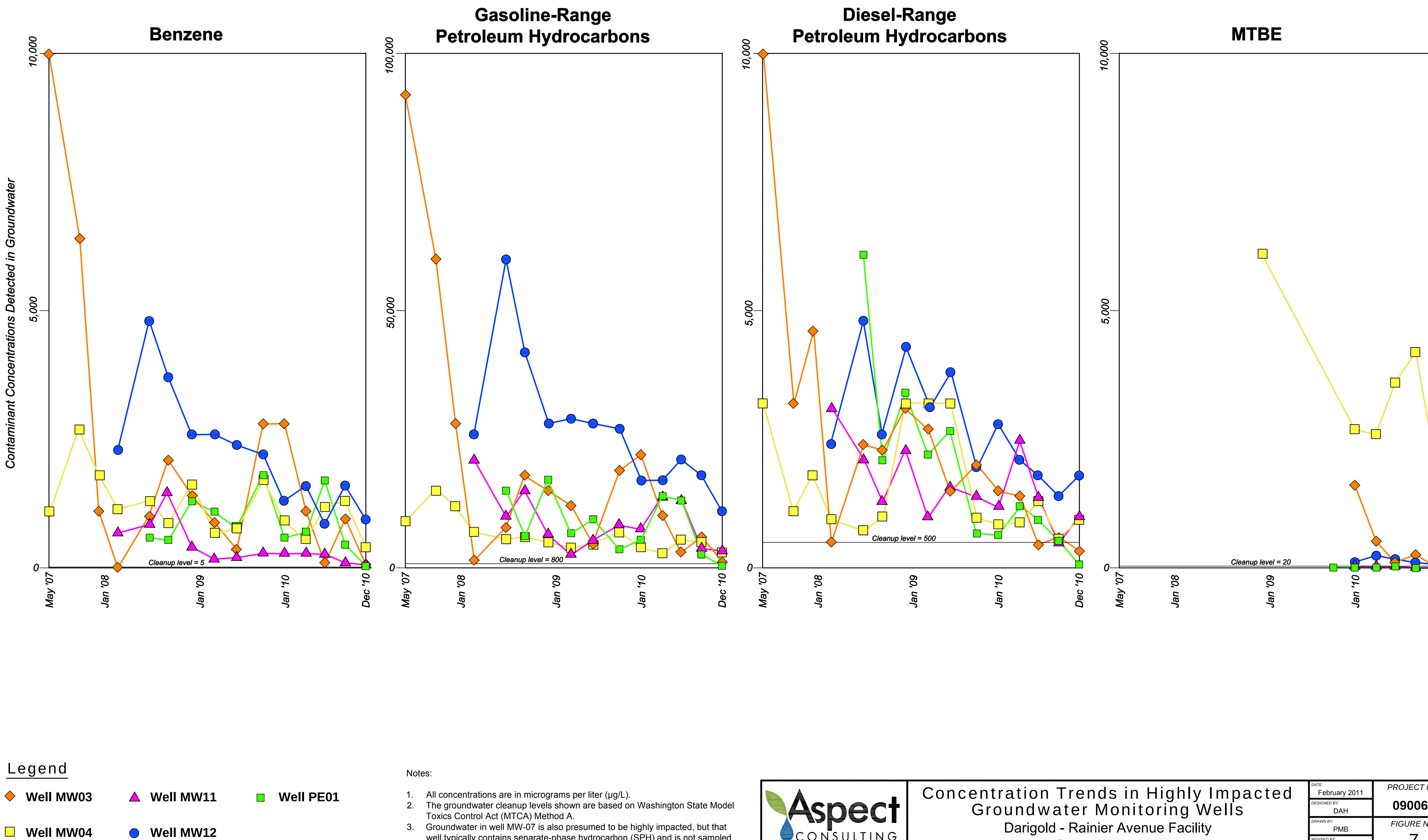
Generalized Cross Section D-D'

Darigold - Rainier Avenue Facility
Seattle, Washington

DATE: January 2011	PROJECT NO. 090066
DESIGNED BY: DAH	
DRAWN BY: PMB	FIGURE NO. 6
REVISED BY: SCC	

Q:\Darigold\090066 Rainier Avenue Facility\2011-01 FFS\090066-06.dwg Figure 2 (8.5 x 11)

Jan 13, 2011 1:20pm scudd



Notes:

1. All concentrations are in micrograms per liter (µg/L).
2. The groundwater cleanup levels shown are based on Washington State Model Toxics Control Act (MTCA) Method A.
3. Groundwater in well MW-07 is also presumed to be highly impacted, but that well typically contains separate-phase hydrocarbon (SPH) and is not sampled.

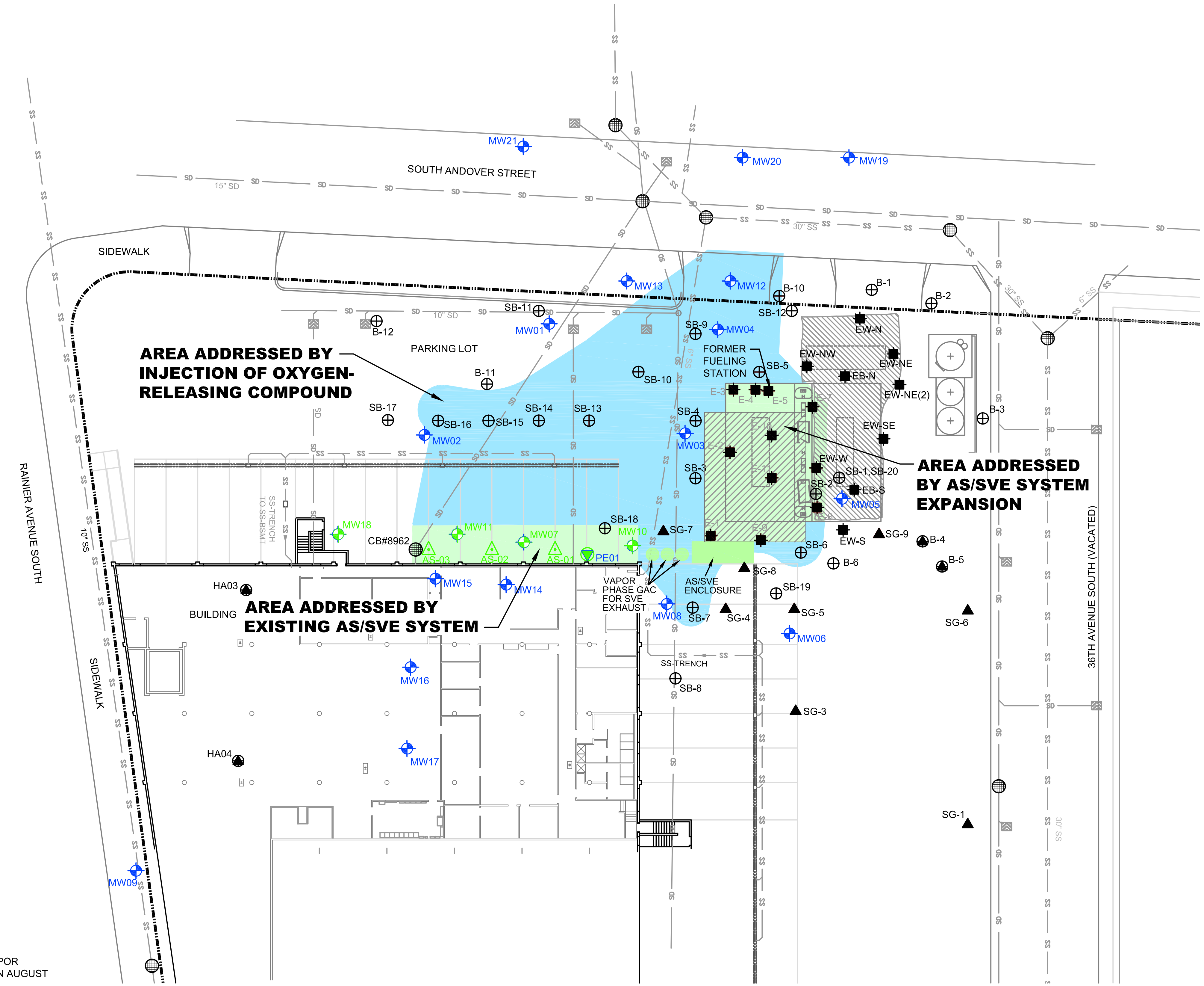
Aspect CONSULTING

Concentration Trends in Highly Impacted Groundwater Monitoring Wells

Darigold - Rainier Avenue Facility

Seattle, Washington

DATE:	February 2011	PROJECT NO.	090066
DESIGNED BY:	DAH		
DRAWN BY:	PMB	FIGURE NO.	7
REVISED BY:	SCC		



LEGEND

B-1	SOIL BORING
E-1	SOIL EXCAVATION BASE OR SIDEWALL SAMPLE
SG-1	SOIL GAS SAMPLE
MW01	GROUNDWATER MONITORING WELL
PE01	PILOT TEST WELL
	NOTE: Green wells have been incorporated into the soil vapor extraction (SVE) system.
AS-01	AIR SPARGING WELL
	CATCH BASIN OR CURB INLET
	MANHOLE
	PROPERTY BOUNDARY
	APPROXIMATE PARCEL BOUNDARY
SS	SANITARY SEWER
SD	STORM SEWER
	ZIPPER DRAIN
	FORMER UST
	APPROXIMATE FORMER UST EXCAVATION (SES, 2004)
	APPROXIMATE FORMER UST EXCAVATION (SD&C, 1998)
UST	UNDERGROUND STORAGE TANK

Areas of Cleanup Technology Application

- AIR SPARGING / SOIL VAPOR EXTRACTION (AS/SVE)
- INJECTION OF OXYGEN-RELEASING COMPOUND

NOTES:

1.) COMPONENTS OF THE AIR SPARGE/SOIL VAPOR EXTRACTION (AS/SVE) SYSTEM INSTALLED IN AUGUST 2008 ARE COLORED GREEN ON THIS FIGURE

REFERENCES : SES, FIELD MEASUREMENTS, 2004-2009
DARIGOLD, INC, FACILITY DRAWINGS, 2005.
CITY OF SEATTLE, SEWER CARD NOS. 1442, 1443, AND 5412, 2001.
SD&C, UNDERGROUND STORAGE TANK SITE ASSESSMENT REPORT, 1998.

0 40 80
Feet

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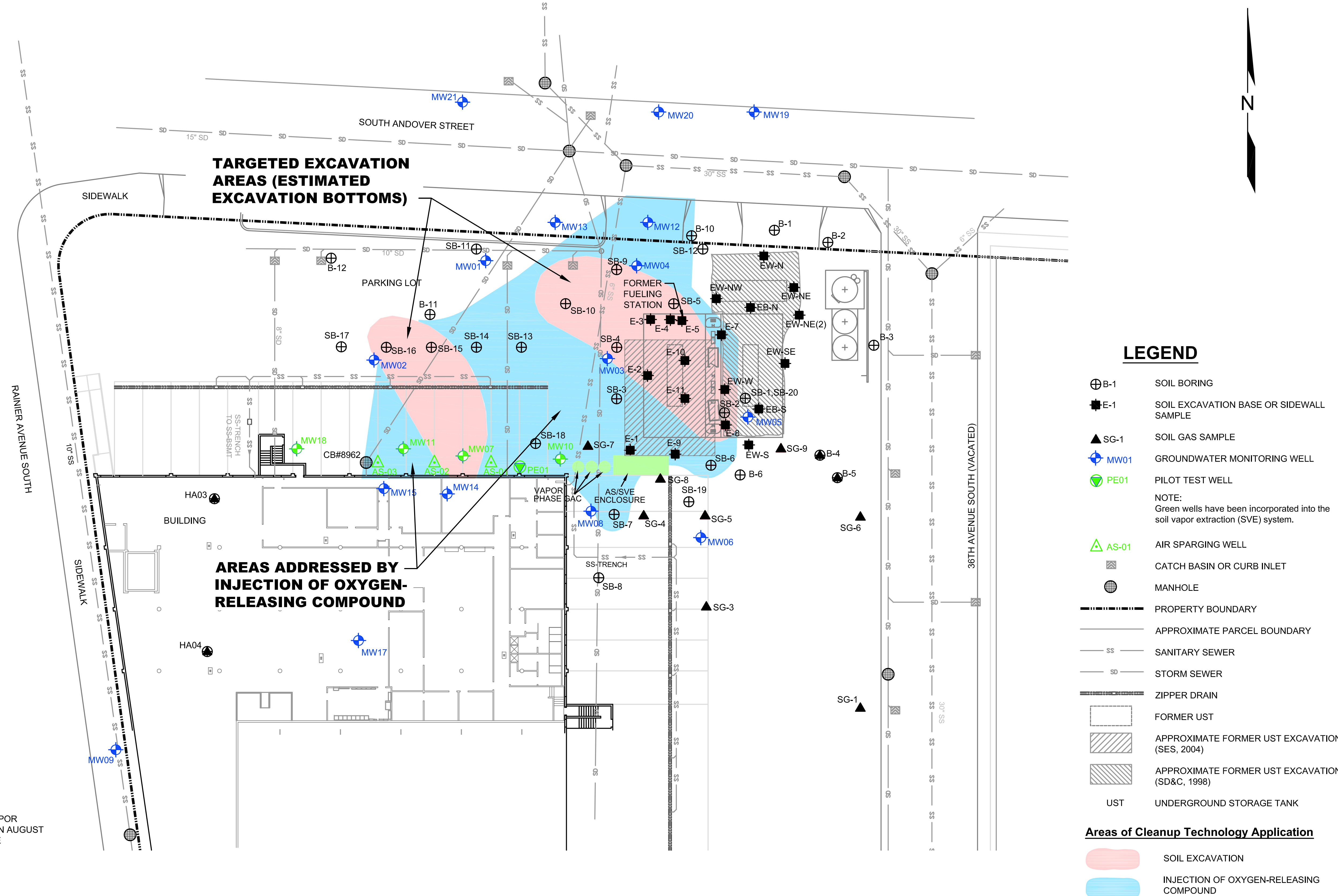
Alternative 3 - Remediation Using *In Situ* Technologies Only
Darigold - Rainier Avenue Facility
Seattle, Washington

DATE: January 2011	PROJECT NO. 090066
DESIGNED BY: DAH	
DRAWN BY: PMB	FIGURE NO. 8
REVISED BY: SCC	

Q:\Darigold\090066 Rainier Avenue Facility\2011-01 FFS\090066-04.dwg Figure 4 (11 x 17)
Jan 13, 2011 1:24pm scudd



NOTES:

1.) COMPONENTS OF THE AIR SPARGE/SOIL VAPOR EXTRACTION (AS/SVE) SYSTEM INSTALLED IN AUGUST 2008 ARE COLORED GREEN ON THIS FIGURE

REFERENCES : SES, FIELD MEASUREMENTS, 2004-2009
DARIGOLD, INC, FACILITY DRAWINGS, 2005.
CITY OF SEATTLE, SEWER CARD NOS. 1442, 1443, AND 5412, 2001.
SD&C, UNDERGROUND STORAGE TANK SITE ASSESSMENT REPORT, 1998.

N
0 40 80
Feet

Aspect CONSULTING

Alternative 4 - Targeted Excavation

Darigold - Rainier Avenue Facility
Seattle, Washington

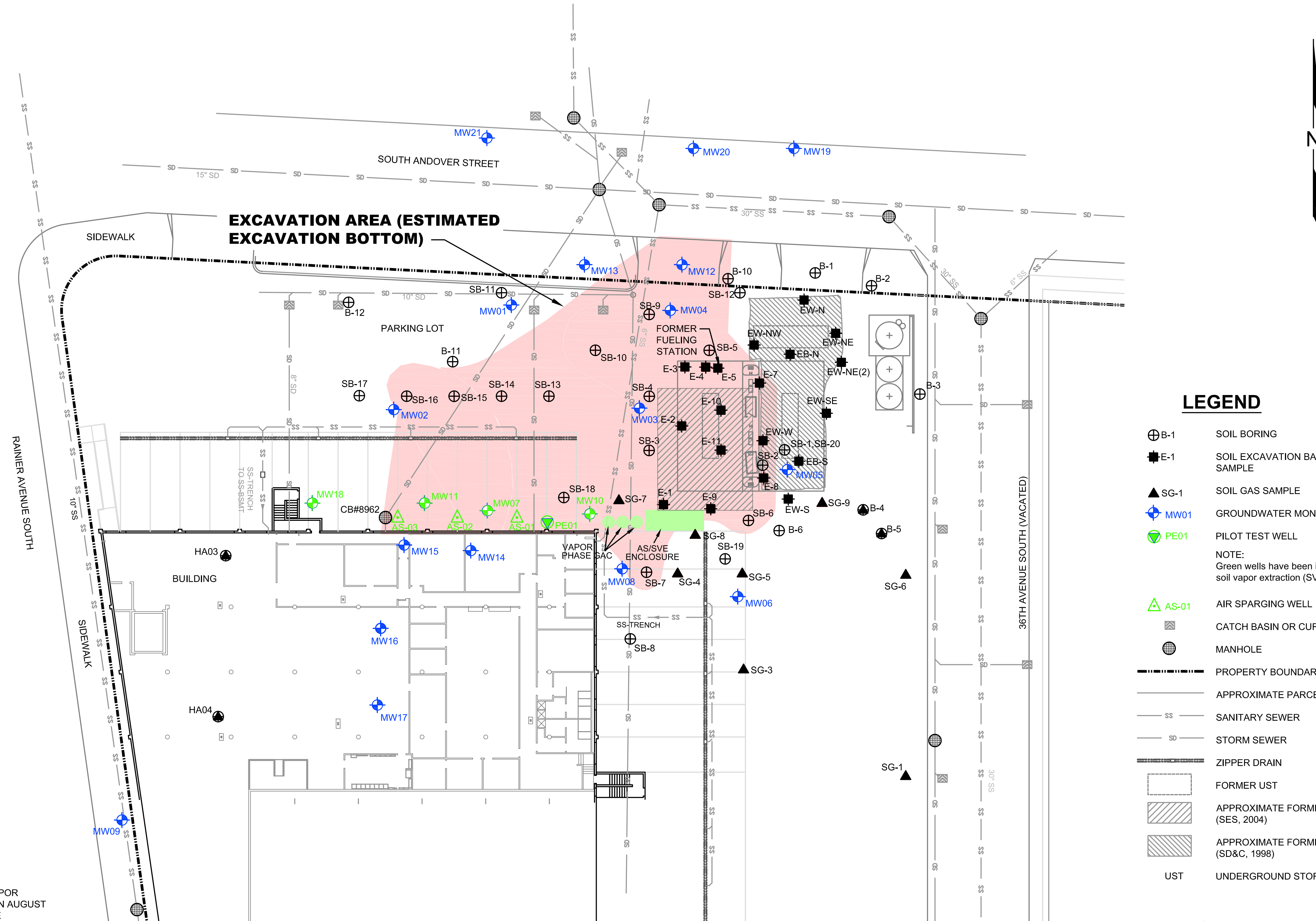
DATE: January 2011
DESIGNED BY: DAH
DRAWN BY: PMB
REVISED BY: SCC

PROJECT NO. 090066

FIGURE NO. 9

Q:\Darigold\090066 Rainier Avenue Facility\2011-01 FFS\090066-05.dwg Figure 5 (11 x 17)

Jan 13, 2011 1:25pm scudd



LEGEND

B-1	SOIL BORING
E-1	SOIL EXCAVATION BASE OR SIDEWALL SAMPLE
SG-1	SOIL GAS SAMPLE
MW01	GROUNDWATER MONITORING WELL
PE01	PILOT TEST WELL
	NOTE: Green wells have been incorporated into the soil vapor extraction (SVE) system.
AS-01	AIR SPARGING WELL
	CATCH BASIN OR CURB INLET
	MANHOLE
	PROPERTY BOUNDARY
	APPROXIMATE PARCEL BOUNDARY
SS	SANITARY SEWER
SD	STORM SEWER
	ZIPPER DRAIN
	FORMER UST
	APPROXIMATE FORMER UST EXCAVATION (SES, 2004)
	APPROXIMATE FORMER UST EXCAVATION (SD&C, 1998)
UST	UNDERGROUND STORAGE TANK

Areas of Cleanup Technology Application

SOIL EXCAVATION

NOTES:

1.) COMPONENTS OF THE AIR SPARGE/SOIL VAPOR EXTRACTION (AS/SVE) SYSTEM INSTALLED IN AUGUST 2008 ARE COLORED GREEN ON THIS FIGURE

REFERENCES : SES, FIELD MEASUREMENTS, 2004-2009
DARIGOLD, INC, FACILITY DRAWINGS, 2005.
CITY OF SEATTLE, SEWER CARD NOS. 1442, 1443, AND 5412, 2001.
SD&C, UNDERGROUND STORAGE TANK SITE ASSESSMENT REPORT, 1998.

0 40 80
Feet

Aspect CONSULTING

Alternative 5 - Extensive Excavation

Darigold - Rainier Avenue Facility
Seattle, Washington

DATE: January 2011
DESIGNED BY: DAH
DRAWN BY: PMB
REVISED BY: SCC

PROJECT NO. 090066

FIGURE NO. 10

Q:\Darigold\090066 Rainier Avenue Facility\2011-01 FFS\090066-07.dwg Figure 6 (11 x 17)

Jan 13, 2011 1:27pm scudd

APPENDIX A

Cost Estimates for Remedial Alternatives

Table A.1 - Cost Estimate for Alternative 1

No Action

FFS, Darigold Rainier Avenue Facility

	No. of Units	Units	Unit Cost	Cost	Year of Expenditure	Present Worth Cost	Notes
SUNK COSTS							
Permitting, design, & infrastructure already invested	1	ls	$275,000	$275,000	2008	$291,832	(3)
TOTAL PRESENT WORTH COST (2011 Dollars)						**$291,832**	

Notes:

1) These FS-level cost estimates are based on 2011 dollars and have an accuracy of -30/+50 percent.

2) Present worth costs are calculated using a discount rate of 2 percent.

3) Sunk costs are primarily 2008 expenditures for pilot testing, design, and construction of the existing AS/SVE system.

Table A.2 - Cost Estimate for Alternative 2

Operate Existing AS/SVE System with MNA

FFS, Darigold Rainier Avenue Facility

	No. of Units	Units	Unit Cost	Year of Expenditure	Present Worth Cost	Notes
PRESENT WORTH OF SUNK COSTS (from Table A.1)					**$291,832**	
COSTS RELATED TO CLEANUP INITIATION						(3)
Pre-CAP testing of existing AS/SVE system (incl. PSCAA permit)	1	ls	$70,000	2011	$70,000	
CAP/eng. design/O&M manual/MNA mon. & contingency plan	1	ls	$60,000	2011	$60,000	
Property deed restrictions	1	ls	$20,000	2011	$20,000	
Present Worth of Costs Related to Cleanup Initiation					**$150,000**	

LONGER-TERM COSTS	No. of Units	Units	Unit Cost	Annual Cost	Years of Expenditure	Present Worth Cost	Notes
Annual AS/SVE system O&M costs, incl. electricity	1	ea	$75,000	$75,000	2012 - 2014	$212,050	(4)
Quarterly groundwater monitoring/reporting	4	events	$10,000	$40,000	2011 - 2014	$152,309	(5)
Semi-annual groundwater monitoring/reporting	2	events	$10,000	$20,000	2015 - 2040	$371,775	(6)
Closure coordination & reporting	1	ls	$40,000	$40,000	2040	$22,524	(6)
Present Worth of Longer-Term Costs						**$758,658**	
TOTAL PRESENT WORTH COST (2011 Dollars)						**$1,200,491**	

Notes:

1) These FS-level cost estimates are based on 2011 dollars and have an accuracy of -30/+50 percent.
2) Present worth costs are calculated using a discount rate of 2 percent.
3) It is assumed that indoor air and the CB#8962 storm sewer are further investigated, and are determined not to be potential exposure pathways. Investigation costs are not included in this cost estimate.
4) It is assumed that SPH in the vicinity of Well MW07 is demonstrated to be remediated after 3 years of AS/SVE operation, at which point the AS/SVE system is shut down.
5) Quarterly groundwater monitoring is assumed for the first 4 years, followed by semi-annual.
6) The remediation time frame for this alternative is estimated at 30 years or more. This cost estimate assumes that cleanup levels are achieved in 2040.

Table A.3 - Cost Estimate for Alternative 3

In Situ Technologies Only

FFS, Darigold Rainier Avenue Facility

	No. of Units	Units	Unit Cost	Year of Expenditure	Present Worth Cost	Notes
PRESENT WORTH OF SUNK COSTS (from Table A.1)					**$291,832**	
COSTS RELATED TO CLEANUP INITIATION/CONSTRUCTION						(3)
Pre-CAP testing of existing AS/SVE system (incl. PSCAA permit)	1	ls	$70,000	2011	$70,000	
Pilot study of ORC® injection	1	ls	$50,000	2011	$50,000	
CAP/eng. design/O&M manual/mon. & contingency plan	1	ls	$90,000	2011	$90,000	
Property deed restrictions	1	ls	$20,000	2011	$20,000	
Construct AS/SVE system expansion	1	ls	$180,000	2011	$180,000	
Present Worth of Costs Related to Cleanup Initiation/Construction					**$410,000**	

LONGER-TERM COSTS	No. of Units	Units	Unit Cost	Annual Cost	Years of Expenditure	Present Worth Cost	Notes
Annual AS/SVE system O&M costs, incl. electricity	1	ea	$130,000	$130,000	2012 - 2016	$600,735	(4)
ORC® injection	1	ea	$180,000	-	2012/2014/2016	$509,120	(5)
Quarterly groundwater monitoring/reporting	4	events	$10,000	$40,000	2011 - 2016	$224,057	(6)
Semi-annual groundwater monitoring/reporting	2	events	$10,000	$20,000	2017 - 2021	$83,708	(7)
Closure coordination & reporting	1	ls	$40,000	$40,000	2021	$32,814	(7)
Present Worth of Longer-Term Costs						**$1,450,435**	
TOTAL PRESENT WORTH COST (2011 Dollars)						**$2,152,267**	

Notes:

1) These FS-level cost estimates are based on 2011 dollars and have an accuracy of -30/+50 percent.
2) Present worth costs are calculated using a discount rate of 2 percent.
3) It is assumed that indoor air and the CB#8962 storm sewer are further investigated, and are determined not to be potential exposure pathways. Investigation costs are not included in this cost estimate.
4) It is assumed that the expanded AS/SVE system is operated for 5 years.
6) Three ORC® injection events are assumed, occurring at 2-year intervals. Costs include planning, coordination, execution, performance evaluation, and reporting.
6) Quarterly groundwater monitoring is assumed for the first 6 years, followed by semi-annual.
7) The remediation time frame for this alternative is estimated at 10 years.

Table A.4 - Cost Estimate for Alternative 4

Targeted Excavation

FFS, Darigold Rainier Avenue Facility

	No. of Units	Units	Unit Cost	Year of Expenditure	Present Worth Cost	Notes
PRESENT WORTH OF SUNK COSTS (from Table A.1)					**$291,832**	
COSTS RELATED TO CLEANUP INITIATION/CONSTRUCTION						(3)
Pilot study of ORC® injection	1	ls	$50,000	2011	$50,000	
CAP/eng. design/permitting/mon. & contingency plan	1	ls	$90,000	2011	$90,000	
Property deed restrictions	1	ls	$20,000	2011	$20,000	
Targeted soil excavation						
- Construction preparation	1	ls	$70,000	2011	$70,000	(4)
- TESC measures, traffic controls, flaggers, site security	1	ls	$90,000	2011	$90,000	
- Asphalt & concrete saw cutting, demolition, & disposal	230	ton	$100	2011	$23,000	
- CDF berm construction	600	cy	$130	2011	$78,000	
- Excavate, transport, & dispose of overburden soil	1,035	ton	$40	2011	$41,400	(5,6)
- Excavate, transport, & dispose of contaminated soil	3,105	ton	$90	2011	$279,450	(5,6)
- ORC® placement in excavation	1	ls	$30,000	2011	$30,000	
- Import, place, & compact clean structural fill	3,060	ton	$50	2011	$153,000	(6)
- Utilities reroute/reconnect	1	ls	$30,000	2011	$30,000	
- Pavement restoration (asphalt & concrete)	1	ls	$50,000	2011	$50,000	
- Water management during construction	1	ls	$30,000	2011	$30,000	
- Subcontractor markup @ 15% (incl. state & local taxes)	1	ls	$131,228	2011	$131,228	
- Other indirect costs	1	ls	$130,000	2011	$130,000	(7)
Present Worth of Costs Related to Cleanup Initiation/Construction					**$1,296,078**	

LONGER-TERM COSTS	No. of Units	Units	Unit Cost	Annual Cost	Years of Expenditure	Present Worth Cost	Notes
ORC® injection	1	ea	$150,000	-	2012/2014	$288,407	(8)
Quarterly groundwater monitoring/reporting	4	events	$10,000	$40,000	2011 - 2014	$152,309	(9)
Semi-annual groundwater monitoring/reporting	2	events	$10,000	$20,000	2015 - 2017	$53,285	(10)
Closure coordination & reporting	1	ls	$40,000	$40,000	2017	$35,519	(10)
Present Worth of Longer-Term Costs						**$529,520**	
TOTAL PRESENT WORTH COST (2011 Dollars)						**$2,117,430**	

Notes:

1) These FS-level cost estimates are based on 2011 dollars and have an accuracy of -30/+50 percent.
2) Present worth costs are calculated using a discount rate of 2 percent.
3) It is assumed that indoor air and the CB#8962 storm sewer are further investigated, and are determined not to be potential exposure pathways. Investigation costs are not included in this cost estimate. In addition, it is assumed that the existing AS/SVE system is rejected as a remedial component without testing.
4) Construction preparation includes bid package preparation/solicitation/award, contracting, preconstruction submittals, bonding/insurance, mobilization, surveying, and site preparation.
5) All excavated soil (2,300 cy assumed) is assumed to be disposed of offsite (no onsite area available for stockpiling). Assume 25% of excavated soil can be disposed of as "clean" overburden; 75% as petroleum-impacted.
6) An in-place density of 1.8 ton/cy is assumed for both the excavated soil and the imported structural fill.
7) "Other indirect costs" include construction oversight, performance monitoring, confirmation sampling, analytical laboratory costs, and removal action reporting. A 7-week construction period is assumed.
8) Two ORC® injection events are assumed, occurring at 2-year intervals. Costs include planning, coordination, execution, performance evaluation, and reporting.
9) Quarterly groundwater monitoring is assumed for the first 4 years, followed by semi-annual.
10) The remediation time frame for this alternative is estimated at 6 years.

Table A.5 - Cost Estimate for Alternative 5

Extensive Excavation

FFS, Darigold Rainier Avenue Facility

	No. of Units	Units	Unit Cost	Year of Expenditure	Present Worth Cost	Notes
PRESENT WORTH OF SUNK COSTS (from Table A.1)					**$291,832**	
COSTS RELATED TO CLEANUP INITIATION/CONSTRUCTION						(3)
CAP/eng. design/permitting/mon. & contingency plan	1	ls	$200,000	2011	$200,000	
Extensive soil excavation						
- Construction preparation	1	ls	$120,000	2011	$120,000	(4)
- TESC measures, traffic controls, flaggers, site security	1	ls	$200,000	2011	$200,000	
- Asphalt & concrete saw cutting, demolition, & disposal	1	ls	$60,000	2011	$60,000	
- Shoring - H-pile & lagging (on property)	8,000	sf	$55	2011	$440,000	
- Shoring - sheet pile (Andover ROW)	800	sf	$60	2011	$48,000	
- Excavate, transport, & dispose of overburden soil	2,700	ton	$40	2011	$108,000	(5,6)
- Excavate, transport, & dispose of contaminated soil	8,100	ton	$90	2011	$729,000	(5,6)
- Import, place, & compact clean structural fill	10,800	ton	$50	2011	$540,000	(6)
- Utilities reroute/reconnect	1	ls	$80,000	2011	$80,000	
- Pavement restoration (asphalt & concrete)	1	ls	$90,000	2011	$90,000	
- Water management during construction	1	ls	$100,000	2011	$100,000	
- Subcontractor markup @ 15% (incl. state & local taxes)	1	ls	$377,250	2011	$377,250	
- Other indirect costs	1	ls	$280,000	2011	$280,000	(7)
Present Worth of Costs Related to Cleanup Initiation/Construction					**$3,372,250**	

LONGER-TERM COSTS	No. of Units	Units	Unit Cost	Annual Cost	Years of Expenditure	Present Worth Cost	Notes
Quarterly groundwater monitoring/reporting	4	events	$10,000	$40,000	2011 - 2012	$77,662	(8)
Closure coordination & reporting	1	ls	$40,000	$40,000	2017	$35,519	(9)
Present Worth of Longer-Term Costs						**$113,181**	
TOTAL PRESENT WORTH COST (2011 Dollars)						**$3,777,263**	

Notes:

1) These FS-level cost estimates are based on 2011 dollars and have an accuracy of -30/+50 percent.
2) Present worth costs are calculated using a discount rate of 2 percent.
3) It is assumed that the existing AS/SVE system is rejected as a remedial component without testing.
4) Construction preparation includes bid package preparation/solicitation/award, contracting, preconstruction submittals, bonding/ insurance, mobilization, surveying, and site preparation.
5) All excavated soil (6,000 cy assumed) is assumed to be disposed of offsite (no onsite area available for stockpiling). Assume 25% of excavated soil can be disposed of as "clean" overburden; 75% as petroleum-impacted.
6) An in-place density of 1.8 ton/cy is assumed for both the excavated soil and the imported structural fill.
7) "Other indirect costs" include construction oversight, performance monitoring, confirmation sampling, analytical laboratory costs, and removal action reporting. A 15-week construction period is assumed.
8) Quarterly groundwater monitoring is assumed for 2 years.
9) The remediation time frame for this alternative is estimated at 2 years.

APPENDIX B

Soil Vapor Extraction Pilot Test Data

SOUND ENVIRONMENTAL STRATEGIES
www.soundenvironmental.com

Table 1.1
Recovery Well Measurements
SVE Test Well MW07
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

SVE Pilot Test Well: MW07																		
						Instrument Train								Bleed Air				
Date	Time	Barometric Pressure (psi)	Manual Dilution Valve (% open)	Well-Head Vacuum (in. H_2O)	Vacuum Truck Vacuum (in.Hg)	Total/Static Vacuum (in. H_2O)	Diff. Pressure (in. H_2O)	Temp (°F)	VOC (ppmv)	LEL (%)	O_2 (%)	CO_2 (% or ppm)	Flow Rate (scfm)	Total/Static Vacuum (in. H_2O)	Diff. Pressure (in. H_2O)	Temp (°F)	Flow Rate (scfm)
06/03/08	1430	14.64	100	5.5	0	5.0	0.04	53	1617	>100	12.4	>5.0%	11.82	6.0	4	58	117.43
06/03/08	1530	14.64	75	6.0	0	6.0	0.02	55	1660	>95	9.0	4.71%	8.33	2.5	3.5	57	110.43
06/03/08	1550	14.64	50	8.5	0	8.5	0.02	56	>2,000	>95	11.2	>4.9%	8.30	5.5	3.5	56	110.15
06/03/08	1605	14.64	25	29.0	NM	28.0	0.08	54	>2,000	>100	11.0	>5.0%	16.22	27.0	3.0	53	99.49
06/03/08	1625	14.64	15	60.0	4	65.0	0.22	56	>2,000	>100	11.2	>5.0%	25.50	62.0	1.5	58	66.70
06/03/08	1635	14.64	15	*Collect vapor sample.*													
06/03/08	1640	14.64	NM	*End test.*													
			Maximum:	**60.0**								**Maximum:**	**25.5**				
			Minimum:	**5.5**								**Minimum:**	**8.3**				
			Average:	**21.8**								**Average:**	**14.0**				

NOTES:

4-Gas Meter Alarm Limits: LEL, Peak = 100%; CO_2 = 5.00%; O_2 = 20.9.
PID Meter Alarm Limit: 2,000 ppm.
Static pressure was taken from LP/HP; calculate flow rate with reading from HP.
VOCs measured with the PID; 4-Gas Meter measured LEL/O_2/CO_2.
Vapor sample collected - MW07-20080603 at 1635.
End SVE test on MW07 at 1640.
Barometric pressure readings were downloaded from the Weather Underground website: <http://www.wunderground.com>.

> = greater than detection limit
°F = degrees Fahrenheit
CO_2 = carbon dioxide
DGI = Darigold, Inc.
Diff. = differential
HP = high port on DS-300
in. H_20 = inches of water
in. Hg = inches of mercury
LEL = lower explosive limit
LP = low port on DS-300

NM = not measured
O_2 = oxygen
PID = photoionization detector
ppm = parts per million
ppmv = parts per million by volume
psi = pounds per square inch
scfm = standard cubic feet per minute
SVE = soil vapor extraction
Temp = temperature
VOC = volatile organic compound

SOUND ENVIRONMENTAL STRATEGIES
www.soundenvironmental.com

Table 1.2
Observation Well-Head Vacuum Measurements
SVE Test Well MW07
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

SVE Pilot Test Well: MW07									
Date	Time	Manual Dilution Valve (% open)	Well-Head Vacuum Measurements (inches of water)						
			MW01	MW02	MW07	MW10	MW11	PE01
istance to SVE Pilot Test Well (feet):			77	51.0	NA	32	23	23
06/03/08	1430	100	0.00	0.03	**5.0**	0.05	0.06	0.04
06/03/08	1530	75	0.00	0.02	**6.0**	0.02	0.06	0.06
06/03/08	1550	50	0.00	0.18	**8.5**	0.04	0.22	0.24
06/03/08	1605	25	0.04	0.20	**28.0**	0.04	0.23	0.18
06/03/08	1625	15	0.02	0.36	**65.0**	0.08	0.40	0.42
		Maximum ROI:	77					
		Minimum ROI:	23					
		Average ROI:	41					

NOTES:

Shaded area denotes a measurement from the pilot test well.

NA = not applicable

DGI = Darigold, Inc.

ROI = radius of influence

SVE = soil vapor extraction

Table 2.1
Recovery Well Measurements
SVE Test Well MW10
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

SVE Pilot Test Well: MW10																	
						Instrument Train								Bleed Air			
Date	Time	Barometric Pressure (psi)	Manual Dilution Valve (% open)	Well-Head Vacuum (in. H_2O)	Vacuum Truck Vacuum (in.Hg)	Total/ Static Vacuum (in. H_2O)	Diff. Pressure (in. H_2O)	Temp (°F)	VOC (ppmv)	LEL (%)	O_2 (%)	CO_2 (% or ppm)	Flow Rate (scfm)	Total/ Static Vacuum (in. H_2O)	Diff. Pressure (in. H_2O)	Temp (°F)	Flow Rate (scfm)
06/03/08	1658	14.64	100	6.0	0	6.0	0.02	60	NM	NM	NM	NM	8.30	1.5	4.5	60	125.13
06/03/08	1710	14.64	50	10.0	0	9.5	0.00	60	124	22	17.3	1.70%	0.00	6.0	4.5	58	124.67
06/03/08	1730	14.64	25	37.0	1	36.0	0.02	60	88.7	12	19.4	7280 ppm	7.98	32.0	3.5	59	106.21
06/03/08	1750	14.65	15	88.0	4	89.0	0.00	60	24.8	23	18.0	1.40%	0.00	86.0	2.0	58	74.35
06/03/08	1805	14.64	50	10.5	0	*Collect vapor sample.*											
06/03/08	1810	14.65	NM	NM	NM	*End test.*											
			Maximum:	**88**								**Maximum:**	**8**				
			Minimum:	**6**								**Minimum:**	**8**				
			Average:	**30**								**Average:**	**8**				

NOTES:
4-Gas Meter Alarm Limits: LEL, Peak = 100%; CO_2 = 5.00%; O_2 = 20.9.
PID Meter Alarm Limit: 2,000 ppm.
Static Pressure was taken from LP/HP; calculate flow rate with reading from HP.
VOCs measured with the PID; 4-Gas Meter measured LEL/O_2/CO_2.
Vapor sample collected - MW10-20080603 at 1805.
End SVE Test on MW07 at 1810.
Barometric pressure readings were downloaded from the Weather Underground website: <http://www.wunderground.com>.

> = greater than detection limit
°F = degrees Fahrenheit
CO_2 = carbon dioxide
DGI = Darigold, Inc.
Diff. = differential
in. H_20 = inches of water
in. Hg = inches of mercury
HP = high port on DS-300
LEL = lower explosive limit
LP = low port of DS-300

NM = not measured
O_2 = oxygen
PID = photoionization detector
ppm = parts per million
ppmv = parts per million by volume
psi = pounds per square inch
scfm = standard cubic feet per minute
SVE = soil vapor extraction
Temp = temperature
VOC = volatile organic compound

Table 2.2
Observation Well-Head Vacuum Measurements
SVE Test Well MW10
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

SVE Pilot Test Well: MW10									
		Manual Dilution Valve	**Well-Head Vacuum Measurements** (inches of water)						
Date	**Time**	(% open)	MW01	MW02	MW07	MW08	MW10	MW11	PE01
Distance to SVE Test Well (feet):			83	82	32	24	NA	60	15
06/03/08	1710	50	0.00	0.00	0.00	0.00	**9.5**	0.00	0.00
06/03/08	1730	25	0.00	0.00	0.02	0.01	**36.0**	0.01	0.04
06/03/08	1750	15	0.00	0.00	0.01	0.01	**89.0**	0.01	0.02
		Maximum ROI:	**32**						
		Minimum ROI:	**15**						
		Average ROI:	**12**						

NOTES:
Shaded area denotes a measurement from the pilot test well.

DGI = Darigold, Inc.
NA = not applicable
ROI = radius of influence
SVE = soil vapor extraction

Table 3.0
Depth-to-Water Measurements
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Site: DGI, Rainier Avenue Facility
Equipment: Interface Probe

Date: 06/03/08
Field Personnel: PJK/SER

Date	Time	SVE Pilot Test - Depth to Water (feet)													
		MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	MW10	MW11	MW12	MW14	MW15	PE01
06/03/08	0750	NM	9.25	6.71	NM	NM	NM	10.81	10.81	10.67	10.58	NM	NM	1.62	10.77
06/03/08	1030	NM	9.25	6.81	NM	NM	NM	10.78	10.79	10.66	10.57	NM	NM	1.97	10.75
06/03/08	1245	NM	9.25	NM	NM	NM	NM	10.77	10.81	10.66	10.61	NM	NM	1.97	11.20
06/03/08	1330	7.28	9.24	NM	NM	NM	NM	10.82	NM	10.69	10.59	NM	NM	NM	10.75
06/03/08	1640	7.27	9.23	NM	NM	NM	NM	8.46	10.81	10.70	10.59	NM	NM	NM	10.72
06/03/08	1810	7.27	9.24	NM	NM	NM	NM	10.72	10.8	9.91	10.58	NM	NM	NM	10.71

NOTES:
Depth-to-water measurements are not corrected for product thickness (if applicable).
1245 depth to product in MW07 was 10.71 feet and depth to water was 10.72 feet.
1330 depth to product in MW07 was 10.74 feet and depth to water was 10.82 feet.

DGI = Darigold, Inc.
NM = not measured

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Table 4.0
Effluent Vapor Sample Analytical Results
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Sample ID	Date	Effluent Vapor Sample Analytical Results[1] (milligrams per cubic meter)				
		GRPH[2]	Benzene[3]	Toluene[3]	Ethylbenzene[3]	Total Xylenes[3]
MW07	06/03/08	19,000	44	270	150	800
MW10	06/03/08	1,600	0.8	5.8	4.5	25.0

NOTES:

[1]Vapor samples collected from DS-300 on the well head leg of the instrument train.
[2]Analyzed by Northwest Method NWTPH-Gx.
[3]Analyzed by EPA Method 8021B.

< = analyte not detected at concentration above the laboratory's lower reporting limit
DGI = Darigold, Inc.
EPA = United States Environmental Protection Agency
GRPH = gasoline-range petroleum hydrocarbon
PERS = Plume Eater® Remedial System
SVE = soil vapor extraction extraction

APPENDIX C

Air Sparge Pilot Test Data

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Table 1.1
Pilot Test Wellhead Measurements
AS Pilot Test Well PE01
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

AS Pilot Test Well: PE01							
Date	**Time**	**Regulator Pressure** (psi)	**Compressed Air Tank Pressure Gauge** (psi)	**Flow Meter** (scfm)	**Test Well-Head Pressure** (psi)	**DO[1]** (mg/L)	**Temp.** (°C)
06/03/08	1030	68	400	2.6	26.0	8.4	12.2
Measure Baseline and Record Above							
06/03/08	1145	68	300	2.6	26.0	NM	NM
06/03/08	1220	68	250	2.6	26.0	NM	NM
06/03/08	1230	68	225	2.6	26.0	NM	NM
06/03/08	1245	68	225	2.6	26.0	10.3	11.9

NOTES:
[1]DO Baseline measurements taken at 13 feet below ground surface

AS = air sparge
°C = degrees Celsius
DGI = Darigold, Inc.
DO = dissolved oxygen
mg/L = milligrams per liter
NM = not measured
psi = pounds per square inch
scfm = standard cubic feet per minute

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Table 1.2
Observation Wellhead Parameters
AS Pilot Test Well PE01
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

AS Pilot Test Well: PE01							
			Dissolved Oxygen Concentration (mg/L)				
Date	**Time**	**Pilot Test Well-head Pressure** (psi)	MW02	MW03	MW08	MW10	MW11
Distances to AS Pilot Test Well (feet)			67	50	36	16	41
06/03/08	1030	26.0	0.06	0.30	0.38	0.28	0.28
06/03/08	1145	26.0	0.36	0.33	0.57	0.18	0.13
06/03/08	1245	26.0	0.30	0.25	0.91	0.30	0.12
Date	**Time**	**Pilot Test Well-head Pressure** (psi)	**ORP**				
06/03/08	1030	26.0	NM	NM	NM	NM	NM
06/03/08	1145	26.0	NM	NM	NM	NM	NM
06/03/08	1245	26.0	NM	NM	NM	NM	NM
Date	**Time**	**Pilot Test Well-head Pressure** (psi)	**Temperature** (°C)				
06/03/08	1030	26.0	12.9	14.0	14.0	13.9	12.4
06/03/08	1145	26.0	13.0	14.1	14.1	13.9	12.4
06/03/08	1245	26.0	13.1	13.9	14.1	13.8	12.4

NOTES:

°C = degrees Celsius
AS = air sparge
DGI = Darigold, Inc.
mg/L = milligrams per liter
NM = not measured
ORP = oxidation reduction potential
psi = pounds per square inch

Table 2.0
Depth-to-Water Measurements
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Site: DGI, Rainier Avenue Facility
Equipment: Interface Probe

Date: 06/03/08
Field Personnel: PJK/SER

		AS Pilot Test - Depth to Water Measurements (feet below top-of-casing)													
Date	**Time**	MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	MW10	MW11	MW12	MW14	MW15	PE01
06/03/08	0750	NM	9.25	6.71	NM	NM	NM	10.81	10.81	10.67	10.58	NM	NM	1.62	10.77
06/03/08	1030	NM	9.25	6.81	NM	NM	NM	10.78	10.79	10.66	10.57	NM	NM	1.97	10.75
06/03/08	1245	NM	9.25	NM	NM	NM	NM	10.77	10.81	10.66	10.61	NM	NM	1.97	11.20
06/03/08	1330	7.28	9.24	NM	NM	NM	NM	10.82	NM	10.69	10.59	NM	NM	NM	10.75

NOTES:
Depth-to-water measurements are not corrected for product thickness (if applicable).
1030 baseline depth-to-water measurements for the AS Test on PE01; depth to product in MW07 was 10.71 feet and depth to water was 10.78 feet.
1245 depth to product in MW07 was 10.71 feet and depth to water was 10.72 feet.
1330 depth to product in MW07 was 10.74 feet and depth to water was 10.82 feet.

DGI = Darigold, Inc.
NM = not measured

APPENDIX D

Groundwater Recirculation Pilot Test Data

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Table 1.0
Observation Wellhead Parameters
PERS Pilot Test Well PE01
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

PERS Pilot Test Well PE01															
					Observation Wells										
							MW02	MW03	MW08	MW09	MW10	MW11	MW14	MW15	PE01
		Compressor Regulator Setting (psi)	**Air Flow Meter** (scfm)	**Pressure Gauge** (psi)	**Distance to PERS Test Well** (ft)		67	50	36	16	41	35	55	NA	NA
Date	**Time**				Observation Parameters										
06/01/08	0915	Pre-Test	Pre-Test	Pre-Test	Meter Depth	feet	12	12	12	NM	12	12	NM	NM	12
					DO mg/L		0.84	1.03	0.89	NM	0.83	0.68	NM	NM	0.75
					Temp.	°C	12.69	13.31	13.50	NM	13.37	12.20	13.31	NM	14.88
					Conductivity	μs/cm^3	1144	368	956	NM	1749	1370	368	NM	1430
					Pressure	psi	2.070	2.759	1.059	NM	1.978	2.099	2.759	NM	2.325
					Pressure	feet	4.795	6.379	2.447	NM	4.589	4.835	6.379	NM	5.401
					Rhodamine Dye	μg/L	1.3*	1.5	1.0	NM	1.9	1.0	1.5	NM	1.1
06/01/08	1100	50.0	2.5	26.5	DO mg/L		1.10	0.77	1.13	NM	0.85	0.78	NM	NM	NM
					Temp.	°C	12.8	13.3	14.2	NM	13.3	13.9	NM	NM	NM
06/01/08	1200	50.0	2.5	26.5	DO mg/L		0.53	0.74	1.19	NM	1.50	0.97	NM	NM	NM
					Temp.	°C	13.3	14.2	14.3	NM	15.0	12.6	NM	NM	NM
06/01/08	1300	50.0	2.5	26.5	DO mg/L		0.67	0.57	1.62	NM	0.98	0.98	NM	NM	NM
					Temp.	°C	13.5	14.0	14.2	NM	14.0	12.8	NM	NM	NM
06/01/08	1400	50.0	2.5	26.5	DO mg/L		0.77	0.75	1.03	NM	0.46	0.54	NM	NM	NM
					Temp.	°C	13.4	14.1	14.1	NM	13.9	12.7	NM	NM	NM
06/01/08	1500	50.0	2.5	26.5	DO mg/L		0.85	0.60	1.12	NM	0.64	0.55	NM	NM	NM
					Temp.	°C	13.3	13.9	14.0	NM	14.4	12.7	NM	NM	NM

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Table 1.0
Observation Wellhead Parameters
PERS Pilot Test Well PE01
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

PERS Pilot Test Well PE01

Date	Time	Compressor Regulator Setting (psi)	Air Flow Meter (scfm)	Pressure Gauge (psi)	Observation Wells		MW02	MW03	MW08	MW09	MW10	MW11	MW14	MW15	PE01
					Distance to PERS Test Well (ft)		67	50	36	16	41	35	55	NA	NA
					Observation Parameters										
06/01/08	1620	56.0	2.0	27.0	Meter Depth	feet	12	12	12	NM	12	12	NM	NM	NM
					DO mg/L		0.22	0.18	0.44	NM	0.11	0.05	NM	NM	NM
					Temp.	°C	13.2	14.0	14.0	NM	13.7	12.4	NM	NM	NM
06/01/08	1745	56.0	2.0	27.5	Meter Depth	feet	12	12	12	NM	12	12	NM	NM	NM
					DO mg/L		0.30	0.16	0.57	NM	0.24	0.58	NM	NM	NM
					Temp.	°C	13.2	14.1	14.1	NM	13.9	12.3	15.1	15.2	NM
					Conductivity	$\mu s/cm^3$	NM	NM	NM	NM	NM	NM	0.0	0.0	NM
					Pressure	psi	NM	NM	NM	NM	NM	NM	0.684	0.685	NM
					Pressure	feet	NM	NM	NM	NM	NM	NM	1.582	1.583	NM
					Rhodamine Dye	µg/L	NM	NM	NM	NM	NM	NM	2.1	1.9	NM
06/02/08	0815	70.0	1.8	28.5	Meter Depth	feet	12	12	12	NM	12	12	NM	NM	NM
	0950	68.0	1.8	28.0	DO mg/L		0.30	0.23	0.32	NM	0.34	0.37	NM	NM	NM
	1015	68.0	1.8	28.0	Temp.	°C	12.9	14.7	14.0	NM	14.5	12.4	NM	NM	NM
	1045	70.0	2.0	30.0	Conductivity	$\mu s/cm^3$	1167	342	901	NM	1721	1076	0.0	0.0	NM
					Pressure	psi	1.841	3.154	1.062	NM	1.217	1.357	0.670	0.670	NM
					Pressure	feet	4.254	7.291	2.453	NM	2.807	3.131	1.650	1.650	NM
					Rhodamine Dye	µg/L	1.3	0.9	0.9	NM	2.1	0.8	1.5	1.5	NM

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Table 1.0
Observation Wellhead Parameters
PERS Pilot Test Well PE01
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

PERS Pilot Test Well PE01															
					Observation Wells										
							MW02	MW03	MW08	MW09	MW10	MW11	MW14	MW15	PE01
		Compressor Regulator Setting (psi)	**Air Flow Meter** (scfm)	**Pressure Gauge** (psi)	**Distance to PERS Test Well** (ft)		67	50	36	16	41	35	55	NA	NA
Date	**Time**				Observation Parameters										
06/02/08	1115	70.0	2.0	30.0	Meter Depth	feet	12	12	12	NM	12	12	NM	NM	NM
	1215	70.0	1.9	30.0	DO mg/L		0.31	0.38	0.48	NM	0.28	0.09	NM	NM	NM
					Temp.	°C	13.1	14.4	14.5	NM	13.8	12.5	NM	NM	NM
					Conductivity	$\mu s/cm^3$	1153	345	0	NM	1669	1328	NM	NM	NM
					Pressure	psi	1.754	2.616	1.066	NM	1.107	1.248	NM	NM	NM
					Pressure	feet	4.510	6.058	2.461	NM	2.556	2.880	NM	NM	NM
					Rhodamine Dye	µg/L	1.9	0.8	0.9	NM	1.8	1.2	NM	NM	NM
06/02/08	1235	70.0	1.9	30.0	Meter Depth	feet	12	12	12	NM	12	12	NM	NM	NM
	1300	70.0	1.9	30.0	DO mg/L		0.32	0.24	0.56	NM	0.22	0.19	NM	NM	NM
	1340	70.0	1.9	30.0	Temp.	°C	12.9	14.0	14.4	NM	13.9	12.6	NM	NM	NM
					Conductivity	$\mu s/cm^3$	1039	361	968	NM	1594	1108	NM	NM	NM
					Pressure	psi	1.782	2.535	1.017	NM	1.013	1.275	NM	NM	NM
					Pressure	feet	4.114	5.861	2.350	NM	2.333	2.930	NM	NM	NM
					Rhodamine Dye	µg/L	1.5	1.0	1.1	NM	2.6	1.1	NM	NM	NM

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Table 1.0
Observation Wellhead Parameters
PERS Pilot Test Well PE01
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

PERS Pilot Test Well PE01															
					Observation Wells										
							MW02	MW03	MW08	MW09	MW10	MW11	MW14	MW15	PE01
		Compressor Regulator Setting	**Air Flow Meter**	**Pressure Gauge**	**Distance to PERS Test Well** (ft)		67	50	36	16	41	35	55	NA	NA
Date	**Time**	(psi)	(scfm)	(psi)	Observation Parameters										
06/02/08	1400	70.0	1.9	30.0	Meter Depth	feet	12	12	12	NM	12	12	NM	NM	NM
	1545	70.0	1.8	30.0	DO mg/L		0.22	0.34	0.39	NM	0.27	0.05	NM	NM	NM
					Temp.	°C	13.3	14.2	14.2	NM	14.3	12.4	17.3	17.2	NM
					Conductivity	µs/cm^3	1164	375	925	NM	1614	1344	0	0	NM
					Pressure	psi	2.523	2.693	1.134	NM	1.172	1.382	0.653	0.653	NM
					Pressure	feet	5.834	6.227	2.619	NM	2.713	3.198	1.510	1.511	NM
					Rhodamine Dye	µg/L	2.8	1.1	1.2	NM	1.8	1.3	1.4	2.0	NM
06/02/08	1600	70.0	1.8	30.0	Meter Depth	feet	12	12	12	NM	12	12	NM	NM	NM
	1645	72.0	1.8	30.5	DO mg/L		0.23	0.33	0.48	NM	0.35	0.16	NM	NM	NM
					Temp.	°C	13.2	14.1	14.2	NM	14.2	12.4	NM	NM	NM
					Conductivity	µs/cm^3	1041	344	856	NM	1728	1368	NM	NM	NM
					Pressure	psi	1.628	2.674	1.058	NM	0.999	1.236	NM	NM	NM
					Pressure	feet	3.761	6.183	2.445	NM	3.027	2.853	NM	NM	NM
					Rhodamine Dye	µg/L	2.0	1.1	1.2	NM	2.5	1.6	NM	NM	NM

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Table 1.0
Observation Wellhead Parameters
PERS Pilot Test Well PE01
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

PERS Pilot Test Well PE01															
					Observation Wells										
							MW02	MW03	MW08	MW09	MW10	MW11	MW14	MW15	PE01
		Compressor Regulator Setting	**Air Flow Meter**	**Pressure Gauge**	**Distance to PERS Test Well** (ft)		67	50	36	16	41	35	55	NA	NA
Date	**Time**	(psi)	(scfm)	(psi)	Observation Parameters										
06/02/08	1700	72.0	1.8	30.5	Meter Depth	feet	12	12	12	NM	12	12	NM	NM	NM
					DO mg/L		0.23	0.38	0.52	NM	0.42	0.15	NM	NM	NM
					Temp.	°C	13.2	13.8	14.1	NM	14.3	12.4	NM	NM	NM
					Conductivity	$\mu s/cm^3$	913	363	892	NM	1818	999	0	0	NM
					Pressure	psi	1.828	2.415	1.026	NM	0.826	1.081	0.627	0.628	NM
					Pressure	feet	4.222	5.580	2.370	NM	1.910	2.494	1.450	1.452	NM
					Rhodamine Dye	μg/L	3.3	0.8	1.3	NM	2.2	1.3	3.7	1.8	NM
06/03/08	0800	70.0	1.8	31.0	Meter Depth	feet	13	13	12	NM	12	13	NM	NM	13
					DO mg/L		0.24	0.39	0.39	NM	0.30	0.40	NM	NM	8.20
					Temp.	°C	13.0	13.9	14.0	NM	14.1	12.4	11.3	11.2	11.9
					Conductivity	$\mu s/cm^3$	1071	333	930	0	1637	1169	0	0	177
					Pressure	psi	1.716	2.765	0.969	0.521	1.761	1.145	0.521	0.521	1.371
					Pressure	feet	3.965	6.395	2.207	1.205	4.070	2.645	1.205	1.264	3.250
					Rhodamine Dye	μg/L	1.1	1.0	1.4	0.9	1.7	1.2	2.9	1.6	143.0

NOTES:

*Data Entry - Checked field notes with author. Confirmed it was 1.3 and not 11.3.

°C = degrees Celsius
μg/L = micrograms per liter
$\mu s/cm^3$ = micro-Siemens per cubic centimeter
DGI = Darigold, Inc.
DO = dissolved oxygen
mg/L = milligrams per liter

NA = not applicable
NM = not measured
PERS = Plume Eater® Remediation System
psi = pounds per square inch
scfm = standard cubic feet per minute
Temp. = temperature

Table 2.0
Depth-to-Water Measurements
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Site: DGI, Rainier Avenue Facility
Equipment: Interface Probe

Date: 06/03/08
Field Personnel: PJK/SER

Date	Time	Pilot Test - Depth to Water (feet)													
		MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	MW10	MW11	MW12	MW14	MW15	PE01
06/01/08	0815	NM	9.30	7.41	NM	NM	NM	10.87	10.84	10.72	10.62	NM	2.06	1.96	10.80
06/01/08	1100	NM	9.30	7.40	NM	NM	NM	10.87	10.84	10.73	10.62	NM	2.06	1.96	NM
06/01/08	1200	NM	9.30	7.41	NM	NM	NM	10.80	10.85	10.74	10.63	NM	2.06	1.96	NM
06/01/08	1300	NM	9.30	7.41	NM	NM	NM	10.80	10.85	10.74	10.63	NM	2.06	1.96	NM
06/01/08	1400	NM	9.30	7.41	NM	NM	NM	10.80	10.85	10.74	10.63	NM	2.06	1.96	NM
06/01/08	1500	NM	9.30	7.41	NM	NM	NM	10.80	10.84	10.74	10.63	NM	2.06	1.96	NM
06/01/08	1620	NM	9.31	7.41	NM	NM	NM	10.81	10.84	10.74	10.62	NM	2.06	1.96	NM
06/02/08	0815	NM	9.32	7.65	NM	NM	NM	10.81	10.84	10.73	10.66	NM	NM	1.97	NM
06/02/08	1115	NM	9.32	7.42	NM	NM	NM	10.84	10.85	10.72	10.68	NM	NM	NM	NM
06/02/08	1400	NM	9.30	7.41	NM	NM	NM	10.82	10.83	10.68	10.62	NM	NM	1.96	NM
06/02/08	1700	NM	9.27	NM	NM	NM	NM	NM	10.83	10.68	10.58	NM	NM	1.99	NM
06/03/08	0750	NM	9.25	6.71	NM	NM	NM	10.81	10.81	10.67	10.58	NM	NM	1.62	10.77

NOTES:
Depth-to-water measurements are not corrected for product thickness (if applicable).

DGI = Darigold, Inc.
NM = Not measured

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Table 3.0
PERS Pilot Test
Effluent Vapor Sample Analytical Results
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Sample ID	Date	Vapor Sample Analytical Results[1] (milligrams per cubic meter)				
		GRPH[2]	Benzene[3]	Toluene[3]	Ethylbenzene[3]	Total Xylenes[3]
PE01	06/01/08	<10	0.1	<0.1	<0.1	<0.3
PE01	06/03/08	<10	<0.1	<0.1	<0.1	<0.3

NOTES:

[1]Vapor samples collected from DS-300 on the well head leg of the instrument train.
[2]Analyzed by Northwest Method NWTPH-Gx.
[3]Analyzed by EPA Method 8021B.

< = analyte not detected at concentration above the laboratory's lower reporting limit
DGI = Darigold, Inc.
EPA = United States Environmental Protection Agency
GRPH = gasoline-range petroleum hydrocarbon
PERS = Plume Eater® Remedial System

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Table 4.0
Groundwater Sample Analytical Results
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Sample ID	Date	Groundwater Samples (micrograms per liter)				
		GRPH[3]	Benzene[4]	Toluene[4]	Ethylbenzene[4]	Total Xylenes[4]
PE01[1]	05/18/08	15,000	590	17	920	3,400
PE01[2]	06/03/08	320	49	1	13	27

NOTES:

[1]Groundwater samples were collected using a peristaltic pump.
[2]Groundwater samples were collected using a dedicated bailer.
[3]Analyzed by Northwest Method NWTPH-Gx.
[4]Analyzed by EPA Method 8021B.

< = analyte not detected at concentration above the laboratory's lower reporting limit
DGI = Darigold, Inc.
EPA = United States Environmental Protection Agency
GRPH = gasoline-range petroleum hydrocarbon
PERS = Plume Eater® Remedial System

APPENDIX E

Aquifer Test Data

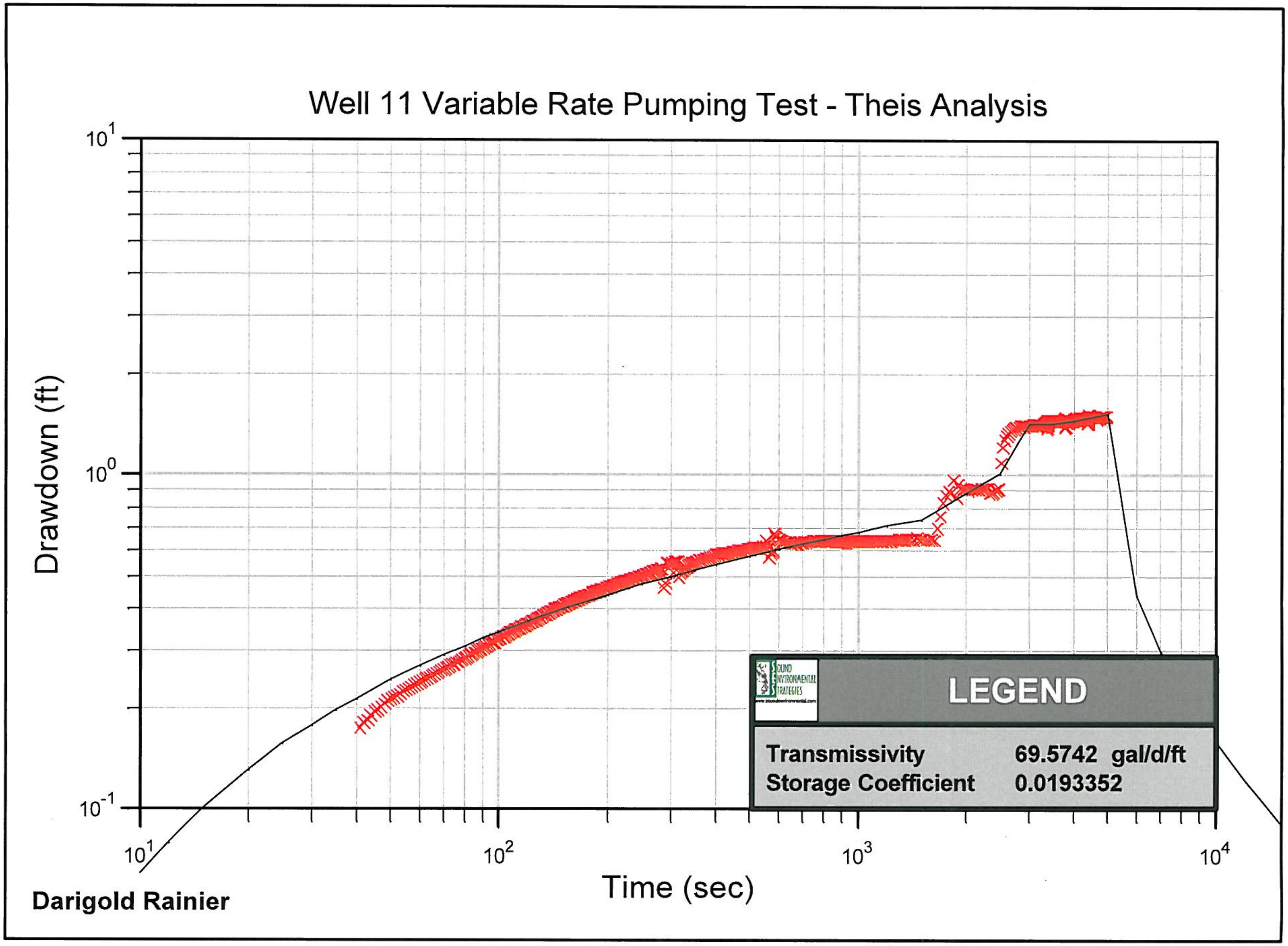
Table 1.1
Pump and Slug Test Results[1]
DGI Rainier Avenue Facility
4058 Rainier Avenue South
Seattle, Washington

Pump Test Results

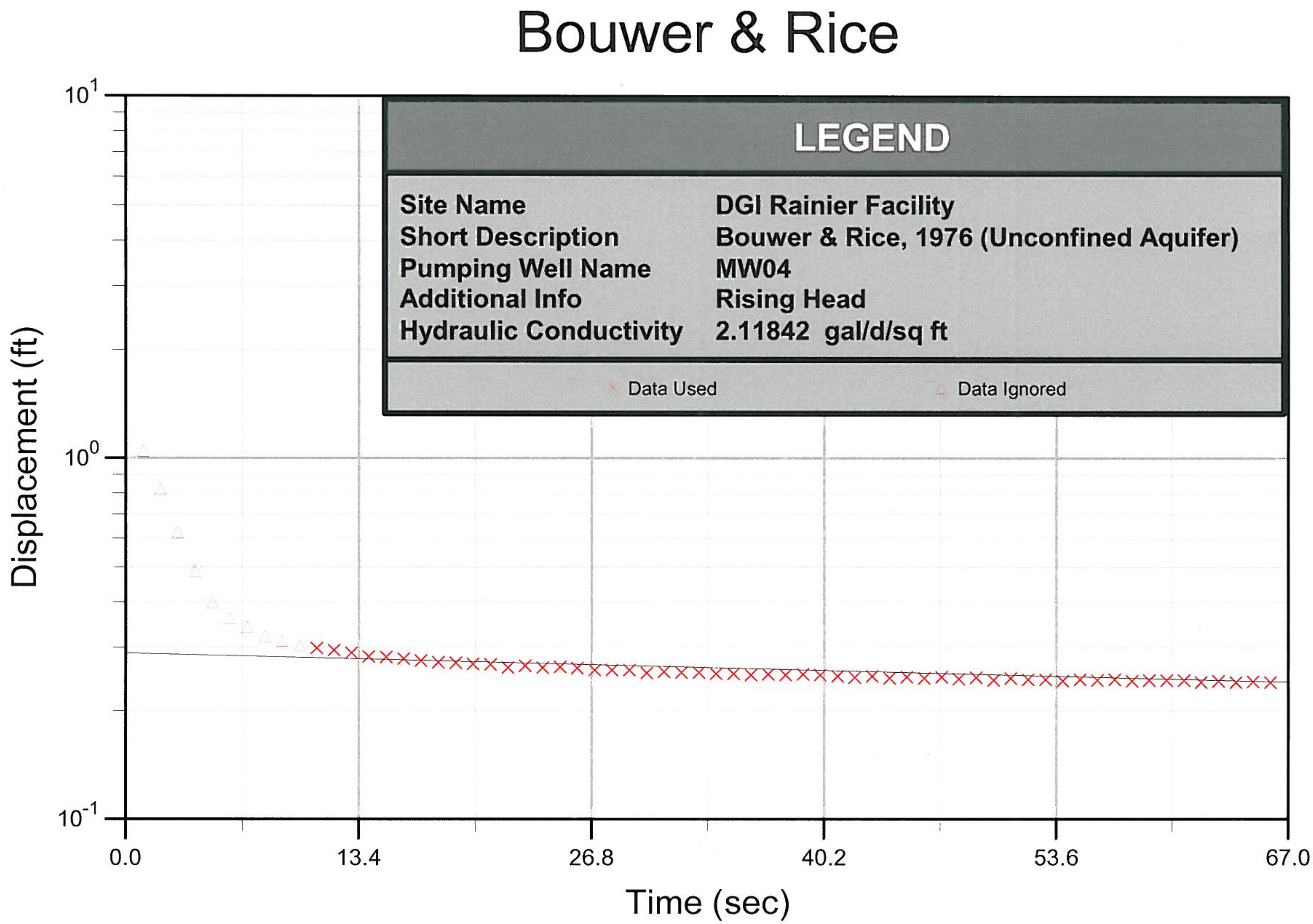
Well Identification	Well Type	Screen Interval (feet)	Analytical Method	Aquifer Model	Transmissivity (gal/day/ft)	Saturated Thickness (feet)	Hydraulic Conductivity, K (gpd/ft^2)	Hydraulic Conductivity, K (ft/day)	Hydraulic Conductivity, K (cm/sec)	Soil Description
MW11	Pump Well	8.11-18.11	Theis (1935)	Unconfined Approximation	6.96E+01	9	7.73E+00	1.03E+00	3.65E-04	Silty Sand/Silt

Slug Test Results

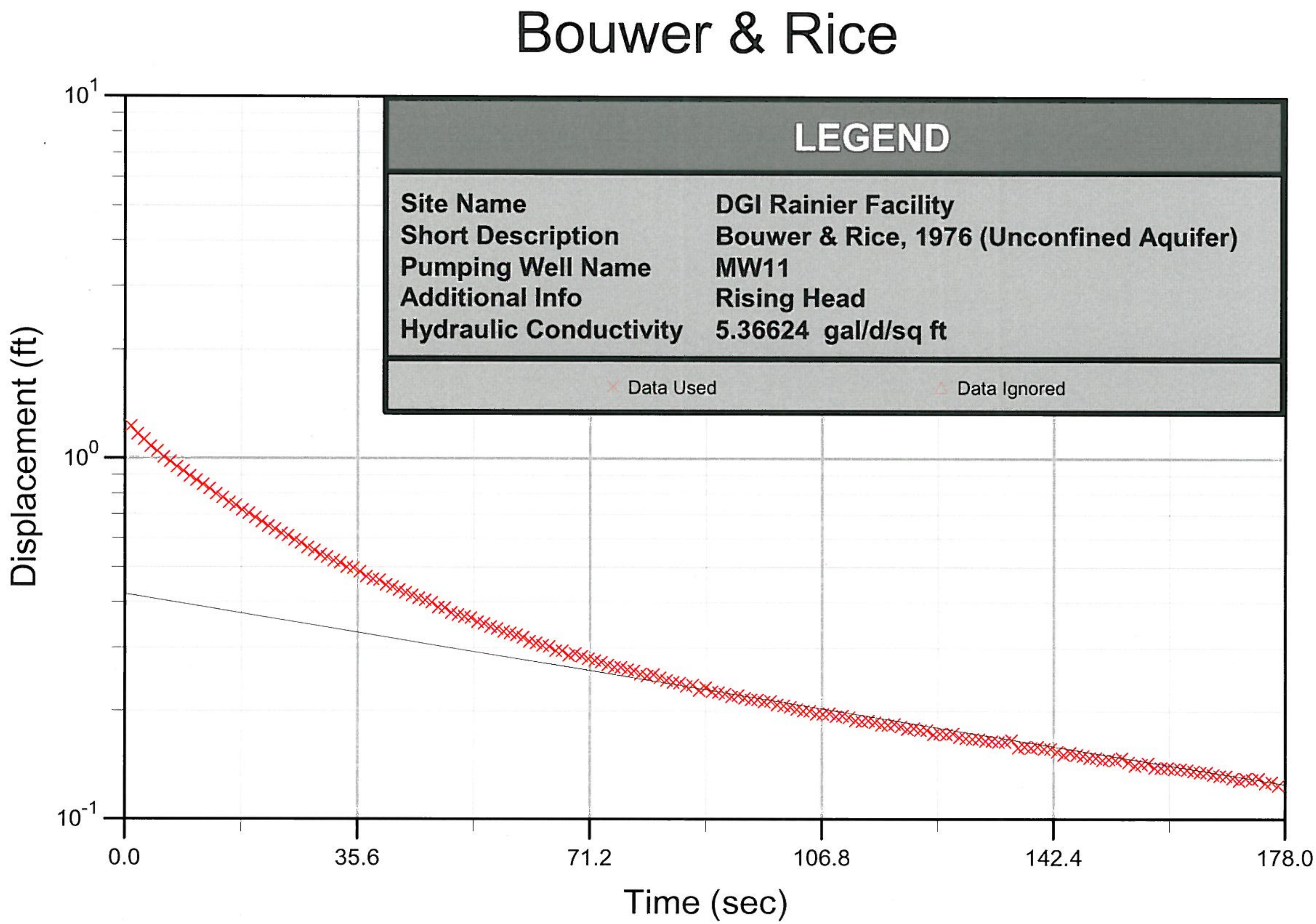
Well Identification	Well Type	Screen Interval (feet)	Analytical Method	Aquifer Model	Transmissivity (gal/day/ft)	Saturated Thickness (feet)	Hydraulic Conductivity, K (gpd/ft^2)	Hydraulic Conductivity, K (ft/day)	Hydraulic Conductivity, K (cm/sec)	Soil Description
MW04	Test Well	4.69-14.69	Bouwer & Rice (1976)	Unconfined	Rising Head	9	2.12E+00	2.83E-01	9.99E-05	Silt/Clay
MW11	Test Well	8.11-18.11	Bouwer & Rice (1976)	Unconfined	Rising Head	9	5.37E+00	7.17E-01	2.53E-04	Silty Sand/Silt



Darigold Rainier



Bouwer & Rice
LEGEND
Site Name
DGI Rainier Facility
Short Description
Bouwer & Rice, 1976 (Unconfined Aquifer)
Pumping Well Name
MW04
Additional Info
Rising Head
Hydraulic Conductivity
2.11842 gal/d/sq ft
Data Used
Data Ignored
Displacement (ft)
10^1
10^0
10^-1
0.0
13.4
26.8
40.2
53.6
67.0
Time (sec)



Bouwer & Rice
LEGEND
Site Name
DGI Rainier Facility
Short Description
Bouwer & Rice, 1976 (Unconfined Aquifer)
Pumping Well Name
MW11
Additional Info
Rising Head
Hydraulic Conductivity
5.36624 gal/d/sq ft
Data Used
Data Ignored
Displacement (ft)
10^1
10^0
10^-1
0.0
35.6
71.2
106.8
142.4
178.0
Time (sec)