REVISED FEASIBILITY STUDY REPORT

Bee-Jay Scales Site
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ACRONYMS/ABBREVIATIONS

1H09	First Half 2009
Agreed Order	*Bee Jay Scales Site Agreed Order No. DE 02TCPCR-3932*
amsl	Above mean sea level
APHA	American Public Health Association
ARARs	Applicable or relevant and appropriate requirements
ARC	Atlantic Richfield Company
ASTs	Above-ground storage tanks
bgs	Below ground surface
CAP	Cleanup action plan
CEMC	Chevron Environmental Management Company
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
Cl^-	Chloride ions
cm/s	Centimeters per second
CULs	Cleanup levels
cy	Cubic yards
2,4-D	2,4-Dichlorophenoxyacetic acid
DO	Dissolved oxygen
DSRA	*Development and Screening of Remedial Alternatives*
Ecology	State of Washington Department of Ecology
FS	Feasibility study
HHRA	*Human Health Risk Assessment*
ICs	Institutional controls
IHSs	Indicator hazardous substances
MCL	Maximum Contaminant Level
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MNA	Monitored natural attenuation
MTCA	Model Toxics Control Act
$N_2(g)$	Nitrogen gas
N_2O	Nitrous oxide

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ACRONYMS/ABBREVIATIONS (cont'd)

NO(g)	Nitric oxide gas
NO_3^{2-}	Nitrate ion
NO_2^-	Nitrite ion
NPDES	National Pollutant Discharge Elimination System
OH^-	Hydroxyl ions
OMM	Operation, maintenance, and monitoring
ORP	Oxidation-reduction potential
%	Percent
PLPs	Potentially liable persons
POTW	Publicly owned treatment works
PRB	Permeable reactive barrier
RAO	Remedial action objective
RI	Remedial investigation
RI/FS Work Plan	*Remedial Investigation/Feasibility Study Work Plan*
ROI	Radius of influence
SECOR	SECOR International Incorporated
sf	Square feet
Site	Bee-Jay Scales Site in Sunnyside, Washington
Stantec	Stantec Consulting Corporation
TEE	Terrestrial ecological evaluation
TOC	Total organic carbon
TPH-Gx	Total petroleum hydrocarbons in the gasoline range
VOCs	Volatile organic compounds
WAC	Washington Administrative Code
UECA	Uniform Environmental Covenants Act
USEPA	United States Environmental Protection Agency

Executive Summary

Stantec Consulting Corporation (Stantec; formerly SECOR International Incorporated [SECOR]), on behalf of Chevron Environmental Management Company (CEMC) and Atlantic Richfield Company (ARC), evaluated remedial alternatives to address soil and groundwater concentrations of indicator hazardous substances (IHSs) above specified cleanup levels (CULs) at the Bee-Jay Scales Site in Sunnyside, Washington (the Site). The feasibility study (FS) presented herein was conducted in accordance with State of Washington Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Regulations (MTCA, 2007) and implemented in compliance with *Bee Jay Scales Site Agreed Order No. DE 02TCPCR-3932* (Agreed Order) [Ecology, 2002]. The purpose of the FS is to evaluate remedial alternatives to enable selection of a cleanup action.

A *Human Health Risk Assessment* (HHRA) was completed to quantify risks associated with chemicals in the soil and groundwater both on-site and off-property (Stantec, 2008). The HHRA indicated that the groundwater ingestion exposure pathway for nitrate is potentially complete for off-property receptors due to the lack of regulatory restrictions on installing water wells. Based on current land use (including locations of existing buildings on-site), risks to current on-site exposure populations are within acceptable limits. However, for hypothetical future commercial or residential land use on-site, ingestion of groundwater containing nitrate and inhalation of indoor vapors containing 1,2,4-trimethylbenzene (from soil) and 1,2-dichloropropane (from groundwater) could result in risk that exceeds acceptable limits.

A *Development and Screening of Remedial Alternatives* (DSRA) was completed to determine an appropriate range of remedial alternatives warranting more detailed analysis in the FS (Stantec, 2009). On-site soil and groundwater remedial alternatives recommended for further evaluation are as follows:

- On-site Remedial Alternative #1: No action.
- On-site Remedial Alternative #2: Monitored natural attenuation (MNA) and institutional controls (ICs).
- On-site Remedial Alternative #3: Permeable reactive barrier (PRB), groundwater monitoring, natural attenuation and capping of soil, and ICs.
- On-site Remedial Alternative #4: *In situ* bioremediation, groundwater monitoring, soil excavation with off-site disposal and/or ex situ biological treatment, ICs, and phytoremediation of groundwater (as an optional addition).

Off-property groundwater remedial alternatives recommended for further evaluation are as follows:

- Off-property Remedial Alternative #1: No action.
- Off-property Remedial Alternative #2: MNA, ICs, and a contingency plan (in the event drinking water wells are installed within the shallow aquifer plume that extends off-property).

The remedial alternatives were evaluated with respect to threshold criteria that must be met for all cleanup actions conducted under Ecology's authority. The threshold criteria include overall protection of human health and the environment, compliance with applicable or relevant and appropriate requirements (ARARs), and opportunity for compliance monitoring.

Remedial alternatives that met the threshold criteria were also evaluated using the following criteria to further aid in selecting a cleanup action:

- Effectiveness (reasonable restoration timeframe, long-term effectiveness and permanence, short-term effectiveness);
- Implementability (technical and administrative implementability, state and community acceptance); and
- Cost.

On-site Remedial Alternative #1 is the "no action" alternative, which represents the most likely future scenario in the absence of any remedial action. It is included primarily as a baseline to which other remedial alternatives can be compared. On-site Remedial Alternative #2 was an expensive remedial alternative and failed two of the effectiveness criteria (reasonable restoration timeframe and long-term effectiveness and permanence). Therefore, only two viable options remain.

On-site Remedial Alternative #3 is the most costly on-site alternative. It only partially meets the criteria for reasonable restoration timeframe and long-term effectiveness and permanence because of the passive treatment nature of PRBs and the fact that on-site source areas would not be directly targeted for treatment. Conversely, On-site Remedial Alternative #4 is the least costly on-site alternative and would be designed to target areas of high soil and groundwater nitrate concentrations via a combination of *in situ* bioremediation (injection wells for delivery of sodium acetate and borings completed to the surface containing calcium acetate) and limited excavation of shallow, unsaturated residual soil source areas. Previous pilot testing of *in situ* bioremediation on-site has demonstrated success in remediating nitrate concentrations in groundwater to below cleanup criteria and reducing nitrate concentrations in saturated soils. Although there is the possibility of increased arsenic concentrations in groundwater in the short-term, pilot study results suggest that arsenic concentrations would decrease after oxidized redox conditions return. Additionally, On-site Remedial Alternative #4 would allow the most flexibility and control during design and implementation since there are several methods of delivering electron donor to the subsurface (injection wells and borings), and multiple application rounds may be implemented as needed to achieve the remedial action objectives (RAOs). Finally, the success of Off-property Remedial Alternative #2 would increase if an aggressive treatment technology is implemented on-site. On-site Remedial Alternative #4 is considered more aggressive than On-site Remedial Alternative #3 because both soil and groundwater source areas would be targeted to provide maximum treatment of nitrates.

Because a majority of options for off-property groundwater were originally screened out in the DSRA due to implementability issues associated with off-property access restrictions and the large footprint of the site-specific off-property nitrate plume, only two remedial alternatives were evaluated as part of the FS. Off-property Remedial Alternative #2 is clearly the best option for the site-specific off-property nitrate plume as it meets all of the evaluation criteria.

Based on the evaluation of on-site and off-property remedial alternatives, the following combination is recommended:

- On-site *in situ* bioremediation, groundwater monitoring, soil excavation with off-site disposal and/or *ex situ* biological treatment, and ICs (i.e., On-site Remedial Alternative #4 without phytoremediation); and

- Off-property MNA, ICs, and a contingency plan (i.e., Off-property Remedial Alternative #2).

Since bench-scale and field pilot studies for the *in situ* bioremediation component above have already been conducted, no additional testing or analysis is needed prior to preparation of a cleanup action plan (CAP).

Following issuance of a future Consent Decree, a CAP would be prepared to describe detailed plans for implementing cleanup action on-site and off-property. An implementation schedule would be included in the CAP.

1.0 Introduction

Stantec Consulting Corporation (Stantec; formerly SECOR International Incorporated [SECOR]), on behalf of Chevron Environmental Management Company (CEMC) and Atlantic Richfield Company (ARC), evaluated remedial alternatives to address concentrations of indicator hazardous substances (IHSs) in soil and groundwater above specified cleanup levels (CULs) at the Bee-Jay Scales Site in Sunnyside, Washington (the Site). The feasibility study (FS) was conducted in accordance with State of Washington Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Regulations (MTCA, 2007) and implemented in compliance with *Bee Jay Scales Site Agreed Order No. DE 02TCPCR-3932* (Agreed Order) [Ecology, 2002].

The *Feasibility Study Report* was originally submitted to Ecology on June 26, 2009, and has been revised per Ecology's comments in a letter dated August 26, 2009 (included in **Appendix A**).

1.1 PURPOSE

The purpose of the FS is to evaluate remedial alternatives to enable selection of a cleanup action.

1.2 ORGANIZATION

The FS follows the framework identified in the Agreed Order, Ecology MTCA Regulations, and Chapter 6, *Detailed Analysis of Alternatives*, of the United States Environmental Protection Agency's (USEPA's) *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988). The FS is structured as follows:

- Section 2 summarizes a description and history of the Site;
- Section 3 summarizes the development and initial screening of remedial alternatives;
- Section 4 provides descriptions of the remedial alternatives retained for further analysis and a detailed evaluation of each;
- Section 5 presents the recommended remedial alternatives to be used as part of a cleanup action plan (CAP); and
- Section 6 provides a draft scope of work to be detailed in the CAP for the recommended remedial alternatives.

2.0 Site Background and Characterization

Information regarding the Site description and historical operations at the Site has been adapted from the *Remedial Investigation/Feasibility Study Work Plan* (RI/FS Work Plan) [CH2M Hill, 2003]. The RI/FS Work Plan was approved by Ecology in March 2003.

2.1 SITE DESCRIPTION

The Site is located in the city of Sunnyside, within Yakima County, and is composed of two property parcels: Parcel No. 22102522014 and Parcel No. 22102522015 as recorded by the Yakima County Department of Assessment. Parcel No. 22102522014 is located at 116 North 1st Street and is owned by Bee-Jay Scales, Inc. Parcel No. 22102522015 is located at 301 Warehouse Avenue and is owned by Hickenbottom & Sons, Inc. Hickenbottom & Sons also owns additional contiguous property on which their business is located. The Site location is shown on **Figure 1**. The Site layout, including buildings, monitoring well locations, and area boundaries, is shown on **Figure 2**.

The Site is divided into six main study areas as follows:

- Area 1 - Liquid Fertilizer Plant and Truck Wash Area;
- Area 2 - Dry Fertilizer Area;
- Area 3 - Drum Storage Area;
- Area 4 - Suspected Historic Washdown Area;
- Area 5 - North Area; and
- Area 6 - Hickenbottom Property.

For the purpose of this report, “the Site” will be defined by the boundaries of the two property parcels specified above. However, off-property parcels affected by source areas on-site will be addressed.

2.2 SITE HISTORY

The Site and adjacent properties have been the location of agricultural warehouses, lumber yards, coal storage, and railroad transportation activities since approximately 1906. Portions of the Site were owned by the Northern Pacific Railroad Company from 1906 until 1989 when they were purchased by the Glacier Park Company. An agricultural distribution facility operated at the Site from the 1960s through at least 1986. This facility consisted of buildings and above-ground storage tanks (ASTs), and was operated by at least two separate companies: Laneger Agricultural Services and Valley Agricultural, Inc. Documentation also indicates that during the 1970s, Amoco, now known as BP, leased portions of this property from Northern Pacific Railroad. The ASTs have since been removed from the Site. A lagoon was constructed by

Valley Agricultural, Inc. in the early 1980s to collect water from the washdown of farm chemical applicator vehicles.

The western portion of Lot 10 was purchased by Chevron Chemical Company in 1981 and sold to Bee-Jay Scales, Inc. in 1987. Bee-Jay Scales, Inc. purchased additional portions of Lots 10 and 11 in 1995 and 1996. Lots 10 and 11 are referenced in the Summary of Ownership included as Appendix B of the RI/FS Work Plan and are not shown on any available figures.

Hickenbottom & Sons, Inc. leased a portion of the Site from the Northern Pacific Railroad Company beginning in 1961 and purchased portions of Lots 10 and 11 in 1992. The Hickenbottom & Sons property was previously used as pastureland; since 1961, it has been used for food packing, storage, and a transportation business.

Three businesses currently operate at the Bee-Jay Scales portion of the property: Sandy Farms, a local trucking company; Sanleco, Inc., an interstate trucking company with an on-site tractor-trailer repair garage; and Bee-Jay Scales, a commercial scale operation.

Hickenbottom & Sons, Inc. is a food-processing and distribution company. Most of Hickenbottom & Sons current operation consists of a refrigeration warehouse. The Hickenbottom & Sons property that makes up a portion of the Site is currently leased to the Johnson Fruit Company and is used to store produce bins, pallets, tractor-trailer rigs, and other miscellaneous equipment. The remainder of the Hickenbottom & Sons property is used for tractor-trailer and produce storage, as well as transportation.

2.3 PREVIOUS INVESTIGATIONS

Investigations conducted by previous consultants before July 2003 are summarized in the RI/FS Work Plan. Investigations and evaluations conducted by Stantec (formerly SECOR) at the Site since 2003 are presented in the following reports:

- *Bee-Jay Scales Site Phase I Remedial Investigation Report* (SECOR, 2003);
- *Phase II Remedial Investigation Report for the Bee-Jay Scales Site* (SECOR, 2005a);
- Phase II Treatability Investigation (documented in the *Phase II Remedial Investigation Report for the Bee-Jay Scales Site*);
- BIOSCREEN Modeling (documented in the *Preliminary Screening of Remedial Alternatives Technical Memorandum for the Bee-Jay Scales Site* [SECOR, 2005b]);
- *Phase III Remedial Investigation Report for the Bee-Jay Scales Site* (SECOR, 2007a);
- *2006 Interim Remedial Measures Completion Report for the Bee-Jay Scales Site* (SECOR, 2007b);
- *Down-Gradient Assessment Documentation Report for the Bee-Jay Scales Site* (SECOR, 2008);
- *Human Health Risk Assessment* (Stantec, 2008); and
- *Development and Screening of Remedial Alternatives* (Stantec, 2009).

The following subsections summarize the key findings of each investigation and evaluation along with the groundwater monitoring that has occurred since 2003.

2.3.1 Phase I Remedial Investigation

The Phase I remedial investigation (RI) activities were conducted in July 2003 and consisted of soil and groundwater investigations. Soil borings advanced and monitoring wells installed during the Phase I RI are shown on **Figure 3**.

SECOR collected soil samples from borings completed to depths of up to 11 feet below ground surface (bgs) in each of the six identified main study areas at the Site. Eight soil borings were advanced in Area 1, seven soil borings in Area 2, two soil borings in Area 3, six soil borings in Area 4, five shallow soil borings in Area 5, and seven soil borings in Area 6 (two of which were shallow). Results indicated that the concentration of total petroleum hydrocarbons in the gasoline range (TPH-Gx) at a depth of 7.5 feet bgs at A3-SB-002 exceeded the MTCA Method C CUL, which was used for comparison at the time. Also, nitrogen compounds (nitrates, nitrites, and ammonia) and sulfate were present in soil throughout the unsaturated zone at high concentrations in potential surface source areas.

Three, two-inch diameter wells were installed as part of the Phase I groundwater investigation to supplement information provided by three existing wells (MW-1, MW-3, and MW-4). The fourth previously installed monitoring well (MW-2) could not be located. Two of the new wells (MW-5 and MW-6) were installed in Area 2, and one well (MW-7) was installed in Area 5. The constituents in the groundwater requiring further evaluation based on the Phase I RI results were: 1,2-dichloropropane, arsenic, total nitrates and nitrites, sulfate, and iron.

Groundwater at the Site was encountered at depths ranging from approximately 7.4 to 11.9 feet bgs during the Phase I RI, and the groundwater flow direction was determined to be southeasterly. The near-surface lithology beneath the Site appeared to consist of sandy silt with gravel to a depth of approximately 30 feet bgs, followed by trace clay or clayey silt to the maximum explored depth of 31.5 feet bgs. The estimated hydraulic conductivity of the water-bearing zone beneath the Site, based on slug tests conducted on all six monitoring wells during Phase I activities, ranged from 2.57E-04 centimeters per second (cm/s) to 8.12E-02 cm/s, and the estimated average hydraulic conductivity was 1.59E-02 cm/s.

The findings from the Phase I RI are summarized below:

- 1,2-Dichloropropane was not detected in soil, indicating on-site soils are not the source of its detection in groundwater at MW-4;
- Arsenic concentrations in soil were less than or just above the natural background concentration;
- The soil data suggested an above-ground source of stored fertilizer that had leached nitrogen compounds to the soil. The major nitrogen source area appeared to be directly

east of the Dry Fertilizer Manufacturing Building in Area 2, and two source areas appeared to be located adjacent to the lagoon;

- The potential sulfate source areas were consistent with identified nitrogen source areas, indicating sulfate may have been a component in the fertilizer blends at the Site; and
- Iron was present in surface soils at levels below the natural background concentration. These concentrations may be contributing to the presence of iron in groundwater.

2.3.2 Phase II Remedial Investigation

The Phase II RI included soil, groundwater, and surface water/sediment investigations and pump testing for hydraulic conductivity. Soil borings, vertical profile borings, and monitoring wells completed during the Phase II RI are shown on **Figure 4**.

SECOR conducted the Phase II soil investigation in May 2004. Soil samples were collected from borings advanced in Areas 3 and 5. In Area 3, concentrations of TPH-Gx at a depth of 7.5 feet bgs were above the MTCA Method B CUL. In Area 5, concentrations of constituents in subsurface soil (ammonia, iron, nitrate, nitrite, phosphate, and sulfate) did not exceed MTCA Method B CULs or other screening criteria.

Ten of the soil samples from Area 5 were selected for synthetic precipitate leaching procedure analysis to evaluate the soil leaching to groundwater pathway. Comparing the detected results to MTCA Method B CULs or secondary Maximum Contaminant Levels (MCLs), nitrite and sulfate did not exceed CULs. Nitrate and iron did exceed MTCA Method B CULs and secondary MCLs, respectively.

The Phase II groundwater investigation consisted of the advancement of vertical profile borings and installation of permanent monitoring wells. A total of 18 vertical profile boreholes were installed for groundwater sample collection at depths of 10 and 20 feet bgs. The vertical profile borings were advanced in Areas 1, 5, and 6. Nitrate concentration isopleths developed from the vertical profile sampling show source areas primarily located in the southeastern portion of the property (Area 1 and the southern section of Area 6). Exceedances of the MTCA Method B CULs were observed in the vertical profile borings at both the 10-foot and 20-foot depths for ammonia, arsenic, nitrate, and nitrite, and at the 20-foot depth for 2,4-dichlorophenoxyacetic acid (2,4-D) and dinoseb.

A total of five permanent monitoring wells were installed during various stages of the Phase II RI. MW-8 was installed in Area 1 in May 2004. Four additional wells, one off-property (MW-9) and three on-site (MW-10 through MW-12), were installed in October 2004. Nitrate was detected in all newly installed wells at concentrations above the MTCA Method B CUL. The elevated concentrations observed in MW-8 and MW-12 were within the main nitrate source areas defined in the Phase I RI. Elevated nitrate concentrations were also detected in MW-9, which is located off-property in a southeasterly direction. The nitrate concentrations detected at MW-10 and MW-11 were only slightly above the MTCA Method B CUL and likely approach background concentrations. Ammonia was also detected at MW-8 and MW-12, within the source areas identified during the Phase I RI. Ammonia was not detected in MW-9, which suggests that ammonia is being naturally attenuated and not migrating off-property.

The 2,4-D concentration in MW-12 was slightly above the MTCA Method B CUL. Arsenic concentrations in all five newly installed wells exceeded the MTCA Method B CUL. However, the range of arsenic concentrations was fairly consistent across the property and within normal background concentrations. The benzene concentration in MW-10 exceeded the MTCA Method B CUL.

The surface water/sediment investigation of the lagoon located in the southeastern portion of Area 1 was completed in June 2004. One sample of the lagoon surface water and one sample of the lagoon sediment were collected to evaluate the nitrogen compound concentrations. Concentrations of ammonia were detected in the lagoon surface water and sediment samples. Nitrate and nitrite were not detected.

Single well pump tests were performed at wells MW-1 and MW-3 through MW-8 to estimate the aquifer's horizontal hydraulic conductivity. The calculated hydraulic conductivities ranged from 2.74E-05 to 4.12E-04 cm/s, with an average hydraulic conductivity of 1.45E-04 cm/s. This hydraulic conductivity is characteristic of fine sands, organic and inorganic silts, and mixtures of sand, silt, and clay.

2.3.3 Phase II Treatability Investigation

A treatability investigation, including both a bench-scale study and field pilot study (consisting of *in situ* injection of sodium acetate into four injection wells installed around well MW-4), was conducted as part of the Phase II RI to guide potential nitrate and herbicide remediation activities. Results are summarized below:

- The treatability study determined the most effective treatment was denitrification using acetate as an electron donor.
- The pilot study demonstrated that injection of acetate was successful in remediating nitrate, nitrite, and dinoseb concentrations to below detectable limits in groundwater at well MW-4 within a 10-foot radius for the duration of the monitoring period and reducing concentrations of those constituents in saturated soils.
- Groundwater samples collected from borings advanced at locations 10 and 15 feet west of the pilot study area were used to determine the radius of influence (ROI) of the pilot study treatment. Nitrate concentrations above the MTCA Method B CUL were observed (maximum of 388 milligrams per liter [mg/L] at SB-PS-003) indicating these boring locations were outside the main zone of influence.
- Elevated concentrations of nitrate and ammonia appear to be toxic to the bacteria that convert ammonia to nitrates.
- Subsurface aeration was not effective in removing ammonia concentrations from the groundwater. Although pH adjustment was able to de-ionize the ammonium ions to form

ammonia gas, the ammonia gas was absorbed by the overlying soil column before reaching ground surface.

2.3.4 BIOSCREEN Modeling

Based on Phase II RI data and assumed parameters, a BIOSCREEN model was used to predict time of travel for down-gradient nitrate transport. The following predictions were made from the modeling:

- The center of the nitrate plume was moving at a rate of approximately 1 to 2 feet per year. Due to dispersion, the front of the plume was shown to move at a rate of approximately 2 to 3 feet per year.
- Dispersion was causing the maximum concentration of the plume to decay exponentially. Thus, the maximum concentration of the plume would decrease at least one order of magnitude by the time it travels 900 feet.
- The plume will require a travel distance of more than one mile (travel time of more than 2,000 years) before the maximum concentration of nitrate will decrease by dissolution to less than the Federal Drinking Water MCL of 10 mg/L, and significantly longer to reach the MTCA Method B CUL of 1.6 mg/L.

2.3.5 Phase III Remedial Investigation

The Phase III RI was conducted in March and May 2007 and consisted of completion and sampling of 12 vertical profile borings (OP-VP-001 through OP-VP-006 and OP-VP-008 through OP-VP-013) and one permanent groundwater monitoring well (MW-13). The off-property borings completed during the Phase III RI are shown on **Figure 5**.

The objectives of the Phase III RI were to:

- Evaluate horizontal and vertical extent of off-property nitrate impacts down-gradient of the Bee-Jay Scales property.
- If necessary, install one or more monitoring wells at the down-gradient edge of the nitrate plume for performance monitoring.
- Define a site-specific soil/water partitioning coefficient for nitrate to provide more accurate fate and transport modeling results.

The findings from the Phase III RI are summarized below:

- The nitrate plume extends off-property. However, boundaries to the east and west have been delineated below the nitrate Federal MCL of 10 mg/L. The plume was not fully delineated to the south because a probable second source of nitrate and ammonia was encountered off-property.
- Nitrate concentrations suggest a source south of the Site is contributing to the nitrate plume, most likely near boring OP-VP-011. Nitrate test strip concentrations increased

from 50 to 400 mg/L between borings OP-VP-010 and OP-VP-011, and corresponding concentrations determined by the laboratory increased from 6.6 to 133 mg/L.

- Ammonia concentrations also indicate a second source. The ammonia concentration in the on-site source area was 952 mg/L (Second Quarter 2007 at MW-4). The ammonia concentration down-gradient of the on-site source area was 186 mg/L (at OP-VP-001), and ammonia was not detected at OP-VP-004. However, the ammonia concentration increased to 1,050 mg/L at OP-VP-011, more than 700 feet from the on-site source.
- The possibility for an additional source down-gradient of the Site is also confirmed by a significant change in groundwater chemistry observed at OP-VP-011 for pesticide residuals, alkalinity, salts, and elevated arsenic concentrations.
- In addition to nitrate, several constituents (including nitrite, dinoseb, benzene, and 1,2-dichloroethane) were detected above their MTCA Method B CULs at OP-VP-011.
- The property west of OP-VP-011 is owned by the J.R. Simplot Company, a food and agribusiness corporation whose primary activities involve food, fertilizer, turf and horticultural, cattle feeding, and other enterprises related to agribusiness. The property north of OP-VP-011 is owned by Valley Processing, Inc., a fruit juice and concentrate processor.
- TPH-Gx and 2-methylnaphthalene were detected above their MTCA Method B CULs in OP-VP-009, indicating there may have been a source of petroleum hydrocarbons in the vicinity of OP-VP-009.
- The BIOSCREEN model was re-calibrated using Phase III RI data and showed the effective groundwater flow velocity is approximately 8 to 9 feet per year, and nitrate in groundwater moves approximately 15 to 16 feet per year with dispersion. The model predicted the leading edge of the nitrate plume is approximately 550 to 600 feet away from the on-site source location; therefore, the high concentrations of nitrate observed 600 to 800 feet down-gradient of the Site likely result from a second source.

2.3.6 Down-Gradient Assessment

SECOR conducted the down-gradient assessment in March 2008 to further evaluate: 1) the off-property extent of nitrate concentrations down-gradient of the Site; and 2) a potential separate off-property source of nitrate concentrations. The assessment consisted of the advancement and sampling of one off-property vertical profile boring (OP-VP-014), which is shown on **Figure 5**.

The findings from the down-gradient assessment are summarized below:

- Nitrate concentrations of 292 mg/L and 110 mg/L were detected at the 10-foot and 20-foot depths, respectively, in OP-VP-014 above the MTCA Method B CUL of 1.6 mg/L.
- The nitrate plume extends off-property and encompasses OP-VP-014. The maximum nitrate concentration at OP-VP-014 exceeds the concentration at up-gradient well MW-13 indicating a potential second source down-gradient of the Site may still exist; however, the nitrate plumes are commingled.

- There are two separate ammonia sources. The maximum ammonia concentration in March 2008 in the on-site source area was 204 mg/L (well MW-12). The ammonia concentrations decrease down-gradient of the on-site source area, which was confirmed by the low ammonia concentration (0.4 mg/L) at OP-VP-014. However, the ammonia concentration measured during the Phase III RI was 1,050 mg/L at OP-VP-011, which is more than 700 feet from the on-site source area and is significantly greater than the concentration at OP-VP-014.
- Several constituents (nitrite, dinoseb, arsenic, benzene, chloride, sulfate, 1,2-dichloroethane, and 1,2-dichloropropane) were detected above MTCA Method B CULs or secondary MCLs at OP-VP-011 during the Phase III RI. These constituents were either not detected or were at lower concentrations in up-gradient OP-VP-014, confirming the potential of an additional source in the vicinity of OP-VP-011.

The assessment results provided further evidence of a potential additional source based on the detached ammonia plumes and relatively higher concentrations of several constituents at OP-VP-011 (down-gradient of potential off-property source) than at OP-VP-014 (up-gradient of potential off-property source). However, a commingled nitrate plume was observed.

2.3.7 Interim Remedial Measures

In 2006, SECOR conducted interim remedial measures including: 1) lagoon closure activities; and 2) treatment of petroleum hydrocarbon impacts in Area 3 using persulfate injections.

The former lagoon was removed as a potential source and safety hazard, and calcium acetate was placed into the excavation to mitigate any residual impacts remaining in the soil.

In situ injection of sodium persulfate into four injection wells was conducted in Area 3 for the treatment of petroleum hydrocarbons, and favorable geochemical conditions were observed in the injection wells during and immediately after injection. Groundwater samples collected from nearby well MW-10 three months after injection showed an average percent (%) reduction in petroleum hydrocarbon concentrations of over 78%.

2.3.8 Groundwater Monitoring

Groundwater monitoring has been conducted since July 2003. Currently, the following monitoring wells are sampled on a semi-annual basis: MW-1, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-13. Monitoring well locations are shown on **Figure 2**. Groundwater concentrations from September 2005 through March 2009 for nutrients and metals, volatile organic compounds (VOCs), and herbicides are presented in **Table 1a**, **Table 1b**, and **Table 1c**, respectively.

Based on the hydrogeologic data collected during the most recent groundwater monitoring event (First Half 2009 [1H09]), depth to groundwater ranged from 6.40 feet below the top of well casing elevation in well MW-11 to 11.47 feet below the top of well casing elevation in well

MW-1. The groundwater elevation ranged from 732.44 feet above mean sea level (amsl) at off-property well MW-13 to 735.70 feet amsl in the southwestern portion of the Site at well MW-11.

The groundwater flow direction is generally to the northeast in the northern portion of the Site (near MW-1 and MW-7) and to the east-southeast in the southern portion of the Site and off-property, with a groundwater flow divide observed at the southern edge of Area 5. The groundwater contour map from 1H09 is presented as **Figure 6**.

2.3.9 Human Health Risk Assessment

A *Human Health Risk Assessment* (HHRA) was completed to quantify risks associated with chemicals in the soil and groundwater both on-site and off-property (Stantec, 2008).

MTCA regulations provide three options for establishing CULs: Method A, Method B, and Method C. Method A provides CULs published in tables for common hazardous substances found in soil and groundwater. Method B CULs are established using applicable state and federal laws, risk assessment equations, and either generic default assumptions (standard Method B) or chemical-specific or site-specific information (modified Method B). Method C is used to establish soil and air CULs at industrial sites and to set CULs for air in manholes and utility vaults. To provide a conservative assessment and to allow for unrestricted land use, the IHSs were established based on comparisons to Method A CULs, background levels in soil, and standard and modified Method B CULs.

In accordance with MTCA Method B regulations, all potential IHSs were evaluated for risks to current and reasonable future exposure populations, which include commercial workers, residents, and construction workers.

The IHSs in soil that were evaluated in the HHRA due to exceedances of Method B CULs for the protection of groundwater and/or air include nitrate, nitrite, cadmium, chromium, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and 2-methylnapthalene. IHSs evaluated for on-site groundwater include nitrate, nitrite, arsenic, 1,2-dichloropropane, benzene, chlorobenzene, 2,4-D, and dinoseb. IHSs evaluated for off-property groundwater include nitrate, nitrite, manganese, iron, 1,2-dichloropropane, 2-methylnapthalene, dinoseb, and arsenic. Although present in Site-related media, ammonia, sulfate, phosphate, and chloride were not deemed toxic based on literature review and the exposure pathways relevant to the Site; therefore, they were not analyzed in the HHRA. TPH-Gx was also not evaluated in the HHRA as its toxicity is best quantified by its toxic constituents.

To fully assess the overall exposure and risk posed to human health by on-site and off-property IHSs, exposure pathways were investigated. Based on the site conceptual model and the assumption that the Site could potentially be occupied by residences in the future, the following complete or potentially complete exposure pathways were identified:

- Outdoor inhalation of vapors emitted from soil on-site and groundwater on-site and off-property by residents, commercial/industrial workers, and construction workers;
- Indoor inhalation of vapors emitted from soil on-site and groundwater on-site and off-property by residents and commercial/industrial workers;
- Ingestion of and dermal contact with groundwater if a water supply well was installed in close proximity to the plume; and
- Inhalation of VOCs from tap water if a water supply well was installed in the area of the plume containing volatile hydrocarbons.

As part of the risk characterization, it was determined that on-site and off-property commercial workers and future residential receptors are not exposed to unacceptable risks by IHSs in soil and groundwater via inhalation of ambient air. Additionally, it is expected that construction workers, who are exposed for a much shorter frequency and duration than commercial workers or residents, would also be protected. Therefore, no further risk analysis for construction workers was required.

It was also determined that cumulative risks to off-property future residents and on-site and off-property current commercial workers via indoor inhalation of fugitive emissions from VOCs in groundwater were below target levels.

A vapor intrusion evaluation was conducted for hypothetical future residential or commercial structures above impacted soil and groundwater on-site, and results showed there may be unacceptable risks resulting from 1,2,4-trimethylbenzene in soil and 1,2-dichloropropane in groundwater on-site. However, it is expected that quantities of these VOCs will continue to decline over time via natural attenuation and will eventually reach concentrations below MTCA Method B CULs.

The HHRA showed that impacts to potable water resources by on-site groundwater are not expected; however, there are currently no regulatory restrictions on where water wells can be installed. The IHS concentrations in groundwater currently exceed Method B CULs and, in some cases, Federal MCLs. The potential risks related to exposure to chemicals in tap water were not quantified in the HHRA as the Federal MCL will be used as the remediation goal, which will be protective of all receptors.

In summary, the HHRA indicated that the groundwater ingestion exposure pathway for nitrate is potentially complete for off-property receptors due to the lack of regulatory restrictions on installing water wells. Based on current land use (including locations of existing buildings on-site), risks to current on-site exposure populations are within acceptable limits. However, for hypothetical future commercial or residential land use on-site, ingestion of groundwater containing nitrate and indoor inhalation of vapors containing 1,2,4-trimethylbenzene (from soil) and 1,2-dichloropropane (from groundwater) could result in risk that exceeds acceptable limits.

2.3.10 Development and Screening of Remedial Alternatives

A *Development and Screening of Remedial Alternatives* (DSRA) was completed to determine an appropriate range of remedial alternatives warranting more detailed analysis in the FS (Stantec, 2009). Section 3 is summarized from the DSRA and serves as the basis for the detailed analysis of remedial alternatives in Section 4.

3.0 Development and Screening of Remedial Alternatives

The DSRA followed the framework identified in the Agreed Order, Ecology MTCA Regulations, and Chapter 4, *Development and Screening of Alternatives*, of the USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988).

3.1 DEVELOPMENT OF CLEANUP LEVELS, REMEDIAL ACTION OBJECTIVES, AND GENERAL RESPONSE ACTIONS

Per Washington Administrative Code (WAC) 173-340-7490, a terrestrial ecological evaluation (TEE) is used to determine "whether a release of hazardous substances to soil presents a threat to the terrestrial environment", to characterize "existing or potential threats to terrestrial plants or animals exposed to hazardous substances in soil", and aid in establishing "site-specific cleanup standards for the protection of terrestrial plants and animals". A TEE must be conducted at all sites where a release of a hazardous substance to soils has occurred. As nitrate has been released to the soils, this regulation applies to the Site, and either an exclusion, a simplified TEE, or a site-specific TEE is required.

The Site qualified for a simplified TEE. A simplified TEE consists of three parts: exposure analysis, pathways analysis, and contaminants analysis. While conducting the exposure analysis, it was determined that no further action regarding the simplified TEE was necessary as land use at the Site and surrounding areas makes substantial wildlife exposure unlikely. The exposure analysis procedure (Table 749-1) from WAC 173-340-900 was used to make this assessment, and is included as **Appendix B**. As part of the exposure analysis, the area of contiguous undeveloped land on the Site or within 500 feet of any area of the Site was estimated to be approximately 3.5 acres. A map showing an estimate of the area of contiguous undeveloped land is included in **Appendix B**.

As the pathways and contaminants analyses were not needed at the Site, site-specific soil CULs do not need to be developed for protection of terrestrial plants and animals; however, an institutional control (IC) that ensures that land use in the future continues to make substantial wildlife exposure unlikely may be necessary.

Site-specific CULs for groundwater have been developed from a combination of primary MCLs, standard MTCA Method A CULs, and standard and modified MTCA Method B CULs. Primary MCLs are set as the CUL for constituents for which they have been developed. If no MCL has been established, modified MTCA Method B CULs are generally used. In cases where modified MTCA Method B CULs have not been developed (TPH-Gx and manganese), standard MTCA Method A or Method B CULs are used. A list of groundwater CULs is provided in **Table 2**. CULs for IHSs are shown in bold text in **Table 2**, and will be used for evaluation of the effectiveness of the implemented remedial alternatives. CULs for additional constituents included in the semi-annual groundwater monitoring program are also shown in **Table 2**; though they will not be used to determine compliance, they will be used as screening levels in the evaluation of groundwater monitoring data.

In the DSRA, remedial action objectives (RAOs) were developed to prevent unacceptable risk to current receptors (i.e., ingestion of groundwater containing nitrate in excess of the Federal MCL by off-property residential receptors) as identified in the HHRA.

The RAO for soil is as follows: for the protection of human health, prevent leaching of nitrate from soil to groundwater by reducing soil concentrations on-site to a preliminary cleanup level of 452 milligrams per kilogram (mg/kg) or otherwise preventing leaching to off-property groundwater in excess of the Federal MCL of 10 mg/L.

The RAO for groundwater is as follows: for the protection of human health, prevent ingestion of groundwater with nitrate in excess of the Federal MCL of 10 mg/L by off-property residential receptors.

A variety of general response actions may be taken to satisfy the soil and groundwater RAOs. For soil, containment, removal, and treatment were considered. For groundwater, ICs, containment, removal, treatment, and discharge were considered.

Note that hypothetical future exposure pathways and receptors were not considered in the development of the RAOs. However, the remedial alternatives presented in the FS, with the exception of the "no action" alternatives, incorporate hypothetical future exposure pathways and receptors through the use of ICs. For example, the ICs for On-site Remedial Alternatives #2 through #4 involve a "restriction on installing drinking water wells in the shallow aquifer on-site while nitrate concentrations in groundwater exceed the Federal MCL of 10 mg/L" and "a restriction on construction or relocation of buildings on-site that would … result in unacceptable risks from inhalation of vapors containing 1,2,4-trimethylbenzene (from soil) and 1,2-dichloropropane (from groundwater)", as described in Sections 4.2.2.1, 4.2.3.1, and 4.2.4.1, respectively.

Also, in addition to residential properties within the off-property plume, commercial/industrial properties were considered in the development of the off-property remedial alternatives. For example, the IC for Off-property Remedial Alternative #2 involves a "restriction on installing drinking water wells in the shallow aquifer at properties within the off-property plume while nitrate concentrations in groundwater exceed the Federal MCL of 10 mg/L", as described in Section 4.4.2.1. Note that the IC does not distinguish between commercial/industrial properties and residential properties.

3.2 IDENTIFICATION OF AREAS AND VOLUMES OF IMPACTS

Areas and volumes of impacted soil and groundwater were identified. Four nitrate source areas in soil were identified on-site where nitrate concentrations exceeded 452 mg/kg as shown in **Figure 7**. An area in the western portion of Area 5 (Soil Area A) extends approximately 1,370 square feet (sf) to a depth of approximately 0.5 feet bgs for a volume of approximately 25 cubic yards (cy). An area directly east of the Dry Fertilizer Manufacturing Building in Area 2 (Soil Area B) extends approximately 780 sf at a depth of 0.5 feet bgs and approximately 940 sf at a depth of 4.5 feet bgs, for a volume of approximately 170 cy. An area west of the former lagoon (Soil Area C) extends approximately 3,230 sf to a depth of approximately 4.5 feet for a volume of approximately 540 cy. An area immediately east of the former lagoon (Soil Area D) extends approximately 2,340 sf to a depth of approximately 4.5 feet for a volume of approximately 390 cy.

In groundwater, the nitrate plume that consists of concentrations above the Federal MCL of 10 mg/L covers an area of approximately 9.8 acres and extends down-gradient from on-site source areas to off-property areas as shown in **Figure 8**. Groundwater is typically encountered at approximately 10 feet bgs, and a clay aquitard exists at approximately 30 feet bgs. Therefore, the volume of groundwater impacted with nitrates above 10 mg/L is estimated at 19 million gallons assuming 30% soil porosity.

However, evidence of a second source down-gradient of the Site has been documented. Re-calibration of the BIOSCREEN model using Phase III RI data predicted the leading edge of the nitrate plume is approximately 550 to 600 feet away from the on-site source location; therefore, the high concentrations of nitrate and ammonia observed 600 to 800 feet down-gradient of the Site likely result from a second source (possibly associated with an off-property release of ammonium nitrate fertilizer). Thus, the nitrate plume that is believed to originate from the Site covers an area of approximately 5.2 acres and consists of a volume of 10 million gallons.

For purposes of this report, the 9.8-acre plume will be hereafter referred to as the combined nitrate plume, and the 5.2-acre plume will be hereafter referred to as the site-specific nitrate plume. In discussions of remedial alternatives for off-property groundwater, the phrases "site-specific off-property groundwater plume" and "site-specific off-property nitrate plume" refer to the off-property portion of the site-specific nitrate plume. Similarly, the phrase "combined off-property nitrate plume" refers to the off-property portion of the combined nitrate plume.

3.3 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS BASED ON TECHNOLOGICAL EFFECTIVENESS

Based on general response actions applicable for the site-specific RAOs, relevant remedial technologies were identified. Process options for each remedial technology were then identified for qualitative screening. A preliminary screening of technologies was performed to eliminate technologies that are considered technologically ineffective (i.e., ineffective for nitrate or ineffective to achieve the RAOs).

For soil, the following remedial technologies (and process options) were identified: containment (capping); removal (off-site disposal - solid waste facility); *ex situ* treatment (biological treatment, phytoremediation, and soil washing); and *in situ* treatment (bioremediation, electrokinetics, flushing, natural attenuation, and phytoremediation).

For groundwater, the following remediation technologies (and process options) were identified: ICs (government controls, proprietary controls, and site inspection); containment (hydraulic [extraction wells and extraction trenches] and vertical barriers); removal (evapotranspiration, extraction wells, and extraction trenches); *ex situ* treatment (biological treatment, electrodialysis, ion exchange, and reverse osmosis); *in situ* treatment (bioremediation, electrokinetics, flushing, natural attenuation, permeable reactive barrier [PRB], and phytoremediation); and discharge (beneficial re-use, injection or infiltration, National Pollutant Discharge Elimination System [NPDES] permit, and Publicly Owned Treatment Works [POTW]).

Remedial technologies and associated process options were screened based on technological effectiveness with respect to addressing nitrates in soil (on-site) and groundwater (on-site and off-property). Process options removed from further consideration included *ex situ* phytoremediation for soil due to the lack of open space for spreading excavated soil, evapotranspiration for groundwater due to the depth of impacted groundwater and the expected low removal rate via this method, and injection/infiltration for groundwater due to the potentially large volumes of groundwater and moderately low soil permeability.

3.4 EVALUATION OF PROCESS OPTIONS BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND RELATIVE COST

The remaining process options were carried through for further evaluation with respect to effectiveness, implementability, and relative cost. Process options that passed the screening phase were retained for developing remedial alternatives.

Several process options for on-site soil were screened out due to implementability issues associated with the current and anticipated use of the Site and cost:

- Implementing *in situ* phytoremediation for soil at the source areas would affect a large area, and therefore would impede current commercial activities.
- Excavation of Soil Area B, which is adjacent to and partially beneath the Dry Fertilizer Manufacturing Building in Area 2, would not be possible; therefore, options requiring removal (i.e., off-site disposal and *ex situ* treatment options) were screened out.
- High costs and low probability of success associated with the *in situ* treatment options of electrokinetics and flushing screened out these process options from further consideration.

Although they were screened out in the DSRA as stand-alone remedial alternatives, excavation, off-site disposal, and *ex situ* biological treatment were retained for use in On-site Remedial Alternative #4, as described in Section 3.5, to address unsaturated residual soil source areas.

Process options for on-site groundwater were screened out due to a variety of reasons including low effectiveness, implementability issues, and cost:

- The *in situ* treatment option of electrokinetics was screened out due to its ineffectiveness in achieving the groundwater RAO; additionally, it would require subsequent extraction and treatment of groundwater, thus proving cost-prohibitive.
- Several other options, including extraction wells/trenches, flushing, and *ex situ* biological treatment, were screened out due to the high cost associated with managing large volumes of groundwater and performing long-term operations and maintenance activities on the systems.
- Impermeable vertical barriers and electrodialysis would be costly and difficult to implement under the current and anticipated use of the Site (active commercial operations).
- Ion exchange and reverse osmosis would require large-scale treatment systems on-site that would be costly and require close monitoring.

The high solubility of nitrate makes it difficult to treat by many conventional technologies. A majority of process options for off-property groundwater were screened out due to implementability issues associated with off-property access restrictions and the large footprint of the site-specific off-property nitrate plume:

- Vertical barriers and PRBs would be intrusive and require several access agreements; their lack of effectiveness in protecting wells, or potential wells, within the existing off-property plume was also a factor in screening them out.
- Options requiring the installation of numerous off-property wells (due to the large footprint of the site-specific off-property nitrate plume) would also be intrusive and difficult to implement; these options include extraction wells/trenches, *ex situ* treatment options without the option for individual well head systems (i.e., biological treatment and electrodialysis), and certain *in situ* treatment options (bioremediation, electrokinetics, and flushing).
- Phytoremediation would be difficult to implement for similar reasons and would not achieve the desired effectiveness to meet the groundwater RAO.

Additionally, the discharge options, including beneficial re-use, NPDES permit, and POTW, were eliminated for both on-site and off-property groundwater because contingent remedial technologies (removal and *ex situ* large-scale treatment systems) were screened out.

3.5 ASSEMBLING OF REMEDIAL ALTERNATIVES

On-site soil and groundwater remedial alternatives recommended for further evaluation are as follows:

- On-site Remedial Alternative #1:
    - No action.

- On-site Remedial Alternative #2:
    - Monitored natural attenuation (MNA); and

  - ICs.

- On-site Remedial Alternative #3:
  - PRB;
  - Groundwater monitoring;
  - Natural attenuation and capping of soil; and
  - ICs.

- On-site Remedial Alternative #4:
  - *In situ* bioremediation;
  - Groundwater monitoring;
  - Soil excavation with off-site disposal and/or *ex situ* biological treatment;
  - ICs; and
  - Phytoremediation of groundwater (as an optional addition).

As mentioned above, although they were screened out in the DSRA as stand-alone remedial alternatives, excavation, off-site disposal, and *ex situ* biological treatment were retained for use in On-site Remedial Alternative #4 to address unsaturated residual soil source areas.

Off-property groundwater remedial alternatives recommended for further evaluation are as follows:

- Off-property Remedial Alternative #1:
  - No action.

- Off-property Remedial Alternative #2:
  - MNA;
  - ICs; and
  - Contingency plan (in the event drinking water wells are installed within the shallow aquifer plume off-property): alternative supply of drinking water or *ex situ* treatment systems at individual well heads (ion exchange or reverse osmosis).

Note that three off-property remedial alternatives were recommended in the DSRA, but only two are presented above for further evaluation in the FS. In addition to the remedial alternatives listed above, a third alternative included just MNA of groundwater and ICs. However, providing an alternative supply of drinking water or installing *ex situ* treatment systems at individual well heads in Off-property Remedial Alternative #2 above is simply a contingency plan in the event drinking water wells are installed within the shallow aquifer plume off-property (currently, there are none). Future installations are unlikely as high nitrate concentrations in the shallow aquifer are wide-spread throughout Washington, especially in the agriculturally intensive regions that include Yakima County and the vicinity of the Site. Therefore, wells are drilled in the deeper aquifer to provide customers with good quality water, avoid potential liability concerns to the well drillers, and meet the well construction standards. Installation of drinking water wells within the shallow aquifer is also unlikely because businesses and residents within the city are supplied municipal water.

Therefore, Off-property Remedial Alternative #2 is essentially the same as the third alternative from the DSRA, with the addition of a necessary contingency plan. As such, a decision was made (after submission of the DSRA) to evaluate just the two off-property remedial alternatives above in the FS.

4.0 Detailed Analysis of Remedial Alternatives

4.1 EVALUATION CRITERIA

The remedial alternatives were evaluated with respect to threshold criteria that must be met for all cleanup actions conducted under Ecology's authority. The threshold criteria include overall protection of human health and the environment, compliance with applicable or relevant and appropriate requirements (ARARs), and opportunity for compliance monitoring.

Remedial alternatives that met the threshold criteria were also evaluated using the following criteria to further aid in selecting a cleanup action:

- Effectiveness (reasonable restoration timeframe, long-term effectiveness and permanence, short-term effectiveness);
- Implementability (technical and administrative implementability, state and community acceptance); and
- Cost.

The evaluation criteria were developed based on requirements outlined in the WAC 173-340-360 and the Agreed Order for the Site. *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* was also consulted for general guidance (USEPA, 1988). The criteria are described below.

4.1.1 Threshold Criteria

<u>Overall Protection of Human Health and the Environment</u>

The assessment for this criterion describes how the remedial alternative provides overall protection of human health and the environment with consideration given to the following:

- Elimination or removal of all physical hazards;
- The degree to which existing risks are reduced;
- Time required to reduce risk at the Site and attain cleanup standards;
- On-site and off-property risks resulting from implementing the remedial alternative; and
- Improvement of the overall environmental quality.

Compliance with ARARs

The assessment for this criterion determines whether each remedial alternative complies with site-specific ARARs, or if a waiver is required and how it is justified. The list of site-specific ARARs, included as **Table 3**, was drafted by Stantec and approved by Ecology in a May 4, 2009 teleconference. It includes applicable cleanup standards regulated under MTCA.

Opportunity for Compliance Monitoring

The assessment for this criterion evaluates whether implementation of compliance monitoring is possible for each remedial alternative. There are three types of compliance monitoring: protection, performance, and confirmational monitoring. The purposes of these three types of compliance monitoring and evaluation of the data are as follows:

- Protection monitoring: Confirm that human health and the environment are adequately protected during construction and the operation and maintenance period of a cleanup action as described in the health and safety plan;
- Performance monitoring: Confirm that the cleanup action has attained cleanup standards and, if appropriate, remediation levels or other performance standards such as construction quality control measurements or monitoring necessary to demonstrate compliance with a permit or, where a permit exemption applies, the substantive requirements of other laws; and
- Confirmational monitoring: Confirm the long-term effectiveness of the cleanup action once cleanup standards and, if appropriate, remediation levels or other performance standards have been attained.

4.1.2 Effectiveness

Reasonable Restoration Timeframe

The assessment for this criterion determines whether a cleanup action provides for a reasonable restoration timeframe with consideration given to the following:

- Potential risks posed by the Site to human health and the environment;
- Practicability of achieving a shorter restoration timeframe;
- 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 ICs;
- 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.

Long-term Effectiveness and Permanence

The assessment for this criterion evaluates the degree of certainty that the remedial alternative will be successful in meeting and maintaining the RAOs.

Long-term effectiveness includes the degree of certainty that the remedial alternative will be successful, the reliability of the remedial alternative during the period of time hazardous substances are expected to remain on-site at concentrations that exceed CULs, the magnitude of residual risk with the remedial alternative in place, and the effectiveness of controls required to manage treatment residues or remaining wastes. The following types of cleanup action components may be used as a guide, in descending order, when assessing the relative degree of long-term effectiveness: reuse or recycling; destruction or detoxification; immobilization or solidification; on-site or off-site disposal in an engineered, lined, and monitored facility; on-site isolation or containment with attendant engineering controls; and ICs and monitoring.

A permanent cleanup action is defined as one in which cleanup standards can be met without further action being required, other than the approved disposal of any residue from the treatment of hazardous substances. An evaluation of permanence considers the degree to which the remedial alternative permanently reduces the toxicity, mobility, or volume of hazardous substances, including the adequacy of the remedial 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 process, and the characteristics and quantity of treatment residuals generated.

Short-term Effectiveness

The assessment for this criterion examines the effectiveness of each remedial alternative in protecting human health and the environment during the construction and implementation of the remedy until the RAOs have been met (i.e., management of short-term risks).

4.1.3 Implementability

Technical and Administrative Implementability

The assessment for this criterion evaluates the technical and administrative feasibility of remedial alternatives with consideration given to the following:

- Availability of necessary off-site facilities and services (e.g., transportation, disposal, analytical), equipment, and materials;
- Health and safety of workers during implementation;
- Scheduling, size, and complexity;
- Future operation, maintenance, and monitoring (OMM) requirements;
- Integration with existing operations at the Site and other current or potential remedial actions;
- Site access; and
- Enforceability of ICs, as applicable.

State and Community Acceptance

The assessment for this criterion reflects apparent preferences among or concerns about remedial alternatives from Ecology and the community. Ecology's acceptance of the remedial alternatives was established following comment on this FS report. Community acceptance of the remedial alternatives will be evaluated during a subsequent 30-day public comment period that may involve individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the Site.

4.1.4 Cost

The assessment for this criterion evaluates estimated costs to implement each remedial alternative. Due to the preliminary nature of FS cost estimates, they should be regarded as having a relatively large degree of uncertainty (± 30%). As such, they are intended for use only in the relative comparison of remedial alternatives and should not be construed as actual cost estimates for implementing the chosen alternative. The costs account for the following:

- Construction and oversight costs that include ICs, permits, equipment and materials, waste management, analytical services, and labor; and
- Long-term OMM costs that include maintaining ICs and permits, replacement and repair of equipment and materials, waste management, analytical services, labor, and net present value based on an estimated design life of the cleanup action.

4.2 INDIVIDUAL ANALYSIS OF REMEDIAL ALTERNATIVES FOR ON-SITE SOIL AND GROUNDWATER

Descriptions of the remedial alternatives and detailed evaluations of each with respect to the evaluation criteria are provided in the subsequent sections. A summary of the evaluation is provided in **Table 4**. The evaluation summary lists whether each remedial alternative meets, partially meets, or fails the criteria.

4.2.1 On-site Remedial Alternative #1 – No Action

4.2.1.1 Description

On-site Remedial Alternative #1 involves leaving all concentrations of nitrate in on-site soil and groundwater in place with no further action. It is included primarily as a baseline to which other remedial alternatives can be compared.

4.2.1.2 Evaluation

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

On-site Remedial Alternative #1 is not protective of human health and therefore fails this criterion.

Compliance with ARARs

On-site Remedial Alternative #1 would not be effective in reducing nitrate concentrations present in on-site soil and groundwater to appropriate CULs (as defined in the RAOs). Therefore, it fails this criterion.

Opportunity for Compliance Monitoring

On-site Remedial Alternative #1 does not allow the opportunity for compliance monitoring and therefore fails this criterion.

EFFECTIVENESS

On-site Remedial Alternative #1 did not fulfill the threshold criteria, so a further evaluation of its effectiveness is not warranted.

IMPLEMENTABILITY

On-site Remedial Alternative #1 did not fulfill the threshold criteria, so a further evaluation of its implementability is not warranted.

COST

On-site Remedial Alternative #1 did not fulfill the threshold criteria, so a further evaluation of its cost is not warranted.

4.2.2 On-site Remedial Alternative #2 – Monitored Natural Attenuation and Institutional Controls

4.2.2.1 Description

On-site Remedial Alternative #2 would involve MNA combined with ICs. A more detailed description of this remedial alternative follows.

MNA

Natural attenuation refers to the natural physical, chemical, and/or biological processes that reduce the mass, toxicity, or mobility of constituents in the subsurface over time without aggressive remediation techniques. MNA involves sampling and analysis to verify that attenuation of the constituents is occurring. Natural attenuation processes are typically modeled to predict long-term performance. Some of the processes involved in natural attenuation of nitrate are biodegradation, dispersion, and sorption.

These mechanisms have been insufficient at preventing nitrate loads from historical fertilizer operations from impacting groundwater at concentrations above the Federal MCL for nitrate. However, natural attenuation may be sufficient to address the residual nitrate concentrations in soil now that the primary sources of nitrate to the soil no longer exist. Similarly, MNA can be an inexpensive and viable option for degrading low concentrations of nitrates in groundwater. However, more aggressive remediation strategies may be needed to control the site-specific nitrate plume for the protection of human health due to the high concentrations of nitrate (maximum of 683 mg/L in well MW-4 in 1H09) and the lack of available electron donors in the groundwater.

On-site MNA would involve monitoring wells MW-1, MW-3 through MW-8, and MW-10 through MW-12 for the following parameters on a semi-annual basis:

- Field analysis of dissolved oxygen (DO) by USEPA Method 360.1, oxidation-reduction potential (ORP) by American Public Health Association (APHA) Method 2580, and pH by USEPA Method 150.1;
- Alkalinity by SM20 Method 2320 B;
- Nitrate and nitrite by USEPA Method 353.2 and sulfate by USEPA Method 300.0;
- Dissolved manganese and iron by USEPA Method 6010;

- Phosphorous by USEPA Method 365.1;
- Ferrous iron by SM20 Method 3500 Fe B Modified; and
- Total organic carbon (TOC) by SM20 Method 5310 B/C.

These parameters would be incorporated into the current semi-annual groundwater monitoring program to facilitate compliance monitoring of this remedial alternative.

ICs

ICs are administrative and/or legal controls that minimize exposure to constituents by limiting the use of the land and its resources. Ecology would likely require that appropriate ICs be described in a restrictive covenant (i.e., a deed restriction) if nitrate remains in soil and/or groundwater at concentrations that exceed the applicable CULs. The purpose of a restrictive covenant is to prohibit activities that may interfere with a cleanup action, OMM, or other measures necessary to assure the integrity of the cleanup action and continued protection of human health and the environment. Since the owners of the Site (Bee-Jay Scales and Hickenbottom & Sons) were named as potentially liable persons (PLPs) in the current Agreed Order, Ecology would require the restrictive covenant be executed by the owners and recorded with the register of deeds for Yakima County.

A restrictive covenant for On-site Remedial Alternative #2 would include the following:

- A restriction on installing drinking water wells in the shallow aquifer on-site while nitrate concentrations in groundwater exceed the Federal MCL of 10 mg/L.
- A restriction on construction or relocation of buildings on-site that would prevent proper monitoring of soil and groundwater concentrations or result in unacceptable risks from inhalation of vapors containing 1,2,4-trimethylbenzene (from soil) and 1,2-dichloropropane (from groundwater).

While restrictive covenants have been used for many years, they have sometimes been rendered unenforceable under common law (e.g., waiver, abandonment, acquiescence, adverse possession, foreclosure of a tax lien, the rule against perpetuities, and requirements for privity or appurtenance, etc.). However, in 2007, Washington enacted the Uniform Environmental Covenants Act (UECA), which establishes environmental covenants for sites in Washington that are remediated under Ecology or USEPA. Environmental covenants created under UECA contain activity or land use restrictions on real property that legally stay with the land, regardless of changes of property ownership. The covenants are based on traditional property law principles and are recorded in local land records, thereby binding successive owners of the property. The purpose of the UECA is to ensure that environmental covenants created for a particular site are not invalidated by conflicts or misunderstandings with other local, state, or federal regulations. The UECA provides clear rights for Ecology or USEPA to create, record, monitor, enforce, modify and terminate environmental covenants and thereby ensure with greater certainty the protection of human health and the environment throughout the life of the environmental covenant, including during real estate transactions or legal actions. Ecology has updated the language in its Model Restrictive (Environmental) Covenant (**Appendix C**) to be consistent with the UECA.

To determine whether there are government controls prohibiting the installation of drinking water wells within the shallow aquifer in the City of Sunnyside, Stantec researched regulations in WAC and Sunnyside Municipal Code and contacted employees at Ecology (Division of Water Resources, Office of Wells) and the City of Sunnyside.

Although there are no specific regulations prohibiting the installation of drinking water wells within the shallow aquifer in the City of Sunnyside, WAC 173-160 establishes minimum standards for construction and maintenance of wells, which includes:

- Putting responsibility and liability on the water well operator who constructs the well, the property owner, and the water well contractor to take necessary measures to guard against waste and contamination of groundwater resources (WAC 173-160-101);
- Providing minimum set-back distances for water wells other than for public water supply (generally 100 feet from known or potential sources of contamination such as industrial lagoons, hazardous waste sites, and chemical storage areas) [WAC 173-60-171 (3)(a)-(b)];
- Requiring approval of all public water supply well locations by the department of health or the local health jurisdiction (WAC 173-60-171 (3)(c));
- Considering adjacent land uses and local groundwater conditions when a driller sites a well (WAC 173-60-171 (4));
- Setting the minimum surface seal of drilled wells at 18 feet bgs (WAC 173-160-231(c)); and
- Establishing standards for preserving the natural barriers to groundwater movement between aquifers (WAC 173-160-181).

During conversations with Ecology (Division of Water Resources, Office of Wells), which regulates the installation of all wells in Washington, it was noted that high nitrate concentrations in the shallow aquifer are wide-spread throughout Washington, especially in the agriculturally intensive regions that include Yakima County and the vicinity of the Site. Therefore, wells are drilled in the deeper aquifer to provide customers with good quality water, avoid potential liability concerns to the well drillers, and meet the well construction standards. During a conversation with a local, licensed drilling company, the policy of drilling into deep aquifers was confirmed. See the telephone conversation records in **Appendix D** for details on the discussions.

Installation of drinking water wells within the shallow aquifer is also unlikely because businesses and residents within the city are supplied municipal water.

4.2.2.2 Evaluation

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

Because it contains an IC component, On-site Remedial Alternative #2 is slightly more protective of human health and the environment than current on-site activities (i.e., semi-annual groundwater monitoring). Since fertilizer production is no longer on-going at the Site, natural attenuation may be sufficient to address the residual nitrate concentrations in soil. However, the high concentrations of nitrate (maximum of 683 mg/L in well MW-4 in 1H09) and the lack of available electron donors in the groundwater suggest that a more aggressive remedial alternative may be needed. It is uncertain whether MNA alone will be able to reduce on-site nitrate concentrations in groundwater to below CULs. Even if possible, the time required to do so would be long. Therefore, On-site Remedial Alternative #2 partially meets this criterion.

Compliance with ARARs

Although natural attenuation may be sufficient to address the residual nitrate concentrations in soil, it is uncertain whether MNA alone will be able to reduce on-site nitrate concentrations in groundwater to below CULs. Therefore, On-site Remedial Alternative #2 partially meets this criterion.

Opportunity for Compliance Monitoring

On-site Remedial Alternative #2 allows the opportunity for compliance monitoring (through existing monitoring wells) and therefore meets this criterion.

EFFECTIVENESS

Reasonable Restoration Timeframe

Due to the high concentrations of nitrate and the lack of available electron donors in the groundwater, it is uncertain whether MNA alone will be able to reduce on-site concentrations to below CULs. As shown in **Figure 9**, nitrate concentrations in wells MW-1 and MW-3 through MW-13 have remained stable since the start of groundwater monitoring in July 2003 (with the exception of a dip in nitrate concentrations in MW-4 between July 2004 and January 2006 that is attributable to the effects of the *in situ* pilot study). Thus, even if MNA is able to reduce on-site concentrations in groundwater to below CULs, the time required to do so would be long, especially in comparison with other feasible on-site remedial alternatives (i.e., On-site Remedial Alternatives #3 and #4). Therefore, On-site Remedial Alternative #2 fails this criterion.

Long-term Effectiveness and Permanence

As previously mentioned, natural attenuation may be sufficient to address the residual nitrate concentrations in soil, but it is uncertain whether MNA alone will be able to reduce on-site nitrate concentrations in groundwater to below CULs. Although MNA would reduce the mass of nitrate in on-site groundwater to some extent, there is a low degree of certainty that it would effectively reduce concentrations to below CULs. Therefore, On-site Remedial Alternative #2 fails this criterion.

Short-term Effectiveness

Based on current land use, risks to on-site exposure populations are within acceptable limits. Additionally, implementation of ICs (under Ecology's UECA) would protect hypothetical future exposure populations until the RAOs are met. Therefore, On-site Remedial Alternative #2 meets this criterion.

IMPLEMENTABILITY

Technical and Administrative Implementability

The MNA component of On-site Remedial Alternative #2 is essentially the same as current Site activities (semi-annual groundwater monitoring) with the addition of a few samples and analyses at each well. Therefore, MNA would be easy to implement.

Regarding ICs, the owners of the Site, Bee-Jay Scales and Hickenbottom & Sons, would be required to execute a restrictive covenant. The fact that they are named on the current Agreed Order suggests they will cooperate in this activity. The restrictive covenant would be administered by Ecology under the UECA, which sets clear rights for Ecology to administer restrictive covenants and thereby ensure with greater certainty the protection of human health and the environment throughout the life of the covenant, including during real estate transactions or legal actions. Therefore, On-site Remedial Alternative #2 meets this criterion.

State and Community Acceptance

Based on Ecology's expectations for cleanup action alternatives (WAC 173-340-370) and because of a lack of source control and incomplete evidence of natural attenuation associated with this alternative, Ecology's acceptance of On-site Remedial Alternative #2 is uncertain. Therefore, On-site Remedial Alternative #2 is anticipated to fail this criterion. Community acceptance of the remedial alternatives will be evaluated during a subsequent 30-day public comment period.

COST

The estimated net present value life cycle cost of this remedial alternative is approximately $1,500,000 as shown in **Table 4** and detailed in **Appendix E**. The cost is based on the following:

- 30 years of semi-annual monitoring of the 10 existing on-site wells (MW-1, MW-3 through MW-8, and MW-10 through MW-12);
- MNA costs based on the 2009 budget for the project including parameters listed in Section 4.2.2.1;
- A one-time, up-front cost to obtain a restrictive covenant; and
- Inflation of 2% per year (for calculation of net present worth).

4.2.3 On-site Remedial Alternative #3 – Permeable Reactive Barrier, Groundwater Monitoring, Natural Attenuation and Capping of Soil, and Institutional Controls

4.2.3.1 Description

On-site Remedial Alternative #3 would involve constructing a PRB, groundwater monitoring, natural attenuation and capping of soil, and ICs. A more detailed description of this remedial alternative follows.

PRB

PRBs are vertical barriers containing a particular type of media that remediates contaminants in groundwater as the groundwater flows through the PRB under the natural hydraulic gradient and flow direction. For this application, a biologically-operated PRB consisting of sand mixed with phosphate and some type of organic material (mulch, compost, wood chips) would be appropriate. The organic material would provide a source of carbon (electron donor) to stimulate the denitrification process within the PRB. As groundwater moves through the PRB and dissolves the media, an extended treatment zone will develop directly down-gradient of the PRB over time. The PRB would be approximately 500 feet in length along the southern (down-gradient) property boundary of the Site to intersect the plume. It would be keyed into the clay aquitard located at approximately 30 feet bgs. Bench-scale testing would be required prior to implementation of this remedial alternative to determine the necessary design parameters for the PRB.

Groundwater Monitoring

Continuation of the current semi-annual groundwater monitoring program would facilitate compliance monitoring of this remedial alternative. The following parameters would be incorporated into the current program:

- Field analysis of DO by USEPA Method 360.1, ORP by APHA Method 2580, and pH by USEPA Method 150.1;
- Alkalinity by SM20 Method 2320 B;
- Nitrate and nitrite by USEPA Method 353.2 and sulfate by USEPA Method 300.0;
- Dissolved manganese and iron by USEPA Method 6010B;
- Phosphorous by USEPA Method 365.1;
- Ferrous iron by SM20 Method 3500 Fe B Modified; and
- TOC by SM20 Method 5310 B/C.

In addition to existing monitoring wells, additional wells would need to be installed in close proximity up-gradient and down-gradient of the PRB to monitor its performance.

<u>Natural Attenuation and Capping of Soil</u>

Since fertilizer production is no longer on-going at the Site, natural attenuation may be sufficient to address the residual nitrate concentrations in soil. Natural attenuation was previously described in Section 4.2.2.1.

In combination with natural attenuation, capping of the residual source areas would provide greater protection of groundwater. Capping is a technology that involves the placement of an impermeable liner consisting of clay or a synthetic liner material over impacted soils. With respect to nitrates, the primary purpose of capping is to prevent infiltration, the primary transport mechanism through which nitrates in unsaturated soils are transported to groundwater.

Capping would consist of small clay caps over each of the four nitrate source areas in soil (where concentrations exceed 452 mg/kg). Soil Areas A, B, C, and D are approximately 1,370 sf, 780 sf, 3,230 sf, and 2,340 sf, respectively, for a total area of 7,720 sf. With a 20% factor of safety, the total capped area would be approximately 9,260 sf.

<u>ICs</u>

ICs were previously described in Section 4.2.2.1.

A restrictive covenant for On-site Remedial Alternative #3 would include the following:

- A restriction on installing drinking water wells in the shallow aquifer on-site while nitrate concentrations in groundwater exceed the Federal MCL of 10 mg/L.
- A restriction on construction or relocation of buildings on-site that would prevent proper monitoring of soil and groundwater concentrations or result in unacceptable risks from

inhalation of vapors containing 1,2,4-trimethylbenzene (from soil) and 1,2-dichloropropane (from groundwater).

- A restriction on disturbance of the PRB and caps.

4.2.3.2 Evaluation

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

The PRB would be designed to remediate nitrate concentrations in groundwater to below cleanup criteria. Capping of the residual source areas would provide greater protection of groundwater by preventing infiltration and subsequent transport of nitrates in unsaturated soils to groundwater. In the interim, implementation of ICs would provide additional protection of human health and the environment. Therefore, On-site Remedial Alternative #3 meets this criterion.

Compliance with ARARs

Several additional ARARs apply to this remedial alternative due to the intrusive nature of the construction efforts involved (e.g., trenching to construct the PRB, topsoil excavation and grading to construct the caps, stockpiling of native soil and backfill/cap materials) as shown in **Table 3**. The following permits/plans would be required:

- Stormwater Construction Permit from the City of Sunnyside;
- Erosion and Sediment Control Permit from the City of Sunnyside; and
- Preparation of a site-specific fugitive dust control plan for the Yakima Regional Clean Air Agency.

Compliance with these and other ARARs, including cleanup criteria, is anticipated; therefore, On-site Remedial Alternative #3 meets this criterion.

Opportunity for Compliance Monitoring

On-site Remedial Alternative #3 allows the opportunity for compliance monitoring (through existing monitoring wells and additional PRB performance wells) and therefore meets this criterion.

EFFECTIVENESS

Reasonable Restoration Timeframe

Almost immediately after installation, the caps should prevent infiltration and subsequent transport of nitrates in unsaturated soils to groundwater, and the PRB should begin reducing nitrate concentrations in groundwater flowing through the PRB to below cleanup criteria. However, because PRBs operate under the natural hydraulic gradient, and residual nitrate concentrations exist down-gradient of the Site, reductions in nitrate concentrations in off-property groundwater to below cleanup criteria would be delayed. The restoration timeframe for off-property groundwater is estimated to be on the order of 20 years. Therefore, On-site Remedial Alternative #3 partially meets this criterion.

Long-term Effectiveness and Permanence

As previously mentioned, the PRB would be designed to remediate nitrate concentrations in groundwater to below CULs. Nitrates in groundwater flowing through the PRB (and the extended treatment zone directly down-gradient of the PRB) would be permanently converted to nitrogen gas through biodenitrification. Caps over the residual source areas would provide long-term prevention of infiltration. However, on-site source areas would not be directly targeted for treatment with this remedial alternative, resulting in some degree of uncertainty associated with the permanence of this option. Therefore, On-site Remedial Alternative #3 partially meets this criterion.

Short-term Effectiveness

Based on current land use, risks to on-site exposure populations are within acceptable limits. As discussed above, the PRB should begin reducing nitrate concentrations in groundwater flowing through the PRB almost immediately after installation. Additionally, capping of the residual source areas would provide greater protection of groundwater immediately upon installation, and implementation of ICs (under Ecology's UECA) would protect hypothetical future exposure populations until the RAOs are met. Therefore, On-site Remedial Alternative #3 meets this criterion.

IMPLEMENTABILITY

Technical and Administrative Implementability

Design and construction of the PRB and caps would be feasible. Although there would be obstacles associated with both (e.g., fences in Area 1, a building in Area 2, general active use of the Site), Stantec would anticipate cooperation of the property owners to facilitate implementation of this remedial alternative.

Regarding ICs, the owners of the Site, Bee-Jay Scales and Hickenbottom & Sons, would be required to execute a restrictive covenant. The fact that they are named on the current Agreed

Order suggests they will cooperate in this activity. The restrictive covenant would be administered by Ecology under the UECA, which sets clear rights for Ecology to administer restrictive covenants and thereby ensure with greater certainty the protection of human health and the environment throughout the life of the covenant, including during real estate transactions or legal actions. Therefore, On-site Remedial Alternative #3 meets this criterion.

State and Community Acceptance

Based on Ecology's expectations for cleanup action alternatives (WAC 173-340-370), Ecology's acceptance of On-site Remedial Alternative #3 is uncertain. Although this alternative utilizes a treatment technology (PRB) to remediate nitrate in groundwater, it does not target defined source areas. Additionally, Ecology recommends engineering controls, such as caps, for large volumes of materials with relatively low levels of hazardous substances where treatment is impracticable. However, the soil impacts on-site are relatively shallow and small in extent, and treatment is considered practicable. Therefore, On-site Remedial Alternative #3 is anticipated to partially meet this criterion. Community acceptance of the remedial alternatives will be evaluated during a subsequent 30-day public comment period.

COST

The estimated net present value life cycle cost of this remedial alternative is approximately $1,700,000 as shown in **Table 4** and detailed in **Appendix E**. The cost is based on the following:

- Installation of a 500-foot long, 30-foot deep, 2-foot wide PRB with a continuous trenching machine;
- Installation of four PRB performance monitoring wells;
- Installation of four clay caps;
- 20 years of OMM;
    - Quarterly monitoring of the 10 existing on-site wells (MW-1, MW-3 through MW-8, and MW-10 through MW-12) and four new performance monitoring wells (with analysis of only nitrate, nitrite, TOC, and herbicides for two of the events annually) in the first and second years; and
    - Semi-annual monitoring in the remaining years.
- Groundwater monitoring costs based on the 2009 budget for the project including parameters listed in Section 4.2.3.1;
- A one-time, up-front cost to obtain a restrictive covenant; and
- Inflation of 2% per year (for calculation of net present worth).

4.2.4 On-site Remedial Alternative #4 – *In Situ* Bioremediation, Groundwater Monitoring, Soil Excavation with Off-site Disposal and/or *Ex Situ* Biological Treatment, Institutional Controls, and Phytoremediation of Groundwater (Optional Addition)

4.2.4.1 Description

On-site Remedial Alternative #4 would involve *in situ* bioremediation, groundwater monitoring, soil excavation with off-site disposal and/or *ex situ* biological treatment, ICs, and phytoremediation of groundwater (as an optional addition). A more detailed description of this remedial alternative follows.

<u>*In Situ* Bioremediation</u>

In situ bioremediation involves stimulating the natural denitrification process by introducing electron donor into the subsurface through the use of closely spaced injection wells or borings to target a particular source area. With stimulation, indigenous microorganisms transform nitrate into nitrogen gas in the multi-step denitrification process below. Microorganisms utilize the nitrate ion (NO_3^{2-}) as an electron acceptor and a carbon source as an electron donor during anaerobic respiration. The NO_3^{2-} is converted to a nitrite ion (NO_2^-), whereby anaerobic respiration continues with the formation of innocuous nitric oxide gas [NO(g)], nitrous oxide (N_2O), and, finally, nitrogen gas [N_2(g)]. Typical carbon sources for stimulation of denitrification in groundwater include acetate, ethanol, and sugar (sucrose).

$$NO_3^{2-} \rightarrow NO_2^- \rightarrow NO(g) \rightarrow N_2O \rightarrow N_2(g)$$

As summarized in Section 2.3.3, a treatability investigation, including both a bench-scale study and field pilot study (consisting of *in situ* injection of sodium acetate into four injection wells installed around well MW-4), was conducted as part of the Phase II RI to guide potential nitrate and herbicide remediation activities. The treatability study determined the most effective treatment was denitrification using acetate as an electron donor. The pilot study demonstrated that injection of acetate was successful in remediating nitrate and nitrite concentrations to below detectable limits in groundwater at well MW-4 within a 10-foot radius for the duration of the monitoring period and reducing concentrations of those constituents in saturated soils.

A potential consequence of creating anaerobic, reduced redox conditions in the aquifer to promote denitrification is increased dissolved arsenic concentrations in groundwater. Reduced redox conditions in the aquifer may result in enhanced solubility and resulting dissolution of ferric iron oxyhydroxide minerals that contain adsorbed arsenic. As the iron minerals dissolve, arsenic is released to the groundwater, resulting in elevated dissolved arsenic concentrations. However, dissolved arsenic concentrations should decrease after oxidized redox conditions return.

Baseline arsenic concentrations in groundwater (prior to the pilot study in July 2004) were 0.006 mg/L to 0.007 mg/L in MW-4. Following the pilot study, the arsenic concentration in

MW-4 was 0.069 mg/L in September 2004 and a maximum of 0.277 mg/L in December 2004. Subsequently, the arsenic concentration in MW-4 decreased to 0.0586 mg/L in September 2005, and concentrations have not been observed above the limit of quantitation of 0.02 mg/L since December 2006.

Application of *in situ* bioremediation would involve a combination of temporary injection wells and large diameter (e.g., 12-inch) borings to target areas of high soil and groundwater nitrate concentrations. The injection wells would deliver a sodium acetate solution through one or more rounds of injections as necessary to reduce concentrations of nitrate in on-site groundwater to below the Federal MCL of 10 mg/L. The borings would be backfilled with a mixture of calcium acetate, which quickly dissolves into groundwater, and pea gravel, which provides structural support of the boring and prevents settling as the salt dissolves.

Groundwater Monitoring

Continuation of the current semi-annual groundwater monitoring program would facilitate compliance monitoring of this remedial alternative. The following parameters would be incorporated into the current program:

- Field analysis of DO by USEPA Method 360.1, ORP by APHA Method 2580, and pH by USEPA Method 150.1;
- Alkalinity by SM20 Method 2320 B;
- Nitrate and nitrite by USEPA Method 353.2 and sulfate by USEPA Method 300.0;
- Dissolved manganese and iron by USEPA Method 6010B;
- Phosphorous by USEPA Method 365.1;
- Ferrous iron by SM20 Method 3500 Fe B Modified; and
- TOC by SM20 Method 5310 B/C.

Soil Excavation with Off-site Disposal and/or *Ex Situ* Biological Treatment

As mentioned in Section 3.2, four nitrate source areas in soil were identified on-site (**Figure 7**). Soil Area A extends to a depth of approximately 0.5 feet bgs with a volume of approximately 25 cy. Soil Areas B, C, and D extend to a depth of approximately 4.5 feet bgs with respective volumes of approximately 170 cy, 540 cy, and 390 cy. All of the source areas are in unsaturated soils; therefore, a combination of *in situ* calcium acetate borings to the surface (as described in the *In Situ* Bioremediation section above) and excavation could be utilized to address these areas.

Completion of calcium acetate borings to the surface could target areas of elevated nitrate concentrations in soil and groundwater in the vicinity of Soil Areas B, C, and D. However, in Soil Area A, which is outside the nitrate plume, borings may be excessive. In this area, limited excavation of the top 6 to 12 inches of soil may be sufficient. Additionally, some portions of Soil Areas B, C, and D could be excavated (where accessible) prior to completing borings in these areas. Excavated areas would be backfilled with clean fill, and excavated soil could be transported off-site for disposal in a landfill or incorporated into an *ex situ* biological treatment cell on-site.

<u>ICs</u>

ICs were previously described in Section 4.2.2.1.

A restrictive covenant for On-site Remedial Alternative #4 would include the following:

- A restriction on installing drinking water wells in the shallow aquifer on-site while nitrate concentrations in groundwater exceed the Federal MCL of 10 mg/L.

- A restriction on construction or relocation of buildings on-site that would prevent proper monitoring of soil and groundwater concentrations or result in unacceptable risks from inhalation of vapors containing 1,2,4-trimethylbenzene (from soil) and 1,2-dichloropropane (from groundwater).

<u>Phytoremediation (as an Optional Addition)</u>

Phytoremediation is a process in which plants remove, transfer, stabilize, or destroy contaminants in soil, sediment, or groundwater. It applies to all biological, chemical, and physical processes that are influenced by plants and that aid in the cleanup of constituents. As a fertilizer, nitrate can be readily utilized by a wide variety of plants. Once the nitrate is absorbed, the plants use denitrification to convert the nitrate to nitrogen gas, which is contained within the plant and then either metabolized or released to the atmosphere. Phytoremediation generally meets with public acceptance due to its simplicity and the use of natural, living things to transform an impacted site.

Phytoremediation would involve planting a “barrier” of willow or cottonwood trees approximately 500 feet in length along the southern (down-gradient) property boundary to intersect the plume. Unfortunately, there are several obstacles to using phytoremediation. The high nitrate concentrations in the area could result in plant toxicity, either overall or at certain developmental stages of the plant. Even if the nitrate concentrations do not prove toxic, it would take a significant length of time for the trees to mature and become effective at significant nitrate removal. Finally, even at maturity, the depth of the root structure from willow or cottonwood trees may not be sufficient to affect the entire depth of the aquifer (10 to 30 feet bgs). Although the root structure would likely penetrate into upper portions of the aquifer and locally enhance the reduction of nitrate concentrations, it is unlikely to affect deeper groundwater. Ultimately, phytoremediation is not considered necessary to the overall success of On-site Remedial

Alternative #4. Upon further evaluation of the disadvantages associated with this treatment technology, it was removed from further consideration and is not included in the evaluation of On-site Remedial Alternative #4.

4.2.4.2 Evaluation

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

Pilot testing of *in situ* bioremediation through injection wells has demonstrated the success of this technology on-site in remediating nitrate concentrations in groundwater to below cleanup criteria and reducing nitrate concentrations in saturated soils. Unsaturated soils would be addressed via a combination of *in situ* calcium acetate borings to the surface and limited excavation (with off-site disposal and/or *ex situ* biological treatment). In the interim, implementation of ICs would provide additional protection of human health and the environment. Therefore, On-site Remedial Alternative #4 meets this criterion.

Compliance with ARARs

Washington's Underground Injection Control Program applies to this remedial alternative; therefore, injection wells would need to be registered and authorized by Ecology. Due to the excavation component, several additional ARARs may apply to this remedial alternative as shown in **Table 3**. Depending on the amount of soil to be excavated, the following permits/plans may be required:

- Stormwater Construction Permit from the City of Sunnyside;
- Erosion and Sediment Control Permit from the City of Sunnyside; and
- Preparation of a site-specific fugitive dust control plan for the Yakima Regional Clean Air Agency.

Compliance with these and other ARARs, including cleanup criteria, is anticipated. Although there is the possibility of increased arsenic concentrations in groundwater (as a result of anaerobic, reduced redox conditions in the aquifer to promote denitrification), pilot study results suggest that arsenic concentrations would decrease after oxidized redox conditions return. Therefore, On-site Remedial Alternative #4 meets this criterion.

Opportunity for Compliance Monitoring

On-site Remedial Alternative #4 allows the opportunity for compliance monitoring (through existing monitoring wells) and therefore meets this criterion.

EFFECTIVENESS

Reasonable Restoration Timeframe

Reductions in nitrate concentrations in on-site groundwater are expected to be observed almost immediately after implementation of *in situ* bioremediation and excavation of unsaturated soils. As relatively cleaner groundwater flows down-gradient, diluting off-property groundwater, reductions in nitrate concentrations in off-property groundwater are also expected to be observed. The on-site restoration timeframe would depend on the rate of biodenitrification in the subsurface as well as the frequency and concentration of electron donor applications. Multiple rounds of injections may be implemented as needed. Ultimately, this remedial alternative would allow more control of nitrate remediation on-site than any of the other alternatives proposed. As with On-site Remedial Alternatives #2 and #3, the off-property restoration timeframe would depend on the natural hydraulic gradient, which cannot be controlled. Nonetheless, the restoration timeframe on-site and off-property is estimated to be on the order of 10 and 15 years, respectively. Therefore, On-site Remedial Alternative #4 meets this criterion.

Long-term Effectiveness and Permanence

As previously mentioned, pilot testing of *in situ* bioremediation has demonstrated the success of this technology in remediating nitrate concentrations in groundwater to below cleanup criteria and reducing nitrate concentrations in saturated soils. Full-scale application of this technology to target areas of high soil and groundwater nitrate concentrations is anticipated to be successful in meeting and maintaining the RAOs. Therefore, On-site Remedial Alternative #4 meets this criterion.

Short-term Effectiveness

Based on current land use, risks to on-site exposure populations are within acceptable limits. Additionally, implementation of ICs (under Ecology's UECA) would protect hypothetical future exposure populations until the RAOs are met. However, the possibility of increased arsenic concentrations in groundwater (as a result of anaerobic, reduced redox conditions in the aquifer to promote denitrification) exists in the short-term. Therefore, On-site Remedial Alternative #4 partially meets this criterion.

IMPLEMENTABILITY

Technical and Administrative Implementability

Design and construction of an *in situ* bioremediation system would be feasible and, to some degree, flexible since there are several methods of delivering electron donor to the subsurface. A combination of injection wells and borings may be utilized depending on which method would work best with current operations (e.g., storage, truck turnaround, etc.). Excavation of unsaturated soils would be limited in extent (primarily Soil Area A) and not overly intrusive.

Therefore, Stantec would anticipate cooperation of the property owners to facilitate implementation of this remedial alternative.

Regarding ICs, the owners of the Site, Bee-Jay Scales and Hickenbottom & Sons, would be required to execute a restrictive covenant. The fact that they are named on the current Agreed Order suggests they will cooperate in this activity. The restrictive covenant would be administered by Ecology under the UECA, which sets clear rights for Ecology to administer restrictive covenants and thereby ensure with greater certainty the protection of human health and the environment throughout the life of the covenant, including during real estate transactions or legal actions. Therefore, On-site Remedial Alternative #4 meets this criterion.

State and Community Acceptance

Based on Ecology's expectations for cleanup action alternatives (WAC 173-340-370), Ecology's acceptance of On-site Remedial Alternative #4 is expected because of the combination of treatment and removal of source areas associated with this alternative. Therefore, On-site Remedial Alternative #4 is anticipated to meet this criterion. Community acceptance of the remedial alternatives will be evaluated during a subsequent 30-day public comment period.

COST

The estimated net present value life cycle cost of this remedial alternative is approximately $1,100,000 as shown in **Table 4** and detailed in **Appendix E**. The cost is based on the following:

- Installation of a total of 21 temporary injection wells (within the portion of Area 1 not addressed by borings in Soil Areas B and C [30-foot ROI]);
- One round of sodium acetate injections and subsequent well abandonments at the end of the first year;
- Completion of a total of 26 12-inch diameter, 20-foot deep borings on 15-foot centers (six borings in Soil Area B, 11 borings in Soil Area C, nine borings in Soil Area D) with a mixture of calcium acetate and pea gravel;
- Excavation and disposal of approximately 50 cy of soil from Soil Area A;
- 15 years of OMM;
    - Quarterly monitoring (with analysis of only nitrate, nitrite, TOC, and herbicides for two of the events annually) in the first and second years; and
    - Semi-annual monitoring in the remaining years.

- Groundwater monitoring costs based on the 2009 budget including parameters listed in Section 4.2.4.1;
- A one-time, up-front cost to obtain a restrictive covenant; and
- Inflation of 2% per year (for calculation of net present worth).

4.3 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR ON-SITE SOIL AND GROUNDWATER

Four on-site remedial alternatives were evaluated as part of the FS. On-site Remedial Alternative #1 is the “no action” alternative, which represents the most likely future scenario in the absence of any remedial action. It is included primarily as a baseline to which other remedial alternatives can be compared. On-site Remedial Alternative #2 was an expensive remedial alternative and failed two of the effectiveness criteria (reasonable restoration timeframe and long-term effectiveness and permanence). Therefore, only two viable options remain.

On-site Remedial Alternative #3 is the most costly on-site alternative. It only partially meets the criteria for reasonable restoration timeframe and long-term effectiveness and permanence because of the passive treatment nature of PRBs and the fact that on-site source areas would not be directly targeted for treatment. Conversely, On-site Remedial Alternative #4 is the least costly on-site alternative and would be designed to target areas of high soil and groundwater nitrate concentrations via a combination of *in situ* bioremediation (injection wells for delivery of sodium acetate and borings completed to the surface containing calcium acetate) and limited excavation of shallow, unsaturated residual soil source areas. Previous pilot testing of *in situ* bioremediation on-site has demonstrated success in remediating nitrate concentrations in groundwater to below CULs and reducing nitrate concentrations in saturated soils. Although there is the possibility of increased arsenic concentrations in groundwater in the short-term, pilot study results suggest that arsenic concentrations would decrease after oxidized redox conditions return. Additionally, On-site Remedial Alternative #4 would allow the most flexibility and control during design and implementation since there are several methods of delivering electron donor to the subsurface (injection wells and borings), and multiple application rounds may be implemented as needed to achieve the RAOs. Finally, as discussed in more detail in Sections 4.4 and 4.5 regarding analysis of off-property remedial alternatives, the success of Off-property Remedial Alternative #2 would increase if an aggressive treatment technology is implemented on-site. On-site Remedial Alternative #4 is considered more aggressive than On-site Remedial Alternative #3 because both soil and groundwater source areas would be targeted to provide maximum treatment of nitrates.

4.4 INDIVIDUAL ANALYSIS OF REMEDIAL ALTERNATIVES FOR OFF-PROPERTY GROUNDWATER

The remedial alternatives for off-property groundwater were generally evaluated based on addressing the site-specific off-property nitrate plume. However, when evaluating the ICs, a listing of all properties within the combined off-property nitrate plume was considered. In addition, within the cost analysis, a range of costs was developed including a cost for addressing the combined off-property nitrate plume.

4.4.1 Off-property Remedial Alternative #1 – No Action

4.4.1.1 Description

Off-property Remedial Alternative #1 involves leaving all concentrations of nitrate in the site-specific off-property groundwater plume in place with no further action. It is included primarily as a baseline to which other remedial alternatives can be compared.

4.4.1.2 Evaluation

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

Off-property Remedial Alternative #1 is not protective of human health and therefore fails this criterion.

Compliance with ARARs

Off-property Remedial Alternative #1 would not be effective in reducing nitrate concentrations present in the site-specific off-property groundwater plume to below CULs (as defined in the RAOs). Therefore, it fails this criterion.

Opportunity for Compliance Monitoring

Off-property Remedial Alternative #1 does not allow the opportunity for compliance monitoring and therefore fails this criterion.

EFFECTIVENESS

Off-property Remedial Alternative #1 did not fulfill the threshold criteria, so a further evaluation of its effectiveness is not warranted.

IMPLEMENTABILITY

Off-property Remedial Alternative #1 did not fulfill the threshold criteria, so a further evaluation of its implementability is not warranted.

COST

Off-property Remedial Alternative #1 did not fulfill the threshold criteria, so a further evaluation of its cost is not warranted.

4.4.2 Off-property Remedial Alternative #2 – Monitored Natural Attenuation, Institutional Controls, Contingency Plan

4.4.2.1 Description

Off-property Remedial Alternative #2 would involve MNA of groundwater combined with ICs and a contingency plan in the event drinking water wells are installed within the shallow aquifer site-specific off-property nitrate plume. A more detailed description of this remedial alternative follows.

MNA

MNA was previously described in Section 4.2.2.1. Concentrations of nitrate in the site-specific off-property groundwater plume are relatively low, suggesting a good probability of remediation success via MNA.

Off-property MNA would involve monitoring wells MW-9 and MW-13 for the following parameters on a semi-annual basis:

- Field analysis of DO by USEPA Method 360.1, ORP by APHA Method 2580, and pH by USEPA Method 150.1;
- Alkalinity by SM20 Method 2320 B;
- Nitrate and nitrite by USEPA Method 353.2 and sulfate by USEPA Method 300.0;
- Dissolved manganese and iron by USEPA Method 6010B;
- Phosphorous by USEPA Method 365.1;
- Ferrous iron by SM20 Method 3500 Fe B Modified; and
- TOC by SM20 Method 5310 B/C.

These parameters would be incorporated into the current semi-annual groundwater monitoring program to facilitate compliance monitoring of this remedial alternative.

ICs

ICs were previously described in Section 4.2.2.1.

As mentioned in Section 3.2, the combined nitrate plume covers approximately 9.8 acres. As shown in **Figure 8**, this plume encompasses a total of 39 off-property parcels as follows:

- Eight residential properties (parcel numbers 221025-23420, 221025-23425, 221025-23426, 221025-23430 through 221025-23432, 221025-23478, and 221025-32413);
- 28 commercial properties (parcel numbers 221025-22502, 221025-22902, 221025-22903, 221025-23414, 221025-23416 through 221025-23419, 221025-23421 through 221025-23423, 221025-23429, 221025-23433, 221025-23436 through 221025-23447, 221025-23903, 221025-32410, and 221025-32412); and
- Three industrial properties (parcel numbers 221025-22555, 221025-23901, and 221025-23902).

The site-specific nitrate plume covers approximately 5.2 acres. As shown in **Figure 8**, this plume encompasses a total of 13 off-property parcels as follows:

- 10 commercial properties (parcel numbers 221025-22502, 221025-22902, 221025-22903, 221025-23416, 221025-23437 through 221025-23442); and
- Three industrial properties (parcel numbers 221025-22555, 221025-23901, and 221025-23902).

Restrictive covenants for Off-property Remedial Alternative #2 would include a restriction on installing drinking water wells in the shallow aquifer at properties within the site-specific off-property groundwater plume while nitrate concentrations in groundwater exceed the Federal MCL of 10 mg/L.

Since the owners of the off-property parcels are not PLPs under the current Agreed Order, Ecology might require the PLPs make a good faith effort to obtain restrictive covenants before using other legal or administrative mechanisms. Examples of alternative mechanisms include zoning overlays, notices in local zoning or building department records or state lands records, public notices, educational mailings, and/or yearly well surveys (a search for well logs can be conducted from the Ecology website at http://apps.ecy.wa.gov/welllog/). Obtaining restrictive covenants for all of the properties may be difficult to initially implement due to the large number of properties within the off-property plume and the fact that owners of these properties are not PLPs under the current Agreed Order. However, restrictive covenants would likely be less costly over time than other legal or administrative mechanisms that would require implementation on a recurring basis (e.g., educations mailings, yearly well surveys).

Contingency Plan

In the unlikely event drinking water wells are installed within the shallow aquifer site-specific off-property nitrate plume, a contingency plan would be implemented. The contingency plan may consist of, in order of preference: 1) providing an alternative supply of drinking water, which could include installing a connection to the municipal water system or supplying bottled water for drinking and cooking purposes, or 2) installing small-scale *ex situ* treatment systems at individual wellheads (ion exchange or reverse osmosis).

Since businesses and residents within the city are supplied municipal water, a connection to this service, or a repair of an existing connection, would be the most logical contingency plan.

Installation of small-scale *ex situ* ion exchange or reverse osmosis treatment systems at individual wellheads would be difficult and costly to implement; therefore, it should be considered only when providing an alternative supply of drinking water is not an option. A description of each of these treatment technologies follows:

- Ion exchange removes dissolved anions such as nitrate from groundwater using an anion exchange media consisting of synthetic organic resins. As groundwater passes through the exchange media, strong resins exchange hydroxyl ions (OH^-) for nitrate while weaker resins exchange chloride ions (Cl^-) for negatively charged ions. Resins have limited capacities and must be regenerated upon exhaustion; anion resins are regenerated with a strong base that replenishes OH^-. The process requires close monitoring of the treated water to detect breakthrough or determine the need for regeneration. If available, nitrate-selective resins, which favor the removal of nitrates over other anions such as sulfates, should be used to avoid nitrate dumping.

- Reverse osmosis separates dissolved constituents such as nitrate from groundwater by using a pressure differential that forces groundwater through a semi-permeable membrane. Dissolved constituents are retained by the membrane, allowing only clean water to exit. Hard water tends to cause excessive fouling of the membranes, resulting in a high degree of maintenance. In addition, depending on operational parameters, significant amounts of the concentrated wastewater can be generated by the process. The process requires close monitoring to ensure effectiveness.

4.4.2.2 Evaluation

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

Concentrations of nitrate in the site-specific off-property groundwater plume are relatively low, suggesting a good probability of remediation success via MNA. The probability of success would likely increase if an aggressive treatment technology is implemented on-site (i.e., On-site Remedial Alternative #4); off-property nitrate concentrations would further decrease, thereby facilitating MNA. In the interim, implementation of ICs and a contingency plan, if needed, would provide additional protection of human health and the environment. Therefore, Off-property Remedial Alternative #2 meets this criterion.

Compliance with ARARs

Since concentrations of nitrate in the site-specific off-property groundwater plume are relatively low, MNA will likely be able to reduce off-property concentrations to below CULs. Therefore, Off-property Remedial Alternative #2 meets this criterion.

Opportunity for Compliance Monitoring

Off-property Remedial Alternative #2 allows the opportunity for compliance monitoring (through existing monitoring wells) and therefore meets this criterion.

EFFECTIVENESS

Reasonable Restoration Timeframe

Due to the relatively low concentrations of nitrate in the site-specific off-property groundwater plume, there is a good probability that MNA will be able to reduce off-property concentrations to below CULs in a reasonable timeframe. Additionally, the restoration timeframe would likely be accelerated if an aggressive treatment technology is implemented on-site (i.e., On-site Remedial Alternative #4). Therefore, Off-property Remedial Alternative #2 meets this criterion.

Long-term Effectiveness and Permanence

As previously mentioned, MNA will likely be able to reduce concentrations in the site-specific off-property nitrate plume to below CULs. The degree of certainty that this remedial alternative would be successful in meeting and maintaining cleanup criteria significantly increases when combined with an aggressive treatment technology on-site (i.e., On-site Remedial Alternative #4). Therefore, Off-property Remedial Alternative #2 meets this criterion.

Short-term Effectiveness

Although the groundwater ingestion exposure pathway for nitrate is potentially complete for off-property receptors due to the lack of regulatory restrictions on installing water wells, there are currently no such wells installed within the shallow aquifer site-specific off-property nitrate plume. Future installations are unlikely based on interpretations of Ecology's minimum standards for construction and maintenance of wells (WAC 173-160); conversations with Ecology (Division of Water Resources, Office of Wells) and a local, licensed drilling company for the City of Sunnyside; and the fact that businesses and residents within the city are supplied municipal water. Additionally, implementation of ICs (under Ecology's UECA) and a contingency plan, if needed, at off-property parcels would protect hypothetical future exposure populations until the RAOs are met. Therefore, Off-property Remedial Alternative #2 meets this criterion.

IMPLEMENTABILITY

Technical and Administrative Implementability

The MNA component of Off-property Remedial Alternative #2 is essentially the same as current activities (semi-annual groundwater monitoring) with the addition of a few samples and analyses at each well. Therefore, MNA would be easy to implement.

Regarding ICs, Ecology might require the PLPs make a good faith effort to obtain restrictive covenants before using other legal or administrative mechanisms since the owners of the properties are not PLPs under the current Agreed Order. Obtaining restrictive covenants for all of the properties may be difficult to initially implement due to the large number of properties within the off-property plume and the fact that owners of these properties are not PLPs under the current Agreed Order. However, the alternative (e.g., administrative mechanisms such as educational mailings and yearly well surveys using Ecology's online database of well logs) would be easy to implement. Therefore, Off-property Remedial Alternative #2 meets this criterion.

State and Community Acceptance

Based on Ecology's expectations for cleanup action alternatives (WAC 173-340-370), Ecology's acceptance of Off-property Remedial Alternative #2 is expected because concentrations of nitrate in the site-specific off-property groundwater plume are relatively low, suggesting a good probability of remediation success via MNA. Ecology's acceptance of this remedial alternative is expected to increase when combined with an aggressive treatment technology on-site (i.e., On-site Remedial Alternative #4). Therefore, Off-property Remedial Alternative #2 is anticipated to meet this criterion. Community acceptance of the remedial alternatives will be evaluated during a subsequent 30-day public comment period.

COST

The estimated net present value life cycle cost of this remedial alternative is approximately $480,000 to $530,000, with possible additional costs of approximately $70,000 to $210,000 for implementation of a worst-case scenario contingency plan as shown in **Table 4** and detailed in **Appendix E**. The low end of each range assumes costs associated only with the 13 off-property parcels within the site-specific nitrate plume. The high end of the range assumes costs associated with all 39 off-property parcels within the combined nitrate plume. The costs are based on the following:

- 30 years of semi-annual monitoring of the two existing off-property wells (MW-9 and MW-13);
- MNA costs based on the 2009 budget including parameters listed in Section 4.4.2.1;
- A one-time, up-front cost to obtain restrictive covenants for the off-property parcels;

- Contingency plan assuming worst-case costs involving installation and yearly OMM of individual reverse osmosis treatment systems at each of the off-property parcels; and
- Inflation of 2% per year (for calculation of net present worth).

4.5 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR OFF-PROPERTY GROUNDWATER

Because a majority of options for off-property groundwater were originally screened out in the DSRA due to implementability issues associated with off-property access restrictions and the large footprint of the site-specific off-property nitrate plume, only two remedial alternatives were evaluated as part of the FS. Off-property Remedial Alternative #2 is clearly the best option for the site-specific off-property nitrate plume. As summarized in **Table 4**, this remedial alternative meets all of the evaluation criteria.

When MNA is chosen as a cleanup action, Ecology has the following expectations (per WAC 173-340-370):

- Source control (including removal and/or treatment of hazardous substances) has been conducted to the maximum extent practicable.
- Leaving contaminants on-site during the restoration timeframe does not pose an unacceptable threat to human health or the environment.
- There is evidence that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate.
- Appropriate monitoring requirements are conducted to ensure that the natural attenuation process is taking place and that human health and the environment are protected.

Stantec therefore believes MNA is an appropriate cleanup action for the site-specific off-property groundwater plume for the following respective reasons:

- Selection of On-site Remedial Alternative #4 would facilitate source control for on-site soil and groundwater.
- No water wells are currently installed within the shallow aquifer site-specific off-property nitrate plume, and future installations are unlikely based on interpretations of Ecology's minimum standards for construction and maintenance of wells (WAC 173-160); conversations with Ecology (Division of Water Resources, Office of Wells) and a local, licensed drilling company for the City of Sunnyside; and the fact that businesses and residents within the city are supplied municipal water. Additionally, implementation of ICs (under Ecology's UECA) and a contingency plan, if needed, at off-property parcels would protect hypothetical future exposure populations until the RAOs are met.

- Due to the relatively low concentrations of nitrate in the off-property site-specific groundwater plume, there is a good probability that MNA would be able to reduce off-property concentrations to below CULs in a reasonable timeframe, especially in combination with On-site Remedial Alternative #4.

- MNA parameters would be incorporated into the current semi-annual groundwater monitoring program to facilitate compliance monitoring.

5.0 Recommended Remedial Alternatives

Based on the evaluation of on-site and off-property remedial alternatives, the following combination is recommended:

- On-site *in situ* bioremediation, groundwater monitoring, soil excavation with off-site disposal and/or *ex situ* biological treatment, and ICs (i.e., On-site Remedial Alternative #4 without phytoremediation); and

- Off-property MNA, ICs, and a contingency plan (i.e., Off-property Remedial Alternative #2).

Since bench-scale and field pilot studies for the *in situ* bioremediation component above have already been conducted, no additional testing or analysis is needed prior to preparation of a CAP.

6.0 Cleanup Action Plan and Schedule

Following issuance of a future Consent Decree, a CAP would be prepared to describe detailed plans for implementing cleanup action on-site and off-property. An implementation schedule would be included in the CAP.

The scope of work for cleanup action on-site and off-property, to be described in greater detail in a future CAP, would involve the following:

- Install a combination of *in situ* bioremediation injection wells for delivery of a sodium acetate solution and borings for delivery of calcium acetate as follows;
    - Install an estimated 21 temporary injection wells (within the portion of Area 1 not addressed by borings in Soil Areas B and C [30-foot ROI]).
    - Complete an estimated 26 12-inch diameter, 20-foot deep borings on 15-foot centers (six borings in Soil Area B, 11 borings in Soil Area C, nine borings in Soil Area D).
    - Injection wells were selected for use in areas that are not frequently utilized by current business operations (and vice versa for borings).
- Excavate shallow soil from Soil Areas A, B, C, and D (as accessible), backfill with clean fill, and either transport off-site for disposal in a landfill or incorporate into an *ex situ* biological treatment cell on-site.
- Continue the current semi-annual groundwater monitoring program (using existing on-site and off-property wells) with the addition of the following parameters in all wells to evaluate *in situ* bioremediation and/or natural attenuation:
    - Field analysis of DO by USEPA Method 360.1, ORP by APHA Method 2580, and pH by USEPA Method 150.1;
    - Alkalinity by SM20 Method 2320 B;
    - Nitrate and nitrite by USEPA Method 353.2 and sulfate by USEPA Method 300.0;
    - Ferrous iron by SM20 Method 3500 Fe B Modified; and
    - TOC by SM20 Method 5310 B/C.
- Monitor for the following parameters during two additional events during the first two years, then continue with the semi-annual monitoring program:

  - Nitrate and nitrite by USEPA Method 353.2;
  - TOC by SM20 Method 5310 B/C; and
  - Herbicides by USEPA Method 8151A.
- Obtain a restrictive covenant with the following provisions:
  - A restriction on installing drinking water wells in the shallow aquifer on-site while nitrate concentrations in groundwater exceed the Federal MCL of 10 mg/L.
  - A restriction on construction or relocation of buildings on-site that would prevent proper monitoring of soil and groundwater concentrations or result in unacceptable risks from inhalation of vapors containing 1,2,4-trimethylbenzene (from soil) and 1,2-dichloropropane (from groundwater).
- Obtain restrictive covenants for the 13 off-property parcels within the site-specific nitrate plume with the following provision:
  - A restriction on installing drinking water wells in the shallow aquifer at properties within the site-specific off-property groundwater plume while nitrate concentrations in groundwater exceed the Federal MCL of 10 mg/L.
- Should a good faith effort to obtain restrictive covenants for the off-property parcels fail, the following administrative mechanisms could be implemented:
  - Educational mailings; and
  - Yearly well surveys using Ecology's online database of well logs (http://apps.ecy.wa.gov/welllog/).
- Prepare a contingency plan to implement if drinking water wells are installed within the shallow aquifer site-specific off-property nitrate plume.

7.0 References

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8.0 Limitations and Certification

This report was prepared in accordance with the scope of work outlined in Stantec's contract and with generally accepted professional engineering and environmental consulting practices existing at the time this report was prepared and applicable to the location of the site. It was prepared for the exclusive use of CEMC and ARC for the express purpose stated above. Any re-use of this report for a different purpose or by others not identified above shall be at the user's sole risk without liability to Stantec. To the extent that this report is based on information provided to Stantec by third parties, Stantec may have made efforts to verify this third party information, but Stantec cannot guarantee the completeness or accuracy of this information. The opinions expressed and data collected are based on the conditions of the site existing at the time of the field investigation. No other warranties, expressed or implied are made by Stantec.

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All information, conclusions, and recommendations provided by Stantec in this document regarding the Subject Property have been prepared under the supervision of and reviewed by the Licensed Professional whose signature appears below:

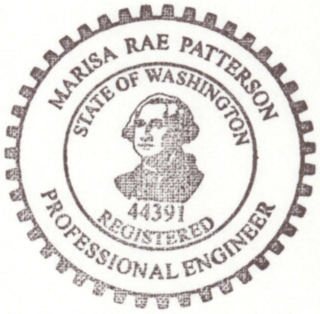
Licensed Approver:

Name: Marisa Patterson, P.E.

Signature: Marisa Patterson

Date: 10/12/2009

Stamp:



Tables

Table 1a
Historical Nutrient and Metals Concentrations in Groundwater
Bee-Jay Scales Site
Sunnyside, Washington

Location ID	Sample Date	Nitrate	Nitrite**	Ammonia	Sulfate	Chloride	Arsenic	Iron	Manganese
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-01	9/28/2005	3.8	<0.05	0.15	30.3	6.4	<0.02	<0.2	0.149
	1/12/2006	3.8	<0.05	<0.1	32.5	6.8	<0.02	<0.2	0.362
	3/29/2006	3.8	<0.05	<0.1	26.3	6.9	<0.02	<0.2	0.237
	6/27/2006	3.8	<0.05	<0.1	30.6	7.4	<0.02	<0.2	0.0824
	9/19/2006	3.9	<0.05	<0.1	28.1	6.7	<0.02	<0.2	0.239
	12/19/2006	3.9	<0.05	<0.1	32.2	5.3	<0.02	<0.2	0.0654
	3/20/2007	3.6	<0.05	<0.1	30.9	6.8	<0.02	<0.2	0.0511
	6/26/2007	3.8	<0.05	<0.1	29.2	7.6	<0.02	<0.2	0.0178
	9/18/2007	3.8	<0.05	NA	NA	NA	NA	NA	NA
	12/17/2007	3.4	<0.05	NA	NA	NA	NA	NA	NA
	3/11/2008	3.7	<0.05	NA	NA	NA	NA	NA	NA
	6/17/2008	3.8	<0.05	NA	NA	NA	NA	NA	NA
	9/9/2008	3.9	<0.05	NA	NA	NA	NA	NA	NA
	3/11/2009	3.7	<0.05	NA	NA	NA	NA	NA	NA
MW-03	9/29/2005	23.1	1.4	119	34	12.3	0.122	<0.2	0.0501
	1/12/2006	15.6	0.32	117	32.5	18.4	0.0809	<0.2	0.0541
	3/30/2006	16	0.93	135	32.5	23	0.0724	<0.2	0.054
	6/28/2006	13.5	0.25	69.9	32	20.5	0.0522	<0.2	0.0532
	9/20/2006	21	0.35	128	29.5	22.7	0.0805	<0.2	0.0441
	12/20/2006	11.4	0.34	79.6	24.8	20.2	0.0643	<0.2	0.0578
	3/21/2007	11.8	0.15	102	25.8	13.5	0.0637	<0.2	0.0589
	6/26/2007	10.8	0.38	86	22.8	10.3	0.0543	<0.2	0.0591
	9/18/2007	13.4	0.33	74.1	NA	NA	0.0865	NA	NA
	12/18/2007	10.9	0.45	68.1	NA	NA	0.0623	NA	NA
	3/12/2008	12.1	0.62	86.8	NA	NA	0.0374	NA	NA
	6/18/2008	12.7	<0.05	98	NA	NA	0.0373	NA	NA
	9/10/2008	19.3	0.38	126	NA	NA	0.0761	NA	NA
	3/12/2009	9.7	0.28	58.2	NA	NA	0.0306	NA	NA
MW-04	9/30/2005	100	5.4	231	423	78.4	0.0586	2.05	0.113
	1/13/2006	531	10.9	651	344	63.6	0.0214	0.371	0.118
	3/30/2006	545	7.1	599	315	66.8	<0.02	6.57	0.315
	6/29/2006	924	2.1	280	203	49.2	0.0644	<0.2	0.822
	9/20/2006	757	6.6	706	342	93.2	0.0274	<0.2	0.132
	12/20/2006	778	4.6	847	283	83.8	<0.02	<0.2	0.172
	3/21/2007	961	<0.05	854	247	67.9	<0.02	<0.2	0.275
	6/27/2007	984	9.8	952	231	56.9	<0.02	6.03	0.897
	9/19/2007	1100	11.8	257	329	NA	<0.02	<0.2	0.355
	12/19/2007	916	5.8	7.9	240	NA	<0.02	<0.2	0.314
	3/13/2008	778	<0.05	153	253	NA	<0.02	0.265	0.412
	6/18/2008	768	4.2	301	240	NA	<0.02	<0.2	0.298
	9/10/2008	922	3.2	422	303	NA	<0.02	<0.2	0.278
	3/12/2009	683	3.1	44.2	274	NA	<0.02	0.719	0.345

Table 1a
Historical Nutrient and Metals Concentrations in Groundwater
Bee-Jay Scales Site
Sunnyside, Washington

Location ID	Sample Date	Nitrate	Nitrite**	Ammonia	Sulfate	Chloride	Arsenic	Iron	Manganese
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-05	9/29/2005	453	<0.05	171	525	160	<0.02	0.48	0.355
	1/12/2006	334	0.072	180	431	95.6	<0.02	<0.2	0.442
	3/29/2006	689	<0.05	167	405	157	<0.02	<0.2	0.687
	6/28/2006	370	<0.05	128	388	101	<0.02	<0.2	0.511
	9/19/2006	416	<0.05	241	368	133	<0.02	<0.2	0.245
	12/19/2006	417	<0.05	107	371	121	<0.02	0.437	0.357
	3/20/2007	341	0.066	165	367	100	<0.02	<0.2	0.369
	6/26/2007	381	<0.05	158	431	136	<0.02	<0.2	0.361
	9/18/2007	429	<0.05	151	195	NA	NA	<0.2	NA
	12/18/2007	339	<0.05	126	344	NA	NA	<0.2	NA
	3/12/2008	333	0.062	115	385	NA	NA	<0.2	NA
	6/17/2008	1640	<0.05	114	360	NA	NA	<0.2	NA
	9/9/2008	289	<0.05	126	368	NA	NA	<0.2	NA
	3/11/2009	288	<0.05	137	293	NA	NA	NA	NA
MW-06	9/29/2005	4.3	0.096	0.12	41.7	7.1	0.0312	<0.2	0.207
	1/12/2006	12.1	<0.05	<0.1	48.1	21.3	<0.02	0.335	0.415
	3/29/2006	14.9	<0.05	<0.1	50.2	13.7	0.022	<0.2	0.0311
	6/27/2006	29.5	<0.05	<0.1	59.3	23.9	<0.02	<0.2	0.0333
	9/19/2006	6.1	0.098	<0.1	42	9.3	0.0247	<0.2	0.203
	12/19/2006	16.6	<0.05	<0.1	45.3	20	<0.02	<0.2	0.206
	3/20/2007	9.2	<0.05	<0.1	49.9	13.3	0.0211	<0.2	0.0299
	6/26/2007	4.6	<0.05	<0.1	38.3	11.6	0.0253	<0.2	0.054
	9/18/2007	2.8	0.077	NA	38.8	NA	0.0327	NA	NA
	12/18/2007	5.9	<0.05	NA	43.4	NA	0.0255	NA	NA
	3/11/2008	9.7	<0.05	NA	49.1	NA	0.0296	NA	NA
	6/17/2008	3.3	<0.05	NA	44.7	NA	0.0221	NA	NA
	9/9/2008	3.0	0.081	NA	52.7	NA	0.0219	NA	NA
	3/11/2009	4.0	<0.05	NA	NA	NA	0.0225	NA	NA
MW-07	9/29/2005	3.1	<0.05	<0.1	44.5	8.8	<0.02	<0.2	<0.005
	1/12/2006	3.2	<0.05	<0.1	44.4	9.4	<0.02	<0.2	<0.005
	3/29/2006	3.2	<0.05	<0.1	42.2	9.7	<0.02	0.598	0.0144
	6/27/2006	3.1	<0.05	<0.1	40.2	9.5	<0.02	<0.2	<0.005
	9/19/2006	3.1	<0.05	<0.1	42	10.1	<0.02	<0.2	<0.005
	12/19/2006	3.2	<0.05	<0.1	42.4	8.2	<0.02	<0.2	<0.005
	3/20/2007	3.0	<0.05	<0.1	43.4	9.6	<0.02	<0.2	<0.005
	6/26/2007	3.0	<0.05	<0.1	39.8	12	<0.02	<0.2	<0.005
	9/18/2007	3.0	<0.05	NA	NA	NA	NA	NA	NA
	12/17/2007	2.8	<0.05	NA	NA	NA	NA	NA	NA
	3/11/2008	3.3	<0.05	NA	NA	NA	NA	NA	NA
	6/17/2008	3.3	<0.05	NA	NA	NA	NA	NA	NA
	9/9/2008	3.3	<0.05	NA	NA	NA	NA	NA	NA
	3/11/2009	3.1	<0.05	NA	NA	NA	NA	NA	NA

Table 1a
Historical Nutrient and Metals Concentrations in Groundwater
Bee-Jay Scales Site
Sunnyside, Washington

Location ID	Sample Date	Nitrate	Nitrite**	Ammonia	Sulfate	Chloride	Arsenic	Iron	Manganese
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-08	9/29/2005	477	<0.05	6.8	297	119	<0.02	<0.2	1.17
	1/12/2006	238	<0.05	4.1	395	143	<0.02	<0.2	1.59
	3/29/2006	133	0.052	4.4	339	141	<0.02	<0.2	2.12
	6/28/2006	527	<0.05	4.5	351	132	<0.02	<0.2	1.78
	9/19/2006	468	<0.05	4.4	244	110	<0.02	<0.2	1.07
	12/20/2006	427	<0.05	3	335	122	<0.02	<0.2	1.59
	3/20/2007	393	<0.05	3.9	309	109	<0.02	<0.2	1.47
	6/26/2007	439	<0.05	5	289	125	<0.02	<0.2	1.36
	9/18/2007	336	<0.05	3.9	239	NA	NA	NA	NA
	12/18/2007	264	<0.05	2.2	300	NA	NA	NA	NA
	3/12/2008	304	<0.05	3.7	300	NA	NA	NA	NA
	6/17/2008	1470	<0.05	4.9	292	NA	NA	NA	NA
	9/9/2008	283	<0.05	3.9	222	NA	NA	NA	NA
	3/12/2009	210	<0.05	2.6	282	NA	NA	NA	NA
MW-09	9/30/2005	482	<0.05	1.3	316	58.4	<0.02	<0.2	0.102
	1/13/2006	352	<0.05	1.1	249	44.3	<0.02	<0.2	0.0533
	3/30/2006	552	<0.05	1.5	264	48.8	<0.02	<0.2	0.0789
	6/28/2006	543	<0.05	3.2	231	50.6	<0.02	<0.2	0.08
	9/20/2006	691	<0.05	2.3	280	67	<0.02	<0.2	0.0966
	12/20/2006	770	<0.05	3.2	326	70.8	<0.02	<0.2	0.124
	3/21/2007	270	<0.05	4.8	229	57.7	<0.02	<0.2	0.0412
	6/27/2007	393	<0.05	9.7	260	58.8	<0.02	<0.2	0.086
	9/19/2007	707	<0.05	7	441	NA	NA	NA	NA
	12/19/2007	331	<0.05	15.2	243	NA	NA	NA	NA
	3/12/2008	363	<0.05	31.7	223	NA	NA	NA	NA
	6/18/2008	487	<0.05	17.1	229	NA	NA	NA	NA
	9/10/2008	519	<0.05	29.7	245	NA	NA	NA	NA
	3/12/2009	440	<0.05	43.4	198	NA	NA	NA	NA
MW-10	9/29/2005	3.8	0.21	<0.1	40.4	9.1	0.0266	<0.2	0.395
	1/12/2006	3.8	0.24	<0.1	38.6	10.4	<0.02	0.293	0.472
	3/29/2006	3.6	0.11	<0.1	41.8	9.4	0.0258	<0.2	0.409
	6/27/2006	2.5	<0.05	<0.1	35.7	10	<0.02	<0.2	0.46
	9/19/2006	2.1	0.09	<0.1	34.1	8.9	<0.02	<0.2	0.299
	12/19/2006	2.0	0.071	<0.1	33.9	8.4	0.0246	<0.2	0.444
	3/20/2007	1.8	<0.05	<0.1	36.2	8.8	0.0221	<0.2	0.334
	6/26/2007	1.7	0.083	<0.1	34.5	8.9	0.0235	0.233	0.547
	9/18/2007	2.1	<0.05	NA	35.6	NA	0.0275	NA	NA
	12/18/2007	1.8	<0.05	NA	34.8	NA	0.0236	NA	NA
	3/11/2008	2.2	<0.05	NA	36.6	NA	0.0205	NA	NA
	6/17/2008	2.1	<0.05	NA	35.7	NA	0.0231	NA	NA
	9/9/2008	2.3	<0.05	NA	35.7	NA	<0.02	NA	NA
	3/11/2009	2.1	<0.05	NA	NA	NA	0.0218	NA	NA

Table 1a
Historical Nutrient and Metals Concentrations in Groundwater
Bee-Jay Scales Site
Sunnyside, Washington

Location ID	Sample Date	Nitrate	Nitrite**	Ammonia	Sulfate	Chloride	Arsenic	Iron	Manganese
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-11	9/29/2005	8.9	0.18	0.18	73	16.6	0.0599	<0.2	0.237
	1/12/2006	7.8	0.11	<0.1	68.4	14.1	0.0434	<0.2	0.227
	3/29/2006	8.4	0.079	<0.1	68.7	14.5	0.0512	1.29	0.348
	6/27/2006	9.1	<0.05	<0.1	67.7	19.2	0.0462	<0.2	0.267
	9/19/2006	7.9	0.1	<0.1	64.7	14.6	0.0479	<0.2	0.316
	12/19/2006	7.1	0.093	<0.1	62.6	13.2	0.0478	<0.2	0.346
	3/20/2007	7.1	0.087	<0.1	67.7	14.6	0.0528	<0.2	1.03
	6/26/2007	7.6	0.12	<0.1	61.9	30.5	0.0522	<0.2	0.448
	9/18/2007	0.55	0.14	NA	62.1	NA	0.0564	NA	NA
	12/18/2007	6.8	<0.05	NA	68.1	NA	0.0519	NA	NA
	3/11/2008	6.7	<0.05	NA	63.7	NA	0.0475	NA	NA
	6/17/2008	6.6	0.11	NA	60	NA	0.0445	NA	NA
	9/9/2008	33.1	<0.05	NA	57.5	NA	0.0484	NA	NA
	3/11/2009	5.1	0.077	NA	NA	NA	0.0522	NA	NA
MW-12	9/29/2005	593	0.13	351	827	259	<0.02	0.575	0.561
	1/13/2006	772	0.5	574	394	146	0.0434	<0.2	0.595
	3/30/2006	945	0.46	335	388	149	0.0354	0.403	0.655
	6/28/2006	834	<0.05	229	436	180	0.0452	<0.2	0.669
	9/20/2006	859	0.31	425	587	267	0.0361	0.457	0.797
	12/20/2006	811	<0.05	292	658	304	<0.02	<0.2	0.943
	3/21/2007	772	0.27	387	423	168	0.0355	<0.2	0.652
	6/26/2007	666	0.47	645	528	214	0.0437	0.292	0.722
	9/19/2007	765	<0.5	222	854	326	0.0343	<0.2	NA
	12/18/2007	566	0.11	10.3	701	273	0.093	<0.2	NA
	3/12/2008	367	<0.05	204	356	174	0.0408	<0.2	NA
	6/18/2008	569	<0.05	296	641	217	0.0957	<0.2	NA
	9/10/2008	495	<0.05	271	655	256	0.0471	<0.2	NA
	3/12/2009	633	<0.5	NA	638	276	0.316	1.99	NA
MW-13	6/27/2007	170	0.058	0.28	268	69.1	<0.02	0.98	0.0645
	9/19/2007	174	<0.05	0.52	263	81.2	<0.02	<0.2	0.0363
	12/19/2007	181	0.078	<0.1	294	90.5	<0.02	0.452	0.0344
	3/12/2008	172	<0.05	0.19	338	121	<0.02	0.299	0.0223
	6/18/2008	167	<0.05	<0.1	265	67.7	<0.02	0.243	0.0177
	3/12/2009	148	<0.05	<0.1	246	NA	NA	0.666	NA

Notes:
**Select 3Q05 samples were analyzed outside 48-hour hold time for nitrite.
mg/L = milligrams per liter.
NA = Not analyzed.

Table 1b
Historical Volatile Organic Compound Concentrations in Groundwater
Bee-Jay Scales Site
Sunnyside, Washington

Location ID	Sample Date	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene	1,2-Dichloropropane	1,3,5-Trimethylbenzene	Benzene	Chlorobenzene	Ethylbenzene	m+p-Xylene	Naphthalene	Toluene	TPH-Gx
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-04	9/30/2005	0.039	<0.005	0.044	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	1/13/2006	0.026	<0.005	0.029	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005	NA
	3/30/2006	0.029	<0.005	0.035	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	6/29/2006	0.014	<0.005	0.02	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	9/20/2006	0.051	<0.005	0.11	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	12/20/2006	0.048	<0.005	0.086	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	3/21/2007	0.023	<0.005	0.028	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	6/27/2007	0.02	<0.005	0.025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	9/19/2007	0.027	<0.005	0.037	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	12/19/2007	0.019	<0.005	0.021	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	3/13/2008	0.018	<0.005	0.024	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	6/18/2008	0.016	<0.005	0.018	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	9/10/2008	0.05	<0.005	0.071	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	3/12/2009	0.015	<0.005	0.019	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
MW-09	9/30/2005	0.048	<0.005	0.069	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	1/13/2006	0.031	<0.005	0.027	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005	NA
	3/30/2006	0.047	<0.005	0.048	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	6/28/2006	0.033	<0.005	0.029	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	9/20/2006	0.057	<0.005	0.15	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	12/20/2006	0.06	<0.005	0.16	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	3/21/2007	0.02	<0.005	0.012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	6/27/2007	0.021	<0.005	0.015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	9/19/2007	0.056	<0.005	0.11	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	12/19/2007	0.028	<0.005	0.019	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	3/12/2008	0.023	<0.005	0.018	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	6/18/2008	0.028	<0.005	0.023	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	9/10/2008	0.026	<0.005	0.028	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	3/12/2009	0.031	<0.005	0.021	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
MW-10	9/29/2005	<0.005	0.01	<0.005	0.008	0.15	<0.005	0.037	0.012	0.016	<0.005	0.31
	1/12/2006	<0.005	0.006	<0.005	<0.005	0.11	<0.005	0.008	NA	<0.005	<0.005	<0.25
	3/29/2006	<0.005	0.006	<0.005	<0.005	0.065	<0.005	0.009	<0.005	<0.005	<0.005	<0.25
	6/27/2006	<0.005	0.017	<0.005	0.008	0.13	<0.005	0.033	0.024	0.014	<0.005	0.4
	9/19/2006	<0.005	<0.005	<0.005	<0.005	0.043	<0.005	0.009	<0.005	<0.005	<0.005	<0.25
	12/19/2006	<0.005	0.006	<0.005	<0.005	0.041	<0.005	0.019	<0.005	0.006	<0.005	<0.25
	3/20/2007	<0.005	0.012	<0.005	<0.005	0.059	<0.005	0.023	0.013	0.007	<0.005	0.32
	6/26/2007	<0.005	0.015	<0.005	0.008	0.082	<0.005	0.04	0.014	0.012	0.006	0.43
	9/18/2007	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	12/18/2007	<0.005	0.006	<0.005	<0.005	0.024	<0.005	0.015	<0.005	<0.005	<0.005	<0.25
	3/11/2008	<0.005	<0.005	<0.005	<0.005	0.012	<0.005	0.006	<0.005	<0.005	<0.005	<0.25
	6/17/2008	<0.005	<0.005	<0.005	<0.005	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	9/9/2008	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	3/11/2009	<0.005	<0.005	<0.005	<0.005	0.012	<0.005	0.01	<0.005	<0.005	<0.005	<0.25

Table 1b
Historical Volatile Organic Compound Concentrations in Groundwater
Bee-Jay Scales Site
Sunnyside, Washington

Location ID	Sample Date	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene	1,2-Dichloropropane	1,3,5-Trimethylbenzene	Benzene	Chlorobenzene	Ethylbenzene	m+p-Xylene	Naphthalene	Toluene	TPH-Gx
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-11	9/29/2005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	1/12/2006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005	<0.25
	3/29/2006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	6/27/2006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	9/19/2006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	12/19/2006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	3/20/2007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	6/26/2007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	9/18/2007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	12/18/2007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	3/11/2008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	6/17/2008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	9/9/2008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.25
	3/11/2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.25
MW-12	9/29/2005	0.12	<0.005	1.2	<0.005	0.011	0.14	<0.005	<0.005	<0.005	<0.005	NA
	1/13/2006	0.037	<0.005	0.24	<0.005	<0.005	0.11	<0.005	NA	<0.005	<0.005	NA
	3/30/2006	0.13	<0.005	1.3	<0.005	0.009	0.1	<0.005	<0.005	<0.005	<0.005	NA
	6/28/2006	0.031	<0.005	0.3	<0.005	<0.005	0.085	<0.005	<0.005	<0.005	<0.005	NA
	9/20/2006	0.17	<0.01	2.3	<0.01	0.017	0.098	<0.01	<0.01	<0.01	<0.01	NA
	12/20/2006	0.069	<0.005	0.76	<0.005	0.008	0.14	<0.005	<0.005	<0.005	<0.005	NA
	3/21/2007	0.047	<0.005	0.45	<0.005	0.005	0.1	<0.005	<0.005	<0.005	<0.005	NA
	6/26/2007	0.12	<0.013	1.1	<0.013	<0.013	0.18	<0.013	<0.013	<0.013	<0.013	NA
	9/19/2007	0.2	<0.01	2.4	<0.01	0.018	0.13	<0.01	<0.01	<0.01	<0.01	NA
	12/18/2007	0.055	<0.01	0.54	<0.01	<0.01	0.1	<0.01	<0.01	<0.01	<0.01	NA
	3/12/2008	0.028	<0.005	0.3	<0.005	<0.005	0.12	<0.005	<0.005	<0.005	<0.005	NA
	6/18/2008	0.14	<0.013	1.4	<0.013	0.013	0.2	<0.013	<0.013	<0.013	<0.013	NA
	9/10/2008	0.067	<0.005	0.76	<0.005	0.008	0.2	<0.005	<0.005	<0.005	<0.005	NA
	3/12/2009	0.11	<0.01	0.94	<0.01	0.011	0.23	<0.01	<0.01	<0.01	<0.01	NA
MW-13	6/27/2007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	9/19/2007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	12/19/2007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	3/12/2008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	6/18/2008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA
	3/12/2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
TPH-Gx = Total petroleum hydrocarbons as gasoline by NWTPH-Gx method.
mg/L = milligrams per liter.
NA = Not analyzed.

Table 1c
Historical Herbicide Concentrations in Groundwater
Bee-Jay Scales Site
Sunnyside, Washington

Location ID	Sample Date	2,4,5-T	2,4,5-TP	2,4-D	2,4-DB	2,4-DP (Dichloroprop)	Dalapon	Dicamba	Dinoseb	MCPA	MCPP	Pentachlorophenol
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-03	1/12/2006	<0.000049	<0.000049	<0.00049	<0.00099	<0.00049	<0.0012	<0.0003	0.0016	<0.99	<0.2	<0.000049
	3/30/2006	<0.000049	<0.000049	<0.00049	<0.00097	<0.00049	<0.0012	<0.00029	0.0019	<0.97	<0.19	<0.000049
	6/28/2006	<0.000051	<0.000051	0.00099	<0.001	<0.00051	<0.0013	<0.0003	0.0008	<1	<0.2	<0.000051
	9/20/2006	<0.000048	<0.000048	0.0018	<0.00097	<0.00048	<0.0012	<0.00029	0.0018	<0.97	<0.19	<0.000048
	12/20/2006	<0.000048	<0.000048	0.0015	<0.00095	<0.00048	<0.0012	<0.00029	0.0011	<0.95	<0.19	<0.000048
	3/21/2007	<0.000048	<0.000048	<0.00048	<0.00097	<0.00048	<0.0012	<0.00029	0.00088	<0.97	<0.19	<0.000048
	6/26/2007	<0.00005	<0.00005	<0.0005	<0.00099	<0.0005	<0.0012	<0.0003	0.00083	<0.99	<0.2	<0.00005
	9/18/2007	<0.000048	<0.000048	0.00076	<0.00096	<0.00048	<0.0012	<0.00029	0.0008	<0.96	<0.19	<0.000048
	12/18/2007	<0.000048	<0.000048	<0.00048	<0.00095	<0.00048	<0.0012	<0.00029	0.0011	<0.95	<0.19	<0.000048
	3/12/2008	<0.000049	<0.000049	<0.00049	<0.00099	<0.00049	<0.0012	<0.0003	0.001	<0.99	<0.2	<0.000049
	6/18/2008	<0.000047	<0.000047	<0.00047	<0.00095	<0.00047	<0.0012	<0.00028	0.00056	<0.95	<0.19	<0.000047
	9/10/2008	<0.000049	<0.000049	0.0017	<0.00099	<0.00049	<0.0012	<0.0003	0.0029	<0.99	<0.2	<0.000049
	3/12/2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-04	9/30/2005	<0.00047	<0.00047	<0.0047	<0.0095	<0.0047	<0.012	<0.0028	0.02	<9.5	<1.9	0.00053
	1/13/2006	0.00013	<0.000048	0.0022	<0.00096	<0.00048	<0.0012	<0.00029	<0.24	<0.96	<0.19	0.00042
	3/30/2006	0.00036	<0.000047	0.001	<0.00095	<0.00047	<0.0012	<0.00028	<0.00047	<0.95	<0.19	0.00038
	6/29/2006	0.00027	<0.000052	0.0009	0.0024	<0.00052	<0.0013	<0.00031	<0.00052	<1	<0.21	0.00013
	9/20/2006	<0.00097	<0.00097	<0.0097	<0.019	<0.0097	<0.024	<0.0058	0.025	<19	<3.9	<0.00097
	12/20/2006	0.000077	<0.000048	<0.00048	<0.00096	<0.00048	<0.0012	<0.00029	0.19	<0.96	<0.19	0.00026
	3/21/2007	0.000052	<0.000048	0.0011	<0.00097	<0.00048	<0.0012	<0.00029	0.11	<0.97	<0.19	0.00014
	6/27/2007	<0.000047	<0.000047	<0.00047	<0.00095	<0.00047	<0.0012	<0.00028	0.11	<0.95	<0.19	0.00015
	9/19/2007	0.00013	<0.000049	0.0019	<0.00097	<0.00049	<0.0012	<0.00029	0.27	<0.97	<0.19	0.00033
	12/19/2007	<0.00034	<0.000047	0.0007	0.0029	<0.00047	<0.0012	<0.00028	0.11	<0.95	<0.19	0.00022
	3/13/2008	0.0005	<0.000049	0.00091	0.0033	<0.00049	<0.0012	0.00085	0.13	<0.98	<0.2	0.00029
	6/18/2008	<0.000048	<0.000048	0.00092	0.0024	<0.00048	<0.0012	0.00079	0.23	<0.97	<0.19	0.00031
	9/10/2008	0.00055	<0.000051	0.002	0.0044	<0.00051	<0.0013	<0.015	0.57	<1	<0.2	0.00032
	3/12/2009	<0.000048	<0.000048	0.00063	<0.00095	<0.00048	<0.0012	<0.00029	0.19	<0.95	<0.19	0.00023
MW-09	9/30/2005	<0.000048	<0.000048	<0.00048	0.0028	<0.00048	<0.0012	<0.14	<0.24	<0.95	<0.19	<0.000048
	1/13/2006	<0.00005	<0.00005	<0.0005	<0.00099	<0.0005	<0.0012	<0.006	0.062	<0.99	<0.2	<0.00005
	3/30/2006	<0.000055	<0.000055	<0.00055	0.0022	<0.00055	<0.0014	0.001	<0.00055	<1.1	<0.22	<0.000055
	6/28/2006	<0.00005	<0.00005	<0.0005	<0.001	<0.0005	<0.0013	0.0011	<0.0005	<1	<0.2	<0.00005
	9/20/2006	<0.000048	<0.000048	0.0006	<0.00096	<0.00048	<0.0012	<0.00029	0.14	<0.96	<0.19	<0.000048
	12/20/2006	<0.000048	<0.000048	<0.00048	0.0011	<0.00048	<0.0012	0.00077	0.17	<0.96	<0.19	<0.000048
	3/21/2007	<0.000048	<0.000048	<0.00048	0.0014	<0.00048	<0.0012	0.00047	0.1	<0.96	<0.19	<0.000048
	6/27/2007	<0.000048	<0.000048	<0.00048	<0.00096	<0.00048	<0.0012	<0.00029	0.1	<0.96	<0.19	<0.000048
	9/19/2007	<0.000048	<0.000048	<0.00048	<0.00097	<0.00048	<0.0012	<0.00029	0.2	<0.97	<0.19	<0.000048
	12/19/2007	<0.000047	<0.000047	<0.00047	0.0019	<0.00047	<0.0012	0.00056	0.21	<0.95	<0.19	<0.000047
	3/12/2008	<0.000052	<0.000052	<0.00052	<0.001	<0.00052	<0.0013	0.00052	0.1	<1	<0.21	<0.000052
	6/18/2008	<0.000049	<0.000049	<0.00049	0.0022	<0.00049	<0.0012	0.00051	0.17	<0.98	<0.2	<0.000049
	9/10/2008	<0.000049	<0.000049	0.0091	<0.0049	<0.00049	<0.0012	<0.0015	0.22	<0.98	<0.2	<0.000049
	3/12/2009	<0.000048	<0.000048	<0.00048	<0.00095	<0.00048	<0.0012	0.00035	0.17	<0.95	<0.19	<0.000048

Table 1c
Historical Herbicide Concentrations in Groundwater
Bee-Jay Scales Site
Sunnyside, Washington

Location ID	Sample Date	2,4,5-T	2,4,5-TP	2,4-D	2,4-DB	2,4-DP (Dichloroprop)	Dalapon	Dicamba	Dinoseb	MCPA	MCPP	Pentachlorophenol
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MW-12	9/29/2005	<0.00047	<0.00047	0.034	<0.0095	0.034	<0.012	<0.0028	1.2	<9.5	<1.9	<0.00047
	1/13/2006	<0.000049	0.000074	0.0056	<0.00099	<0.00049	<0.0012	0.003	1.2	<0.99	0.39	0.000088
	3/30/2006	<0.000048	0.00033	0.064	0.0087	<0.00048	<0.0012	<0.00029	1.2	<0.95	<0.19	<0.00005
	6/28/2006	<0.000051	0.00015	<0.1	0.0019	<0.00051	<0.0013	<0.00031	1.3	<1	<0.2	<0.000051
	9/20/2006	<0.00096	<0.00096	0.53	<0.019	<0.0096	<0.024	<0.058	1.8	<19	<3.8	<0.00096
	12/20/2006	0.00019	0.000079	0.19	<0.001	<0.00048	<0.0012	<0.00029	1	<0.95	<0.19	<0.000048
	3/21/2007	<0.000049	<0.000049	0.1	<0.00099	<0.00049	<0.0012	<0.0003	1.4	<0.99	<0.2	0.000055
	6/26/2007	<0.000048	<0.000048	0.25	0.00096	<0.00048	<0.0012	<0.00029	1.7	<0.96	<0.19	0.000062
	9/19/2007	<0.048	<0.048	1.1	<0.97	<0.48	<1.2	<0.29	3.2	<970	<190	<0.048
	12/18/2007	<0.000047	<0.00005	0.19	<0.001	<0.00047	<0.0012	<0.00028	2.6	<0.95	<0.19	0.00023
	3/12/2008	<0.00005	0.00013	0.066	0.003	<0.0005	<0.0013	<0.0003	1.6	<1	<0.2	<0.00005
	6/18/2008	<0.005	<0.005	0.57	<0.099	<0.05	<0.12	<0.03	2.7	<99	<20	<0.005
	9/10/2008	<0.0049	<0.0049	0.77	<0.097	<0.049	<0.12	<0.029	2.2	<97	<19	<0.0049
	3/12/2009	<0.000048	<0.000048	0.11	0.0015	<0.00048	<0.0012	<0.0058	0.85	<19	<3.9	0.0002
MW-13	6/27/2007	<0.000048	<0.000048	<0.00048	<0.00097	<0.00048	<0.0012	<0.00029	<0.00048	<0.97	<0.19	<0.000048
	9/19/2007	<0.000048	<0.000048	<0.00048	<0.00095	<0.00048	<0.0012	<0.00029	0.0016	<0.95	<0.19	<0.000048
	12/19/2007	<0.000048	<0.000048	<0.00048	<0.00096	<0.00048	<0.0012	<0.00029	0.0015	<0.96	<0.19	<0.000048
	3/12/2008	<0.00005	<0.00005	<0.0005	<0.001	<0.0005	<0.0013	<0.0003	0.0012	<1	<0.2	<0.00005
	6/18/2008	<0.000049	<0.000049	0.0037	<0.00097	<0.00049	<0.0012	<0.00029	0.017	<0.97	<0.19	<0.000049
	3/12/2009	<0.000049	<0.000049	<0.00049	<0.00098	<0.00049	<0.0012	<0.00029	0.0032	<0.98	<0.2	<0.000049

Notes:
2,4,5-T = 2,4,5-Trichlorophenoxyacetic acid
2,4,5-TP = 2-(2,4,5-Trichlorophenoxy)propionic acid
2,4-D = 2,4-Dichlorophenoxyacetic acid
2,4-DB = 4-(2,4-Dichlorophenoxy)butyric acid
2,4-DP (Dichlorprop) = α-(2,4-Dichlorophenoxy)propionic acid
MCPA = 2-Methyl-4-chlorophenoxyacetic acid
MCPP = 2-(2-Methyl-4-chlorophenoxy)propionic acid
mg/L = milligrams per liter.
NA = Not analyzed.

Table 2
Groundwater Cleanup Levels
Bee-Jay Scales Site
Sunnyside, Washington

Analyte*	Groundwater Cleanup Level (mg/L)	Source
1,2,3-Trichloropropane	0.00001	Modified MTCA Method B
1,2,4-Trimethylbenzene	0.4	Modified MTCA Method B
1,2-Dichloropropane	0.005	Primary MCL
1,3,5-Trimethylbenzene	0.4	Modified MTCA Method B
2-Methylnaphthalene	0.032	Modified MTCA Method B
2,4,5-T	0.16	Modified MTCA Method B
2,4,5-TP	0.05	Primary MCL
2,4-D	0.07	Primary MCL
2,4-DB	0.128	Modified MTCA Method B
Arsenic	0.01	Primary MCL
Benzene	0.005	Primary MCL
Chlorobenzene	0.1	Primary MCL
Dicamba	0.48	Modified MTCA Method B
Dinoseb	0.007	Primary MCL
Ethylbenzene	0.7	Primary MCL
Iron	11.2	Modified MTCA Method B
Manganese	2.2	Standard MTCA Method B
Naphthalene	0.16	Modified MTCA Method B
Nitrate Nitrogen	10	Primary MCL
Nitrite Nitrogen	1	Primary MCL
Pentachlorophenol	0.001	Primary MCL
Toluene	1	Primary MCL
TPH-Gx	0.8	Standard MTCA Method A
Xylenes	10	Primary MCL

Notes:
2,4,5-T = 2,4,5-Trichlorophenoxyacetic acid
2,4,5-TP = 2(2,4,5-Trichlorophenoxy)propionic acid
2,4-D = 2,4-Dichlorophenoxyacetic acid
2,4-DB = 4-(2,4-Dichlorophenoxy)butyric acid
TPH-Gx = Total petroleum hydrocarbons in the gasoline range
mg/L = milligrams per liter
MCL = Maximum Contaminant Level
MTCA = Model Toxics Control Act
*Alkalinity, ammonia, chloride, pH, and sulfate will be analyzed, but do not present a human health risk and, no cleanup levels are available.
Bold analytes are indicator hazardous substances (IHSs); all analytes are included in the current semi-annual groundwater monitoring program.

Table 3
Applicable or Relevant and Appropriate Requirements
Bee-Jay Scales Site
Sunnyside, Washington

REGULATION	CODE	TYPE	SUMMARY	ADMINISTERING AGENCY	ANALYSIS
WATER POLLUTION STATUTES AND REGULATIONS					
Storm Water Construction Permit Regulation	SMC 13.30.140	Action Specific	Beginning in 2010, prior to construction of any structure, grading or improvement upon real property located within City limits, a storm water plan shall be submitted and upon approval, a storm water construction permit shall be issued upon payment of the storm water construction permit fees as provided in SMC 13.30.150.	City of Sunnyside	Relevant and appropriate for On-site Remedial Alternatives #3 and #4.
PUBLIC WATER SUPPLY STATUTES AND REGULATIONS					
Safe Drinking Water Act	40 CFR 141.11-141.16	Chemical Specific	MCLs are enforceable maximum permissible levels of a contaminant that is delivered to any user of a public water system. Applicable MCLs are based on MCLGs, best available technology, best treatment techniques, and cost.	USEPA Office of Water	Relevant and appropriate. Groundwater cleanup level of 10 mg/L based on this ARAR.
Washington MTCA Groundwater Cleanup Standards	WAC 173-340-720	Chemical Specific	Establishes standards for groundwater covered under MTCA. MTCA standards are applicable at sites where hazardous substances have been found.	Washington Department of Ecology	Applicable.
Washington MTCA Deriving Soil Concentrations for Groundwater Protection	WAC 173-340-747	Chemical Specific	Establishes soil concentrations that will not cause contamination of groundwater at levels that exceed the groundwater cleanup levels established under WAC 173-340-720.	Washington Department of Ecology	Applicable. Soil preliminary cleanup level of 452 mg/kg is based on this ARAR.
Washington Underground Injection Control Program	WAC 173-218	Action Specific	An example of Class V injection wells that are allowed in Washington are those used for remediation wells receiving fluids intended to cleanup, treat, or prevent subsurface contamination. The wells must be registered and rule authorized (WAC 173-218-070)	Washington Department of Ecology	Applicable for On-site Remedial Alternative #4.
COMPLIANCE MONITORING STATUTES AND REGULATIONS					
Washington MTCA Compliance Monitoring Requirements	WAC 173-340-410	Action Specific	Compliance monitoring includes protection monitoring (to confirm protection of human health and the environment during cleanup), performance monitoring (to confirm cleanup has attained cleanup standards), and confirmational monitoring (to confirm long-term effectiveness of the cleanup)	Washington Department of Ecology	Applicable. Remedial alternatives must be able to incorporate these types of compliance monitoring.
INSTITUTIONAL CONTROLS STATUTES AND REGULATIONS					
Washington MTCA Institutional Controls Regulation	WAC 173-340-440	Action Specific	Provides guidance on institutional controls used to prohibit activities that may interfere with the integrity of an interim action or cleanup action or that may result in exposure to hazardous substances at a site.	Washington Department of Ecology	Applicable for remedial alternatives that utilize institutional controls.
AIR POLLUTION STATUTES AND REGULATIONS					
Washington Clean Air Act (Ambient Air Quality Standards for Particulate Matter)	WAC 173-470	Action Specific	Establishes maximum acceptable levels for particulate matter in the ambient air.	Washington Department of Ecology	Relevant and appropriate for On-site Remedial Alternatives #3 and #4.
Construction Dust Control Policy of the Yakima Regional Clean Air Agency	Incorporates Regulation I of Yakima County Regional Clean Air Agency Chapter 70.94 RCW and Chapter 173-400 of WAC	Action Specific	Requires any owner, developer, or operator engaged in construction, repair, remodeling, or demolition of any building; engaged in any road construction or repair; or construction site preparation or landscaping within the exterior boundaries of Yakima County to prepare a site-specific fugitive dust control plan to be reviewed by the Yakima Regional Clean Air Agency.	Yakima Regional Clean Air Agency	Relevant and appropriate for On-site Remedial Alternatives #3 and #4.
EROSION AND SEDIMENT CONTROL STATUTES AND REGULATIONS					
Erosion and Sediment Control Permit Regulation	SMC 15.54	Action Specific	Prohibits grubbing, clearing, grading, filling, excavating, quarrying, mining and/or stockpiling of soil on any property within the City of Sunnyside or improving or developing any such property without an erosion and sedimentation control permit.	City of Sunnyside	Relevant and appropriate for On-site Remedial Alternative #3 and #4.

Table 3
Applicable or Relevant and Appropriate Requirements
Bee-Jay Scales Site
Sunnyside, Washington

REGULATION	CODE	TYPE	SUMMARY	ADMINISTERING AGENCY	ANALYSIS
WORKER SAFETY STATUTES AND REGULATIONS					
Occupational Safety and Health Act	29 CFR 1910	Action Specific	Establishes general safety procedures and general construction safety standards applicable to workers during cleanup actions.	OSHA	Applicable.
Washington Industrial Safety and Health Act	WAC 296, Chapters 06-17A, 24, 62-63, 155, 200A, 800-809, 817, 839-843, 863, 874, 876 and WAC 173-340-810	Action Specific	Establishes safety and health rules that apply to most workplaces and workers in the State of Washington.	Washington Department of Labor and Industries	Applicable.
OVERALL ENVIRONMENT STATUTES AND REGULATIONS					
State Environmental Policy Act	43.21C RCW	Action Specific	Enacted in 1971, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. A SEPA checklist must be prepared with any new proposal to provide information to help the agency identify environmental impacts from the proposal, and to help the agency decide whether and EIS is required.	Washington Department of Ecology	Applicable.

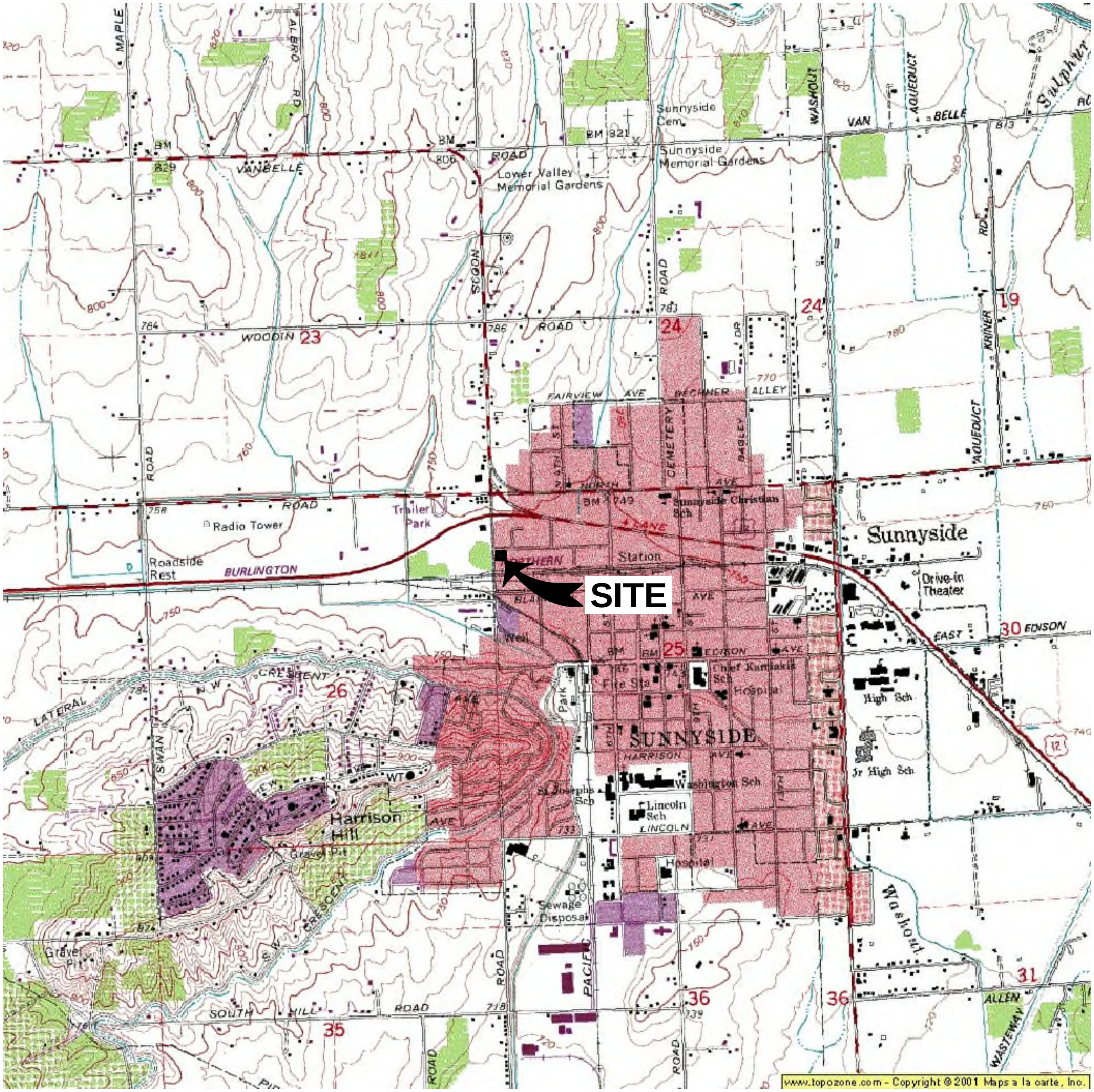
Notes:
ARAR = Applicable or relevant and appropriate requirement
CFR = Code of Federal Regulations
EIS = Environmental Impact Statement
MCLs = Maximum Contaminant Levels
MCLGs = Maximum Contaminant Level Goals
mg/L = milligrams per liter
MTCA = Model Toxics Control Act
OSHA = Occupational Safety and Health Administration
RCW = Revised Code of Washington
SEPA = State Environmental Policy Act
SMC = Sunnyside Municipal Code
USEPA = United States Environmental Protection Agency
WAC = Washington Administrative Code

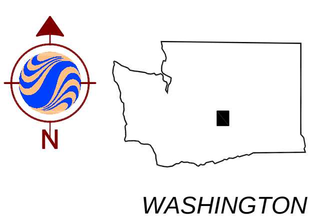
Table 4
Remedial Alternative Evaluation Summary
Bee-Jay Scales Site
Sunnyside, Washington

EVALUATION CRITERIA	**ON-SITE SOIL AND GROUNDWATER**				**OFF-PROPERTY GROUNDWATER**	
	Remedial Alternative #1 No Action	Remedial Alternative #2 MNA of Soil and GW and ICs	Remedial Alternative #3 PRB, GWM, NA and Capping of Soil, and ICs	Remedial Alternative #4 *In Situ* Bioremediation, GWM, ICs, and Phytoremediation of GW (Optional Addition)	Remedial Alternative #1 No Action	Remedial Alternative #2 MNA, ICs, Contingency Plan
THRESHOLD CRITERIA						
Overall Protection of Human Health and the Environment	Fails Criterion	Partially Meets	Meets Criterion	Meets Criterion	Fails Criterion	Meets Criterion
Compliance with ARARs	Fails Criterion	Partially Meets	Meets Criterion	Meets Criterion	Fails Criterion	Meets Criterion
Opportunity for Compliance Monitoring	Fails Criterion	Meets Criterion	Meets Criterion	Meets Criterion	Fails Criterion	Meets Criterion
EFFECTIVENESS						
Reasonable Restoration Timeframe	N/A	Fails Criterion	Partially Meets	Meets Criterion	N/A	Meets Criterion
Long-term Effectiveness and Permanence	N/A	Fails Criterion	Partially Meets	Meets Criterion	N/A	Meets Criterion
Short-term Effectiveness	N/A	Meets Criterion	Meets Criterion	Partially Meets	N/A	Meets Criterion
IMPLEMENTABILITY						
Technical and Administrative Implementability	N/A	Meets Criterion	Meets Criterion	Meets Criterion	N/A	Meets Criterion
State and Community Acceptance	N/A	Fails Criterion*	Partially Meets*	Meets Criterion*	N/A	Meets Criterion*
COST						
Cost	N/A	$1,455,044	$1,692,544	$1,112,770	N/A	$482,192 to $534,192**
Contingency Plan	--	--	--	--	--	*$70,595 to $211,786***

Notes:
ARARs = Applicable or relevant and appropriate requirements
GW = Groundwater
GWM = Groundwater monitoring
ICs = Institutional controls
MNA = Monitored natural attenuation
NA = Natural attenuation
N/A = Not applicable (alternative failed one or more threshold criteria)
PRB = Permeable reactive barrier
* Evaluation of anticipated Ecology acceptance is provided. Final Community acceptance will be evaluated after public comment.
** Low end of range = costs for 13 off-property parcels within site-specific nitrate plume. High end of range = costs for 39 off-property parcels within the combined nitrate plume.
Costs are net present worth assuming 2% inflation.
Highlighted cells indicate recommended alternatives.

Figures





1 1/2 0 1

SCALE IN MILE

1000 0 1000 2000 3000 4000 5000 6000 7000

SCALE IN FEET

SOURCE: USGS 7.5 MINUTE QUADRANGLE; SUNNYSIDE, WASHINGTON; 1975

Stantec
2321 CLUB MERIDIAN DR. SUITE E
OKEMOS, MI
PHONE: (517) 349-9499 FAX: (517) 349-6863

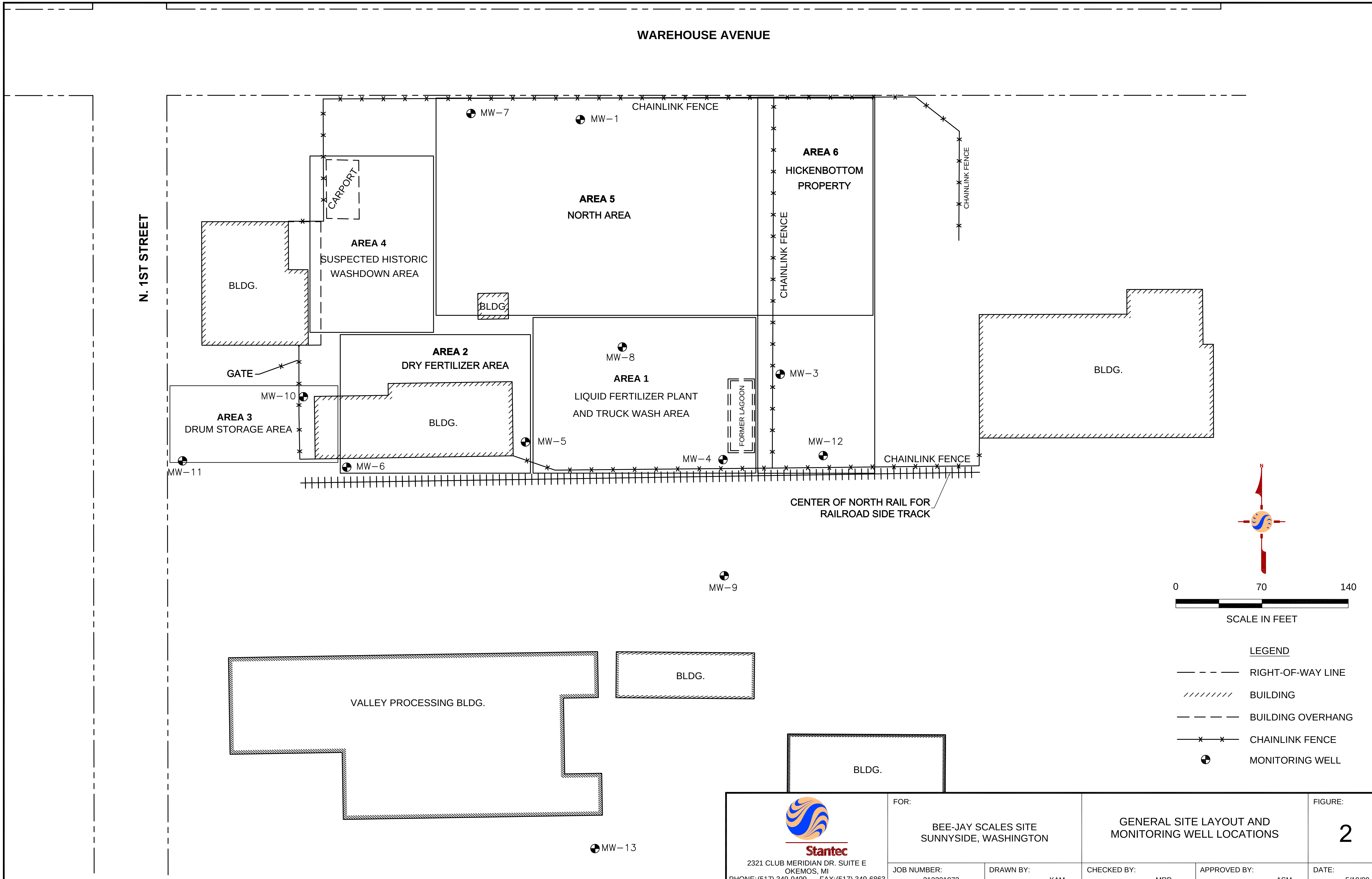
FOR:

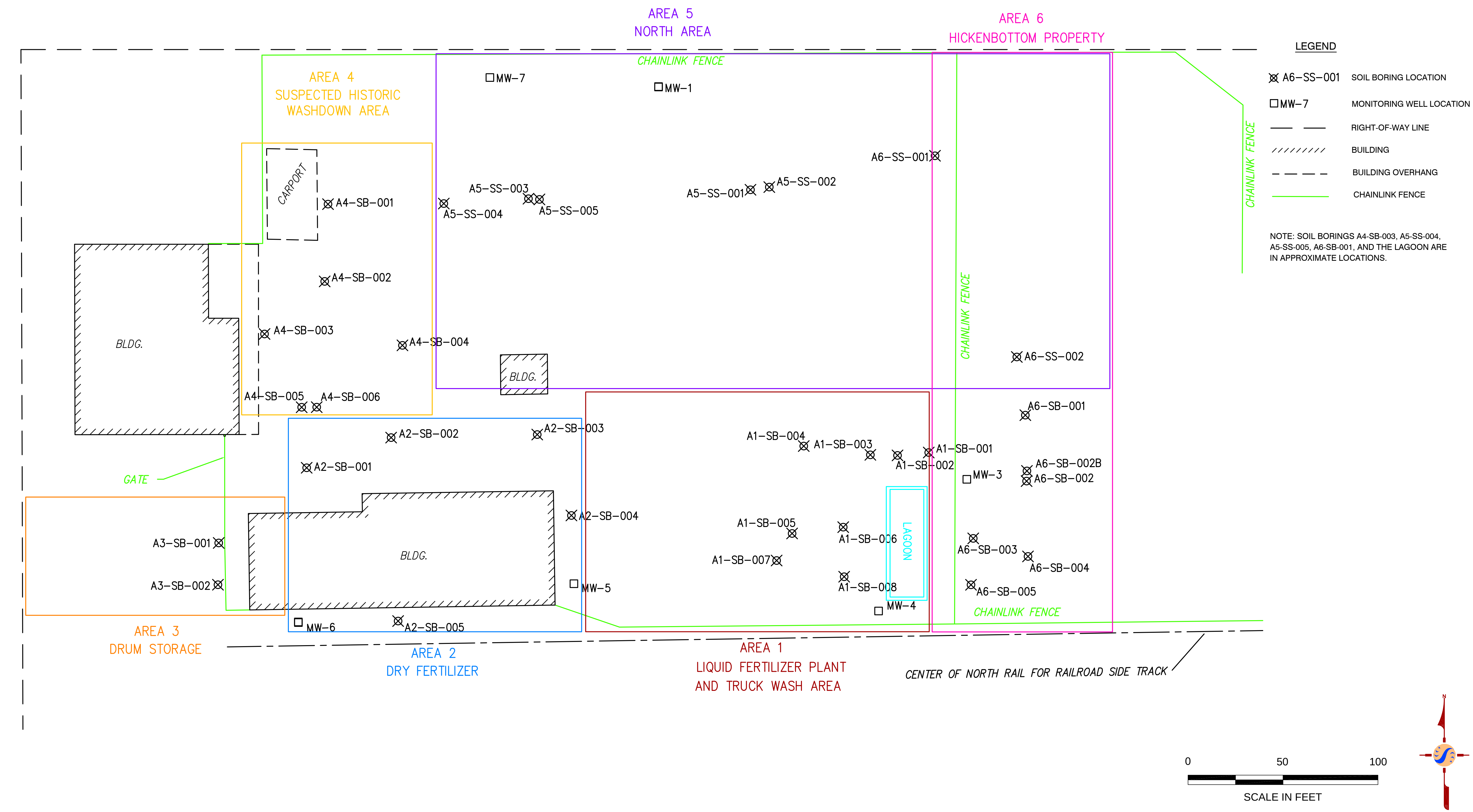
BEE-JAY SCALES SITE
SUNNYSIDE, WASHINGTON

SITE LOCATION MAP

FIGURE: 1

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
213201072	KAM	HMS	MRP	5/19/09


WAREHOUSE AVENUE
N. 1ST STREET
CHAINLINK FENCE
MW−7
MW−1
AREA 5
NORTH AREA
AREA 6
HICKENBOTTOM
PROPERTY
CHAINLINK FENCE
CHAINLINK FENCE
CARPORT
AREA 4
SUSPECTED HISTORIC
WASHDOWN AREA
BLDG.
BLDG.
AREA 2
DRY FERTILIZER AREA
MW−8
AREA 1
LIQUID FERTILIZER PLANT
AND TRUCK WASH AREA
FORMER LAGOON
MW−3
BLDG.
GATE
MW−10
AREA 3
DRUM STORAGE AREA
BLDG.
MW−5
MW−4
MW−12
CHAINLINK FENCE
MW−11
MW−6
CENTER OF NORTH RAIL FOR
RAILROAD SIDE TRACK
MW−9
0
70
140
SCALE IN FEET
LEGEND
RIGHT-OF-WAY LINE
BUILDING
BUILDING OVERHANG
CHAINLINK FENCE
MONITORING WELL
VALLEY PROCESSING BLDG.
BLDG.
BLDG.
MW−13
Stantec
2321 CLUB MERIDIAN DR. SUITE E
OKEMOS, MI
PHONE:(517) 349-9499 FAX:(517) 349-6863
FOR:
BEE-JAY SCALES SITE
SUNNYSIDE, WASHINGTON
GENERAL SITE LAYOUT AND
MONITORING WELL LOCATIONS
FIGURE:
2
JOB NUMBER:
213201072
DRAWN BY:
KAM
CHECKED BY:
MRP
APPROVED BY:
ASM
DATE:
5/19/09



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OKEMOS, MI
PHONE:(517) 349-9499 FAX:(517) 349-6863

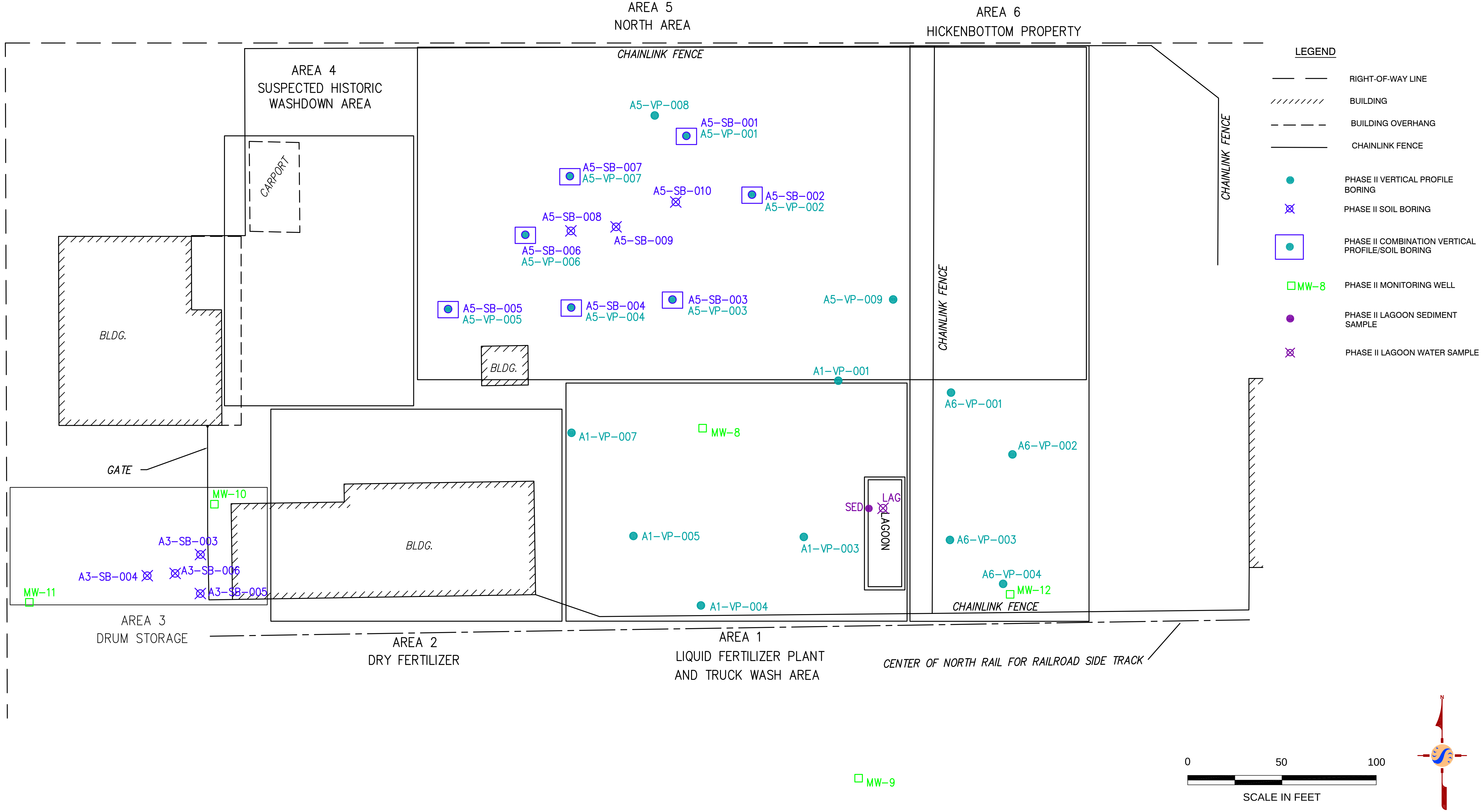
FOR:
BEE-JAY SCALES SITE
SUNNYSIDE, WASHINGTON

BORING LOCATIONS FROM PHASE I REMEDIAL INVESTIGATION

FIGURE: **3**

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
213201072	PMW	MRP	JRB	5/19/09

FILEPATH:P:\Chevron\Bee-Jay Scales\Feasibility Study Report\Figures\Drawings\Fig 3_Boring Location Phase I.dwg|swhitaker|May 19, 2009 at 14:47|Layout: Fig 3



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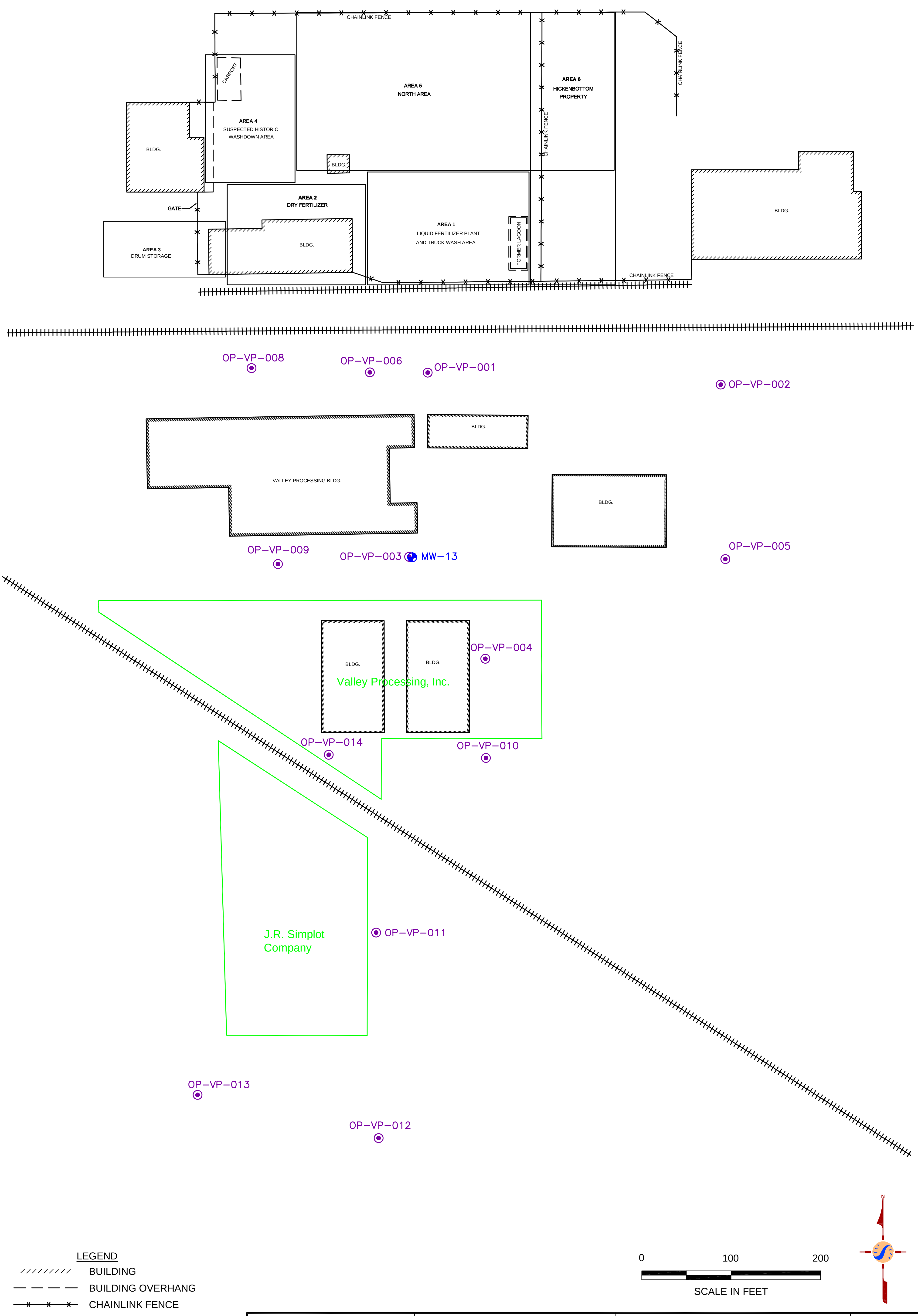
FOR: BEE-JAY SCALES SITE SUNNYSIDE, WASHINGTON		BORING LOCATIONS FROM PHASE II REMEDIAL INVESTIGATION		FIGURE: 4
JOB NUMBER: 213201072	DRAWN BY: DRM	CHECKED BY: MRP	APPROVED BY: JRB	DATE: 5/19/09

FILEPATH:P:\Chevron\Bee-Jay Scales\Feasibility Study Report\Figures\Drawings\Fig 4_Boring Location Phase II.dwg|swhitaker|May 19, 2009 at 14:48|Layout: Fig 4



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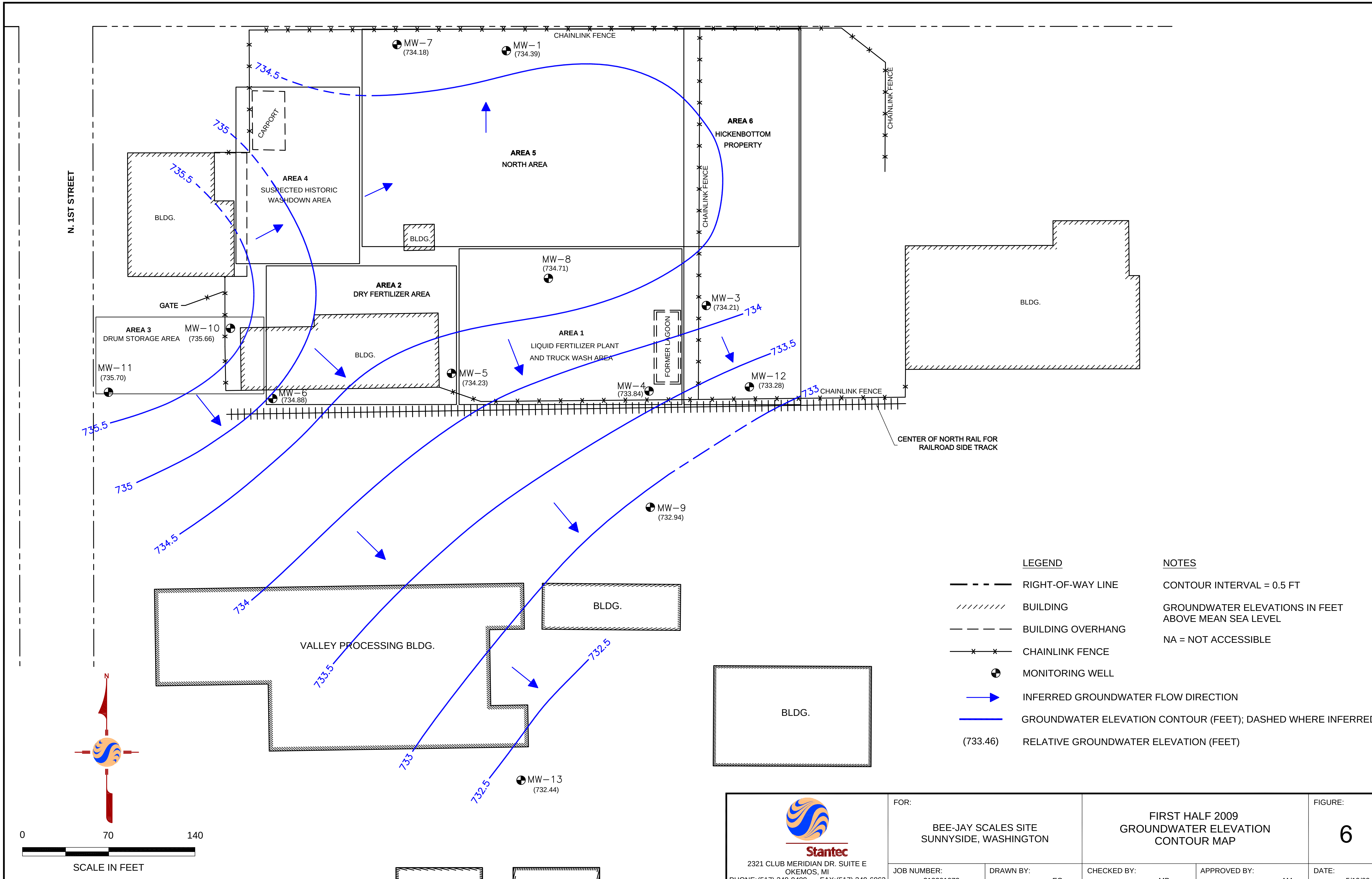
FOR:
BEE-JAY SCALES SITE
SUNNYSIDE, WASHINGTON

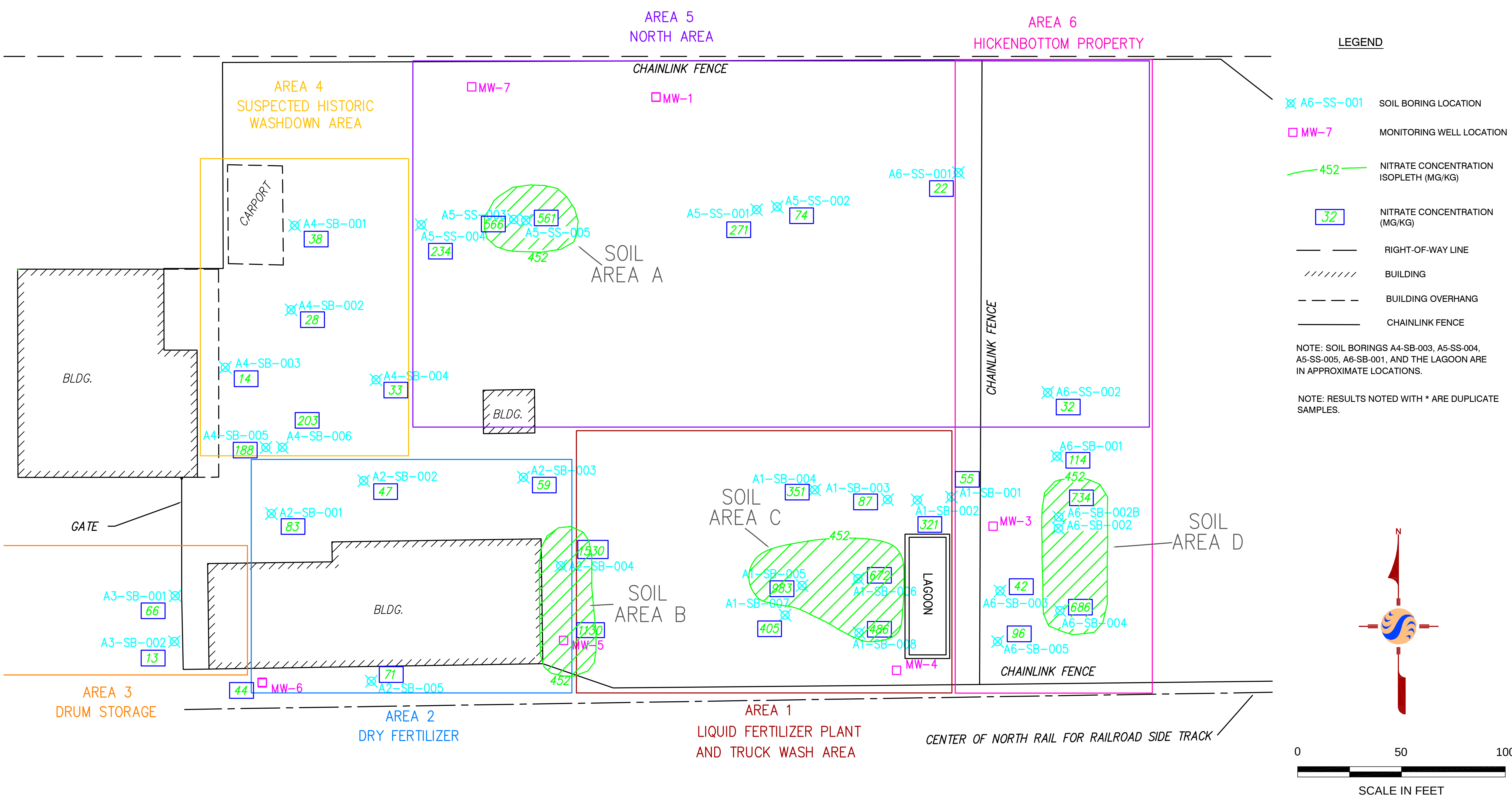
OFF-PROPERTY BORING LOCATIONS FROM PHASE III REMEDIAL INVESTIGATION

FIGURE: **5**

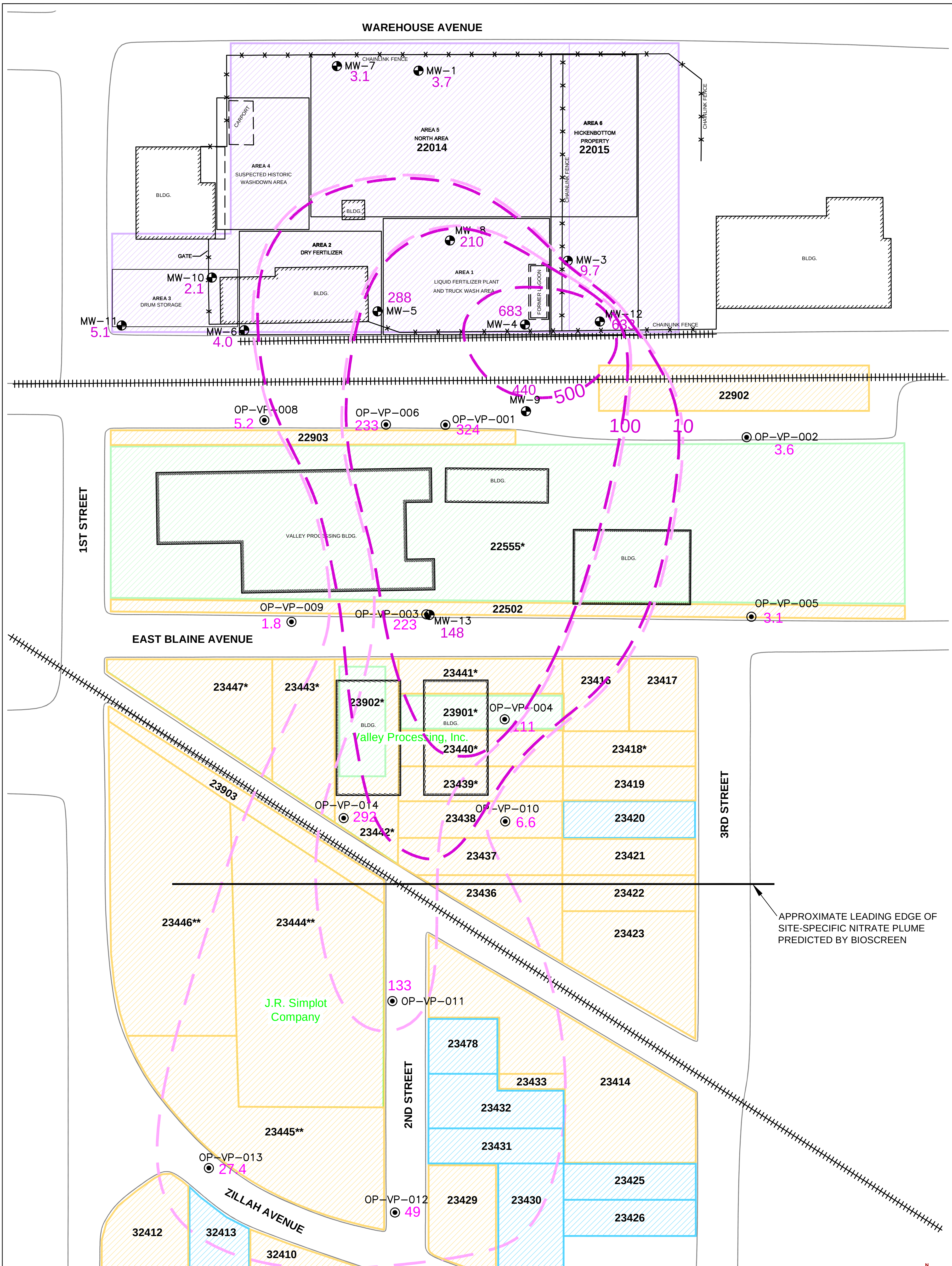
JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
213201072	SRW	BAL	MRP	5/19/09

FILEPATH:P:\Chevron\Bee-Jay Scales\Feasibility Study Report\Figures\Drawings\Fig 5_OffSite Boring Location Phase III.dwg|eomalley|Sep 24, 2009 at 15:16|Layout: Fig 5


N. 1ST STREET
CHAINLINK FENCE
MW-7
(734.18)
MW-1
(734.39)
734.5
735
735.5
CARPORT
AREA 4
SUSPECTED HISTORIC
WASHDOWN AREA
AREA 5
NORTH AREA
AREA 6
HICKENBOTTOM
PROPERTY
CHAINLINK FENCE
CHAINLINK FENCE
BLDG.
BLDG.
AREA 2
DRY FERTILIZER AREA
MW-8
(734.71)
GATE
AREA 3
DRUM STORAGE AREA
MW-10
(735.66)
MW-11
(735.70)
BLDG.
MW-6
(734.88)
MW-5
(734.23)
AREA 1
LIQUID FERTILIZER PLANT
AND TRUCK WASH AREA
FORMER LAGOON
MW-4
(733.84)
MW-3
(734.21)
734
733.5
MW-12
(733.28)
733
CHAINLINK FENCE
BLDG.
CENTER OF NORTH RAIL FOR
RAILROAD SIDE TRACK
735.5
735
734.5
MW-9
(732.94)
734
VALLEY PROCESSING BLDG.
BLDG.
733.5
732.5
BLDG.
733
732.5
MW-13
(732.44)
N
0
70
140
SCALE IN FEET
LEGEND
RIGHT-OF-WAY LINE
BUILDING
BUILDING OVERHANG
CHAINLINK FENCE
MONITORING WELL
INFERRED GROUNDWATER FLOW DIRECTION
GROUNDWATER ELEVATION CONTOUR (FEET); DASHED WHERE INFERRED
(733.46) RELATIVE GROUNDWATER ELEVATION (FEET)
NOTES
CONTOUR INTERVAL = 0.5 FT
GROUNDWATER ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL
NA = NOT ACCESSIBLE
Stantec
2321 CLUB MERIDIAN DR. SUITE E
OKEMOS, MI
PHONE:(517) 349-9499 FAX:(517) 349-6863
FOR:
BEE-JAY SCALES SITE
SUNNYSIDE, WASHINGTON
FIRST HALF 2009
GROUNDWATER ELEVATION
CONTOUR MAP
FIGURE:
6
JOB NUMBER: 213201072
DRAWN BY: EO
CHECKED BY: MP
APPROVED BY: AM
DATE: 5/19/09



Stantec 2321 Club Meridian Dr., Suite E Okemos, MI PHONE: (517) 349-9499 FAX: (517) 349-6863	FOR: BEE JAY SCALES SITE SUNNYSIDE, WASHINGTON	NITRATE CONCENTRATION IN SOIL DEPTH 0.5 - 4.5 FEET	FIGURE: 7
	JOB NUMBER: 213201072 / DRAWN BY: EEO	CHECKED BY: HMS / APPROVED BY: MRP	DATE: 5/19/09



LEGEND

///////////	BUILDING
— — —	BUILDING OVERHANG
—×—×—	CHAINLINK FENCE
++++++++	RAILROAD TRACKS
◐	MONITORING WELL
⦿	VERTICAL PROFILE BORING
— — (magenta)	CONTOURS FOR SITE-SPECIFIC NITRATE PLUME
— — (pink)	CONTOURS FOR COMBINED NITRATE PLUME
(purple hatch)	SITE
(blue hatch)	RESIDENTIAL PROPERTIES
(orange hatch)	COMMERCIAL PROPERTIES
(green hatch)	INDUSTRIAL PROPERTIES
23445	PARCEL ID NUMBER

NOTES:

CONCENTRATIONS IN MILLIGRAMS PER LITER (mg/L)
THE MAXIMUM CONCENTRATIONS FROM THE VERTICAL PROFILE BORINGS WERE USED TO GENERATE THE ISOCONCENTRATIONS.
RESULTS AT MW-1 AND MW-3 THROUGH MW 13 FROM SAMPLING EVENT IN MARCH 2009.
RESULTS AT OP-VP-001 THROUGH OP-VP-013 FROM SAMPLING EVENT IN MARCH AND MAY 2007.
RESULTS AT OP-VP-014 FROM SAMPLING EVENT IN MARCH 2008.
THE TOWN RANGE SECTION FOR ALL PARCELS IS 221025.
* PARCEL OWNED BY VALLEY PROCESSING, INC.
** PARCEL OWNED BY J.R. SIMPLOT COMPANY.

0 100 200
SCALE IN FEET

Stantec
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OKEMOS, MI
PHONE: (517) 349-9499 FAX: (517) 349-6863

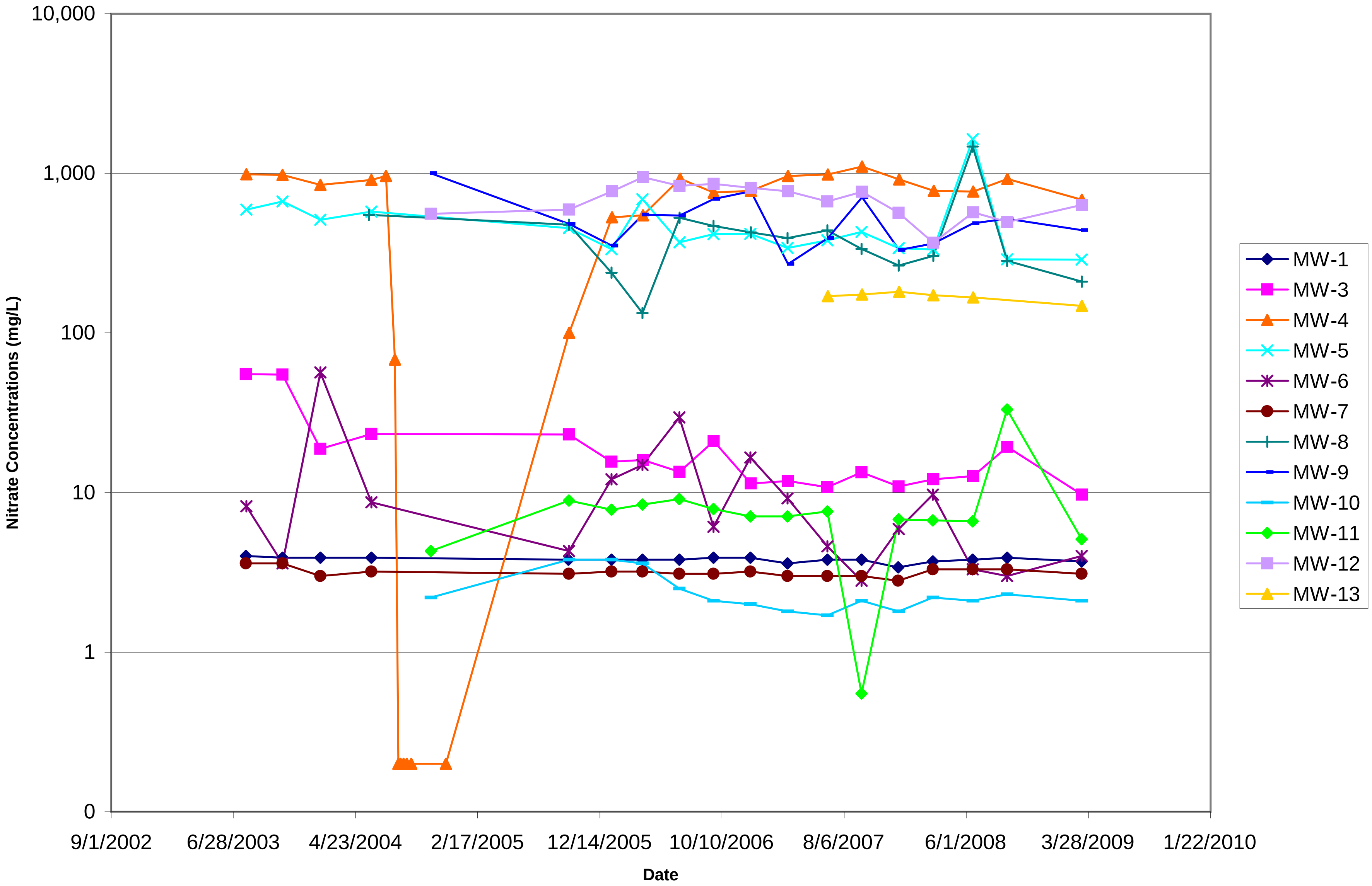
FOR: BEE-JAY SCALES SITE
SUNNYSIDE, WASHINGTON

NITRATE ISOCONCENTRATION AND ZONING MAP

FIGURE: 8

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
213201072	SW	EO	HS	5/19/09

Figure 9
Nitrate Concentrations versus Time
Bee-Jay Scales Site
Sunnyside, Washington



Appendix A

Ecology Comments On Feasibility Study Report

AUG 31 2009

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
15 West Yakima Avenue, Suite 200 • Yakima, Washington 98902-3452 • (509) 575-2490

August 26, 2009

Ms. Marisa Patterson, P.E.
Stantec Consulting Corporation
2321 Club Meridian Drive, Suite E
Okemos, MI 48864

RE: Comments on *Feasibility Study Report* for the Bee-Jay Scales Site (FS ID #504)

Dear Ms. Patterson:

On June 26, 2009, the Washington State Department of Ecology (Ecology) received the *Feasibility Study Report* for Agreed Order # DE 02TCPCR-3932. I have reviewed the report and have the following comments:

1. Ecology recommends that the terms "off-site" be changed to "off-property." The definition of "site" or "facility" in WAC 173-340, the Model Toxics Control Act (MTCA) is, "…any site or area where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located."

2. Even though the Site may be designated for industrial land use, a terrestrial ecological evaluation in accordance with WAC 173-340-7490 must be completed for the site, or it must be shown that the site qualifies for an exclusion from a terrestrial ecological evaluation in accordance with WAC 173-340-7491.

3. *Table 3: Applicable or Relevant and Appropriate Requirements.* An additional requirement that wasn't discussed during Development and Screening of Remedial Alternatives is the completion of a State Environmental Policy Act (SEPA) checklist. This will need to be added to the table and completed prior to cleanup activities.

Please contact me at (509) 454-7835 if you have any questions about this letter.

Sincerely,

Brianne Plath

Brianne Plath
Site Manager
Toxics Cleanup Program

cc: Caryl Weekley, Chevron
Kyle Christie, Atlantic Richfield Company

Appendix B

Simplified Terrestrial Ecological Evaluation - Exposure Analysis Procedure

Table 749-1

Simplified Terrestrial Ecological Evaluation-Exposure Analysis Procedure

Estimate the area of contiguous (connected) undeveloped land on the site or within 500 feet of any area of the site to the nearest 1/2 acre (1/4 acre if the area is less than 0.5 acre).	
1) From the table below, find the number of points corresponding to the area and enter this number in the field to the right.	
Area (acres) — Points 0.25 or less — 4 0.5 — 5 1.0 — 6 1.5 — 7 2.0 — 8 2.5 — 9 3.0 — 10 3.5 — 11 4.0 or more — 12	11
2) Is this an industrial or commercial property? If yes, enter a score of 3. If no, enter a score of 1	3
3)[a] Enter a score in the box to the right for the habitat quality of the site, using the following rating system[b]. High=1, Intermediate=2, Low=3	3
4) Is the undeveloped land likely to attract wildlife? If yes, enter a score of 1 in the box to the right. If no, enter a score of 2.[c]	2
5) Are there any of the following soil contaminants present: Chlorinated dioxins/furans, PCB mixtures, DDT, DDE, DDD, aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor, benzene hexachloride, toxaphene, hexachlorobenzene, pentachlorophenol, pentachlorobenzene? If yes, enter a score of 1 in the box to the right. If no, enter a score of 4.	4
6) Add the numbers in the boxes on lines 2-5 and enter this number in the box to the right. If this number is larger than the number in the box on line 1, the simplified evaluation may be ended.	12

Notes for Table 749-1

[a] It is expected that this habitat evaluation will be undertaken by an experienced field biologist. If this is not the case, enter a conservative score of (1) for questions 3 and 4.

[b] **Habitat rating system.** Rate the quality of the habitat as high, intermediate or low based on your professional judgment as a field biologist. The following are suggested factors to consider in making this evaluation:

> **Low:** Early successional vegetative stands; vegetation predominantly noxious, nonnative, exotic plant species or weeds. Areas severely disturbed by human activity, including intensively cultivated croplands. Areas isolated from other habitat used by wildlife.

High: Area is ecologically significant for one or more of the following reasons: Late-successional native plant communities present; relatively high species diversity; used by an uncommon or rare species; priority habitat (as defined by the Washington Department of fish and Wildlife); part of a larger area of habitat where size or fragmentation may be important for the retention of some species.

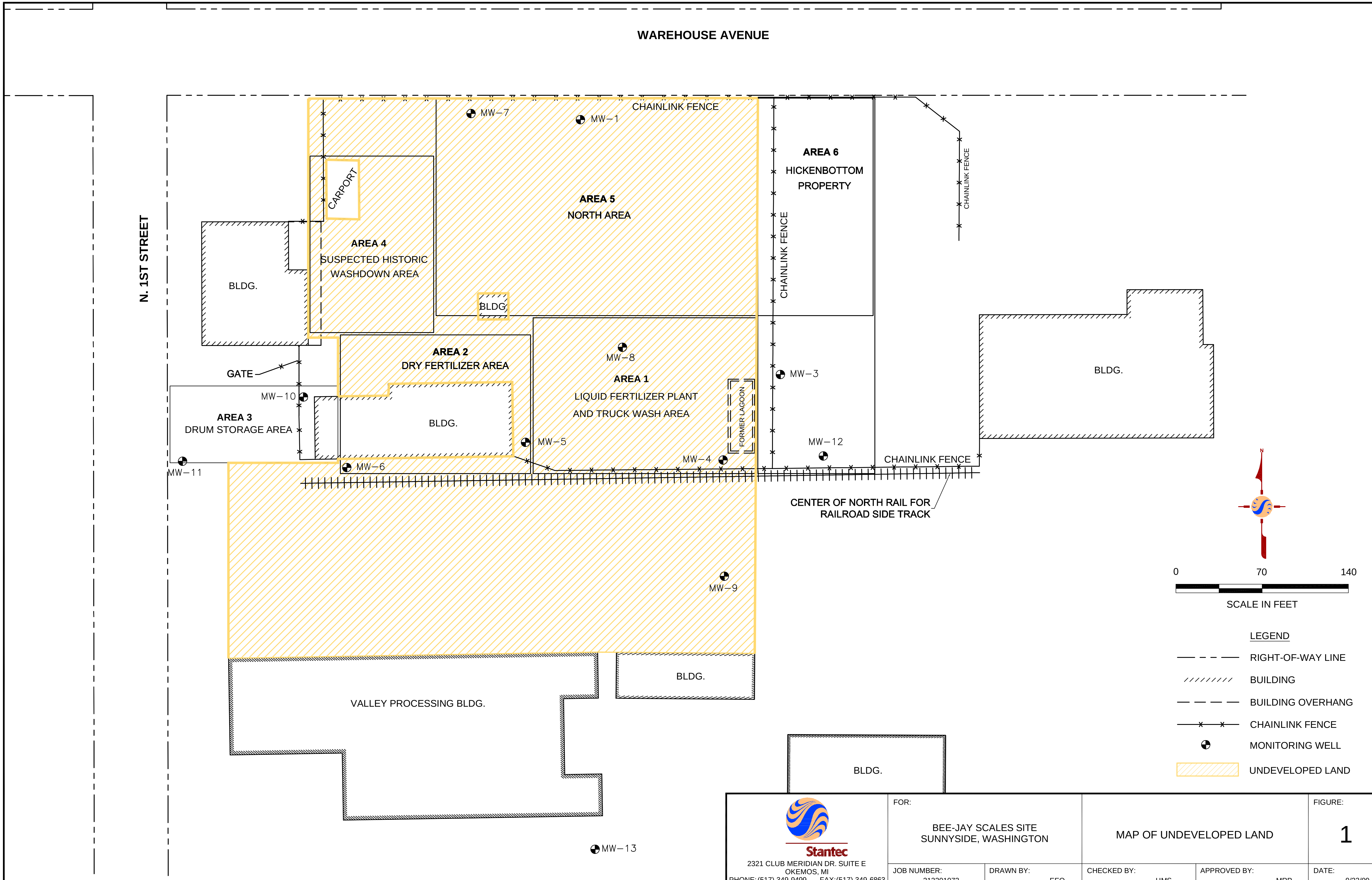
Intermediate: Area does not rate as either high or low.

[c] Indicate "yes" if the area attracts wildlife or is likely to do so. Examples: Birds frequently visit the area to feed; evidence of high use b mammals (tracks, scat, etc.); habitat "island" in an industrial area; unusual features of an area that make it important for feeding animals; heavy use during seasonal migrations.

[Area Calculation Aid] [Aerial Photo with Area Designations] [TEE Table 749-1] [Index of Tables]

[Exclusions Main] [TEE Definitions] [Simplified or Site-Specific?] [Simplified Ecological Evaluation] [Site-Specific Ecological Evaluation] [WAC 173-340-7493]

[TEE Home]


WAREHOUSE AVENUE
N. 1ST STREET
CHAINLINK FENCE
MW−7
MW−1
AREA 6
HICKENBOTTOM
PROPERTY
CHAINLINK FENCE
CHAINLINK FENCE
CARPORT
AREA 5
NORTH AREA
AREA 4
SUSPECTED HISTORIC
WASHDOWN AREA
BLDG.
BLDG.
BLDG.
AREA 2
DRY FERTILIZER AREA
MW−8
MW−3
GATE
AREA 1
LIQUID FERTILIZER PLANT
AND TRUCK WASH AREA
MW−10
AREA 3
DRUM STORAGE AREA
BLDG.
FORMER LAGOON
MW−5
MW−12
MW−4
CHAINLINK FENCE
MW−11
MW−6
CENTER OF NORTH RAIL FOR
RAILROAD SIDE TRACK
MW−9
0
70
140
SCALE IN FEET
LEGEND
RIGHT-OF-WAY LINE
BUILDING
BUILDING OVERHANG
CHAINLINK FENCE
MONITORING WELL
UNDEVELOPED LAND
BLDG.
VALLEY PROCESSING BLDG.
BLDG.
MW−13
Stantec
2321 CLUB MERIDIAN DR. SUITE E
OKEMOS, MI
PHONE: (517) 349-9499 FAX: (517) 349-6863
FOR:
BEE-JAY SCALES SITE
SUNNYSIDE, WASHINGTON
MAP OF UNDEVELOPED LAND
FIGURE:
1
JOB NUMBER:
213201072
DRAWN BY:
EEO
CHECKED BY:
HMS
APPROVED BY:
MRP
DATE:
9/23/09

Appendix C

Model Restrictive (Environmental) Covenant

Model Restrictive (Environmental) Covenant

After Recording Return to:
____
Department of Ecology
[fill in regional address]

Environmental Covenant

Grantor: **[land owner]**
Grantee: State of Washington, Department of Ecology
Legal: **[fill in brief legal description]**
Tax Parcel Nos.: **[fill in]**
Cross Reference: **[if amendment, recording number of original covenant]**

Grantor, _____**[land owner]**_______, hereby binds Grantor, its successors and assigns to the land use restrictions identified herein and grants such other rights under this environmental covenant (hereafter "Covenant") made this day of ____________, 200__ in favor of the State of Washington Department of Ecology (Ecology). Ecology shall have full right of enforcement of the rights conveyed under this Covenant pursuant to the Model Toxics Control Act, RCW 70.105D.030(1)(g), and the Uniform Environmental Covenants Act, 2007 Wash. Laws ch. 104, sec. 12.

This Declaration of Covenant is made pursuant to RCW 70.105D.030(1)(f) and (g) and WAC 173-340-440 by [NAME OF PROPERTY OWNER], its successors and assigns, and the State of Washington Department of Ecology, its successors and assigns (hereafter "Ecology").

A remedial action (hereafter "Remedial Action") occurred at the property that is the subject of this Covenant. The Remedial Action conducted at the property is described in the following document[s]:

[INSERT THE DATE AND TITLE FOR CLEANUP ACTION PLAN and other documents as applicable].

These documents are on file at Ecology's [Insert Office Location] Office.

+++++++Select the appropriate scenario for the property+++++++

SCENARIO 1:

This Covenant is required because the Remedial Action resulted in residual concentrations of [SPECIFICALLY LIST SUBSTANCE(S)] which exceed the Model Toxics Control Act Method [LIST APPLICABLE METHOD] Cleanup Level(s) for [SOIL, GROUNDWATER, ETC.] established under WAC 173-340-____.

++++and/or++++

SCENARIO 2:

This Restrictive Covenant is required because a conditional point of compliance has been established for [SOIL, GROUNDWATER, ETC.].SCENARIO 3:

If the Remedial Action does not fit within Scenarios 1 and/or 2 and you believe that the property still needs a Restrictive Covenant, contact the AG's office.

++

The undersigned, [NAME OF PROPERTY OWNER], is the fee owner of real property (hereafter "Property") in the County of [NAME OF COUNTY], State of Washington, that is subject to this Covenant. The Property is legally described [AS FOLLOWS: (insert legal description language)] -or- [IN ATTACHMENT A OF THIS COVENANT AND MADE A PART HEREOF BY REFERENCE (attach document containing legal description)].

[NAME OF PROPERTY OWNER] makes the following declaration as to limitations, restrictions, and uses to which the Property may be put and specifies that such declarations shall constitute covenants to run with the land, as provided by law and shall be binding on all parties and all persons claiming under them, including all current and future owners of any portion of or interest in the Property (hereafter "Owner").

Section 1. (This Section must describe with particularity the restrictions to be placed on the property.)

1. If the property was remediated to industrial soil cleanup standards, then use the following sentence: "The Property shall be used only for traditional industrial uses, as described in RCW 70.105D.020(23) and defined in and allowed under the [CITY -or- COUNTY] of [________________'s] zoning regulations codified in the [OFFICIAL NAME OF ZONING REGULATION] as of the date of this Restrictive Covenant."

2. If the groundwater contains hazardous substances above cleanup levels, then use the following sentence: "No groundwater may be taken for [LIST THE PROHIBITED USES, E.G., DOMESTIC, AGRICULTURAL, OR ANY USE] from the Property."

3. If the soil contains hazardous substances above cleanup levels, then describe prohibited activities as follows:

a. For contaminated soil under a structure use the following sentence: "A portion of the Property contains [SPECIFICALLY LIST SUBSTANCE(S)] contaminated soil located [SPECIFICALLY DESCRIBE WHERE THE SOIL IS LOCATED, I.E., UNDER THE SOUTHEAST PORTION OF BUILDING 10]. The Owner shall not alter, modify, or remove the existing structure[s] in any manner that may result in the release or exposure to the environment of that contaminated soil or create a new exposure pathway without prior written approval from Ecology."

b. Example language for contaminated soil under a cap: "Any activity on the Property that may result in the release or exposure to the environment of the contaminated soil that was contained as part of the Remedial Action, or create a new exposure pathway, is prohibited. Some examples of activities that are prohibited in the capped areas include: drilling, digging, placement of any objects or use of any equipment which deforms or stresses the surface beyond its load bearing capability, piercing the surface with a rod, spike or similar item, bulldozing or earthwork."

Section 2. Any activity on the Property that may interfere with the integrity of the Remedial Action and continued protection of human health and the environment is prohibited.

Section 3. Any activity on the Property that may result in the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Remedial Action, or create a new exposure pathway, is prohibited without prior written approval from Ecology.

Section 4. The Owner of the property must give thirty (30) day advance written notice to Ecology of the Owner's intent to convey any interest in the Property. No conveyance of title, easement, lease, or other interest in the Property shall be consummated by the Owner without adequate and complete provision for continued monitoring, operation, and maintenance of the Remedial Action.

Section 5. The Owner must restrict leases to uses and activities consistent with the Covenant and notify all lessees of the restrictions on the use of the Property.

Section 6. The Owner must notify and obtain approval from Ecology prior to any use of the Property that is inconsistent with the terms of this Covenant. Ecology may approve any inconsistent use only after public notice and comment.

Section 7. The Owner shall allow authorized representatives of Ecology the right to enter the Property at reasonable times for the purpose of evaluating the Remedial Action; to take samples, to inspect remedial actions conducted at the property, to determine compliance with this Covenant, and to inspect records that are related to the Remedial Action.

Section 8. The Owner of the Property reserves the right under WAC 173-340-440 to record an instrument that provides that this Covenant shall no longer limit use of the Property or be of any further force or effect. However, such an instrument may be recorded only if Ecology, after public notice and opportunity for comment, concurs.

[NAME OF GRANTOR]

____
[Name of Signatory]
[Title]

Dated: __________________

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

____
[Name of Person Acknowledging Receipt]
[Title]

Dated: __________________

[INDIVIDUAL ACKNOWLEDGMENT]

STATE OF ____________________
COUNTY OF __________________

On this ______ day of __________________, 20__, I certify that ______________ personally appeared before me, and acknowledged that **he/she** is the individual described herein and who executed the within and foregoing instrument and signed the same at **his/her** free and voluntary act and deed for the uses and purposes therein mentioned.

____
Notary Public in and for the State of
Washington, residing at ______________.
My appointment expires______________.

[CORPORATE ACKNOWLEDGMENT]

STATE OF ____________________
COUNTY OF __________________

On this ______ day of __________________, 20__, I certify that ______________ personally appeared before me, acknowledged that **he/she** is the ____________________ of the corporation that executed the within and foregoing instrument, and signed said instrument by free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that **he/she** was authorized to execute said instrument for said corporation.

____
Notary Public in and for the State of
Washington, residing at
_______________.
My appointment
expires_______________.

[REPRESENTATIVE ACKNOWLEDGEMENT]

STATE OF ____________________
COUNTY OF __________________

On this ______ day of __________________, 20__, I certify that ______________ ______ personally appeared before me, acknowledged that **he/she** signed this instrument, on oath stated that **he/she** was authorized to execute this instrument, and acknowledged it as the

___________________________ [type of authority] of _________________________ [name of party being represented] to be the free and voluntary act and deed of such party for the uses and purposes mentioned in the instrument.

____
Notary Public in and for the State of
Washington, residing at ______________.
My appointment expires ______________.

Exhibit A
Legal Description

Appendix D

Telephone Conversation Records

SECOR

Telephone Conversation Record

Date: 4-29-09 **Time:** 16:00

Project Name: Bee Jay Scales FS **Project Number:**

Phone Number: 509-575-2639 **Prepared By:** Heather Stevens

Call: ☐ Placed ☒ Received

Contact/Title: Avery Richardson, Contact for Well Construction in Central Region

Agency/Region: Dept. of Ecology, Water Resources, Wells-Licensing, Const & Reporting

Discussion: Avery called back & I asked him if Ecology's well construction/permitting department can prohibit the placement of wells in known areas of nitrate contamination. He said no - that this basically falls back on the PLP/PRP. Also well construction dept is not linked to MTCA resources so they don't have a way of knowing where exactly contamination exists. However, nitrate contam. of the shallow aquifer is very wide-spread + well-known throughout the state. Therefore, well drillers drill wells into a deeper aquifer to avoid potential liability concerns & there are standards for well construction (WAC 173-160) that set min depth @ 21' (seal 18'). There has been talk w/in the well construction department of regulating installation of wells within a large, delineated area of nitrate contamination - requiring these wells to be installed in the deeper aquifer. However, this is not yet in effect.

Action Required: Research WAC 173-160.
Call/interview local drilling company & City of Sunnyside.

cc:

	Telephone Conversation Record	ADMIN- 302
Stantec		Page 1 of 1
		Rev. 1.1 / Aug. 2008

Date: 5/7/09 **Time:** 14:10

Project Name: Bee-Jay Scales **Project Number:**

Phone Number: 509-966-7409 **Prepared By:** Erin O'Malley

Call: ☒ Placed ☐ Received

Contact/Title: Employee

Agency/Region: Water Wells Drilling

Discussion: I asked if they drill water wells for drinking and he said yes they do. I then asked if I told him that Ecology said that nitrate contamination of the shallow aquifer was well known in the area and he said he was aware of that. I asked if they only drill into the deeper aquifer for drinking water wells and he said that was true. Wells are not set in the shallow aquifer because that water is "brown" and "gross" and "yucky" and is contaminated. Wells are typically drilled to the second "layer" or deeper so that the customer gets clear water. I asked if someone asked them to drill into the shallow aquifer, would they do it or be able to do it and they said no. I believe this is more an internal policy than a regulation. When drilling into the deeper aquifer, bentonite is used to seal off the shallow

~~**Action Required:**~~ aquifer and prevent cross-contamination.

CC: ______ Page ____ of ____

Appendix E

Cost Summary

Cost Summary
Bee-Jay Scales Site
Sunnyside, Washington

COST ITEM	ON-SITE SOIL AND GROUNDWATER				OFF-PROPERTY GROUNDWATER	
	Remedial Alternative #1 No Action	Remedial Alternative #2 MNA of Soil and GW and ICs	Remedial Alternative #3 PRB, GWM, NA and Capping of Soil, and ICs	Remedial Alternative #4 *In Situ* Bioremediation, GWM, ICs, and Phytoremediation of GW (Optional Addition)	Remedial Alternative #1 No Action	Remedial Alternative #2 MNA, ICs, Contingency Plan
Implementation	--	$40,676	$674,401	$514,173	--	$37,245 to $89,245**
Yearly OMM (Today's Dollars)	--	$35,745	$43,702 to $51,966*	$35,745 to $51,613*	--	$11,245
Total w/NPW	--	$1,455,044	$1,692,544	$1,112,770	--	$482,192 to $534,192**
Contingency Plan Total w/NPW	--	--	--	--	--	$70,595 to $211,786**

Notes:
MNA = Monitored Natural Attenuation
GW = Groundwater
ICs = Institutional Controls
PRB = Permeable Reactive Barrier
GWM = Groundwater Monitoring
NA = Natural Attenuation
OMM = Operations, maintenance, and monitoring
NPW = Net present worth
Costs are net present worth assuming 2% inflation
* Yearly OMM costs vary by year due to quarterly monitoring in years 1 and 2 compared with semi-annual monitoring in years 3+.
** Low end of range = costs for 13 off-property parcels within site-specific nitrate plume. High end of range = costs for 39 off-property parcels within the combined nitrate plume.