B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR)

Prepared for

B&L Custodial Trust
606 Columbia Street NW, Suite 212
Olympia, Washington 98501

Prepared by

Floyd|Snider
Two Union Square
600 Union Street, Suite 601
Seattle, Washington 98101

AMEC Geomatrix
600 University Street, Suite 1020
Seattle, Washington 98101

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FINAL

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List of Acronyms and Abbreviations

Acronym/Abbreviation	**Definition**
AMEC	AMEC Geomatrix, Inc.
APE	Area of Potential Effect
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	Below ground surface
CAA	Cleanup Action Area
CAP	Cleanup Action Plan
CBN/T Site	Commencement Bay Nearshore/Tideflats Superfund Site
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminant of concern
CPT	Cone penetrometer testing
CRWP	Cultural Resources Work Plan
CUL	Cleanup level
DAHP	Washington State Department of Archaeology and Historic Preservation
Decree	Consent Decree
DOC	Dissolved organic carbon
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
FS	Feasibility Study
GAE	Groundwater Alternatives Evaluation
GIWP	Geotechnical Investigation Work Plan
GRWP	Groundwater Remediation Work Plan
HRA`	Historical Research Associates, Inc.
I-5	Interstate 5
ICMP	Interim Compliance Monitoring Plan
KJC	Kennedy/Jenks/Chilton
LEL	Lower explosive limit
Landfill	B&L Landfill

Acronym/Abbreviation	**Definition**
LFG	Landfill gas
MTCA	Washington State Model Toxics Control Act
Murray	Murray Pacific Corporation
NHPA	National Historic Preservation Act
OMI&MP	Operations, Monitoring, Inspection, and Maintenance Plan
PLP	Potentially liable party
POC	Point of Compliance
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAO	Remedial Action Objective
RI	Remedial Investigation
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SEPA	State Environmental Policy Act
Site	B&L Woodwaste Site
SOW	Scope of Work
SR	State Route
TDS	Total dissolved solids
Tribe	Puyallup Tribe of Indians
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

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1.0 Introduction

In response to documented releases from the B&L Woodwaste Site (Site), the Washington State Department of Ecology (Ecology) has issued a Final Cleanup Action Plan (2008 CAP, Ecology 2008) to remediate contaminated groundwater and achieve compliance with regulatory requirements established under the Washington State Model Toxics Control Act (MTCA). The 2008 CAP remedy will provide a comprehensive, long-term solution to protect human health and the environment for Site contamination.

Initial implementation of the 2008 CAP is covered under the terms of Consent Decree No. 08 210610 7 (Consent Decree; Ecology vs. Murray 2008a) between Ecology and Murray Pacific Corporation (MPC). As described in the Scope of Work (SOW, Exhibit B to the Consent Decree), the 2008 CAP will be implemented in three major phases. Phases 1 and 2 include additional Site investigation, testing, collection of design data, design, construction, and startup for all elements of the remedy; these implementation phases will be performed under the Consent Decree. Phase 3 includes long-term operations, maintenance, and monitoring for the Site; this implementation phase will be performed after completing the work covered under the Consent Decree. As specified in the Consent Decree, upon completion of Phases 1 and 2, Ecology will assume complete responsibility for implementation of Phase 3. The three phases comprise the complete remedy specified in the 2008 CAP.

The remedial actions to be implemented at the B&L Site involve different technologies on different sections of the Site. For this reason, the remedy design and construction will occur in sections or phases as follows:

- **Phase 1:** Part 1 focuses on source control on the Landfill site itself and includes the construction of the slurry wall containment system and associated structures such as the interceptor trench.
- **Phase 1:** Part 2 focuses on the End-of-Plume Cleanup Action Area (CAA) and is intended to halt the migration of arsenic at 12th Street East.
- **Phase 2:** This phase addresses remediation of groundwater contamination that exists outside the footprint of the Landfill (where source control has now blocked future releases) and upgradient of the End-of-Plume CAA (where further migration has also been blocked).

Ecology work in Phase 3 may also be incorporated into this Engineering Design Report (EDR) in the future.

To support the work to be completed under this phased approach, the EDR will be released to the public in discrete packets addressing the work elements noted above as follows:

- **Release 1:** The main body of the EDR that describes the Site and the planned remedial actions plus Addendum 1, which contains a detailed description of the work to be performed in Phase 1, Part 1: the Barrier Wall and Groundwater Interception Trench.

- **Release 2:** Addendum 2 which contains the detailed description of the work to be performed in Phase 1, Part 2: the End-of-Plume In-situ Treatment System.
- **Release 3 and beyond:** Additional releases, referred to as Addenda, will be developed as appropriate during Phase 2 to address the residual groundwater contamination and hydraulic control of groundwater beneath the Landfill. Future addenda may also be identified or developed by Ecology to address long-term operations, maintenance, or monitoring activities.

This EDR outlines general plans as required under the Consent Decree and in accordance with Washington Administrative Code (WAC) 173-340-400(4)(a). More specific engineering designs for remedy components are provided in the Addenda to this EDR.

1.1 PURPOSE AND SCOPE OF CLEANUP MEASURES

As described in the 2008 CAP, the cleanup action has been separated to address three CAAs as defined in the 2008 CAP and as shown on Figure 1.1. The cleanup action proposed by in the 2008 CAP (Ecology vs. Murray 2008a) for each area includes the following:

- **Landfill/Ditch CAA**. Installation of a perimeter slurry wall around the Landfill that is tied into both the existing Landfill cap and a low permeability soil unit located below the Landfill, the diversion of clean surface water and groundwater before it reaches the slurry wall, and the extraction and treatment of leachate from within the slurry wall to maintain hydraulic control by creating an inward hydraulic flow gradient. Once the slurry wall is installed, contaminated sediments in the adjacent agricultural drainage ditches will be excavated and disposed of at a permitted landfill.
- **Wetlands CAA.** A groundwater pump and treat system will be used to remove arsenic from the groundwater plume in the Wetlands CAA. Performance-based criteria will be used to assure compliance with MTCA requirements. It is anticipated that up to 120 million gallons of water may require treatment.
- **End-of-Plume CAA.** In-situ treatment will be used to precipitate out dissolved arsenic followed by monitored natural attenuation of groundwater that reaches 12th Street East. Performance-based criteria will be used to assure compliance with MTCA requirements. Only a thin layer of arsenic-contaminated groundwater remains above the cleanup level in the End-of-Plume CAA; without treatment this area would likely come into compliance as the effect of cleanups in the Landfill and Wetlands CAAs reached the End-of-Plume CAA. Treatment in the End-of-Plume CAA is, therefore, intended to reduce the restoration time frame by bringing the area into compliance within 2 to 5 years; although treatment will be continued as long as needed based on the performance criteria.

Definitions

A few additional definitions are useful moving forward.

The Site: Under the definitions specified in the MTCA regulations, the Site is defined as the source area where releases to the environment occurred (i.e., the B&L Woodwaste Landfill) and all areas that have been contaminated by those releases. Therefore, all three of the CAAs are contained within the Site.

The Landfill: The B&L Woodwaste Landfill (the Landfill) is an approximately 13-acre area on which woodwaste materials mixed with Asarco slag have been placed and covered by an engineered cap. The demarcation of the Landfill is based on the presence of refuse, in this case, wood debris and slag.

The B&L Property: The Landfill sits on a larger property (18.5 acres) that is privately owned by the party who developed the Landfill. The Landfill CAA is contained within the B&L Property.

The Wetlands: Unless otherwise indicated in specific sections of the document, the term “the Wetlands” refers to the wetlands located north of the Landfill that have become contaminated by a plume of arsenic contaminated groundwater coming from the Landfill. The Wetlands areas impacted by contaminated groundwater are owned by several different owners that include municipalities and private parties. The Wetlands and End-of-Plume CAA are contained within the Wetlands.

The Halo: In addition to the downgradient plume of arsenic contaminated groundwater, there are various localized areas of groundwater contamination that are close to the footprint of the Landfill. These areas are referred to collectively as “the Halo.” Their locations are described in future detail in later sections of the EDR.

1.2 OVERVIEW OF 2008 CLEANUP ACTION

The cleanup action addressed by this EDR comprehensively addresses the B&L Woodwaste Site, as defined in the Consent Decree. The cleanup action will provide physical and hydraulic containment for waste and contaminated groundwater within and beneath the Landfill. Groundwater contamination beneath the Wetlands area immediately north of the Landfill and in areas to the east, south, and west of the Landfill will be remediated to attain the cleanup levels specified in the 2008 CAP. Groundwater at the leading edge of the plume, designated as the End-of-Plume area, will be treated to attain cleanup levels. Finally, contaminated sediment in ditches associated with the Landfill will be removed to ensure the ditches attain cleanup levels.

Specific cleanup actions for each of the CAAs are described below.

1.2.1 Landfill Cleanup Action Area

This CAA, as described in the CAP, includes the Landfill, the Halo area, and contaminated ditch sediment adjacent to and extending off the B&L Property. The planned cleanup action for the Landfill CAA includes the following elements:

1. A slurry wall around the entire perimeter of the Landfill, that is tied into the existing landfill cap above and, to the extent possible, the Lower Silt Aquitard beneath the

Landfill. The landfill cap, slurry wall, aquitard, and existing hydraulic gradients will work together to form a physical containment system for landfill materials, leachate, and contaminated groundwater beneath the Landfill.

2. An interceptor trench outside the slurry wall to redirect groundwater that historically would have flowed beneath the Landfill. The goal will be to prevent the build-up of groundwater in the Upper Sand Aquifer immediately upgradient of the Landfill to limit the contribution of groundwater to seasonal flooding of the area near the Landfill.
3. Hydraulic control will be maintained within the area contained by the slurry wall to prevent leakage of contaminated groundwater from the area. Hydraulic control will use groundwater extraction (followed by treatment and discharge) to augment the existing hydraulic gradients.
4. The groundwater extraction system within the slurry wall will be designed to dewater the saturated Landfill waste if this is determined by Ecology to be practicable.
5. As defined in the 2008 CAP, the Halo areas, which consist of contaminated groundwater located adjacent to or very near the Landfill, will be remediated by extraction and treatment of the contaminated groundwater. The groundwater extracted from the Halo will be treated and discharged with groundwater recovered from beneath the Landfill.
6. The agricultural ditches identified in the 2008 CAP will be cleaned by excavation of contaminated sediments. Excavated sediment will be disposed of in accordance with applicable Ecology regulations.
7. A Conditional Point of Compliance (CPOC) has been established at the perimeter of the landfill cap (which corresponds to the edge of refuse), as described in the 2008 CAP.
8. Performance monitoring of the containment system will be accomplished by a network of paired piezometers located inside and outside the slurry wall. The performance monitoring network will be installed and baseline measurements will be collected following barrier wall installation. Performance monitoring will consist of a discrete period to assess the initial effectiveness of the containment system following startup of the groundwater extraction and treatment systems. After system performance is confirmed, hydraulic measurements will continue as part of long-term compliance monitoring.
9. Compliance monitoring wells and piezometers will be installed and monitored as needed to confirm attainment of the cleanup standard and to monitor performance of the slurry wall, hydraulic control system, and other remedy components.

Implementation Phases

Phase 1 Part 1 of the implementation process will include items 1, 2, and 8. Baseline conditions of item 9 will also be included in Phase 1 Part 1. The other components of the Landfill/Ditch CAA will be implemented during Phase 2, as described in further detail in later sections of this report.

1.2.2 Wetlands Cleanup Action Area

This CAA includes the Wetlands area to the west and north of the Landfill CAA that overlies groundwater that has been impacted by releases from the Landfill. Following the Final Arsenic Characterization Study conducted in 2008 (refer to Appendix A), this area was modified to accurately reflect the extent of the groundwater plume. The boundaries of the Wetlands CAA shown on Figure 1.1 (from the CAP) do not reflect the correct extent of the plume to the west. Further investigation in this area is planned for 2009 to better define the area that will be remediated.

The cleanup action for the Wetlands CAA specified in the 2008 CAP includes the following elements:

- Pumping of groundwater from the Upper Sand Aquifer beneath the Wetlands in the core of the plume.
- Treatment of the pumped groundwater to remove arsenic.
- Re-infiltration of treated groundwater into existing stormwater ponds or back into the Wetlands.
- Monitoring of groundwater quality in the Wetlands CAA to document eventual attainment of cleanup levels.

The intent of the cleanup action for the Wetlands CAA, as specified in the 2008 CAP, is to install a number of pumping wells to remove arsenic-contaminated groundwater with a goal of achieving cleanup levels. Many years of pumping and treatment will likely be required; the ultimate achievement of the arsenic cleanup level (set equal to background arsenic concentrations) may not be possible. The extracted groundwater will be piped to the treatment system used to treat groundwater extracted from the Landfill CAA.

The goal for cleanup of the Wetlands CAA is to meet the groundwater CUL of 5 µg/L. According to the 2008 CAP, an alternative treatment technology may be considered to achieve this goal if Ecology considers it appropriate.

Implementation Phases

Remedy implementation for the Wetlands CAA is planned for Phase 2.

1.2.3 End-of-Plume Cleanup Action Area

This CAA consists of the Wetlands area near 12th Street East to the north of the Wetlands CAA, which comprises the leading edge of impacted groundwater. The cleanup action for the Wetlands CAA contains the following elements:

- In situ treatment of contaminated groundwater to irreversibly precipitate the dissolved arsenic, preventing future migration.

- Monitoring of groundwater quality to ensure attainment of cleanup levels within the End-of-Plume CAA.

This will be accomplished along the 12th Street East right-of-way. Treatment reagents will be injected into the base of the aquifer where natural conditions are already reducing and favorable for the microbial reactions that will cause the arsenic to irreversibly precipitate. Compliance monitoring wells will be installed downgradient of the 12th Street East right-of-way to monitor the success of the remedy and confirm compliance with Site arsenic cleanup levels.

Implementation Phases

This work will be implemented as Phase 1 Part 2.

1.3 CLEANUP GOALS AND PERFORMANCE REQUIREMENTS

1.3.1 Landfill/Ditch Cleanup Action Area

Remedial Action Objectives

Since the installation of the 1993 remedy, the exposure pathways from the Landfill are limited to the migration of arsenic-contaminated groundwater beyond the perimeter of the Landfill and into the surrounding ditches and adjacent Wetlands area. The drainage ditch system along the perimeter of the Landfill presents potential exposure pathways to terrestrial receptors (animals and birds) and occasional recreational human users. Both groups would come into incidental direct contact with the surface water and sediments. Since water from the ditches eventually drains into Hylebos Creek, there is also the potential for contamination from the perimeter ditches to reach Hylebos Creek, although current data indicate that this has not happened since the 1993 remedy was implemented.

The following Remedial Action Objectives (RAOs) apply to this action area:

- Meet MTCA threshold requirements, as defined by WAC 173-340-760(6)(f) for containment remedies.
- Implement closure requirements from Minimum Functional Standards for Solid Waste Landfills (Chapter 173-304 WAC).
- Prevent arsenic-containing groundwater from migrating beyond the Landfill into adjacent wetlands and agricultural drainage ditches.
- Meet MTCA minimum requirements, including the use of a permanent solution to the maximum extent possible.
- Protect the sediment and surface water quality of Hylebos Creek (and associated restoration projects) from arsenic releases from the B&L Landfill.

Cleanup Levels

The cleanup level (CUL) for arsenic in soil is 20 mg/kg. The point of compliance for soil, as defined in WAC 173-304-462(2)(e)(i) and WAC 173-304-100, is limited to those soils that are outside the footprint of the Landfill containment area. Since this CAA only includes the Landfill footprint and surrounding ditches, this effectively means that the clean soil layer of the landfill cap must meet the soil CUL.

The CUL for arsenic in groundwater is 5 µg/L or the background level, whichever is higher. The groundwater CPOC is at the landfill cap perimeter areally (refer to Section 5.3 for additional details). A series of groundwater wells (many of which already exist) will be installed around the perimeter of the Landfill and will act to measure groundwater quality at the landfill cap perimeter. Monitoring at this point will be used to assess the successful implementation of source control at the Landfill.

The CUL for arsenic in sediment is 20 mg/kg and includes consideration for the protection of Hylebos Creek. The point of compliance for this area is throughout the ditch system.

The CUL for arsenic in surface water is 5 µg/L or the background level, whichever is higher. Because some of the surface water within the Landfill CAA comes from groundwater discharge (these are drainage ditches for seasonally flooded agricultural lands), the regional groundwater background concentration has been considered in establishing the surface water standard. The point of compliance for surface water is everywhere within the perimeter ditch system.

1.3.2 Wetlands Cleanup Action Area

Remedial Action Objectives

The potential exposure pathway for groundwater contaminants within the Wetlands CAA is due to discharge of arsenic-contaminated groundwater to the surface of the Wetlands CAA. Therefore, the RAOs for this CAA include the following objectives to prevent or minimize exposure of potential human or ecological receptors to groundwater within the Upper Sand Aquifer and surface water, as well as exposure to contaminated surface water in the Wetlands CAA. Wetlands CAA soils are not considered an exposure pathway because sampling of Wetlands CAA soils has determined them to be in compliance with CULs.

The following RAOs apply to this CAA:

- Meet MTCA threshold requirements, including protection of recreational, human, and ecological receptors from arsenic contamination that is seasonally present in ponded surface water, soil porewater, and groundwater.
- Meet MTCA minimum requirements, including the use of a permanent solution to the maximum extent practicable.
- Remove or control the potential for the groundwater plume in the Wetlands CAA to continue to migrate downgradient into the End-of-Plume CAA and discharge to surface water, within a reasonable restoration time frame.

- Ensure remediation activities in Wetlands CAA will be consistent with the potential restoration activities in the area associated with the Washington State Department of Transportation (WSDOT) SR 167 Project and potential Hylebos Creek relocation. Coordination with the WSDOT planning process is anticipated to ensure the selected alternative will not negatively impact the planned riparian restoration along Hylebos Creek.

Cleanup Levels

The CUL for groundwater in the Wetlands CAA is 5 µg/L. Soils in the Wetlands CAA already comply with the MTCA soil CUL of 20 mg/kg (Hydrometrics 2001). The point of compliance is the upper 15 feet of the Wetlands soils throughout the CAA.

1.3.3 End-of-Plume Cleanup Action Area

Remedial Action Objectives

Within the End-of-Plume CAA, there appears to be no current exposure to the thin seam of arsenic-contaminated groundwater at the base of the aquifer; therefore, the RAOs for this CAA are designed to prevent discharge of contaminated groundwater to Hylebos Creek. The following RAOs apply to this CAA:

- Meet MTCA threshold requirements, including considerations for the long-term potential for the plume to reach Hylebos Creek.
- Meet MTCA minimum requirements, including the use of a permanent solution to the maximum extent possible.
- Ensure that remediation activities in the End-of-Plume CAA will be consistent with the potential restoration activities in the area associated with the WSDOT SR 167 project and potential Hylebos Creek relocation. Coordination with the WSDOT planning process is anticipated to ensure the selected alternative will not negatively impact the planned riparian restoration along Hylebos Creek.

Cleanup Levels

Soils in the End-of-Plume CAA already comply with MTCA CULs. The CUL for arsenic in groundwater is 5 µg/L. Groundwater within the End-of-Plume CAA must comply with the CUL throughout the Upper Sand Aquifer.

1.4 RESPONSIBILITY FOR THE CLEANUP ACTION

The entity that is implementing the remedy does not own the Landfill property or any of the adjacent properties involved in the remedy. As described in the Consent Decree and Exhibit G to the Consent Decree, the entity that is implementing this cleanup action is the B&L Woodwaste Site Custodial Trust (Trust). The sole beneficiary of this Trust is Ecology. The

Trust is obligated to fulfill the Scope of Work as outlined in Exhibit B to the Consent Decree through Phase 2. Upon completion of Phase 2, Ecology will be obligated to conduct the long-term monitoring and maintenance phase of the remedy. At that point, the Trust will be dissolved.

1.5 REGULATORY REQUIREMENTS AND EDR ORGANIZATION

This EDR and the Addenda have been designed to fulfill MTCA regulatory requirements under WAC 173-340-400(a) and to accommodate the phased implementation program for this cleanup action described above. The generally applicable information is presented in the main body of this EDR in Sections 1.0 through 7.0. The main body of the EDR has been organized as follows:

- **Section 1.** General introductory information, an overview of the cleanup action, cleanup levels, and cleanup scope and objectives.
- **Section 2.** A description of the B&L Property, property ownership, Site physical description, land use, and historical cleanup actions.
- **Section 3.** Summaries of the Site geologic, hydrogeologic, and climate conditions.
- **Section 4.** Summaries of the predesign studies completed under the Groundwater Remediation Work Plan (GRWP) in 2008, with complete reports for additional site characterization, geotechnical characterization, the hydrogeologic study, the Wetlands assessment, and the cultural resources evaluation appended to this EDR.
- **Section 5.** An outline of the long-term monitoring program to be implemented after completing remedial construction.
- **Section 6.** A general description of considerations for institutional controls to be implemented during Phase 2.
- **Section 7.** A summary of the overall CAP implementation approach and projected schedule.
- **Section 8**. Tabulations of references used in this report.

As noted above, several Addenda will be added to this EDR as future phases of the CAP implementation proceed. These Addenda will provide the detailed technical information and plans to address the technical regulatory requirements under MTCA for each major construction component in the implementation program. Detailed information documenting compliance with WAC 173-340-400(a) is included in Section 1.1 of each Addendum attached to this EDR. This information includes a table citing the relevant regulatory requirements and referencing the relevant sections of this EDR and the Addendum that addresses the regulatory requirements. Plans and specifications addressing the requirements under WAC 173-340-400(b) will be prepared as attachments to the Addenda. They will be prepared in the same sequence as the Addenda, with the first set of plans and specifications addressing the Barrier Wall and Interceptor Trench. This approach will ultimately provide a complete and concise set of design and engineering documents addressing the full remedy specified in the final 2008 CAP.

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2.0 Site Description and Background

2.1 PHYSICAL SITE DESCRIPTION

The Site is located in Pierce County and consists of the B&L Property, the parcel on which the Landfill is situated, and adjacent areas that have been affected by releases from the Landfill. Portions of the Site extend into the city limits of Milton and Fife, Washington. Approximate Site boundaries based on the extent of contamination are illustrated on Figure 1.1. As described in the 2008 CAP, the Site includes the following areas:

- The B&L Woodwaste Landfill (Landfill) is an approximately 13-acre area on which wood waste materials have been placed and covered by an engineered cap. The Landfill contains an estimated volume of 350,000 cubic yards of wood waste material, over 95 percent of which is log yard deck debris consisting of soil, wood, rock, and slag.
- The B&L Property, which includes property on which the Landfill is located and is owned by the same party as the Landfill.
- Contaminated groundwater adjacent to the Landfill to the south, west, and north, and in a discrete area to the east of the Landfill, some of which extends beyond the B&L Property boundaries. These areas of contaminated groundwater include a plume that extends north from the Landfill beneath the Wetlands areas and beyond the 12th Street East right-of-way, and an area that extends northwest from the Landfill beneath the adjacent agricultural field and Interurban Trail.
- Contaminated ditch sediments adjacent to and extending to the west of the Landfill.

The B&L Property tax parcel is comprised of approximately 18.5 acres in unincorporated Pierce County, approximately 1/4 mile east of Interstate 5 (I-5) and 5 miles east of Tacoma. The property is situated in a residential and agricultural area in northern Pierce County. Farmland borders the western and southwestern edges of the B&L Property, and the Autumn Village Apartment complex adjoins the southeastern corner. Fife Way defines the southeastern boundary. Puget Power Access Road, which was very recently converted to a bicycle trail and is now known as the Interurban Trail (it also is referenced as Barth Road on some local maps) delineates the north side. The Interurban Trail and adjacent drainage ditches are located in the City of Milton. The pentagonal-shaped Landfill occupies approximately 13 acres of the 18.5 acre B&L Property and rises to an elevation of approximately 53 feet in elevation (NAVD 88).

To the north of the Landfill and Interurban Trail is former farmland that has re-established itself as a grassy wetland that stretches north and west to I-5. Portions of this wetland have been affected by releases from the Landfill and are, therefore, within the Site. This wetland area is located in unincorporated Pierce County. The wetland ground surface is flat and lies at approximately 13 feet in elevation (NAVD 88). During winter months, the ground is generally covered with shallow standing water. Several hundred feet north of the Interurban Trail is another roadway, 12th Street East, a primitive, unused, and now mostly overgrown road grade that cuts through the wetland, marking the boundary between the parcels.

2.2 SITE LAND USE

Historically, land surrounding the B&L Property has been used for agriculture; however, in recent years it has become increasingly developed, as has most of the land in northern Pierce County and southern King County. The B&L Property, wetlands, and 12th Street East parcels are zoned for moderate-density, single-family development (Pierce County 2008). The Interurban Trail is zoned as an open space district as part of the Interurban Trail project (City of Milton 2008).

The B&L Property is undeveloped and currently used only for ongoing monitoring, maintenance, and other remediation activities. The B&L Property is currently bordered by vacant and/or agricultural lands immediately to the south (farmed land), west (vacant and farmed lands,) and north (wetlands). Several of these wetlands and agricultural properties would be impacted by a major proposed WSDOT highway project, the completion of State Route (SR) 167 between SR 161 in North Puyallup and SR 509 in Tacoma (refer to Section 3.4.) East of the B&L Property is Fife Way East, which is a public road. To the south is a multi-unit residential apartment complex (Autumn Village Apartments, which was formerly Greenwood Apartments) built in the late-1980s. To the northeast lies a privately owned, unoccupied parcel of land previously occupied by a single private residence; according to public record, this property was the subject of permit applications in 2007 for development of 10 single-family homes.

2.3 SITE OWNERSHIP

It should be noted that neither the B&L Property, nor any other properties that comprise the Site, are owned by the entity performing the remedy, the B&L Custodial Trust (refer to Section 1.3).

The B&L Property is currently owned by Executive Bark, Inc., which is a dissolved corporation. Camille Fjetland was at one time an officer of Executive Bark and remained the sole shareholder when the corporation was administratively dissolved. Property taxes for the property have been paid by Ms. Fjetland through her attorney. Communications regarding the current activities on the Site have been conducted through her attorney.

Ownership of parcels in the vicinity of the B&L Property and that comprise the Site are illustrated on Figure 1.1. The City of Fife currently owns the agricultural fields to the south and west of the B&L Property. M-F Associates owns the wetland property directly to the north of the Interurban Trail. WSDOT owns the wetland parcels to the west and north of the M-F Associates parcel. The Autumn Village Apartments parcel to south of the Landfill is owned by GRE Greenwood LLC. Benaroya Capital Company, LLC owns the parcel along the northeast side of the B&L Property. The City of Milton owns the Interurban Trail and maintains the Fife Way easement. The 12th Street East unimproved easement is held by Pierce County.

2.4 SITE HISTORY AND PREVIOUS CLEANUP ACTIONS

Relevant elements of the detailed Site history presented in the GRWP are summarized here. The Landfill was operated beginning in the 1970s as a disposal site for deck debris from log sort yards operating in the Tacoma Tideflats area. The log sort yards operators used Asarco slag as roadway and yard ballast, believing it to be inert “rock.” This slag was mixed with the bark and dirt that was cleaned periodically from the log sort yards and transported to the Landfill for disposal.

Following the discovery by Ecology in the early 1980s that the slag at the yards and at the Landfill was leaching arsenic and other heavy metals at concentrations in exceedance of surface water standards, the Landfill was included as a source of metal contamination to Hylebos Waterway and the Commencement Bay Nearshore/Tideflats (CBN/T) CERCLA site by the U.S. Environmental Protection Agency (USEPA). In January 1988, Ecology sent notices to Potentially Responsible Parties (PLPs) under MTCA for contamination at the Landfill. A Consent Decree was negotiated in March 1989 to conduct a Remedial Investigation/Feasibility Study (RI/FS) and implement a cleanup remedy at the Site. The RI/FS was completed in September 1990 (Kennedy/Jenks/Chilton [KJC] and AGI 1990a and b) and a Cleanup Action Plan was issued in 1991 (1991 CAP; Ecology 1991).

In 1988, the owners of the log sort yard and the Port of Tacoma sued Asarco for slag-related contamination at the yards and at the Landfill. The court found Asarco liable for 79 percent of the costs to cleanup the Site, the Landfill operator for 14 percent (assigned equally to Eagle Trucking, Inc. and William Fjetland), and MPC responsible for the remaining 7 percent. The verdict and decision were affirmed on appeal in 1994.

2.4.1 1993 Remedial Action

Following the judgment in the federal lawsuit, Ecology issued an Enforcement Order (No. DE-91TC-S267) to Asarco, MPC, and Executive Bark, Inc. (care of Camille Fjetland, who is Mr. Fjetland’s widow) to develop preliminary designs for the remedial actions (RAs) identified in the 1991 Cleanup Action Plan (1991 CAP). In June 1992, Ecology issued another Enforcement Order (No. DE-92TC-S214) to Asarco, MPC, and Executive Bark, Inc. for construction, operation, and monitoring of the selected RA. Asarco and its consultant, Hydrometrics, Inc. (Hydrometrics), took the lead in implementing the remedy, which was substantially completed in 1993 (Hydrometrics 1994).

In the 1991 CAP (Ecology 1991), Ecology identified a selected remedial alternative for the Site consisting of the following elements:

- Consolidation of the Landfill to a less than 13-acre footprint.
- Installation of a multimedia Resource Conservation and Recovery Act (RCRA) cap or equivalent.
- Installation of a stormwater system, including a detention basin.
- Excavation of ditch sediments.
- Passive landfill gas controls.
- Placement of institutional controls (including barrier fencing around the Landfill and groundwater and surface water monitoring).
- Surface and groundwater monitoring.

- Contingency for groundwater actions, if needed in the future.

The remedy selected in the 1991 CAP was implemented in 1993. This cleanup action primarily consisted of consolidating and capping landfill materials with a multi-layer, RCRA-equivalent capping system; installing landfill gas collection wells; installing a leachate monitoring system; a stormwater collection pond and infiltration trenches; ditch remediation; institutional controls (site fencing); and routine monitoring of surface water and groundwater. A groundwater remedy (pump and treat) was evaluated, but not implemented, as it was viewed only as a future contingency action. The 1993 capping of the Landfill was effective in reducing surface water infiltration into the Landfill and likely substantially reduced the production of leachate generated by surface water infiltration. The remedy did not include the bottom liner for the Landfill that was a component of the preferred remedy in the FS, and as a result did not adequately address groundwater under or adjacent to the Landfill.

Groundwater monitoring and investigative activities conducted by Hydrometrics beginning in 1994 indicated the presence of an off-site plume of elevated arsenic in groundwater that was determined to have migrated from the Landfill into downgradient areas, including wetlands north of the Landfill and ditches to the west and north of the Landfill (Hydrometrics 2001a). In June 2001, Asarco submitted a “Contingency Plan for the B&L Landfill” that proposed several remedies for controlling groundwater at the Landfill (Hydrometrics 2001b). Asarco did not complete the activities scoped in the Plan.

2.4.2 2005 Enforcement Order and 2008 CAP

In February 2005, the Second Amendment to the Enforcement Order issued by Ecology required the resumption, completion, and implementation of the activities outlined in the 2001 Contingency Plan.

Asarco declared bankruptcy on August 10, 2005 with none of the activities outlined in the Second Amendment to the Enforcement Order completed. In the interim, MPC took on the investigation of groundwater contamination in the Wetlands and the development of remedial alternatives to address groundwater. The alternatives were evaluated and presented in the Groundwater Alternatives Evaluation (GAE; Floyd|Snider 2007), which provided a basis for Ecology’s alternative selection as presented in the 2008 CAP (Ecology 2008).

Executive Bark, Inc. has not participated in remedial activities at the Site. According to records obtained from the Secretary of State, Executive Bark, Inc. has been administratively dissolved. Counsel for the former corporation’s sole shareholder, Camille Fjetland, was contacted during the planning process for implementation of the work specified in the 2008 CAP and was informed of the requirements of the 2008 CAP and the activities that will be performed on the B&L Property.

2.4.3 2008 Consent Decree

Initial implementation of the 2008 CAP under the terms of the Consent Decree between Ecology and MPC (Ecology vs. Murray 2008a), including additional Site investigation, testing, collection of design data, design, construction, and startup for all elements of the remedy are described in the GRWP (Floyd|Snider/AMEC Team 2008). The results of these activities are included as appendices and/or addenda to this EDR.

Consistent with the terms of the Consent Decree, MPC established a Settlement Trust as a Qualified Settlement Fund. MPC funded the Settlement Trust in accordance with the terms specified in the Consent Decree. The purpose of the Settlement Trust is to fund and manage the work required under the Consent Decree. Any funds in the possession of the Settlement Trust will be used to perform the work required under the Consent Decree, including the reimbursement of Ecology's RA costs, implementation costs, and the expenses of administering the Settlement Trust. The terms and responsibilities of the Trust, including the funding of the Trust, are described in Exhibit G to the Consent Decree and the Custodial Trust Agreement that has been signed by MPC and Ecology (Ecology vs. Murray 2008b).

After funding of the Settlement Trust, the obligations set forth in the sections identified in Exhibit G of the Consent Decree and clarified in the Custodial Trust Agreement (Ecology vs. Murray 2008b), became those of the Settlement Trust and MPC shall have no further obligations under those sections. The Settlement Trustee was selected to oversee the implementation with a fiduciary duty to act in the best interest of the Trust and thereby, the beneficiary to the Trust (the State), while meeting the requirements of the Consent Decree.

The Consent Decree, between MPC and the State, designated Floyd|Snider as the selected consultant to implement the remedy. Floyd|Snider will implement the remedy as required by the Consent Decree. Floyd|Snider has assembled a Project Team that includes key personnel from both Floyd|Snider and AMEC Geomatrix to implement the remedy as outlined in the final CAP.

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3.0 Site Conditions

The following descriptions of Site conditions are generally based on previous summaries (Floyd|Snider/AMEC 2009a, Ecology 2008; Floyd|Snider 2007; KJC and AGI 1990b) that are updated where appropriate with the results from 2008 pre-design activities.

3.1 GEOLOGIC AND HYDROGEOLOGIC SETTING

The regional topographic and hydrologic setting exerts significant influence upon the surface water and the shallow groundwater regime at the Site. Regional topography, surface water, and drainage features are shown in Figure 3.1. The Site is located in the floodplain of the Hylebos Creek watershed, close to where it merges with the larger Puyallup River valley. To the east of the Site, Fife Way marks the steep transition between the flat floodplain and the rolling hilly relief of the uplands glacial drift plain.

The Hylebos Creek watershed is a tributary sub-basin that drains 19 square miles of urban and suburban area between Fife and Federal Way. The primary surface water body, Hylebos Creek, is primarily a man-made channel in the vicinity of the Landfill. Hylebos Creek generally flows in a southerly direction until turning west for the last 2 miles prior to its discharge into the Hylebos Waterway. The last 1.6 miles of stream is influenced by tidal backwater (MSG et al. 2004). A historic survey completed in 1870 indicates the floodplain was already cleared, drained, and at least partially diked for agriculture by the time of the survey (MSG et al. 2004).

The Hylebos Creek floodplain is situated on a series of alluvial deposits. The transition between the adjacent glacial drift hills and the floodplain alluvium is marked by a mixed gravel and sand colluvial deposit. Groundwater flowing from the glacial hills recharges the several hundred feet of water-bearing alluvial sand units that are punctuated by low-permeability strata (aquitards). The inputs of groundwater from this higher elevation drive groundwater flow beneath the Landfill in a northwesterly direction toward its eventual discharge into Hylebos Creek. Recent field measurements confirm the recurrence of flooding during major storm events, likely due to a combination of flat topography, high groundwater table, and backwater conditions experienced at high tide during major storm events.

3.1.1 Local Geology and Hydrostratigraphy

Beneath the Landfill material and forming the surface soils in the Wetlands is an organic silt and peat unit 4- to 7-feet thick that transitions into a plastic silt deposit approximately 6-inches thick at its base. These deposits correspond to the pre-landfill ground surface.[1] Boring logs indicate that the silt unit beneath the Landfill has been compacted and partially reworked into the fill material by grading and filling activities.

Saturated alluvial deposits (primarily sands) underlie the surface soils and comprise the Upper and Lower Sand Aquifer. These alluvial sands were encountered to the depths of the deepest

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[1] This near-surface, low permeability unit was referred to as the “Upper Silt Aquitard” in the RI (KJC and AGI 1990b).

borings advanced for remedial investigation. At the southeastern edge of the Site, closest to the glacial drift plain, the alluvial deposits grade into the colluvium and Pleistocene glacial silty gravel deposits. Previous subsurface investigations (KJC and AGI 1990b; Hydrometrics 2001a) identified the Upper Sand Aquifer and Lower Sand Aquifer as the primary water-bearing units underlying the Landfill. At the Landfill, the Upper Sand Aquifer extends into the lowest several feet of consolidated wood waste within the cap[2]. The alluvial deposits are divided in much of the area of the Site into the Upper and Lower Sand Aquifer by the Lower Aquitard, a 3- to 6-foot thick layer of interbedded silt, peat, and silty sand. This low permeability silt unit was determined not to be continuous beneath the Landfill during 2008 pre-design investigation activities, with gaps identified in the southwest corner and eastern side of the Landfill apparently associated with channel scouring. (Refer to Section 4.2 and Appendix B for additional results from the geotechnical investigation.)

Soil borings in the Wetlands demonstrate that the same native geologic units extend throughout the Wetland area. Subsurface soils are generally uniform throughout the Upper Sand Aquifer in the Wetland area, with fine silty sands coarsening downward and becoming increasingly silt-free until the Lower Aquitard is encountered.[3] The Lower Silt Aquitard is approximately 3-feet deeper at the northern end of the Wetlands investigation area than at the southern end.

3.1.2 Local Hydrogeology and Surface Water Hydrology

3.1.2.1 Groundwater Flow Direction and Gradients

Groundwater potentiometric contours (refer to Appendix C) are consistent with topography and a flow path towards Hylebos Creek. The groundwater flow direction in the Upper Sand Aquifer is north-northwesterly, from the upland bluff area east of the Landfill to the Wetlands area north of the Landfill, where the flow direction shifts westerly towards Hylebos Creek. The flow direction generally becomes more westerly in the wet season. The groundwater flow direction in the Lower Sand Aquifer is northwesterly towards Hylebos Creek during the dry seaon, and becomes more westerly in the wet season.

Also reflecting topography are the horizontal groundwater gradients that are steeper adjacent to the upland bluff area east of the Landfill than beneath the Landfill and in the Wetlands, where the gradient is comparatively flat. Horizontal gradients in the Upper Sand Aquifer range from approximately 0.0025 to 0.005 in the vicinity of the Landfill and generally steepen slightly during the wet season as groundwater builds up on the upgradient side of the Landfill. Horizontal gradients beneath the Wetlands are generally less than 0.001. Horizontal gradients at the transition from the Landfill to the bluff area are generally greater than 0.006.

Vertical gradients between the Lower and Upper Sand Aquifers are generally flat or weakly downward in the areas upgradient of the Landfill (approximately -0.001), and transition to neutral and then increasingly strong (up to +0.1) upward gradients on the northern side of the Landfill and in the Wetlands area. These vertical upward gradients are characteristic of floodplains that function as regional groundwater discharge areas.

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[2] Saturated refuse was referred to as the “Fill Aquifer” in the RI (KJC and AGI 1990b).
[3] The Upper Sand Aquifer was referred to as the “Shallow Aquifer” in the 2005 Data Report (Floyd|Snider 2006).

3.1.2.2 Hydraulic conductivity and average linear velocity

Pump and slug testing of the Upper Sand Aquifer in the Wetlands indicates a highly transmissive aquifer with a preferential direction of hydraulic conductivity in the north–south direction. Calculated hydraulic conductivities in the Wetlands areas are in the range of 100 to 220 feet per day (0.035 to 0.078 cm/s) parallel to the direction of groundwater flow and 2.7 to 5.7 feet per day (9.5 x 10^{-4} to 2 x 10^{-3} cm/s) perpendicular to the direction of groundwater flow. Average linear groundwater (seepage) velocities within the Wetlands, calculated based on a wetlands hydraulic gradient of 0.001 and an assumed effective porosity of 35 percent, indicate range from approximately 100 to 260 feet/year. Hydraulic conductivities in the areas upgradient of the Landfill are in the range of 0.3 to 11 ft/day (1.04 x 10^{-4} to 3.7 x 10^{-3}). Average linear groundwater velocities in the upgradient area, calculated based on a hydraulic gradient of 0.006 and an assumed effective porosity of 35 percent, indicate a range from approximately 2 to 67 feet/year.

The observed anisotropy in hydraulic conductivities, with hydraulic conductivity an order of magnitude greater in the approximate north-south direction than in the east-west direction, is consistent with the observed presence of coarser sand grain sizes (up to medium-to-coarse and thin deposits of coarse sand at the base of the Upper Sand Aquifer) in apparent channel features along the southwest corner of the Landfill and the eastern edge of the Landfill and extending into the Wetlands. This may reflect that the Upper Sand Aquifer is composed of highly elongated sand channels that were deposited by alluvial processes, predominantly in a northwest-southeast direction.

3.1.2.3 Local Surface Water Hydrology and Flooding

Surface water at the vicinity of the Site drains to Hylebos Creek via two small sub-basins, one north of the Interurban Trail in the wetlands within the floodplain of Hylebos Creek and the other south of the road, in the agricultural farmlands of the Puyallup River valley (refer to Figure 3.1). Surface water features close to the Site are shown on Figure 1.1.

The Wetlands receive significant surface water input via precipitation, runoff from Fife Way and, during flood stages, overflow from Hylebos Creek. Flooding of Hylebos Creek is most frequently caused by precipitation events occurring between October and March, with melting snow occasionally contributing to flooding. Hylebos Creek rises quickly because of the relatively steep terrain and extent of development in the upper watershed. As a rule, the creek rises to flood stage within a day of peak rainfall and the duration of the flooding is only a few days (FEMA 1987). Flood waters in the Wetlands slowly drain to the west to Hylebos Creek but the low areas of the Wetlands remain seasonally ponded well into summer, depending on dry season rainfall intensity. In the Wetlands, during winter months or other wet conditions, the potentiometric surface rises above the ground surface due to both flooding inputs and upward discharge from the aquifer.

Flood events that approach or exceed the elevation of the Interurban Trail (approximately 18 feet NAVD 88), flooding the adjacent farm fields and inundating nearly all the ground surface surrounding the Landfill, have been observed repeatedly in recent years. This magnitude of flood stage, which corresponds with the 100-year flood event (MSG 2004), is an important Site condition for remedial design purposes.

Land south of the Interurban Trail is drained by the agricultural ditches that run along the perimeter of the B&L Property and further south, the larger Surprise Lake Drain. These ditches are within Pierce County Drainage District #23. The headwaters for the Surprise Lake Drain are located on the north hill plateau in the City of Milton—east of the project area. The outlet from Surprise Lake flows through a ravine, then along the Puyallup valley, and finally into a ditch system that receives runoff from mostly agricultural land, including land immediately surrounding the project area to the south and southeast. The drain discharges to Hylebos Creek via the 70th Avenue culvert under I-5.

The ditch adjacent to the south and west perimeter of the B&L Property drains surface water from the agricultural fields and the apartment complex south of the Landfill. Water is conveyed along a ditch running parallel to the Puget Power Access Road and then south to where it joins the Surprise Lake Drain. The agricultural fields west of the Landfill drain overland flow into this ditch system as well. Portions of the fields near the Landfill are observed to be slightly lower, and they flood more easily. These ponded waters drain slowly due to saturated soil conditions and backwater caused by the normally higher water level in the Surprise Lake drainage channel.

Within the fenced area surrounding the Landfill, precipitation drains into troughs around the Landfill that lead to an infiltration/detention pond. Within the primary infiltration/detention pond immediately north of the Landfill, there is an overflow pipe that leads into the agricultural ditch system (refer to Figure 1.1). This ditch system also captures stormwater that overflows from the smaller secondary stormwater detention pond outside the northeast corner of the Landfill; the secondary detention pond drains the B&L Property east of the Landfill.

The agricultural drainage ditches outside the B&L Property boundary (shown on Figure 1.1) are deep enough to receive seasonal groundwater discharge from the Upper Sand Aquifer. These ditches collect groundwater discharge over most of the year, but locally and seasonally can recharge the shallow groundwater system. The section of ditch along the northern perimeter of the Landfill is higher than the rest of the ditch system and is often dry; therefore, this section is not as prone to receiving groundwater discharge. The ditch system drains to the west where it joins the Surprise Lake Drain; however, drainage of ditch water is limited by the shallow depth of the ditch, its flat gradient, and the generally consistent flow of water in the Surprise Lake Drain (the release of which is controlled from Surprise Lake).

3.1.3 Local Seismicity

Because the Puget Sound Lowland is situated in the fore-arc basin of the subduction zone associated with the collision of the Juan de Fuca and North American tectonic plates, the entire region is at risk for earthquake hazard. Over the last 100 years, large magnitude earthquakes (greater than 5.0) have occurred repeatedly in the Puget Sound region. This plate collision results in three types of earthquakes: deep intraplate earthquakes within the subducting plate, thought to be the most frequent large events that affect Pierce County; shallow crustal earthquakes associated with faults within the North American Plate, which may be significant to local seismic risk if the Tacoma fault is determined to be active; and deep Cascadia Subduction Zone (interplate) earthquakes, which are thought to occur less frequently but with a regional source area.

The Pierce County Mitigation Planning Team determined the probability of recurrence for the earthquake hazard in Pierce County to be "100 years or less occurrence." The prediction was made in the context of differences and uncertainties in recurrence intervals for each type of earthquake. On average, the intervals are on the order of decades for intraplate earthquakes, and centuries for Cascadia Subduction Zone earthquakes. The interval for shallow crustal earthquakes is highly uncertain and dependent on the movement history of local faults. Limited research has been completed on the history of movement along the Tacoma Fault, which is known to extend as far east as Commencement Bay, several miles west of the Site, and runs westward and northwestward across much of the Puget Lowland.

Based on previous earthquakes in the region, an earthquake at or near the Site is likely to be amplified by the unconsolidated, sandy and silty alluvial deposits at the Site. The southern edge of the Hylebos Embayment, including most or all of the Site, is located within an area of potential seismic hazard that extends throughout the Puyallup River valley. This area is considered an area of high potential for liquefaction hazards and high potential for dynamic settlement hazards. Liquefaction hazard areas are underlain by unconsolidated sandy or silt soils and a shallow groundwater table capable of liquefying in response to earthquake shaking. Noteworthy liquefaction took place in nearby Puyallup during the 1949 earthquake. Dynamic settlement hazard areas are areas underlain by a significant thickness of loose or soft soil not susceptible to liquefaction, but that could result in vertical settlement of the ground surface in response to earthquake shaking (Pierce County Department of Emergency Management 2004).

3.2 SITE CLIMATE

Climate conditions at the Site are typical for the coastal marine environment of the Puget Sound Lowland in which conditions are controlled largely by air movements from the Pacific Ocean. Average temperatures are in the range of approximately 40 degrees Fahrenheit in the winter and approximately 70 degrees Fahrenheit in the summer. Temperatures rarely exceed 90 degrees Fahrenheit. Winters are wet and overcast, and summers are generally warm and dry. Average annual precipitation, based on data from 1918 through 2008 at nearby Tacoma rain gauge stations, is 38.8 inches, with most of this occurring as rain between October and March (NOAA-NCDC 2009). Annual evaporation, based on pan evaporation data, averages 25 to 30 inches (KJC and ACI 1990b).

3.3 LANDFILL GAS

Emission of landfill gas (LFG), including methane, was not identified during the 1990 RI as a pathway by which contamination leaves the Site, and was not included in the 1991 CAP as a risk associated with the Site. Active and passive LFG controls were evaluated as part of the 1990 Focused Feasibility Study, which noted that existing information regarding the type and quantity of gas production at the Landfill was inadequate for determining which approach was more appropriate. In the 1992 EDR, passive gas controls were selected based on calculations of the maximum potential emissions of methane and carbon dioxide from decomposition of wood waste (Hydrometrics 1992). Passive gas controls were installed as part of the consolidation and capping remedy implemented in 1993 to control the potential release of LFG. Methane was monitored at the edge of the Landfill mound to ensure it did not exceed the lower explosive limit (LEL) as part of protection monitoring (Hydrometrics 1994). Air monitoring was not included in post-1993 remediation monitoring.

Based on November 2005 air quality measurements of the vents of the gas collection system, the Landfill does not appear to produce measurable quantities of methane. Based on 2005 monitoring, the Landfill is also not emitting measurable quantities of hydrogen sulfide. Due to the potential for methane production, the passive venting system will be maintained.

3.4 SITE PLANNING AND DEVELOPMENT ISSUES

The development plans for parcels that are adjacent to the B&L Property, some of which are part of the Site, may have important implications for remedial design. As described in previous sections, the B&L Property is undeveloped and currently used only for ongoing remediation activities. There are currently no other known uses for the B&L Property, much of which is physically constrained by the presence of the Landfill and its protective cap. Much of the B&L Property will be subject to institutional controls (refer to Section 6.0). Remedy implementation will include construction of a permanent groundwater treatment building with associated parking, access road, electrical, water, and telephone connections.

Several parcels to the north and west of the B&L Property likely will be impacted by a major proposed WSDOT highway project, the completion of SR 167 between SR 161 in north Puyallup and SR 509 in Tacoma (refer to Figure 3.2). As part of its proposed SR 167 project, WSDOT has proposed major riparian restoration projects in the vicinity of the Landfill, including relocating both the Hylebos Creek and the Surprise Lake Drain, and enhancement of wetland areas. The proposed mitigation project is designed to mitigate SR 167 construction impacts, to improve stormwater management, and to enhance and protect aquatic habitat. While the exact locations of the new creek channels and wetland areas are subject to change prior to completing the final design, the present preliminary layout for the proposed relocation, as shown on Figure 3.2, indicates that the Hylebos Creek channel may be relocated several hundred feet closer to the Site. The current Surprise Lake Drain will also be restored to a more natural meandering channel. Based on the anticipated schedule for the WSDOT mitigation project, the groundwater in the End-of-Plume area is expected to be remediated and under control prior to the initiation of the SR 167 mitigation project.

4.0 Predesign Studies

In this section, the results of predesign studies completed in 2008 to support design of the barrier wall and interceptor trench are summarized. These predesign studies were implemented in general accordance with the GRWP (Floyd|Snider/AMEC Team 2008). The results of several of these studies are presented as appendices to this EDR. Additional pre-design study results will be presented as Addenda to this EDR.

4.1 NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

The 2008 Arsenic Characterization Study (included as Appendix A) is the latest of a number of investigations and monitoring activities that have been conducted to examine soil, surface water, ditch sediment, and groundwater conditions at the Site. This investigation was performed to further delineate the Site plume in support of design for the remedy in the 2008 CAP. The results of these investigations and years of groundwater monitoring indicate that arsenic is the only constituent of concern (COC; Ecology 2008). Arsenic exceeds CULs in groundwater, surface water, and ditch sediments.

Elevated arsenic concentrations in groundwater generally extend from beneath the Landfill in the Upper Sand Aquifer, beneath the Interurban Trail and into groundwater beneath the Wetlands north of the Landfill. A section of the plume also extends beneath the agricultural field west of the Landfill. Arsenic contamination in surface water and sediments in the drainage ditch system extends to the west of the Landfill. The pattern of groundwater contamination at the Landfill perimeter includes a “halo” of slightly elevated concentrations immediately adjacent to the Landfill perimeter. Groundwater monitoring since the 1990s has indicated that the arsenic plume in the Wetlands is generally stable (Floyd|Snider 2007 and Floyd|Snider/AMEC Team 2009b). Further descriptions of the nature and extent of the arsenic plume are given below.

4.1.1 Arsenic Release to Groundwater from Landfill Materials

Arsenic speciation and the reduction-oxidation (redox) chemistry that controls it are central to the release, transport, and attenuation mechanisms at the Site. The plume of elevated arsenic concentrations in groundwater beneath the Site is primarily composed of As(III), a form of inorganic arsenic (known as trivalent arsenic or arsenite) that generally occurs under moderately reducing conditions. Such reducing conditions within the Landfill are generally responsible for releases of arsenic trapped on mineral surfaces in soil or slag via dissolution and desorption. In addition to arsenic and iron, Landfill materials appear to be the source of elevated groundwater concentrations of dissolved organic carbon (DOC) and common groundwater ions present in Landfill leachate, including chloride, calcium, magnesium, and sodium. The presence of elevated concentrations of DOC and these ions, and the resulting elevated total dissolved solids (TDS) and specific conductance, define a general leachate plume in the Wetlands that overlaps with, and is broader than, the arsenic plume.

4.1.2 Extent of Arsenic Groundwater Plume

The areal extent of the arsenic groundwater plume, which is present only in the Upper Sand Aquifer, is illustrated in Figure 3.2. The plume downgradient of the Landfill consists primarily of a broad central lobe beneath the Wetlands that terminates within approximately 300 feet of the Landfill boundary, an elongated eastern plume 'finger' that extends approximately 400-feet downgradient of the Landfill. In addition, a western lobe of the plume is present beneath the City of Fife property that extends several hundred feet beyond the B&L Property boundary to the northwest, beneath the adjacent agricultural fields. The western lobe, which appears to extend beneath the Interurban Trail, has not been fully delineated. The halo areas upgradient of the Landfill include an area of groundwater contamination along the southern edge of the Landfill and a small area of groundwater contamination on the B&L Property, adjacent to Fife Way.

In an area of high arsenic concentrations near the southern edge of the Wetlands CAA, known as the Wetlands "hotspot", arsenic is present at concentrations up to approximately 2,500 µg/L and is elevated throughout the full saturated thickness of the Upper Sand Aquifer. The northernmost extent of the plume beneath the Wetlands (the End-of-Plume CAA; refer to Section 1.2.3) is characterized by a thin seam of elevated concentrations at the more permeable coarse sandy base of the Upper Sand Aquifer. Elevated arsenic within the End-of-Plume CAA has been delineated to extend approximately 100-feet beyond the existing raised roadway (12th Street East). Along 12th Street East, arsenic is present at concentrations of approximately 50 µg/L across a transect 250-feet wide by 5-feet thick, between depths of 17 and 22 feet.

The area previously identified as Halo West (refer to the GRWP) has been further delineated as the western lobe of the arsenic plume, emanating from the Landfill and being transported toward the north, in the direction of groundwater flow. Arsenic has been detected in this area at concentrations up to 950 µg/L, and elevated arsenic is generally present throughout the saturated thickness of the Upper Sand Aquifer. The western boundary of this lobe has been delineated. The northern extent of the lobe has not been fully delineated; additional characterization is planned to complete the northern extent of the western lobe of the plume. Further information is presented in Appendix A.

Figure 3.2 also shows that a relatively small halo of arsenic extends from the Landfill to the south (referred to as Halo South), which is limited to an area within about 75-feet of the Landfill boundary. Several borings more than 100-feet south of the Landfill (i.e., upgradient of the Landfill) indicate an apparent pattern of scattered, low-level arsenic exceedances that may not be associated with the wastes within the Landfill (refer to Appendix A).

A localized area of elevated concentrations exists on the B&L Property upgradient of and to the east of the Landfill in the vicinity of Monitoring Well D-10A. This well is completed in a colluvium deposit, upgradient of the Upper Sand Aquifer This area, known as the Halo East hotspot (refer to the GRWP), has been delineated and is limited to a small plume that extends approximately 150-feet downgradient from Monitoring Well D-10A with a plume front approximately 150-feet wide. Concentrations of arsenic in Halo East groundwater appear to be higher within the upper 15-feet of groundwater, which is consistent with a shallow source. The source of this contamination is unknown, but its footprint and concentrations have remained stable since the RI was conducted in the late-1980s.

Groundwater monitoring in the Lower Sand Aquifer indicates that the Landfill has had little or no impact on the aquifer. The only exceedance of CULs for arsenic in the Lower Sand Aquifer potentially related to the Landfill was found at Well D-8B. In October 2008 compliance monitoring (Floyd|Snider/AMEC 2009b), arsenic was detected in D-8B at 11.6 µg/L; concentrations in this monitoring well have displayed a decreasing trend since elevated concentrations were detected following implementation of the 1993 remedy. The Lower Silt Aquitard is discontinuous in this area, but neutral to upward hydraulic gradients continue to prevent contamination of Lower Sand Aquifer Groundwater.

4.2 GEOTECHNICAL CHARACTERIZATION

As noted previously, earlier subsurface investigations identified four subsurface units in the vicinity of the Landfill. These units, in sequence from shallow to deep are as follows:

1. A near surface silt or shallow silt layer designated as the Upper Silt Aquitard.
2. A water bearing sand designated as the Upper Sand Aquifer.
3. A low-permeability silt layer designated as the Lower Silt Aquitard.
4. A water bearing sand designated as the Lower Sand Aquifer.

A geotechnical investigation was completed along the alignment for the slurry wall to assess the upper three strata and to collect information needed for design and engineering of the slurry wall. The geotechnical investigation was performed consistent with the Geotechnical Investigation Work Plan (GIWP) that was appended to the GWRP.

The purposes of the geotechnical investigation was to determine the depth to the Lower Silt Aquitard, to assess the continuity of the Lower Silt Aquitard (and the extent of any gaps), to assess engineering characteristics of subsurface soils along the barrier wall alignment, and to collect samples to evaluate the backfill amendments and compatibility of backfill with Site groundwater. The specific objectives of this investigation were as follows:

- Develop stratigraphic information concerning the depth and thickness of the upper sand aquifer and the presence and the depth to the lower silt aquitard.
- Obtain sufficient geotechnical data to complete the design of the subsurface barrier wall.
- Collect soil and groundwater samples for compatibility testing for use in designing the barrier wall backfill.

The following tasks were completed for this investigation:

- Drilled 15 soil borings using hollow-stem augers along the proposed barrier wall alignment.
- Advanced 9 push probes in the vicinity of the southwest gap in the Lower Silt Aquitard.

- Conducted cone penetrometer testing (CPT) at 46 locations along the anticipated subsurface barrier wall alignment and the areas of the known gaps in the Lower Silt Aquitard.
- Collected soil samples that were subsequently submitted to a geotechnical laboratory for testing of physical characteristics and for performing compatibility testing.
- Collected a groundwater sample from an existing monitoring well in the Upper Sand Aquifer and potable water sample from the local water supply.
- Conducted compatibility testing to confirm that the proposed barrier wall construction materials are compatible with the contaminated Site groundwater.

The geotechnical exploration locations are shown in Figure 4.1. A geotechnical investigation report is included as Appendix B.

The geotechnical investigation borings revealed the presence of a 3- to 3.5-ft thick layer of fill at the ground surface, which is the existing perimeter road berm. The Upper Silt Aquitard was encountered in most borings at depths ranging from approximately 3- to 11-feet below ground surface. A distinct shallow silt layer, corresponding to the Upper Silt Aquitard, was absent at Borings H-3, H-12, and H-14. The Lower Silt Aquitard, where present, was encountered at depths ranging from approximately 14- to 30-feet below grade. In two portions of the alignment (i.e., at the southwest corner and along the east side of the Landfill, the Lower Silt Aquitard was generally absent or was present as discontinuous seams or lenses. The southwest aquitard gap is located between Borings H-3 and H-15 and the eastern aquitard gap is located between Borings H-9 and H-10. Refer to Figure 4.1. At most locations, transitions between silt and sand layers were very gradual; otherwise, these layers were interbedded.

These field observations combined with physical test results lead to the following recommendations regarding the barrier wall depth: (1) the barrier wall should extend to at least the midsection of the Lower Silt Aquitard, where a distinct silt layer is present and (2) when the Lower Silt Aquitard is absent, the wall should continue below the silt lenses. The recommended depth to the bottom of the barrier wall surrounding the Landfill is presented in Table B.1.

Five soil mixes of the composite samples were tested for hydraulic conductivity using Site groundwater and potable water samples. The hydraulic conductivity tests indicated only minor differences between groundwater and potable water; these differences are believed to be in the range of accuracy of the test method. These results indicate that Site groundwater does not adversely affect the permeability of the barrier wall backfill. The results also indicate that a mixture of 3 percent bentonite with soil underlying the Landfill would achieve a laboratory hydraulic conductivity of about 5 x 10^{-8} cm/s, and would be suitable for construction of the barrier wall.

4.3 HYDROGEOLOGIC STUDY

A hydrogeologic study was conducted as part of the Phase 1 implementation plan described in the GRWP (Floyd|Snider/AMEC 2009a). The objectives of the hydrogeologic study were (1) to establish a baseline for evaluating the effects of Phase 1 remedy components, including barrier wall and interceptor trench, on local hydrology; and (2) to support the design of Phase 2 remedy components. Tasks performed included collection of hydrogeologic and surface water data, aquifer tests, refinement of the existing conceptual hydrologic model, and development of a numerical groundwater model for the selected domain area (Figure 4.2).

A hydrogeologic monitoring network was established through the installation of 39 piezometers and 19 wells, and surveying of existing monitoring wells (refer to Figure 4.2). During installation of wells and piezometers, borings were logged to provide detailed characterization of subsurface lithology. Monthly depth to water measurements were collected at each location within the monitoring network to determine groundwater elevations and gradients. At select locations, pressure transducers with data loggers were deployed for hourly water level information.

Surface water data were collected from a surface water monitoring network that consists of 15 staff gauges installed in the agricultural ditches, Surprise Lake Drain, and Hylebos Creek (Figure 4.2). Monthly measurements of stage height and velocity were conducted to determine discharge at each monitoring location. A complete description of both hydrogeologic and surface water data collection activities is provided in Section 2 of Appendix C.

Aquifer tests conducted adjacent to the Landfill and in the Wetland areas provided data that were used to define the range of aquifer parameters used within the numerical groundwater model.

A numerical groundwater model was developed based upon the current conceptual model, which incorporates refinements based upon the collected hydrogelogic and surface water data. The numerical model was used as a decision tool to help understand the physical flow system, evaluate various remedial design scenarios, and assess potential affects of the remedial actions specified in the 2008 CAP on local hydrology. The U.S. Geological Survey's Modular Three-Dimensional Finite-Difference Groundwater Flow Model (MODFLOW-2000) was used to simulate groundwater flow within the model domain (Figure 4.2). MODFLOW (McDonald and Harbaugh 1988; Harbaugh and McDonald 1996; and Harbaugh et al. 2000) is a well documented program that is publically available and used extensively in the environmental industry to characterize and assess groundwater flow.

The model domain spans approximately 290 acres and includes the Landfill, Wetlands, and End-of-Plume CAAs. Based upon available lithologic data, the numerical model represents major hydrostratigraphic units including the Landfill, the Upper Sand Aquifer, the Lower Silt Aquitard, and the Lower Sand Aquifer. Major surface water features represented within the numerical model include the agricultural ditches, Surprise Lake Drain, and Hylebos Creek. Boundary conditions include constant head and flux boundaries. A detailed summary of numerical model development is presented in Section 4 of Appendix C.

The numerical model was calibrated under steady-state condition using a suite of both quantitative and qualitative criteria. The calibrated model is able to adequately simulate groundwater elevations and gradients within the model domain. Details regarding model calibration and results are discussed in Section 5 of Appendix C. The calibrated model will be used to evaluate design alternatives of Phase 1 and Phase 2 remedy components and their effects on local hydrology. These results are presented in the Addenda to the EDR.

Model runs were used to evaluate the relationship between drawdown within the barrier wall, associated pumping rates, and barrier wall depth in the areas where the Lower Silt Aquitard is absent. These model runs were used to support the decision to extend the barrier wall to a depth of 35 ft below land surface in the areas where the aquitard is absent.

4.4 WETLANDS ASSESSMENT

The Critical Areas Study (CAS: Appendix D) describes wetland locations and boundaries, and characterizes those wetlands within the remediation area that may be affected by construction in 2009. Project team scientists delineated wetlands based on best professional judgment, existing Site conditions during field analysis, and information from previous environmental site investigations. The project team delineated wetland boundaries using the Routine Determinations Method described in the U.S. Army Corps of Engineers (USACE) Wetland Determination Manual (USACE 1987). Delineated and surveyed wetland boundaries are subject to verification and approval by jurisdictional agencies.

Project scientists verified the presence of five wetlands and one stream (Hylebos Creek) within the remediation area. The areas identified as wetlands met all three jurisdictional wetland criteria (hydrophytic vegetation, hydric soils, and wetland hydrology). To assess the resource value of the identified wetlands, project scientists determined wetland ratings using the Washington State Wetland Rating System for Western Washington (Hruby 2004). In addition to Wetlands A-F and Hylebos Creek, the project team also verified the locations of four ditches: (1) the Interurban Trail ditch, (2) landfill cap drainage ditch, (3) Surprise Lake Drain, and (4) an unnamed ditch. Figure 4.3 shows critical area locations in the vicinity of the remediation area.

USACE has regulatory jurisdiction over “Waters of the U.S.” (33 CFR Part 328). Hylebos Creek is classified as a “Water of the U.S.” The ditches and wetlands within the remediation area may also classify as “Waters of the U.S.” A jurisdictional determination from USACE would be required to determine which, if any, ditch or wetland is regulated by the USACE. Any alteration to a USACE jurisdictional wetland or ditch requires a federal permit from the USACE.

For 2009 construction of the barrier wall and interceptor trench systems, the USACE reviewed a project site plan and issued a No Permit Required letter, indicating that the proposed construction appears to be outside of USACE jurisdiction (USACE 2009). A jurisdictional determination may be required for future remediation activities, including remediation of the Wetlands CAA and the cleanout and restoration of the agricultural ditch system.

4.5 CULTURAL RESOURCES

A Cultural Resources Assessment was completed at the B&L Landfill by Floyd|Snider and Historical Research Associates, Inc. (HRA) in accordance with the requirements of WAC 197-11, Revised Code of Washington (RCW) 27.44, and RCW 27.53. RCW Chapter 197-11 requires that state and local agencies evaluate and mitigate the impacts of their actions on cultural resources. The State Environmental Policy Act (SEPA) requires that significant properties be given consideration when actions have the potential to impact them. Although SEPA does not include a requirement to obtain Department of Archaeology and Historic Preservation (DAHP) concurrence of the Area of Potential Effect (APE), as is required by the National Historic Preservation Act's (NHPA) regulations, Floyd|Snider invited the DAHP and the Puyallup Tribe of Indians (Tribe) to review the project description and APE, and to observe field work.

Cultural resources monitoring was completed for exploratory drilling during predesign studies, followed by a cultural resources survey to determine if any cultural resources have the potential to be impacted by the remainder of ground-disturbing activities. All fieldwork was completed in accordance with the Cultural Resources Work Plan, submitted as Appendix C to the GRWP.

As part of the consultation process for the CAP implementation, the Draft Cultural Resources Work Plan was provided to both the Tribe and DAHP for comment prior to the fieldwork. At that time the Tribe and DAHP were invited to the Site to observe the monitoring and the survey activities. No comment or inquiry was received. A copy of the Final Cultural Resources Work Plan was then provided to both the Tribe and DAHP, and in March 2009, a copy of the Archaeological Monitoring and Cultural Resources Assessment documenting the findings of the assessment was provided.

No prehistoric- or historic-period cultural resources were observed during the surface or subsurface survey. The groundwater monitoring project did not adversely affect any identified cultural resources in the APE. However, the potential remains for unidentified archaeological materials to be present within the APE. The APE's position within former marsh- and tidelands suggest that shell midden deposits, or other evidence of resource-gathering or processing activities (i.e., lithic scatters, hearths or other fire-features) may exist, potentially buried beneath alluvial sediments or hidden by the dense vegetation. The findings are summarized in the Archaeological Monitoring and Cultural Resources Assessment Report. This Report contains sensitive information regarding archaeological sites and has not been provided for public review. Copies have been provided to DAHP and the Tribe.

Additional archaeological monitoring will be completed prior to slurry wall construction. Excavations are planned nearby in the APE that will allow for subsurface examination through archaeological monitoring. Geotechnical test pits will be conducted around the perimeter of the landfill pile ahead of construction activities. These test pits will be approximately 15- x -3-feet and extend to approximately 5-feet below the ground surface. The pits will be spaced approximately 250-feet apart. In addition, a detention basin and additional direct-push soil borings will be conducted west of the landfill pile. HRA will monitor each of these excavations and soil borings, which will collectively provide an adequate subsurface sample of the portion of the APE south of the former railroad grade to conclude that no significant cultural deposits are or will be impacted by the project. The results of all future monitoring activities will be described in an addendum report.

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5.0 Interim and Long-term Monitoring

Monitoring of the cleanup action will be performed in accordance with the requirements of WAC 173-340-410 and the Consent Decree, and will include protection, performance, and confirmational monitoring. The overall approach by which the cleanup action will address these monitoring requirements is presented in this section. Specific requirements for the ongoing, semiannual monitoring of the cleanup action during Phases 1 and 2 are provided in the Interim Compliance Monitoring Plan (ICMP; Appendix E). Because the current remedy implementation is planned over several years in a phased implementation program, the monitoring provisions in the ICMP will be modified as appropriate during Phases 1 and 2 to address changing conditions as new information is acquired during remedy implementation, new groundwater quality monitoring wells are installed, and/or as remedy components are installed during phased construction. The monitoring provisions in the ICMP will be modified with subsequent versions to replace and supersede the January 2009 version that was approved by Ecology and is included as Appendix E to this EDR. Other provisions for hydraulic monitoring to confirm the operational effectiveness of the Landfill CAA containment system are presented in a Performance Monitoring Plan that is included with Addendum 1 to this EDR. Requirements for monitoring following construction of other major remedial components, including long-term hydraulic and groundwater quality monitoring will be presented in subsequent updates. The final, long-term monitoring program will be documented in the Operation, Monitoring, Inspection and Maintenance Plan (OMI&MP) to be prepared after completing Phase 2 construction, as described in the 2008 CAP.

5.1 COMPLIANCE MONITORING

5.1.1 Monitoring Requirements under the Consent Decree

The measures through which the remedy addresses the monitoring requirements established in the CAP Implementation SOW (Exhibit B to the Decree) are summarized in this section. In Phase 1, the Consent Decree calls for the development of an interim compliance monitoring plan for the entire Site that will be implemented during Phases 1 and 2. This plan, the ICMP, was originally submitted to Ecology as Appendix A to the GRWP and was subsequently approved by Ecology; the ICMP is appended to this EDR as Appendix E. The interim compliance monitoring program is aimed at monitoring plume behavior and trends during remedy implementation. According to the Consent Decree, interim compliance monitoring must include the following:

- Installation of an interim compliance well network in the vicinity of 12th Street East and compliance monitoring at an interim point of compliance along 12th Street East during Phase 1. These elements of the interim compliance monitoring program will be provided as part of the implementation of the End-of-Plume remedy. The design for this well network and associated ICMP adjustments will be included with the End-of-Plume Remediation Design Report, as Addendum 2 to this EDR.
- Monitoring of the temporary mass-removal action in the Wetlands was an element identified in the SOW included in the Consent Decree. However, this SOW

component was removed in accordance with the provisions of the Consent Decree; therefore, monitoring mass removal will not be included until Phase 2. Interim compliance monitoring will incorporate monitoring of the Wetlands remedy during Phase 2 implementation.

- Performance monitoring for the barrier wall and interceptor trench. During Phase 2, the Consent Decree SOW specifies that interim compliance monitoring will include continued monitoring of the Phase 1 remediation components as needed to achieve their remediation objectives. This requirement will be met through the following:
    - A Performance Monitoring Plan, included with Addendum 1 to this EDR, describes the network of piezometers and program for monitoring hydraulic containment along the barrier wall that will surround the Landfill. The barrier wall and interceptor trench systems are intended to act in conjunction with the hydraulic control and groundwater treatment systems that will be implemented during Phase 2. Performance monitoring will take place for a discrete period following startup of the groundwater extraction and treatment systems to confirm the operational effectiveness of the containment system. Monitoring of the piezometer network prior to the completion of these Phase 2 components will be done to collect baseline data for comparative purposes, for design of the groundwater extraction system, and to develop appropriate hydraulic performance standards in consultation with Ecology. At the completion of performance monitoring, hydraulic monitoring will be incorporated into the compliance monitoring program.
    - Interceptor trench water quality monitoring will be incorporated into interim compliance monitoring as appropriate and in consultation with Ecology.
    - For compliance monitoring of the containment system, the Consent Decree stipulates that a long-term groundwater monitoring system incorporating any additional compliance wells will be designed and constructed during Phase 2. The Consent Decree further requires that a long-term operations, maintenance, inspection and monitoring plan be developed. This OMI&MP will be prepared during the Phase 2 implementation and will supersede and replace the ICMP. The OMI&MP will establish a program of long-term groundwater quality and hydraulic monitoring to confirm attainment of the cleanup standard and to monitor performance of the barrier wall, hydraulic control system, and other remedy components following the construction of the final remedy components.
- Monitoring associated with the Wetlands and Halo remedy components. These compliance monitoring elements will be added during implementation of the groundwater extraction and treatment system. The design for additional wells, associated ICMP adjustments, and a separate Performance Monitoring Plan to assess operational effectiveness will be provided with the Phase 2 Remediation Design Report, Addendum 3 to this EDR. The long-term monitoring program for these components will be included with the OMI&MP.
- Appropriate elements of the existing groundwater monitoring program. As described in the approved ICMP, interim compliance monitoring will monitor the existing monitoring network (refer to Section 5.4 and the ICMP), with modifications as

appropriate and in consultation with Ecology to add additional wells and piezometers as the monitoring network is modified during Phase 1 and Phase 2 implementation.

5.1.2 Monitoring Requirements under MTCA

In accordance with WAC 173-340-410, interim and long-term compliance monitoring will address the three purposes described in MTCA for compliance monitoring: protection, performance, and confirmational monitoring.

Protection monitoring will be conducted to confirm that human health and the environment are adequately protected during implementation of the cleanup action. Provisions for protection monitoring will be provided in the Health and Safety Plans included with the Addenda to this EDR.

The objectives and requirements of performance monitoring under MTCA are currently being met as part of interim compliance monitoring under the ICMP (refer to Section 5.2 below). Monitoring requirements will continue to be met through expansion of the interim compliance monitoring program to monitor the performance of additional remedy components as they are constructed relative to CULs, performance monitoring of the containment system relative to hydraulic performance standards, and long-term compliance monitoring under the OMI&MP, as described in the previous section.

MTCA requirements for confirmational monitoring will be met as appropriate in the Addenda to this EDR (e.g., to confirm removal of contaminated sediment during ditch remediation in Phase 2) and as part of long-term compliance monitoring under the OMI&MP. Elements of long-term monitoring are expected to continue indefinitely, to confirm the long-term effectiveness of the remedy following the attainment of cleanup standards and full implementation of the remedy specified in the 2008 CAP.

5.2 INTERIM COMPLIANCE MONITORING

Interim compliance monitoring is currently being conducted to meet the monitoring, inspection, and maintenance requirements during the implementation of the 2008 CAP, in accordance with the ICMP. These requirements are specified in the Consent Decree and meet the substantive regulatory requirements of MTCA and the Solid Waste Management, Reduction, and Recycle Act. Interim compliance monitoring includes regular assessments of the plume and groundwater quality trends. Compliance monitoring also monitors the condition of the landfill cap and other components from the Site remedy implemented in 1993 to ensure that existing remediation components are properly maintained. The existing interim compliance monitoring program meets the goals of performance monitoring as described in WAC 173-340-410(1)(b), and will be expanded to assess the performance of remedy components as they are constructed, as described above.

Interim compliance monitoring under the ICMP is being implemented in accordance with the SOW included in the Consent Decree, and replaces and supersedes all previous monitoring and inspection plans applicable to the Site. The ICMP establishes a program of semiannual groundwater sampling, water level measurements, and surface water sampling, the first event of which occurred in October 2008 (Floyd|Snider/AMEC 2009b). Specific sampling and quality assurance procedures are provided in the Sampling and Analysis and Quality Assurance Project Plan (SAP/QAPP; Appendix B to the GRWP). The ICMP also sets forth procedures for inspection and maintenance of the landfill cap and other 1993 remedy components. The ICMP will be revised to incorporate hydraulic control monitoring and installation of additional monitoring wells as appropriate during Phases 1 and 2. The ICMP will be replaced by the OMI&MP in Phase 2 for long-term compliance monitoring, inspection, and maintenance of the complete 2008 CAP remedy.

5.3 CONDITIONAL POINT OF COMPLIANCE

As described in the 2008 CAP and in accordance with WAC 173-340-720(8)(c), a CPOC for soil, ditch sediment, groundwater and surface water has been established at the landfill cap perimeter areally, extending vertically downward through the first aquitard. Beyond this CPOC, groundwater and soil cleanup levels must be attained for the Site to be in compliance with the cleanup standards (refer to Section 1.2). As noted in the CAP, the plume of affected groundwater extends well downgradient of the designated CPOC location. Therefore, it is expected that a period of time will be needed to achieve the cleanup levels in areas outside the CPOC. The CPOC will correspond to the final alignment of the barrier wall and landfill cap following barrier wall construction and cap extension (refer to Addendum 1).

5.4 GROUNDWATER AND SURFACE WATER MONITORING SYSTEM

5.4.1 Existing Monitoring Network

The current interim compliance monitoring network is illustrated on Figure 1.1 and monitoring well construction and location details are summarized in Table 5.1 (refer to the ICMP for additional details). Currently, 16 Upper Sand Aquifer monitoring wells are used to monitor the Upper Sand Aquifer across the Landfill, Wetlands, and End-of-Plume CAAs. These include the following:

- Ten monitoring wells surrounding the Landfill and extending into the adjacent Wetlands (D-1U, D-5U, D-6A, D-7A, D-8A, D-9A, D-10A, D-11A, MW-23, MW-30).
- Five monitoring wells distributed across the arsenic plume in the Wetlands and extending to the downgradient edge of the arsenic plume (MW-13, MW-14, MW-15, MW-16, MW-17).
- One monitoring well located at the downgradient edge of the arsenic plume (MW-31A).

Because the arsenic plume is confined to the Upper Sand Aquifer, fewer monitoring wells have been completed in the Lower Sand Aquifer. Seven monitoring wells are currently used to monitor the Lower Sand Aquifer, including six monitoring wells that surround the Landfill and extend into the adjacent Wetlands (D-1U, D-5U, D-6B, D-7B, D-8B, and D-11B), and one monitoring well near the downgradient edge of the arsenic plume (MW-31B).

The existing surface water sampling locations are illustrated in Figure 5.1. Existing surface water sampling locations SW-1 through SW-6 are used to monitor the surface water arsenic concentrations in the agricultural ditch system to protect potential downgradient receptors.

5.4.2 Extension of Monitoring Network

As described above, the current monitoring network will be expanded to address monitoring goals for additional remedy components as they are constructed and to provide for a comprehensive, long-term monitoring network. The anticipated additions to the ICMP during Phase 1 and Phase 2 are described below.

- During Phase 1, the monitoring network will be expanded by the addition of a network of piezometers for measuring hydraulic gradients and the addition of wells to monitor the End-of-Plume remedy. The design for the hydraulic monitoring network is included in the Performance Monitoring Plan attached to Addendum 1 to this EDR. The monitoring network will also be expanded through the installation of an interim compliance well network in the vicinity of 12th Street East to support compliance monitoring for the End-of-Plume remedy along 12th Street East during Phase 1. The design for this extension of the compliance monitoring well network and associated ICMP adjustments will accompany the End-of-Plume Remediation Design Report, which will be submitted as Addendum 2 to this EDR.
- During Phase 2, the monitoring network will be expanded with additional compliance wells that will complete the long-term compliance monitoring network. Locations to be added are expected to include additional wells to monitor groundwater quality at the CPOC and any additional monitoring wells or other sampling locations to monitor wetlands groundwater quality, interceptor trench water quality, or groundwater extraction water quality. Additional monitoring wells and sampling locations will be initially added through modifications to the ICMP. The final design for the compliance monitoring well network will be presented in the OMI&MP during Phase 2.

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6.0 Institutional Controls

The cleanup action specified in the 2008 CAP includes a containment remedy for the Landfill; therefore, the cleanup action will rely on institutional controls to achieve cleanup goals. These institutional controls include on-site features restricting access to the Landfill, such as signs and fences to protect the integrity of the landfill cap and remedy, and legal mechanisms, which may include lease restrictions, deed restrictions, land use and zoning designations, or building permit requirements.

The Trust implementing this remedy does not own any of the properties affected by the remedy. Therefore, to obtain permission to implement these institutional controls at the Site, the Trust will have to negotiate with the current owners of the properties. As described in the Consent Decree, the Trust will take reasonable actions necessary to implement institutional controls for the remedy short of litigation. Figure 1.1 shows current property ownership in the vicinity of the B&L Site.

6.1 RESTRICTING SITE ACCESS (FENCING, GATES, SIGNS)

The Landfill is currently surrounded by security fencing adequate to protect the landfill cap. Sections of this fence will be temporarily removed for construction activities; portions of the cap may be relocated. The fencing will be replaced following construction of the barrier wall and interception trench. Details regarding changes to the fence are included in Addendum 1 to this EDR.

A gate has been installed on the access road to the B&L Property at Fife Way. This gate is expected to prevent unlawful vehicular access to the B&L property and reduce the illegal dumping of trash and debris that has been evident in recent years. At the request of the City of Milton, additional signs have been placed along the Interurban Trail indicating the dangers of the surface water in adjacent ditches. Maintenance and inspection of the signs and entry gate will be incorporated into the ICMP. The final components for security and signage for the B&L Property will be addressed in the OMI&MP.

6.2 INSTITUTIONAL CONTROLS

Under MTCA, institutional controls can include use restrictions limiting the use of the subject property or resources. These restrictions are typically implemented through legal mechanisms such as lease restrictions, deed restrictions, land use and zoning designations, or building permit requirements. Because the Site includes a closed landfill, a restrictive covenant will be required on the B&L Property. Although the Landfill has been located on the B&L Property in its present configuration since 1993, no records of a restrictive covenant were found among the documents recorded for this parcel with the Pierce County Auditor. A restrictive covenant requiring that the Site security features be maintained, restricting invasive work at the Landfill, and limiting withdrawal of groundwater will be drafted for the B&L Property and included with Addendum 3.

Use restrictions and groundwater recovery restrictions may be required for portions of adjacent properties until groundwater CULs are attained. Washington State Well Regulations already require that no drinking water well be screened at depths less than 20 feet and wells are banned from being drilled within 1,000 feet of an existing landfill. Water rights to Hylebos Creek and to groundwater needed to protect flows into Hylebos Creek have been closed since 1976 (WAC 173-510-040 and -050). The need for and scope of any additional restrictions will be determined during Phase 2 of the remedy implementation. Restrictive covenants for adjacent properties, if any, will be included with Addendum 3.

Because the entity that is implementing the 2008 CAP remedy is not the owner of any portion of the Site, negotiations with the property owners will be necessary to determine the nature of the instruments to be used to impose any restrictive covenants needed to protect human health and the environment.

7.0 CAP Implementation

7.1 PERMITTING REQUIREMENTS UNDER MTCA

This cleanup action is being conducted under an Ecology Consent Decree and, therefore, is exempt from the procedural requirements of certain Washington laws and all local permits (WAC 173-340-710[9][b]); however, it must comply with the substantive requirements of these laws and permits and it must comply with any federal permits that may be required.

The exemption from procedural requirements applies to the following laws:

- Washington Clean Air Act (RCW 70.94)
- Solid Waste Management Act (RCW 70.95)
- Hazardous Waste Management Act (RCW 70.105)
- Construction Projects in State Waters (RCW 77.55)
- Water Pollution Control Act (RCW 90.48)
- Shoreline Management Act (RCW 90.58)
- Any laws requiring or authorizing local government permits or approvals

The permitting exemption is not applicable if Ecology determines that the exemption would result in the loss of approval from a federal agency that may be necessary for the state to administer any federal law. For this reason, any component of the cleanup action requiring a permit under Section 402 (NPDES) or Section 404 (dredge and fill) of the federal Clean Water Act, must obtain a permit prior to implementation.

The cleanup action for the Site will fully comply with all action-, chemical- and location-specific Applicable or Relevant and Appropriate Requirements (ARARs) as described in the final 2008 CAP (Ecology 2008). The cleanup action also includes all of the regulatory elements for landfill closure, as specified in Minimum Functional Standards for Solid Waste Landfills (WAC 173-304), including the use of a slurry wall to halt migration of leachate and contaminated groundwater from beneath the Landfill. Table 7.1 provides a summary of general permitting and substantive requirements with a description of how these requirements will be met. The specific permitting requirements for each component of the remedy will be addressed in the Addenda to this EDR that will be prepared as work proceeds under Phases 1 and 2.

7.2 PHASED IMPLEMENTATION APPROACH

Under the Consent Decree, the cleanup actions specified in the 2008 CAP will be implemented using a phased approach. As described in the SOW (Exhibit B to the Consent Decree), the 2008 CAP implementation will occur in three major work phases: Phases 1 and 2 comprise the initial construction that will be performed by the Trust under the Consent Decree. Phase 3, consisting of long-term operations, monitoring, and maintenance, will be performed by Ecology.

The first two implementation phases include design and construction of all components of the remedy specified in the 2008 CAP; at the completion of Phase 2, all components of the final 2008 CAP remedy will be installed and functional, and all work specified in the Consent Decree will be complete

The three implementation phases acknowledge major design, construction, and operations milestones. At the completion of Phase 1, physical containment of the Landfill will be complete, and in-situ treatment will be active for the End-of-Plume CAA. At the completion of Phase 2, contaminated sediments will be removed from area ditches, hydraulic containment will be established for the Landfill CAA, the remedy for the Wetlands CAA will be installed and operational, and it is expected that the End-of-Plume CAA will have attained the cleanup objectives for that area. The OMI&MP that will be prepared during Phase 2 will document plans for long-term containment of the Landfill CAA, final cleanup of the Wetlands CAA, and long-term maintenance and monitoring of the remedy. Phase 1 and 2 work may overlap to effectively and efficiently implement the 2008 CAP. An overview of the work to be performed during Phases 1, 2 and 3 is provided below.

7.2.1 Phase 1

Phase 1 includes activities necessary for the design and construction of the barrier wall, interceptor trench, and the remedy for the End-of-Plume CAA. Predesign investigations have been or are being conducted within all three CAAs. Field data collection and hydrogeologic modeling to support barrier wall and interceptor trench design have been completed. Engineering for the implementation of the barrier wall and interceptor trench is presently underway. Preliminary design and engineering is provided in Addendum 1 to this EDR. Construction of the barrier wall, interceptor trench, and End-of-Plume remedy will take place in Phase 1.

Additional field data are presently being collected as part of the Phase 1 implementation for design of the End-of-Plume CAA remedy. Design and engineering for the End-of-Plume remedy will be provided in Addendum 2 to this EDR. Additional field data will also be collected as part of Phase 1 to complete delineation of the northern extent of the newly identified western lobe of the groundwater arsenic plume. Collection of hydrogeologic data will continue during the Phase 1 implementation to support collection of seasonal hydrologic and hydrogeologic data needed to support groundwater modeling and transient model calibration and establish a baseline representative of full seasonal variation for use during Phase 2.

7.2.2 Phase 2

The Phase 1 construction of the barrier wall and interceptor trench around the Landfill will significantly change the hydrogeologic conditions in the vicinity of the Landfill, including within the Wetlands area immediately downgradient of the Landfill. Additional data collection studies to be conducted during Phase 2 will assess these changes and support design of a cost-effective hydraulic control component for the Landfill. These studies will also support design and implementation of a cost-effective remedy for the Wetlands CAA and Halo areas within the Landfill CAA. The contaminated sediments in the agricultural ditches will also be cleaned up as part of the Phase 2 implementation. Design and engineering for the groundwater extraction and treatment system, ditch cleanup, and Wetlands CAA remedy will be provided in Addendum 3 to this EDR.

Phase 2 will complete the installation and startup of all remedy components specified in the 2008 CAP. The extraction and treatment systems for the Landfill CAA and the Wetlands CAA will be constructed and operations will commence during Phase 2. Contaminated ditch sediments will be excavated and removed from the Site for off-site disposal. Treatment of the End-of-Plume CAA will continue during Phase 2 to achieve the cleanup objectives specified in the 2008 CAP. Installation of the compliance monitoring network will be completed, and the OMI&MP will be prepared and implemented during Phase 2.

7.2.3 Phase 3

On completion of Phase 2, the initial construction specified under the Consent Decree will be complete and Ecology will assume responsibility for implementation of the third and final implementation phase for implementation of the remedy specified in the 2008 CAP. Phase 3 consists of long-term operations, maintenance, inspection, and monitoring. The scope of the Phase 3 activities will be documented in the OMI&MP.

7.3 CAP IMPLEMENTATION SCHEDULE

The implementation of the 2008 CAP will take several years to complete. Phase 1 implementation commenced when the Consent Decree was formally entered by the Court on July 24, 2008. The general schedule projected for implementation of the 2008 CAP is shown in the table below. Dates are subject to change. Detailed schedules will be included in the Addenda to this EDR for each major portion of work described in this EDR.

TASK	EXPECTED DATES	
	Begin	End
Barrier Wall and Interceptor Trench	August 2009	November 2009
End-of-Plume Remedy (on-going injections)	September 2009	August 2012
Groundwater Treatment Plant Construction/Startup	April 2011	December 2011
Hydraulic Containment System Operation, Landfill/Ditch CAA	December 2011	No end date
Ditch Sediment Remediation	August 2011	September 2011
Installation of Wetlands and Halo Extraction System	July 2011	September 2011
Wetlands and Halo Pump and Treat, Wetlands CAA	December 2011	Unknown
Phase 2 Completion, Transition to Ecology		January 2013

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B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR)

Tables

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Table 5.1
Interim Compliance Monitoring Well Information

Monitoring Well	Installed By	Date Installed	Total Depth Drilled (feet bgs)	Total Depth Cased (feet bgs)	Screened Interval (feet bgs)	Casing Size (ID; in.)	Approximate Ground Surface Elevation[1] (feet NAVD 88)	Measuring Point Elevation[1] (feet NAVD 88)	Northing[1] (feet NAD 83/98)	Easting[1] (feet NAD 83/98)
Upper Sand Aquifer										
D-1U	AGI	9/19/1989	15	13.1	8.1–13.1	2	13.764	15.154	702581.1467	1186263.53
D-5U	AGI	7/25/1990	16.5	13.5	8.5–13.5	2	13.339	17.364	702321.4743	1185708.41
D-6A	Hydrometrics	10/26/1993	15	15	10–15	2	13.094	14.128	702465.581	1185996.46
D-7A	Hydrometrics	10/25/1993	14.5	14.5	9.5–14.5	2	15.269	15.854	702190.9768	1185698.42
D-8A	Hydrometrics	11/10/1993	17	15	10–15	2	14.954	16.174	701886.3802	1185691.53
D-9A	Hydrometrics	11/11/1993	16	13.5	8.5–13.5	2	15.514	17.164	701581.3487	1186172.04
D-10A	Hydrometrics	11/9/1993	15	15	10–15	2	19.501	21.534	701754.648	1186794.84
D-11A	Hydrometrics	11/9/1993	15	15	10–15	2	17.925	19.89	702114.962	1186710.32
MW-23	Hydrometrics	4/1/2002	20.5	17.28	7.28–17.28	2	17.264	20.474	701768.884	1186707.69
MW-30	Floyd|Snider	9/14/2006	21	21	16–21	3/4	18.516	18.516	702394.4934	1186126.76
MW-13	Hydrometrics	9/16/1998	15	14.5	9.5–14.5	2	13.304	15.434	702573.9139	1186104.44
MW-14	Hydrometrics	9/16/1998	15	15	10–15	2	12.746	15.201	702656.6904	1185883.56
MW-15	Hydrometrics	9/17/1998	15	15	10–15	2	12.754	15.319	702717.8081	1186011.71
MW-16	Hydrometrics	9/17/1998	15	15	10–15	2	13.364	15.799	702799.199	1186173.74
MW-17	Hydrometrics	9/17/1998	15	15	10–15	2	12.472	15.197	702857.742	1185983.46
MW-31A	Floyd|Snider	3/23/2007	22	22	17–22	2	14.057	16.482	702917.222	1185835.9
Lower Sand Aquifer										
D-1L	AGI	9/18/1989	30.3	30.3	25.3–30.3	2	13.514	15.084	702586.7477	1186260.33
D-5L	AGI	7/24/1990	30.75	30.3	25.3–30.3	2	13.589	17.189	702330.3977	1185711
D-6B	Hydrometrics	10/26/1993	33	33	28–33	2	13.044	14.541	702460.2	1185997.9
D-7B	Hydrometrics	10/25/1993	34	33	28–33	2	15.169	16.429	702196.2509	1185699.32
D-8B	Hydrometrics	11/11/1993	35	33	28–33	2	14.784	16.179	701881.042	1185691.09
D-11B	Hydrometrics	11/10/1993	34	30	25–30	2	17.985	19.934	702110.806	1186706.36
MW-31B	Floyd|Snider	3/23/2007	40	40	35–40	2	14.057	16.322	702916.222	1185840.57

Notes:

1 Survey information from November−December 2008 survey.

Abbreviations:

bgs	Below ground surface
in	Inches
ID	Internal diameter
NAD 83/98	North American Vertical Datum of 1983/1998
NAVD 88	North American Vertical Datum of 1988

Table 7.1
Permitting and Substantive Requirements Documentation

Activity	Regulating Agency	Code/Citation	Permit Required?	Comments
Construction Stormwater Management—Erosion and Sediment Control	Ecology	Stormwater Management Manual for Western Washington	NPDES Construction Stormwater General Permit	Follow Ecology's Stormwater Management Manual for the Puget Sound Basin and Pierce County Stormwater Management Plan.
	Pierce County	Title 17A—Construction and Infrastructure Regulations–Site Development and Stormwater Drainage	MTCA Exemption Title 17A.10.050(I)	
Grading and clearing	Pierce County	Chapter 8—Pierce County Stormwater Management and Site Development Manual	No permit, but must meet substantive requirement	This manual is incorporated by reference in Title 17A and by ordinance. Provides best management practices for grading and sediment control.
Drainage from Interceptor Trench				
Discharge to Privately Owned Property	Pierce County	Title 17A.40.080	Permission needed	Obtain written permission/easements from the owners of record for both the closed depression and potential overflow routes receiving the runoff.
Infiltration Trench	Ecology	Underground Injection Control (UIC)	The trench is not regulated as a underground injection control (UIC) well if it does not meet Class V requirements	If an infiltration trench is "deeper than its widest surface dimension," or includes an assemblage of perforated pipes, drain tiles, or other similar mechanisms intended to distribute fluids below the surface of the ground, it would probably be considered a Class V injection well.
Overflow into Ditches				
Discharge to Privately owned Property	Pierce County	Stormwater Drainage Title 17A.40.080	Written permission/easement with owners recorded with Pierce County Auditor	Because stormwater cannot be controlled by shutting off pumps, to maintain capacity it may be necessary for clean cap stormwater to flow into both the ditches and the wetland north of the Interurban Trail. In this case, these requirements would apply.
	Pierce County Drainage District #23		Permission needed	
End-of-Plume Injection				
Underground Injection Control (UIC)	Ecology	WAC 173-218	Registration Required	Registered for UIC. Rule Authorized.
Washington Water Wells	Ecology	WAC 173-160	Start Card Required	Standard well installation procedures followed.

B&L Woodwaste Site
Pierce County, Washington

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Figures

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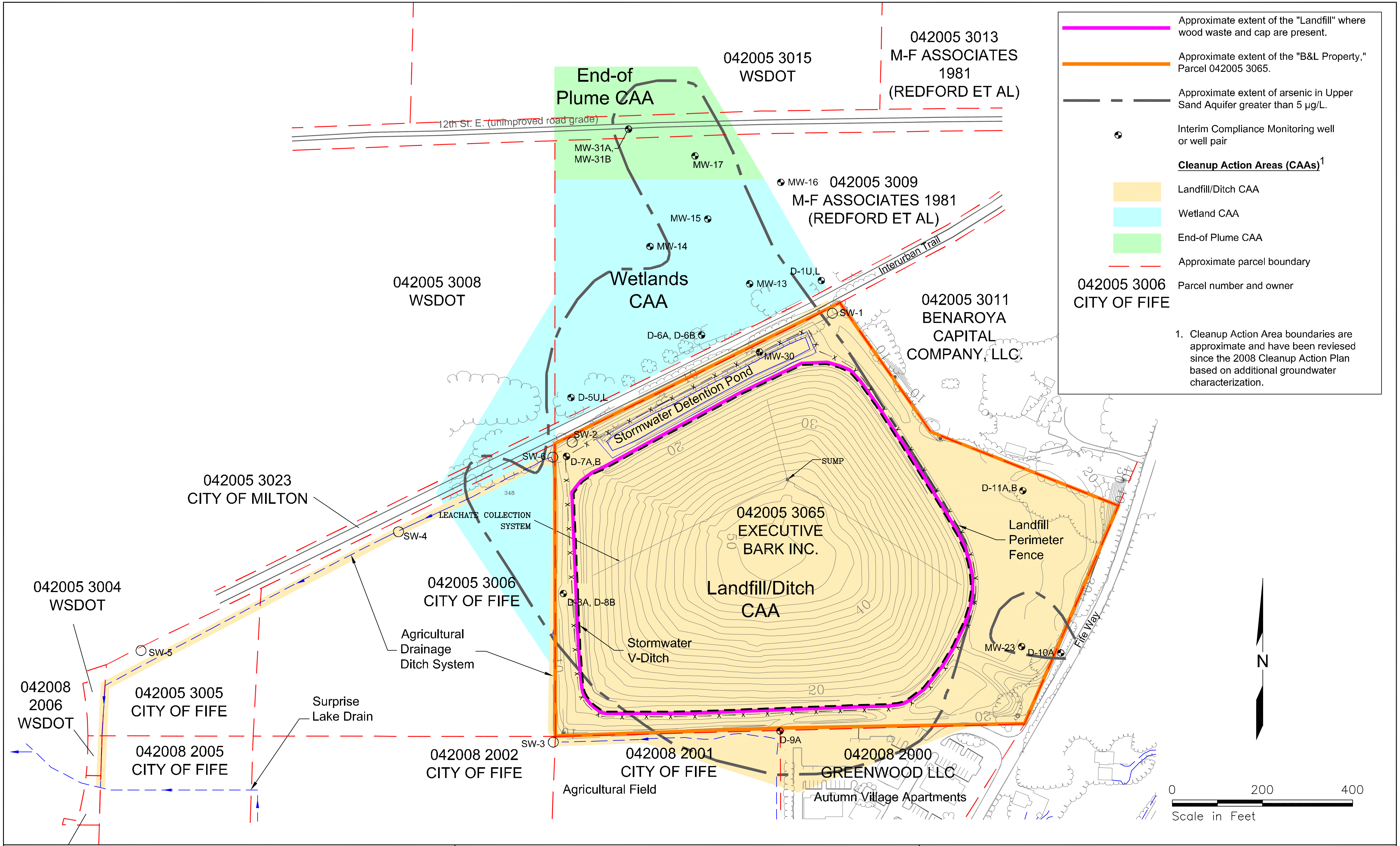

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Engineering Design Report
B&L Woodwaste Site
Pierce County, Washington

Figure 1.1
Site Plan Showing Cleanup Action Areas, Property Ownership, and Interim Compliance Monitoring Locations

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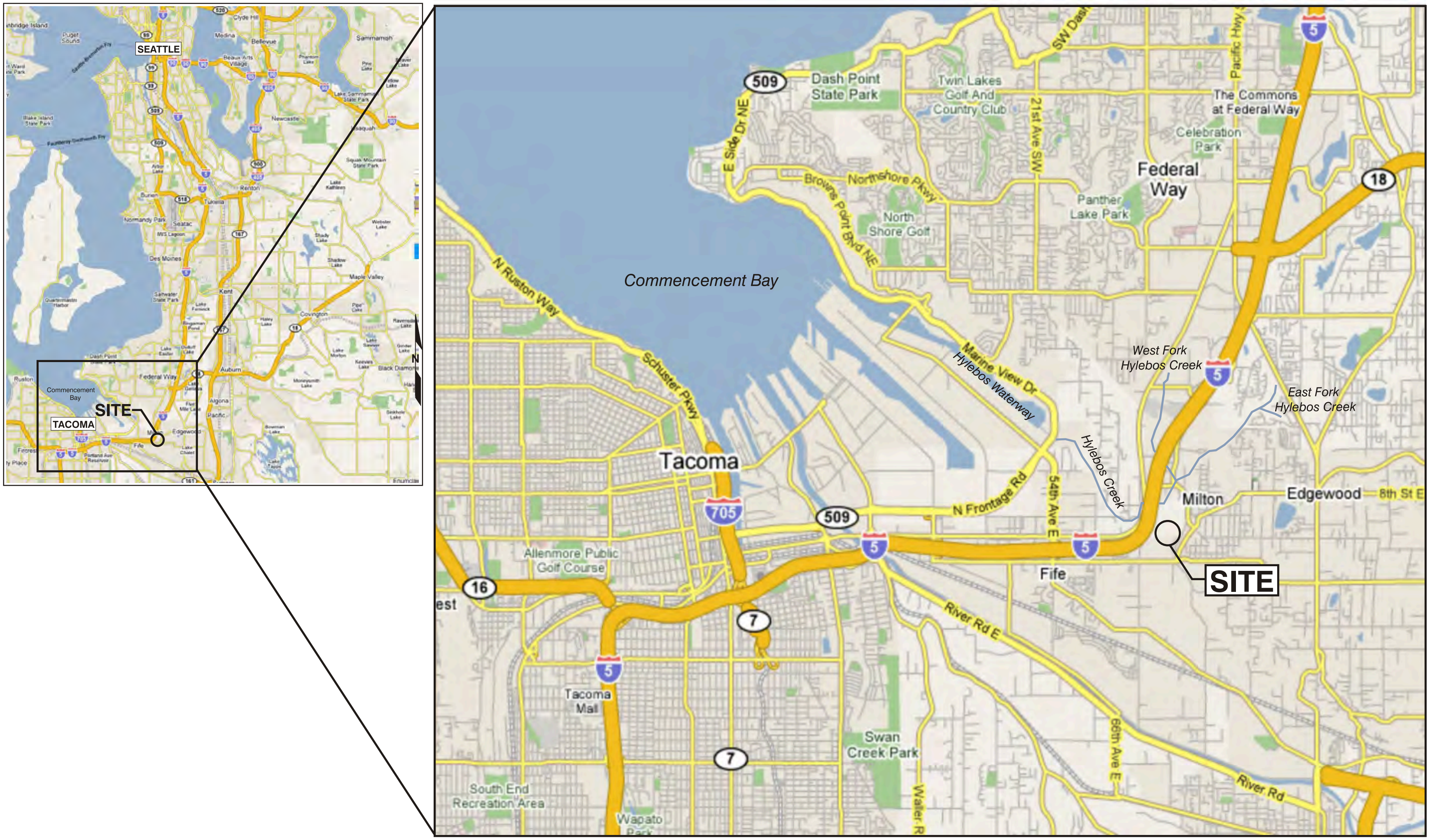

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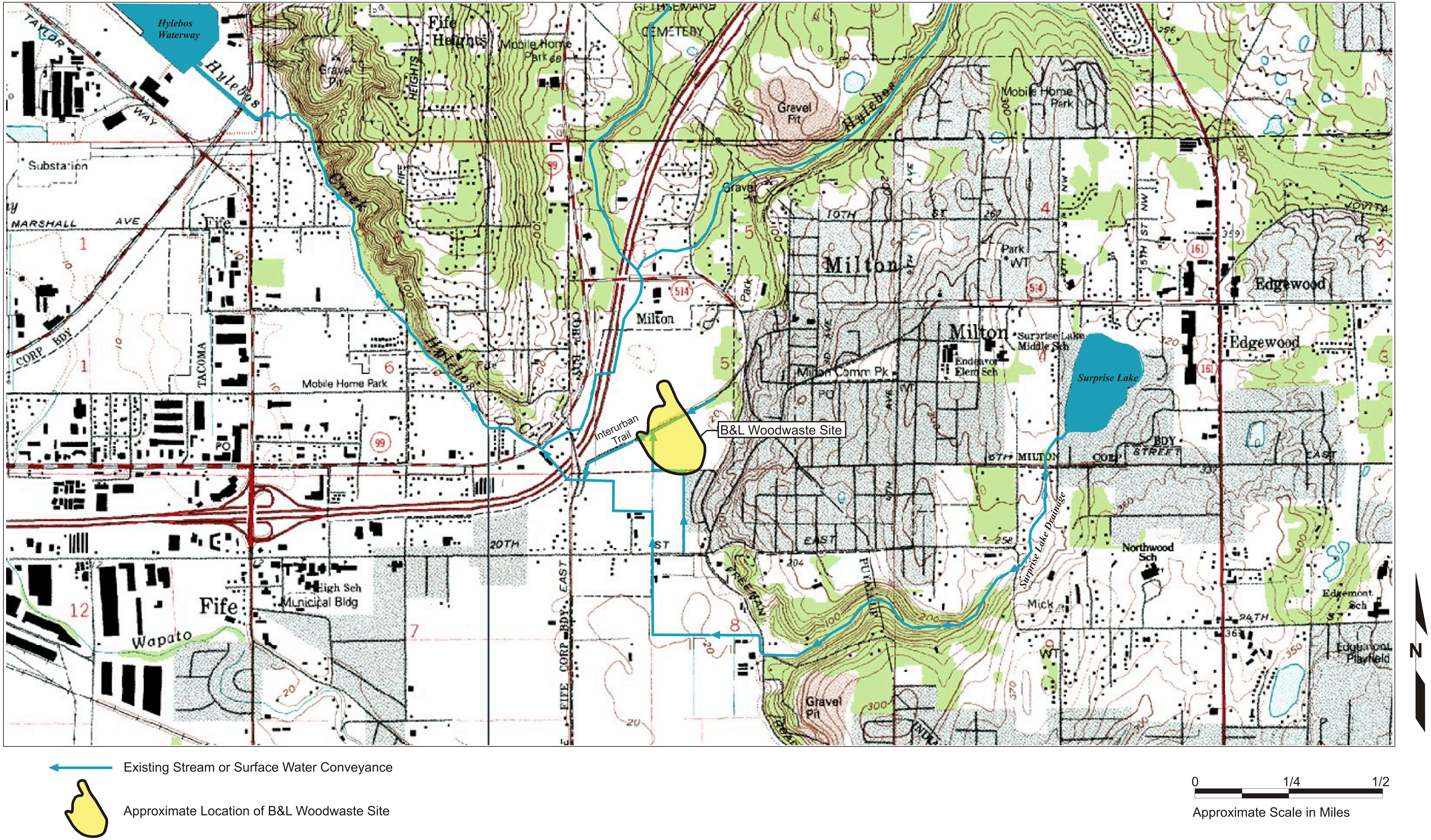
B&L Woodwaste Site
Pierce County, Washington

Figure 2.1
Vicinity Map

g:projects/clients/floydsnider/B&L/EngineeringDesignReport/Figure 2.1.cdr



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B&L Woodwaste Site
Pierce County, Washington

Figure 3.1
Topography and Drainage
Features in Site Vicinity

g:projects/clients/floydsnider/B&L/2008/EngineeringDesignReport/Figure 3.1

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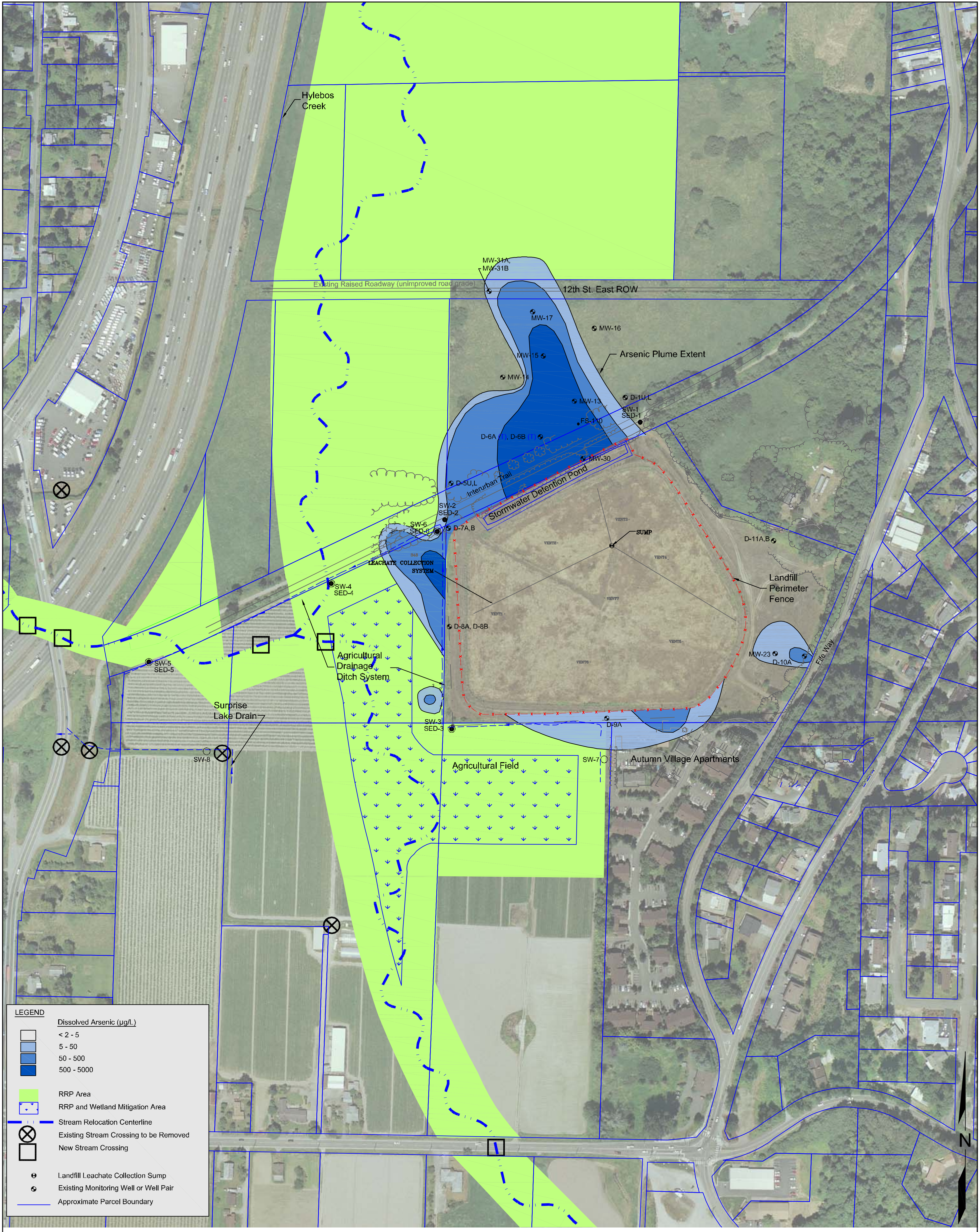

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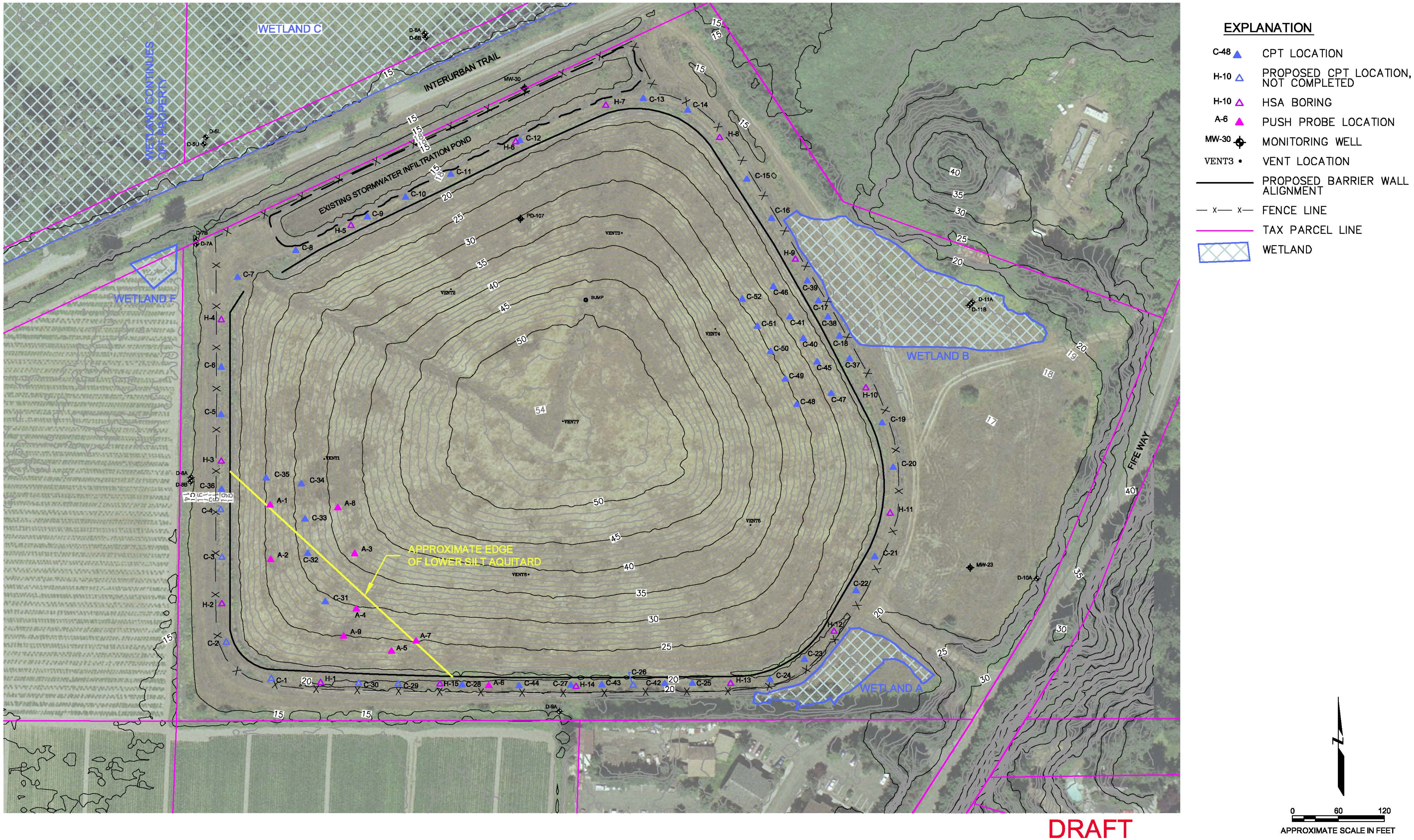
Figure 3.2
Groundwater Arsenic Plume Extent and WSDOT Riparian Restoration



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Pierce County, Washington

Figure 4.1

Geotechnical Exploration Locations

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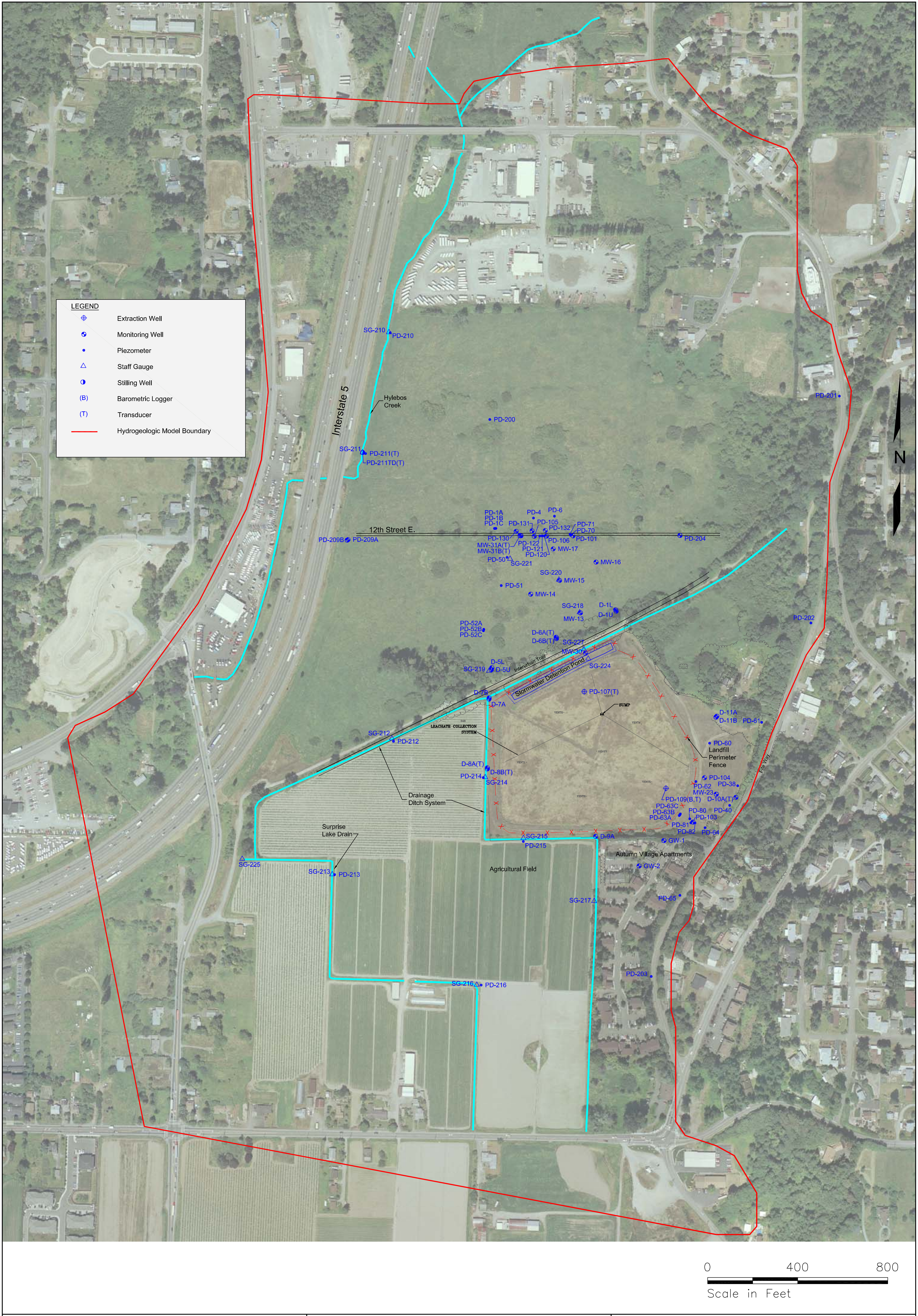

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Figure 4.2
Phase 1 Hydrogeologic Monitoring Points and Model Domain

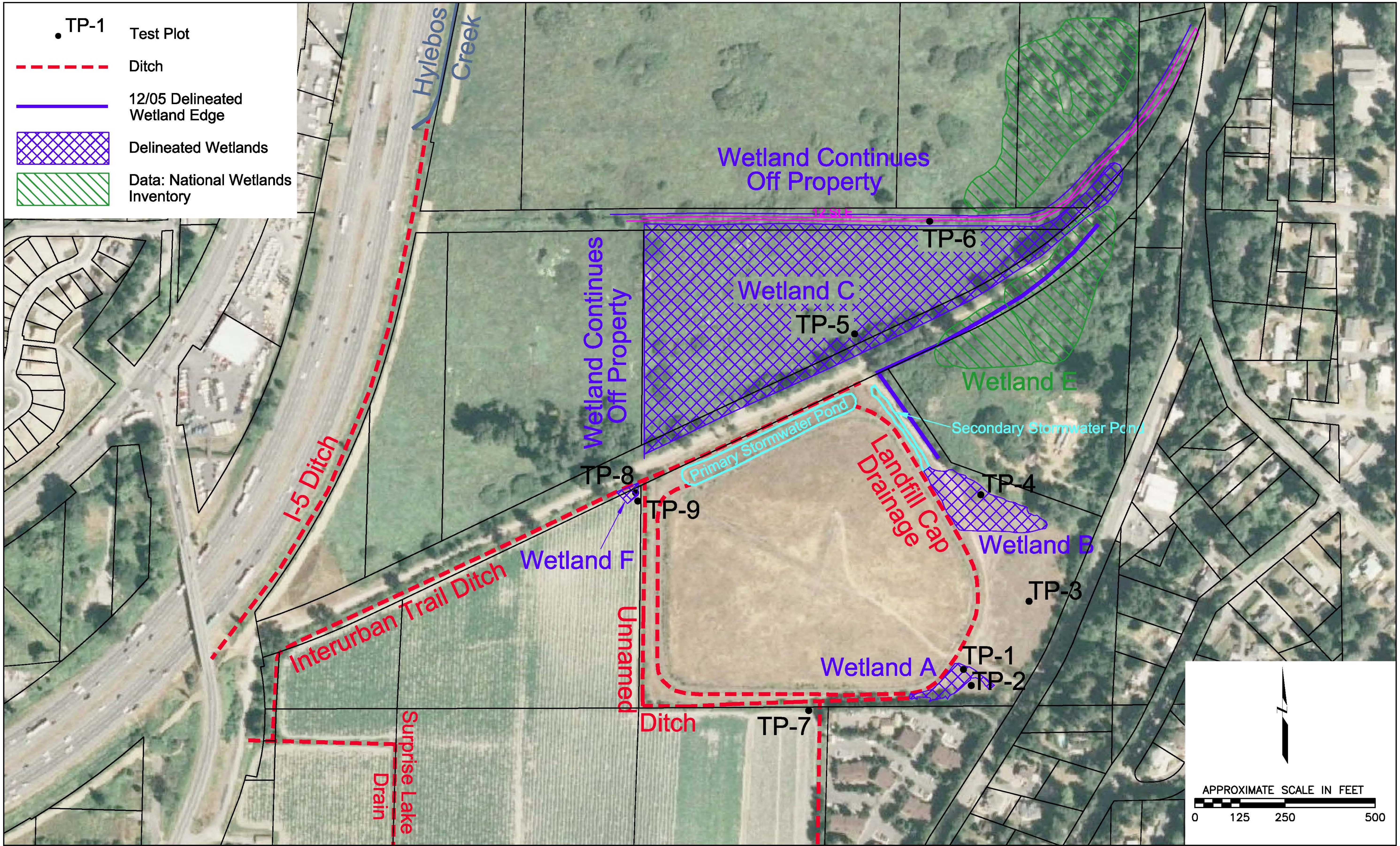

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Figure 4.3

Delineated Wetlands

DWG NAME: S:\13488\002_WetlandDelineation\from Maxwell\B and L Landfill Wetland Delination_031809.dwg
DATE: 3/18/2009 2:31 PM

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Appendix A
Arsenic Characterization Study
Data Report

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600 University Street, Suite 1020 Seattle, WA 98101

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strategy ▪ science ▪ engineering
601 Union Street, Suite 600 Seattle, WA 98101

Technical Memorandum

To: Dom Reale, Department of Ecology
Copies: Dan Silver, B&L Custodial Trust
From: Teri Floyd, Larry McGaughey, Brett Beaulieu
Date: December 10, 2008
Project No: B&L RIM
Re: **Arsenic Characterization Study Data Report**

INTRODUCTION

In this technical memorandum, the data supporting the delineation of arsenic contamination in groundwater at the B&L Woodwaste Site (Site) are presented. These data include compliance monitoring results from the September/October 2008 sampling event in addition to the data collected in the recently completed Arsenic Characterization Study. The purpose of the Arsenic Characterization Study was to fill data gaps necessary for implementation of the Site remedy specified in the final Cleanup Action Plan (CAP) issued by the Washington Department of Ecology (Ecology) in July 2008. As described in the Final Characterization Work Plan (FCWP, Appendix G of the Groundwater Remediation Work Plan [GRWP]), additional data collection was conducted in areas where the extent of arsenic in the Upper Sand Aquifer (USAq) was uncertain or where more precise delineation was necessary for design of the CAP remedy. The recently collected data were gathered from the following areas:

- The arsenic plume beneath the Wetlands immediately north of the Landfill, including the End-of-Plume area
- The Halo area along the western edge of the Landfill (Halo West)
- The Halo area along the southern edge of the Landfill (Halo South)
- The discrete Halo area east of the Landfill, near Wells D-10A and MW-23 (Halo East)

With the modifications noted below, the Arsenic Characterization Study was carried out as described in the FCWP.

FIELD METHODOLOGY

Groundwater and Soil Sampling Methods

Groundwater samples were collected from the depth intervals described in the FCWP. In general, two intervals within the USAq were sampled at each location: an upper and lower interval, according to the rationale provided in the FCWP. Retractable-screen groundwater samples were collected from direct-push borings in accordance with the procedures described in the FCWP and the SAP/QAPP (Appendix B of the GRWP). Analytical laboratory reports are included as Attachment A.[1]

Soil samples were collected and logged for each groundwater sampling location in accordance with the FCWP and SAP/QAPP. Boring logs are included as Attachment B. In selected locations in the Halo West area, including hand-dug shallow sample locations, soil sub-samples were collected and submitted for total arsenic analysis according to standard methods and procedures described in the SAP/QAPP. Analytical laboratory reports for soil are included in Attachment A.

In one location where the interval being sampled did not produce sufficient water for sampling (the lower interval at PD-30; refer to Figure 1), the sample from this interval was not collected.

In three locations in the Halo East area (PD-41, PD-42, and PD-43; refer to Figure 2), the standard procedure was lightly modified. Borings at these locations were advanced as step-out borings to supplement the initial delineation locations in this area. Preliminary results from the initial borings indicated that elevated arsenic was limited to upper-interval groundwater. Therefore, only the upper interval was sampled in these three locations. No soil was sampled and no boring logs were produced for these locations.

Arsenic Field Test Screening

Hach Arsenic Test Kits were specified for field screening in the FCWP. The test kits were used for field testing of arsenic in groundwater for the Halo East and End-of-Plume areas to provide rapid screening results and to improve the efficiency of the delineation process. The results of arsenic field screening were recorded in the field log book and were initially used by the field geologist to determine whether additional step-out borings were warranted. Where field test results indicated concentrations greater than approximately 10 µg/L, additional borings were advanced to delineate the plume boundaries.

After the laboratory analytical results were received and reviewed, it became apparent that the arsenic field test kit was not a reliable measurement of whether or not arsenic was greater than 10 µg/L. The margin of error in the colorimetric test kits was greater than expected and greater than described in the test kit literature. Therefore, the use of the test kits was discontinued and field testing was not used to assist with the delineation of arsenic in the Halo West and Halo South areas.

Laboratory Analyses and Field Quality Control

As specified in the FCWP, the only constituent analyzed for was dissolved arsenic. For retractable-screen groundwater sampling, dissolved arsenic (field filtered using disposable 0.45 µm filters) is considered the appropriate measurement of groundwater arsenic, due to the turbid nature of retractable-screen samples and the presence of natural arsenic within soil.

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[1] Due to its volume, Attachment A is included as a standalone PDF file.

Equipment decontamination and field quality control procedures were performed as described in the SAP/QAPP.

ARSENIC CHARACTERIZATION STUDY RESULTS

Halo West—Groundwater

Results for delineation of arsenic in groundwater for the Halo West area are presented in Table 1 and illustrated in Figure 1 with relevant monitoring well and surface water sampling results from September/October 2008 compliance monitoring. Direct-push boring locations (PD-13 through PD-21) were advanced in north to south transects in the agricultural field west of the Landfill and drainage ditch. Additional step out boring locations (PD-22, PD-90, PD-91, PD-92, PD-94, PD-96, and PD-97) were advanced around areas that required further delineation to the west in Fife field.

Concentrations of dissolved arsenic in the upper interval of the USAq (typically 4- to 8-feet below ground surface [bgs]) ranged from non-detect to 390 µg/L. Dissolved arsenic in groundwater from the lower interval of the USAq (typically 12- to 16-feet bgs) ranged from non-detect to 950 µg/L.

The majority of detections of elevated arsenic in Halo West groundwater occurred in borings advanced in the northern area. Groundwater in the northern portion of the Halo West area exceeded the Site cleanup level (5 µg/L) in both depth intervals within the USAq, and these results indicate that a lobe of the elevated arsenic plume extends several hundred feet beyond the property boundary with the Landfill.

This Halo West plume is present beneath the northeastern corner of the agricultural field and may extend northward into the adjacent, downgradient parcels. The western extent of the plume has been delineated as shown on Figure 1. The northern extent of the plume as it approaches the ditch, Interurban Trail, and wetlands to the north has not yet been fully delineated, as noted by the broken lines in this area on Figure 1.

With one exception, the concentrations of dissolved arsenic in the southern portion of Halo West area were reported at or below the Site cleanup level of 5 µg/L. Concentrations in the upper interval ranged from non-detect to 5 µg/L. In one location, PD-18, a dissolved arsenic concentration of 160 µg/L was detected in groundwater from the lower interval. Borehole PD-18 is located downgradient of the area where slag was observed in shallow soil outside the Landfill as described below. Lower interval groundwater surrounding PD-18 was otherwise less than the detection limit of 2 µg/L, indicating that the issue is very localized around PD-18.

Halo West—Observed Wood Debris in Soil

During the Cultural Resources Survey, shovel test pits (STPs) were advanced in the City of Fife fields to the west of the Site to look for artifacts of historical or cultural significance. Wood debris was identified in shallow soil in several of the test pits along the western boundary of the B&L Property. Additionally, an isolated piece of slag was identified in STP-6 located in the agricultural field on the west side of the ditch near the southwestern corner of B&L Property.

The STP locations, approximate extent of observed woody material, and the location of the observed slag are shown in Figure 1.

Observations of woody material were treated as if they were associated with Landfill wood waste due to their shallow depth and the presence of slag. Native deposits of woody material are also frequently encountered in borings at the Site, though typically at deeper intervals, and consistent with the wetlands nature of the Site.

This finding of wood debris outside the Landfill resulted in additional characterization work outside the scope of the investigation described in the FCWP. Based on this finding, additional step-out direct-push borings were advanced further to the west to assess the extent of woody material and whether the material had impacted groundwater. The characterization was supplemented by STPs and shallow soil sample locations. The extent of woody material in shallow soil is generally limited to shallow soil at depths of approximately 1.5- to 2-feet bgs within approximately 30-feet west of the ditch between the agricultural field and the Landfill. As shown in Figure 1, woody material was also observed in shallow soil further from the Landfill boundary in STP 20.

The finding also resulted in collection and analysis of soil and woody material samples. Soil results are provided in Figure 1 and Table 2. The soil and woody material data suggest that the woody material did not exceed soil cleanup levels (for example, arsenic was detected at 2.3 mg/kg in a representative sample from location P-4). The data also suggest no correlation between woody material and elevated arsenic in groundwater with the possible exception of PD-18, which was located near the observed piece of slag in shallow soil.

Arsenic was detected in shallow soil above the Site cleanup level of 20 mg/kg at location PD-13, which is near the northwest corner of the Landfill. No woody material was observed in shallow soil at this location. The elevated arsenic concentration in soil at PD-13 may be associated with the elevated arsenic present in sediment within the nearby ditch.

Halo South

Results for the Halo South arsenic delineation are presented in Table 3 and illustrated in Figure 1; this figure includes direct-push and monitoring well sampling results from September/October 2008 compliance monitoring. Direct-push boring locations (PD-25 through PD-34) were advanced south of the Landfill in the agricultural field and in the northwestern portion of the Autumn Village Apartments property. Dissolved arsenic concentrations from the upper interval (typically 4- to 8-feet bgs) ranged from non-detect to 180 µg/L, and from the lower interval (typically 11- to 15-feet bgs) ranged from non-detect to 27 µg/L.

The highest concentration of dissolved arsenic, 180 µg/L, was detected within the upper sampling interval of the USAq at PD-31. This boring is located on the Autumn Village Apartments property, approximately 50 feet from the Landfill boundary, where elevated arsenic concentrations were anticipated based on previous sampling results. The extent of elevated arsenic in groundwater near PD-31 is bounded to the southwest by Boring PD-30, in which arsenic was below the cleanup level at a depth of 5- to 9-feet bgs.

Boring locations PD-33 and PD-34 returned the highest concentration of dissolved arsenic in groundwater collected from the lower interval of the USAq. The results were reported at 17 and 27 µg/L, respectively. The pattern of detections in this area, more than 100-feet upgradient of the Landfill, appears to be one of scattered, low-level exceedances that may not be related to the Halo South area or attributable to leaching from the Landfill.

Halo East

Results for the Halo East delineation are presented in Table 4 and illustrated in Figure 2 along with monitoring well sampling results from September/October 2008 compliance monitoring. Boring locations (PD-37 through PD-43) were advanced on B&L Property east of the Landfill and in close proximity to Monitoring Wells MW-23 and D-10A. The results delineate the horizontal extent of elevated arsenic for this hotspot. Elevated arsenic within this Halo area is limited to an area extending approximately 150-feet downgradient from D-10A. The concentrations of dissolved arsenic suggest a small plume emanating from a localized source near D-10A. Elevated concentrations adjacent to D-10A are confined to a narrow area approximately 75-feet wide, while elevated dissolved arsenic appears to spread out laterally as it moves downgradient, broadening to a plume of low-level detections approximately 150-feet wide. This plume may affect groundwater quality in an interceptor trench that may be placed immediately east of the planned barrier wall.

The results also characterize the vertical distribution of arsenic: the highest concentrations of elevated arsenic in Halo East groundwater are present in shallow groundwater (i.e., the upper 15 feet). Near the apparent source of the plume at PD-D10A, the highest concentrations in the Halo East groundwater were detected in the upper interval at 400 µg/L, while 100 µg/L was detected in the lower interval (12- to 16-feet bgs). More elevated concentrations in the upper interval than lower interval were also observed in groundwater collected from the downgradient location PD-37.

End-of-Plume and Wetlands

Results for the End-of-Plume area are illustrated in Figure 3 along with monitoring well sampling results from September/October 2008 compliance monitoring As described in the FCWP, boring locations (PD-1 through PD-6) were advanced in an east-west transect north of the 12th Street East right-of-way in the area anticipated to be the downgradient edge of the plume. The results indicate that arsenic concentrations within the End-of-Plume area have been delineated, with the plume extending approximately 100-feet beyond the existing raised roadway (12th Street East). At locations PD-1 through PD-6, concentrations of dissolved arsenic from the upper interval (8- to 12-feet bgs) of the USAq ranged from 3 to 5 µg/L. Concentrations of dissolved arsenic from the lower interval (16- to 20-feet bgs) of the USAq ranged from 3 to 10 µg/L.

Boring locations PD-50, PD-51, and PD-52 were advanced in a north-to-south transect to the west of MW-14 to delineate the western extent of affected groundwater within the Wetlands area primarily located on the Redford property. Concentrations of dissolved arsenic were reported to be non-detect or at the method reporting limit at these locations, indicating that the western boundary of the plume in this area has been delineated. Based on these results, the areal extent of arsenic-impacted groundwater within the Wetlands and End-of-Plume Cleanup Action Areas (CAAs) is shown on Figure 3.

SUMMARY OF FINDINGS

The primary findings associated with these analytical results are summarized as follows. Refer to Figure 4 for a summary of the extent of elevated arsenic in groundwater.

- The area previously identified as Halo West has been delineated as a lobe of the arsenic plume in groundwater that extends several hundred feet beyond the B&L Property boundary to the northwest, onto property owned by the City of Fife, the Interurban Trail, and, possibly, onto property owned by the Washington State Department of Transportation (WSDOT). The western boundary of this lobe has been delineated. The northern extent of the lobe has not been fully delineated and may require additional characterization on WSDOT property.

- Woody material in shallow soil and an isolated piece of slag were identified in area of the agricultural field west of the landfill. Most of the woody material has not been contaminated by arsenic. The data suggest no correlation between woody debris and the lobe of the arsenic plume identified in groundwater beneath the agricultural field.

- A discrete area with elevated arsenic was identified west of the Landfill, at boring location PD-18. This detection appears to be associated with the presence of slag outside the Landfill boundary.

- The highest concentration of dissolved arsenic in the Halo South area was 180 µg/L, which was detected within the upper groundwater interval at PD-31. This boring is located where elevated arsenic concentrations were anticipated based on historic characterization data. Elevated arsenic within the Halo South area appears to be limited to an area within about 75-feet of the Landfill boundary, extending from the central portion of the southern Landfill boundary to the east just beyond PD-32.

- Several borings more than 100-feet south of the Landfill (i.e., upgradient of the Landfill) indicate an apparent pattern of scattered, low-level arsenic exceedances that may not be associated with the wastes within the Landfill.

- The Halo East hotspot appears to be limited to a small plume emanating from the area near Monitoring Well D-10A. This small plume extends approximately 150-feet downgradient from D-10A with a plume front approximately 150-feet wide. Concentrations of arsenic in Halo East groundwater appear to be higher within the upper 15-feet of groundwater, which is consistent with a shallow source.

- The Halo East hotspot extends into an area in which an interceptor trench may be constructed, and may affect the quality of intercepted groundwater.

- Elevated arsenic within the End-of-Plume area has been delineated to extend approximately 100-feet beyond the existing raised roadway (12th Street East).

- The western extent of elevated arsenic within the Wetlands area primarily on the Redford property has been delineated.

Encl.:	Table 1	Groundwater Arsenic Results for Halo West Area
	Table 2	Soil Arsenic Results for Halo West Area
	Table 3	Groundwater Arsenic Results for Halo South Area
	Table 4	Groundwater Arsenic Results for Halo East Area
	Table 5	Groundwater Arsenic Results for End-of-Plume Area
	Figure 1	Halo West & South Arsenic Characterization Results
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	Attachment A	Analytical Laboratory Results
	Attachment B	Boring Logs

Tables

Table 1
Groundwater Arsenic Results for Halo West Area

Upper Sand Aquifer Groundwater Monitoring Well Data				
Location	**Depth (ft bgs)**	**Sample Date**	**Dissolved Arsenic (µg/L)**	**Total Arsenic (µg/L)**
D-7A	9.5–14.5	10/1/2008	**93.0**	**97.5**
D-8A	10–15	10/1/2008	**26.1**	**37.7**

Upper Sand Aquifer Groundwater Data from Direct-push Borings				
Location	**Depth (ft bgs)**	**Sample Date**	**Dissolved Arsenic (µg/L)**	
			Upper Interval	**Lower Interval**
PD-13	4–8	10/16/2008	2 U	
	12–16			**8**
PD-14	4–8	10/16/2008	**950**	
	12–16			**230**
PD-15	4–8	10/15/2008	**390**	
	12–16			**160**
PD-16	4–8	10/15/2008	**64**	
	12–16			**19**
PD-17	4–8	10/15/2008	2 U	
	12–16			2 U
PD-18	4–8	10/15/2008	4	
	12–16			**160**
PD-19	4–8	10/22/2008	**28**	
	12–16			**42**
PD-20	4–8	10/22/2008	3	
	12–16			2 U
PD-21	4–8	10/22/2008	2 U	
	12–16			2
PD-22	4–8	10/16/2008	5	
	12–16			2 U
PD-90	4–8	10/22/2008	2 U	
	12–16			**350**

Upper Sand Aquifer Groundwater Data from Direct-push Borings

Location	Depth (ft bgs)	Sample Date	Dissolved Arsenic (µg/L)	
			Upper Interval	Upper Interval
PD-91	4–8	10/22/2008	**110**	
	12–16			**190**
PD-92	4–8	10/22/2008	4	
	12–16			4
PD-94	4–8	10/23/2008	3	
	12–16			2 U
PD-96	4–8	10/23/2008	2 U	
	12–16			2 U
PD-97	4–8	10/23/2008	2 U	
	12–16			2 U

Notes:

Bold	Indicates value exceeds Site cleanup level in groundwater of 5 µg/L

Abbreviations:

bgs	Below ground surface
ft	Feet
U	Analyte is undetected at given reporting limit

Table 2
Soil Arsenic Results for Halo West Area

Location	Depth (ft bgs)	Sample Date	Arsenic (mg/kg)
P-4-2	2	10/15/2008	2.4
PD-17-2	2	10/15/2008	1 U
PD-14-5	5	10/16/2008	1 U
PD-14-8	8	10/16/2008	1 U
PD-13-2	2	10/16/2008	**37**
PD-13-3	3	10/16/2008	3.6
PD-13-12	12	10/16/2008	1 U
PD-13-12D	12	10/16/2008	1 U
PD97-2.5'	2.5	10/23/2008	7.7
PD97-2.5'D	2.5	10/23/2008	7.9

Notes:

Bold	Indicates value exceeds Site cleanup level in soil of 20 mg/kg

Abbreviations:

bgs	Below ground surface
ft	Feet
U	Analyte is undetected at given reporting limit

Table 3
Groundwater Arsenic Results for Halo South Area

Upper Sand Aquifer Groundwater Monitoring Well Data				
Location	**Depth (ft bgs)**	**Sample Date**	**Dissolved Arsenic (µg/L)**	**Total Arsenic (µg/L)**
D-9A	8.5–13.5	10/1/2008	**35.4**	**38.1**
Upper Sand Aquifer Groundwater Data from Direct-push Borings				
Location	**Depth (ft bgs)**	**Sample Date**	**Dissolved Arsenic (µg/L)**	
			Upper Interval	**Lower Interval**
PD-25	4–8	10/16/2008	2 U	
	12–16			2 U
PD-26	4–8	10/16/2008	2 U	
	12–16			2 U
PD-27	4–8	10/16/2008	2 U	
	12–16			2 U
PD-28	4–8	10/17/2008	**9**	
	12–16			2 U
PD-29	4–8	9/26/2008	2 U	
	9–13			**12**
PD-30	5–9	9/26/2008	4	NA
PD-31	5–9	9/26/2008	**180**	
	10–14			2 U
PD-32	4–8	8/6/2008	**10**	
	11–15			2
PD-33	4–8	10/17/2008	2 U	
	12–16			**17**
PD-34	4–8	9/26/2008	2 U	
	10–14			**27**

Notes:

Bold	Indicates value exceeds site cleanup level in groundwater of 5 µg/L

Abbreviations:

bgs	Below ground surface
ft	Feet
U	Analyte is undetected at given reporting limit

Table 4
Groundwater Arsenic Results for Halo East Area

Upper Sand Aquifer Groundwater Monitoring Well Data

Location	Depth (ft bgs)	Sample Date	Dissolved Arsenic (µg/L)	Total Arsenic (µg/L)
D-10A	12–16	9/29/2008	**211**	**204**
D-11A	10–15	10/1/2008	0.6	0.5
MW-23	10–15	9/30/2008	**15.6**	**20.9**

Upper Sand Aquifer Groundwater Data from Direct-push Borings

Location	Depth (ft bgs)	Sample Date	Dissolved Arsenic (µg/L)	
			Upper Interval	Lower Interval
PD-37	10–14	8/7/2008	**26**	
	16–20			4
PD-38	10–14	8/7/2008	2 U	
	16–20			2
PD-39	10–14	8/6/2008	2 U	
	16–20			2 U
PD-40	10–14	8/6/2008	3	
	16–20			3
PD-41	10–14	8/8/2008	**10**	NA
PD-42	10–14	8/8/2008	**8**	NA
PD-43	10–14	8/8/2008	5	NA
PD-D10A	9–13	8/27/2008	**400**	
	12–16			**100**

Notes:

Bold	Indicates value exceeds site cleanup level in groundwater of 5 µg/L

Abbreviations:

bgs	Below ground surface
ft	Feet
U	Analyte is undetected at given reporting limit
NA	Not analyzed

Table 5
Groundwater Arsenic Results for End-of-Plume Area

Upper Sand Aquifer Groundwater Monitoring Well Data

Location	Depth (ft bgs)	Sample Date	Dissolved Arsenic (µg/L)	Total Arsenic (µg/L)
D-1U	8–13	9/29/2008	2.8	2.9
D-5U	8.5–13.5	9/29/2008	**131**	**143**
D-6A	10–15	9/29/2008	**1,500**	**1,430**
MW-13	9.5–14.5	9/30/2008	**2,420**	**2,510**
MW-14	10–15	10/2/2008	3.4	3.9
MW-15	10–15	10/1/2008	**1,520**	**1,720**
MW-16	10–15	10/2/2008	4.1	4.6
MW-17	10–15	10/1/2008	3.6	2.8
MW-30	16–21	10/1/2008	**2,310**	**2,260**
MW-31A	10–15	10/1/2008	**22.7**	**22.2**
PD-105	12–22	10/1/2008	**45.4**	**45.5**
PD-106	12–22	10/1/2008	**14.4**	**12.8**

Upper Sand Aquifer Groundwater Data from Direct-push Borings

Location	Depth (ft bgs)	Sample Date	Dissolved Arsenic (µg/L)	
			Upper Interval	Lower Interval
PD-1	8–12	8/15/2008	3	
	14–18	8/15/2008		3
PD-2	8–12	8/13/2008	3	
	14–18			4
PD-3	8–12	8/13/2008	4	
	16–20			5
PD-4	8–12	8/14/2008	5	
	16–20			**10**
PD-5	8–12	8/14/2008	5	
	16–20			**8**
	17–21			**8**

Upper Sand Aquifer Groundwater Data from Direct-push Borings				
Location	**Depth (ft bgs)**	**Sample Date**	**Dissolved Arsenic (µg/L)**	
			Upper Interval	**Upper Interval**
PD-6	8–12	8/15/2008	4	
	17–21			**8**
PD-50	8–12	8/19/2008	2 U	
	13–17			2 U
PD-51	8–12	8/19/2008	2 U	
	12–16			3.6
PD-52	9–13	8/19/2008	2 U	
	15–19			2 U

Notes:

Bold	Indicates value exceeds site cleanup level in groundwater of 5 µg/L

Abbreviations:

bgs	Below ground surface
ft	Feet
U	Analyte is undetected at given reporting limit

Notes:

1. Analytical results from sampling during August - October, 2008.

2. Groundwater CUL = 5 µg/L As
Soil CUL = 20 mg/kg As

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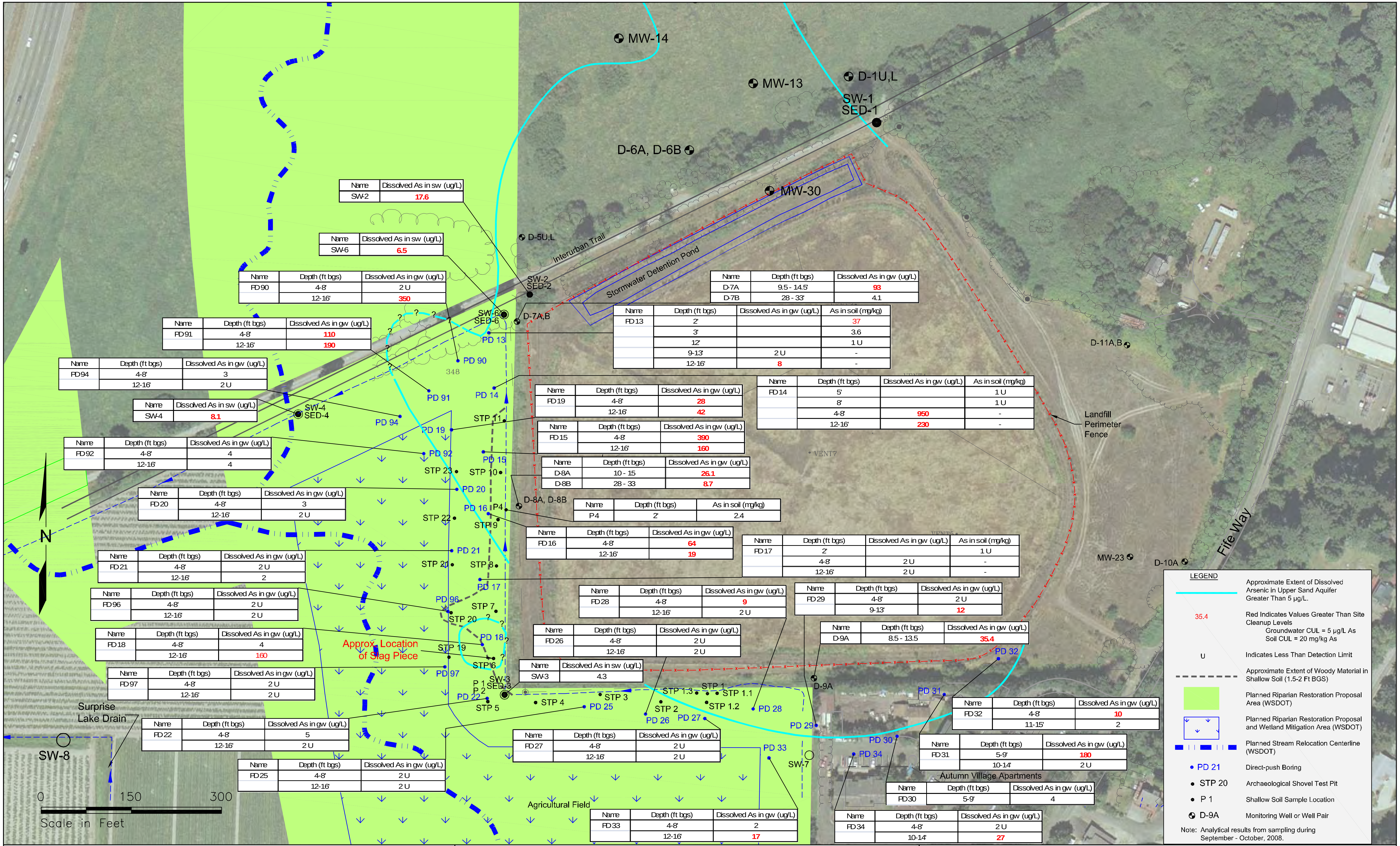
Arsenic Characterization Study
B&L Woodwaste Site
Pierce County, Washington

Figure 4
Arsenic Characterization
Results Summary

DWG NAME: G:\project\Clients\Floyd and Snider\BandL\BandL052.dwg
DATE: 12/03/08 11:54am

Figures



Name	Dissolved As in sw (ug/L)
SW-2	17.6

Name	Dissolved As in sw (ug/L)
SW-6	6.5

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 90	4-8'	2 U
	12-16'	350

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 91	4-8'	110
	12-16'	190

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 94	4-8'	3
	12-16'	2 U

Name	Dissolved As in sw (ug/L)
SW-4	8.1

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 92	4-8'	4
	12-16'	4

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 20	4-8'	3
	12-16'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 21	4-8'	2 U
	12-16'	2

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 96	4-8'	2 U
	12-16'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 18	4-8'	4
	12-16'	160

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 97	4-8'	2 U
	12-16'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 22	4-8'	5
	12-16'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 25	4-8'	2 U
	12-16'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
D-7A	9.5 - 14.5'	93
D-7B	28 - 33'	4.1

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)	As in soil (mg/kg)
PD 13	2'		37
	3'		3.6
	12'		1 U
	9-13'	2 U	-
	12-16'	8	-

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 19	4-8'	28
	12-16'	42

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)	As in soil (mg/kg)
PD 14	5'		1 U
	8'		1 U
	4-8'	950	-
	12-16'	230	-

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 15	4-8'	390
	12-16'	160

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
D-8A	10 - 15	26.1
D-8B	28 - 33	8.7

Name	Depth (ft bgs)	As in soil (mg/kg)
P4	2'	2.4

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 16	4-8'	64
	12-16'	19

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)	As in soil (mg/kg)
PD 17	2'		1 U
	4-8'	2 U	-
	12-16'	2 U	-

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 28	4-8'	9
	12-16'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 29	4-8'	2 U
	9-13'	12

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 26	4-8'	2 U
	12-16'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
D-9A	8.5 - 13.5	35.4

Name	Dissolved As in sw (ug/L)
SW-3	4.3

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 32	4-8'	10
	11-15'	2

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 27	4-8'	2 U
	12-16'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 31	5-9'	180
	10-14'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 30	5-9'	4

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 33	4-8'	2
	12-16'	17

Name	Depth (ft bgs)	Dissolved As in gw (ug/L)
PD 34	4-8'	2 U
	10-14'	27

LEGEND

━	Approximate Extent of Dissolved Arsenic in Upper Sand Aquifer Greater Than 5 µg/L.
35.4	Red Indicates Values Greater Than Site Cleanup Levels Groundwater CUL = 5 µg/L As Soil CUL = 20 mg/kg As
U	Indicates Less Than Detection Limit
- - - -	Approximate Extent of Woody Material in Shallow Soil (1.5-2 Ft BGS)
🟩	Planned Riparian Restoration Proposal Area (WSDOT)
☐	Planned Riparian Restoration Proposal and Wetland Mitigation Area (WSDOT)
▬ ǀ ǀ ▬ ǀ ǀ ▬	Planned Stream Relocation Centerline (WSDOT)
• PD 21	Direct-push Boring
• STP 20	Archaeological Shovel Test Pit
• P 1	Shallow Soil Sample Location
⊕ D-9A	Monitoring Well or Well Pair

Note: Analytical results from sampling during September - October, 2008.

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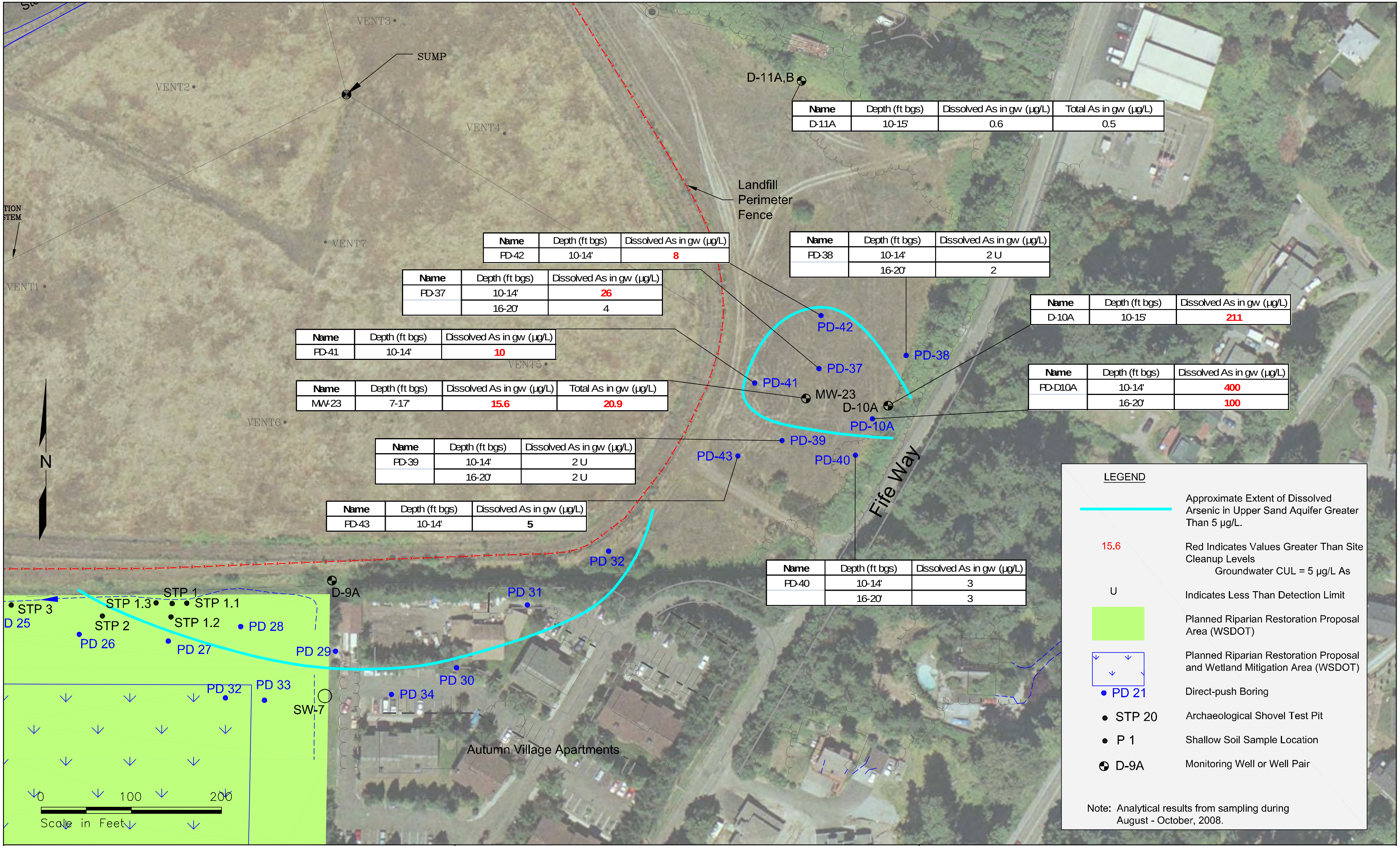
Arsenic Characterization Study
B&L Woodwaste Site
Pierce County, Washington

Figure 1
Halo West & South Arsenic Characterization Results

DWG NAME: G:\project\Clients\Floyd and Snider\BandL\BandL049.dwg
DATE: 12/03/08 11:21am



Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
D-11A	10-15'	0.6	0.5

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-42	10-14'	8

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-38	10-14'	2 U
	16-20'	2

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-37	10-14'	26
	16-20'	4

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
D-10A	10-15'	211

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-41	10-14'	10

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
MW-23	7-17'	15.6	20.9

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-D10A	10-14'	400
	16-20'	100

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-39	10-14'	2 U
	16-20'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-43	10-14'	5

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-40	10-14'	3
	16-20'	3

LEGEND

—	Approximate Extent of Dissolved Arsenic in Upper Sand Aquifer Greater Than 5 µg/L.
15.6	Red Indicates Values Greater Than Site Cleanup Levels Groundwater CUL = 5 µg/L As
U	Indicates Less Than Detection Limit
🟩	Planned Riparian Restoration Proposal Area (WSDOT)
↓	Planned Riparian Restoration Proposal and Wetland Mitigation Area (WSDOT)
● PD 21	Direct-push Boring
● STP 20	Archaeological Shovel Test Pit
● P 1	Shallow Soil Sample Location
⊕ D-9A	Monitoring Well or Well Pair

Note: Analytical results from sampling during August - October, 2008.

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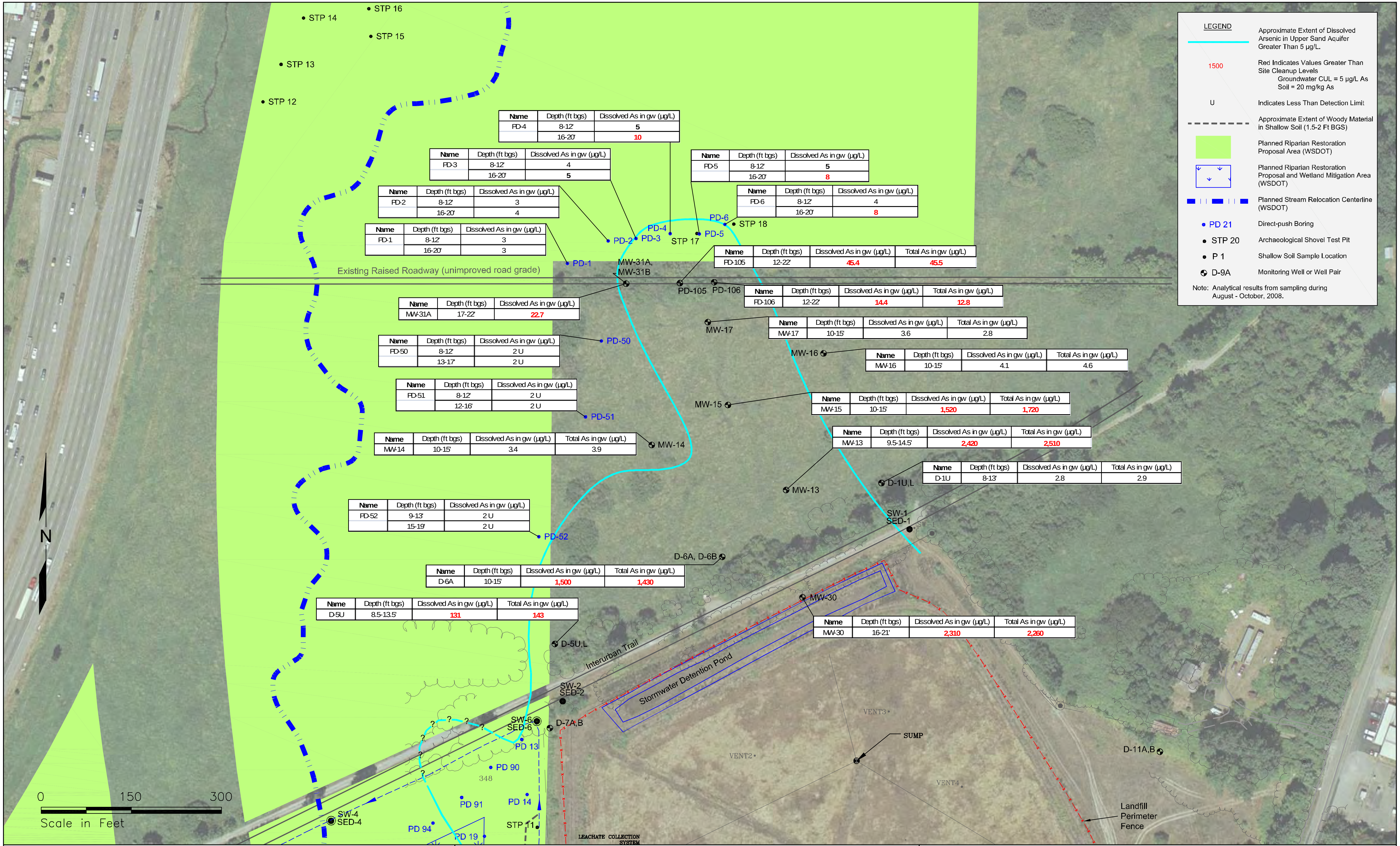
AMEC Geomatrix

Arsenic Characterization Study
B&L Woodwaste Site
Pierce County, Washington

Figure 2
Halo East Arsenic
Characterization Results

DWG NAME: G:\project\Clients\Floyd and Snider\BandL\BandL050.dwg
DATE: 12/03/08 11:30am



Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-4	8-12'	**5**
	16-20'	**10**

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-3	8-12'	4
	16-20'	**5**

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-5	8-12'	**5**
	16-20'	**8**

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-2	8-12'	3
	16-20'	4

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-6	8-12'	4
	16-20'	**8**

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-1	8-12'	3
	16-20'	3

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
PD-105	12-22'	**45.4**	**45.5**

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
PD-106	12-22'	**14.4**	**12.8**

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
MW-31A	17-22'	**22.7**

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
MW-17	10-15'	3.6	2.8

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-50	8-12'	2 U
	13-17'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
MW-16	10-15'	4.1	4.6

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-51	8-12'	2 U
	12-16'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
MW-15	10-15'	**1,520**	**1,720**

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
MW-14	10-15'	3.4	3.9

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
MW-13	9.5-14.5'	**2,420**	**2,510**

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
D-1U	8-13'	2.8	2.9

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)
PD-52	9-13'	2 U
	15-19'	2 U

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
D-6A	10-15'	**1,500**	**1,430**

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
D-5U	8.5-13.5'	**131**	**143**

Name	Depth (ft bgs)	Dissolved As in gw (µg/L)	Total As in gw (µg/L)
MW-30	16-21'	**2,310**	**2,260**

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Arsenic Characterization Study
B&L Woodwaste Site
Pierce County, Washington

Figure 3
End-of-Plume Arsenic Characterization Results

DWG NAME: G:\project\Clients\Floyd and Snider\BandL\BandL051.dwg
DATE: 12/03/08 11:34am

Attachment A

Analytical Laboratory Results

Analytical Resources, Incorporated
Analytical Chemists and Consultants

October 29, 2008

Brett Beaulieu
Floyd Snider
600 Union Street, Suite 600
Seattle, WA 98101-2341

RE: Project: B&L Landfill
ARI Job No: NS10

Dear Brett:

Please find enclosed the original Chain-of-Custody (COC) records, sample receipt documentation, and the final results for the samples for the project referenced above. Analytical Resources, Inc. (ARI) accepted twenty water samples in good condition on October 1, 2008. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form.

The samples were analyzed for Total and Dissolved Arsenic and various conventional parameters, as requested on the COC.

TDS was present in the method blank at a concentration that was greater than the reporting limit. All associated samples contained concentrations of TDS that were greater than ten times the concentration of the method blank. No further corrective action was required.

The LCS percent recovery of sulfide fell outside the control limits low. The matrix spike percent recovery was within the LCS control limits. No further corrective action was required.

The matrix spike percent recovery of Ferrous Iron was outside the control limits for sample **BLW-GW-PD103**. The sample concentration exceeded the spike concentration by a factor of four or more, therefore no further corrective action was required.

An electronic copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Cheronne Oreiro
Project Manager
-For-
Susan Dunnihoo
Director, Client Services
sue@arilabs.com
206-695-6207

cc: eFile NS43

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: N510
Turn-around Requested: Normal TAT
Page: 1 of ~~4~~ 7
ARI Client Company: Floyd-Snider
Phone: 206·292·2078
Date:
Ice Present? Yes
Client Contact: Brett Beaulieu
No. of Coolers:
Cooler Temps:
Client Project Name: B+L Landfill
Client Project #: B+L RIM TRUST
Samplers: L.Meoli / E. Murray

Sample ID	Date	Time	Matrix	No. Containers	TOTAL AS	DISS AS							Notes/Comments
BLW-GW-D6B-F	9/29/08	1405	GW	1	✓	✓							– all DISS. samples
BLW-GW-D6B		1405		1	✓	✓							were field filtered.
BLW GW-D5U-F		1220		1	✓	✓							
BLW GW-D5U		1220		1	✓	✓							
BLW-GW-D5UA-F		1225		1	✓	✓							
BLW-GW-D5UA		1225		1	✓	✓							
BLW GW-11B-F		1040		1	✓	✓							
BLW GW-11B		1040		1	✓	✓							
BLW GW-DILF		1500		1	✓	✓							
BLW-GW-DIL		1500		1	✓	✓							

Comments/Special Instructions

	Relinquished by:	Received by:	Relinquished by:	Received by:
(Signature)	Lisa Meoli	Jonathan Walter		
Printed Name:	Lisa Meoli	Jonathan Walter		
Company:	Floyd Snider	ARI		
Date & Time:	10/1/08 1615	10/1/08 1615		

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: NS10	Turn-around Requested: Standard TAT
ARI Client Company: Floyd/Snider	Phone: 206-292-2078
Client Contact: Brett Beaulieu	
Client Project Name: B&L Landfill	
Client Project #: B&L RIM TRUST	Samplers: Liza Merli / E. Murray

Page: 2	of 7
Date: 9/30/08	Ice Present? Yes
No. of Coolers:	Cooler Temps:

					Analysis Requested								Notes/Comments
Sample ID	Date	Time	Matrix	No. Containers	TOT AS	Diss AS	Ferrous Iron	Sulfate, Cl, NO3	Sulfide Alkalinity	TDS, TOC, DOC			
BLWGW-D7A-F	9/30/08	1000	GW	1	✓	✓					-		All Diss. samples were
BLWGW-D7A		1000		1	✓	✓							field filtered.
BLWGW-D8A-F		1105		1	✓	✓							
BLWGW-D8A		1105		1	✓	✓							
BLW-GW-PD106		9:20		1	✓	✓	✓	✓	✓	✓			
BLW-GW-PD106F	10/1/08	9:20		1	✓	✓							
BLW-GW-PD105	10/1/08	10:00		1	✓	✓	✓	✓	✓	✓			
BLW-GW-PD105-F		10:00		1	✓	✓							
BLW-GW-MW31A		10:15		1	✓	✓	✓	✓	✓	✓			
BLW-GW-MW31A-F		10:15		1	✓	✓							

Comments/Special Instructions

Relinquished by:	Received by:	Relinquished by:	Received by:
(Signature)	(Signature)	(Signature)	(Signature)
Printed Name: Erin Murray	Printed Name: Jonathon Walter	Printed Name:	Printed Name:
Company: Floyd Snider	Company: ARI	Company:	Company:
Date & Time: 10/1/08 4:15	Date & Time: 10/1/08 1615	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Floyd Snider
COC No:
Assigned ARI Job No: NS10

Project Name: B&L Landfill
Delivered by: Hand
Tracking No:

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]
Were custody papers included with the cooler? .... [✓ YES] NO
Were custody papers properly filled out (ink, signed, etc.) .... [✓ YES] NO
Record cooler temperature (recommended 2.0-6.0 °C for chemistry 15.4, 9.2, 12.4, 9.2

Cooler Accepted by: JW Date: 10/1/08 Time: 1615

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? .... YES [✓ NO]
What kind of packing material was used? .... ICE
Was sufficient ice used (if appropriate)? .... YES [✓ NO]
Were all bottles sealed in individual plastic bags? .... YES [✓ NO]
Did all bottle arrive in good condition (unbroken)? .... [✓ YES] NO
Were all bottle labels complete and legible? .... [✓ YES] NO
Did all bottle labels and tags agree with custody papers? .... YES [✓ NO]
Were all bottles used correct for the requested analyses? .... [✓ YES] NO
Do any of the analyses (bottles) require preservation? (attach preservation checklist) .... [✓ YES] NO
Were all VOC vials free of air bubbles? .... [✓ NA] YES NO
Was sufficient amount of sample sent in each bottle? .... [✓ YES] NO

Samples Logged by: JW Date: 10/2/08 Time: 1520

***** Notify Project Manager of discrepancies or concerns *****

Explain discrepancies or negative responses:
Sample BLW-GW-PD105 missing DOC bottle

By:
Date:

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-D6B-F
SAMPLE

Lab Sample ID: NS10A
LIMS ID: 08-26101
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**2.4**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-D6B
SAMPLE

Lab Sample ID: NS10B
LIMS ID: 08-26102
Matrix: Water
Data Release Authorized
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**2.4**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-D5U-F
SAMPLE

Lab Sample ID: NS10C
LIMS ID: 08-26103
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.5	**131**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: BLW-GW-D5U
SAMPLE

Lab Sample ID: NS10D
LIMS ID: 08-26104
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	1	**143**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-D5UA-F
SAMPLE

Lab Sample ID: NS10E
LIMS ID: 08-26105
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.5	**129**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-D5UA
SAMPLE

Lab Sample ID: NS10F
LIMS ID: 08-26106
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	0.5	**140**	

U-Analyte undetected at given RL
RL-Reporting Limit

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INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: BLW-GW-11B-F
SAMPLE

Lab Sample ID: NS10G
LIMS ID: 08-26107
Matrix: Water
Data Release Authorized
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	7440-38-2	Arsenic	0.2	0.6	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-11B
SAMPLE

Lab Sample ID: NS10H
LIMS ID: 08-26108
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**0.5**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: BLW-GW-D1L-F
SAMPLE

Lab Sample ID: NS10I
LIMS ID: 08-26109
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.5	**8.2**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-D1L
SAMPLE

Lab Sample ID: NS10J
LIMS ID: 08-26110
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**8.2**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-D7A-F
SAMPLE

Lab Sample ID: NS10K
LIMS ID: 08-26111
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.5	**93.0**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: BLW-GW-D7A
SAMPLE

Lab Sample ID: NS10L
LIMS ID: 08-26112
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.5	**97.5**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: BLW-GW-D8A-F
SAMPLE

Lab Sample ID: NS10M
LIMS ID: 08-26113
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**26.1**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: BLW-GW-D8A
SAMPLE

Lab Sample ID: NS10N
LIMS ID: 08-26114
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**37.7**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: BLW-GW-PD106
SAMPLE

Lab Sample ID: NS10O
LIMS ID: 08-26115
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.5	**12.8**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: BLW-GW-PD106-F
SAMPLE

Lab Sample ID: NS10P
LIMS ID: 08-26116
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	**Prep Date**	**Analysis Method**	**Analysis Date**	**CAS Number**	**Analyte**	**RL**	**µg/L**	**Q**
200.8	10/08/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	0.5	**14.4**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-PD105
SAMPLE

Lab Sample ID: NS10Q
LIMS ID: 08-26117
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.5	**45.5**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-PD105-F
SAMPLE

Lab Sample ID: NS10R
LIMS ID: 08-26118
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	0.5	**45.4**	

U-Analyte undetected at given RL
RL-Reporting Limit

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INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-MW31A
SAMPLE

Lab Sample ID: NS10S
LIMS ID: 08-26119
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/20/08	**7440-38-2**	**Arsenic**	0.5	**22.2**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-MW31A-F
SAMPLE

Lab Sample ID: NS10T
LIMS ID: 08-26120
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	0.5	**22.7**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: NS10MB
LIMS ID: 08-26101
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	7440-38-2	Arsenic	0.2	0.2	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: METHOD BLANK

Lab Sample ID: NS10MB
LIMS ID: 08-26102
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/08/08	200.8	10/14/08	7440-38-2	Arsenic	0.2	0.2	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: NS10LCS
LIMS ID: 08-26101
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	24.7	25.0	98.8%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: NS10LCS
LIMS ID: 08-26102
Matrix: Water
Data Release Authorized:
Reported: 10/21/08

QC Report No: NS10-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	24.3	25.0	97.2%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

SAMPLE RESULTS-CONVENTIONALS
NS10-Floyd-Snider

Matrix: Water
Data Release Authorized:
Reported: 10/20/08

Project: B&L LANDFILL
Event: NA
Date Sampled: 09/30/08
Date Received: 10/01/08

Client ID: BLW-GW-PD106
ARI ID: 08-26115 NS10O

Analyte	**Date Batch**	**Method**	**Units**	**RL**	**Sample**
Alkalinity	10/09/08 100908#2	SM 2320	mg/L CaCO3	1.0	796
Total Dissolved Solids	10/02/08 100208#1	EPA 160.1	mg/L	13.3	1,010
Ferrous Iron	10/01/08 100108#1	SM3500 FeD	mg/L	4.00	91.5
Chloride	10/08/08 100808#2	EPA 325.2	mg/L	10.0	52.8
N-Nitrate	10/02/08	Calculated	mg-N/L	0.200	< 0.200 U
N-Nitrite	10/02/08 100208#1	EPA 353.2	mg-N/L	0.200	< 0.200 U
Nitrate + Nitrite	10/02/08 100208#1	EPA 353.2	mg-N/L	0.200	< 0.200 U
Sulfate	10/16/08 101608#1	EPA 375.2	mg/L	2.0	16.8
Sulfide	10/06/08 100608#1	EPA 376.2	mg/L	0.050	< 0.050 U
Total Organic Carbon	10/13/08 101308#1	EPA 415.1	mg/L	6.00	56.8
Dissolved Organic Carbon	10/13/08 101308#1	EPA 415.1	mg/L	6.00	56.4

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
NS10-Floyd-Snider

Matrix: Water
Data Release Authorized:
Reported: 10/20/08

Project: B&L LANDFILL
Event: NA
Date Sampled: 10/01/08
Date Received: 10/01/08

Client ID: BLW-GW-PD105
ARI ID: 08-26117 NS10Q

Analyte	**Date** **Batch**	**Method**	**Units**	**RL**	**Sample**
Alkalinity	10/09/08 100908#2	SM 2320	mg/L CaCO3	1.0	796
Total Dissolved Solids	10/02/08 100208#1	EPA 160.1	mg/L	13.3	961
Ferrous Iron	10/01/08 100108#1	SM3500 FeD	mg/L	4.00	77.1
Chloride	10/08/08 100808#2	EPA 325.2	mg/L	10.0	73.5
N-Nitrate	10/02/08	Calculated	mg-N/L	0.200	< 0.200 U
N-Nitrite	10/02/08 100208#1	EPA 353.2	mg-N/L	0.200	< 0.200 U
Nitrate + Nitrite	10/02/08 100208#1	EPA 353.2	mg-N/L	0.200	< 0.200 U
Sulfate	10/16/08 101608#1	EPA 375.2	mg/L	2.0	18.0
Sulfide	10/06/08 100608#1	EPA 376.2	mg/L	0.050	< 0.050 U
Total Organic Carbon	10/13/08 101308#1	EPA 415.1	mg/L	6.00	58.8
Dissolved Organic Carbon	10/13/08 101308#1	EPA 415.1	mg/L	6.00	53.2

RL	Analytical reporting limit
U	Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
NS10-Floyd-Snider

Matrix: Water
Data Release Authorized:
Reported: 10/20/08

Project: B&L LANDFILL
Event: NA
Date Sampled: 10/01/08
Date Received: 10/01/08

Client ID: BLW-GW-MW31A
ARI ID: 08-26119 NS10S

Analyte	**Date Batch**	**Method**	**Units**	**RL**	**Sample**
Alkalinity	10/09/08 100908#2	SM 2320	mg/L CaCO3	1.0	758
Total Dissolved Solids	10/02/08 100208#1	EPA 160.1	mg/L	13.3	888
Ferrous Iron	10/01/08 100108#1	SM3500 FeD	mg/L	4.00	91.5
Chloride	10/08/08 100808#2	EPA 325.2	mg/L	5.0	45.4
N-Nitrate	10/02/08	Calculated	mg-N/L	0.200	< 0.200 U
N-Nitrite	10/02/08 100208#1	EPA 353.2	mg-N/L	0.200	< 0.200 U
Nitrate + Nitrite	10/02/08 100208#1	EPA 353.2	mg-N/L	0.200	< 0.200 U
Sulfate	10/16/08 101608#1	EPA 375.2	mg/L	2.0	14.8
Sulfide	10/06/08 100608#1	EPA 376.2	mg/L	0.050	< 0.050 U
Total Organic Carbon	10/13/08 101308#1	EPA 415.1	mg/L	6.00	55.2
Dissolved Organic Carbon	10/13/08 101308#1	EPA 415.1	mg/L	6.00	59.2

RL	Analytical reporting limit
U	Undetected at reported detection limit

MS/MSD RESULTS-CONVENTIONALS
NS10-Floyd-Snider

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 10/20/08

Project: B&L LANDFILL
Event: NA
Date Sampled: 09/30/08
Date Received: 10/01/08

Analyte	Method	Date	Units	Sample	Spike	Spike Added	Recovery
ARI ID: NS10O	**Client ID: BLW-GW-PD106**						
Ferrous Iron	SM3500 FeD	10/01/08	mg/L	91.5	101	5.00	190.0%
Chloride	EPA 325.2	10/08/08	mg/L	52.8	152	100	99.2%
N-Nitrite	EPA 353.2	10/02/08	mg-N/L	< 0.200	22.8	25.0	91.2%
Nitrate + Nitrite	EPA 353.2	10/02/08	mg-N/L	< 0.200	24.4	25.0	97.6%
Sulfide	EPA 376.2	10/06/08	mg/L	< 0.050	5.46	6.11	89.4%
Total Organic Carbon	EPA 415.1	10/13/08	mg/L	56.8	131	80.0	92.8%
Dissolved Organic Carbon	EPA 415.1	10/13/08	mg/L	56.4	129	80.0	90.8%
ARI ID: NS10Q	**Client ID: BLW-GW-PD105**						
Sulfate	EPA 375.2	10/16/08	mg/L	18.0	34.5	20.0	82.5%

REPLICATE RESULTS-CONVENTIONALS
NS10-Floyd-Snider

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 10/20/08

Project: B&L LANDFILL
Event: NA
Date Sampled: 09/30/08
Date Received: 10/01/08

Analyte	Method	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: NS10O Client ID: BLW-GW-PD106						
Alkalinity	SM 2320	10/09/08	mg/L CaCO3	796	794	0.3%
Total Dissolved Solids	EPA 160.1	10/02/08	mg/L	1,010	1,020	1.0%
Ferrous Iron	SM3500 FeD	10/01/08	mg/L	91.5	96.6	5.4%
Chloride	EPA 325.2	10/08/08	mg/L	52.8	52.4	0.8%
N-Nitrite	EPA 353.2	10/02/08	mg-N/L	< 0.200	< 0.200	NA
Nitrate + Nitrite	EPA 353.2	10/02/08	mg-N/L	< 0.200	< 0.200	NA
Sulfide	EPA 376.2	10/06/08	mg/L	< 0.050	< 0.050	NA
Total Organic Carbon	EPA 415.1	10/13/08	mg/L	56.8	57.6	1.4%
Dissolved Organic Carbo	EPA 415.1	10/13/08	mg/L	56.4	57.2	1.4%
ARI ID: NS10Q Client ID: BLW-GW-PD105						
Sulfate	EPA 375.2	10/16/08	mg/L	18.0	17.6	2.2%

LAB CONTROL RESULTS-CONVENTIONALS
NS10-Floyd-Snider

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 10/20/08

Project: B&L LANDFILL
Event: NA
Date Sampled: NA
Date Received: NA

Analyte	Method	Date	Units	LCS	Spike Added	Recovery
Total Dissolved Solids	EPA 160.1	10/02/08	mg/L	508	500	101.6%
Ferrous Iron	SM3500 FeD	10/01/08	mg/L	0.771	0.800	96.4%
Sulfide	EPA 376.2	10/06/08	mg/L	0.487	0.503	96.8%
		10/06/08		4.60	6.11	75.3%

METHOD BLANK RESULTS-CONVENTIONALS
NS10-Floyd-Snider

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 10/20/08

Project: B&L LANDFILL
Event: NA
Date Sampled: NA
Date Received: NA

Analyte	Method	Date	Units	Blank
Total Dissolved Solids	EPA 160.1	10/02/08	mg/L	8.5
Ferrous Iron	SM3500 FeD	10/01/08	mg/L	< 0.040 U
Chloride	EPA 325.2	10/08/08	mg/L	< 1.0 U
N-Nitrite	EPA 353.2	10/02/08	mg-N/L	< 0.010 U
Nitrate + Nitrite	EPA 353.2	10/02/08	mg-N/L	< 0.010 U
Sulfate	EPA 375.2	10/16/08	mg/L	< 2.0 U
Sulfide	EPA 376.2	10/06/08 10/06/08 10/06/08	mg/L	< 0.050 U < 0.050 U < 0.050 U
Total Organic Carbon	EPA 415.1	10/13/08	mg/L	< 1.50 U
Dissolved Organic Carbon	EPA 415.1	10/13/08	mg/L	< 1.50 U

STANDARD REFERENCE RESULTS-CONVENTIONALS
NS10-Floyd-Snider

Matrix: Water
Data Release Authorized:
Reported: 10/20/08

Project: B&L LANDFILL
Event: NA
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Method	Date	Units	SRM	True Value	Recovery
Alkalinity ERA #P114506	SM 2320	10/09/08	mg/L CaCO3	100	101	99.0%
Chloride ERA #38084	EPA 325.2	10/08/08	mg/L	5.1	5.0	102.0%
N-Nitrite ERA #23034	EPA 353.2	10/02/08	mg-N/L	0.507	0.500	101.4%
Nitrate + Nitrite ERA #20034	EPA 353.2	10/02/08	mg-N/L	0.523	0.500	104.6%
Sulfate ERA #37065	EPA 375.2	10/16/08	mg/L	26.2	25.0	104.8%
Total Organic Carbon ERA #0528-08-02	EPA 415.1	10/13/08	mg/L	20.0	20.0	100.0%
Dissolved Organic Carbon ERA #0206-02-02	EPA 415.1	10/13/08	mg/L	20.0	20.0	100.0%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

October 29, 2008

Brett Beaulieu
Floyd Snider
600 Union Street, Suite 600
Seattle, WA 98101-2341

RE: Project: B&L Landfill
ARI Job No: NS43

Dear Brett:

Please find enclosed the original Chain-of-Custody (COC) records, sample receipt documentation, and the final results for the samples for the project referenced above. Analytical Resources, Inc. (ARI) accepted twenty water samples in good condition on October 1, 2008. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form.

The samples were analyzed for Total and Dissolved Arsenic as requested on the COC.

Arsenic was present in the 10/16/08 method blank at a level that was greater than the reporting limit. The client action level for arsenic is 5ug/L. All samples either contained concentrations of arsenic that were greater than ten times the concentration of the method blank or were less than the client action level. No further corrective action was required.

No other analytical complications were noted for these analyses. Quality control results are included for your review.

An electronic copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.
Cheronne Oreiro
Project Manager
-For-
Susan Dunnihoo
Director, Client Services
sue@arilabs.com
206-695-6207

Enclosures

cc: eFile NS43

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: NS43
Turn-around Requested:
Page: 3 of 7
ARI Client Company: Floyd/Snider
Phone: 206-292-2078
Date: 10/1/08
Ice Present?
Client Contact: Brett Beaulieu
No. of Coolers:
Cooler Temps:
Client Project Name: B&L Landfill
Client Project #: B&L RIM TRUST
Samplers: L. Meoli & E. Murray

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested								Notes/Comments
					TOT AS	DISS AS							
BLW-GW-10A-F	9/29/08	9:45	GW	1	✓	✓							
BLW-GW-10A	9/29/08	9:45		1	✓	✓							
BLW-GW-11A-F	9/29/08	10:30		1	✓	✓							
BLW-GW-11A	9/29/08	10:30		1	✓	✓							
BLW-GW-D5L-F	9/29/08	12:25		1	✓	✓							
BLW-GW-D5L	9/29/08	12:25		1	✓	✓							
BLW-GW-D6A-F	9/29/08	14:00		1	✓	✓							
BLW-GW-D6A	9/29/08	14:00		1	✓	✓							
BLW-GW-D1U-F	9/29/08	14:50		1	✓	✓							
BLW-GW-D1U	9/29/08	14:50		1	✓	✓							

Comments/Special Instructions	Relinquished by:	Received by:	Relinquished by:	Received by:
	(Signature)	(Signature)	(Signature)	(Signature)
	Printed Name: Erin Murray	Printed Name: Jonathon Walter	Printed Name:	Printed Name:
	Company: Floyd Snider	Company: ARI	Company:	Company:
	Date & Time: 10/1/08 1615	Date & Time: 10/1/08 1615	Date & Time:	Date & Time:

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: NS43
Turn-around Requested: Standard
Page: 4 of 7
ARI Client Company: Floyd|Snider
Phone: 206-292-2078
Date: 10/1/08
Ice Present?
Client Contact: Brett Beaulieu
No. of Coolers:
Cooler Temps:
Client Project Name: B & L Woodwaste
Client Project #: B&L-RIM TRUST
Samplers: E. Murray & L. Meoli

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

					Analysis Requested								Notes/Comments
Sample ID	Date	Time	Matrix	No. Containers	AS TOT	AS DISS							
BLW-GW-D7B-F	9/30/08	10:00	GW	1	✓	✓							
BLW-GW-D7B	9/30/08	10:00		1	✓	✓							
BLW-GW-D8B-F	9/30/08	11:05		1	✓	✓							
BLW-GW-D8B	9/30/08	11:05		1	✓	✓							
BLW-GW-MW23-F	9/30/08	12:00		1	✓	✓							
BLW-GW-MW23	9/30/08	12:00		1	✓	✓							
BLW-GW-D9A-F	9/30/08	13:50		1	✓	✓							
BLW-GW-D9A	9/30/08	13:50		1	✓	✓							
BLW-GW-MW13-F	9/30/08	1525		1	✓	✓							
BLW-GW-MW13	9/30/08	1525		1	✓	✓							

Comments/Special Instructions

Relinquished by: (Signature)	Received by: (Signature) Jonathan Walter	Relinquished by: (Signature)	Received by: (Signature)
Printed Name: Erin Murray	Printed Name: Jonathon Walter	Printed Name:	Printed Name:
Company: Floyd Snider	Company: ARI	Company:	Company:
Date & Time: 10/1/08 4:15	Date & Time: 10/1/08 1615	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Floyd Snider
COC No:
Assigned ARI Job No: NS43

Project Name: B+L Landfill
Delivered by: Hand
Tracking No:

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]
Were custody papers included with the cooler? .... [✓ YES] NO
Were custody papers properly filled out (ink, signed, etc.) .... [✓ YES] NO
Record cooler temperature (recommended 2.0-6.0 °C for chemistry 15.4, 9.2, 12.4, 9.2

Cooler Accepted by: JW Date: 10/1/08 Time: 1615

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? .... YES [✓ NO]
What kind of packing material was used? .... ICE
Was sufficient ice used (if appropriate)? .... YES [✓ NO]
Were all bottles sealed in individual plastic bags? .... YES [✓ NO]
Did all bottle arrive in good condition (unbroken)? .... [✓ YES] NO
Were all bottle labels complete and legible? .... [✓ YES] NO
Did all bottle labels and tags agree with custody papers? .... [✓ YES] NO
Were all bottles used correct for the requested analyses? .... [✓ YES] NO
Do any of the analyses (bottles) require preservation? (attach preservation checklist) .... [✓ YES] NO
Were all VOC vials free of air bubbles? .... [✓ NA] YES NO
Was sufficient amount of sample sent in each bottle? .... [✓ YES] NO

Samples Logged by: JW Date: 10/3/08 Time: 1300

***** Notify Project Manager of discrepancies or concerns *****

Explain discrepancies or negative responses:

By: Date:

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-10A-F
SAMPLE

Lab Sample ID: NS43A
LIMS ID: 08-26224
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	0.2	**211**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-11A-F
SAMPLE

Lab Sample ID: NS43B
LIMS ID: 08-26225
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**0.5**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-D5L-F
SAMPLE

Lab Sample ID: NS43C
LIMS ID: 08-26226
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**3.3**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-D6A-F
SAMPLE

Lab Sample ID: NS43D
LIMS ID: 08-26227
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	5	1,500	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-D1U-F
SAMPLE

Lab Sample ID: NS43E
LIMS ID: 08-26228
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.5	**2.8**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-D7B-F
SAMPLE

Lab Sample ID: NS43F
LIMS ID: 08-26229
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**4.1**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-D8B-F
SAMPLE

Lab Sample ID: NS43G
LIMS ID: 08-26230
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	0.2	**8.7**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-MW23-F
SAMPLE

Lab Sample ID: NS43H
LIMS ID: 08-26231
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	0.2	15.6	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-D9A-F
SAMPLE

Lab Sample ID: NS43I
LIMS ID: 08-26232
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	0.2	35.4	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-MW13-F
SAMPLE

Lab Sample ID: NS43J
LIMS ID: 08-26233
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	5	2,420	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-10A
SAMPLE

Lab Sample ID: NS43K
LIMS ID: 08-26234
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**204**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Page 1 of 1

Sample ID: BLW-GW-11A
SAMPLE

Lab Sample ID: NS43L
LIMS ID: 08-26235
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**0.6**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-D5L
SAMPLE

Lab Sample ID: NS43M
LIMS ID: 08-26236
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	0.2	3.3	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-D6A
SAMPLE

Lab Sample ID: NS43N
LIMS ID: 08-26237
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/17/08	**7440-38-2**	**Arsenic**	5	**1,430**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-D1U
SAMPLE

Lab Sample ID: NS43O
LIMS ID: 08-26238
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/29/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/17/08	**7440-38-2**	**Arsenic**	0.5	**2.9**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-D7B
SAMPLE

Lab Sample ID: NS43P
LIMS ID: 08-26239
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**4.6**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-D8B
SAMPLE

Lab Sample ID: NS43Q
LIMS ID: 08-26240
Matrix: Water
Data Release Authorized
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	0.2	**11.6**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-MW23
SAMPLE

Lab Sample ID: NS43R
LIMS ID: 08-26241
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**20.9**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-D9A
SAMPLE

Lab Sample ID: NS43S
LIMS ID: 08-26242
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**38.1**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-MW13
SAMPLE

Lab Sample ID: NS43T
LIMS ID: 08-26243
Matrix: Water
Data Release Authorized
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	5	2,510	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS **Sample ID: METHOD BLANK**
Page 1 of 1

Lab Sample ID: NS43MB
LIMS ID: 08-26224
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/14/08	7440-38-2	Arsenic	0.2	0.2	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: NS43MB
LIMS ID: 08-26234
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/09/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	0.2	0.5	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: NS43LCS
LIMS ID: 08-26224
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	23.0	25.0	92.0%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: NS43LCS
LIMS ID: 08-26234
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS43-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	23.8	25.0	95.2%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

October 21, 2008

Brett Beaulieu
Floyd Snider
600 Union Street, Suite 600
Seattle, WA 98101-2341

RE: Project: B&L Landfill
ARI Job No: NS44

Dear Brett:

Please find enclosed the original Chain-of-Custody records, sample receipt documentation, and the final results for the samples for the project referenced above. Analytical Resources, Inc. (ARI) accepted twenty-two water samples in good condition on October 1, 2008. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form.

The samples were analyzed for Total and Dissolved Arsenic as requested on the COC.

No analytical complications were noted for these analyses. Quality control results are included for your review.

An electronic copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Cheronne Oreiro
Project Manager
-For-
Susan Dunnihoo
Director, Client Services
sue@arilabs.com
206-695-6207

Enclosures

cc: eFile NS44

Fremont Analytical

Chain of Custody Record

2930 Westlake Ave. N. Suite 100
Seattle, WA 98109

Tel: 206-352-3790
Fax: 206-352-7178

Date: 10.1.08

Page: 5 of: 7

Client: Floyd Snider
Address: 601 Union Street
City, State, Zip: Seattle WA
Tel: 206-292-2078

Project Name: B&L RIM TRUS
Location: B&L
Collected by: C. Meoli & E. Murray

Reports To (PM):
Fax:
Email: bett.beaulien@floydsnider.com
Project No:

	Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS: As TOT	Metals: As Diss	Metals: RCRA-8			Comments/Depth
1	BLW-GW-D8C	11:30	GW	500 ml	9/30/08											✓					
2	BLW-GW-D8C-F	11:30	GW	500 ml	"											[illegible]	✓				
3	BLW-SW-02	1010	"	"	"											✓					
4	BLW-SW-02-F	1010	"	"	"												✓				
5	BLW-SW-04	1440	"	"	"											✓					
6	BLW-SW-04-F	1440	"	"	"												✓				
7	BLW-SW-03	1135	"	"	"											✓					
8	BLW-SW-03-F	1135	"	"	"												✓				
9	BLW-SW-05	1450	"	"	"											✓					
10	BLW-SW-05-F	1450	"	"	"												✓				

Relinquished x
Date/Time 10/1/08 4:15
Received x
Date/Time:

Relinquished x
Date/Time 10/1/08 1615
Received x
Date/Time:

Sample Receipt:
Good?
Temperature:
Seals Intact?:
Total Number of Containers:

Special Remarks

TAT --> 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

www.fremontanalytical.com

Fremont Analytical

2930 Westlake Ave. N. Suite 100
Seattle, WA 98109

Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record

Date: 10.1.08

Page: 6 of: 7

Client: Floyd/Snider
Address: 601 Union Street
City, State, Zip: Seattle, WA
Tel: 206-292-2078

Project Name: ~~BAL~~ RIM TRUST
Location: BAL
Collected by: L. Meoli & E. Murray

Reports To (PM):
Fax:
Email: brett.beaulieu@floydsnider.com
Project No:

	Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	CI PESTICIDES 8081	CI HERBICIDES 8151A	METALS: As (Tot)	Metals: ~~MTCA-5~~ As (Diss)	Metals: RCRA-8			Comments/Depth
1	BLW-SW-06	1425	GW	500mL	9/30/08											✓					
2	BLW-SW-06F	1425	SW	"	"												✓				
3	~~[illegible]~~																				
4	BLW-GW-MW31B-F	11:00	GW	[illegible]	10/1/08												✓				
5	BLW-GW-MW31B	11:00	GW	" [illegible]	10/1/08											✓					
6	BLW-GW-MW30-F	12:30	GW	500mL	10/1/08												✓				
7	BLW-GW-MW30	12:30	GW	500mL	10/1/08											✓					
8	BLW-GW-MW30B-F	12:45	GW	"	"												✓				
9	BLW-GW-MW30B	12:45	GW	"	"											✓					
10	BLW-GW-MW15-F	14:45	GW	"	"												✓				

Relinquished x | Date/Time 10/1/08 4:15 | Received x | Date/Time:

Relinquished x | Date/Time 10/1/08 1615 | Received x | Date/Time:

Sample Receipt:

Good?	
Temperature:	
Seals Intact?:	
Total Number of Containers:	

Special Remarks

TAT --> 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

Fremont Analytical
2930 Westlake Ave. N. Suite 100
Seattle, WA 98109
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record

Date: 10/1/08
Page: 7 **of:** 7

Client: Floyd|Snider
Address: 601 Union St.
City, State, Zip Sea, WA 98101
Tel: 206·292·2078
Project Name: B&L RIM TRUST
Location:
Collected by:
Reports To (PM):
Fax:
Email: Brett. Beaulieu@floydsnider.com
Project No:

	Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS: As TOT	Metals: ~~MTCA-5~~ As Diss	Metals: RCRA-8			Comments/Depth
1	BLW-GW-MW15	14:45	GW	500mL	10/1/08											✓					As TOT
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

Relinquished	Date/Time	Received	Date/Time:
x	10/1/08 4:15	x	
x Garet Watts	10/1/08 1615	x	

Sample Receipt:

Good?	
Temperature:	
Seals Intact?:	
Total Number of Containers:	

Special Remarks

TAT --> 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Floyd Snider
COC No:
Assigned ARI Job No:
Project Name:
Delivered by: Hand
Tracking No:

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]
Were custody papers included with the cooler? [✓ YES] NO
Were custody papers properly filled out (ink, signed, etc.) [✓ YES] NO
Record cooler temperature (recommended 2.0-6.0 °C for chemistry 15.4, 9.2, 12.4, 9.2

Cooler Accepted by: JW Date: 10/1/08 Time: 1615

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? YES [✓ NO]
What kind of packing material was used? ICE
Was sufficient ice used (if appropriate)? YES [✓ NO]
Were all bottles sealed in individual plastic bags? YES [✓ NO]
Did all bottle arrive in good condition (unbroken)? [✓ YES] NO
Were all bottle labels complete and legible? [✓ YES] NO
Did all bottle labels and tags agree with custody papers? YES [✓ NO]
Were all bottles used correct for the requested analyses? [✓ YES] NO
Do any of the analyses (bottles) require preservation? (attach preservation checklist) [✓ YES] NO
Were all VOC vials free of air bubbles? [✓ NA] YES NO
Was sufficient amount of sample sent in each bottle? [✓ YES] NO

Samples Logged by: JW Date: 10/2/08 Time:

***** Notify Project Manager of discrepancies or concerns *****

Explain discrepancies or negative responses:

Sample BLW-GW-MW17 & BLW-GW-MW17-F were not on COC's

By: Date:

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-D8C
SAMPLE

Lab Sample ID: NS44A
LIMS ID: 08-26244
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**12.2**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-SW-02
SAMPLE

Lab Sample ID: NS44B
LIMS ID: 08-26245
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**25.0**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-SW-04
SAMPLE

Lab Sample ID: NS44C
LIMS ID: 08-26246
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**8.9**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-SW-03
SAMPLE

Lab Sample ID: NS44D
LIMS ID: 08-26247
Matrix: Water
Data Release Authorized
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	8.7	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-SW-05
SAMPLE

Lab Sample ID: NS44E
LIMS ID: 08-26248
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	54.0	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-SW-06
SAMPLE

Lab Sample ID: NS44F
LIMS ID: 08-26249
Matrix: Water
Data Release Authorized
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**26.1**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-MW31B
SAMPLE

Lab Sample ID: NS44G
LIMS ID: 08-26250
Matrix: Water
Data Release Authorized
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**4.1**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-MW30
SAMPLE

Lab Sample ID: NS44H
LIMS ID: 08-26251
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	5	**2,260**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-MW30B
SAMPLE

Lab Sample ID: NS44I
LIMS ID: 08-26252
Matrix: Water
Data Release Authorized
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	5	2,270	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-MW15
SAMPLE

Lab Sample ID: NS44J
LIMS ID: 08-26253
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	5	1,720	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-MW17
SAMPLE

Lab Sample ID: NS44K
LIMS ID: 08-26254
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/17/08	7440-38-2	Arsenic	0.5	2.8	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-D8C-F
SAMPLE

Lab Sample ID: NS44L
LIMS ID: 08-26255
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**8.8**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-SW-02-F
SAMPLE

Lab Sample ID: NS44M
LIMS ID: 08-26256
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	17.6	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-SW-04-F
SAMPLE

Lab Sample ID: NS44N
LIMS ID: 08-26257
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	8.1	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-SW-03-F
SAMPLE

Lab Sample ID: NS44O
LIMS ID: 08-26258
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**4.3**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-SW-05-F
SAMPLE

Lab Sample ID: NS44P
LIMS ID: 08-26259
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**8.0**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-SW-06-F
SAMPLE

Lab Sample ID: NS44Q
LIMS ID: 08-26260
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 09/30/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**6.5**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-MW31B-F
SAMPLE

Lab Sample ID: NS44R
LIMS ID: 08-26261
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	**7440-38-2**	**Arsenic**	0.2	**3.8**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-MW30-F
SAMPLE

Lab Sample ID: NS44S
LIMS ID: 08-26262
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/16/08	**7440-38-2**	**Arsenic**	5	**2,310**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-MW30B-F
SAMPLE

Lab Sample ID: NS44T
LIMS ID: 08-26263
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/17/08	**7440-38-2**	**Arsenic**	5	2,290	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-MW15-F
SAMPLE

Lab Sample ID: NS44U
LIMS ID: 08-26264
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/17/08	**7440-38-2**	**Arsenic**	5	**1,520**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-MW17-F
SAMPLE

Lab Sample ID: NS44V
LIMS ID: 08-26265
Matrix: Water
Data Release Authorized
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: 10/01/08
Date Received: 10/01/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/17/08	**7440-38-2**	**Arsenic**	0.5	**3.6**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: NS44LCS
LIMS ID: 08-26244
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	23.4	25.0	93.6%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: NS44LCS
LIMS ID: 08-26255
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	22.2	25.0	88.8%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: NS44MB
LIMS ID: 08-26244
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	7440-38-2	Arsenic	0.2	0.2	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: NS44MB
LIMS ID: 08-26255
Matrix: Water
Data Release Authorized:
Reported: 10/20/08

QC Report No: NS44-Floyd-Snider
Project: B&L LANDFILL

Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/10/08	200.8	10/14/08	7440-38-2	Arsenic	0.2	0.2	U

U-Analyte undetected at given RL
RL-Reporting Limit

Analytical Resources, Incorporated
Analytical Chemists and Consultants

October 30, 2008

Brett Beaulieu
Floyd Snider
600 Union Street, Suite 600
Seattle, WA 98101-2341

RE: Project: B&L Woodwaste
ARI Job No: NS72

Dear Brett:

Please find enclosed the original Chain-of-Custody record, sample receipt documentation, and the final results for the samples for the project referenced above. Analytical Resources, Inc. (ARI) accepted four water samples in good condition on October 2, 2008. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form.

The samples were analyzed for Total and Dissolved Arsenic as requested on the COC.

No analytical complications were noted for these analyses. Quality control results are included for your review.

An electronic copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Cheronne Oreiro
Project Manager
-For-
Susan Dunnihoo
Director, Client Services
sue@arilabs.com
206-695-6207

Enclosures

cc: eFile NS72

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: NS72
Turn-around Requested: Standard
Page: 1 of 1
ARI Client Company: Floyd/Snider
Phone: 206/292-2078
Date: 10/2/08
Ice Present? Y
Client Contact: Brett Beaulieu
No. of Coolers: 1
Cooler Temps: 6.6
Client Project Name: B&L Woodwaste
Client Project #: B&L-Trust
Samplers: E. Murray / L. Meoli

Sample ID	Date	Time	Matrix	No. Containers	As-Total	As-Dissolved							Notes/Comments
BLW-GW-MW14	10/2/08	1530	GW	1	✓	✓							
BLW-GW-MW14-F		1530		1									
BLWGW-MW16F		1420		1									
BLWGW-MW16		1420		1									

Comments/Special Instructions

Relinquished by: (Signature) Tina Garcy	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
Printed Name: Tina Garcy	Printed Name: BRIAN KEASE	Printed Name:	Printed Name:
Company: Floyd/Snider	Company: ARI	Company:	Company:
Date & Time: 10/02/08 1700	Date & Time: 10/2/08 1700	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: FSI
COC No: —
Assigned ARI Job No:

Project Name: B & L Woodwaste
Delivered by: Hand
Tracking No: —

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]
Were custody papers included with the cooler? .... [✓ YES] NO
Were custody papers properly filled out (ink, signed, etc.) .... [✓ YES] NO
Record cooler temperature (recommended 2.0-6.0 °C for chemistry .... 6.6 °C

Cooler Accepted by: Date: 10/2/08 Time: 1700

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? .... YES [✓ NO]
What kind of packing material was used? .... Ice
Was sufficient ice used (if appropriate)? .... [✓ YES] NO
Were all bottles sealed in individual plastic bags? .... YES [✓ NO]
Did all bottle arrive in good condition (unbroken)? .... [✓ YES] NO
Were all bottle labels complete and legible? .... YES NO
Did all bottle labels and tags agree with custody papers? .... YES NO
Were all bottles used correct for the requested analyses? .... [✓ YES] NO
Do any of the analyses (bottles) require preservation? (attach preservation checklist) .... [✓ YES] NO
Were all VOC vials free of air bubbles? .... [✓ NA] YES NO
Was sufficient amount of sample sent in each bottle? .... [✓ YES] NO

Samples Logged by: KR Date: 10/6/08 Time: 1200

***** Notify Project Manager of discrepancies or concerns *****

Explain discrepancies or negative responses:

By: Date:

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-MW14
SAMPLE

Lab Sample ID: NS72A
LIMS ID: 08-26350
Matrix: Water
Data Release Authorized:
Reported: 10/29/08

QC Report No: NS72-Floyd-Snider
Project:

Date Sampled: 10/02/08
Date Received: 10/02/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/24/08	200.8	10/28/08	**7440-38-2**	**Arsenic**	0.5	**3.9**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: BLW-GW-MW16
SAMPLE

Lab Sample ID: NS72B
LIMS ID: 08-26351
Matrix: Water
Data Release Authorized:
Reported: 10/29/08

QC Report No: NS72-Floyd-Snider
Project:

Date Sampled: 10/02/08
Date Received: 10/02/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/24/08	200.8	10/28/08	**7440-38-2**	**Arsenic**	0.2	**4.6**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-MW14F
SAMPLE

Lab Sample ID: NS72C
LIMS ID: 08-26352
Matrix: Water
Data Release Authorized:
Reported: 10/29/08

QC Report No: NS72-Floyd-Snider
Project:

Date Sampled: 10/02/08
Date Received: 10/02/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/24/08	200.8	10/28/08	**7440-38-2**	**Arsenic**	0.5	**3.4**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: BLW-GW-MW16F
SAMPLE

Lab Sample ID: NS72D
LIMS ID: 08-26353
Matrix: Water
Data Release Authorized:
Reported: 10/29/08

QC Report No: NS72-Floyd-Snider
Project:

Date Sampled: 10/02/08
Date Received: 10/02/08

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/24/08	200.8	10/28/08	**7440-38-2**	**Arsenic**	0.2	**4.1**	

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: NS72LCS
LIMS ID: 08-26350
Matrix: Water
Data Release Authorized:
Reported: 10/29/08

QC Report No: NS72-Floyd-Snider
Project:

Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	**Analysis Method**	**Spike Found**	**Spike Added**	**% Recovery**	**Q**
Arsenic	200.8	27.0	25.0	108%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: NS72LCS
LIMS ID: 08-26352
Matrix: Water
Data Release Authorized:
Reported: 10/29/08

QC Report No: NS72-Floyd-Snider
Project:

Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	26.5	25.0	106%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: NS72MB
LIMS ID: 08-26350
Matrix: Water
Data Release Authorized:
Reported: 10/29/08

QC Report No: NS72-Floyd-Snider
Project:

Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/24/08	200.8	10/28/08	7440-38-2	Arsenic	0.2	0.2	U

U-Analyte undetected at given RL
RL-Reporting Limit

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: NS72MB
LIMS ID: 08-26352
Matrix: Water
Data Release Authorized:
Reported: 10/29/08

QC Report No: NS72-Floyd-Snider
Project:

Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/24/08	200.8	10/28/08	7440-38-2	Arsenic	0.2	0.2	U

U-Analyte undetected at given RL
RL-Reporting Limit

Fremont
Analytical

2930 Westlake Ave. N. Suite 100
Seattle, WA 98109

Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record

Date: 8/29/08

Page: 1 of: 1

Client: FLOYD/SNIDER

Address: 601 UNION ST. SUITE 600

City, State, Zip: SEATTLE WA 98101

Tel: 206 292-2078

Project Name: BFL WOODWASTE

Location:

Collected by: ERIN MURRAY/ BRENT BEAULIEU LISA MEOLI

Reports To (PM):

Fax:

Email:

Project No: BFL RIM

	Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	~~NWTPH-HCID~~ ARSENIC	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	~~HERBICIDES 8151~~ pH 150.1	METALS: As, Ca (6010) Fe, Mg, Na	~~Metals MTCA-5~~ Chloride 325.2	~~Metals RCRA-8~~ Sulfate 375.2	ORGANIC CARBON 415.1	Total Alkalinity 310.1	Comments/Depth
1	PD-107-W-30'	11:00	W	3x 500 mL Poly 1x 500 mL Amber	8/29/08										X	X	X	X	X	X	ORGANIC CARBON SAMPLE
2	~~PD-10A-13'~~	~~12:40~~	~~W~~	~~2x 500 mL Poly~~																	FIELD-FILTERED
3	~~PD-10A~~	SB	8/29/08																		
4	BLW-D4-PDD10A-13F	12:40	W	1x 500 mL Poly	8/27/08				X												FIELD-FILTERED
5	BLW-D4-PDD10A-16F	11:00	W	1x 500 mL Poly	8/27/08				X												FIELD-FILTERED
6																					
7																					
8																					
9																					
10																					

Relinquished x Lisa Meoli Date/Time 8/29/08 1600 Received x Date/Time: 8/29/08 1600

Relinquished x Date/Time Received x Date/Time:

Sample Receipt:

Good?	
Temperature:	
Seals Intact?:	
Total Number of Containers:	

Special Remarks

TAT -> 24HR 48HR Standard

Fremont
Analytical

2930 Westlake Ave N Suite 100
Seattle, WA 98109
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste Site
Fremont Project No: CHM080926-1

October 1st, 2008

Brett:

Enclosed are the analytical results for the ***B & L Woodwaste*** water samples delivered to Fremont Analytical on September 26th, 2008.

The samples were received in good condition – in a cooler with wet ice, in the proper containers (500mL Polys), properly sealed, labeled and within holding time. The cooler temperature upon receipt was 5.4°C, which is within the laboratory recommended cooler temperature range (<4°C - 10°C). The samples were extracted and stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C. There were no sample analysis or sample receipt issues to report.

Examination was conducted for the presence of the following:

- ***Dissolved Metals (As) in Water by EPA Method 6020***
- ***Total Metals (As) in Water by EPA Method 6020***

These applications were performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

If you have any questions about the results, please contact the laboratory.

Thank you for using Fremont Analytical!

Sincerely,

M Clements

Michelle Clements
Lab Manager / Sr. Chemist
mclements@fremontanalytical.com

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

					Duplicate	
EPA 6020 (mg/L)	**MRL**	**Method Blank**	**LCS**	**BLW-D4-PD31-9F**	**BLW-D4-PD31-9F**	**RPD**
Date Extracted		9/29/08	9/29/08	9/29/08	9/29/08	%
Date Analyzed		9/30/08	9/30/08	9/30/08	9/30/08	
Matrix		Water		Water	Water	
Arsenic (As)	0.002	nd	86%	**0.18**	**0.16**	12%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD31-14-F**	**BLW-D4-PD30-9-F**	**BLW-D4-PD34-8-F**
Date Extracted		9/29/08	9/29/08	9/29/08
Date Analyzed		9/30/08	9/30/08	9/30/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	nd	**0.004**	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD34-14-F**	**BLW-D4-PD29-8F**	**BLW-D4-PD29-13F**
Date Extracted		9/29/08	9/29/08	9/29/08
Date Analyzed		9/30/08	9/30/08	9/30/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	**0.027**	nd	**0.012**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

		MS	MSD	
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD31-9F**	**BLW-D4-PD31-9F**	**RPD**
Date Extracted		9/29/08	9/29/08	%
Date Analyzed		9/30/08	9/30/08	
Matrix		Water	Water	
Arsenic (As)	0.002	88%	89%	1%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

EPA 6020 (mg/L)	**MRL**	**Method Blank**	**LCS**	**Decon 4**	**Decon 3**	**Decon 2**	**Decon 1**	Duplicate **Decon 1**
Date Extracted		9/29/08	9/29/08	9/29/08	9/29/08	9/29/08	9/29/08	9/29/08
Date Analyzed		9/30/08	9/30/08	9/30/08	9/30/08	9/30/08	9/30/08	9/30/08
Matrix		Water		Water	Water	Water	Water	Water
Arsenic (As)	0.002	nd	86%	nd	nd	nd	nd	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
MS, MSD, LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

		MS	MSD	
EPA 6020 (mg/L)	**MRL**	**Decon 1**	**Decon 1**	**RPD**
Date Extracted		9/29/08	9/29/08	%
Date Analyzed		9/30/08	9/30/08	
Matrix		Water	Water	
Arsenic (As)	0.002	94%	95%	1%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
MS, MSD, LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Fremont
Analytical
2930 Westlake Ave. N. Suite 100
Seattle, WA 98109
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record

Date: 9/26/08

Page: 1 of:

Client: FLOYD/SNIDER

Address: 601 UNION ST, SUITE 600

City, State, Zip: SEATTLE, WA 98101 Tel: 206 292 2078

Project Name: B+L WOOD WASTE

Location:

Collected by: BRETT BEAULIEU

Reports To (PM): Fax: Email: Project No:

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS	Metals: MTCA-5	Metals: RCRA-8	ARSENIC TO 0.002 mg/L		Comments/Depth
1 BLW-D4-PD31-9F	9:00	W	500 mL Poly	9/26/08														X		FIELD FILTERED -> DISSOLVED
2 BLW-D4-PD31-14-F	9:30																	X		ARSENIC
3 BLW-D4-PD30-9-F	10:30																	X		
4 BLW-D4-PD34-8F	11:00																	X		
5 BLW-D4-PD34-14-F	11:45																	X		
6 BLW-D4-PD29-8F	13:00																	X		
7 BLW-D4-PD29-13F	13:30																	X		
8 DECON 4	16:00																	X		TOTAL AS/UNFILTER
9 DECON 3	16:05																	X		
10 DECON 2	16:10																	X		
11. DECON 1	16:15																	X		

Relinquished x 1	Date/Time 9/26/08	Received x	Date/Time: 9/26/08 1740	**Sample Receipt:**	
				Good?	Y
				Temperature:	5.4°C
Relinquished x	Date/Time	Received x	Date/Time:	Seals Intact?:	Y
				Total Number of Containers:	⑪

Special Remarks

⑪ SAMPLES

TAT -> 24HR 48HR [✓ Standard]

Distribution: White - Lab, Yellow - File, Pink - Originator

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F: (206) 352-7178
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Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste
Fremont Project No: CHM080808-4
Floyd | Snider Project No: B&L RIM

August 13th, 2008

Brett:

Enclosed are the analytical results for the ***B & L Woodwaste*** water samples delivered to Fremont Analytical on August 8th, 2008.

The samples were received in good condition – in the proper containers, properly sealed, labeled and within holding time. The samples were contained in 500mL polys, preserved with HNO_3. The cooler temperature upon receipt was 5°C, which is within the laboratory recommended cooler temperature range (4°C - 10°C). The samples were stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C. There were no sample receipt or sample analysis issues to report.

Examination was conducted for the presence of the following:

- ***Total Arsenic in Water by EPA Method 6020***

This application was performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

Thank you for using Fremont Analytical!

Sincerely,

Michael Dee
Sr. Chemist / Principal

mikedee@fremontanalytical.com

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080808-4

					Duplicate	
EPA 6020 (mg/L)	**MRL**	**Method Blank**	**LCS**	**BLW-D4-PD39-14**	**BLW-D4-PD39-14**	**BLW-D4-PD39-20**
Date Extracted		8/11/08	8/11/08	8/11/08	8/11/08	8/11/08
Date Analyzed		8/11/08	8/11/08	8/11/08	8/11/08	8/11/08
Matrix		Water		Water	Water	Water
Arsenic (As)	0.002	nd	92%	nd	nd	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%
Spike Concentration:
As = 100 µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080808-4

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD40-14**	**BLW-D4-PD40-20**	**BLW-D4-PD37-14**
Date Extracted		8/11/08	8/11/08	8/11/08
Date Analyzed		8/11/08	8/11/08	8/11/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	**0.003**	**0.003**	**0.026**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%
Spike Concentration:
As = 100 µg/L

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080808-4

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD37-20**	**BLW-D4-PD38-20**	**BLW-D4-PD38-20D**
Date Extracted		8/11/08	8/11/08	8/11/08
Date Analyzed		8/11/08	8/11/08	8/11/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	**0.004**	**0.002**	**0.002**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%
Spike Concentration:
As = 100 µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080808-4

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD42-14**	**BLW-D4-PD41-14**	**BLW-D4-PD43-14**	**BLW-D4-PD32-8**
Date Extracted		8/11/08	8/11/08	8/11/08	8/11/08
Date Analyzed		8/11/08	8/11/08	8/11/08	8/11/08
Matrix		Water	Water	Water	Water
Arsenic (As)	0.002	**0.008**	**0.010**	**0.005**	**0.010**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%
Spike Concentration:
As = 100 µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080808-4

			MS	MSD	
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD32-15**	**BLW-D4-PD40-14**	**BLW-D4-PD40-14**	**RPD**
Date Extracted		8/11/08	8/11/08	8/11/08	%
Date Analyzed		8/11/08	8/11/08	8/11/08	
Matrix		Water	Water	Water	
Arsenic (As)	0.002	**0.002**	119%	119%	0%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%

Spike Concentration:
As = 100 µg/L

Fremont Analytical

Chain of Custody Record

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Tel: 206-352-3790
Fax: 206-352-7178

Date: 8/6/08

Page: 1 of: 2

Client: Floyd | Snider
Address: 601 Union St., Ste. 600
City, State, Zip: Seattle, WA 98101
Tel: 206-292-2078
Project Name: B & L Woodwaste
Location: Milton, WA
Collected by: Erin Murray, Brett Beaulieu
Reports To (PM): Brett Beaulieu
Fax: 206-682-7867
Email: brett.beaulieu@floydsnider.com
Project No: B & L RIM

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext	SEMI VOL 8270C	PAH 8270	PCBs 8082	☐ PESTICIDES 8081	☐ HERBICIDES 8151A	METALS Arsenic	Metals: MTCA-5	Metals: RCRA-8			Comments/Depth
1 BLW-D4-PD39-14	11:30	GW	500mL	8/6/08											✓					
2 BLW-D4-PD39-20	12:20	GW	500mL	8/6/08											✓					
3 BLW-D4-PD40-14	14:20	GW	500mL	8/6/08											✓					
4 BLW-D4-PD40-20	15:00	GW	500mL	8/6/08											✓					
5 BLW-D4-PD37-14	09:10	GW	500mL	8/7/08											✓					
6 BLW-D4-PD37-20	09:25	GW	500mL	8/7/08											✓					
7 BLW-D4-PD38-20	12:05	GW	500mL	8/7/08											✓					
8 BLW-D4-PD38-20d	12:15	GW	500mL	8/7/08											✓					
9 BLW-D4-PD42-14	12:05	GW	500mL	8/8/08											✓					
10 BLW-D4-PD41-14	12:35	GW	500mL	8/8/08																

Relinquished	Date/Time	Received	Date/Time
x	8/8/08 7:30	x	8/8/08 1630
x		x	

Sample Receipt:

Good?	Y
Temperature:	5°C
Seals Intact?	Y
Total Number of Containers:	⑬

Special Remarks:

TAT → 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

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Chain of Custody Record

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Seattle, WA 98109

Tel: 206-352-3790
Fax: 206-352-7178

Date: 8/8/08

Page: 2 of: 2

Client: Floyd|Snider
Address: 601 Union St. Ste. 600
City, State, Zip Sea, WA 98101
Tel: ~~206-292-2078~~

Project Name: B&L Woodwaste
Location: Milton, WA
Collected by: Erin Murray, John LaManna

Reports To (PM): Brett Beaulieu
Fax: 206-682-7867
Email: brett.beaulieu@floyd|snider.com
Project No: B&L RIM

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS Arsenic	Metals: MTCA-5	Metals: RCRA-8			Comments/Depth
1 BLW-D4-PD43-14	13.15	GW	500mL	8/8/08											✓					
2 BLW-D4-PD32-8	14.50	GW	500mL	8/8/08											✓					
3 BLW-D4-PD32-15	15-10	GW	500mL	8/8/08											✓					
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Relinquished	Date/Time	Received	Date/Time
x	8/8/08 4:30	x	8/8/08 1630
x		x	

Sample Receipt:

Good?	
Temperature:	
Seals Intact?:	
Total Number of Containers:	

Special Remarks

TAT → 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

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F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L RIM
Fremont Project No: CHM080815-3

August 20th, 2008

Brett:

Enclosed are the analytical results for the ***B & L RIM*** water samples delivered to Fremont Analytical on August 15th, 2008.

The samples were received in good condition – in the proper containers, properly sealed, labeled and within holding time. The samples were contained in 500mL Polys, preserved with HNO_3. The cooler temperature upon receipt was 6°C, which is within the laboratory recommended cooler temperature range (4°C - 10°C). The samples were extracted, analyzed and then stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C. There were no sample receipt or sample analysis issues to report.

Examination was conducted for the presence of the following:

- ***Total Arsenic in Water by EPA Method 6020***

This application was performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

Thank you for using Fremont Analytical!

Sincerely,

Michael Dee
Sr. Chemist / Principal

mikedee@fremontanalytical.com

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L RIM
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080815-3

EPA 6020 (mg/L)	**MRL**	**Method Blank**	**LCS**	**BLW-D4-PD3-22**	**BLW-D4-PD3-16**	**BLW-D4-Rinsate**
Date Extracted		8/18/08	8/18/08	8/18/08	8/18/08	8/18/08
Date Analyzed		8/18/08	8/18/08	8/18/08	8/18/08	8/18/08
Matrix		Water		Water	Water	Water
Arsenic (As)	0.002	nd	94%	**0.005**	**0.004**	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%

Spike Concentration:
As = 100 µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L RIM
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080815-3

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD2-18**	**BLW-D4-PD2-12**	**BLW-D4-PD4-20**	**BLW-D4-PD4-12**
Date Extracted		8/18/08	8/18/08	8/18/08	8/18/08
Date Analyzed		8/18/08	8/18/08	8/18/08	8/18/08
Matrix		Water	Water	Water	Water
Arsenic (As)	0.002	**0.004**	**0.003**	**0.010**	**0.005**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%

Spike Concentration:
As = 100 µg/L

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T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L RIM
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080815-3

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD5-20**	**BLW-D4-PD5-21**	**BLW-D4-PD5-12**	**BLW-D4-PD6-21**
Date Extracted		8/18/08	8/18/08	8/18/08	8/18/08
Date Analyzed		8/18/08	8/18/08	8/18/08	8/18/08
Matrix		Water	Water	Water	Water
Arsenic (As)	0.002	**0.008**	**0.008**	**0.005**	**0.008**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%
Spike Concentration:
As = 100 µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L RIM
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080815-3

				Duplicate	
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD6-12**	**BLW-D4-PD1-18**	**BLW-D4-PD1-18**	**RPD**
Date Extracted		8/18/08	8/18/08	8/18/08	%
Date Analyzed		8/18/08	8/18/08	8/18/08	
Matrix		Water	Water	Water	
Arsenic (As)	0.002	**0.004**	**0.003**	**0.003**	0%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%
Spike Concentration:
As = 100 µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L RIM
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080815-3

			MS	MSD	
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD1-12**	**BLW-D4-PD1-18**	**BLW-D4-PD1-18**	**RPD**
Date Extracted		8/18/08	8/18/08	8/18/08	%
Date Analyzed		8/18/08	8/18/08	8/18/08	
Matrix		Water	Water	Water	
Arsenic (As)	0.002	**0.003**	91%	91%	0%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%

Spike Concentration:
As = 100 µg/L

Fremont Analytical

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Fax: 206-352-7178

Chain of Custody Record

Date: 8/13/08

Page: 1 of:

Client: Floyd|Snider

Address: 601 Union Street STE. 600

City, State, Zip: Seattle, WA, 98101

Tel: 206-292-2078

Project Name: BAL RIM

Location: BAL

Collected by: Erin Murray Lila Meoli

Reports To (PM): Brett Beaulieu

Fax: 206-682-7867

Email: brett.beaulieu@floydsnider.com

Project No:

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS: As	Metals: MTCA-5	Metals: RCRA-8			Comments/Depth
1 BLW-D4-PD3-22	11:30	GW	500mL	8/13/08											✓					
2 BLW-D4-PD3-16	11:55	"	↓	↓											↓					
3 BLW-D4-Rinsate	12:30	"																		
4 BLW-D4-PD2-18	13:17	"																		
5 BLW-D4-PD2-12	13:36	"																		
6 BLW-D4-PD4-20	10:40	GW	500mL	8/14/08																
7 BLW-D4-PD4-12	11:00	"	↓	↓																
8 BLW-D4-PD5-20	13:48	"																		
9 BLW-D4-PD5-21	14:15	"																		
10 BLW-D4-PD5-12	14:25	"																		

Relinquished x | Date/Time 8/15/08 | Received x | Date/Time: 8/15/08 8 40 5pm

Relinquished x | Date/Time | Received x | Date/Time:

Sample Receipt:

Good?	Y
Temperature:	6°C
Seals Intact?:	Y
Total Number of Containers:	14

Special Remarks

TAT → 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

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Chain of Custody Record

Date: 8/15/08

Page: 2 of: 2

Client: Floyd|Snider

Address: 601 Union Street STE, 600

City, State, Zip: Seattle, WA 98101

Tel: 206-292-2078

Project Name: B+L RIM

Location: B+L

Collected by: Erin Murray / Lisa Meoli

Reports To (PM): Brett Beaulieu

Fax: 206-682-7867

Email: brett.beaulieu@floydsnider.com

Project No:

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext	SEMI VOL 8270C	PAH 8270	PCB 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS As	Metals: MTCA-5	Metals: RCRA-8			Comments/Depth
1 BLW-D4-PD6-21	9.45	GW	500ML	8/15/08											✓					
2 BLW-D4-PD6-12	10.10	GW	"	"											✓					
3 BLW-D4-PD1-18	1250	"	"	"											✓					
4 BLW-D4-PD1-12	1300	"	"	"											—					
5																				
6																				
7																				
8																				
9																				
10																				

Relinquished x | Date/Time 8/15/08 | Received x | Date/Time: 8/15/08 4:15pm

Relinquished x | Date/Time | Received x | Date/Time:

Sample Receipt:

Good?	
Temperature:	
Seals Intact?:	
Total Number of Containers:	

Special Remarks:

TAT → 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

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Fremont
Analytical

2930 Westlake Ave N Suite 100
Seattle, WA 98109
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Trust RIM
Fremont Project No: CHM080819-2

August 25th, 2008

Brett:

Enclosed are the analytical results for the ***B & L RIM*** water samples delivered to Fremont Analytical on August 19th, 2008.

The samples were received in good condition – in the proper containers, properly sealed, labeled and within holding time. The samples were contained in 500mL Polys, preserved with HNO_3. The cooler temperature upon receipt was 5.5°C, which is within the laboratory recommended cooler temperature range (4°C - 10°C). The samples were extracted, analyzed and then stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C. There were no sample receipt issues to report.

Examination was conducted for the presence of the following:

- ***Total Arsenic in Water by EPA Method 6020***

This application was performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

> **EPA Method 6020 Notations:** The Relative Percent Difference (RPD%) between sample (BLW-D4-PD51-16) and the sample duplicate exceeded laboratory limits. The Laboratory Control Sample (LCS), Matrix Spike (MS) and MS Duplicate were all within QC Limits, proving the analysis in control.

If you have any questions about the results, please contact the laboratory.

Thank you for using Fremont Analytical!

Sincerely,

M. J. Clements

Michelle Clements
Sr. Chemist / Lab Manager
mclements@fremontanalytical.com

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Trust RIM
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080819-2

EPA 6020 (mg/L)	**MRL**	**Method Blank**	**LCS**	**BLW-D4-PD52-19**	**BLW-D4-PD52-13**	**BLW-D4-PD51-16**
Date Extracted		8/21/08	8/21/08	8/21/08	8/21/08	8/21/08
Date Analyzed		8/21/08	8/22/08	8/25/08	8/25/08	8/25/08
Matrix		Water		Water	Water	Water
Arsenic (As)	0.002	nd	84%	nd	nd	**0.002**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%

Spike Concentrations:
As = 100 µg/L

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Trust RIM
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080819-2

		Duplicate			
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD51-16**	**RPD**	**BLW-D4-PD51-12**	**BLW-D4-PD50-17**
Date Extracted		8/21/08	%	8/21/08	8/21/08
Date Analyzed		8/25/08		8/25/08	8/25/08
Matrix		Water		Water	Water
Arsenic (As)	0.002	**0.004**	53%	nd	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
    LCS, LCSD, MS, MSD: 65% to 135%

Spike Concentrations:
    As = 100 µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Trust RIM
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080819-2

			MS	MSD
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD50-12**	*Batch*	*Batch*
Date Extracted		8/21/08	8/21/08	8/21/08
Date Analyzed		8/25/08	8/21/08	8/21/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	nd	99%	109%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%

Spike Concentrations:
As = 100 µg/L

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2930 Westlake Ave. N. Suite 100
Seattle, WA 98109

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Fax: 206-352-7178

Chain of Custody Record

Date: 8/19/08 **Page:** 1 **of:** 1

Client: Floyd/Snider
Address: 601 Union St Ste 600
City, State, Zip Seattle, WA **Tel:** 206 292-2078
Project Name: B&L Trust RIM
Location: B&L
Collected by: L.McCol / Erik Murray
Reports To (PM): Brett Beaulieu **Fax:** 206-682-7867 **Email:** ~~[illegible]~~ brett.beaulieu@floydsnider **Project No:** B&L RIM

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS As	Metals MTCA-5	Metals RCRA-8			Comments/Depth
1 BLW-D4-PD52-~~[illegible]~~19	1025	GW	500 mL	8/19/08											✓					
2 BLW-D4-PD52-13	1045	"	"	"											✓					
3 BLW-D4-PD51-16	1230	"	"	"											✓					
4 BLW-D4-PD51-12	1250	"	"	"											✓					
5 BLW-D4-PD50-17	14:20	"	"	"											✓					
6 BLW-D4-PD50-12	14:30	"	"	"											✓					
7																				
8																				
9																				
10																				

Relinquished x Date/Time 8/19/08 Received x Date/Time: 8/19/08 16:00
Relinquished x Date/Time Received x Date/Time:

Sample Receipt:

Good?	Y
Temperature:	6°C
Seals Intact?	Y
Total Number of Containers:	6

Special Remarks

TAT => 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

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Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Trust RIM
Fremont Project No: CHM080819-2

August 25th, 2008

Brett:

Enclosed are the analytical results for the ***B & L RIM*** water samples delivered to Fremont Analytical on August 19th, 2008.

The samples were received in good condition – in the proper containers, properly sealed, labeled and within holding time. The samples were contained in 500mL Polys, preserved with HNO_3. The cooler temperature upon receipt was 5.5°C, which is within the laboratory recommended cooler temperature range (4°C - 10°C). The samples were extracted, analyzed and then stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C. There were no sample receipt issues to report.

Examination was conducted for the presence of the following:

- ***Total Arsenic in Water by EPA Method 6020***

This application was performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

> **EPA Method 6020 Notations:** The Relative Percent Difference (RPD%) between sample (BLW-D4-PD51-16) and the sample duplicate exceeded laboratory limits. The Laboratory Control Sample (LCS), Matrix Spike (MS) and MS Duplicate were all within QC Limits, proving the analysis in control.

If you have any questions about the results, please contact the laboratory.

Thank you for using Fremont Analytical!

Sincerely,

M. y. Clements

Michelle Clements
Sr. Chemist / Lab Manager
mclements@fremontanalytical.com

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

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F: 206.352.7178
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Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Trust RIM
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080819-2

EPA 6020 (mg/L)	MRL	Method Blank	LCS	BLW-D4-PD52-19	BLW-D4-PD52-13	BLW-D4-PD51-16
Date Extracted		8/21/08	8/21/08	8/21/08	8/21/08	8/21/08
Date Analyzed		8/21/08	8/22/08	8/25/08	8/25/08	8/25/08
Matrix		Water		Water	Water	Water
Arsenic (As)	0.002	nd	84%	nd	nd	**0.002**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%

Spike Concentrations:
As = 100 µg/L

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
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Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Trust RIM
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080819-2

		Duplicate			
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD51-16**	**RPD**	**BLW-D4-PD51-12**	**BLW-D4-PD50-17**
Date Extracted		8/21/08	%	8/21/08	8/21/08
Date Analyzed		8/25/08		8/25/08	8/25/08
Matrix		Water		Water	Water
Arsenic (As)	0.002	**0.004**	53%	nd	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%

Spike Concentrations:
As = 100 µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Trust RIM
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080819-2

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD50-12**	MS *Batch*	MSD *Batch*
Date Extracted		8/21/08	8/21/08	8/21/08
Date Analyzed		8/25/08	8/21/08	8/21/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	nd	99%	109%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%

Spike Concentrations:
As = 100 µg/L

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Chain of Custody Record

Date: 8/19/08

Page: 1 of: 1

Client: Floyd/Snider

Address: 601 Union St Ste 600

City, State, Zip: Seattle, WA

Tel: 206 292-2078

Project Name: B+L Trust RIM

Location: B+L

Collected by: L.McCol. / Erik Murray

Reports To (PM): Brett Beaulieu

Fax: 206-682-7867

Email: [illegible] brett.beaulieu@floydsnider

Project No: B+L RIM

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS RS	Metals MTCA-5	Metals RCRA-8			Comments/Depth
1 BLW-D4-PD52-19	1025	GW	500 mL	8/19/08											✓					
2 BLW-D4-PD52-13	1045	"	"	"											✓					
3 BLW-D4-PD51-16	1230	"	"	"											✓					
4 BLW-D4-PD51-12	1250	"	"	"											✓					
5 BLW-D4-PD50-17	14:20	"	"	"											✓					
6 BLW-D4-PD50-12	14:30	"	"	"											✓					
7																				
8																				
9																				
10																				

Relinquished x

Date/Time 8/17/08

Received x

Date/Time: 8/19/08

Relinquished x

Date/Time

Received x

Date/Time: 16:00

Sample Receipt:

Good?	Y
Temperature:	6°C
Seals Intact?	Y
Total Number of Containers:	6

Special Remarks

TAT => 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

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2930 Westlake Ave N Suite 100
Seattle, WA 98109
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste Site
Fremont Project No: CHM081016-3

October 20th, 2008

Brett:

Enclosed are the analytical results for the ***B & L Woodwaste*** water samples delivered to Fremont Analytical on October 16th and 17th, 2008 (Note: Soil samples have been archived).

The samples were received in good condition –, in the proper containers (500mL Polys preserved with HNO_3), properly sealed, labeled and within holding time. The cooler temperature(s) upon receipt was 3°C (10/16/08) and 3°C (10/17/08), which is within the laboratory recommended cooler temperature range (<4°C - 10°C). The samples were analyzed and then stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C. There were no sample analysis or sample receipt issues to report.

Examination of these samples was conducted for the presence of the following:

- ***Dissolved Metals (As) in Water by EPA Method 6020***

These applications were performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

If you have any questions about the results, please contact the laboratory.

Thank you for using Fremont Analytical!

Sincerely,

M. Clements

Michelle Clements
Lab Manager / Sr. Chemist
mclements@fremontanalytical.com

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

EPA 6020 (mg/L)	**MRL**	**Method Blank**	**Method Blank**	**LCS**	**LCS**
Date Extracted		10/16/08	10/17/08	10/16/08	10/17/08
Date Analyzed		10/16/08	10/17/08	10/16/08	10/17/08
Matrix					
Arsenic (As)	0.002	nd	nd	104%	116%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD18-8F**	**BLW-D4-PD18-16F**	**BLW-D4-PD17-8F**
Date Extracted		10/16/08	10/16/08	10/16/08
Date Analyzed		10/16/08	10/16/08	10/16/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	**0.004**	**0.16**	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

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F: 206.352.7178
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Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD17-16F**	**BLW-D4-PD16-8F**	**BLW-D4-PD16-16F**
Date Extracted		10/16/08	10/16/08	10/16/08
Date Analyzed		10/16/08	10/16/08	10/16/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	nd	**0.064**	**0.019**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD190-16F**	**BLW-D4-PD15-8F**	**BLW-D4-PD15-16F**
Date Extracted		10/16/08	10/16/08	10/16/08
Date Analyzed		10/16/08	10/16/08	10/16/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	**0.019**	**0.39**	**0.16**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD14-8F**	Duplicate **BLW-D4-PD14-8F**	**RPD**	**BLW-D4-PD13-8F**
Date Extracted		10/16/08	10/16/08	%	10/16/08
Date Analyzed		10/16/08	10/16/08		10/16/08
Matrix		Water	Water		Water
Arsenic (As)	0.002	**0.95**	**0.88**	8%	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD22-8F**	**BLW-D4-PD22-16F**	**BLW-D4-PD25-8F**
Date Extracted		10/16/08	10/16/08	10/16/08
Date Analyzed		10/16/08	10/16/08	10/16/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	**0.005**	nd	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD25-16F**	**BLW-D4-PD26-8F**	**BLW-D4-PD26-16F**
Date Extracted		10/16/08	10/16/08	10/16/08
Date Analyzed		10/16/08	10/16/08	10/16/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	nd	nd	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

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F: 206.352.7178
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Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD27-8F**	**BLW-D4-PD27-16F**	**BLW-D4-PD14-16F**
Date Extracted		10/16/08	10/16/08	10/17/08
Date Analyzed		10/16/08	10/16/08	10/17/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	nd	nd	**0.23**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

			Duplicate		
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD13-16F**	**BLW-D4-PD13-16F**	**RPD**	**BLW-D4-PD33-8F**
Date Extracted		10/17/08	10/17/08	%	10/17/08
Date Analyzed		10/17/08	10/17/08		10/17/08
Matrix		Water	Water		Water
Arsenic (As)	0.002	**0.008**	**0.007**	13%	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD33-16F**	**BLW-D4-PD28-8F**	**BLW-D4-PD28-16F**
Date Extracted		10/17/08	10/17/08	10/17/08
Date Analyzed		10/17/08	10/17/08	10/17/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	**0.017**	**0.009**	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

		MS	MSD	
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD14-8F**	**BLW-D4-PD14-8F**	**RPD**
Date Extracted		10/16/08	10/16/08	%
Date Analyzed		10/16/08	10/16/08	
Matrix		Water	Water	
Arsenic (As)	0.002	104%	110%	6%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081016-3

		MS	MSD	
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD13-16F**	**BLW-D4-PD13-16F**	**RPD**
Date Extracted		10/17/08	10/17/08	%
Date Analyzed		10/17/08	10/17/08	
Matrix		Water	Water	
Arsenic (As)	0.002	121%	123%	2%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Fremont Analytical

Chain of Custody Record

2930 Westlake Ave. N. Suite 100
Seattle, WA 98109

Tel: 206-352-3790
Fax: 206-352-7178

Date: 10-16-08 Page: 1 of: 4

Client: FLOYD|SNIDER
Address: 601 UNION STREET
City, State, Zip: SEATTLE, WA
Tel: 206 ~~852~~ ~~75~~ 292 2078
Project Name: B+L WOODWASTE
Location: MILTON, WA
Collected by: BRETT BEAULIEU
LISA MEOLI
Reports To (PM):
Fax:
Email:
Project No:

	Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext	SEMI VOL 8270C	PAH 8270	PCBs 8082	☐ PESTICIDES 8081	☐ HERBICIDES 8151A	METALS: DISS. ARSENIC	Metals: MTCA-5	Metals: RCRA-8	TOTAL ARSENIC		Comments/Depth
1	BLW-D4-PD18-8F	11:15	W	500mL POLY	10-15-08											X					
2	BLW-D4-PD18-16F	11:45	W	HNO3												X					
3	BLW-D4-PD17-8F	1250	W													X					
4	BLW-D4-PD17-16F	13:05	W													X					
5	BLW-D4-PD16-8F	1350	W													X					
6	BLW-D4-PD16-16F	1400	W													X					
7	BLW-D4-PD190-16F	1430	W	↓												X					
8	P-4-2'	1430	S	4oz JAR															X		HOLD VOLUME FOR ADD'L TCLP
9	BLW-D4-PD15-8F	15:00	W	500mL POLY												X					
10	BLW-D4-PD15-16F	15:10	W	HNO3	↓											X					

Relinquished x Lisa Meoli Date/Time 10/16/08 1630 Received Date/Time 10/16/08 1632
Relinquished x Date/Time Received x Date/Time:

Sample Receipt:

Good?	Y
Temperature:	3°C
Seals Intact?:	Y
Total Number of Containers:	28 LISTED

Special Remarks

TAT → 24HR 48HR Standard

2 samples submitted on 10/17/08

Distribution: White - Lab, Yellow - File, Pink - Originator

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Chain of Custody Record

Date: 10-16-08

Page: 2 of: 4

Client: FLOYD SNIDER
Address: 601 UNION ST.
City, State, Zip SEATTLE, WA **Tel:** 206 292 2078

Project Name: B+L WOODWASTE
Location: MILTON, WA
Collected by: BTB, LM

Reports To (PM):
Fax:
Email:
Project No:

	Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS: DISS As	Metals: MTCA-5	Metals: RCRA-8	TOTAL As		Comments/Depth
1	PD-17 2'	12:30	S	4oz															X		HOLD VOLUME FOR ADD'L TCLP ANALYSES
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

Relinquished	Date/Time	Received	Date/Time
x Lisa Neale	10/16/08 1030		10/16/08 1632
x		x	

Sample Receipt:	
Good?	
Temperature:	
Seals Intact?:	
Total Number of Containers:	

Special Remarks

TAT -> 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

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Chain of Custody Record

Date: 10/16/08

Page: 3 of 4

Client: Floyd Snider
Address: 601 Union Street Suite 600
City, State, Zip: Seattle, WA
Tel: 206-292-2078
Project Name: B&L RIM TRUST
Location: B&L
Collected by: L. Meoli
Reports To (PM): Brett Beaulieu
Fax: —
Email: Brett.Beaulieu@floydsnider.com
Project No: B&L RIM TRUST

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS: As (Diss)	Metals: MTCA-5	Metals: RCRA-8	TOT As		Comments/Depth
1 PD-14-5'	9:00	SOIL	4oz												[illegible]	[illegible]		✓		ARCHIVE FROZEN
2 PD-14-8'	9:05	SOIL	4oz												[illegible]			✓		ARCHIVE FROZEN
3 BLW-D4-PD14-8'-F	9:15	GW	500ml												✓					(Field Filtered)
4 BLW-D4-PD14-16'F	9:30	GW	500ml												✓					ⓧ Submitted 10/17
5 PD-13-2'	10:00	SOIL	4oz												[illegible]	[illegible]		✓		(ARCHIVE FROZEN)
6 PD-13-3'	10:05	SOIL	4oz												[illegible]			✓		(ARCHIVE FROZEN
7 BLW-D4-PD13-8'-F	10:20	GW	500ml												✓					
8 BLW-D4-PD13-16'-F'	10:30	GW	500ml												✓					ⓧ Submitted 10/17
9 PD-13-12'	10:15	SOIL	4oz												[illegible]	[illegible]		✓		ARCHIVE FROZEN
10 BLW-D4-PD22-8'-F	11:30	GW	500ml												✓					

Relinquished x Lisa Meoli	Date/Time 10/16/08	Received	Date/Time 10/16/08 1632	
Relinquished x	Date/Time	Received x	Date/Time	

Sample Receipt:
Good?
Temperature:
Seals Intact?:
Total Number of Containers:

Special Remarks

TAT → [✓ 24HR] 48HR ~~Standard~~

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Fax: 206-352-7178

Chain of Custody Record

Date: 10/16/08

Page: 2 of: 4

Client: Floyd|Snider
Address: 601 Union St Suite 600
City, State, Zip: Seattle, WA 98101
Tel: 206-292-2078
Reports To (PM): Brett Beaulien
Fax: —
Email: brett.beaulien@floydsnider.com

Project Name: B+L RIM TRUST
Location: B+L Landfill
Collected by: C. Meoli
Project No: B+L RIM TRUST

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS: As (Diss	Metals: MTCA-5	Metals: RCRA-8			Comments/Depth
1 BLW-D4-PD22-16'-F	1140	GW	500mL	10/16											✓					
2 BLW-D4-PD25-8'-F	1245	11													✓					
3 BLW-D4-PD25-16'-F	1300	11													✓					
4 BLW-D4-PD26-8'-F	1345														✓					
5 BLW-D4-PD26-16'-F	1350														✓					
6 BLW-D4-PD27-8'-F	1420														✓					
7 BLW-D4-PD27-16'-F	1430														✓					
8																				
9																				
10																				

Relinquished: x Seth Meoli Date/Time: 10/16/08
Received: x Date/Time: 10/16/08 1632
Relinquished: x Date/Time:
Received: x Date/Time:

Sample Receipt:

Good?	
Temperature:	
Seals Intact?:	
Total Number of Containers:	

Special Remarks

TAT → [✓ 24HR] 48HR ~~Standard~~

Distribution: White - Lab, Yellow - File, Pink - Originator

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Chain of Custody Record

Date: 10/17/08

Page: 1 of: 1

Client: Floyd | Snider
Address: 601 Union Street Ste 600
City, State, Zip: Seattle, WA
Tel: 206·292·2078

Project Name: B4L TRUST RIM
Location: B4L Landfill
Collected by: Lisa Meoli

Reports To (PM): Brett.Beaulieu@floydsnider.com

Fax:

Email:

Project No: B4L TRUST RIM

	Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS: Diss Arsenic	Metals: MTCA-5	Metals: RCRA-8			Comments/Depth
1	~~[illegible]~~	~~[illegible]~~	~~GW~~	~~500 ML~~	~~10/17/08~~	fm 10/17/08										✓					
2	~~[illegible]~~	~~[illegible]~~	~~GW~~	~~"~~	~~"~~	fm 10/17/08										✓					
3	BLW-D4-PD33-8'-F	9:45	GW	500ml HNO3	10/17/08											✓					
4	BLW-D4-PD33-16'-F	10:10	GW	↓	↓											✓					
5	BLW-D4-PD28-8'-F	9:00														✓					
6	BLW-D4-PD28-16'-F	9:05														—					
7																					
8																					
9																					
10																					

Relinquished x Lisa Meoli Date/Time 10/17/08
Received x Date/Time: 10/17/08 1115
Relinquished x Date/Time
Received x Date/Time:

Sample Receipt:

Good?	Y
Temperature:	3°C
Seals Intact?:	Y
Total Number of Containers:	6

4 + 2 from CHM081016-3

Special Remarks

TAT → 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

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info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste Site
Fremont Project No: CHM081020-1

October 21st, 2008

Brett:

Enclosed are the additional analytical results for the ***B & L Woodwaste*** soil samples delivered to Fremont Analytical on October 16th, 2008.

Examination of these samples was conducted for the presence of the following:

- ***Total Metals (As) in Soil by EPA Method 6020***

This application was performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

If you have any questions about the results, please contact the laboratory.

Thank you for using Fremont Analytical!

Sincerely,

M Clements

Michelle Clements
Lab Manager / Sr. Chemist
mclements@fremontanalytical.com

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Total Metals in Soil by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081020-1

EPA 6020 (mg/kg)	**MRL**	**Method Blank**	**LCS**	**P-4-2**	**PD-17-2**	**PD-14-5**	**PD-14-8**	**PD-13-2**
Date Extracted		10/20/08	10/20/08	10/20/08	10/20/08	10/20/08	10/20/08	10/20/08
Date Analyzed		10/20/08	10/20/08	10/20/08	10/20/08	10/20/08	10/20/08	10/20/08
Matrix				Soil	Soil	Soil	Soil	Soil
Arsenic (As)	1.0	nd	103%	**2.4**	nd	nd	nd	**37**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentration:
As = 30 mg/kg

Analysis of Total Metals in Soil by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081020-1

				Duplicate	MS	MSD	
EPA 6020 (mg/kg)	**MRL**	**PD-13-3**	**PD-13-12**	**PD-13-12**	**PD-13-12**	**PD-13-12**	**RPD**
Date Extracted		10/20/08	10/20/08	10/20/08	10/20/08	10/20/08	%
Date Analyzed		10/20/08	10/20/08	10/20/08	10/20/08	10/20/08	
Matrix		Soil	Soil	Soil	Soil	Soil	
Arsenic (As)	1.0	**3.6**	nd	nd	96%	111%	14%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentration:
As = 30 mg/kg

Fremont Analytical

2930 Westlake Ave N Suite 100
Seattle WA 98109

Tel 206-352-3790
Fax 206-352-7178

Chain of Custody Record

Date: 10-16-08

Page 1 of 4

Client: FLOYD|SNIDER
Address: 601 UNION STREET
City, State, Zip: SEATTLE, WA
Tel: 206 ~~552~~ ~~75~~ 292 2078
Reports To (PM):
Fax:
Email:

Project Name: B+L WOODWASTE
Location: MILTON, WA
Collected by: BRETT BEAULIEU LISA MEOLI
Project No:

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH Gx	NWTPH-HCID	NWTPH Dx Ext	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS DISS: ARSENIC	Metals MTCA-5	Metals RCRA-8	TOTAL ARSENIC		Comments/Depth
1 BLW D4-PD18-8F	11:15	W	500 mL POLY	10-15-08											X					X Add Analysis 10/20/08
2 BLW-D4-PD18-16F	11:45	W	HNO3	↓											X					
3 BLW-D4-PD17-8F	1250	W	↓												X					
4 BLW D4-PD17-16F	13:05	W													X					
5 BLW-D4-PD16-8F	1350	W													X					
6 BLW-D4-PD16-16F	1400	W													X					
7 BLW-D4-PD190-16F	1430	W													X					
8 R4-2'	1430	S	4 oz JAR															X		HOLD VOLUME FOR ADD'L TCLP
9 BLW D4-PD15-8F	15:00	W	500 mL POLY												X					
10 BLW-D4-PD15-16F	15:10	W	HNO3	↓											X					

Relinquished: Lisa Meoli Date/Time: 10/16/08 1630 Received: Date/Time: 10/16/08 1632
Relinquished: Date/Time: Received: Date/Time:

Sample Receipt:

Good?	Y
Temperature	3°C
Seals Intact?	Y
Total Number of Containers	28 LISTED

Special Remarks:

TAT -> 24HR 48HR Standard

2 samples submitted on 10/17/08

Distribution: White - Lab, Yellow - File, Pink - Originator

Fremont Analytical

2930 Westlake Ave N Suite 100
Seattle, WA 98109

Tel 206-352-3790
Fax 206-352-7178

Chain of Custody Record

Date: 10-16-08

Page: 2 of 4

Client: FLOYD SNIDER
Address: 601 UNION ST
City, State, Zip: SEATTLE, WA
Tel: 206 292 2078

Project Name: B+L WOODWASTE
Location: MILTON, WA
Collected by: BTB, LM

Reports To (PM):
Fax:
Email:
Project No:

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS DISS As	Metals MTCA-5	Metals RCRA-8	TOTAL As		Comments/Depth
1 PD-17 2'	12:30	S	4oz															X		HOLD VOLUME FOR ADD'L TCLP ANALYSES
2																				
3																				① Add Analysis 10/20/08
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Relinquished	Date/Time	Received	Date/Time
Lisa Neale	10/16/08 1030		10/16/08 1632
Relinquished x	Date/Time	Received x	Date/Time

Sample Receipt:

Good?	
Temperature	
Seals Intact?	
Total Number of Containers	

Special Remarks:

TAT -> 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

Fremont Analytical

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Fax 206-352-7178

Chain of Custody Record

Date: 10/16/08

Page: B of 4

Client: Floyd Snider
Address: 601 Union Street Suite 600
City, State, Zip: Seattle, WA
Tel: 206.292.2078
Project Name: B&L Rim Trust
Location: B&L
Collected by: L. Meoli
Reports To (PM): Brett Beaulien
Fax: —
Email: Brett.Beaulien@floydsnider.com
Project No: B&L Rim Trust

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext	SEMI VOL 8270C	PAH 8270	PCBs 8082	☐ PESTICIDES 8081	☐ HERBICIDES 8151A	METALS As (Diss)	Metals MTCA-5	Metals RCRA-8	~~TT~~ As		Comments/Depth
1. PD-14-5'	9:00	SOIL	4oz												[illegible]			✓		ARCHIVE FROZEN)
2. PD-14-8'	9:05	SOIL	4oz												[illegible]			✓		ARCHIVE FROZEN
3. BLW-D4-PD14-8'-F	9:15	GW	500ml												✓					(Field Filtered)
4. BLW-D4-PD14-16'-F	9:30	GW	500ml												✓					(R) Submitted 10/17
5. PD-13-2'	10:00	SOIL	4oz												[illegible]			✓		(ARCHIVE FROZEN)
6. PD-13-3'	10:05	SOIL	4oz												[illegible]			✓		(ARCHIVE FROZEN
7. BLW-D4-PD13-8'-F	10:20	GW	500ml												✓					
8. BLW-D4-PD13-16'-F	10:30	GW	500ml												✓					(R) Submitted 10/17
9. PD-13-12'	10:15	SOIL	4oz												[illegible]			✓		ARCHIVE FROZEN.
10. BLW-D4-PD22-8'-F	11:30	GW	500ml												✓					○ Add Analysis 10/20/08

Relinquished: Lisa Meoli	Date/Time: 10/16/08	Received:	Date/Time: 10/16/08 1832
Relinquished:	Date/Time:	Received:	Date/Time:

Sample Receipt:

Good?	
Temperature	
Seals Intact?	
Total Number of Containers	

Special Remarks:

TAT: [✓ 24HR] 48HR [illegible]

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Fax 206-352-7178

Chain of Custody Record

Date: 10/16/08

Page: 2 of 4

Client: Floyd|Snider
Address: 601 Union St Suite 600
City, State, Zip: Seattle, WA 98101
Tel: 206-292-2078

Project Name: B+L RIM TRUST
Location: B+L Landfill
Collected by: GMeoli

Reports To (PM): Brett Beaulien
Fax: →
Email: brett.beaulien@floydsnider.com
Project No.: B+L RIM TRUST

	Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS As (Diss)	Metals MTCA-5	Metals RCRA-8	[illegible]		Comments/Depth
1	BLW-D4-PD22-16'-F	1140	GW	500mL	10/16											✓					
2	BLW-D4-PD25-8'-F	1245	''	↓	↓											✓					
3	BLW-D4-PD25-16'-F	1300	''	↓	↓											✓					
4	BLW-D4-PD26-8'-F	1345	↓	↓	↓											✓					
5	BLW-D4-PD26-16'-F	1350	↓	↓	↓											✓					
6	BLW-D4-PD27-8'-F	1420	↓	↓	↓											✓					
7	BLW-D4-PD27-16'-F	1430	↓	↓	↓											✓					
8																					
9																					
10																					

Relinquished	Date/Time	Received	Date/Time
x	10/16/08	x	10/16/08 1632
x		x	

Sample Receipt:

Good?	
Temperature	
Seals Intact?	
Total Number of Containers	

Special Remarks

TAT - [✓ 24HR] 48HR

Distribution: White - Lab, Yellow - File, Pink - Originator

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Fremont Analytical

2930 Westlake Ave N Suite 100
Seattle, WA 98109
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste Site
Fremont Project No: CHM081022-4
Floyd | Snider Project No: B&L RIM Trust

October 23rd, 2008

Brett:

Enclosed are the analytical results for the ***B & L Woodwaste*** water samples delivered to Fremont Analytical on October 22nd, 2008

The samples were received in good condition –, in the proper containers (500mL Polys preserved with HNO_3 unless otherwise noted), properly sealed, labeled and within holding time. The cooler temperature upon receipt was 3.7°C, which is within the laboratory recommended cooler temperature range (<4°C - 10°C). The samples were analyzed and then stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C.

Sample Receipt Notation:

BLW-D4-PD92-8F, *BLW-D4-PD92-16*F: Upon sample check in it was noted that the pH was above 2.

- *BLW-D4-PD92-8F:* The laboratory preserved upon receipt.
- *BLW-D4-PD92-16F:* The sample contained a high amount of sediment. The laboratory performed additional filtration before preservation and analysis.

There were no additional sample receipt or sample analysis issues to report.

Examination of these samples was conducted for the presence of the following:

- ***Dissolved Metals (As) in Water by EPA Method 6020***

These applications were performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

If you have any questions about the results, please contact the laboratory.

Thank you for using Fremont Analytical!

Sincerely,

M Clements

Michelle Clements
Lab Manager / Sr. Chemist
mclements@fremontanalytical.com

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081022-4

					Duplicate
EPA 6020 (mg/L)	**MRL**	**Method Blank**	**LCS**	**BLW-D4-PD21-8F**	**BLW-D4-PD21-8F**
Date Extracted		10/22/08	10/22/08	10/22/08	10/22/08
Date Analyzed		10/22/08	10/22/08	10/22/08	10/22/08
Matrix				Water	Water
Arsenic (As)	0.002	nd	79%	nd	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentration:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081022-4

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD21-16F**	**BLW-D4-PD20-8F**	**BLW-D4-PD20-16F**
Date Extracted		10/22/08	10/22/08	10/22/08
Date Analyzed		10/22/08	10/22/08	10/22/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	**0.002**	**0.003**	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentration:
As = 100µg/L

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081022-4

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD19-8F**	**BLW-D4-PD19-16F**	**BLW-D4-PD90-8F**
Date Extracted		10/22/08	10/22/08	10/22/08
Date Analyzed		10/22/08	10/22/08	10/22/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	**0.028**	**0.042**	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentration:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081022-4

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD90-16F**	**BLW-D4-PD91-8F**	**BLW-D4-PD91-16F**
Date Extracted		10/22/08	10/22/08	10/22/08
Date Analyzed		10/22/08	10/22/08	10/22/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	**0.35**	**0.11**	**0.19**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentration:
As = 100µg/L

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081022-4

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD92-8F**	**BLW-D4-PD92-16F**
Date Extracted		10/22/08	10/22/08
Date Analyzed		10/22/08	10/22/08
Matrix		Water	Water
Arsenic (As)	0.002	**0.004**	**0.004**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentration:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM081022-4

		MS	MSD	
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD21-8F**	**BLW-D4-PD21-8F**	**RPD**
Date Extracted		10/22/08	10/22/08	%
Date Analyzed		10/22/08	10/22/08	
Matrix		Water	Water	
Arsenic (As)	0.002	85%	88%	3%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentration:
As = 100μg/L

Fremont Analytical

Chain of Custody Record

2930 Westlake Ave. N. Suite 100
Seattle, WA 98109

Tel: 206-352-3790
Fax: 206-352-7178

Date: 10/22/08 **Page:** 1 **of:** 1

Client: Floyd Snider
Address: 601 Union Street Suite 600
City, State, Zip Seattle, WA 98101 **Tel:** 206-257-9714
Reports To (PM): Lisa Meoli Cell (206) 257-9714 **Fax:**

Project Name: BEL RIM TRUST
Location: BEL Landfill, Milton
Collected by: L. Meoli, E. Murray
Email: + CC: Brett.Beaulieu@floydsnider.com **Project No:** BEL RIM TRUS

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS As (Diss)	Metals: MTCA-5	Metals: RCRA-8			Comments/Depth
1 BLW-D4-PD21-8'-F	10:15	GW ~~[illegible]~~	500 ML [illegible]	10/22/08											✓					(ALL SAMPLES WERE
2 BLW-D4-PD21-16'-F	1020	~~[illegible]~~ GW	↓	↓											✓					FIELD FILTERED)
3 BLW-D4-PD20-8'-F	1120	↓	↓	↓											✓					↓
4 BLW-D4-PD20-16'-F	1125	↓	↓	↓											✓					↓
5 BLW-D4-PD19-8'-F	1220	↓	↓	↓											✓					↓
6 BLW-D4-PD19-16'-F	1230	↓	↓	↓											✓					↓
7 BLW-D4-PD90-8'-F	1400	↓	↓	↓											✓					↓
8 BLW-D4-PD90-16'-F	1410	↓	↓	↓											✓					↓
9 BLW-D4-PD91-8'-F		↓	↓	↓											✓					↓
10 BLW-D4-PD91-16'-F		↓	↓	↓											✓					↓

Relinquished x Lisa Meoli	Date/Time 10/22/08	Received x	Date/Time: 10/22/08 1710
Relinquished x	Date/Time	Received x	Date/Time:

Sample Receipt:

Good?	Y
Temperature:	3.7°C
Seals Intact?:	Y
Total Number of Containers:	12

Special Remarks
Please call Lisa Meoli w/ Results on 10/23 a.m. (206) 257-9714. Thx!

TAT -> [✓ 24HR] 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

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Chain of Custody Record

Date: 10/22/08
Page: 2 of: 2

Client: Floyd|Snider
Address: 601 unionstreet Suite 601
City, State, Zip Seattle, WA 98101 **Tel:** 206-257-9714
Project Name: B+L RIM TRUST
Location: BLW Landfill, Milton
Collected by: L. Meoli / E. Murray
Reports To (PM): Lisa Meoli @206-257-9714 **Fax:** — CC - **Email:** brettbeaulieu@floydsnider.com **Project No:** B+L RIM TRUST

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS As (Diss)	Metals: MTCA-5	Metals: RCRA-8			Comments/Depth
1 BLW-D4-PD92-8'-F	1530	GW	500mL HNO3	10/22/08											✓					(Samples were Field filtered)
2 BLW-D4-PD92-16'-F	1540	↓	↓	↓											✓					
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Relinquished	Date/Time	Received	Date/Time
x Lisa Meoli	10/22/08	x	10/22/08 1710
x		x	

Sample Receipt:

Good?	Y
Temperature:	3.7°C
Seals Intact?:	Y
Total Number of Containers:	2

Special Remarks
Please call Lisa Meoli on 10/23/08 a.m. w/ results (206)257-9714 Thx!
TAT → [✓ 24HR] 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

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F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste Site
Fremont Project No: CHM081023-1
Floyd | Snider Project No: B&L RIM Trust

October 27th, 2008

Brett:

Enclosed are the analytical results for the ***B & L Woodwaste*** soil and water samples delivered to Fremont Analytical on October 23rd, 2008

The samples were received in good condition –, in the proper containers (500mL Polys preserved with HNO_3 & a 4oz soil jar), properly sealed, labeled and within holding time. The samples were analyzed and then stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C. There were no additional sample receipt or sample analysis issues to report.

Examination of these samples was conducted for the presence of the following:

- ***Dissolved Metals (As) in Water by EPA Method 6020***
- ***Total Metals (As) in Soil by EPA Method 6020***

These applications were performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

If you have any questions about the results, please contact the laboratory.

Thank you for using Fremont Analytical!

Sincerely,

M Clements

Michelle Clements
Lab Manager / Sr. Chemist
mclements@fremontanalytical.com

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L - Trust RIM
Lab Project #: CHM081023-1

EPA 6020 (mg/L)	MRL	Method Blank	LCS	BLW-D4-PD96-8F	BLW-D4-PD96-16F
Date Extracted		10/23/08	10/23/08	10/23/08	10/23/08
Date Analyzed		10/24/08	10/24/08	10/24/08	10/24/08
Matrix				Water	Water
Arsenic (As)	0.002	nd	111%	nd	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100 µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L - Trust RIM
Lab Project #: CHM081023-1

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD97-8F**	**BLW-D4-PD97-16F**	**BLW-D4-PD94-8F**
Date Extracted		10/23/08	10/23/08	10/23/08
Date Analyzed		10/24/08	10/24/08	10/24/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	nd	nd	**0.003**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100 μg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L - Trust RIM
Lab Project #: CHM081023-1

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD94-16F**	Duplicate **BLW-D4-PD96-8F**
Date Extracted		10/23/08	10/23/08
Date Analyzed		10/24/08	10/24/08
Matrix		Water	Water
Arsenic (As)	0.002	nd	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100 µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L - Trust RIM
Lab Project #: CHM081023-1

		MS	MSD	
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD96-8F**	**BLW-D4-PD96-8F**	**RPD**
Date Extracted		10/23/08	10/23/08	%
Date Analyzed		10/24/08	10/24/08	
Matrix		Water	Water	
Arsenic (As)	0.002	115%	106%	8%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100 µg/L

Analysis of Total Metals in Soil by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L - Trust RIM
Lab Project #: CHM081023-1

					Duplicate		MS	MSD	
EPA 6020 (mg/kg)	**MRL**	**Method Blank**	**LCS**	**PD97-2.5'**	**PD97-2.5'**	**RPD**	*Batch*	*Batch*	**RPD**
Date Extracted		10/22/08	10/22/08	10/22/08	10/22/08	%	10/22/08	10/22/08	%
Date Analyzed		10/24/08	10/24/08	10/24/08	10/24/08		10/24/08	10/24/08	
Matrix				Soil	Soil		Soil	Soil	
Arsenic (As)	1.0	nd	118%	**7.7**	**7.9**	3%	99%	82%	19%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%
Spike Concentrations:
As = 30 mg/kg

Fremont Analytical

2930 Westlake Ave. N. Suite 100
Seattle, WA 98109

Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record

Date: 10/23/08

Page: 1 of: 1

Client: Floyd | Snider
Address: 601 Union Street Ste. 600
City, State, Zip: Seattle, WA 98103
Tel: 206-292-2078

Project Name: B&L Woodwaste
Location: B&L
Collected by: E. Murray & L. Meoli

Reports To (PM): Brett Beaulieu
Fax: 206-682-7867
Email: brett.beaulieu@floydsnider.com
Project No: B&L-TRUST RIM

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS AS Diss	Metals: MTCA-5	Metals: RCRA-8			Comments/Depth
1 BLW-D4-PD96-8F	0915	GW	500mL	10/23/08											✓					
2 BLW-D4-PD96-16F	0925	↓	↓	↓											✓					
3 BLW-D4-PD97-8F	1015	↓	↓	↓											✓					
4 BLW-D4-PD97-16F	1020	↓	↓	↓											✓					
5 BLW-D4-PD94-8F	1105	↓	↓	↓											✓					
6 BLW-D4-PD94-16F	1120	↓	↓	↓											✓					
7 PD97-2.5'	1000	S	4 oz glass jar	↓											✓					Arsenic - Hold Archive
8																				
9																				
10																				

Relinquished x
Date/Time 10/23/08
Received x
Date/Time: 10/23/08 1320

Relinquished x
Date/Time
Received x
Date/Time:

Sample Receipt:

Good?	Y
Temperature:	04
Seals Intact?:	Y
Total Number of Containers:	7

Special Remarks

TAT -> 24HR 48HR Standard

Distribution: White - Lab, Yellow - File, Pink - Originator

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Fremont
Analytical

2930 Westlake Ave N Suite 100
Seattle, WA 98109
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste Site
Fremont Project No: CHM080829-1
Floyd | Snider Project No: B&L RIM

September 12th, 2008

Brett:

Enclosed are the analytical results for the ***B & L Woodwaste*** water samples delivered to Fremont Analytical on August 29th, 2008.

The samples were received in good condition – in a cooler with wet ice, in the proper containers, properly sealed, labeled and within holding time. The cooler temperature upon receipt was 2°C, which is within the laboratory recommended cooler temperature range (2°C - 10°C). The samples were extracted and stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C. There were no sample receipt issues to report.

Examination was conducted for the presence of the following:

- ***Dissolved Metals (As, Ca, Fe, Mg, Na) in Water by EPA Method 6020***
- ***pH by SM 4500-H***
- ***Nitrate by SM 4500-NO3-E***
- ***Chloride by EPA Method 300*****
- ***Total Organic Carbons by SM 5310-B*****
- ***Total Alkalinity by SM 2320-B*****

These applications were performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

**Analysis performed by Edge Analytical

2930 Westlake Ave N Suite 100
Seattle, WA 98109
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste Site
Fremont Project No: CHM080829-1
Floyd | Snider Project No: B&L RIM

EPA Method 6020 Notations:

- *Metals samples were received in preserved bottles. The Chain of Custody indicated that the samples were "field filtered." Samples PD-107-W-30 and PDD10A-16F had visible sediment and were laboratory filtered before analysis*
- *Matrix spike and matrix spike duplicate for sample "* PD-*107-W-30 " could not be determined for Ca, Fe, Mg and Na due to the concentration of these analytes in the sample relative to the concentration of these analytes in the spike solution*
- *Recoveries for the matrix spike and matrix spike duplicate were low for As due to the concentration of this analyte in the sample.*
- *The LCS recoveries for all analytes were within QC Limits providing Batch QC.*

If you have any questions about the results, please contact the laboratory.

Thank you for using Fremont Analytical!

Sincerely,

Michael Dee
Principal / Sr. Chemist
mikedee@fremontanalytical.com

**Analysis performed by Edge Analytical

Fremont Analytical

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080829-1

					Duplicate		
EPA 6020 (mg/L)	**MRL**	**Method Blank**	**LCS**	**PD-107-W-30'**	**PD-107-W-30'**	**RPD**	**BLW-D4-PDD10A-13F**
Date Extracted		9/3/08	9/3/08	9/3/08	9/3/08	%	9/3/08
Date Analyzed		9/5/08	9/5/08	9/5/08	9/5/08		9/5/08
Matrix		Water		Water	Water		Water
Arsenic (As)	0.002	nd	93%	**2.7**	**2.3**	16%	**0.4**
Calcium (Ca)	0.02	nd	89%	**107**	**83**	25%	*N/A*
Iron (Fe)	0.1	nd	100%	**38**	**31**	20%	*N/A*
Magnesium (Mg)	0.1	nd	97%	**75**	**69**	8%	*N/A*
Sodium (Na)	0.5	nd	80%	**29**	**25**	15%	*N/A*

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%
Spike Concentration:
As, Fe, Mg, Na, Ca = 100µg/L
Fe = 200 µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080829-1

			MS	MSD	
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PDD10A-16F**	**PD-107-W-30'**	**PD-107-W-30'**	**RPD**
Date Extracted		9/3/08	9/3/08	9/3/08	%
Date Analyzed		9/5/08	9/5/08	9/5/08	
Matrix		Water	Water	Water	
Arsenic (As)	0.002	**0.1**	62%	42%	38%
Calcium (Ca)	0.02	*N/A*			
Iron (Fe)	0.1	*N/A*			
Magnesium (Mg)	0.1	*N/A*			
Sodium (Na)	0.5	*N/A*			

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentration:
As, Fe, Mg, Na, Ca = 100µg/L
Fe = 200 µg/L

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Seattle, WA 98109

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email: info@fremontanalytical.com

Analysis of Nitrate by SM 4500 - N0_3^-E

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080829-1

SM 4500-NO_3^-E (mg NO_3^--N/L)	MRL	Method Blank	LCS	PD-107-W-30'	Duplicate PD-107-W-30'	RPD %
Date Analyzed		9/1/08	9/1/08	9/1/08	9/1/08	
Matrix		Water		Water	Water	
Nitrate	0.8	nd	70%	**10.2**	**10.5**	3%

"nd" Indicates not detected at listed reporting limit
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample

Acceptable RPD is determined to be less than 20%

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of pH in Water by SM4500-H

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080829-1

		Duplicate
SM 4500-H	**PD-107-W-30'**	**PD-107-W-30'**
Date Analyzed	9/1/08	9/1/08
Matrix	Water	Water
pH	**6.3**	**6.3**

"int" Indicates that interference prevents determination

Burlington WA
Corporate Office
1620 S Walnut St - 98233
800.755.9295 • 360.757.1400 • 360.757.1402fax

Bellingham WA
Microbiology
805 Orchard Dr Suite 4 - 98225
360.671.0688 • 360.671.1577fax

Data Report

Client Name: Fremont Analytical
2930 Westlake Ave N #100
Seattle, WA 98109

Report Date: 9/4/2008
Reference Number: 08-12499
Project: BTL Woodwaste

Collected By:

Date Received: 9/3/2008
Peer Review:

Lab Number: 26275
Sample Description: PD-107 W 30
Sample Date: 8/29/2008

CAS ID#	Analyte	Result	PQL	MDL	Units	DF	Method	Analyzed	Analyst	Batch	Comments
E-14506	**ALKALINITY**	**648**	5.0	2	mg/L	1.0	SM2320 B	9/4/2008	CCN	ALK_080904	
16887-00-6	**CHLORIDE**	**68**	10.0	0.012	mg/L	100.0	300.0	9/3/2008	BJ	I080903A	
E-10195	**TOTAL ORGANIC CARBON**	**29.6**	0.50	0.0981	mg/L	1.0	SM5310 B	9/3/2008	BJ	TOC_080903	

PQL = Practical Quantitation Limit is the lowest level that can be acheived within specified limits of precision and accuracy during routine laboratory operating conditions.
ND = Not detected above the listed practical quantitation limit (PQL) or not above the Method Detection Limit (MDL), if requested.
D.F. - Dilution Factor

WSDOE Lab C1251
WSDOH Lab 046

EDGE ANALYTICAL LABORATORIES

Burlington WA
Corporate Office
1620 S Walnut St - 98233
800.755.9295 • 360.757.1400 • 360.757.1402fax

Bellingham WA
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QUALITY CONTROL REPORT

Duplicate and Matrix Spike/Matrix Spike Duplicate Report

Reference Number: 08-12499
Report Date: 9/4/2008

Duplicate

Batch	Sample	Analyte	Result	Duplicate Result	Units	%RPD	Limits	QC Qualifier	Comments
ALK_080904									
	26275	ALKALINITY	648	645	mg/L	**0.5**	0-45	DUP	
I080903A									
	26292	CHLORIDE	51	51	mg/L	**0.0**	0-45	DUP	
	26311	CHLORIDE	28	28	mg/L	**0.0**	0-45	DUP	
	26341	CHLORIDE	6	6	mg/L	**0.0**	0-45	DUP	
TOC_080903									
	26057	TOTAL ORGANIC CARBON	1.06	1.06	mg/L	**0.0**	0-50	DUP	
	26318	TOTAL ORGANIC CARBON	4.81	4.81	mg/L	**0.0**	0-50	DUP	

%RPD = Relative Percent Difference

NA = Indicates %RPD could not be calculated

Matrix Spike (MS)/Matrix Spike Duplicate (MSD) analyses are used to determine the accuracy (MS) and precision (MSD) of a analytical method in a given sample matrix. Therefore, the usefulness of this report is limited to samples of similar matrices analyzed in the same analytical batch.

Only Duplicate sample with detections are listed in this report

Matrix Spike

Batch	Sample	Analyte	Result	Spike Result	Duplicate Spike Result	Spike Conc	Units	Percent Recovery MS	Percent Recovery MSD	Limits	%RPD	Limits	QC Qualifier	Comments
I080903A														
	26292	CHLORIDE	51	51		1.00	mg/L	**0**	**NA**	80-120	**NA**	0-60	S	LFM
	26311	CHLORIDE	28	28		1.00	mg/L	**0**	**NA**	80-120	**NA**	0-60	S	LFM
	26341	CHLORIDE	6	7.1		1.00	mg/L	**110**	**NA**	80-120	**NA**	0-60		LFM
TOC_080903														
	26318	TOTAL ORGANIC CARBON	4.81	8.82	8.93	4.00	mg/L	**100**	**103**	65-135	**2.7**	0-70		LFM

%RPD = Relative Percent Difference

NA = Indicates %RPD could not be calculated

Matrix Spike (MS)/Matrix Spike Duplicate (MSD) analyses are used to determine the accuracy (MS) and precision (MSD) of a analytical method in a given sample matrix. Therefore, the usefulness of this report is limited to samples of similar matrices analyzed in the same analytical batch.

Only Duplicate sample with detections are listed in this report

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SAMPLE INDEPENDENT QUALITY CONTROL REPORT

Laboratory Fortified Blank

Reference Number: 08-12499
Report Date: 09/04/08

Batch	Analyte	Result	True Value	Units	Method	% Recovery	Limits	QC Qualifier	Type*	Comment
alk_080904	ALKALINITY	108	100	mg/L	SM2320 B	108	80-120		LFB	
alk_080904	ALKALINITY	108	100	mg/L	SM2320 B	108	80-120		LFB	
TOC_080903	TOTAL ORGANIC CARBON	0.99	1.00	mg/L	SM5310 B	99	90-110		LFB	

---

*Notation:

% Recovery = (Result of Analysis)/(True Value) * 100

NA = Indicates % Recovery could not be calculated.

QCS: Quality Control Sample, a solution containing known concentrations of method analytes which is used to fortify an aliquot of reagent matrix. The QCS is obtained from an external source and is used to check lab performance.

LFB: Laboratory Fortified Blank, an aliquot of reagent matrix to which known quantities of method analytes are added in the lab. The LFB is analyzed exactly like a sample, and its purpose is to determine whether method performance is within accepted control limits.

MB or LRB: Method Blank or Laboratory Reagent Blank, an aliquot of reagent matrix is analyzed exactly like a sample, and its purpose is to determine if there is background contamination.

SAMPLE INDEPENDENT
QUALITY CONTROL REPORT

Laboratory Reagent Blank

Reference Number: 08-12499
Report Date: 09/04/08

Batch	Analyte	Result	True Value	Units	Method	% Recovery	Limits	QC Qualifier	Type*	Comment
I080903A	CHLORIDE	ND		mg/L	300.0		0.10000		LRB	

---

*Notation:

% Recovery = (Result of Analysis)/(True Value) * 100

NA = Indicates % Recovery could not be calculated.

QCS: Quality Control Sample, a solution containing known concentrations of method analytes which is used to fortify an aliquot of reagent matrix. The QCS is obtained from an external source and is used to check lab performance.

LFB: Laboratory Fortified Blank, an aliquot of reagent matrix to which known quantities of method analytes are added in the lab. The LFB is analyzed exactly like a sample, and its purpose is to determine whether method performance is within accepted control limits.

MB or LRB: Method Blank or Laboratory Reagent Blank, an aliquot of reagent matrix is analyzed exactly like a sample, and its purpose is to determine if there is background contamination.

SAMPLE INDEPENDENT QUALITY CONTROL REPORT

Method Blank

Reference Number: 08-12499
Report Date: 09/04/08

Batch	Analyte	Result	True Value	Units	Method	% Recovery	Limits	QC Qualifier	Type*	Comment
TOC_080903	TOTAL ORGANIC CARBON	ND		mg/L	SM5310 B		0.12000		MB	

---

*Notation:

% Recovery = (Result of Analysis)/(True Value) * 100

NA = Indicates % Recovery could not be calculated.

QCS: Quality Control Sample, a solution containing known concentrations of method analytes which is used to fortify an aliquot of reagent matrix. The QCS is obtained from an external source and is used to check lab performance.

LFB: Laboratory Fortified Blank, an aliquot of reagent matrix to which known quantities of method analytes are added in the lab. The LFB is analyzed exactly like a sample, and its purpose is to determine whether method performance is within accepted control limits.

MB or LRB: Method Blank or Laboratory Reagent Blank, an aliquot of reagent matrix is analyzed exactly like a sample, and its purpose is to determine if there is background contamination.

SAMPLE INDEPENDENT QUALITY CONTROL REPORT

Quality Control Sample

Reference Number: 08-12499
Report Date: 09/04/08

Batch	Analyte	Result	True Value	Units	Method	% Recovery	Limits	QC Qualifier	Type*	Comment
I080903A	CHLORIDE	29.4	30.0	mg/L	300.0	98	80-120		QCS	
TOC_080903	TOTAL ORGANIC CARBON	2.13	2.22	mg/L	SM5310 B	96	90-110		QCS	

---

*Notation:

% Recovery = (Result of Analysis)/(True Value) * 100
NA = Indicates % Recovery could not be calculated.

QCS: Quality Control Sample, a solution containing known concentrations of method analytes which is used to fortify an aliquot of reagent matrix. The QCS is obtained from an external source and is used to check lab performance.

LFB: Laboratory Fortified Blank, an aliquot of reagent matrix to which known quantities of method analytes are added in the lab. The LFB is analyzed exactly like a sample, and its purpose is to determine whether method performance is within accepted control limits.

MB or LRB: Method Blank or Laboratory Reagent Blank, an aliquot of reagent matrix is analyzed exactly like a sample, and its purpose is to determine if there is background contamination.

Qualifier Definitions

Reference Number: 08-12499
Report Date: 09/04/08

Qualifier	Definition
M	Matrix induced bias assumed.
S	Spiking amount was lower than the 5:1 spike to background (sample amount) basis for performance criteria. The reported criteria does not apply due to increased errors in measurement of both sample and spike concentration.

Note: Some qualifier definitions found on this page may pertain to results or QC data which are not printed with this report.

Attachment B

Boring Logs

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Boring Location: PD-1a

Drill Date: August 15, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

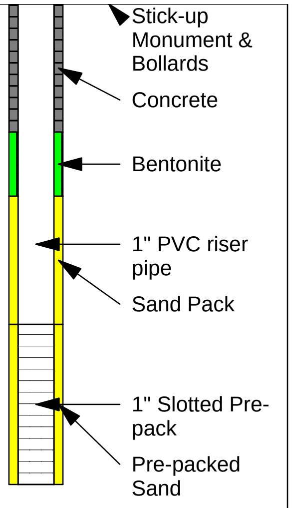
Ground Surf Elev. & Datum: 12.667, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702948.758
Longitude/Easting: 1185729.253
Casing Elevation: 16.167, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 7.5 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Shallow well screen. First of three.
No logging was done.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			
		8			
		9			
		10			
		11			
		12			
		13			
		14			
		15			
		16			
		17			
		18			
		19			
		20			



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-1b

Drill Date: August 15, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

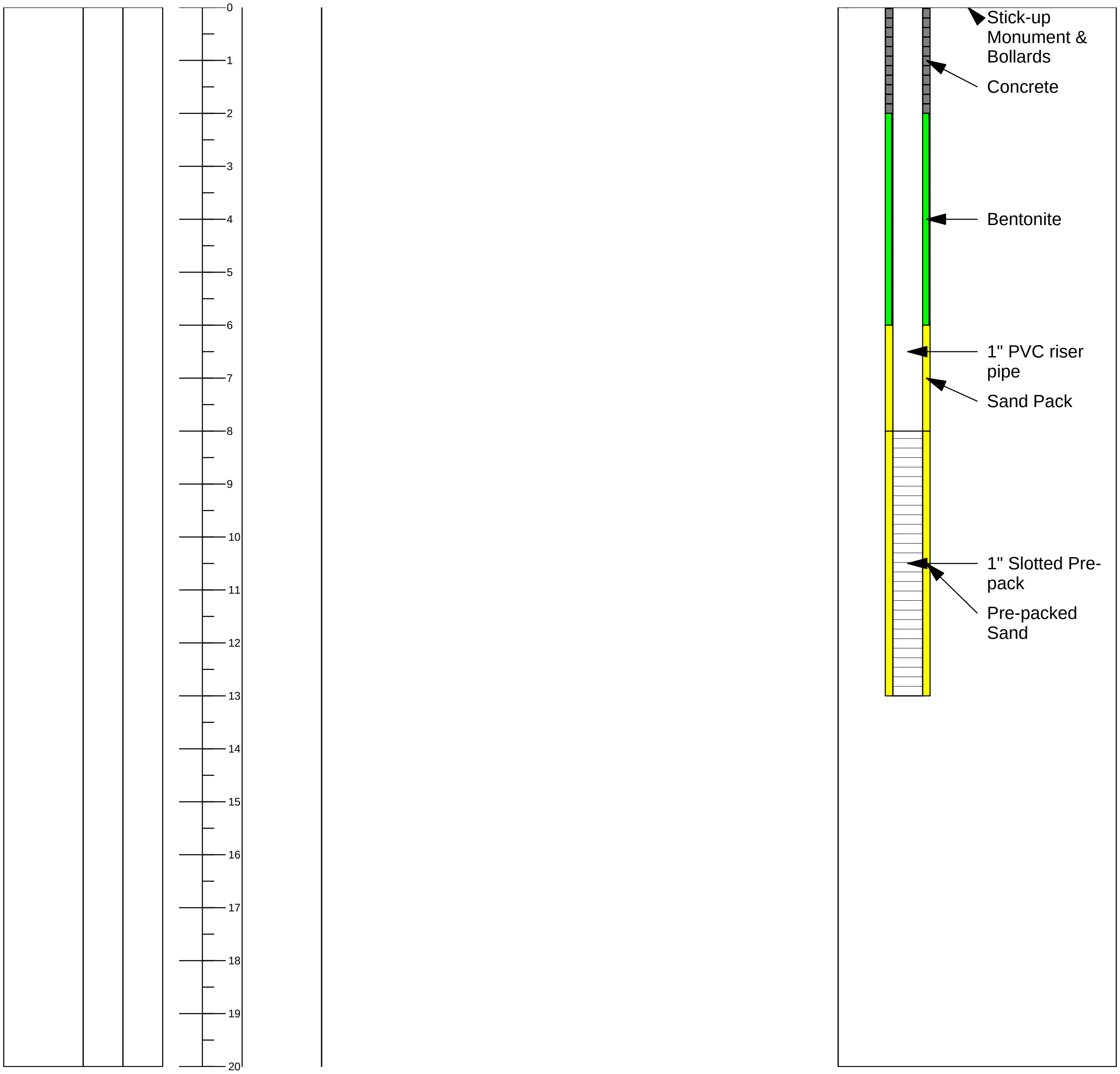
Ground Surf Elev. & Datum: 12.617, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702948.583
Longitude/Easting: 1185725.946
Casing Elevation: 15.732, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 13 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Intermediate well screen. 2 of 3.
No logging was done.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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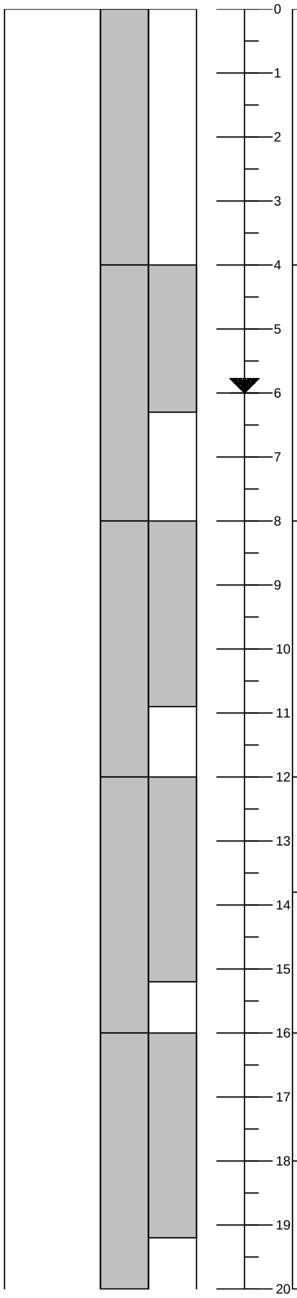
Boring Location: PD-1c

Drill Date: August 15, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 12.617, NAVD 88	**Drill Type:** Track Geoprobe 6620DT	**Client:** B&L Custodial Trust
Coordinate System: NAD 83/98	**Sample Method:** Dual Tube	**Project:** B&L RIM
Latitude/Northing: 702948.758	**Boring Diameter:** 2 inches	**Task Number:**
Longitude/Easting: 1185722.528	**Boring Depth (ft bgs):** 24 ft bgs	**Site Location:** B&L Woodwaste
Casing Elevation: 15.932, NAVD 88	**Groundwater ATD (ft bgs):** 6' bgs	Pierce County, WA

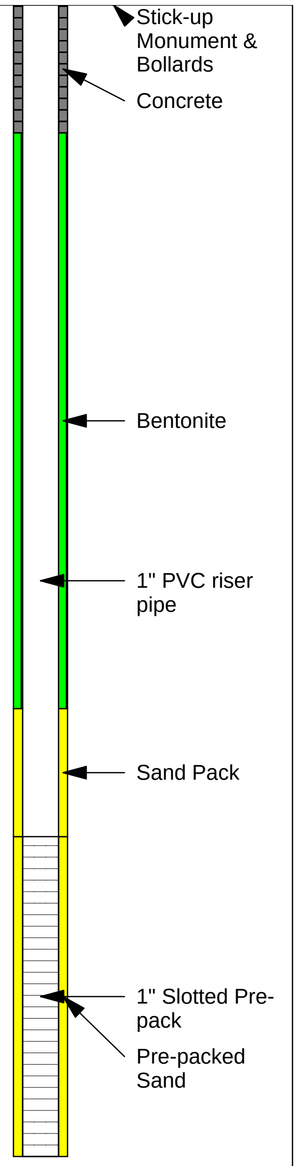
Remarks: Deep well screen. Third of three.
Sunny, hot.

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
	Very soft and heaving.
SM/ML	Top 1 inch woody roots grading down to dark gray, moist, poorly graded silty sand, fine. Silt <15%. At 6.0 inches becomes silt.
SM	Dark gray, wet, poorly graded silty sand, fine. Pieces of wood interbedded.
SM	Medium gray, wet, poorly graded, silty sand, fine.
SP	Dark gray, wet, poorly graded sand, fine-medium. Little to no silt.
SM	Dark gray, wet, poorly graded silty sand, fine.
ML/CL /PT/ML	Medium gray, moist, poorly graded silt. Grading down to peat mixed with silt, then grading back to silt.

WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-1c

Drill Date: August 15, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 12.617, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702948.758
Longitude/Easting: 1185722.528
Casing Elevation: 15.932, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24 ft bgs
Groundwater ATD (ft bgs): 6' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Deep well screen. Third of three.
Sunny, hot.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		20 21 22 23 24	PT/ML/PT	Large woody chunks. At 21.0 mottled gray and brown clayey silt with interbedded organics. At 21.3 turns to peat and then grades to clayey silt with medium plasticity.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-2

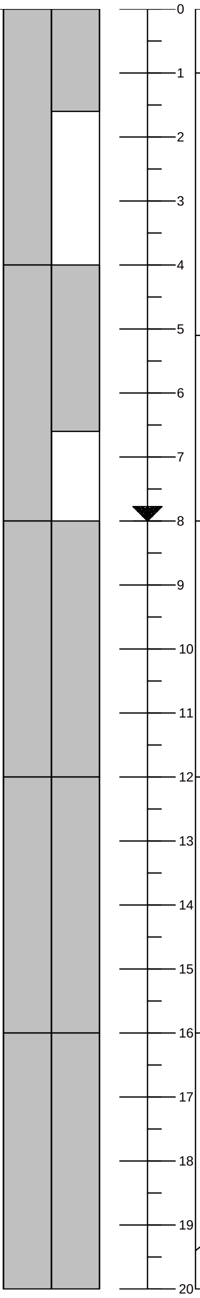
Drill Date: August 13, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 13.577 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702988.529
Longitude/Easting: 1185786.668
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24 ft bgs
Groundwater ATD (ft bgs): 8' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.
Sunny and warm.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	WELL COMPLETION DETAIL (If Applicable)
			ML	Dark brown, moist, peat/silty, woody debris with interbedded roots	
			PT	Dark brown, moist, peat, little silt <10%.	
			ML/SM	Dark gray, silt, at 5.6' bgs grades down to dark grey silty sand, fine to medium, moist.	
			SM	Same as above, wet.	
			SP	Dark grey, wet, poorly graded sand, fine to medium, grading to silty sand in places.	
			SP	Dark gray, wet, poorly graded fine to medium grained sand.	
			SM	Dark grey, wet, silty sand, fine to medium.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-2

Drill Date: August 13, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 13.577 NAVD 88	**Drill Type:** Track Geoprobe 6620DT	**Client:** B&L Custodial Trust
Coordinate System: NAD 83/98	**Sample Method:** Dual Tube	**Project:** B&L RIM
Latitude/Northing: 702988.529	**Boring Diameter:** 2 inches	**Task Number:**
Longitude/Easting: 1185786.668	**Boring Depth (ft bgs):** 24 ft bgs	**Site Location:** B&L Woodwaste
Casing Elevation: NA	**Groundwater ATD (ft bgs):** 8' bgs	Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.
Sunny and warm.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		20 21	SP/SM	Dark gray, wet, poorly graded sand, fine-medium, grading down to silty sand with organic fines, woody debris.	
		22 23 24	ML/CL	Clayey silt, moist.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-3

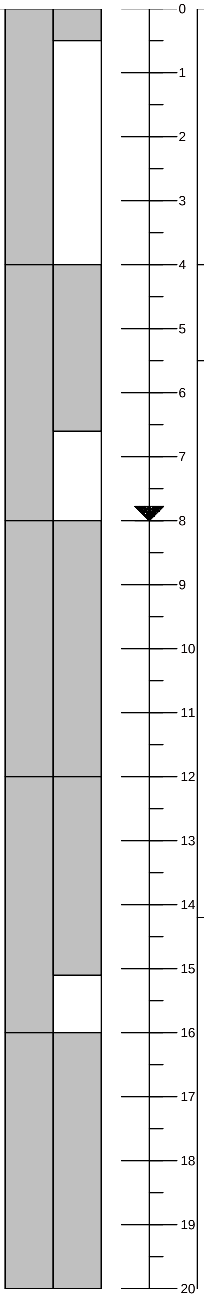
Drill Date: August 13, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 13.545 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702992.564
Longitude/Easting: 1185833.003
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24 ft bgs
Groundwater ATD (ft bgs): 8' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.
Sunny, warm.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			PT	Dark brown peat. Mostly woody with little to no silt or sand. Turns black when exposed to air.	
			PT	Dark brown, moist, woody peat, little silt <5%.	
			SM	Dark gray, wet, poorly graded silty sand.	
			SP	Dark gray, wet, poorly graded, fine and medium sand with no silt.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-3

Drill Date: August 13, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 13.545 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702992.564
Longitude/Easting: 1185833.003
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24 ft bgs
Groundwater ATD (ft bgs): 8' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.
Sunny, warm.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		20			
		21			
		22	SM/ML PT	Medium gray, wet, poorly graded silty sand grading down to medium gray clayey silt, then grading to dark brown woody peat with <5% silt.	
		23			
		24			

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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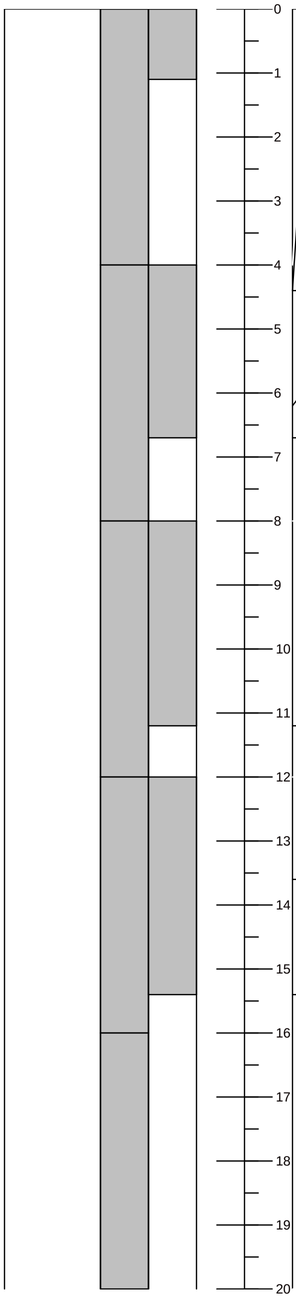
Boring Location: PD-4

Drill Date: August 14, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 12.292 NAVD 88	**Drill Type:** Track Geoprobe 6620DT	**Client:** B&L Custodial Trust
Coordinate System: NAV83/98	**Sample Method:** Dual Tube	**Project:** B&L RIM
Latitude/Northing: 702994.7977	**Boring Diameter:** 2 inches	**Task Number:**
Longitude/Easting: 1185895.931	**Boring Depth (ft bgs):** 24 ft bgs	**Site Location:** B&L Woodwaste
Casing Elevation: 15.297 NAVD 88	**Groundwater ATD (ft bgs):** Unknown	Pierce County, WA

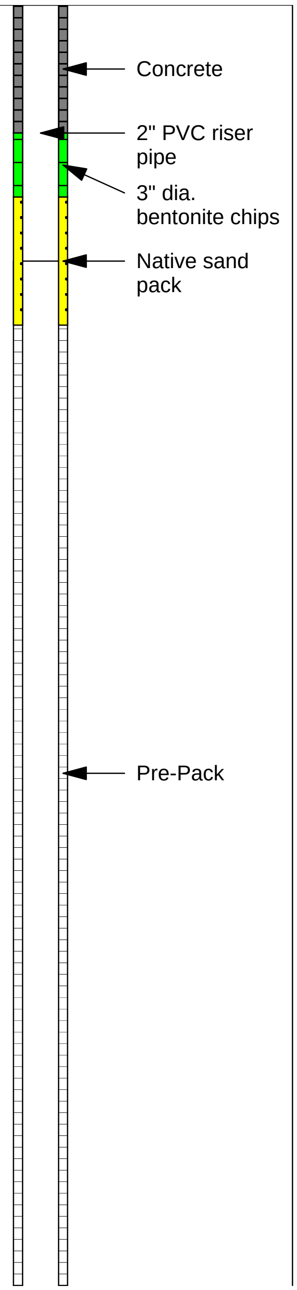
Remarks: Boring log and groundwater sample in wetland.

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
PT	Dark brown, moist, silty peat, wood.
PT	Dark brown peat mixed with silt <15%
SM	Grades to silty sand with organic debris interbedded; grading down to fine sandy silt.
SM/SP	Medium gray, poorly graded sand, fine and medium, silt < 5%.
SM/SP	Medium and dark gray, wet, poorly graded sand, fine and medium, little silt.
SM/SP	Medium and dark gray, wet, poorly graded sand, fine and medium, little silt.
SP	Dark gray, poorly graded clean sand, medium, no silt.
	Liner stuck in sampler but fine and medium sand in top and bottom of liner based on observation.

WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-4

Drill Date: August 14, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 12.292 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 702994.7977
Longitude/Easting: 1185895.931
Casing Elevation: 15.297 NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		20	SP	Dark gray, poorly graded clean sand, medium, no silt.	
		21	SM	Medium and dark gray, wet, poorly graded sand, fine and medium, little silt.	
		22	ML	Medium gray, clayey silt.	
		23	PT	Peat interbedded with clayey silt.	
		24			

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-5

Drill Date: August 14, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

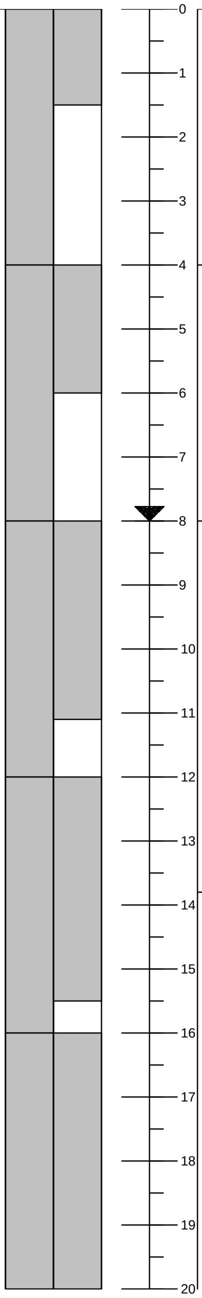
Ground Surf Elev. & Datum: 13.609 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 703000.143
Longitude/Easting: 1185938.281
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24 ft bgs
Groundwater ATD (ft bgs): 8' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.
Sunny, warm.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
PT/ML	Medium brown, silty organic peat. High silt content. At .6 becomes wet, peat with little silt.
PT/ML/ SM	Peat mixed with silt. At 4.6 becomes sandy clayey silt. At 5.0 becomes sandy silt, grading down to gray, sand, fine with silt <15%.
SM	Dark gray, wet, poorly graded sand, fine and medium, < 15% silt.
SP	Dark gray, poorly graded sand, medium. No silt.

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-5

Drill Date: August 14, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 13.609 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 703000.143
Longitude/Easting: 1185938.281
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24 ft bgs
Groundwater ATD (ft bgs): 8' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.
Sunny, warm.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
	▨	20			
	▨	21	SM/ML	Medium gray, moist, poorly graded silty sand, fine, grading down to medium gray clayey silt.	
	▨	22			
	▨	23	PT/ML	Dark brown, moist, woody peat mixed with silt. At 22.7 becomes medium gray, moist, clayey silt with interbedded peat at 23.5.	
		24			

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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Boring Location: PD-6

Drill Date: August 15, 2008
Logged By: Lisa Meoli
Drilled By: Eli Floyd/Cascade Drilling

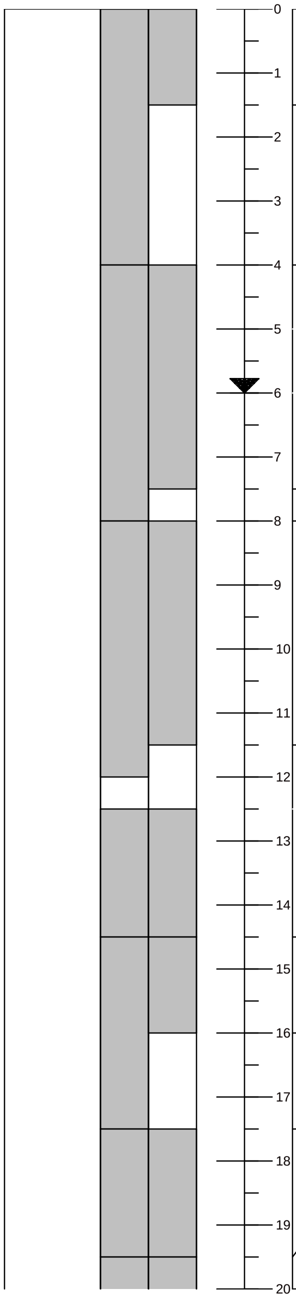
Ground Surf Elev. & Datum: 12.812 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 703003.1398
Longitude/Easting: 1185989.093
Casing Elevation: 15.642 NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 23 ft bgs
Groundwater ATD (ft bgs): 6' bgs

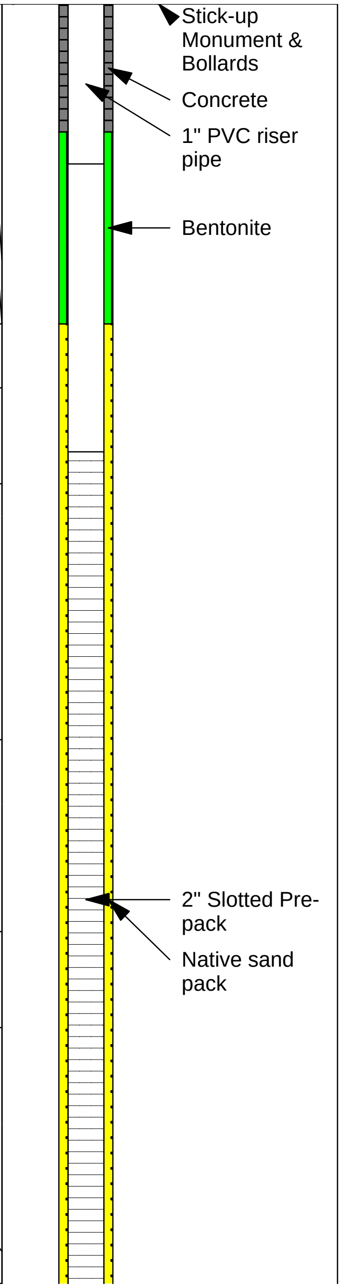
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS | USCS SYMBOL | SOIL DESCRIPTION AND OBSERVATIONS | **WELL COMPLETION DETAIL (If Applicable)**



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
OL/PT	Medium brown, moist, organic silty peat, woody debris and roots.
PT/ML	Brown, moist, peat mixed with silt grading to silty sand at 5' bgs.
SM	Dark gray, moist, silty sand, fine.
SP	Grades to dark grey, wet, poorly graded sand, fine, with <5% silt.
SP	Same as above.
SP	Same as above.
SP	Dark gray, wet, poorly graded sand, medium.
SP	Same as above.
SP	Dark grey, poorly graded silty sand.



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Drill Date: August 15, 2008
Logged By: Lisa Meoli
Drilled By: Eli Floyd/Cascade Drilling

Boring Location: PD-6

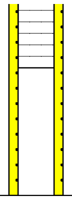
Ground Surf Elev. & Datum: 12.812 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 703003.1398
Longitude/Easting: 1185989.093
Casing Elevation: 15.642 NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 23 ft bgs
Groundwater ATD (ft bgs): 6' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		20			
		21	ML/CL	Dark grey, clayey silt (aquitard).	
		22	PT/ML	Dark brown, organic rich peat, becomes organic silt at 22.5' bgs with interbedded peat at 23'.	
		23			



Notes:
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Boring Location: PD-13

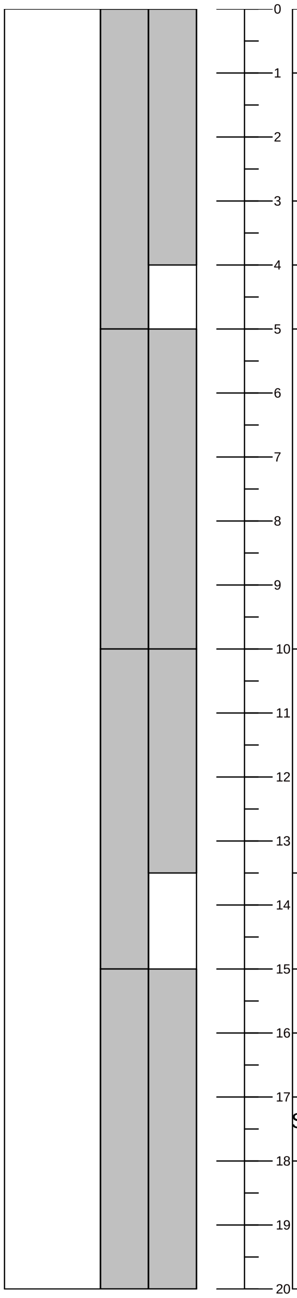
Drill Date: October 16, 2008
Logged By: Lisa Meoli
Drilled By: Casey Goble/Cascade Drilling

Ground Surf Elev. & Datum: 14.18 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 702158.989
Longitude/Easting: 1185642.761
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Piston sampler used below 10' bgs.



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	WELL COMPLETION DETAIL (If Applicable)
ML	Brown, dry (plow zone), silt with some roots and vegetation, woody debris.	
ML	Dark grey and rust motteled, dry, silt, fine, medium plasticity.	
SM	Dark grey, moist, silty sand, fine.	
SM	Same as above, wet.	
SM	Same as above; natural wood deposits at 11 and 13' bgs, turns grey when exposed to air.	
SM	Same as above.	
ML	Dark grey, dry, silt.	
SM/CL/PT	Dark grey, moist, silty sand, fine w/some clayey silt and interbedded peat.	
ML/CL	Light grey, dry, clayey silt, high plasticity (aquitard).	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
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▼ = denotes groundwater table

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Boring Location: PD-14

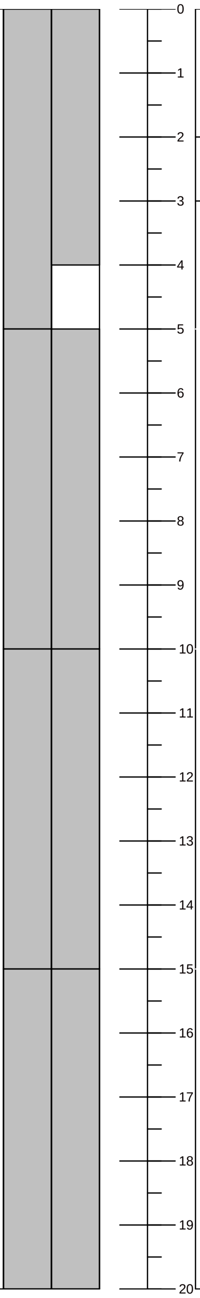
Drill Date: October 16, 2008
Logged By: Lisa Meoli
Drilled By: Casey Goble/Cascade Drilling

Ground Surf Elev. & Datum: 13.84 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 702067.177
Longitude/Easting: 1185651.77
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife field delineation sampling. Piston sampler used below 10' bgs.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	WELL COMPLETION DETAIL (If Applicable)
			SP	Brown, dry, silt w/some roots and vegetation, woody debris, (plow zone).	
			SM	Dark grey and reddish-brown motteled, dry, silt, fine, medium plasticity, some naturally deposited organic material.	
			SP	Dark grey w/reddish and white flecks, saturated, poorly graded sand, fine.	
PD-14-5'			SP	Same as above	
PD-14-8'					
			SP	Same as above	
			SP	Same as above; natural wood deposits at bottom of liner.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
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▼ = denotes groundwater table

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Boring Location: PD-15

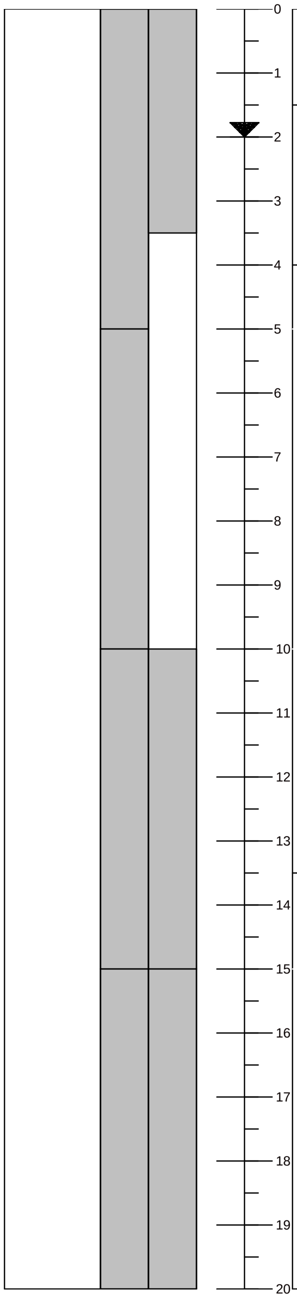
Drill Date: October 15, 2008
Logged By: Brett Beaulieu
Drilled By: Casey Goble/Cascade Drilling

Ground Surf Elev. & Datum: 14.03 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 701960.765
Longitude/Easting: 1185633.762
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 2' bgs.

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife field delineation sampling. Piston sampler used below 10' bgs.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			ML	Brown, moist, silt, low pasticity, becomes grey with rust motteled, silt with clay, non-plastic, trace organics.	
			SP	Dark grey, wet, poorly graded sand, fine, <5% silt.	
			SP	Disturbed sample, knocked out of sleeve w/hammer. Appears to be same as above	
			SP	Same as above	
			SW	Grades to dark grey, wet, well-graded sand, fine-medium, trace coarse up to 1/2" (medium and coarse grains are rounded).	
			SW	Same as above. Predominantly well-graded sand, medium, but some fine to coarse. Some coarse up to 1/2-inch.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
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Boring Location: PD-16

Drill Date: October 15, 2008
Logged By: Brett Beaulieu
Drilled By: Casey Goble/Cascade Drilling

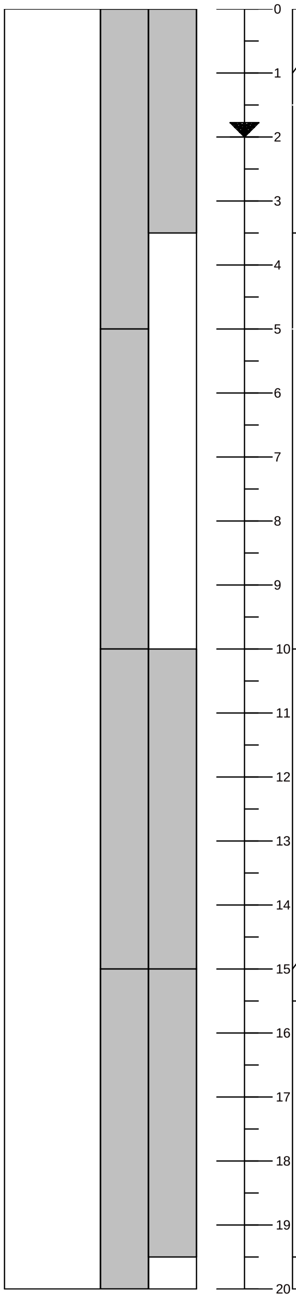
Ground Surf Elev. & Datum: 14.43 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701858.085
Longitude/Easting: 1185641.931
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 2' bgs.

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife field delineation sampling. Piston sampler used below 10' bgs.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			ML	Brown with some orange motteling, dry to moist, silt, low to medium plasticity.	
			SM	Brown, wet, silty sand with trace oraganics.	
			SP	Grades to dark grey, wet, poorly graded sand, fine (characteristic red and white grains).	
			SP	Disturbed sample. Appears to be same as above.	
			SP	Same as above, fine, wet.	
			SP	Same as above, fine, wet.	
			CL	Light grey, moist to dry, clayey silt, approximately 5% coarse, wood pieces.	



Notes:
FT BGS = feet below ground surface
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▼ = denotes groundwater table

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Boring Location: PD-17

Drill Date: October 15, 2008
Logged By: Brett Beaulieu
Drilled By: Casey Goble/Cascade Drilling

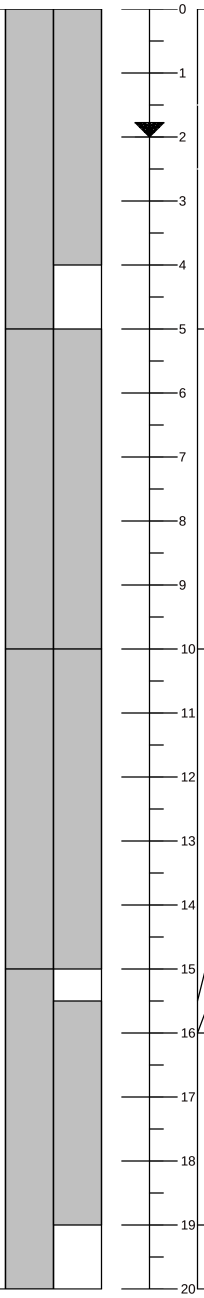
Ground Surf Elev. & Datum: 14.58 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701748.363
Longitude/Easting: 1185628.183
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 2' bgs.

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Piston sampler used below 10' bgs.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			ML	Brown; moist, silt with sand, grades to grey mottled grey and orange, silt, moderately plastic, with trace woody organics.	
			SM	Grades to dark brown-black, wet, silty sand, with dark brown wood chips 5-10%,	
			SP	Grey, wet, poorly graded sand, fine, silt <5%.	
			SP	Same as above; dark grey, fine, coarsening downward.	
			SP	Same as above, w/fine to medium section at 10-11' bgs, then becomes more fine.	
			SP	Dark grey, well graded sand w/coarse gravel, some very coarse grains up to 1" and rounded.	
			CL	Light grey, clayey silt w/trace wood debris, high plasticity.	



Notes:
FT BGS = feet below ground surface
ppm = parts per million
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▼ = denotes groundwater table

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Boring Location: PD-18

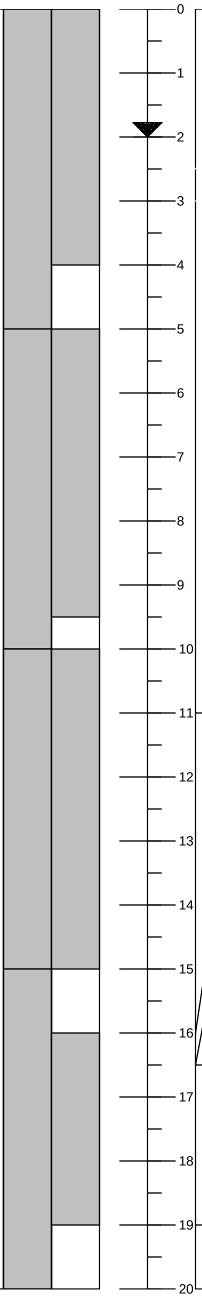
Drill Date: October 15, 2008
Logged By: Brett Beaulieu
Drilled By: Casey Goble/Cascade Drilling

Ground Surf Elev. & Datum: 14.65 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701640.052
Longitude/Easting: 1185632.12
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 2 ' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife field delineation sampling. Piston sampler used below 10' bgs.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			ML	Brown, moist, loose, silt with sand (80%) , fine, organics 5%, becomes grey motteled w/rust, stiffer at 1' bgs, organics.	
			SM	Grades to grey, wet, silty sand, 15% silt, fine, high dilatency.	
			SP-SM	Grades to dark grey, poorly graded sand w/silt, fine, silt varies 10-15%, little to no plasticity, < 5% coarse organics.	
			SP	Grades to dark grey, wet, poorly graded sand w/silt, fine, silt < 5%.	
			SW	Dark grey, wet, well-graded sand, fine to medium, < 5% silt, some trace woody pieces.	
			CL	Light grey clayey silt, highly plastic, with wood chunk at 17' bgs, trace woody material (<5%) throughout.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-19

Drill Date: October 22, 2008
Logged By: Lisa Meoli
Drilled By: Casey Goble/ Cascade Drilling

Ground Surf Elev. & Datum: 13.83 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701997.699
Longitude/Easting: 1185580.781
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife Fields Delineation Sampling. Piston sampler used below 10' bgs.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		0	ML	Brown, silt, low plasticitiy, some roots and vegetation throughout (till/plow zone)	
		1	SP	Dark grey/black with distinct white and red, wet, poorly graded sand; fine.	
		2			
		3			
		4			
		5	SP	Dark grey/black with white and red, poorly graded sand, moist, medium grained.	
		6			
		7			
		8			
		9			
		10	SP	Dark grey/black with white and red, moist, poorly graded sand, fine to medium grained.	
		11			
		12			
		13			
		14	SP	Dark grey/black with white and red, sand, medium to coarse grained, loose with fine rounded gravels <10%.	
		15	SP	Same as above.	
		16			
		17			
		18			
		19			
		20			

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-20

Drill Date: October 22, 2008
Logged By: Erin Murray
Drilled By: Casey Goble/ Cascade Drilling

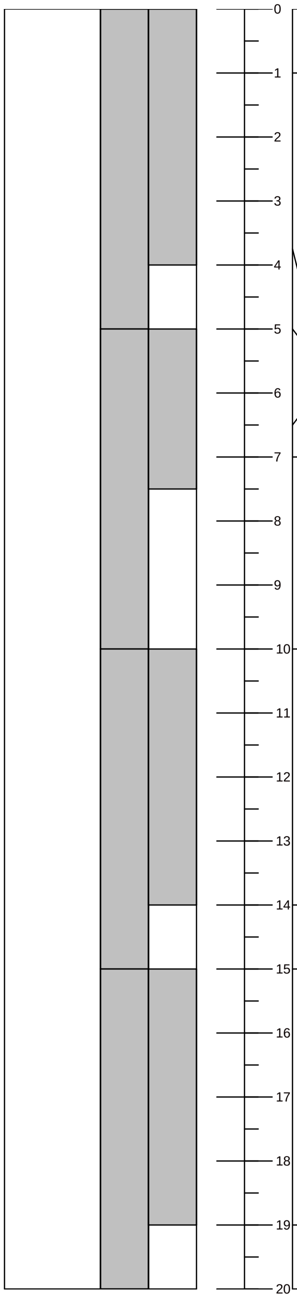
Ground Surf Elev. & Datum: 14.13 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701898.44
Longitude/Easting: 1185589.557
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife Fields Delineation Sampling. Piston sampler used below 10' bgs.

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	WELL COMPLETION DETAIL (If Applicable)
SM	Light to medium brown, silty sand, fine, no plasticity, compact to crumbly.	
ML/CL	Light to medium gray clayey silt, fine, medium plasticity grades to low plasticity.	
SM	Dark grey silty sand, fine.	
SP	Dark gray, poorly graded sand, fine to medium, mixed w/organics.	
SM	Grades to silty sand, fine, low plasticity, mixed w/organics.	
SP	Grades back to dark grey, poorly graded sand, fine to medium.	
SP	Medium gray, wet, poorly graded sand, fine, interbedded organics and wood at 13' bgs.	
ML/CL	Medium gray, wet, clayey silt with sand, grading to clayey silt, medium to high plasticity.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
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▼ = denotes groundwater table

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Boring Location: PD-21

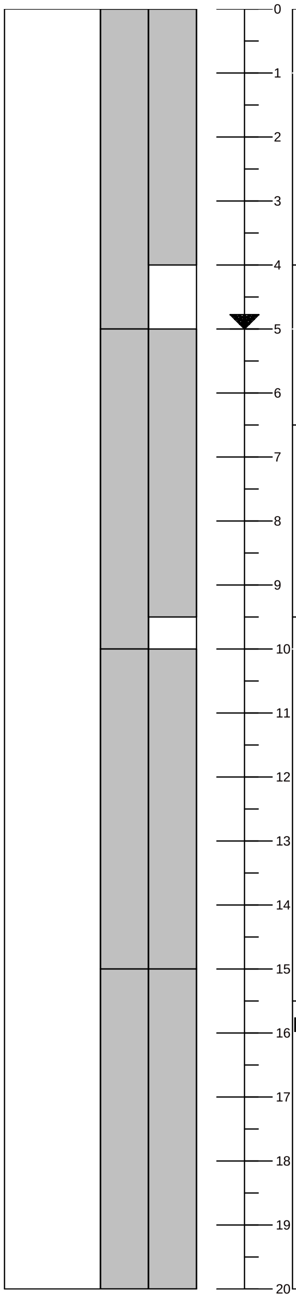
Drill Date: October 22, 2008
Logged By: Erin Murray
Drilled By: Casey Goble/ Cascade Drilling

Ground Surf Elev. & Datum: 14.51 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 701796.375
Longitude/Easting: 1185581.192
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 5' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife Fields Delineation Sampling. Piston sampler used below 10" bgs.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			SM	Light to medium brown, silty sand, fine, no plasticity, compact to crumbly (till/plow zone).	
			SM/ML	Silty sand grading to organic silt with sand, fine.	
			SM	Dark grey, silty sand, fine.	
			SP	Medium grey, wet, poorly graded sand, fine, little to no silt.	
			SP	Dark gray, wet, poorly graded sand, fine grading to fine and medium.	
			ML/CL/PT	Silty clay, inorganic, slight to medium plasticity, with interbedded peat. At 18.5 becomes clayey silt mixed with 50% peat.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-22

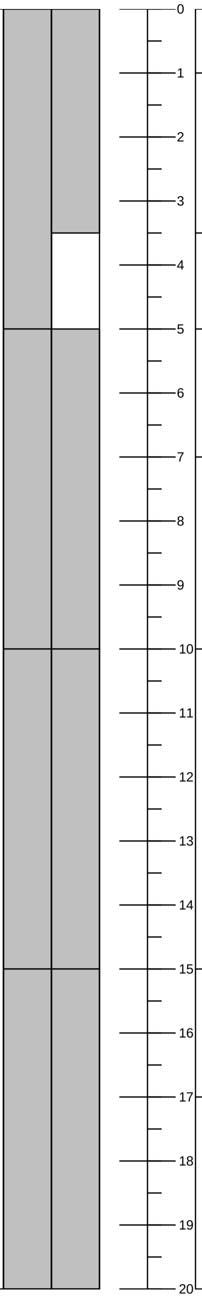
Drill Date: October 15, 2008
Logged By: Lisa Meoli
Drilled By: Casey Goble/Cascade Drilling

Ground Surf Elev. & Datum: 15.14 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701550.652
Longitude/Easting: 1185640.035
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife field delineation sampling. Piston sampler used below 10' bgs.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		0	ML	Brown, silt, low plasticity (plow/till zone).	
		1	ML	Light grey and orange motteled, dry, silt, fine, medium plasticity, stiff.	
		5	SM	Grey with some rust mottling, moist, silty sand, fine.	
		7	SP	Dark grey, wet, poorly graded sand, fine.	
		10	SP	Same as above. Saturated, silty lense at 10.5' bgs.	
		15	SP	Dark grey to black with reddish and white grains, moist, poorly graded sand, fine to medium.	
		17	ML/CL	Light grey, dry, clayey silt, medium plasticity, some organics and woody debris interbedded.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-25

Drill Date: October 16, 2008
Logged By: Lisa Meoli
Drilled By: Casey Goble/ Cascade Drilling

Ground Surf Elev. & Datum: 15.95 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 701536.818
Longitude/Easting: 1185801.647
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 5.5' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife Fields Delineation Sampling. Piston Sampler used below 10' bgs.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			SM	Light to medium brown, silty sand, fine, no plasticity, compact to crumbly (till/plow zone).	
			ML	Light grey and orange mottled, dry, silt, low plasticity, piece of burned wood @2' bgs.	
			SM	Dark grey, moist, poorly graded silty sand, fine.	
		▼	SM	Brown, wet, silty sand, low plasticity.	
			SM	Dark grey, wet, silty sand, fine.	
			SM	Same as above.	
			SP	Dark grey/black with red and white flecks, wet, poorly graded sand, fine to medium, piece of wood deposited at 14.5' bgs, <5% fine, rounded gravels.	
			ML/CL	Light grey, dry, clayey silt, medium to high plasticity, with organics.	
			PT	Peat.	
			SM	Dark brown, moist, silty sand, fine.	

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-26

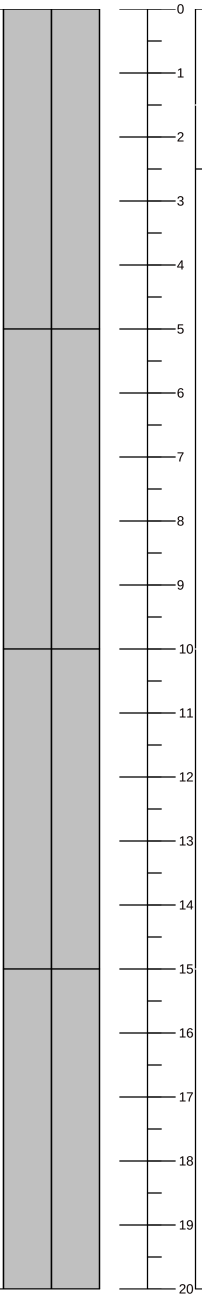
Drill Date: October 16, 2008
Logged By: Lisa Meoli
Drilled By: Casey Goble/Cascade Drilling

Ground Surf Elev. & Datum: 15.82 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 701524.578326
Longitude/Easting: 1185903.5321
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife field delineation sampling. Piston sampler used below 10' bgs.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			SP	Brown, dry, silt, low plasticity, loose (till/plow zone).	
				Brown and light brown mottled, dry to moist, silt, low plasticity.	
			SM	Dark brown/black with red and white, poorly graded sand, fine to medium.	
				Same as above	
				Black with red and white, sand, medium, 10% small gravels. At 20' organics and woody debris.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-27

Drill Date: October 16, 2008
Logged By: Lisa Meoli
Drilled By: Casey Goble/Cascade Drilling

Ground Surf Elev. & Datum: 16.41 NAVD 88
Coordinate System: NAV83/91
Latitude/Northing: 701517.06
Longitude/Easting: 1186002.232
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel.
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife field delineation sampling. Piston sampler used below 10' bgs.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		0	ML	Brown, dry, silt, low plasticity, loose (till/plow zone).	
		1			
		2	ML	Light brown, dry, silt, no plasticity.	
		3	SP	Dark grey/black with distinctive red and white grains, moist, poorly graded sand, fine.	
		4			
		5	SP	Same as above. At 9' bgs, one large gravel approximately 1-inch diameter.	
		6			
		7			
		8			
		9			
		10	SP	Same as above, fine to medium.	
		11			
		12			
		13			
		14			
		15	SP	Same as above, fine to medium.	
		16			
		17			
		18			
		19	SP	Dark grey, wet, poorly graed sand, coarse, with fine to medium gravel (up to 1-inch diameter), trace organics.	
		20			

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-28

Drill Date: August 14, 2008
Logged By: Lisa Meoli
Drilled By: Casey Goble/ Cascade Drilling

Ground Surf Elev. & Datum: 16.34 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701533.223
Longitude/Easting: 1186082.579
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 5' core barrel.
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Piston sampler used below 10' bgs.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	WELL COMPLETION DETAIL (If Applicable)
	▨ ▨	0	ML	Brown, dry, silt, low plasticity, loose (till/plow zone).	
		1	SP	Dark grey, dry, poorly graded sand, fine.	
		2		At 2' bgs, pale yellow-brown layer of intact log appears to be recent. Does not turn grey when exposed to air.	
		3	SP	Dark grey, wet, poorly graded sand, fine.	
	▨ ▨	5	SP	Same as above.	
		7		Intact log (rings present), turns grey when exposed to air.	
		8	SP	At 8', grades back to poorly graded sand, fine (same as above).	
	▨ ▨	10	SP	Dark grey, sand, fine, interbedded woody debris throughout.	
		13		Intact log encountered, turns grey when exposed to air.	
	▨ ▨	15	SP	Dark grey, wet, poorly graded sand, fine, wood interbedded at top of boring. Grades to fine to medium at 19-20' bgs and has distinct red and white grains.	
		20			

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-29

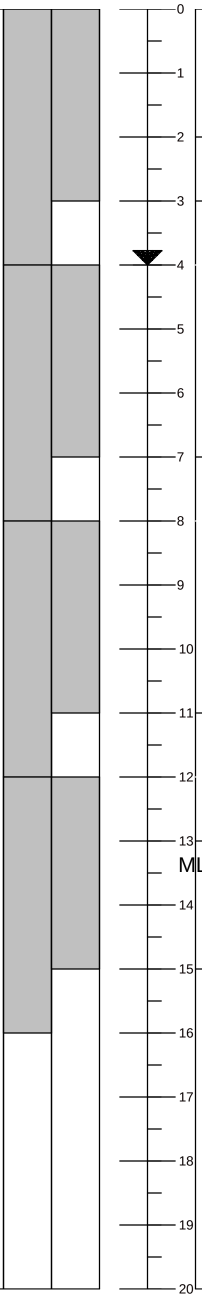
Drill Date: September 26, 2008
Logged By: Brett Beaulieu
Drilled By: Eli Floyd/ Cascade Drilling

Ground Surf Elev. & Datum: 18.20 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 701505.841
Longitude/Easting: 1186187.622
Casing Elevation: NA

Drill Type: Truck CME probe
Sample Method: 2" x 4' core barrel.
Boring Diameter: 2 inches
Boring Depth (ft bgs): 16 ft bgs
Groundwater ATD (ft bgs): 4' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Autumn Village Apartments. Piston sampler used below 4' bgs.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			SM	Light brown, dry, silty sand, fine, silt 3%, gravel (rounded) 5%, color becomes dark brown and moist at 2' bgs.	
			SP	Dark grey, moist, poorly graded sand, fine, silt 5-10%.	
			SP	Same as above. Silt varies 5-15%, wet, gradational lenses of poorly graded sand and silty sand.	
			SP	Same as above. Silt 5-10%, fine silty laminations at 10 and 11' bgs.	
			SP	Same as above. Fine to medium, silt <5%.	
			ML/CL/PT/OL	Grades to light grey, moist, silt with sand for 6", stiff, non-plastic; then 8" of light grey, moist, clayey silt with 5% woody material, high plasticity; then 2" of dark brown peat; then 4" of light grey, silty clay, low-medium plasticity, 5% woody material; then 6" of dark brown peat grading to brown organic silt with mixture of sand in matrix and woody material. Organic silt is highly plastic, sand <10%, gravel <5%.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-30

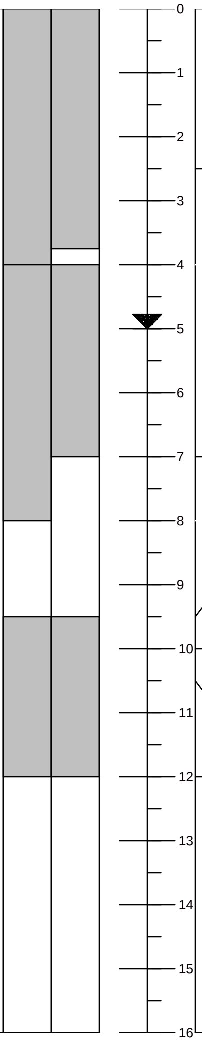
Drill Date: September 26, 2008
Logged By: Brett Beaulieu
Drilled By: Eli Floyd/ Cascade Drilling

Ground Surf Elev. & Datum: 17.93 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 701487.556
Longitude/Easting: 1186321.910
Casing Elevation: NA

Drill Type: Truck CME probe
Sample Method: 2' x 4' core barrel.
Boring Diameter: 2 inches
Boring Depth (ft bgs): 12 ft bgs
Groundwater ATD (ft bgs): 5' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Autumn Village Apartments. Boring in landscaping.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			SW-SM	Light brown, dry, well-graded sand with silt, fine, silt 10-15%, trace gravel, rounded, some roots <5%.	
			SP-SM	Native, dark grey, moist, poorly graded sand with silt, fine, silt 10%, no plasticity.	
			SP-SM	Same as above. Wet with some silty sand lenses, grain size varies between silt and fine sand.	
				No samples collected from 8- 9.5 due to expendable point from groundwater sampling.	
			SP-SM	Same as above. Woody material.	
			ML	Light grey, moist, silt, stiff, very low plasticity.	
			CL/OL	Light grey-brown, moist, clayey silt, high plasticity, organic silt w/5-10% woody debris, 5% rounded gravel, trace sand, peat lenses (no stratification apparent, unusual mix of clasts in clayey silt matrix).	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-31

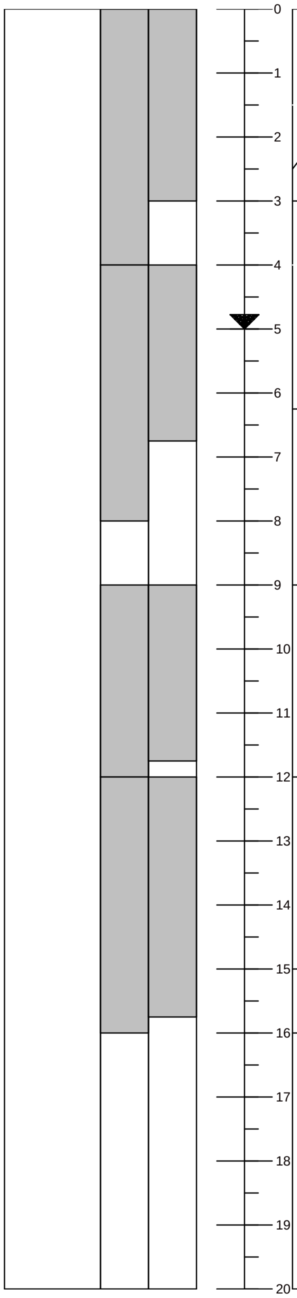
Drill Date: September 26, 2008
Logged By: Brett Beaulieu
Drilled By: Eli Floyd/ Cascade Drilling

Ground Surf Elev. & Datum: 18.73 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 701557.263
Longitude/Easting: 1186400.403
Casing Elevation: NA

Drill Type: Truck CME probe
Sample Method: 2" x 4' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 16 ft bgs
Groundwater ATD (ft bgs): 5' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Autumn Village Apartments



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			SW	Brown, moist, well-graded sand with silt and gravel, silt 10-15%, trace cobbles, gravel 10-15%.	
			SP	Grades to grey, moist to wet poorly graded sand, fine-medium, gravel 10% rounded, silt <5%. 1" dark brown, organic lense at 2.5' bgs,	
			SP-SM	Brown, moist to wet, poorly graded sand, very fine bordering on silt size but high dilatency.	
			SP/SM	Same as above. Wet, silt content varies but high dilatency, low to no plasticity,	
			SP	Grades to dark grey, wet, poorly graded sand, fine, , 5% silt	
			SP	Dark grey, wet, poorly graded silty sand, fine, w/silt 5-20%, little to no plasticity, high dilantency, low plastic inorganic silt lenses at 11' and 11.5' bgs.	
			SP	Same as above. Becomes less saturated below 13.5' bgs, grain size variation increases, trace woody material present.	
			CL/PT	Top 1" consists of moist, clayey silt with organic debris, highly plastic, then 7" of dark brown, moist, woody peat, grading to 5" of light brown-grey, moist, clayey silt with woody material (roots and wood pieces), highly plastic.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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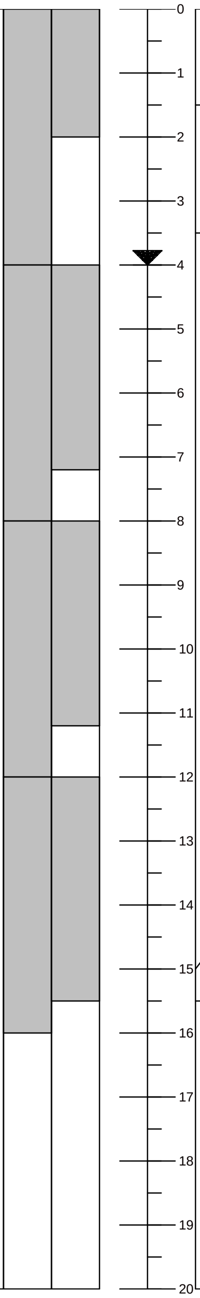
Boring Location: PD-32

Drill Date: August 8, 2008
Logged By: John LaManna
Drilled By: Eli Floyd / Cascade Drilling
Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 4' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 16 ft bgs
Groundwater ATD (ft bgs): 4' bgs

Ground Surf Elev. & Datum: 17.21 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701613.192
Longitude/Easting: 1186474.339
Casing Elevation: NA

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Partly sunny, breezy, warm.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			GW	Olive brown, moist to dry, well graded gravel with sand, sand 25 to 35%, silt approximately 5%. Roots and plant fibers at surface.	
			SP	Very dark gray, moist/wet, poorly graded sand, fine to medium. Gravel is 10 to 15%. Silt is <5%.	
			SM	Very dark gray/black, wet, silty sand, fine, massive to faintly laminated, low plasticity. Dark brown, organic fines 5 to 10%. At 10. 4' bgs, peat for .2 inches.	
			CL/PT	Gray and dark gray, wet, laminated clay over peat.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-33

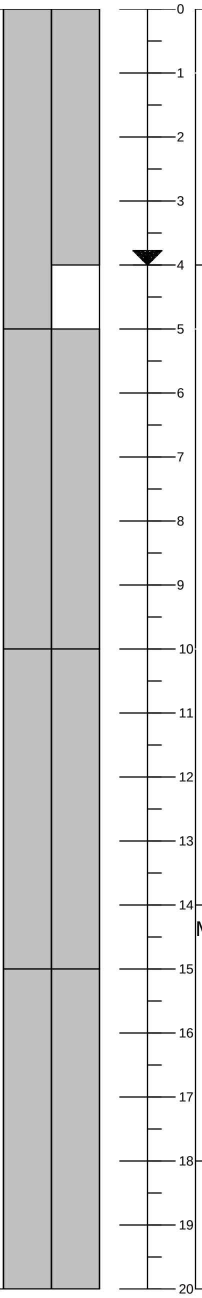
Drill Date: August 14, 2008
Logged By: Lisa Meoli
Drilled By: Casey Goble/ Cascade Drilling

Ground Surf Elev. & Datum: 15.96 NAVD 88
Coordinate System: NAV83/98
Latitude/Northing: 701451.487
Longitude/Easting: 1186108.878
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: 2' x 5' core barrel.
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 4.5' bgs.

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Fife Fields Delineation Sampling. Piston sampler used below 10'.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			ML	Brown, dry, silt, low plasticitiy, some roots and vegetation throughout (till/plow zone)	
			SM	Dark grey and reddish brown mottled, moist, silty sand, fine, wet at 4'.	
			SM	Dark greyish brown, wet, silty sand, fine.	
			SM	Same as above.	
			ML/CL/PT	Light grey, clayey silt, some woody peat interbedded.	
			SM	Dark grey, moist, silty sand.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-34

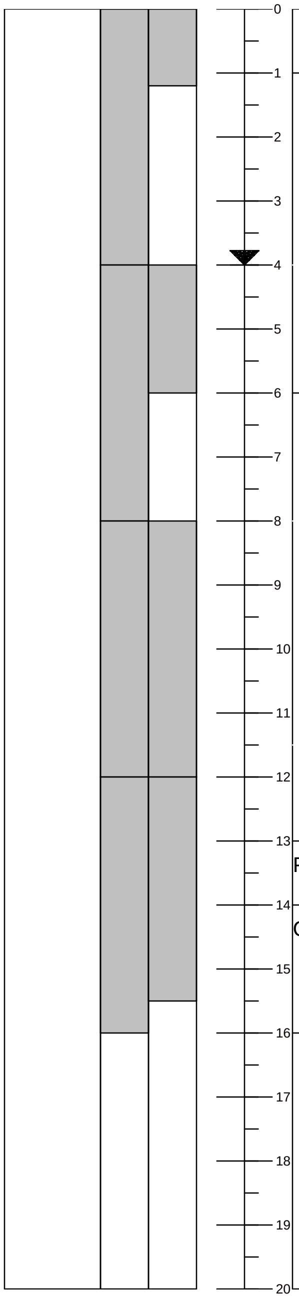
Drill Date: September 26, 2008
Logged By: Brett Beaulieu
Drilled By: Eli Floyd/ Cascade Drilling

Ground Surf Elev. & Datum: 18.28 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701457.951
Longitude/Easting: 1186249.760
Casing Elevation: NA

Drill Type: Truck CME probe
Sample Method: 2" x 4' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 16 ft bgs
Groundwater ATD (ft bgs): 4' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Autumn Village Apartments. Piston sampler used below 4' bgs.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			SW	Light brown, moist, well-graded sand w/silt and gravel, silt 10%, gravel 25% (fill).	
			SP/SM	Dark grey, wet, poorly graded sand, fine, silt 5-10%, grades down to siltier silty sand, silt 10-20%.	
			SP	Dark grey, wet, poorly graded sand, fine, silt 5-10%, fine laminations at 10 and 11' bgs. At 10' bgs size increases, still fine. At bottom of interval, becomes stiff, fine SP/non-plastic ML for 4".	
			SP	Dark grey with white grains, wet, poorly graded sand, fine to medium, with 5-10% woody pieces up to 1/2".	
			PT/OL/CL	4" of dark brown peat grades to brown, moist, organic silt, plastic; then 6" light grey, clayey silt, highly plastic, with woody debris.	
			OL/CL/PT	2" light tan, solid wood, then grades back to 6" of brown, organic silt as above, grey, clayey silt as above and 6" of dark brown organic silt/peat with sand (5-10%).	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-37

Drill Date: August 7, 2008
Logged By: Brett Beaulieu
Drilled By: Casey Goble / Cascade Drilling

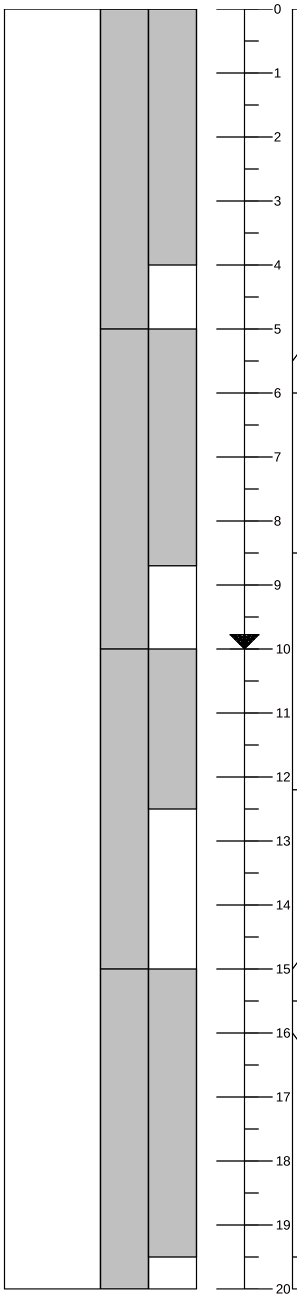
Ground Surf Elev. & Datum: 17.07 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701819.316
Longitude/Easting: 1186723.879
Casing Elevation: NA

Drill Type: Truck Geoprobe 6600
Sample Method: 2" x 5' core barrel
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 10' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Overcast, 60s.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
SM	Light brown, dry, well graded, silty sand with angular and rounded gravels that are > 25%. Grades down to gray, moist, sand with silt and gravels that are more rounded. Mottled brown and gray at 3.5.
SW	Brown, moist, well graded sand with silt.
SW-SM	Gray and brown mottled, moist, well graded sand with silt and gravel that is 25 to 35%. Brown cobbles at 7'. Increasing moisture grading down.
SM	Gray, wet, silty sand with gravel. Grading to well graded silty sand with no coarse grains, fine. Trace fine gravels. Silt <25%.
SW-SM	Gray, wet, well graded sand with silt and little rounded gravels.
PT/OL	Reddish brown, wet, peat. Woody with organic silt.
ML	Light gray, moist, silt, plastic with trace organics. Roots, woody debris <5%.
PT	Reddish brown, wet, peat, woody. Solid wood at 17' to 18'. Organic silt throughout.

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-38

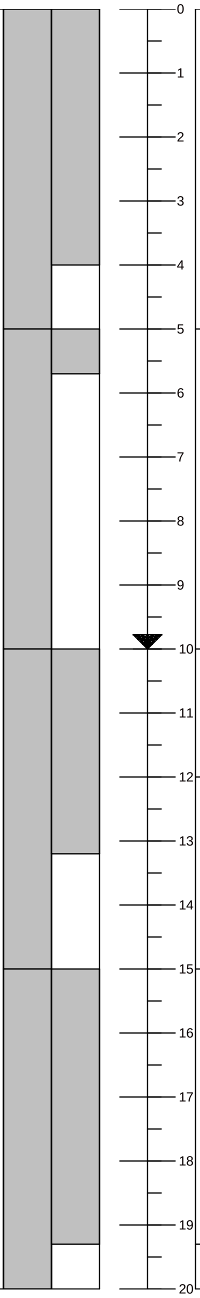
Drill Date: August 7, 2008
Logged By: Brett Beaulieu
Drilled By: Casey Goble / Cascade Drilling

Ground Surf Elev. & Datum: 18.998, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701806.207
Longitude/Easting: 1186803.104
Casing Elevation: 21.635, NAVD 88

Drill Type: Truck Geoprobe 6600
Sample Method: Dual Tube/Macro Core
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 10' bgs

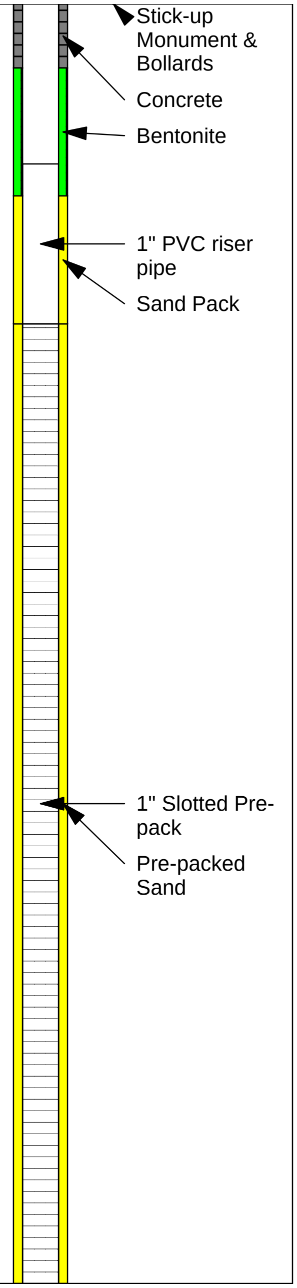
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Driller reports difficulty with 3 1/4" dual-tube due to large cobbles. Switched to 2" x 5' macro core. Log is a composite of two drives. 5 gallons of water added during piezometer installation.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
		0	SM	Light brown, dry, silty sand with gravel and fines. Gravel rounded and angular 25%. Broken cobbles. Grades down to darker brown, moist, then mottled gray, silty sand with gravel and fines. Trace coarse sand. Gravel rounded 30% with > 15% silt.
		5	ML	Brownish gray, moist, silt with organics. 5% woody debris.
		10	SM	Brownish gray, moist, silty sand with gravels and fines. Gravel 15%, silt 15%. Medim stiff. Cobbles at 11'. Becoming very stiff at 11.5, orange and gray mottled.
		12	ML	Gray, dry, very stiff/hard silt with gravel (20%), fine and medium, plastic, with rounded cobbles.
		15	SM	Light brownish gray, moist, silty sand with gravel (30%). Medium dense, fine to coarse with mottled brown and gray sections. Wet sandy sections at 18' for 4 to 6".

WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
ppm = parts per million
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Boring Location: PD-39

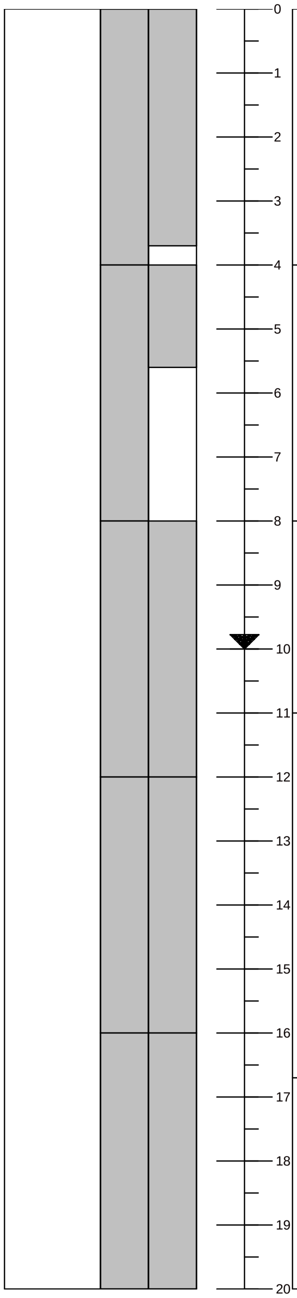
Drill Date: August 6, 2008
Logged By: Brett Beaulieu
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 17.21 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701739.53
Longitude/Easting: 1186682.922
Casing Elevation: NA

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 10' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: The driller reported difficulty drilling 1st. drive. On second drive driller added 4 gallons of water to control heave after removal of 8-12' drive. Log is a composite of the two boring attempts.



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
SM	Light brown, dry, silty sand with gravel. Fine rounded cobbles up to 3". Gravel >30% and very dense. Possible road fill but same as native rounded gravel. Becomes light gray and moist with orange oxidation rinds around gravels.	
SW/SM	Light brown and gray mottled, moist, well graded sand with silt and gravel, fines. Gravels are medium coarse, approximately 25%.	
SM	Dark gray, moist to wet, silty sand with gravel, fine and rounded. Varying silt, sand, and woody debris. Lard like white substance at 9'. Munsell chart color 5YR which is very dark gray.	
ML	Very dark gray, moist, plastic silt (with clays possible). Roots and woddy debris (5 to 10%) with trace to fine sand (<5%). Medium stiff. Trace charcoal.	
ML/PT	Dark brown to black, wet, soft, woody peat for 6"; then grades to gray, moist to wet, silt with woody debris as described above, medium stiff to very soft, for 2'; then grades back to dark brown to black peat that turns black when exposed to air.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-40

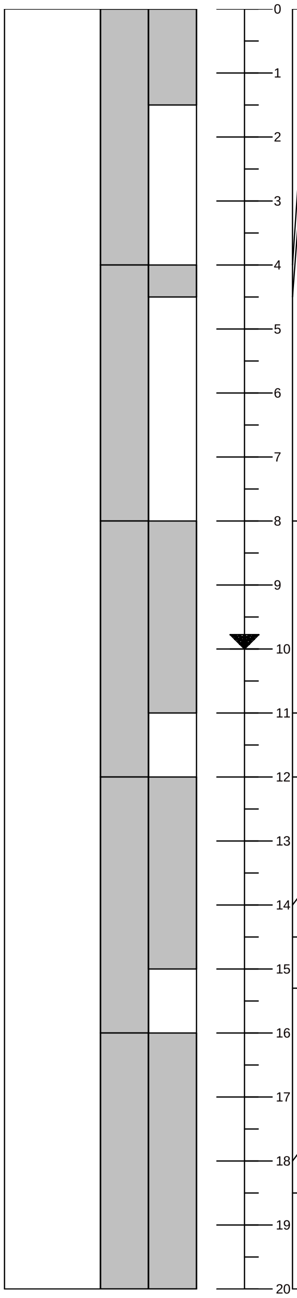
Drill Date: August 6, 2008
Logged By: Brett Beaulieu
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 19.670 NAVD88
Coordinate System: NAD 83/98
Latitude/Northing: 701719.308704
Longitude/Easting: 1186767.139073
Casing Elevation: 22.531 NAVD88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 10' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			SM	Light brown, dry, silty sand with gravel, fine. Gravel, medium-coarse, approximately 25% rounded.	
			SW/SM	Dark grey, moist, silt, plastic, trace fine sand, woody debris <5%.	
			ML	Dark grey, moist, silt, plastic, trace fine sand, woody debris <5%	
			ML	Same as above, increasing woody content.	
			PT	Dark reddish brown woody peat with wood debris.	
			ML/CL	Light grey, clayey silt, trace organics and wood debris.	
			PT	Dark reddish brown, wet, peat, with solid wood up to 3", fades to grey-green in air, some organic silt.	
			SM	Grey and brown, wet, silty sand with gravel, fine to medium, gravel fine to medium and rounded, some woody debris.	
			PT	Dark reddish brown, wet, peat, fades to grey-green in air, some organic silt.	

Notes:
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▼ = denotes groundwater table

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Boring Location: PD-50

Drill Date: August 19, 2008
Logged By: Lisa Meoli
Drilled By: Cascade Drilling

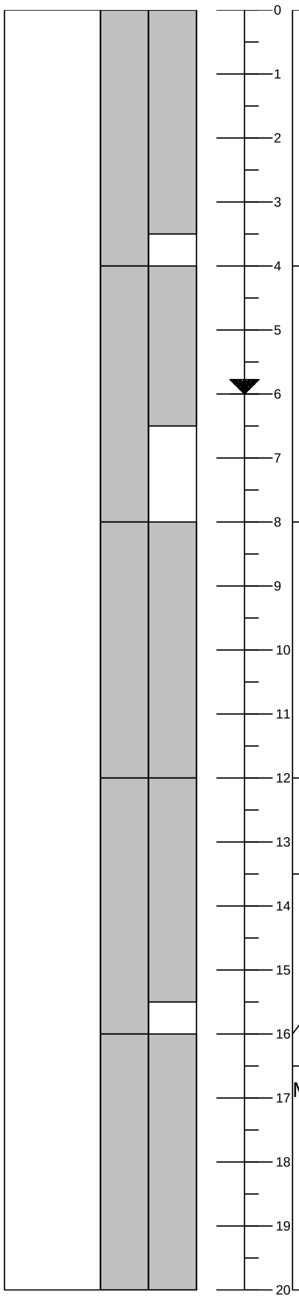
Ground Surf Elev. & Datum: 12.296
Coordinate System: NAV83/98
Latitude/Northing: 702820.184
Longitude/Easting: 1185778.645
Casing Elevation: 14.766

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 6' bgs

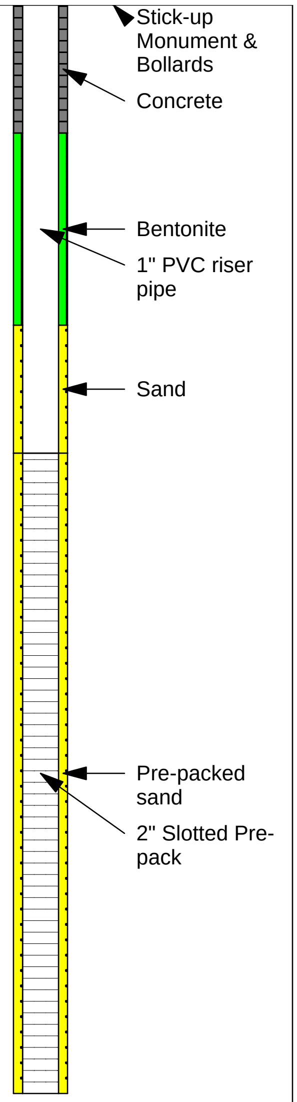
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	WELL COMPLETION DETAIL (If Applicable)



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
OL	Dark brown, moist, organic silt with roots and peat like woody debris.
ML	Dark grey, wet, clayey silt, very fine.
SM	Dark grey, wet, silty sand.
SM	Same as above.
SP	Grades to dark brownish-black and red and white grains, wet, poorly graded sand, medium.
SM	Dark brown, moist, silty sand.
ML/CL/PT	Grades to clayey, silty, sand with interbedded peat.



Notes:
FT BGS = feet below ground surface
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USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-51

Drill Date: August 19, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

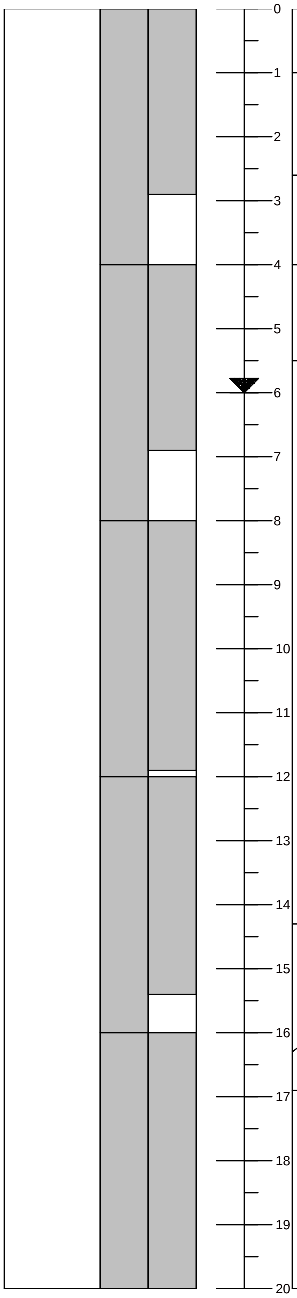
Ground Surf Elev. & Datum: 12.129, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702695.029
Longitude/Easting: 1185752.702
Casing Elevation: 15.199, NAVD 88

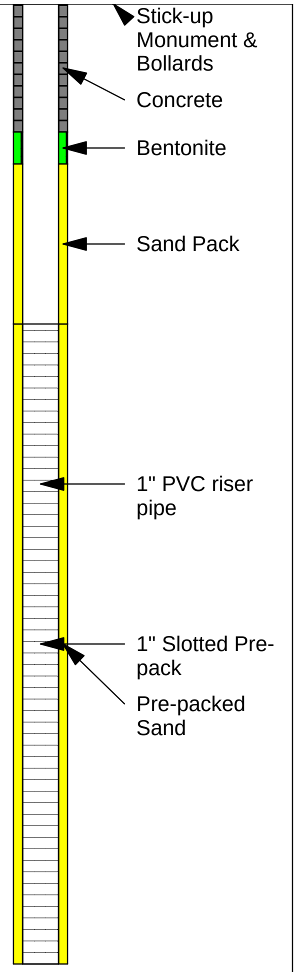
Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 6' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:
Sunny, hot.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			ML	Medium brown/mottled, moist, clayey silt mixed with organics.	
			PT	Peat with lense of silty clay at 2.3.	
			ML	Medium gray, moist, clayey silt.	
			ML/SM	Dark bluish gray, wet, poorly graded, clayey silt. Grading down to wet, silty sand.	
			SM	Dark gray, wet, poorly graded silty sand, fine. At 1.4' bgs is a lense of woody debris.	
			SP	Dark gray, wet, poorly graded sand, medium.	
			ML	Gray, moist, clayey silt.	
			PT/ML/PT	Peat grading down to clayey silt and back to peat.	





Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-52a

Drill Date: August 19, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

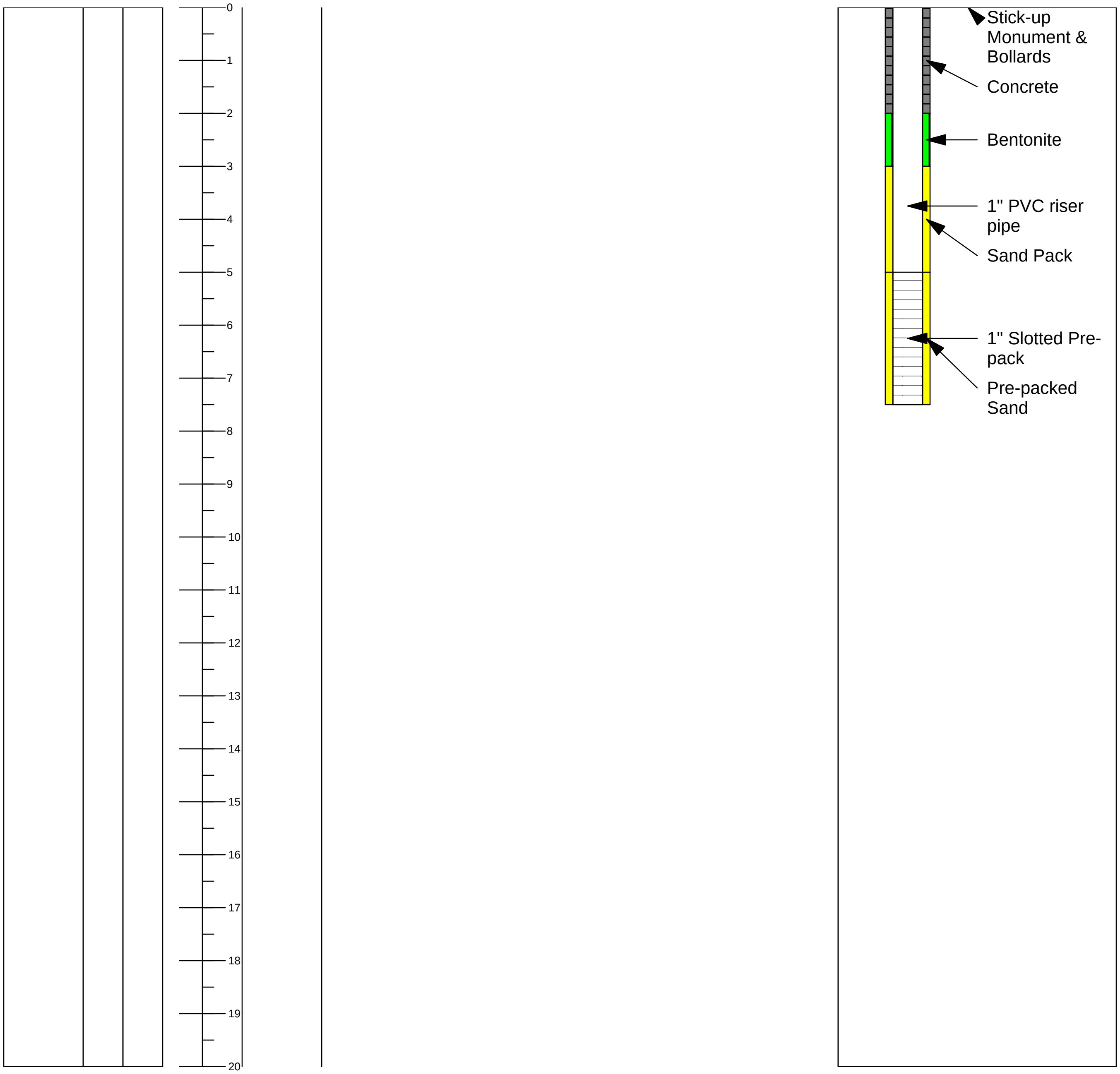
Ground Surf Elev. & Datum: 12.499, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702501.017
Longitude/Easting: 1185675.209
Casing Elevation: 15.044, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 7.5 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Shallow well screen. First of three.
No logging was done.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-52b

Drill Date: August 19, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

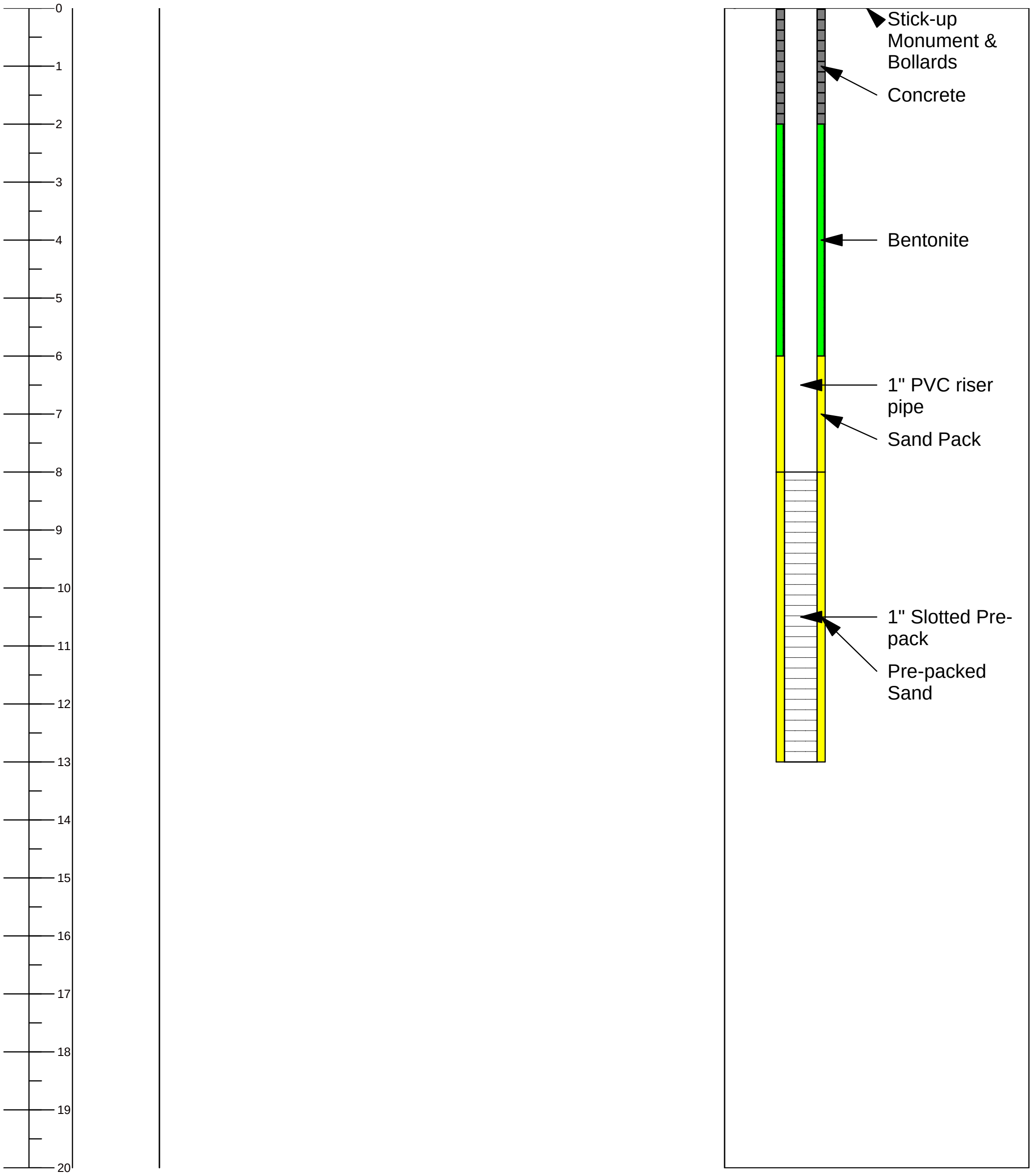
Ground Surf Elev. & Datum: 12.299, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702497.933
Longitude/Easting: 1185674.567
Casing Elevation: 15.104, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 13 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Intermediate well screen. 2 of 3.
No logging was done.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



Notes:
FT BGS = feet below ground surface
ppm = parts per million
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▼ = denotes groundwater table

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Boring Location: PD-52c

Drill Date: August 19, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

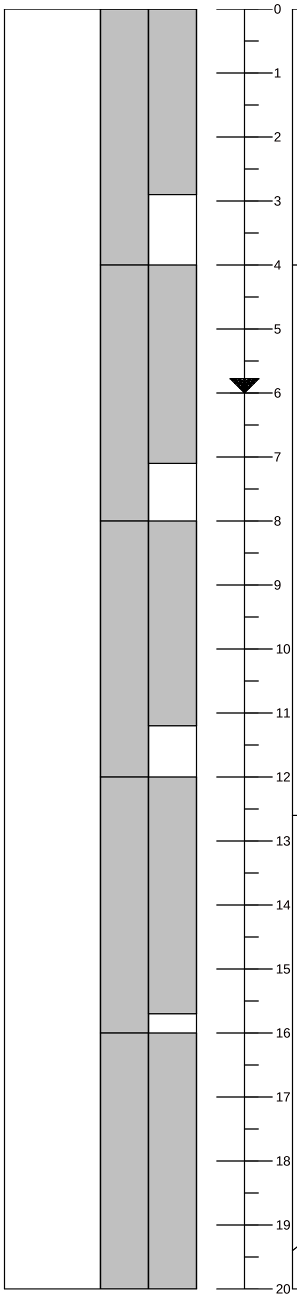
Ground Surf Elev. & Datum: 12.389, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702494.381
Longitude/Easting: 1185673.518
Casing Elevation: 15.039, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 6' bgs

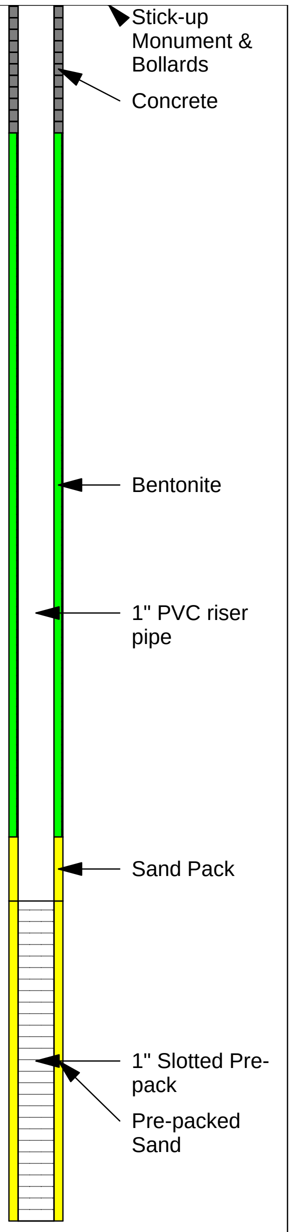
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Deep well screen. Third of three.
Cloudy, warm.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
			PT/ML	Peat mixed with silt. At .6 becomes motteled, moist, clayey silt mixed with organics. At 2.3 becomes medium gray, moist, clayey silt with little to no organics.
			SM	Medium gray, wet, poorly graded silty sand.
			SP	Gray, wet, poorly graded sand with silt < 15%. At 14.4 becomes dark gray, wet, poorly graded sand, medium.
			ML/PT	Gray, moist to dry, clayey silt grading down to peat.



WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR)

Appendix B
Geotechnical Investigation Report

FINAL

AMEC Geomatrix
600 University Street, Suite 1020 Seattle, WA 98101

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601 Union Street, Suite 600 Seattle, WA 98101

Technical Memorandum

Prepared By: Koorus Tahghighi, P.E.
Date: March 20, 2009
Re: **Geotechnical Investigation Report**

INTRODUCTION

This Geotechnical Investigation Report supports implementation of the final Cleanup Action Plan (CAP) for the barrier wall and groundwater interception trench for the B&L Woodwaste Landfill (Landfill) as shown on Figure B.1. The Washington State Department of Ecology (Ecology) issued the final CAP in 2008 and requires, among other cleanup actions, that a perimeter barrier wall be installed around the Landfill. The 2008 CAP specifies that this barrier wall should be tied into both the existing landfill cap and a low-permeability soil unit located below the Landfill. The purpose of the subsurface, low-permeability barrier wall is to hydraulically isolate and contain arsenic-contaminated groundwater beneath the Landfill to prevent migration of arsenic beyond the landfill perimeter.

The physical characteristics of the Landfill are described in the Groundwater Alternatives Evaluation (GAE; Floyd|Snider 2007). Previous subsurface investigations revealed the presence of four subsurface units: (1) a near surface silt or upper silt aquitard, (2) an upper sand aquifer, (3) a lower silt aquitard, and (4) a lower sand aquifer. Although present in most soil borings, the lower silt aquitard appeared to be absent in one boring near the southwest perimeter of the Landfill and in borings to the east of the Landfill

A geotechnical investigation was performed to collect site-specific information needed for design of the subsurface barrier wall. This investigation was completed in general accordance with the Geotechnical Investigation Work Plan (Work Plan) which was included as Appendix F to the Groundwater Remediation Work Plan (GRWP; Floyd|Snider/AMEC Geomatrix 2009). This report presents a summary of the geotechnical investigation and findings. Geotechnical results are presented in the context of the barrier wall design in Addendum 1 to this EDR.

PURPOSE

The purpose of the geotechnical investigation was to determine the depth to the lower silt aquitard, the continuity of the lower silt aquitard, and to assess the engineering characteristics of subsurface soils along the barrier wall alignment. Specifically, the objectives of this geotechnical investigation were as follows:

- Develop stratigraphic information concerning the depth and thickness of the upper sand aquifer and the presence and the depth to the lower silt aquitard;
- Obtain sufficient geotechnical data to complete the design of the subsurface barrier wall; and
- Collect soil and groundwater samples for compatibility testing for use in designing the barrier wall backfill.

SCOPE OF WORK

The following tasks were completed for this investigation:

- Drilled 15 soil borings using hollow-stem augers (HSA) along the proposed barrier wall alignment.
- Advanced nine push probes in the vicinity of the southwest gap in the lower silt aquitard. Push probes were not included in the Work Plan, but were considered necessary to properly characterize the aquitard based on the discontinuities identified in HSA borings.
- Conducted cone penetrometer testing (CPT) at 46 locations along the anticipated subsurface barrier wall alignment and in the areas where gaps in the lower silt aquitard were identified.
- Collected soil samples that were submitted to a geotechnical laboratory for testing of physical characteristics and for compatibility testing.
- Conducted compatibility testing to confirm that the proposed barrier wall construction materials are compatible with the contaminated groundwater, using groundwater from a monitoring well completed in the Upper Sand Aquifer beneath the Landfill and potable water from the local water supply.

FIELD INVESTIGATION

Project staff from Floyd|Snider and AMEC Geomatrix, Inc. (AMEC) conducted the field investigation between August 11 and September 30, 2008 to support implementation of the final 2008 CAP. A representative of the project team was present during all field investigations. After completion of each exploration point, the exploration location was backfilled with bentonite slurry in accordance with the State of Washington water well regulations. The field investigation was performed in general accordance with the Work Plan; the scope of work was modified from the Work Plan scope in consultation with Ecology to investigate the extent of the gaps that were identified in the Lower Silt Aquitard.

FIELD ACTIVITIES

Fifteen soil borings (H-1 through H-15) were drilled around the perimeter of the Landfill on the existing Landfill access road from August 11 to 15, 2008. These boring locations are shown on Figure B.2. The soil borings were completed by Cascade Drilling, Inc. using hollow-stem augers. The soil borings were logged and samples classified based on visual method using the

Unified Soil Classification System (USCS) as described in ASTM Standard D 2487-00. The soil classifications on the boring logs were subsequently adjusted to reflect the laboratory test results. The boring logs are included as Attachment B.1.

Standard penetration tests (SPT) were conducted during the drilling and blow counts were recorded on the logs. The soil borings were advanced to a maximum depth of 41 feet (ft) below ground surface (bgs) through the lower silt aquitard layer where this unit was present. At Boring H-10 location, a gravel and cobble layer was encountered near the ground surface, resulting in refusal. This boring was offset 5 ft and re-drilled, and was completed to the planned depth.

The HSA investigation revealed an absence or substantial reduction of thickness of the lower silt aquitard in the southwest portion of the alignment, between Borings H-3 and H-15, and on the east side between Borings H-9 to H-10.

Following HSA borings, nine push probes (A-1 through A-9) were advanced in the southwest corner of the Landfill from August 22 to 29, 2008 in an attempt to define the extent of the aquitard gap in this area (Figure B.2) based on HSA borings. Push probe logs are included in Attachment B.1.

As described in the Work Plan, in order to assess the continuity of the lower silt aquitard between the HSA borings, 46 cone penetration tests (CPTs) were performed from September 22 to 30, 2008 by In Situ Engineering of Snohomish, Washington. Only 30 CPTs were proposed in the Work Plan; however, additional CPTs were required to delineate the gaps in the lower silt aquitard. To compare results with the HSA method, CPTs C-7 and C-12 were positioned adjacent to Borings H-14 and H-6, respectively. The CPT readouts were compared to the logging results for the HSA borings.

CPTs C-1 through C-4, C-29, and C-30 were not performed as had been proposed in the Work Plan, since the HSA borings indicated a gap in the aquitard beneath the southwest corner of the Landfill, where the CPTs were located. Instead, six CPTs (C-31 through C-35) were completed on the upslope of the Landfill in an effort to identify the extent of the aquitard gap toward the center of the Landfill. Similarly, 10 CPTs (C-40, C-41, and C-45 through C-52) were completed upslope of the eastern aquitard gap to delineate the extent of the aquitard gap on the east side of the Landfill. C-26 was attempted at two locations, but due to refusal it was abandoned. The exploration points were surveyed for location and elevation by Barghausen Consulting Engineers, Inc. A summary of the exploration points, coordinates, and ground surface elevations is presented in Table B.1.

Soil samples were collected from SPT samplers during HSA soil borings for geotechnical testing as described in the Work Plan. Fifteen representative discrete samples were collected for moisture content and grain size for each soil type identified. Six representative discrete samples of cohesive soils were collected for Atterberg limit testing. Four undisturbed samples were collected using large-diameter drive samplers (Shelby tubes) from the Upper Sand Aquifer, fine-grained zones within the Upper Sand Aquifer, and the underlying Lower Silt Aquitard for permeability and triaxial strength testing. Undisturbed samples were also submitted for Atterberg limit testing.

In addition, four 5-gallon (80-lb) composite soil samples were collected from the 15 HSA soil borings to provide materials for compatibility testing. Each composite sample was collected from SPT samples from four to five HSA borings above the Lower Silt Aquitard. The Lower Silt Aquitard material was excluded from the composite samples.

Groundwater samples for compatibility testing were collected from Monitoring Well PD-107 (refer to Figure B.2) in accordance with the procedures described in the Sampling Analysis Plan/Quality Assurance Project Plan (SAP/QAPP; Appendix B to the GRWP) and Work Plan. A potable water sample for compatibility testing was collected from the City of Milton Public Works Department at Kent Street.

INVESTIGATION-DERIVED WASTE

The field sampling equipment and exploration equipment were decontaminated between samples and exploration locations in accordance with the protocols in the Work Plan and SAP/QAPP. Soil cuttings from HSA borings were characterized using composite samples from containerized wastes (WP 4-8 from Borings H-4 through H-8, WP 12-3 from Borings H-12 through H-3, and WP 9-11 from Borings H-9 through H-11) submitted to Fremont Analytical Inc. in Seattle, Washington. Soil cuttings from push probes advanced through the Landfill wastes were containerized and characterized in conjunction with HSA borings advanced through the Landfill (PD-107, PD-108, and PD-109) as part of other predesign studies (refer to Appendix C). Decontamination rinsate was characterized by samples (Decon 1 through Decon 4) submitted to Fremont Analytical.. The investigation-derived waste generated was disposed off-site along with other waste from the predesign investigations as dangerous (hazardous) and non-regulated waste, as applicable based on the waste characterization results. The waste characterization analytical laboratory results and waste manifests are included as Attachment B.2.

LABORATORY TESTING

Soil samples collected by split spoon and Shelby tube samplers were submitted for geotechnical testing to Soil Technology, Inc. on Bainbridge Island, Washington. Selected soil samples were tested for grain size, moisture content, Atterberg limits, strength, and permeability, as described in the Work Plan.

Compatibility testing consisted of testing five soil samples for hydraulic conductivity using potable water and groundwater. Four composite soil samples collected for compatibility testing were consolidated from the four composite samples by the test laboratory prior to preparation of compatibility test samples. The laboratory test report and sample chain of custodies are included in Attachment B.3. Two composite soil samples were mixed with different concentrations of bentonite, another two composite soil samples were mixed with different concentrations of bentonite and cement. A fifth sample was composed of cement mixed with bentonite. The mix ratios and hydraulic conductivity test results are summarized in Table B.2.

Impacted groundwater sampled from beneath the Landfill for compatibility testing was submitted for chemical analysis to Fremont Analytical.. Groundwater was analyzed for metals including arsenic, iron, calcium, magnesium, and sodium, and other water quality indicators including total alkalinity, chloride, dissolved organic carbon, and sulfide. Analytical results are summarized in Table B.3. The laboratory test report and sample chain-of-custody forms are included in Attachment B.3.

INVESTIGATION FINDINGS

The soil borings encountered a 3- to 3.5-ft thick layer of fill at the ground surface, which is the existing perimeter road berm. The Upper Silt Aquitard was encountered in most borings at depths ranging from approximately 3- to 11-ft below ground surface. A distinct shallow silt layer was absent at H-3, H-12, and H-14. Where present, the Lower Silt Aquitard was generally encountered at depths ranging from approximately 14-to 30-ft below grade. In the two areas along the barrier wall alignment, the southwest corner and an area on the eastern side of Landfill (refer to Figure B.2) low-permeability deposits were either not encountered or present only as thin seams or lenses. At most locations, transitions between silt and sand layers were very gradual. Otherwise, these layers were interbedded. The Lower Silt Aquitard was typically identified as olive grey silt or clayey silt, and was in places interbedded with peat. The Lower Silt Aquitard ranged in thickness from approximately 3.5- to 10.5-feet thick.

Delineation of the horizontal extent of the eastern aquitard gap toward the center of the Landfill was attempted, but was not determined. After two transects of CPTs, further delineation toward the center of the Landfill was deemed impractical due to the increasing and substantial thickness of wood waste. The horizontal extent of the southwest aquitard gap into the Landfill is shown on Figure B.2.

The laboratory test results confirmed the presence of silts in the Upper and Lower Silt Aquitards. The results indicated mostly non-plastic or low plasticity silt. However, at four locations the Lower Silt Aquitard was classified as high plasticity, organic silt with an average strength of approximately 1,500 pounds per square foot (psf). Hydraulic conductivity of the lower silt aquitard was tested in the laboratory on the high and low plasticity samples (H-4 at 26-ft bgs and H-11 at 24.7-ft bgs, respectively), to assess the range of hydraulic conductivity values for the Lower Silt Aquitard. The measured hydraulic conductivity ranged between $7x10^{-8}$ to $4 x10^{-6}$ centimeters per second (cm/s).

Based on these findings, the barrier wall should extend to at least the midsection of the Lower Silt Aquitard, where a distinct silt layer is generally present. In the two aquitard gap areas, where a distinct silt layer is absent but thin silt lenses were typically encountered, the wall should continue below the depth of silt lenses. The recommended depth of the bottom of the barrier wall at each HSA boring location is presented in Table B.1.

The compatibility testing results indicate that Site groundwater composition has no significant effect on the barrier wall mix. The hydraulic conductivity tests indicated only minor differences between groundwater and potable water, which are believed to be in the range of accuracy of the test method. The hydraulic conductivity of the Site soil with addition of only 3 percent bentonite was found to be 5×10^{-8} cm/s. This mix ratio will meet the intent of the design and will be used for this project.

REFERENCES

Floyd|Snider. 2007. *B&L Landfill Groundwater Alternatives Evaluation.* Prepared for Murray Pacific Corporation, Tacoma, Washington. January.

Floyd|Snider/AMEC 2009. *Groundwater Remediation Work Plan.* Prepared for B&L Custodial Trust, Olympia, Washington. January.

Encl.: Table B.1–List of Exploration Locations
Table B.2–Backfill Mix Design
Table B.3–Groundwater Analytical Results for PD-107
Figure B.1–Site Vicinity Map
Figure B.2–Geotechnical Exploration Locations
Attachment B.1–Boring Logs and Cone Penetrometer Test Logs
Attachment B.2–Investigation-derived Waste Documentation
Attachment B.3–Laboratory Analytical Reports

Copies:

Tables

Table B.1
List of Exploration Locations[1]

ID	Installation Date	Total Depth (ft. bgs)	Northing[2]	Easting[2]	Ground Surface Elevations (ft. NAVD 88)[3]	Depth to Bottom of Barrier Wall (ft. bgs)[4]
Hollow-stem Auger Borings						
H-1	8/12/2008	36.00	1185860.52	701618.68	20.15	31.00
H-2	8/12/2008	36.00	1185731.80	701721.70	19.49	28.00
H-3	8/12/2008	41.00	1185730.96	701907.42	19.39	35.00
H-4	8/13/2008	41.00	1185731.33	702092.07	18.80	26.00
H-5	8/13/2008	43.00	1185900.34	702214.87	19.20	26.00
H-6	8/13/2008	41.00	1186115.05	702324.37	19.24	26.00
H-7	8/14/2008	41.00	1186232.63	702371.60	19.12	24.00
H-8	8/14/2008	35.00	1186381.07	702329.80	18.95	22.00
H-9	8/14/2008	31.00	1186479.75	702171.01	19.29	27.00
H-10	8/15/2008	31.00	1186571.87	702003.16	19.85	27.00
H-11	8/15/2008	37.00	1186603.45	701839.72	19.93	24.00
H-12	8/11/2008	31.00	1186530.15	701685.61	20.43	23.00
H-13	8/11/2008	31.00	1186395.32	701617.75	20.56	27.00
H-14	8/11/2008	33.00	1186193.91	701613.66	20.80	25.00
H-15	8/15/2008	35.00	1186016.29	701616.94	20.44	27.00
Push Probes						
A-1	8/25/2008	40.00	1185794.60	701850.21	25.70	NA
A-2	8/25/2008	44.00	1185795.45	701779.16	25.79	NA
A-3	8/25/2008	44.00	1185905.00	701787.01	36.01	NA
A-4	8/25/2008	36.00	1185907.06	701714.87	29.35	NA
A-5	8/22/2008	32.00	1185953.23	701659.63	23.11	NA
A-6	8/22/2008	32.00	1186079.77	701614.84	20.54	NA
A-7	8/27/2008	28.00	1185985.27	701672.86	25.00	NA
A-8	8/29/2008	42.00	1185883.05	701846.85	36.02	NA
A-9	8/29/2008	40.00	1185890.57	701679.12	24.81	NA
CPTs						
C-1[5]	--	--	1185796.19	701623.92	20.04	NA
C-2[5]	--	--	1185737.55	701671.45	19.73	NA
C-3[5]	--	--	1185731.99	701781.95	19.49	NA
C-4[5]	--	--	1185730.30	701844.23	19.46	NA
C-5	9/24/2008	36.78	1185730.78	701968.27	19.24	NA
C-6	9/24/2008	29.53	1185730.95	702030.03	18.96	NA
C-7	9/23/2008	36.42	1185752.33	702147.33	19.64	NA
C-8	9/23/2008	33.96	1185828.26	702182.15	19.15	NA
C-9	9/23/2008	33.63	1185921.58	702226.32	19.18	NA
C-10	9/23/2008	32.64	1185971.56	702251.62	19.29	NA
C-11	9/23/2008	31.99	1186030.26	702281.81	19.07	NA
C-12	9/22/2008	34.94	1186120.56	702325.63	19.26	NA
C-13	9/22/2008	28.38	1186281.47	702380.72	19.04	NA
C-14	9/22/2008	26.57	1186339.53	702365.44	19.03	NA
C-15	9/22/2008	31.00	1186416.38	702275.23	19.14	NA
C-16	9/22/2008	22.31	1186448.49	702224.18	19.30	NA
C-17	9/23/2008	39.86	1186509.73	702116.67	19.45	NA
C-18	9/25/2008	32.97	1186537.20	702070.85	19.89	NA
C-19	9/25/2008	35.93	1186593.13	701957.46	19.91	NA

ID	Installation Date	Total Depth (ft. bgs)	Northing[2]	Easting[2]	Ground Surface Elevations (ft. NAVD 88)[3]	Depth to Bottom of Barrier Wall (ft. bgs)[4]
C-20	9/25/2008	35.93	1186607.24	701899.55	20.00	NA
C-21	9/25/2008	32.32	1186583.29	701782.92	19.99	NA
C-22	9/25/2008	26.41	1186558.76	701738.58	19.85	NA
C-23	9/25/2008	32.81	1186491.82	701649.00	20.50	NA
C-24	9/25/2008	38.88	1186446.57	701622.55	20.54	NA
C-25	9/24/2008	23.29	1186345.46	701617.64	20.66	NA
C-26[6]	--	--	1186268.14	701615.45	20.71	NA
C-27	9/22/2008	29.04	1186186.88	701615.24	20.80	NA
C-28	9/24/2008	31.33	1186045.05	701615.62	20.41	NA
C-29[5]	--	--	1185962.04	701616.74	20.34	NA
C-30[5]	--	--	1185910.21	701618.07	20.27	NA
C-31	9/23/2008	39.70	1185866.54	701724.42	29.06	NA
C-32	9/23/2008	40.03	1185844.06	701787.12	31.08	NA
C-33	9/23/2008	42.98	1185840.14	701831.99	31.25	NA
C-34	9/23/2008	46.42	1185835.50	701877.82	30.83	NA
C-35	9/25/2008	42.65	1185789.68	701885.54	25.12	NA
C-36	9/24/2008	42.98	1185731.52	701870.74	19.31	NA
C-37	9/29/2008	26.57	1186550.53	702041.26	20.06	NA
C-38	9/29/2008	29.86	1186521.96	702095.70	19.65	NA
C-39	9/29/2008	33.30	1186495.34	702142.48	19.34	NA
C-40	9/29/2008	32.64	1186490.18	702067.68	23.20	NA
C-41	9/29/2008	33.30	1186472.63	702095.85	23.24	NA
C-42	9/30/2008	32.64	1186309.35	701617.28	20.82	NA
C-43	9/30/2008	33.30	1186227.29	701615.77	20.76	NA
C-44	9/30/2008	29.86	1186119.53	701614.53	20.64	NA
C-45	9/29/2008	26.57	1186508.08	702036.99	23.08	NA
C-46	9/29/2008	30.18	1186451.03	702135.13	22.87	NA
C-47	9/29/2008	32.97	1186526.40	701995.91	23.66	NA
C-48	9/30/2008	38.22	1186481.66	701981.36	30.41	NA
C-49	9/30/2008	28.87	1186466.44	702014.68	30.24	NA
C-50	9/30/2008	40.52	1186447.26	702050.54	30.15	NA
C-51	9/30/2008	46.59	1186430.23	702083.32	29.87	NA
C-52	9/30/2008	27.89	1186410.59	702118.76	29.38	NA

Notes:

1 Exploration locations and elevations were surveyed by Barghausen Consulting Engineering, Inc. in November 2008.

2 Northings and Eastings in Washington State Plane coordinate system, NAD 83 South (ft).

3 Ground surface elevations in NAVD 88.

4 Barrier wall depth based on hollow-stem auger results.

5 CPTs were not advanced because soil borings did not encounter the lower silt aquitard.

6 CPT advanced twice but ultimately encountered refusal. A third boring at this location was not attempted.

Abbreviations:

bgs	Below ground surface
CPT	Cone penetrometer test
ft	Feet
NA	Not applicable

Table B.2
Backfill Mix Design

Mix Ratio	Hydraulic Conductivity (cm/s)	
	With Potable Water	With Groundwater
Soil with 3% bentonite	5×10^{-8}	5×10^{-8}
Soil with 7% bentonite	$<1 \times 10^{-8}$	$<1 \times 10^{-8}$
Soil with 3% bentonite and 7% cement	6×10^{-7}	3×10^{-7}
Soil with 6% bentonite and 7% cement	3×10^{-7}	1×10^{-7}
Cement with 5% bentonite	4×10^{-6}	9×10^{-7}

Table B.3
Groundwater Analytical Results for PD-107

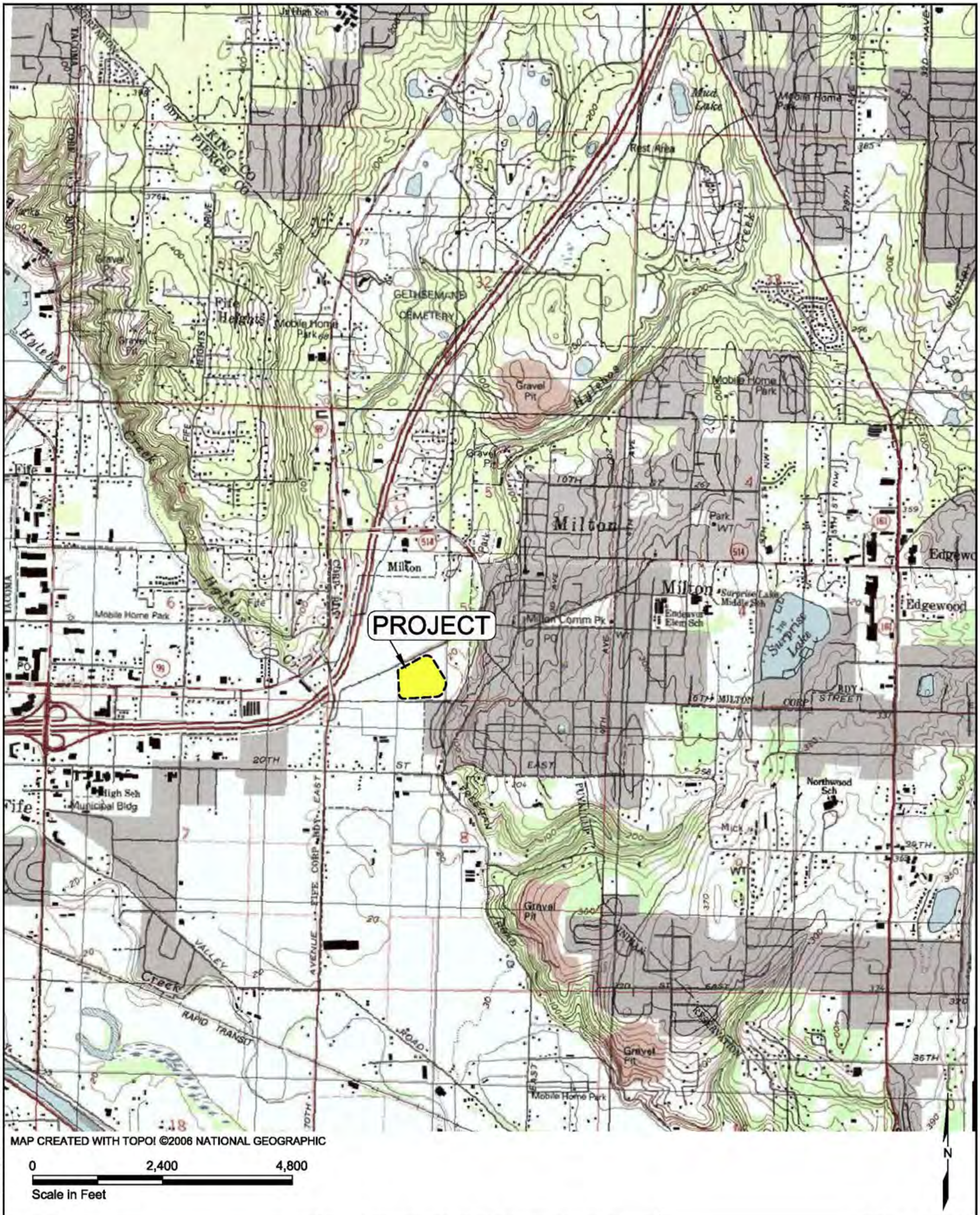
Parameter	Analysis Method	PD-107-W-30' [1]	Units
Alkalinity	SM 2320B	648	mg/L
pH	SM 4500H	6.3	pH
Nitrate	SM 4500N03E	10.2	mg NO_3-N/L
Dissolved Organic Carbon (DOC)[2]	SM 5310B	29.6	mg/L
Arsenic	SW 6020	2.7	mg/L
Calcium		107	mg/L
Iron		38	mg/L
Magnesium		75	mg/L
Sodium		29	mg/L
Chloride	SW 300.0	68	mg/L

Notes:

1 Groundwater sample collected on 8/29/2008 at 11:00:00 AM.

2 Analyzed for total organic carbon following field-filtration at 0.45 µm.

Figures



MAP CREATED WITH TOPO! ©2006 NATIONAL GEOGRAPHIC

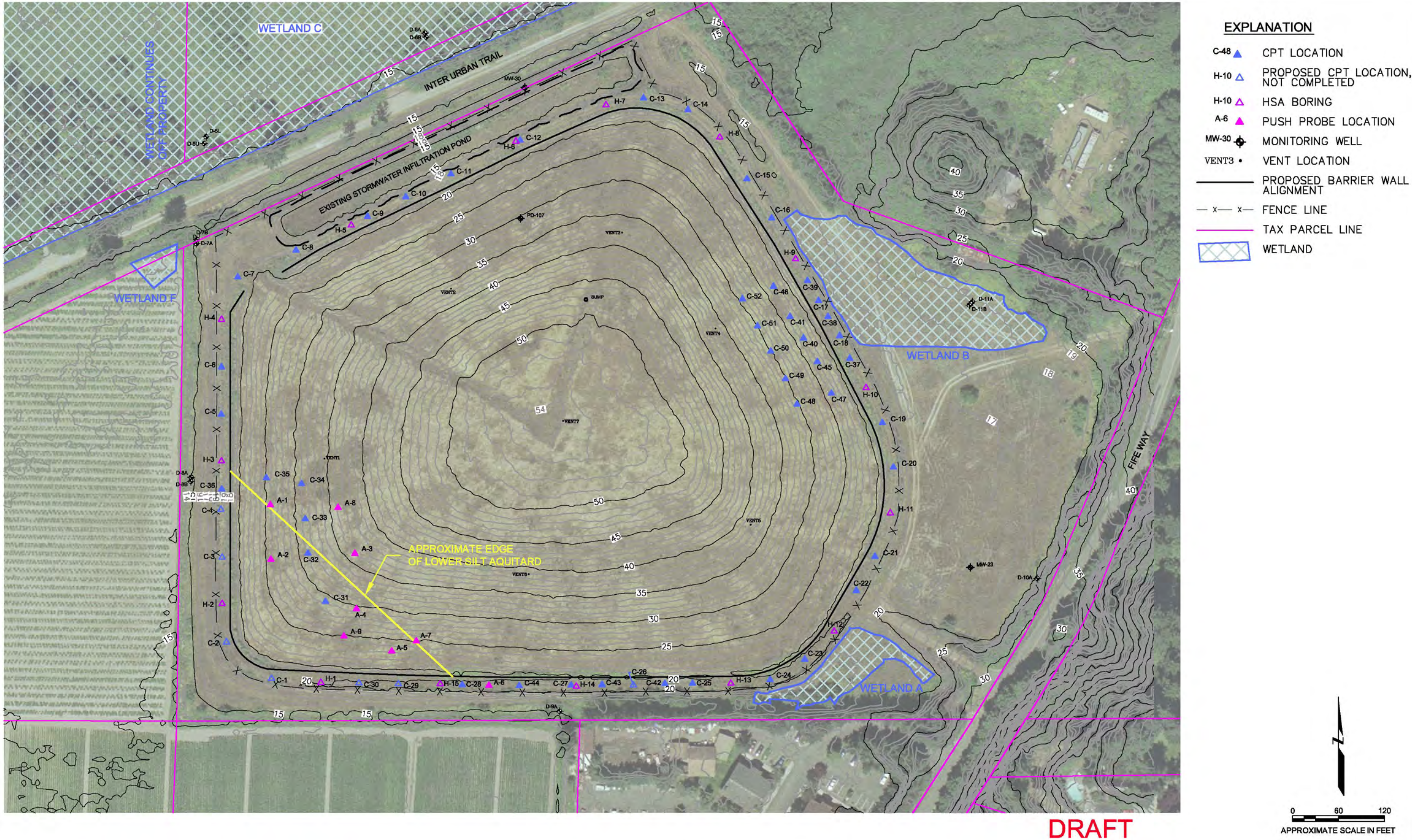
FLOYD | SNIDER
AMEC Geomatrix

Geotechnical Investigation
Memorandum
B&L Woodwaste Property
Pierce County, Washington

Figure B.1

Site Vicinity Map

DWG NAME: 3/23/2009 12:06 PM
DATE: S:\13488\004_Design\Vicinity_LocationMap.dwg



DRAFT

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AMEC Geomatrix

Geotechnical Investigation Memorandum
B&L Woodwaste Property
Pierce County, Washington

Figure B.2

Geotechnical Exploration Locations

DWG NAME: S:\13488\004_Design\SiteMap_geotech_032309.dwg
DATE: 3/18/2009 2:01 PM

Attachment B1

Boring Logs and Cone Penetrometer Test Logs

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-1

BORING LOCATION:

ELEVATION AND DATUM: 20.15 ft NAVD88

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 8/12/2008

DATE FINISHED: 8/12/2008

DRILLING EQUIPMENT: CME 75

TOTAL DEPTH (feet): 36

MEASURING POINT: Ground surface

DRILLING METHOD: 8-inch diameter hollow-stem auger

DEPTH TO FREE WATER FIRST ENCOUNTERED: 9.0 feet

SAMPLING METHOD: SPT split spoon drive sampler [24" x 1.5"]

DEPTH TO FREE WATER AT COMPLETION:

HAMMER WEIGHT: 140 lb

HAMMER DROP: 30 in

LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES			MATERIAL DESCRIPTION	LABORATORY TESTS		
	Sample No.	Sample	Blows/ 6 inches		Moisture Content (%)	Dry Density (pcf)	Other
				(FILL)			
1							
2							
3		☒	8	SILTY SAND (SM) light brown, fine to medium sand, dry (topsoil)			
		☒	13	SAND (SW) Dense, gray, fine to caorse sand, moist, trace gravel, trace silt			
4			19				
			15				
5		☒	3				
			4				
6			3				
			3				
7		☒	2				
		☒	3				
8			8	POORLY GRADED SAND (SP) Medium dense, blackish gray with orange grains, fine to medium sand, moist			
			8	ATD ▽			
9		☒	3	wet			
		☒	6				
10		☒	11				
		☒	11				
11		☒	7				
		☒	8				
12		☒	10				
		☒	11				
13	H-1-13-15'	☒	5		22		Sieve = SP (Poorly graded sand)
		☒	7				
14		☒	12				
		☒	13				
15		☒	3				
		☒	5				Add water to control heave.
16		☒	6				
		☒	12				
17		☒	11				

GT-1 (12/03)

Project No. 13488.130

AMEC Geomatrix, Inc.

Figure

GEES-SOIL 9/08 13488LOGS.GPJ ZANNA090908.GDT 3/11/09

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-1 cont.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content (%)	LABORATORY TESTS: Dry Density (pcf)	LABORATORY TESTS: Other
			7				
18			11				
			13				
19			5				
			6				
20			7				
			10				
21			8				
			12				
22			13				
			15				
23			8				
			9				
24			10				
			10				
25			10				
			10				
26			9				
			8				
27			3	↓ thin peat seams to 31'			
			7				
28			9				
			10				
29			9				
			10				
30			11				
			13				
31			10				
			12				
32			15				
			15				
33			9				
			10	WELL GRADED SAND (SW) Dense, blackish gray with orange grains, medium to coarse sand, wet, trace gravel, trace silt			
34			11				
			20				
35			21				
			50/6"				
36				Bottom of boring at 36.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

PROJECT: Geotechnical Investigation B&L Landfill Milton, Washington	**Log of Boring No. H-2**
BORING LOCATION:	ELEVATION AND DATUM: 19.49 ft NAVD88
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 8/12/2008 DATE FINISHED: 8/12/2008
DRILLING EQUIPMENT: CME 75	TOTAL DEPTH (feet): 36 MEASURING POINT: Ground surface
DRILLING METHOD: 8-inch diameter hollow-stem auger	DEPTH TO FREE WATER FIRST ENCOUNTERED: 9.0 feet
SAMPLING METHOD: SPT split spoon drive sampler [24" x 1.5"]	DEPTH TO FREE WATER AT COMPLETION:
HAMMER WEIGHT: 140 lb HAMMER DROP: 30 in	LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content (%)	LABORATORY TESTS: Dry Density (pcf)	LABORATORY TESTS: Other
			(FILL)			
1						
2						
3		25	SANDY GRAVEL (GW) Dense, light brown, coarse subrounded gravel, some sand, trace silt, dry			
		25				
4		25				
		25	GRAVELLY SAND (SW) Medium dense, olive gray, fine to coarse sand, some gravel, trace silt, dry to moist			
5		18				
		16				
6		12				
		10				
7		4				
		5				
8		5	POORLY GRADED SAND TO SILTY SAND (SP-SM) Loose, blackish gray with orange grains, fine to medium sand, trace to some silt, moist			
		5	ATD ▽			
9		5	↓ wet			
		5				
10		7				
		8				
11		4				
		3				
12		1	WOOD yellowish beige, fresh-looking, not treated, oxidizes to gray within 1 minute			
		4				
13		6	POORLY GRADED SAND (SP) ↓ Loose, blackish gray with orange grains, fine to medium sand, trace silt, moist; 1" wood layers interspersed; wood oxidizes with exposure			
		8				
14		9				
		10				
15		3				
		6				
16		7				
		9				
17		6				

GT-1 (12/03)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-2 cont.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content (%)	LABORATORY TESTS: Dry Density (pcf)	LABORATORY TESTS: Other
			6				Add water to control heave.
18			9				
			10				
19			10				
			5				
20			4				
			4				
21			6				
			10	SANDY SILT (ML) fine sand, some silt, wet; 1" wood layers interspersed; wood oxidizes with exposure			
22			12				
			12				
23			7	POORLY GRADED SAND (SP) Loose, blackish gray with orange grains, fine to medium sand, trace silt, wet; 1" wood layers interspersed; wood oxidizes with exposure			
			9				
24			12				
			13				
25			6				
			8	↓ no wood fragments			
26			8				
			12				
27			9				
			14	POORLY GRADED SAND TO SILTY SAND (SP-SM) Medium dense, blackish gray, fine sand, some silt, wet			
28			15				
			17				
29			10	POORLY GRADED SAND (SP) Medium dense, blackish gray with orange grains, fine to medium sand, trace silt, wet			
			12				
30			13				
			13				
31			15				
			18	WELL GRADED SAND (SW) Dense, blackish gray with orange and white grains, fine to coarse sand, trace gravel, trace silt, wet			
32			21				
			25				
33			12				
			18	↓ gravel content varies			
34			22				
			25				
35			23				
			50/6"				
36				Bottom of boring at 36.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-3

BORING LOCATION:

ELEVATION AND DATUM: 19.39 ft NAVD88

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 8/12/2008

DATE FINISHED: 8/12/2008

DRILLING EQUIPMENT: CME 75

TOTAL DEPTH (feet): 41

MEASURING POINT: Ground surface

DRILLING METHOD: 8-inch diameter hollow-stem auger

DEPTH TO FREE WATER FIRST ENCOUNTERED: 9.0 feet

SAMPLING METHOD: SPT split spoon drive sampler [24" x 1.5"]

DEPTH TO FREE WATER AT COMPLETION:

HAMMER WEIGHT: 140 lb

HAMMER DROP: 30 in

LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	Dry Density (pcf)	Other
				(FILL)			
1							
2							
3			18	WELL GRADED SAND (SW) Loose, light brown, fine to coarse sand			
			20				
4			13	SANDY GRAVEL (GW) Loose, grayish brown, fine gravel, some sand, trace silt			
			12				
5			5				
			6				
6			6				
			6				
7			3				
			3				
8			1				
			5	ATD ▽			
9			25	POORLY GRADED SAND (SP) Medium dense, blackish gray with orange grains, fine to medium sand, trace silt, wet			
			25				
10			25				
			25				
11			7				
			11				
12			11				
			13				
13			8	fresh wood piece at 12.8'			
			14				Add water to control heave.
14			14				
			14				
15			7	fresh wood fragments at 15'			
			8				
16			10				
			20				
17			8		24		Sieve = SM (silty sand)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-3 cont.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content (%)	LABORATORY TESTS: Dry Density (pcf)	LABORATORY TESTS: Other
	H-3-17-19	11				
18		15				
		15				
19		8				
		11				
20		13				
		16				
21		9				
		10				
22		12				
		12				
23		8	WELL GRADED SAND (SW) Medium dense, blackish gray with orange grains, medium to coarse sand, trace gravel, wet			
		11				
24		15				
		16				
25		8	trace wood shreds at 25'			
		10				
26		7				
		10				
27		12				
		10				
28		9				
		9	WELL GRADED SAND with GRAVEL (SW); fresh wood, yellowish beige in shoe; oxidizes to gray trace fresh wood			
29		8				
		10				
30		7				
		7	SILT (ML) Soft to stiff, gray, low plasticity, trace to some sand			
31		6				
		6				
32		8				
		12				
33	H-3-33-35'	5		5		Att. = ML; PI= 1%
		6				
34		8				
		8				
35		5				
		8				
36		12				
		12	POORLY GRADED SAND (SP) Dense, blackish gray with orange grains, fine to medium sand, trace silt, wet			
37		8				
		12				
38		15				
		18				
39						

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-3 cont.

DEPTH (feet)	SAMPLES			MATERIAL DESCRIPTION	LABORATORY TESTS		
	Sample No.	Sample	Blows/ 6 inches		Moisture Content (%)	Dry Density (pcf)	Other
		☒	8				
40			12				
			20				
			20				
41				Bottom of boring at 41.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

Project No. 13488.130

AMEC Geomatrix, Inc.

Figure Cont.

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-4

BORING LOCATION:	ELEVATION AND DATUM: 18.80 ft NAVD88
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 8/13/2008 — DATE FINISHED: 8/13/2008
DRILLING EQUIPMENT: CME 75	TOTAL DEPTH (feet): 41 — MEASURING POINT: Ground surface
DRILLING METHOD: 8-inch diameter hollow-stem auger	DEPTH TO FREE WATER FIRST ENCOUNTERED: 9.0 feet
SAMPLING METHOD: SPT split spoon [24" x 1.5"]; Shelby tube [30" x 2.875"]	DEPTH TO FREE WATER AT COMPLETION:
HAMMER WEIGHT: 140 lb — HAMMER DROP: 30 in	LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	Dry Density (pcf)	Other
				(FILL)			
1							
2							
3			12	WELL GRADED SAND (SW) Medium dense, olive gray, fine to coarse sand, some silt, trace gravel (varies), dry			
			11				
4			7				
			6				
5			4				
			5				
6			5				
			5				
7			1				
			3				
8			1				
			2	POORLY GRADED SAND (SP) Loose, gray, fine sand, trace silt, wet ATD ▽			
9			3				
			7				
10			8				
			9				
11			6				
			6				
12			7	1" peat pocket at 12.3'			
			8				
13			5				
			4				
14			13				
			13				
15			7	↓ blackish gray			
			8				
16			10				
			11				
17			8				Add water to control heave.

GT-1 (12/03)

GEES-SOIL 9/08 13488LOGS.GPJ ZANNA090908.GDT 3/11/09

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-4 cont.

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	LABORATORY TESTS Dry Density (pcf)	LABORATORY TESTS Other
			10	1" peat seam at 17.5'			
18			12				
			12				
19			7	medium dense			
			8				
20			10				
			12				
21			5				
			12				
22			15				
			4	SILT (MH) Soft, dark gray silt, high plasticity; interbedded peat			
23							
24							
25	H-4-25-27'						Att. = OH ; Perm. = 7 x 10-8 cm/sec; Triax. = 1650 psf; PI = 52%
26		S					
27			4	stiff			
			3				
28			3				
			3				
29			8				
			10	SILTY SAND (SM) Medium dense, gray, fine sand, some silt, wet; trace peat fragments			
30			12				
			15				
31			8				
			10				
32			15				
			16				
33			8	POORLY GRADED SAND (SP) Medium dense, blackish gray, fine to medium sand, trace silt, wet			
			10				
34			10				
			10				
35			8				
			8				
36			10				
			11				
37			12				
			18				
38			21				
			26				
39							

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-4 cont.

DEPTH (feet)	SAMPLES			MATERIAL DESCRIPTION	LABORATORY TESTS		
	Sample No.	Sample	Blows/ 6 inches		Moisture Content (%)	Dry Density (pcf)	Other
		☒	8				
			9				
40			16	WELL GRADED SAND (SW) Medium dense, blackish gray, fine to coarse sand, trace gravel, wet			
			26				
41				Bottom of boring at 41.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-5

BORING LOCATION:

ELEVATION AND DATUM: 19.20 ft NAVD88

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 8/13/2008

DATE FINISHED: 8/13/2008

DRILLING EQUIPMENT: CME 75

TOTAL DEPTH (feet): 43

MEASURING POINT: Ground surface

DRILLING METHOD: 8-inch diameter hollow-stem auger

DEPTH TO FREE WATER FIRST ENCOUNTERED: 13.0 feet

SAMPLING METHOD: SPT split spoon drive sampler [24" x 1.5"]

DEPTH TO FREE WATER AT COMPLETION:

HAMMER WEIGHT: 140 lb

HAMMER DROP: 30 in

LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES			MATERIAL DESCRIPTION	LABORATORY TESTS		
	Sample No.	Sample	Blows/ 6 inches		Moisture Content (%)	Dry Density (pcf)	Other
0				(FILL)			
3.0		☒	7	SANDY TOPSOIL			
3.5			6				
4.0			9	SILTY SAND (SM) Loose, olive gray, fine to coarse sand, moist			
4.5			5				
5.0		☒	3				
5.5			2				
6.0			1				
6.5			1				
7.0		☒	1				
7.5			0				
8.0			0				
8.5			1				
9.0		☒	3				
9.5			0				
10.0			0	SILT (ML) Soft, gray silt, trace fine sand, wet, trace peat fragments			
10.5			1				Sieve = ML (silt)
11.0	H-5-11-13'	☒	1		31		
11.5			3				
12.0			5				
12.5			6	ATD ▽			
13.0		☒	3	SILT (ML) Soft, gray silt, some sand, wet, trace peat fragments			
13.5			4				
14.0			5				
14.5			6				
15.0		☒	3	POORLY GRADED SAND (SP) Loose, blackish gray, fine sand, trace silt, wet			
15.5			4				
16.0			5				
16.5			6				
17.0		☒	4				

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-5 cont.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content (%)	LABORATORY TESTS: Dry Density (pcf)	LABORATORY TESTS: Other
		7				
18		7				
		7	fresh wood piece (yellowish beige) at 18.5'			
19		3				
		5				Add water to control heave.
20		6	dark brown bark chunk at 20'			
		12	fresh wood piece at 20.5'			
21		2				
		2				
22		4	SILT (MH)			
		5	Soft, gray, medium plasticity silt, some sand			
23	H-5-23-25'	3	Peat lense at 22.8'	56		Att. = MH; Sieve = MH (silt with sand); PI = 11%
		4	peat lense at 23.5'			
24		5				
		5				
25		1				
		1				
26		2				
		3	PEAT (PT)			
27		3	Reddish dark brown, trace organic odor			
		5	SILT (ML)			
28		6	Firm, gray silt, trace sand, low plasticity to non plastic, trace			
		7	peat fragments			
29		5				
		9				
30		10				
		11				
31		3				
		5				
32		8				
		10	SILTY SAND (SM)			
33		7	Medium dense, gray, fine sand, some silt, wet			
		8				
34		10				
		11	fresh wood lense at 34.5'			
35		3	POORLY GRADED SAND (SP)			
		4	Loose, gray, fine sand, trace silt, wet			
36		5	bark at 35.5'			
		7	POORLY GRADED SAND (SP)			
37		4	Loose, blackish gray, fine to medium sand, trace silt, wet			
		5				
38		6				
		7				
39						

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-5 cont.

DEPTH (feet)	SAMPLES			MATERIAL DESCRIPTION	LABORATORY TESTS		
	Sample No.	Sample	Blows/ 6 inches		Moisture Content (%)	Dry Density (pcf)	Other
			6	bark lense at 38.7'; fresh wood in shoe			
			9				
40			20				
			23				
41			8				
			9				
42			11	WELL GRADED SAND (SW) Loose, blackish gray, fine to coarse sand, trace gravel, wet			
			15				
43				Bottom of boring at 43.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-6

BORING LOCATION:

ELEVATION AND DATUM: 19.24 ft NAVD88

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 8/13/2008

DATE FINISHED: 8/13/2008

DRILLING EQUIPMENT: CME 75

TOTAL DEPTH (feet): 41

MEASURING POINT: Ground surface

DRILLING METHOD: 8-inch diameter hollow-stem auger

DEPTH TO FREE WATER FIRST ENCOUNTERED: 9.0 feet

SAMPLING METHOD: SPT split spoon [24" x 1.5"]; Shelby tube [30" x 2.875"]

DEPTH TO FREE WATER AT COMPLETION:

HAMMER WEIGHT: 140 lb

HAMMER DROP: 30 in

LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES			MATERIAL DESCRIPTION	LABORATORY TESTS		
	Sample No.	Sample	Blows/ 6 inches		Moisture Content (%)	Dry Density (pcf)	Other
				(FILL)			
1							
2							
3			8	WELL GRADED SAND (SW) Medium dense, light brown, fine to coarse sand, some silt, moist			
			11				
4			13				
			13				
5	H-6-5-7'		6		11		Sieve = SM (silty sand)
			6				
6			7				
			8				
7			7				
			5	NON-PLASTIC SILT (ML) Soft gray silt, some sand, wet, trace bark fragments			
8			4				
			2	ATD ▽			
9			3				
			4				
10			7				
			4				
11			3				Add water to control heave.
			1				
12			2				
			4				
13					34		Att. = ML; Triax. = 8300 psf; PI = NP
14	H-6-13-15'	S		POORLY GRADED SAND (SP) Loose, blackish gray with orange grains, fine sand, wet			
15			2				
			3				
16			5				
			7				
17			7				

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-6 cont.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content (%)	LABORATORY TESTS: Dry Density (pcf)	LABORATORY TESTS: Other
18			6 5				
19			5 5				
20			4 4				
21			4 1				
22			1 2	SILT (ML) Soft, olive gray silt, medium plasticity Peat lense (1") at 22.3' Peat lense (1") at 22.7'			
23	H-6-23-25'		3				
24		S					
25			1	SILT (ML) Soft, olive gray to dark brown, low plasticity, mixed with peat, minor organic odor			
26			2 5				
27			6 6				
28			5 4				
29			4 2				
30			3 6				
31	H-6-31-33'		4 6		37		Sieve = ML (silt)
32			4 5				
33			5 0	fresh wood			
34			1 3	fresh wood			
35			5 1	POORLY GRADED SAND (SP) Loose, gray to blackish gray with orange grains, fine sand, trace silt, wet			
36			2 4				
37			5 3				
38			4 9				
39			12				

GT-2 (8/01)

Project No. 13488.130 | **AMEC Geomatrix, Inc.** | Figure Cont.

Log of Boring No. H-6 cont.

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	Dry Density (pcf)	Other
		☒	7				
			18				
40			21	small silt pockets at 40.1'			
			25				
41				Bottom of boring at 41.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-7

BORING LOCATION:

ELEVATION AND DATUM: 19.13 ft NAVD88

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 8/14/2008

DATE FINISHED: 8/14/2008

DRILLING EQUIPMENT: CME 75

TOTAL DEPTH (feet): 41

MEASURING POINT: Ground surface

DRILLING METHOD: 8-inch diameter hollow-stem auger

DEPTH TO FREE WATER FIRST ENCOUNTERED: 11.0 feet

SAMPLING METHOD: SPT split spoon drive sampler [24" x 1.5"]

DEPTH TO FREE WATER AT COMPLETION:

HAMMER WEIGHT: 140 lb

HAMMER DROP: 30 in

LOGGED BY: N. Bacher

DEPTH (feet)	Sample No.	Sample	Blows/ 6 inches	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Other (LABORATORY TESTS)
0–3				(FILL)			
3–6.5			7 9 10 10 3 6 8	WELL GRADED SAND (SW) Medium dense, light brown, fine to coarse sand, some gravel, some silt			
6.5–10.5			8 8 4 4 10 3 6 10	SILTY SAND (SM) Loose, gray, fine to coarse sand, some silt, moist medium dense (9)			
10.5–17.5			11 5 8 10 11 6 8 10 12 3 5 8 9 9	POORLY GRADED SAND (SP) Medium dense, gray to blackish gray with orange grains, fine sand, trace silt, wet ATD ▽ (11)	26 (17)		Sieve = SM (silty sand) Add water to

GT-1 (12/03)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-7 cont.

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	Dry Density (pcf)	Other
	H-7-17-19		12				control heave.
18			14				
			16				
19			6				
			10				
20			12				
			12				
21			3				
			5				
22			8	HIGH PLASTICITY SILT (OH) Soft, olive gray, high plasticity silt; interbedded peat and wood lenses			
			12				
23	H-7-23-25'		1		91		Att. = OH; PI = 32%
			1				
24			2				
			3				
25			5				
			7	PEAT (PT) Soft, dark brown, slight organic odor			
26			8				
			9	SILT (ML) Soft, gray			
27			2				
			3				
28			4	dark brown peat			
			5				
29			6	SANDY SILT (ML) Loose, gray, fine sand, wet			
			7				
30			8				
			9				
31			3	SILTY SAND (SM) Loose, gray, fine sand, wet			
			4				
32			8				
			9				
33			5	POORLY GRADED SAND (SP) Medium dense, gray to blackish gray with orange grains, fine to medium sand, trace silt, wet			
			8				
34			9				
			10				
35			9				
			10				
36			12				
			13				
37			10				
			18	silt lense			
38			28				
			30				
39							

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-7 cont.

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	Dry Density (pcf)	Other
		☒	5 9 11				
40							
			18				
41				Bottom of boring at 41.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-8

BORING LOCATION:

ELEVATION AND DATUM: 18.95 ft NAVD88

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 8/14/2008

DATE FINISHED: 8/14/2008

DRILLING EQUIPMENT: CME 75

TOTAL DEPTH (feet): 35

MEASURING POINT: Ground surface

DRILLING METHOD: 8-inch diameter hollow-stem auger

DEPTH TO FREE WATER FIRST ENCOUNTERED: 9.0 feet

SAMPLING METHOD: SPT split spoon [24" x 1.5"]; Shelby tube [30" x 2.875"]

DEPTH TO FREE WATER AT COMPLETION:

HAMMER WEIGHT: 140 lb

HAMMER DROP: 30 in

LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	LABORATORY TESTS Dry Density (pcf)	LABORATORY TESTS Other
				(FILL)			
1							
2							
3		☒	6	WELL GRADED SAND (SW) Dense, yellowish brown, fine to coarse sand, some silt, trace gravel, moist			
		☒	26				
4			30				
			32				
5		☒	23	piece of ballast on top of sample			
		☒	24	medium dense, gray			
6			15				
			12				
7		☒	3				
		☒	4	SANDY SILT (ML) Soft, dark brown silt, minor roots/grass, loose, gray, some fine sand, moist			
8			8				
			4	ATD ∇			
9		☒	4	wet			
		☒	5				
10			5				
			1				
11		☒	5				
		☒	2				
12		☒	4				
			10				
13		☒	1				
		☒	4	SILTY SAND (SM) Loose, gray, silty fine sand, wet			
14		☒	7				
			8				
15		☒	1				
		☒	3				
16		☒	5	POORLY GRADED SAND with SILT (SP-SM) Loose, blackish gray with orange grains, fine to medium, wet			
			8				
17		☒	5	medium dense			

GT-1 (12/03)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-8 cont.

DEPTH (feet)	SAMPLES			MATERIAL DESCRIPTION	LABORATORY TESTS		
	Sample No.	Sample	Blows/ 6 inches		Moisture Content (%)	Dry Density (pcf)	Other
		☒	8				
18		☒	10				
			12				
19		☒	1				
		☒	2	SILT with SAND (ML) Soft, olive gray, high plasticity silt, some sand dark brown peat lense dark brown peat lense			
20		☒	3				
			4				
21	H-8-21-23'	S					Att. = OH; Triax. = 1350 psf; PI = 54%
22				HIGH PLASTICITY SILT (OH)			
23	H-8-23-25'	☒	3		73		Sieve = ML (silt with sand)
		☒	5	PEAT with SAND (PT) dark brown			
24			5				
			5				
25		☒	1				
		☒	2				
26		☒	2	SILT (ML) soft, gray silt			
			3				
27		☒	2				
		☒	1	dark brown peat lense			
28		☒	1	dark brown peat lense			
			4				
29		☒	0				
		☒	2				
30		☒	4				
			4				
31		☒	7	POORLY GRADED SAND (SP) Medium dense, blackish gray with orange grains, fine to medium sand, some silt, wet			
		☒	8				
32		☒	10				
			12				
33		☒	5				
		☒	10				
34			5				
			12				
35				Bottom of boring at 35.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-9

BORING LOCATION:	ELEVATION AND DATUM: 19.29 ft NAVD88
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 8/14/2008 DATE FINISHED: 8/14/2008
DRILLING EQUIPMENT: CME 75	TOTAL DEPTH (feet): 31 MEASURING POINT: Ground surface
DRILLING METHOD: 8-inch diameter hollow-stem auger	DEPTH TO FREE WATER FIRST ENCOUNTERED: 9.0 feet
SAMPLING METHOD: SPT split spoon drive sampler [24" x 1.5"]	DEPTH TO FREE WATER AT COMPLETION:
HAMMER WEIGHT: 140 lb HAMMER DROP: 30 in	LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content (%)	LABORATORY TESTS: Dry Density (pcf)	LABORATORY TESTS: Other
				(FILL)			
1							
2							
3			20	WELL GRADED SAND (SW) gray, fine to coarse sand, some gravel, some silt, moist			
			28				
4			18				
			12				
5			5				
			8				
6			8	SILT AND SAND (SM) Soft, gray, moist silt and sand			
			5				
7	H-9-7-9'		0		23		Sieve = SM (silt and sand)
			1				
8			1				
			1	ATD ▽			
9			0				
			1				
10			3				
			6	POORLY GRADED SAND (SP) Loose, blackish gray with orange grains, fine sand, trace silt, wet			
11			3				
			6				
12			8				
			10	1/8" peat lense			
13			0				
			2	peat lense peat lense			
14			1	SILT (MH) olive gray, medium to high plasticity			
			4				
15			2	WOOD () yellowish beige, fresh, small chips, oxidizes gray			
			2				
16			2	PEAT (PT) dark brown, slight organic odor			
			2				
17			4				

GT-1 (12/03)

GEES-SOIL 9/08 13488LOGS.GPJ ZANNA090908.GDT 3/11/09

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-9 cont.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content (%)	LABORATORY TESTS: Dry Density (pcf)	LABORATORY TESTS: Other
			12	WELL GRADED SAND (SW) Medium dense, gray, fine to coarse sand, some gravel, some silt, wet			
18							
			13				
			14				
19							
			8				
			11				
20							
			12				
			16	POORLY GRADED SAND (SP) multicolored, medium sand, wet			
21							
			11				
			14				
22							
			17	WELL GRADED SAND (SW) Dense, orange brown, fine to coarse sand, some gravel, some silt, wet			
			18				
23							
			15	WELL GRADED SAND (SW) Dense, orange brown, fine to coarse sand, trace gravel, trace silt, wet			
			23				
24							
			24				
			28				
25							
			7				
			11				
26							
			12	SILTY SAND (SM) Medium dense, olive brown with orange oxidation mottling and metallic flakes, fine sand, some silt, wet			
			14				
27							
			7				
			8				
28							
			12				
			14				
29							
			6				
			12				
30							
			14				
			14				
31				Bottom of boring at 31.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-10

BORING LOCATION:

ELEVATION AND DATUM: 19.85 ft NAVD88

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 8/15/2008

DATE FINISHED: 8/15/2008

DRILLING EQUIPMENT: CME 75

TOTAL DEPTH (feet): 31

MEASURING POINT: Ground surface

DRILLING METHOD: 8-inch diameter hollow-stem auger

DEPTH TO FREE WATER FIRST ENCOUNTERED: 3.0 feet

SAMPLING METHOD: SPT split spoon [24" x 1.5"]; Shelby tube [30" x 2.875"]

DEPTH TO FREE WATER AT COMPLETION:

HAMMER WEIGHT: 140 lb

HAMMER DROP: 30 in

LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	Dry Density (pcf)	Other
				(FILL)			
1							
2							
3			0	ATD ▽ GRAVEL AND COBBLE			Very cobbly while drilling; water coming into hole at 3.'
			1				
4			3				
			15				
5							
6							
7							
8				WELL GRADED SAND (SW) Loose, gray, fine to coarse sand, some gravel, some silt, wet			
9		☒	3				
			3				
10			2				
			3				
11			0				
			1	SILT (ML) Soft, gray, none to low plasticity silt, trace sand, minor peat fragments throughout			
12			2				
			1				
13	H-10-13-15'	☒	0		42		Sieve = ML (silt with sand)
			1				
14			2	fresh wood chunk			
			2				
15	H-10-15-17'	S					
16							
17		☒	3	peat lense			

GT-1 (12/03)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-10 cont.

DEPTH (feet)	SAMPLES			MATERIAL DESCRIPTION	LABORATORY TESTS		
	Sample No.	Sample	Blows/ 6 inches		Moisture Content (%)	Dry Density (pcf)	Other
			5	PEAT (PT) Soft, dark brown			
18			8				
			10	POORLY GRADED SAND (SP) Loose, gray, fine to medium sand, trace silt, wet			
19			6				
			5				
20			6				
			6	SILT (MH): olive gray, medium to high plasticity, trace peat fragments, medium dense, white and orange sand grains			
21			9				
			12	POORLY GRADED SAND (SP) Loose, gray, fine to medium sand, trace silt, wet			
22			9				
			11				
23			7				
			12	▽ grayish brown with orange oxidation mottling			
24			15				
			21				
25			3	POSSIBLE NON-PLASTIC SILT			
			6				
26			7				
			8				
27			3	POORLY GRADED SAND (SP) Loose, gray, fine to medium sand, trace silt, wet			
			8				
28			29				
			30				
29			30				
			11				
30			18				
			20				
31				Bottom of boring at 31.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-11

BORING LOCATION:

ELEVATION AND DATUM: 19.93 ft NAVD88

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 8/15/2008

DATE FINISHED: 8/15/2008

DRILLING EQUIPMENT: CME 75

TOTAL DEPTH (feet): 37

MEASURING POINT: Ground surface

DRILLING METHOD: 8-inch diameter hollow-stem auger

DEPTH TO FREE WATER FIRST ENCOUNTERED: 9.0 feet

SAMPLING METHOD: SPT split spoon [24" x 1.5"]; Shelby tube [30" x 2.875"]

DEPTH TO FREE WATER AT COMPLETION:

HAMMER WEIGHT: 140 lb

HAMMER DROP: 30 in

LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	Dry Density (pcf)	Other
				(FILL)			
1							
2							
3		☒	9	SANDY GRAVEL (GW) Medium dense, orange brown, fine and coarse gravel, some sand			
			13				
4			14				
			15	WELL GRADED SAND (SW) Medium dense, brown, fine to coarse sand, some gravel, some silt, moist			
5		☒	9				
			13				
6			14				
			14				
7		☒	10	⊤ gray			
			17				
8			18				
			6	ATD ∇			
9			3				
			5	POORLY GRADED SAND (SP) Loose, blackish gray with orange grains, fine to medium sand, trace silt, wet			
10			9				
			10				
11		☒	3				
			5				
12			6				
			8				
13	H-11-13-15'	☒	4		27		Sieve = SP-SM (poorly graded sand with silt)
			6				
14			7				
			8				
15		☒	6				Add water to control heave.
			5				
16			4				
			4	SILT with SAND (ML) Soft, gray, non-plastic to low plasticity			
17		☒	2				

GT-1 (12/03)

GEES-SOIL 9/08 13488LOGS.GPJ ZANNA090908.GDT 3/11/09

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-11 cont.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content (%)	LABORATORY TESTS: Dry Density (pcf)	LABORATORY TESTS: Other
18			3 1				
19			3 1				
20			2 3				
21			4 1				
22			2 3	SILT (ML) Soft, gray, low plasticity to medium plasticity			
23	H-11-23-25'		3				Att. = ML; Perm. = 4 x 10-6 cm/sec; Triax. = 2800 psf; PI = 7
24		S					
25			2				
26			2 2				
27			2 1	PEAT (PT) Soft, dark brown to black SILT (ML)			
28			2 4	SILT (ML)			
29			6 0				
30			1 3				
31			4 1				
32			3 5				
33	H-11-33-35'		6 5	SILT NON-PLASTIC SILT (ML) Firm blackish gray silt, some orange fine sand, wet	34		Sieve = ML (silt with sand)
34			7 8				
35			9 5				
36			7 8				
37			9	Bottom of boring at 37.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-12

BORING LOCATION:

ELEVATION AND DATUM: 20.43 ft NAVD88

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 8/11/2008

DATE FINISHED: 8/11/2008

DRILLING EQUIPMENT: CME 75

TOTAL DEPTH (feet): 31

MEASURING POINT: Ground surface

DRILLING METHOD: 8-inch diameter hollow-stem auger

DEPTH TO FREE WATER FIRST ENCOUNTERED: 16.0 feet

SAMPLING METHOD: SPT split spoon drive sampler [18" x 1.5" and 24" x 1.5"]

DEPTH TO FREE WATER AT COMPLETION:

HAMMER WEIGHT: 140 lb

HAMMER DROP: 30 in

LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES			MATERIAL DESCRIPTION	LABORATORY TESTS		
	Sample No.	Sample	Blows/ 6 inches		Moisture Content (%)	Dry Density (pcf)	Other
1							
2							
3		☒	5	WELL GRADED SAND (SW) Loose, brownish gray, fine to medium sand, trace silt, trace gravel, moist			
		☒	6				
4			7				
		☒	4				
5		☒	5				
			5				
6		☒	4				
			6				
7			7				
	H-12-7.5-9'	☒	3		10		Sieve = SM (silty sand with gravel)
8		☒	1				
			1				
9		☒	0				
		☒	3	SANDY SILT (ML) Firm, gray silt, some fine sand, non-plastic			
10		☒	5				
		☒	5				
11		☒	2				
		☒	3				
12		☒	5	↓ slightly wet			
		☒	7				
13		☒	1				
		☒	3				
14		☒	5				
			7				
15	H-12-15-17'	☒	1		36		Att. = ML; PI = NP
		☒	3	ATD ▽			
16		☒	5	↓ wet			
		☒	7				
17		☒	3				

GT-1 (12/03)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-12 cont.

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	Dry Density (pcf)	Other
			5				
18			8				
			8				
19			3				
			4				
20			5	SILT (ML)			
			5				
21			0	PEAT (PT) Soft, dark brown to reddish brown, wood shreds, slight organic odor			
			1				
22			3				
			4				
23			0				
			3				
24			13				
			16	POORLY GRADED SAND (SP) Medium dense, blackish gray with orange grains, fine to medium sand, trace silt, wet			
25			3				
			5				
26			7				
			12				
27			7				
			9				
28			16	dense			
			21				
29			7				
			10				
30			12				
			16				
31				Bottom of boring at 31.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-13

BORING LOCATION:

ELEVATION AND DATUM: 20.56 ft NAVD88

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 8/11/2008

DATE FINISHED: 8/11/2008

DRILLING EQUIPMENT: CME 75

TOTAL DEPTH (feet): 31

MEASURING POINT: Ground surface

DRILLING METHOD: 8-inch diameter hollow-stem auger

DEPTH TO FREE WATER FIRST ENCOUNTERED: 12.0 feet

SAMPLING METHOD: SPT split spoon drive sampler [24" x 1.5"]

DEPTH TO FREE WATER AT COMPLETION:

HAMMER WEIGHT: 140 lb

HAMMER DROP: 30 in

LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES			MATERIAL DESCRIPTION	LABORATORY TESTS		
	Sample No.	Sample	Blows/ 6 inches		Moisture Content (%)	Dry Density (pcf)	Other
1							
2							
3			9	WELL GRADED SAND (SW) Dense, gray, fine to coarse sand, some gravel, trace silt, moist			
			18				
4			20				
			20	WELL GRADED GRAVEL (GW) Dense, gray, fine subangular gravel, some sand, moist			
5			10				
			12				
6			15				
			17				
7			4	POORLY GRADED SAND (SP) Medium dense, gray, fine sand, some silt, moist			
			9				
8			9				
			8				
9			2				
			5				
10			10	POORLY GRADED SAND (SP) Loose, blackish gray with orange grains, medium sand, trace silt, moist to slightly wet			
			12				
11	H-13-11-13'		5	SANDY SILT (ML) Firm, blackish gray, fine sandy silt, wet	31		Sieve = ML (sandy silt)
			8				
12			9	ATD ▽			
			9				
13			1				
			4				
14			6				
			9				
15			3				
			5	SILT (OH) Soft to firm silt, some sand, wet			
16			5				
			6				
17	H-13-17-19'		0		79		Att. = OH; PI = 32%

GEES-SOIL 9/08 13488LOGS.GPJ ZANNA090908.GDT 3/11/09

GT-1 (12/03)

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-13 cont.

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	LABORATORY TESTS Dry Density (pcf)	LABORATORY TESTS Other
			1	dark brown peat			
18			1	SILT (MH) Soft, olive gray, medium plasticity, wet			
			2				
19			1	PEAT (PT) reddish dark brown, wood shreds, strong odor			
			1				
20			3				
			5	SILT (ML) Soft, olive gray, medium plasticity silt, some sand, wet; scattered 1" peat pockets			
21	H-13-21-23'		3		41		Sieve = ML (silt with sand)
			5				
22			7	SILTY SAND (SM) Loose, gray, fine sand, some silt, interbedded 1/8" silt lenses; trace peat material; trace red oxidation mottling			
			13				
23			4				
			5				
24			6				
			7				
25			0				
			1	SILT (ML) Soft, olive gray silt, interbedded with peat			
26			2				
			7				
27			5				
			5				
28			8	SILTY SAND (SM) Loose, gray, fine to coarse sand, wet			
			8				
29			6	POORLY GRADED SAND (SP) Medium dense, gray, medium sand, trace silt, wet			
			7				
30			8				
			10				
31				Bottom of boring at 31.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

Project No. 13488.130

AMEC Geomatrix, Inc.

Figure Cont.

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-14

BORING LOCATION:	ELEVATION AND DATUM: 20.81 ft NAVD88
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 8/11/2008 DATE FINISHED: 8/11/2008
DRILLING EQUIPMENT: CME 75	TOTAL DEPTH (feet): 33 MEASURING POINT: Ground surface
DRILLING METHOD: 8-inch diameter hollow-stem auger	DEPTH TO FREE WATER FIRST ENCOUNTERED: 12.0 feet
SAMPLING METHOD: SPT split spoon drive sampler [24" x 1.5"]	DEPTH TO FREE WATER AT COMPLETION:
HAMMER WEIGHT: 140 lb HAMMER DROP: 30 in	LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content (%)	LABORATORY TESTS: Dry Density (pcf)	LABORATORY TESTS: Other
				(FILL)			
1							
2							
3			17	TOPSOIL			
			19	WELL GRADED SAND (SW) Medium dense, gray, fine to coarse sand, trace gravel, trace silt, dry			
4			20				
			20				
5			6	moist			
			8				
6			13				
			14				
7			9				
			13				
8			14	POORLY GRADED SAND (SP) Loose, gray, fine sand, trace silt, moist			
			9				
9			6				
			6				
10			6				
			6				
11			4				
			7				
12			8	ATD ∇			
			10				
13			4				
			6				
14			10				
			12				
15			2				
			5				
16			6	some orange sand grains			
			4				
17			1				

GEES-SOIL 9/08 13488LOGS.GPJ ZANNA090908.GDT 3/11/09

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-14 cont.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS: Moisture Content (%)	LABORATORY TESTS: Dry Density (pcf)	LABORATORY TESTS: Other
		2				
18		1	SAND (SM) Loose, gray, fine sand, wet			
		2				
19		1				
		1				
20		6	▽ trace brown peat pockets, trace silt lenses			
		7				
21		1	SANDY SILT (ML) Sandy, soft, gray, no plasticity			
		3				
22		2				
		5				
23	H-14-23-25'	0		29		Att. = ML; PI = NP
		3	SILT (ML) Firm, gray, low plasticity, scattered peat pockets/clumps			
24		7				
		11				
25		4				
		6				
26		9	POORLY GRADED SAND (SP) Medium dense, gray, fine sand, trace silt, wet			
		11				
27		0				
		3				
28		1				
		8				
29		6				
		10				
30		23				
		24	WELL GRADED SAND (SW) Dense, gray, fine to coarse sand, trace gravel, trace silt, wet			
31		8				
		10				
32		15	WELL GRADED GRAVEL (GW) Dense, gray, rounded fine and coarse gravel, some sand, trace silt, wet			
		17				
33			Bottom of boring at 33.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

Project No. 13488.130

AMEC Geomatrix, Inc.

Figure Cont.

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-15

BORING LOCATION:

ELEVATION AND DATUM: 20.44 ft NAVD88

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 8/15/2008

DATE FINISHED: 8/15/2008

DRILLING EQUIPMENT: CME 75

TOTAL DEPTH (feet): 35

MEASURING POINT: Ground surface

DRILLING METHOD: 8-inch diameter hollow-stem auger

DEPTH TO FREE WATER FIRST ENCOUNTERED: 9.0 feet

SAMPLING METHOD: SPT split spoon drive sampler [24" x 1.5"]

DEPTH TO FREE WATER AT COMPLETION:

HAMMER WEIGHT: 140 lb

HAMMER DROP: 30 in

LOGGED BY: N. Bacher

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	Dry Density (pcf)	Other
0				(FILL)			
3			5 3 2 3	WELL GRADED SAND (SW) Loose, brownish gray, fine to coarse sand, some gravel, trace silt, moist			
5			1 6 2 3				
7			1 8 0 4	brown POORLY GRADED SAND (SP) Loose, blackish gray with orange grains, fine to medium sand, trace silt, wet ATD ▽			
9			4 8 9 10				
11			9 12 12 13				Add water to control heave.
13			6 7 8 8				
15			5 6 8 8	trace peat pocket at 16'			
17			7	dense			

PROJECT: Geotechnical Investigation
B&L Landfill
Milton, Washington

Log of Boring No. H-15 cont.

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ 6 inches	MATERIAL DESCRIPTION	LABORATORY TESTS Moisture Content (%)	Dry Density (pcf)	Other
			13				
18			18 22				
19			8 10				
20			12 14	WELL GRADED SAND (SW): loose, blackish gray, fine to coarse sand, wet			
21			9 15				
22			18 20				
23			7 8	WELL GRADED SAND (SW) Medium dense, blackish gray with white and orange grains, fine to coarse sand, trace silt, wet			
24			10 12	gray silt lense			
25			7 8				Sand bridging when pulling out rods.
26			9 13	gray silty clay lense with trace peat			
27			12 15	dark brown silty peat lense			
28			18 23				
29			8 12				
30			23 25	POORLY GRADED SAND (SP) Dense, gray, fine sand, some silt, wet			
31			8 10				
32			12 14				
33			10 25	POORLY GRADED SAND (SP) Medium dense to dense, gray, fine sand, wet			
34			26 28				
35				Bottom of boring at 35.0 feet. Borehole backfilled with tremied bentonite baroid grout (Quick-Grout).			

GT-2 (8/01)

FLOYD | SNIDER
strategy ▪ science ▪ engineering

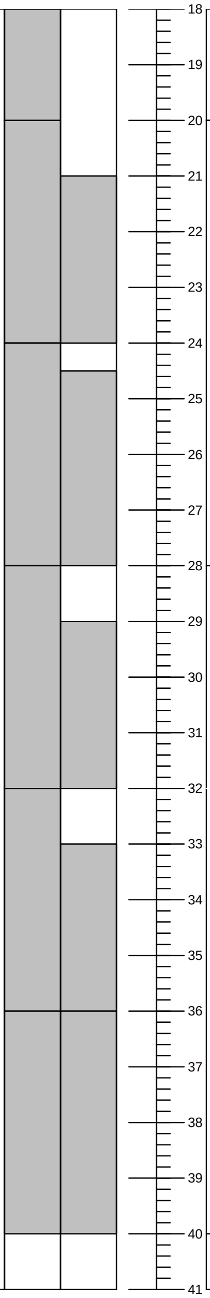
Boring ID: A-9

Drill Date: August 29, 2008
Logged By: Lisa Meoli
Drilled By: Eli Floyd / Cascade Drilling
Drill Type: Track Mounted Geoprobe
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 40 FT BGS
Groundwater ATD (ft bgs): Unknown

Coordinate System: NAD 83/98
Ground Surface Elevation: 24.81 ft., NAVD 88
Latitude/Northing: 701679
Longitude/Easting: 1185891
Boring Location: Landfill Cap

Client: B&L Custodial Trust
Project: B&L RIM
Task:
Address: B&L Woodwaste
Pierce County, Washington

Remarks: Ground surface consists of landfill cap. Did not locate aquitard.



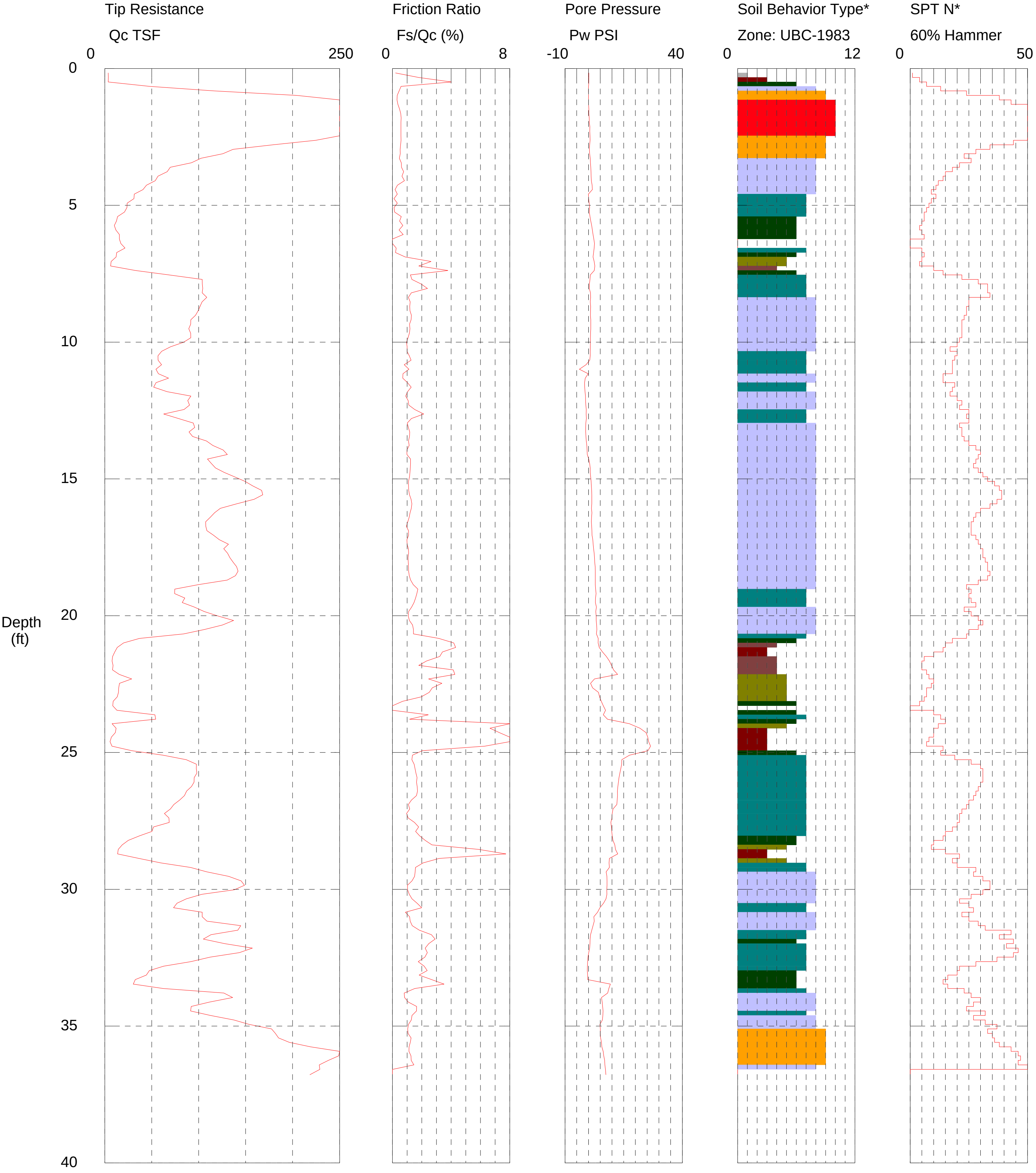
OIL INDICATORS	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
					No samples collected; drilled to targeted depth of 20 ft bgs and began sample collection.
				SP	Black, moist, poorly-graded SAND, medium-coarse, reddish-white flecks present in sample.
				SW-SP	Black, moist, poorly-graded SAND with gravel, coarse. 20-25% gravel present in sample. Reddish-white flecks present in sample.
					Grades to < 10% gravel content.
					Bottom of Excavation: 40.0 FT BGS

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System, modified from ASTM D2488
= denotes groundwater table

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-5
Cone Used: DSG1029

CPT Date/Time: 9/24/2008 11:33:12 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 36.78 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

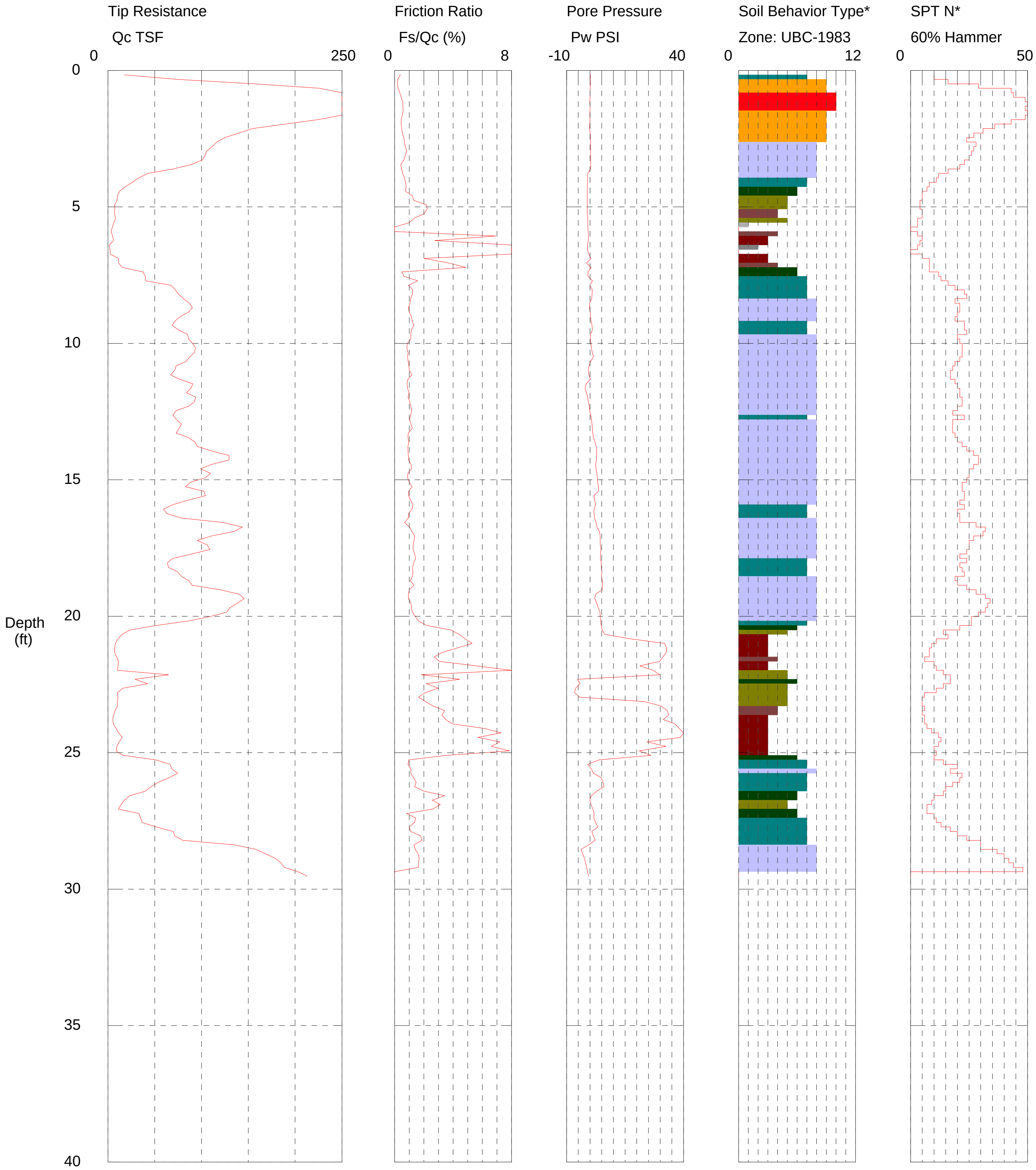
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-6
Cone Used: DSG1029

CPT Date/Time: 9/24/2008 10:13:33 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 29.53 feet

Depth Increment = 0.164 feet

- ■ 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- ■ 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

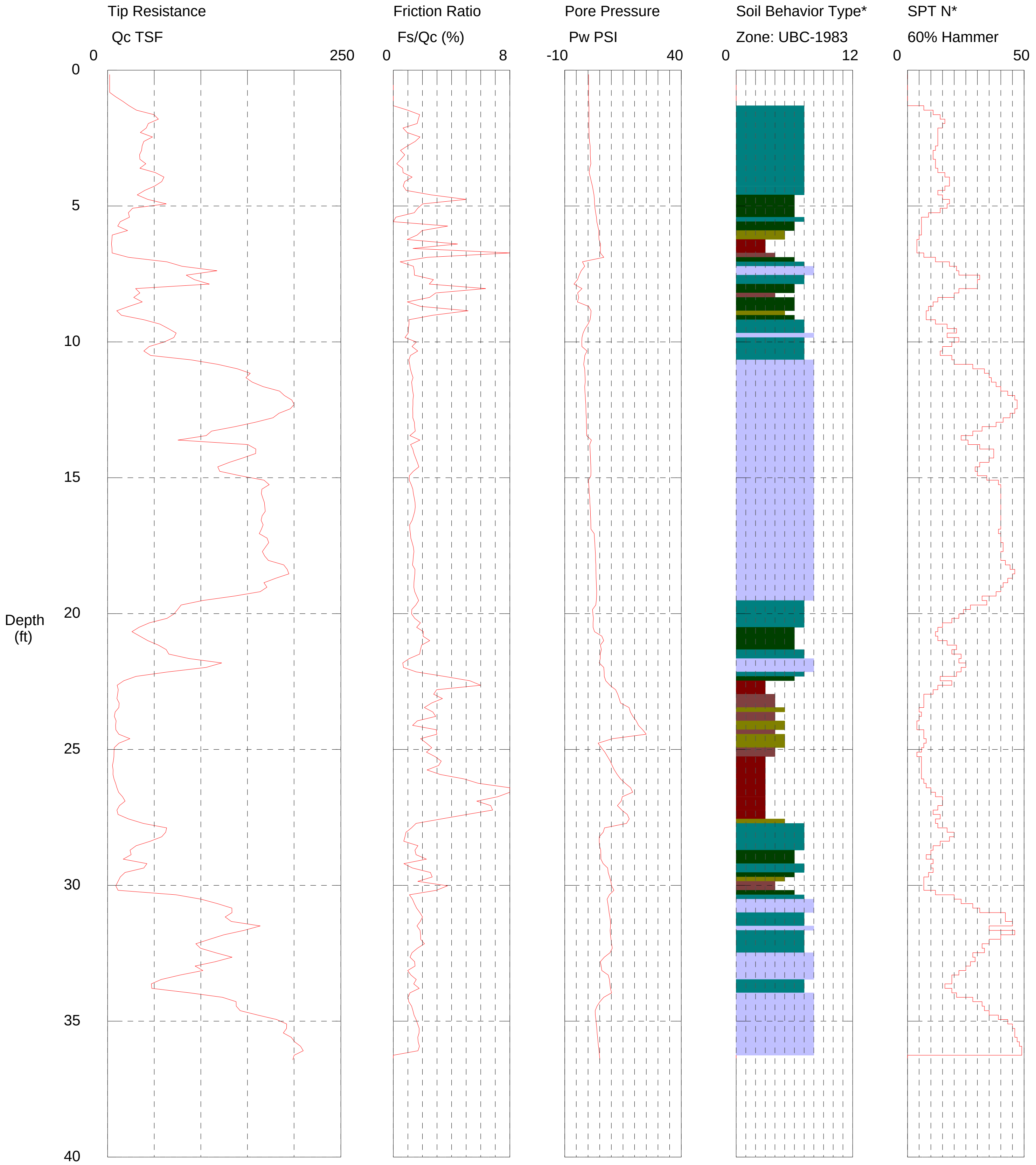
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-7
Cone Used: DSG1029

CPT Date/Time: 9/23/2008 3:36:41 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 36.42 feet

Depth Increment = 0.164 feet

⬜ 1 sensitive fine grained
⬛ 2 organic material
🟥 3 clay

🟫 4 silty clay to clay
🟨 5 clayey silt to silty clay
🟩 6 sandy silt to clayey silt

🟦 7 silty sand to sandy silt
🟪 8 sand to silty sand
🟧 9 sand

🟥 10 gravelly sand to sand
🟪 11 very stiff fine grained (*)
🟦 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

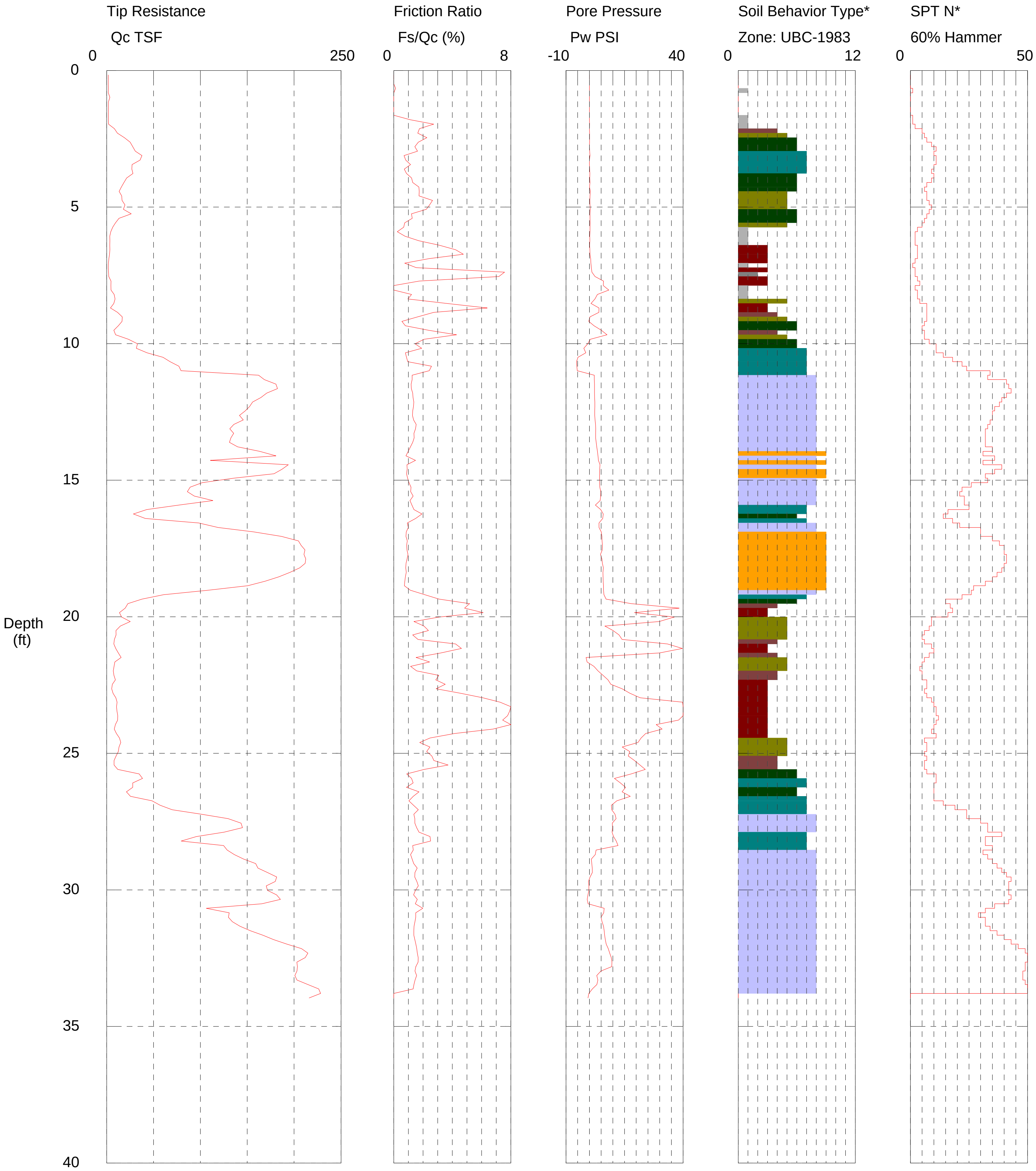
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-8
Cone Used: DSG1029

CPT Date/Time: 9/23/2008 1:57:28 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 33.96 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained	■ 4 silty clay to clay	■ 7 silty sand to sandy silt	■ 10 gravelly sand to sand
■ 2 organic material	■ 5 clayey silt to silty clay	■ 8 sand to silty sand	■ 11 very stiff fine grained (*)
■ 3 clay	■ 6 sandy silt to clayey silt	■ 9 sand	■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

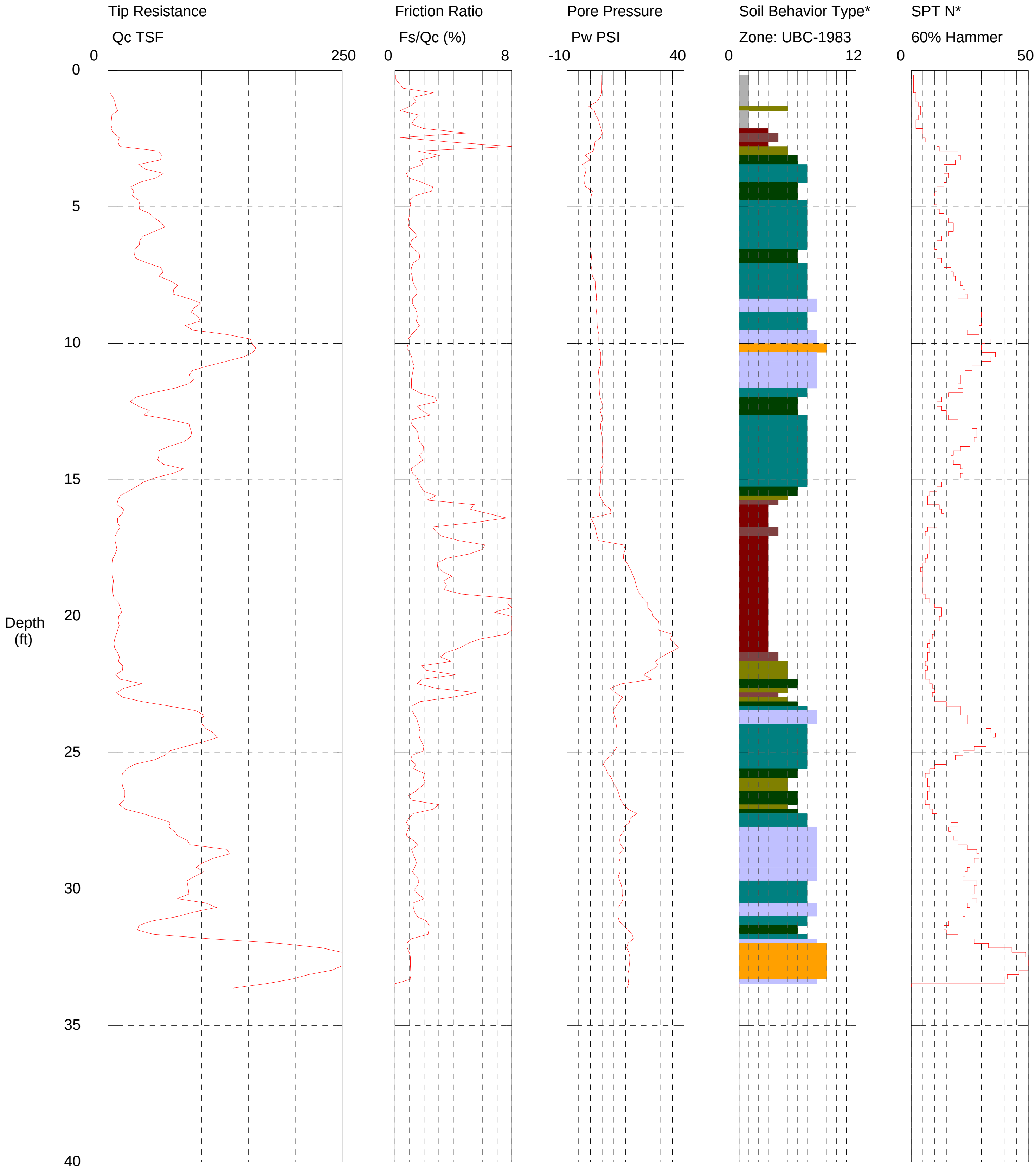
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-9
Cone Used: DSG1029

CPT Date/Time: 9/23/2008 12:22:12 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 33.63 feet

Depth Increment = 0.164 feet

- ■ 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- ■ 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

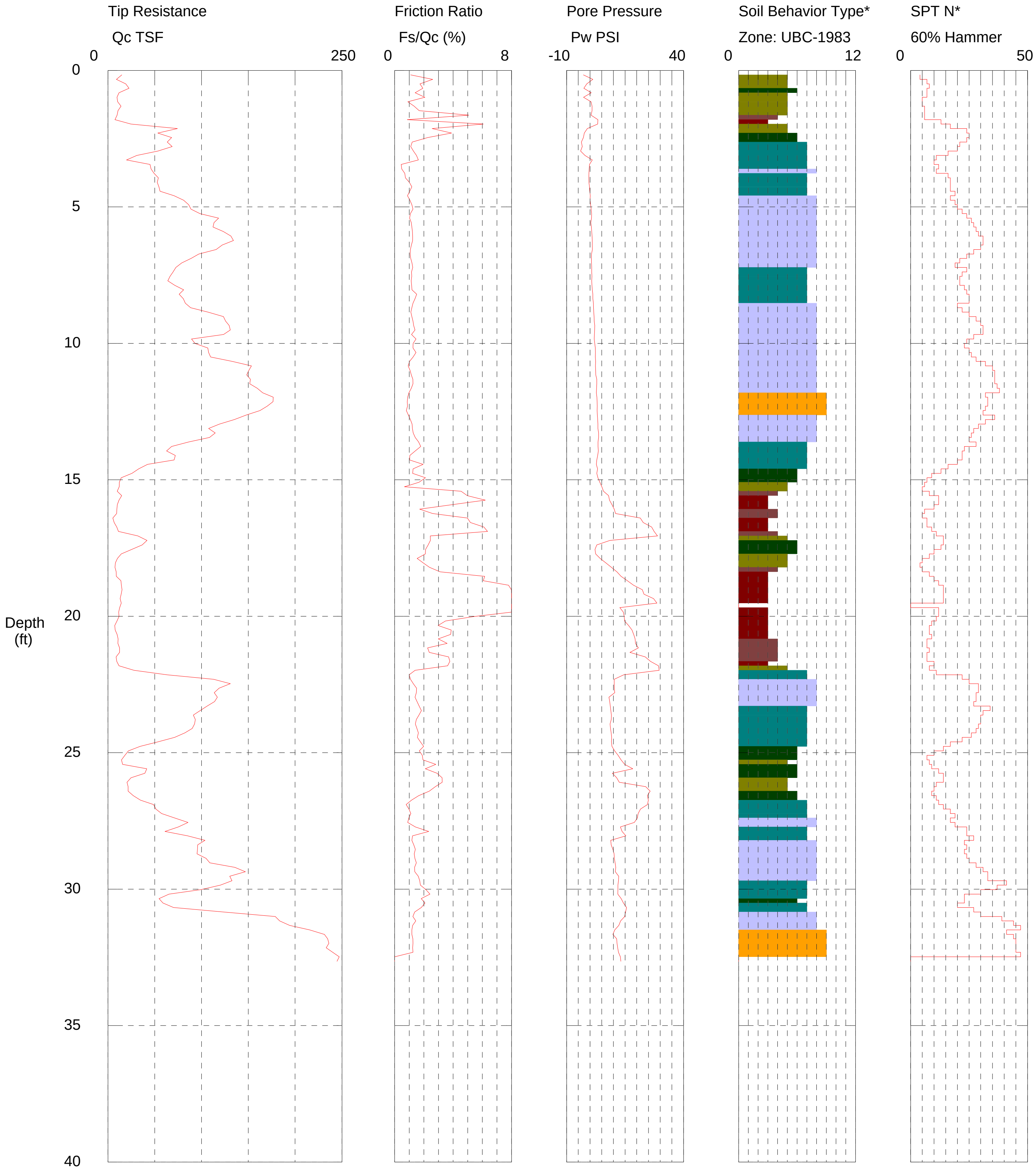
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-10a
Cone Used: DSG1029

CPT Date/Time: 9/23/2008 11:10:56 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 32.64 feet

Depth Increment = 0.164 feet

⬜ 1 sensitive fine grained
⬛ 2 organic material
🟥 3 clay
🟫 4 silty clay to clay
🟩 5 clayey silt to silty clay
🟩 6 sandy silt to clayey silt
🟦 7 silty sand to sandy silt
🟪 8 sand to silty sand
🟧 9 sand
🟥 10 gravelly sand to sand
🟦 11 very stiff fine grained (*)
🟦 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

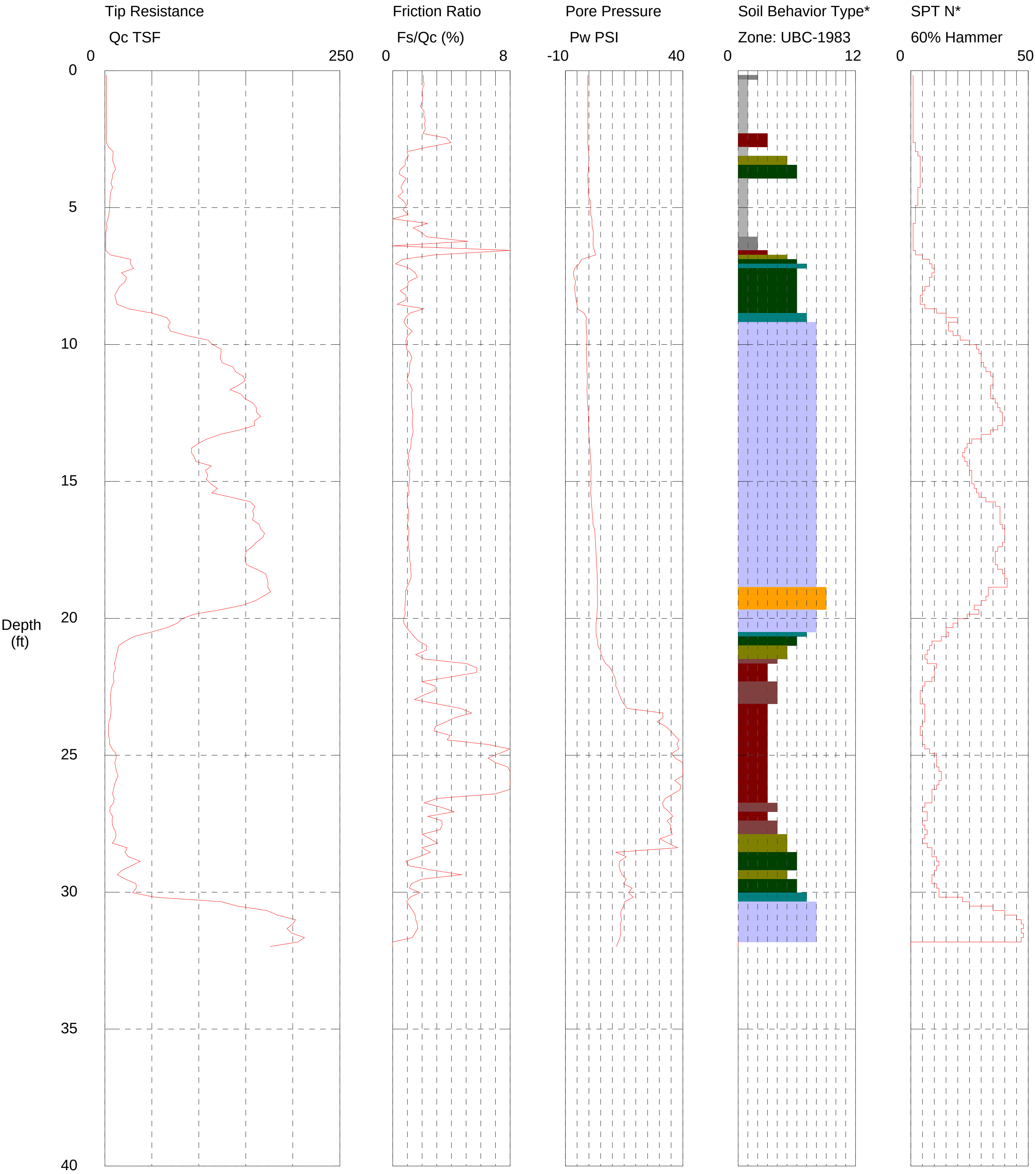
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-11
Cone Used: DSG1029

CPT Date/Time: 9/23/2008 10:09:22 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 31.99 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained	■ 4 silty clay to clay	■ 7 silty sand to sandy silt	🟥 10 gravelly sand to sand
■ 2 organic material	■ 5 clayey silt to silty clay	■ 8 sand to silty sand	■ 11 very stiff fine grained (*)
■ 3 clay	■ 6 sandy silt to clayey silt	🟧 9 sand	■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

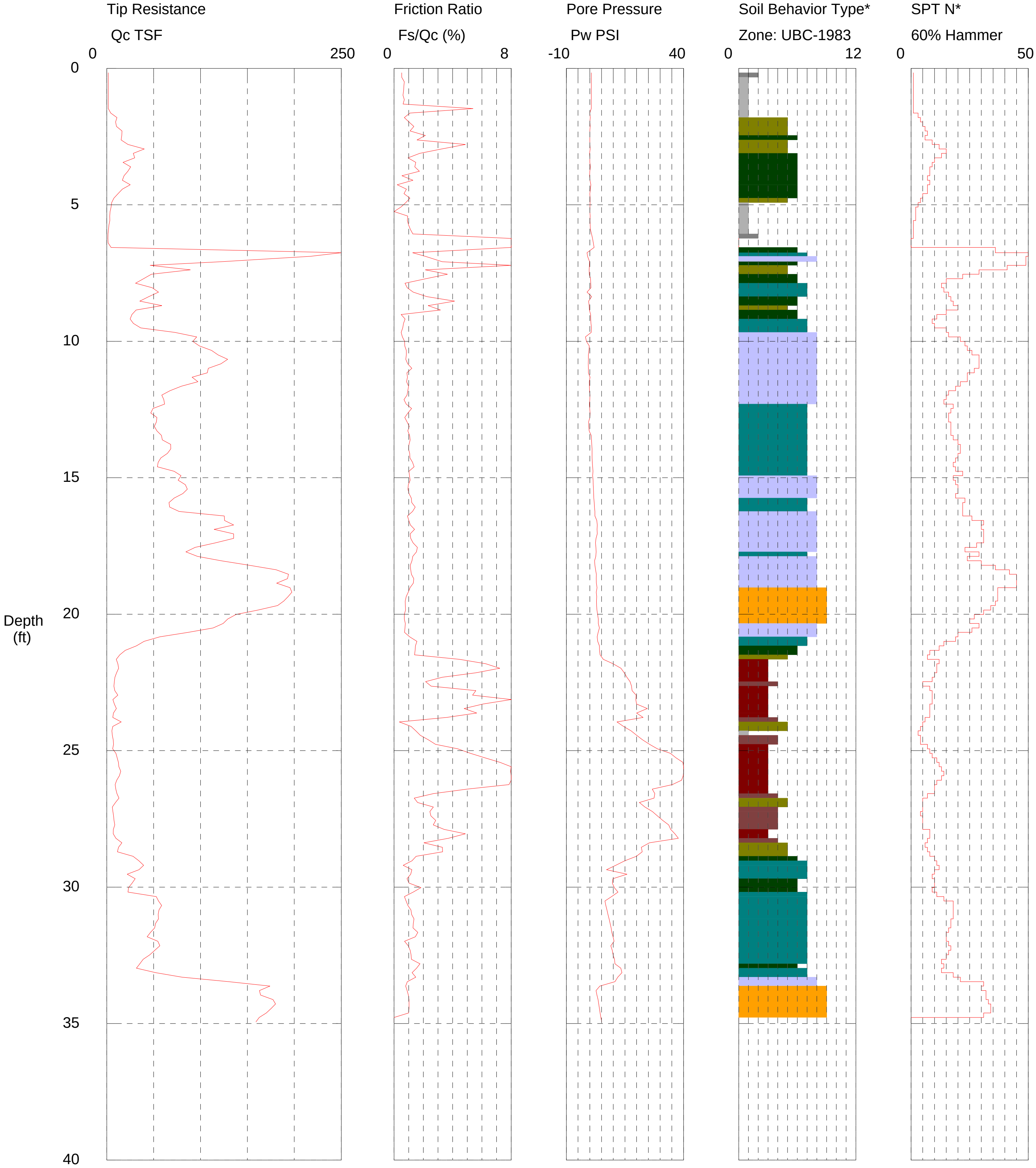
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-12
Cone Used: DSG1029

CPT Date/Time: 9/22/2008 12:42:12 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 34.94 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay

■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt

■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand

■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

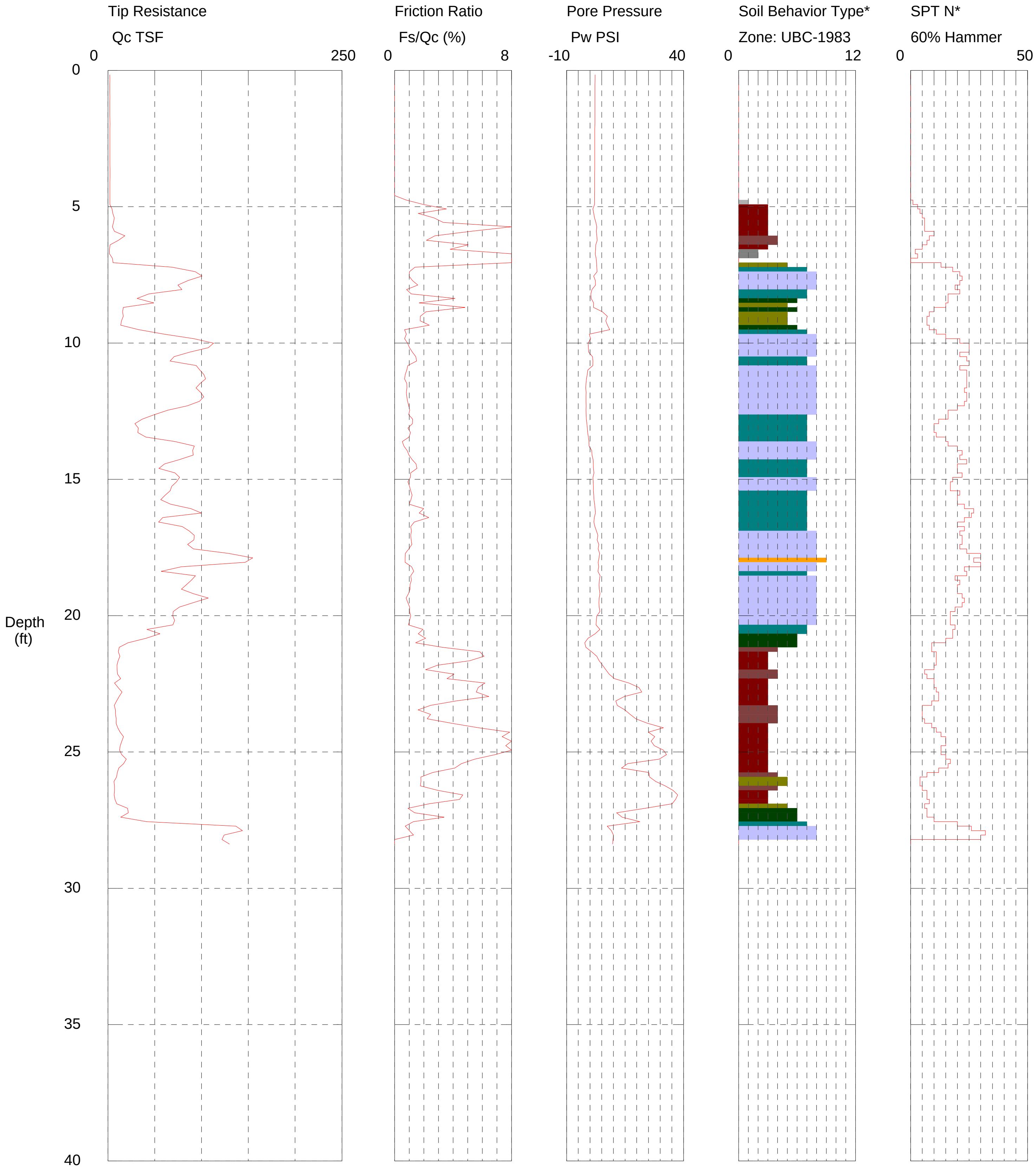
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-13
Cone Used: DSG1029

CPT Date/Time: 9/22/2008 2:01:18 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 28.38 feet

Depth Increment = 0.197 feet

▨ 1 sensitive fine grained
▨ 2 organic material
▨ 3 clay
▨ 4 silty clay to clay
▨ 5 clayey silt to silty clay
▨ 6 sandy silt to clayey silt
▨ 7 silty sand to sandy silt
▨ 8 sand to silty sand
▨ 9 sand
▨ 10 gravelly sand to sand
▨ 11 very stiff fine grained (*)
▨ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

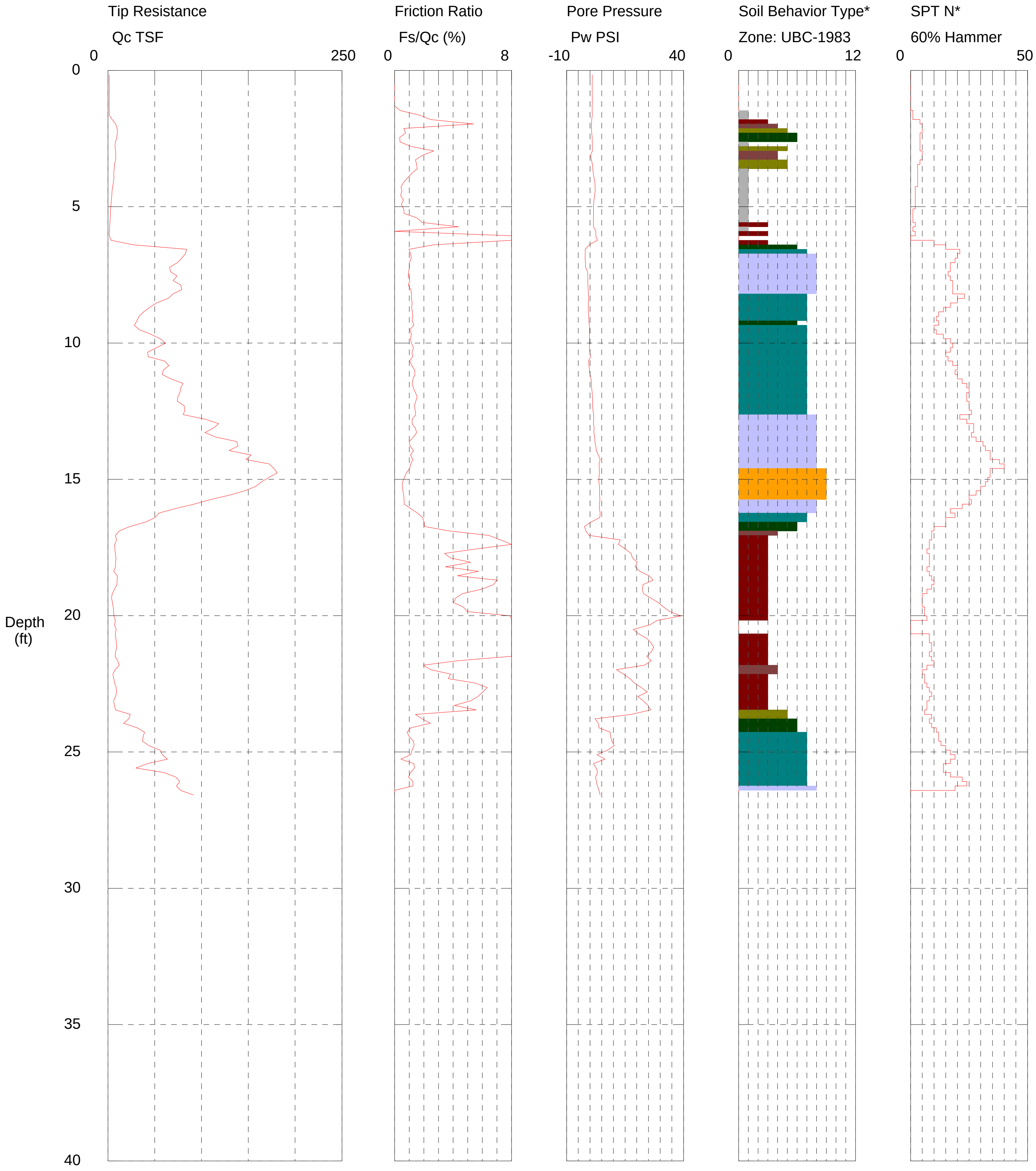
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-14
Cone Used: DSG1029

CPT Date/Time: 9/22/2008 2:51:35 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 26.57 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

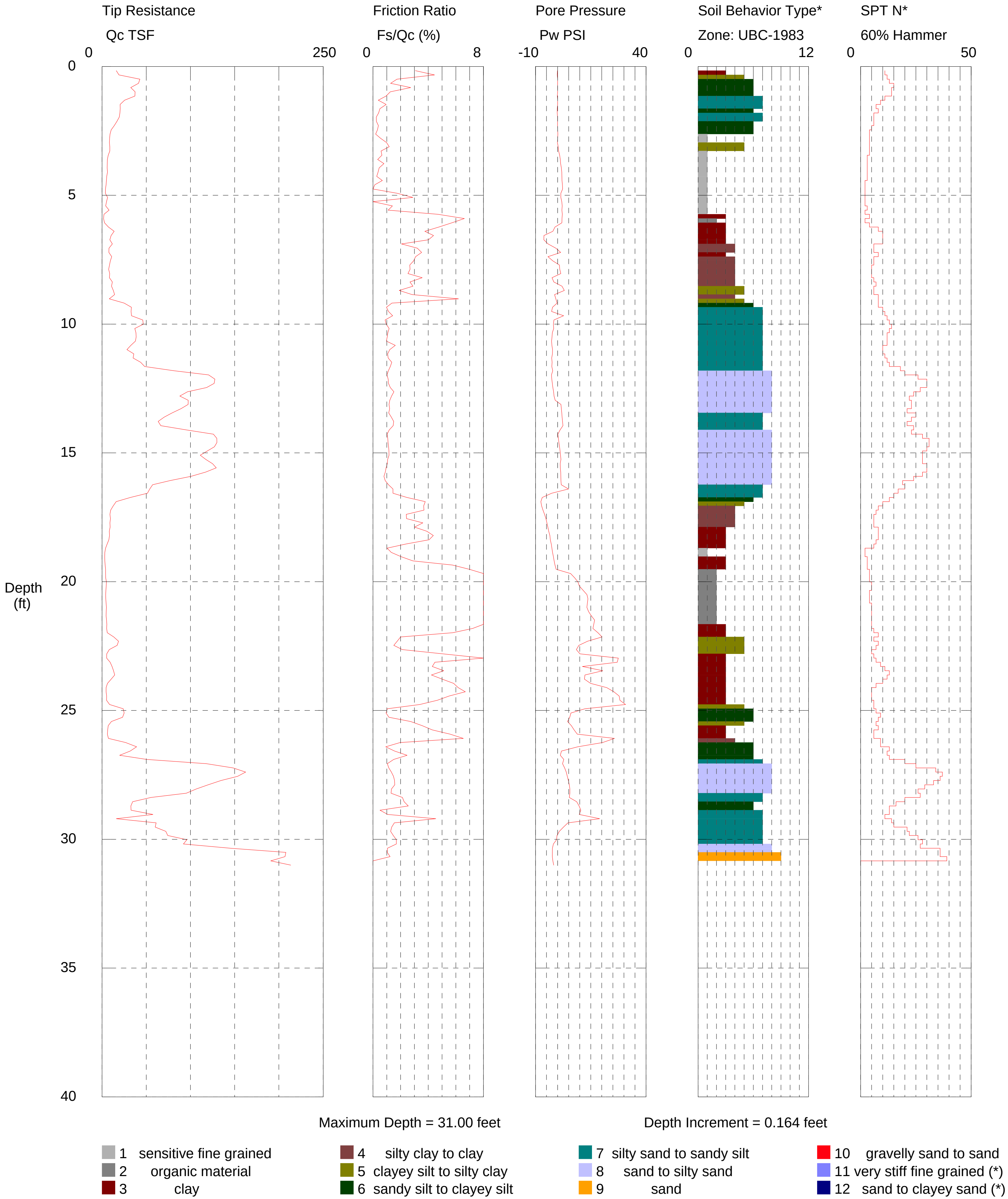
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-15
Cone Used: DSG1029

CPT Date/Time: 9/22/2008 3:43:06 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 31.00 feet

Depth Increment = 0.164 feet

Top 7 feet predrilled and then backfilled.

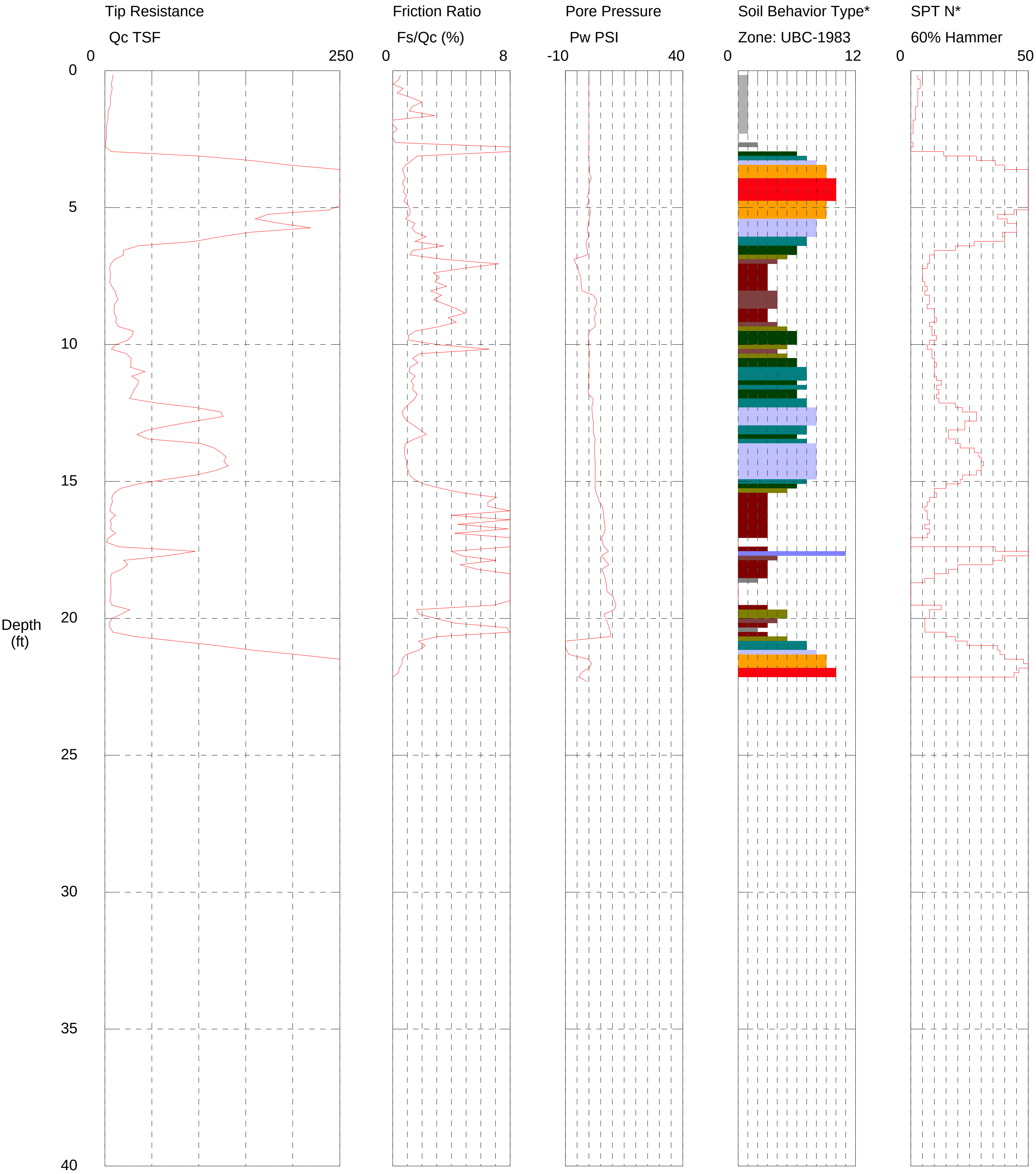
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-16
Cone Used: DSG1029

CPT Date/Time: 9/22/2008 4:22:30 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 22.31 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Top 4 feet predrilled and then backfilled.

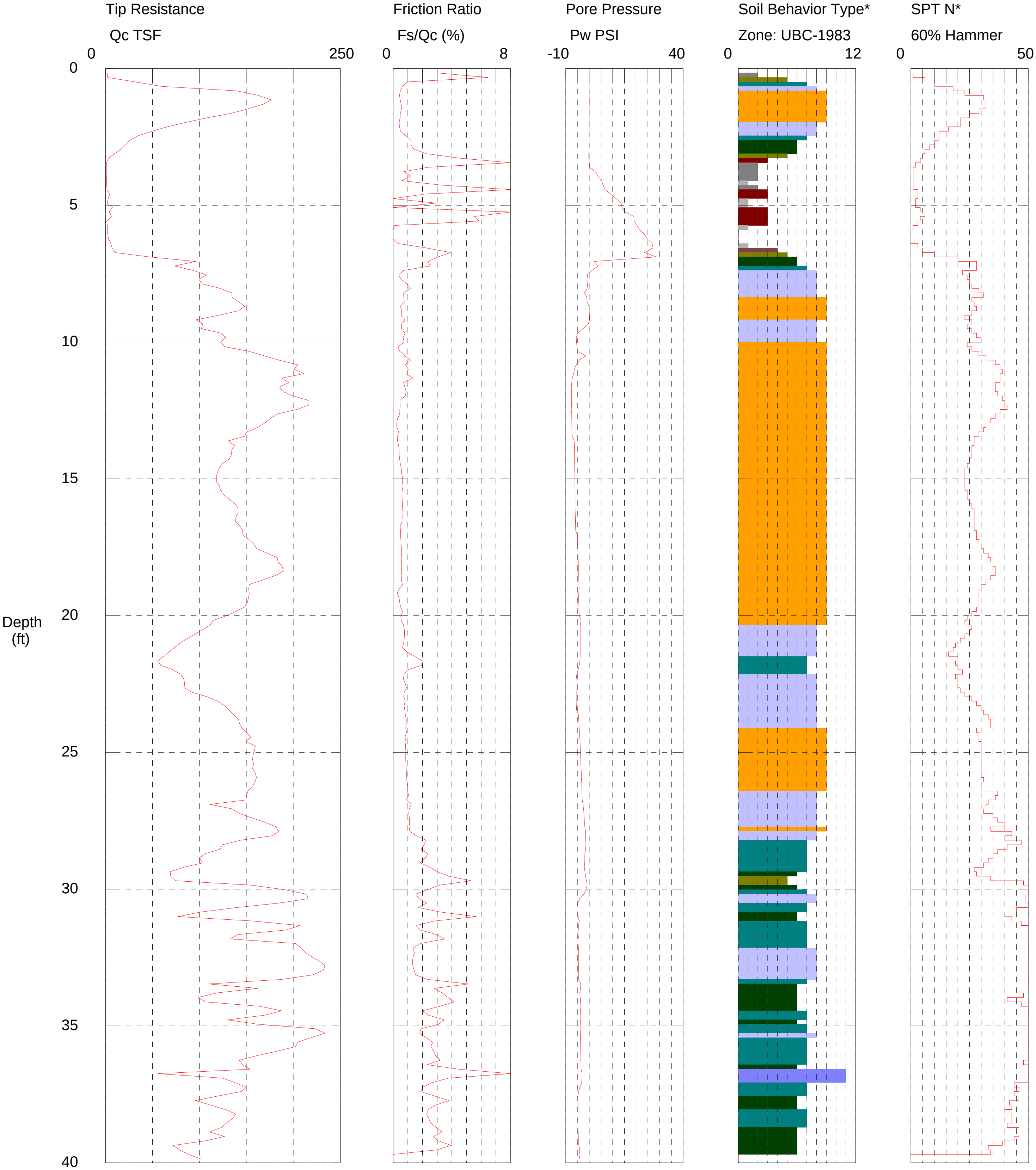
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-17
Cone Used: DSG1029

CPT Date/Time: 9/23/2008 9:13:07 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 39.86 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

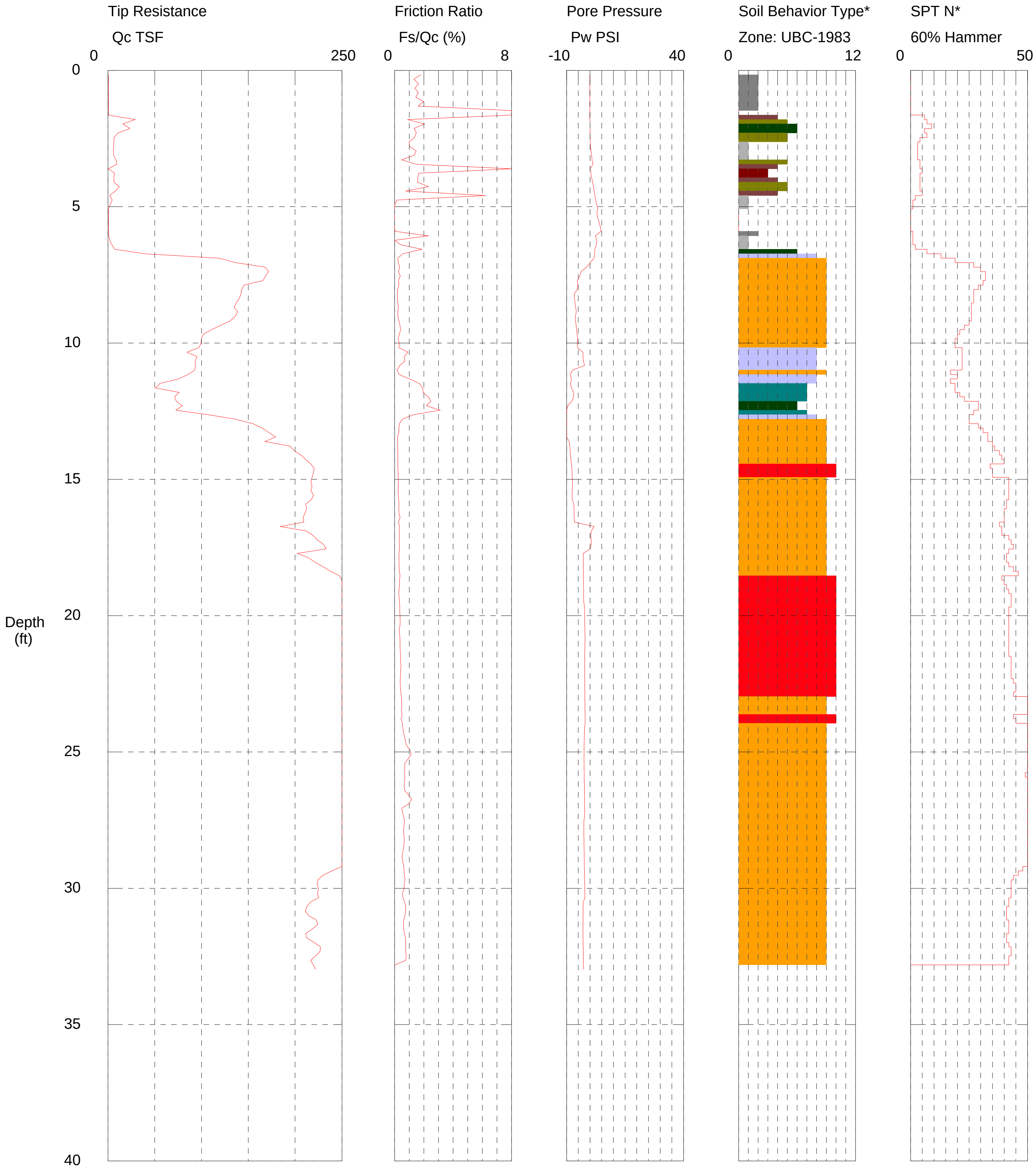
Top 7 feet predrilled and then backfilled.

In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown	CPT Date/Time: 9/25/2008 3:35:57 PM
Sounding: CPT-18	Location: B & L Wood Waste Site
Cone Used: DSG1015	Job Number: BL RIM 304



Maximum Depth = 32.97 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained	■ 4 silty clay to clay	■ 7 silty sand to sandy silt	■ 10 gravelly sand to sand
■ 2 organic material	■ 5 clayey silt to silty clay	■ 8 sand to silty sand	■ 11 very stiff fine grained (*)
■ 3 clay	■ 6 sandy silt to clayey silt	■ 9 sand	■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

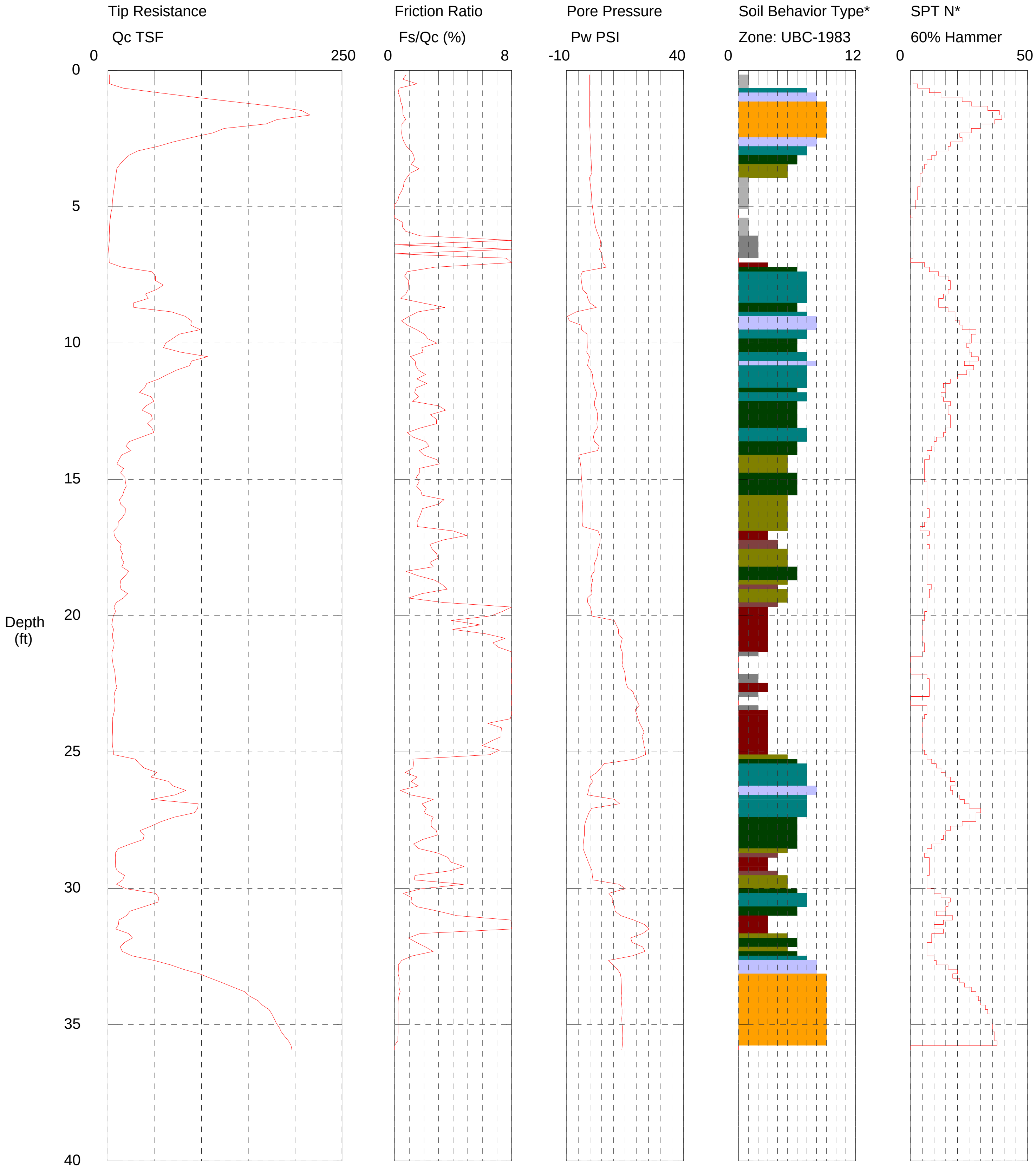
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-19
Cone Used: DSG1015

CPT Date/Time: 9/25/2008 2:02:20 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 35.93 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

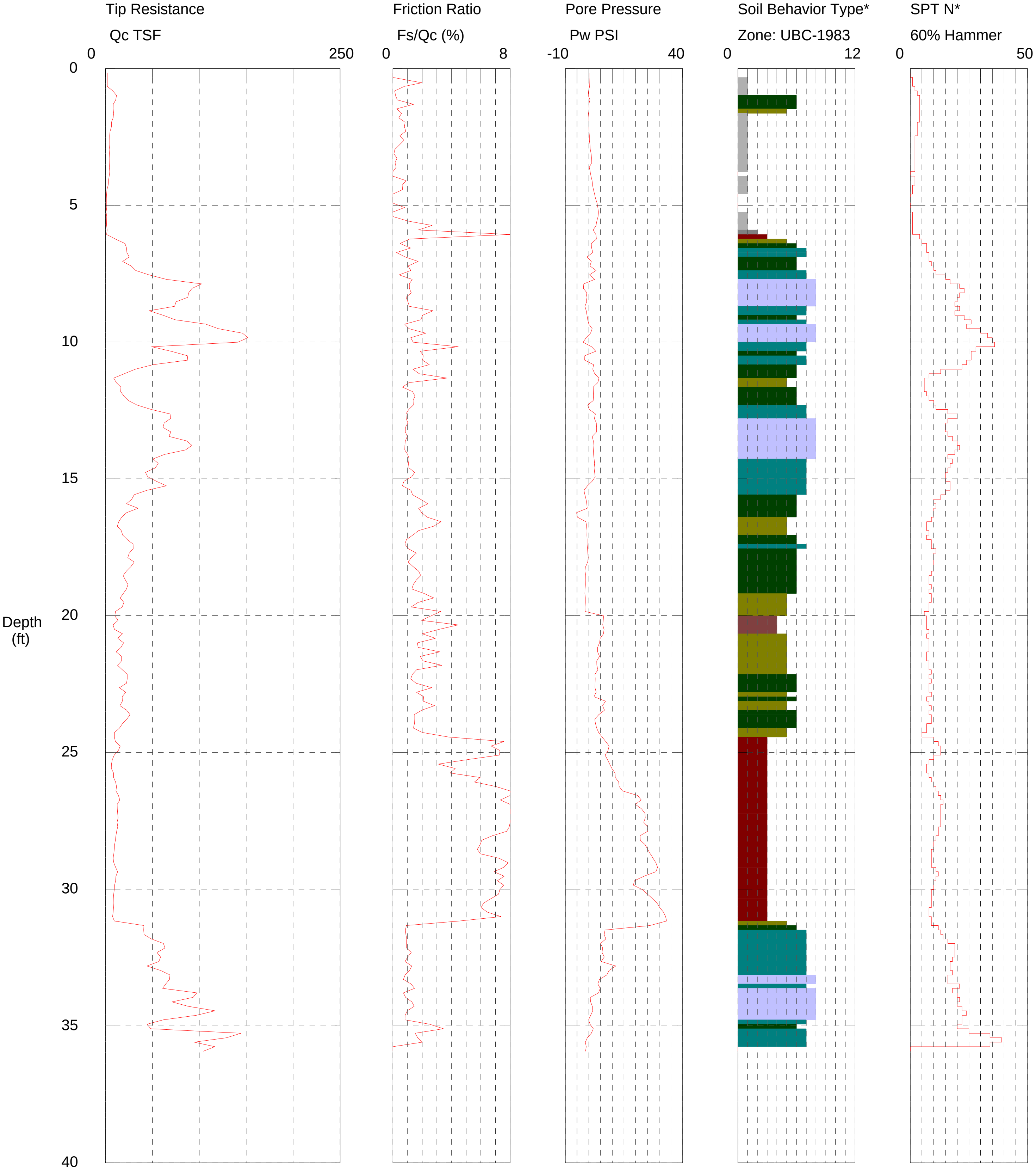
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-20
Cone Used: DSG1015

CPT Date/Time: 9/25/2008 1:20:25 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 35.93 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained	■ 4 silty clay to clay	■ 7 silty sand to sandy silt	■ 10 gravelly sand to sand
■ 2 organic material	■ 5 clayey silt to silty clay	■ 8 sand to silty sand	■ 11 very stiff fine grained (*)
■ 3 clay	■ 6 sandy silt to clayey silt	■ 9 sand	■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

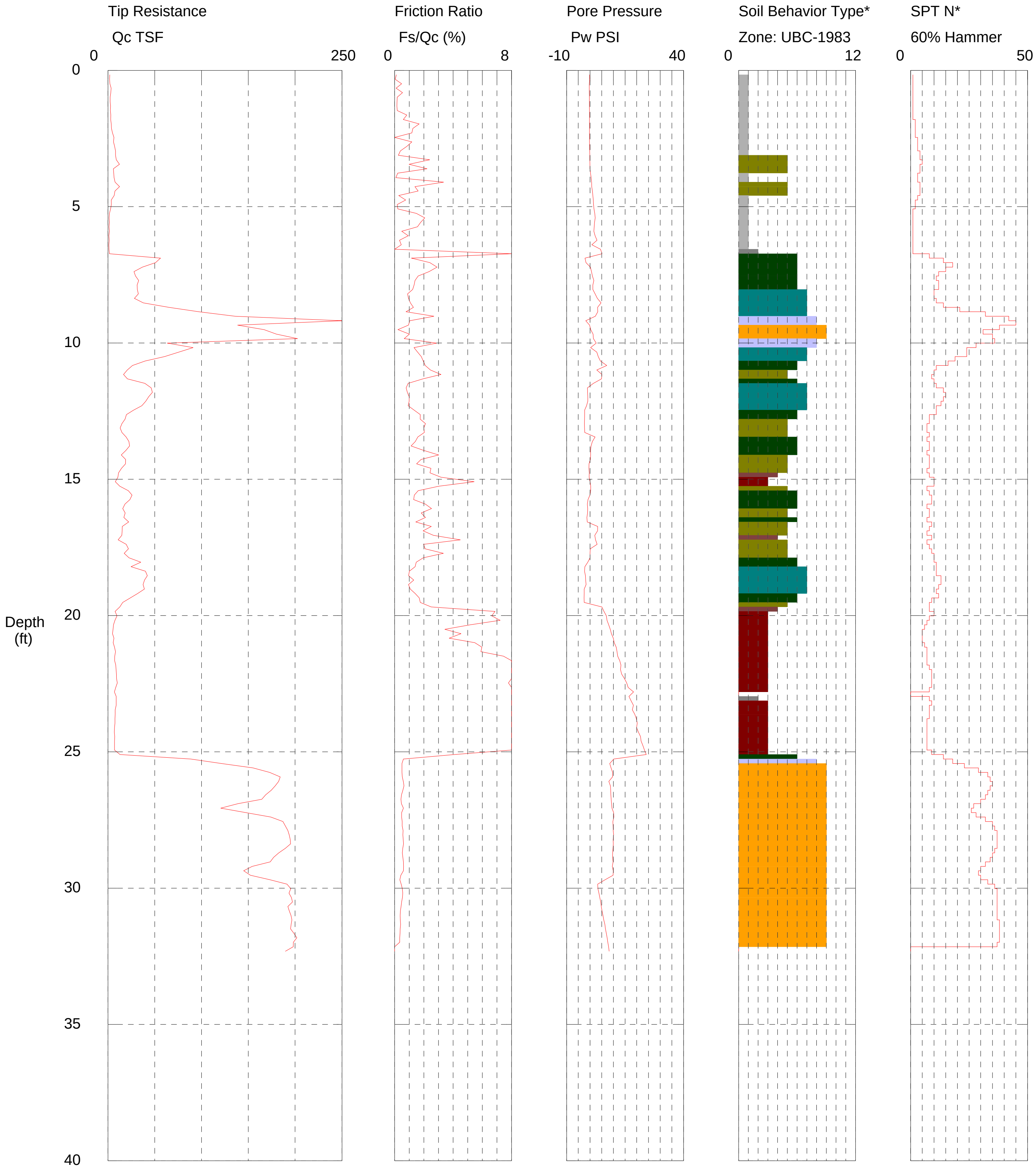
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-21
Cone Used: DSG1015

CPT Date/Time: 9/25/2008 12:21:09 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 32.32 feet

Depth Increment = 0.164 feet

- ▨ 1 sensitive fine grained
- ▨ 2 organic material
- ▨ 3 clay
- ▨ 4 silty clay to clay
- ▨ 5 clayey silt to silty clay
- ▨ 6 sandy silt to clayey silt
- ▨ 7 silty sand to sandy silt
- ▨ 8 sand to silty sand
- ▨ 9 sand
- ▨ 10 gravelly sand to sand
- ▨ 11 very stiff fine grained (*)
- ▨ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

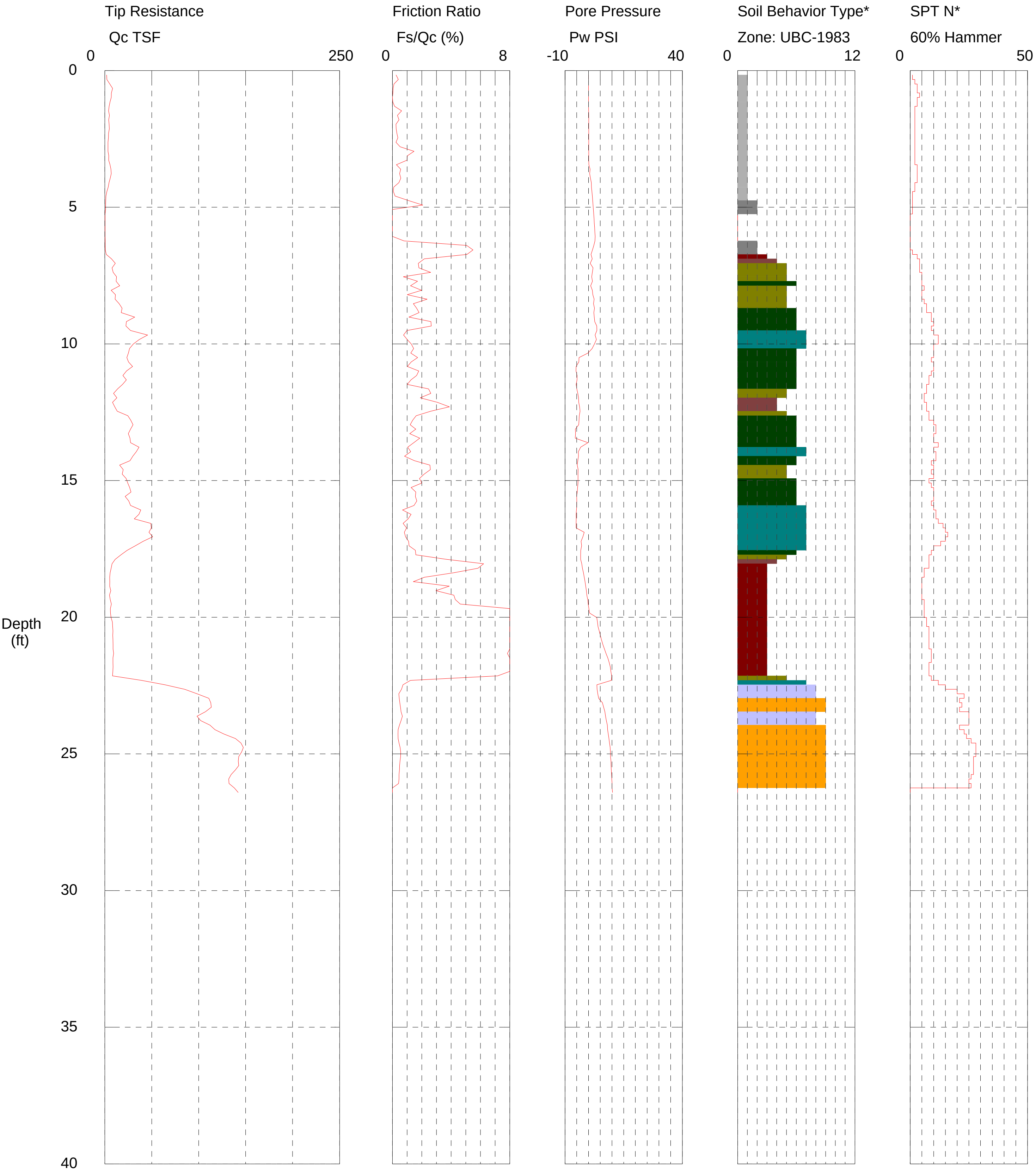
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-22
Cone Used: DSG1015

CPT Date/Time: 9/25/2008 11:57:09 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 26.41 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

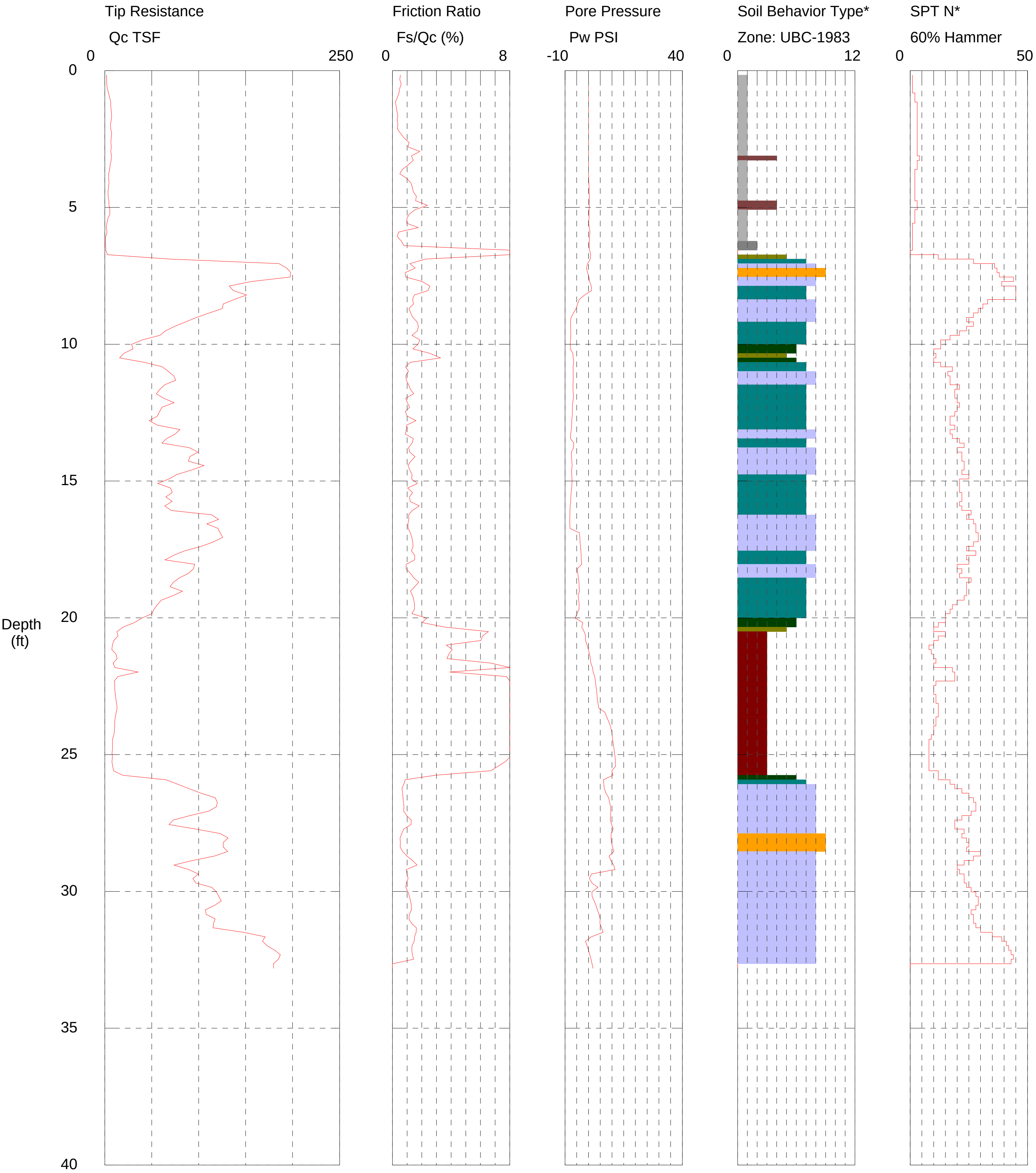
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-23
Cone Used: DSG1015

CPT Date/Time: 9/25/2008 10:58:02 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 32.81 feet

Depth Increment = 0.164 feet

- ⬜ 1 sensitive fine grained
- ⬛ 2 organic material
- 🟥 3 clay
- 🟫 4 silty clay to clay
- 🟨 5 clayey silt to silty clay
- 🟩 6 sandy silt to clayey silt
- 🟦 7 silty sand to sandy silt
- 🟪 8 sand to silty sand
- 🟧 9 sand
- 🟥 10 gravelly sand to sand
- 🟪 11 very stiff fine grained (*)
- 🟦 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

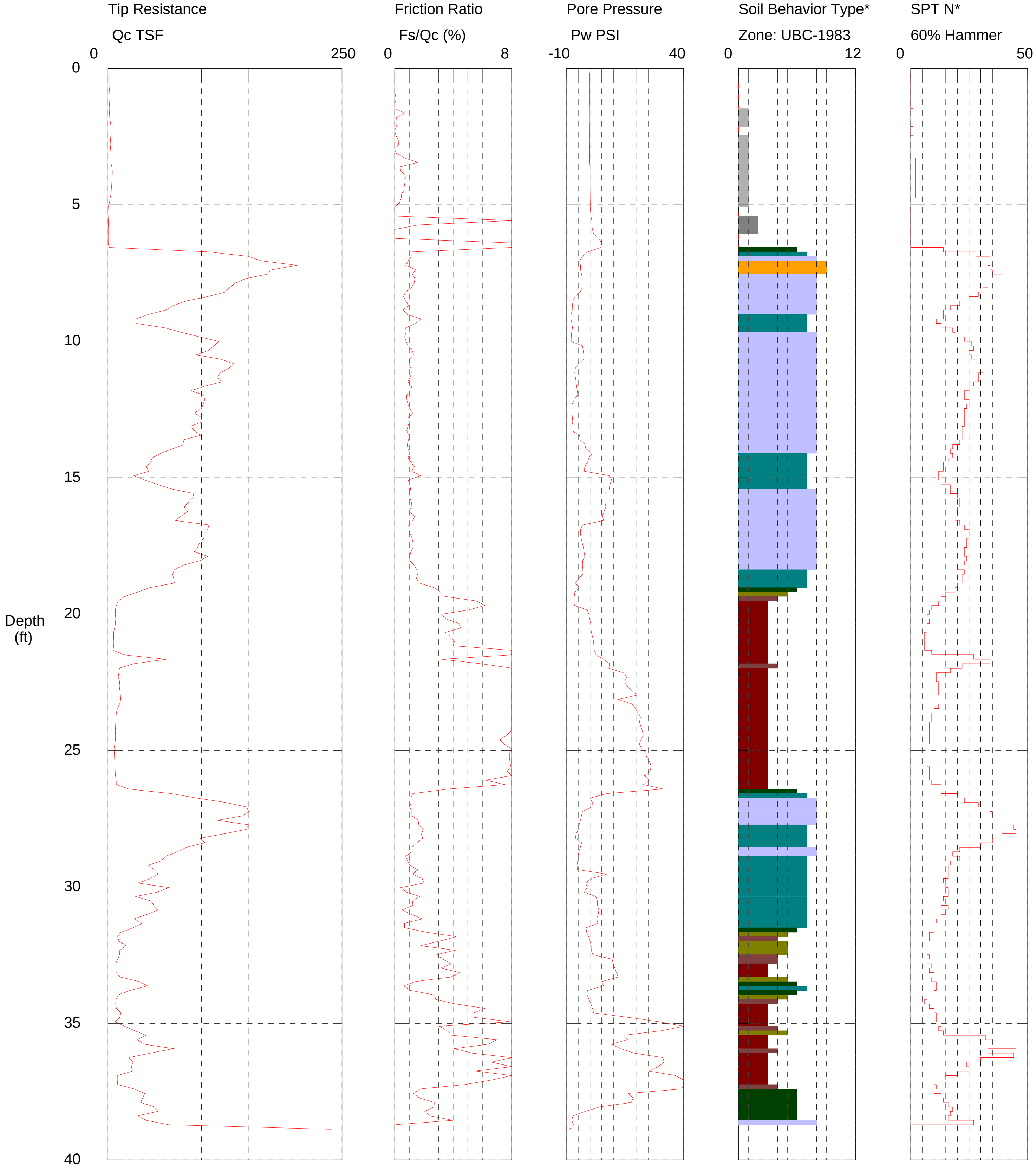
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-24
Cone Used: DSG1015

CPT Date/Time: 9/25/2008 10:10:12 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 38.88 feet

Depth Increment = 0.164 feet

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

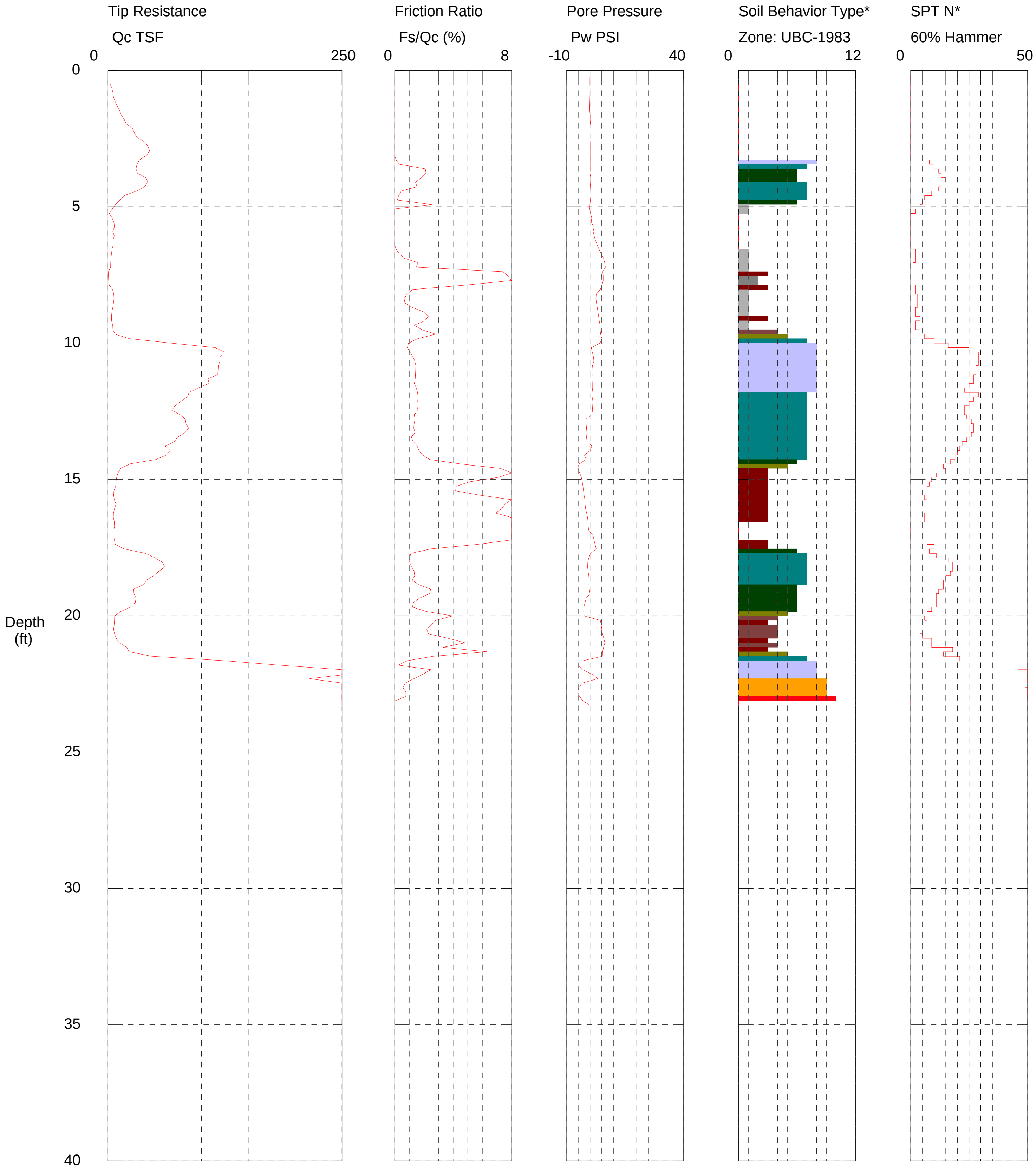
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-25
Cone Used: DSG1029

CPT Date/Time: 9/24/2008 5:37:24 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 23.29 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Top 10 feet predrilled and then backfilled.

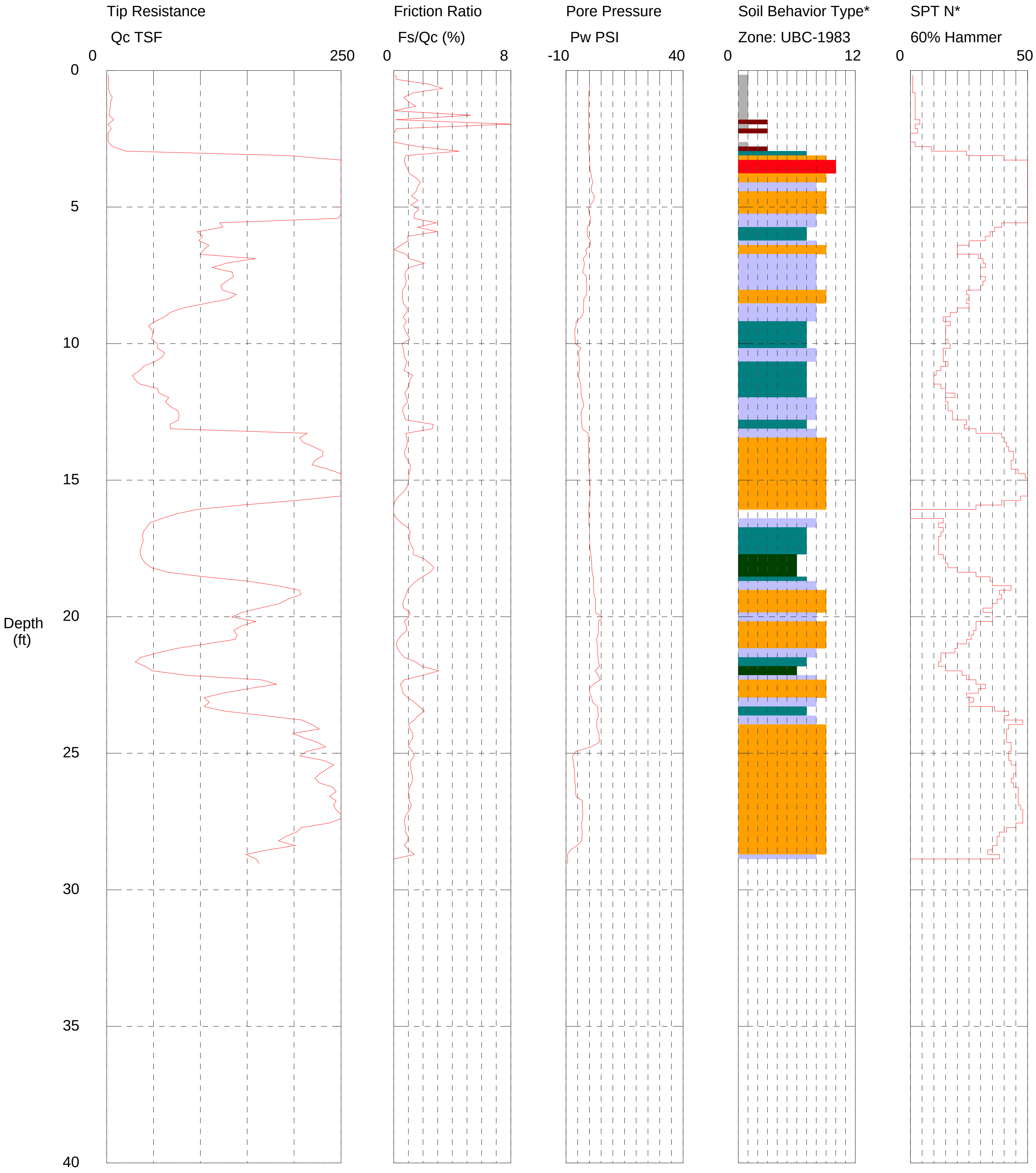
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-27
Cone Used: DSG1029

CPT Date/Time: 9/22/2008 11:16:15 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 29.04 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

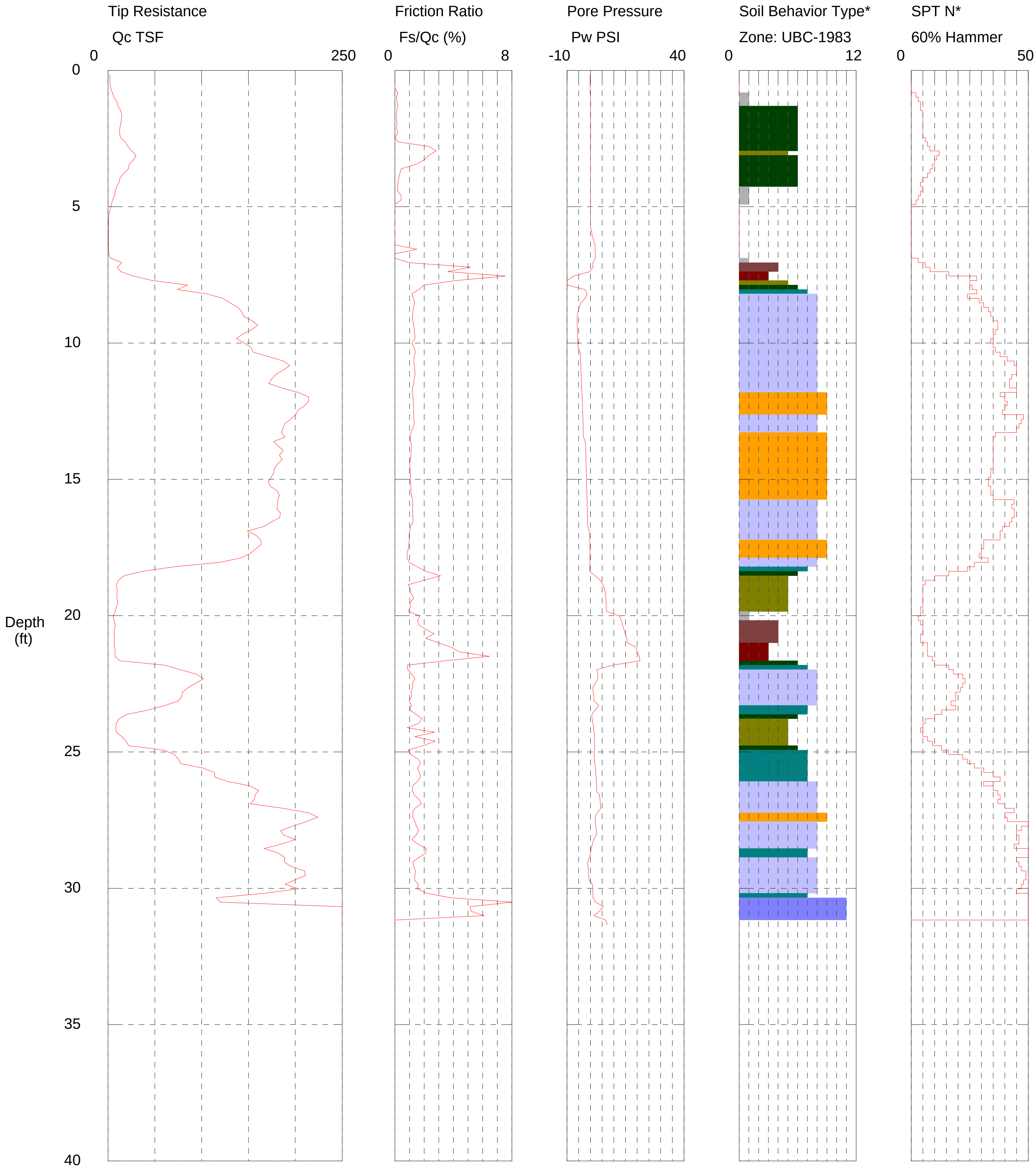
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-28
Cone Used: DSG1029

CPT Date/Time: 9/24/2008 2:39:15 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 31.33 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay

■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt

■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand

■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Top 7 feet predrilled and then backfilled.

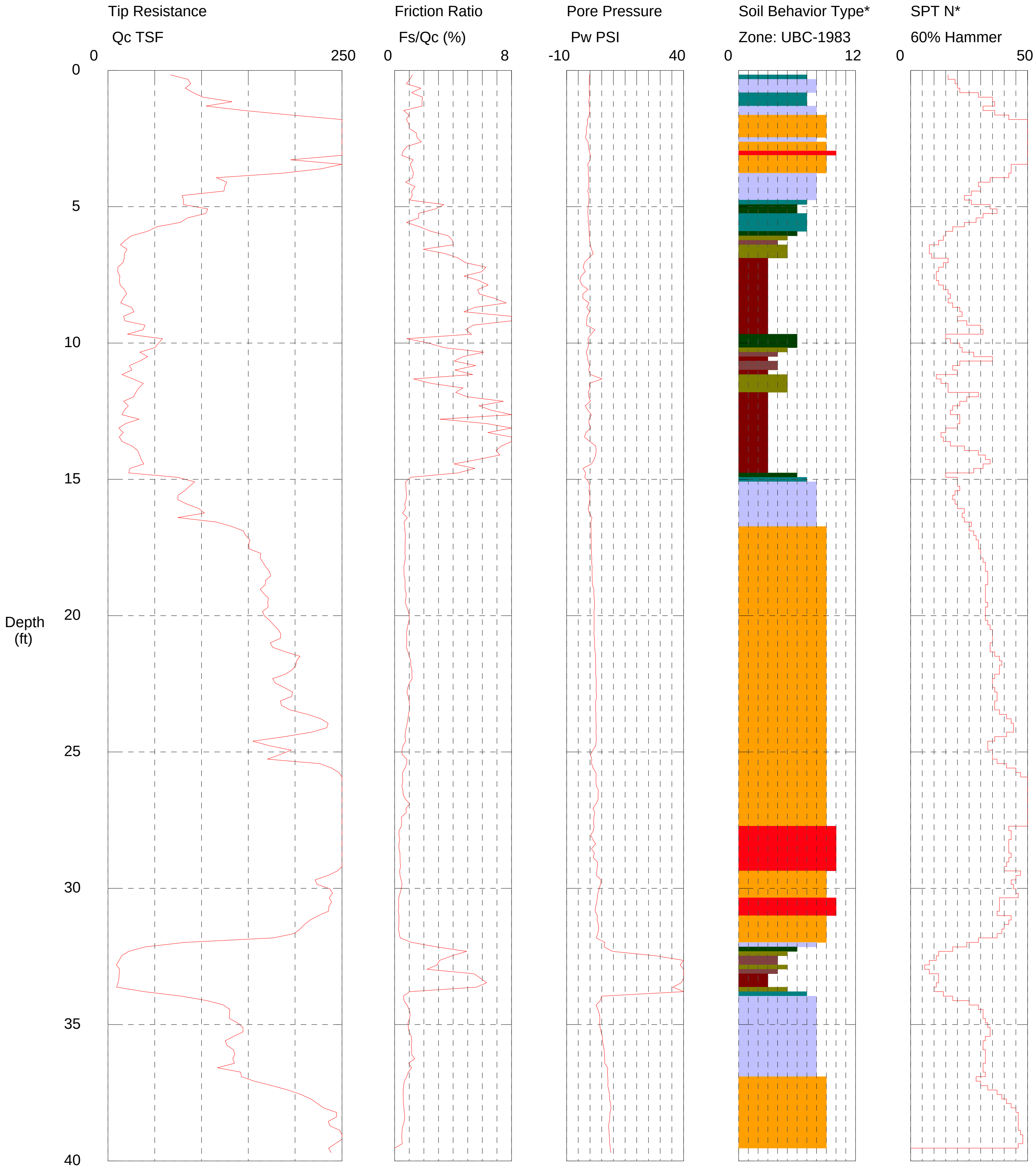
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-31
Cone Used: DSG1079

CPT Date/Time: 9/23/2008 12:10:56 PM
Location: B & L Wood Waste
Job Number: BL RIM 1306



Maximum Depth = 39.70 feet

Depth Increment = 0.164 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Test is through cap and waste pile.

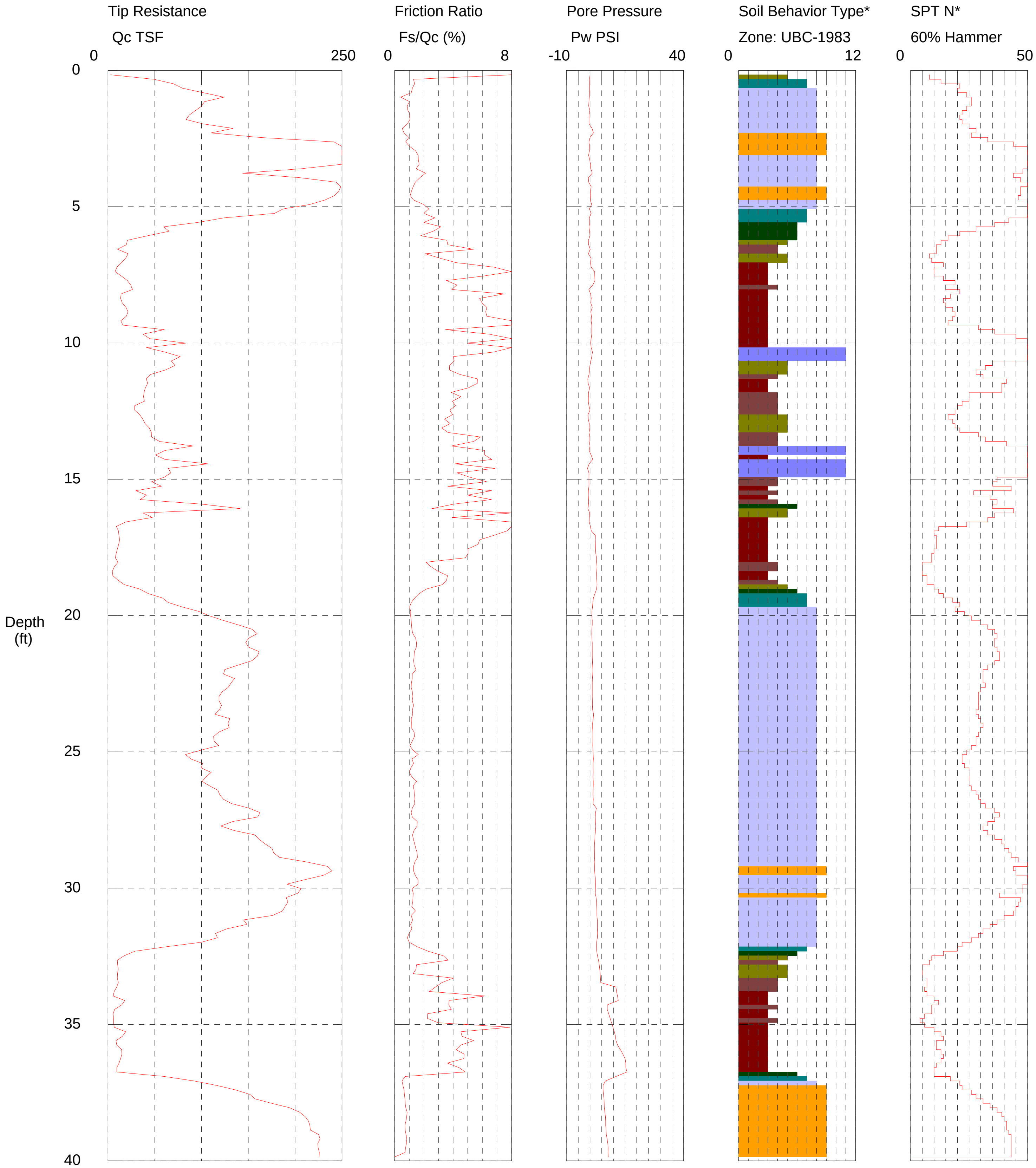
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-32
Cone Used: DSG1079

CPT Date/Time: 9/23/2008 1:16:31 PM
Location: B & L Wood Waste
Job Number: BL RIM 1306



Maximum Depth = 40.03 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
🟥 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Test is through cap and waste pile.

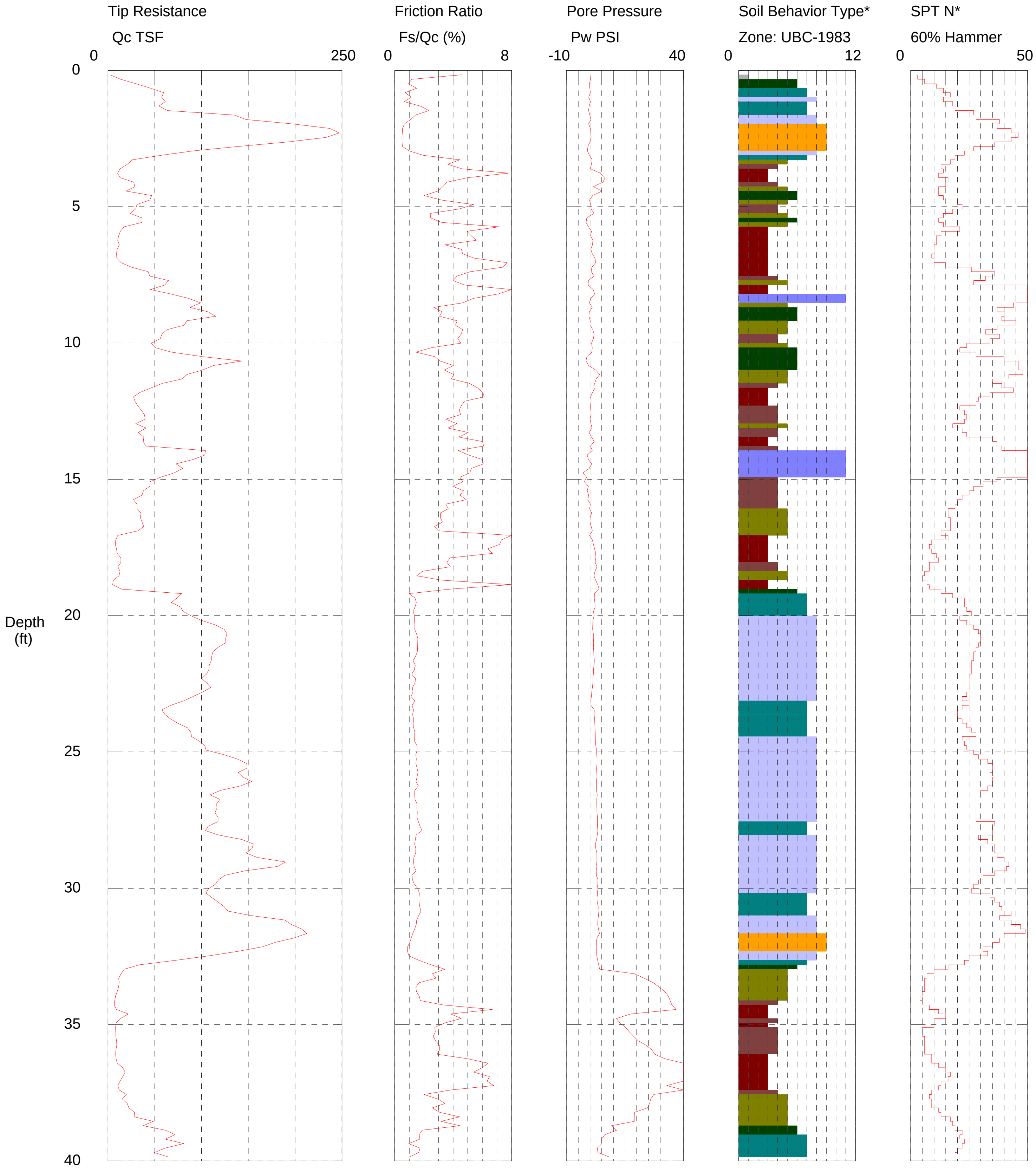
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-33
Cone Used: DSG1079

CPT Date/Time: 9/23/2008 2:33:00 PM
Location: B & L Wood Waste
Job Number: BL RIM 1306



Maximum Depth = 42.98 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay

■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt

■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand

■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Test is through cap and waste pile.

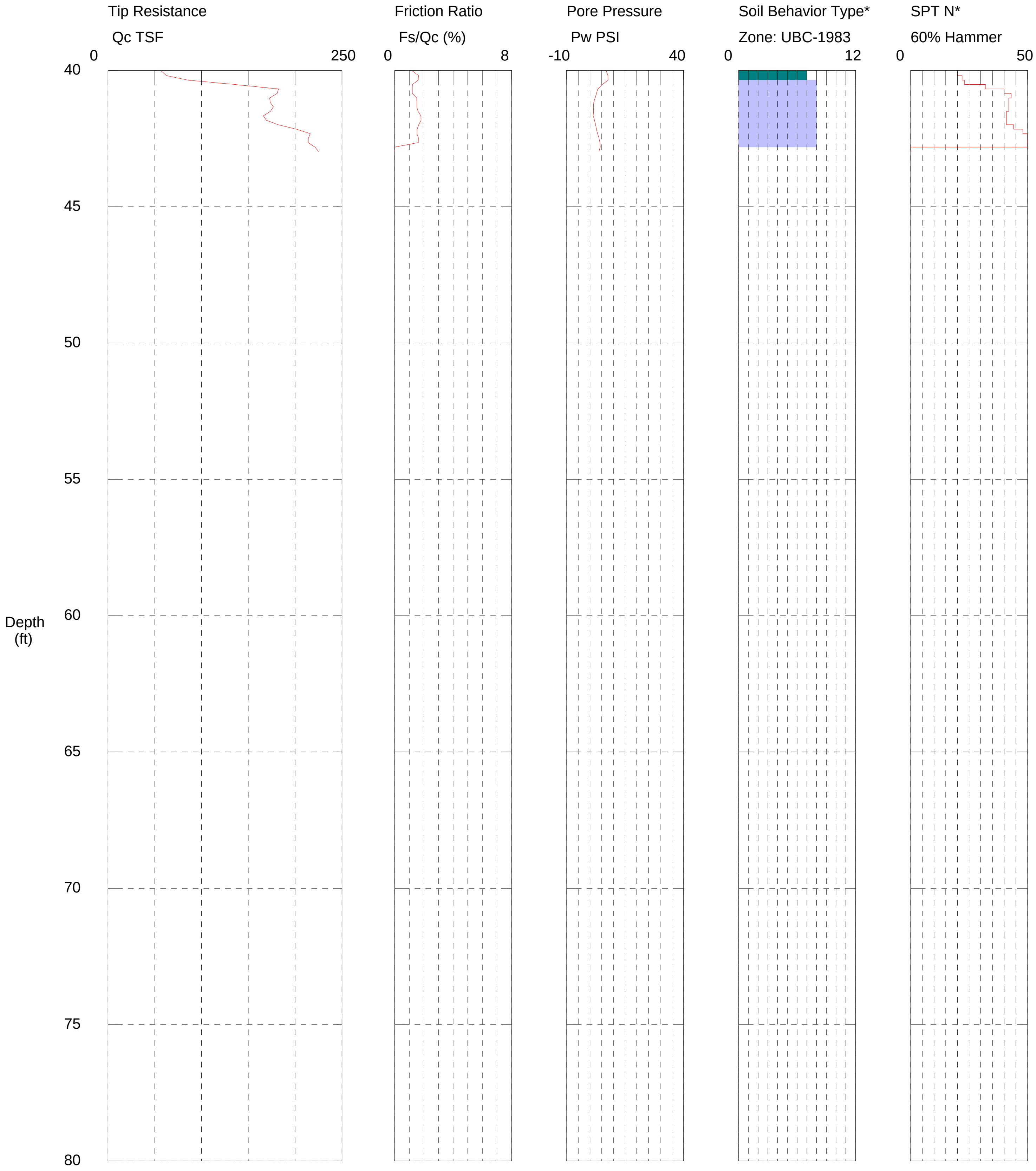
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-33
Cone Used: DSG1079

CPT Date/Time: 9/23/2008 2:33:00 PM
Location: B & L Wood Waste
Job Number: BL RIM 1306



Maximum Depth = 42.98 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Test is through cap and waste pile.

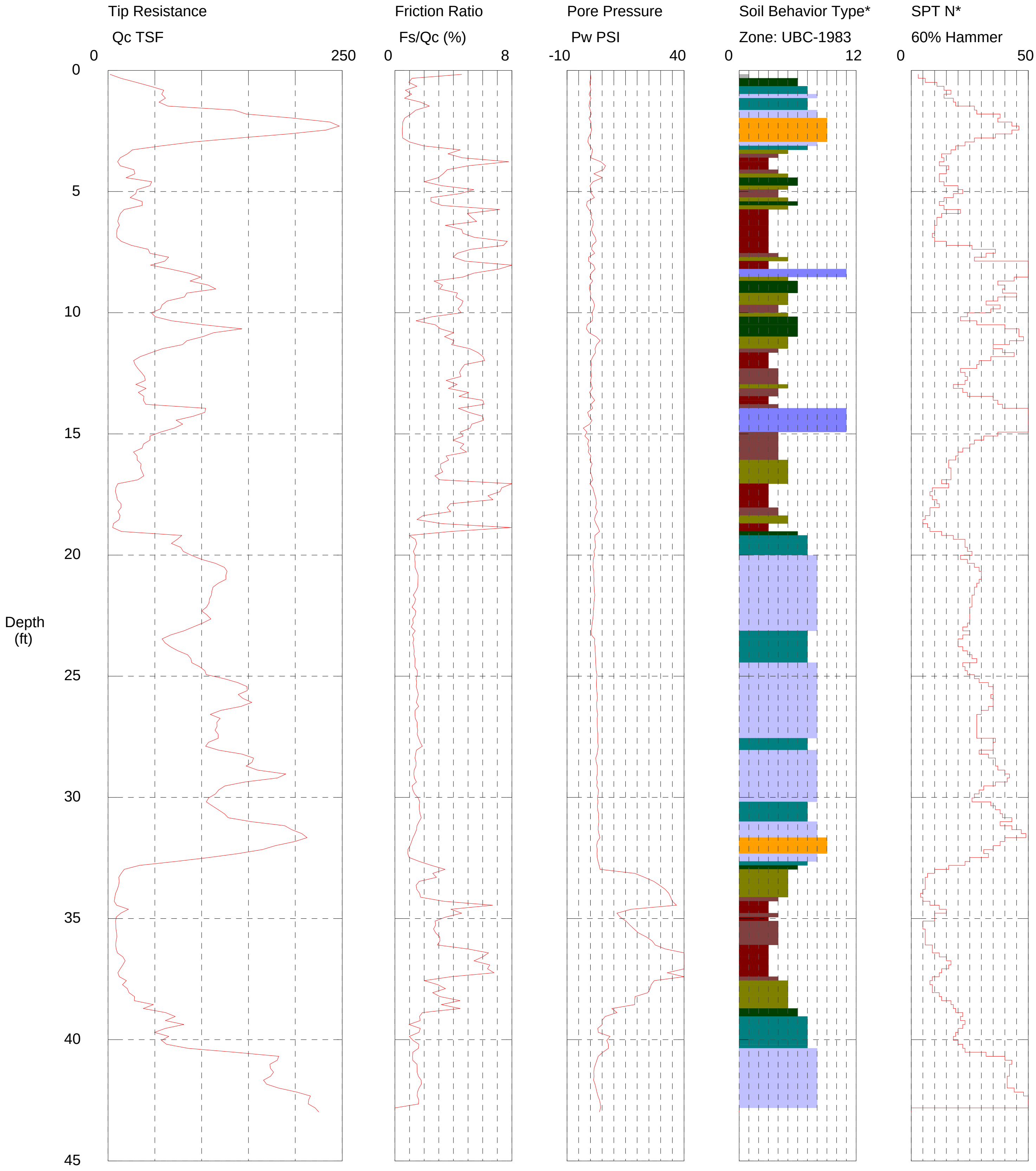
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-33
Cone Used: DSG1079

CPT Date/Time: 9/23/2008 2:33:00 PM
Location: B & L Wood Waste
Job Number: BL RIM 1306



Maximum Depth = 42.98 feet

Depth Increment = 0.164 feet

1	sensitive fine grained	4	silty clay to clay	7	silty sand to sandy silt	10	gravelly sand to sand
2	organic material	5	clayey silt to silty clay	8	sand to silty sand	11	very stiff fine grained (*)
3	clay	6	sandy silt to clayey silt	9	sand	12	sand to clayey sand (*)

Test is through cap and waste pile.

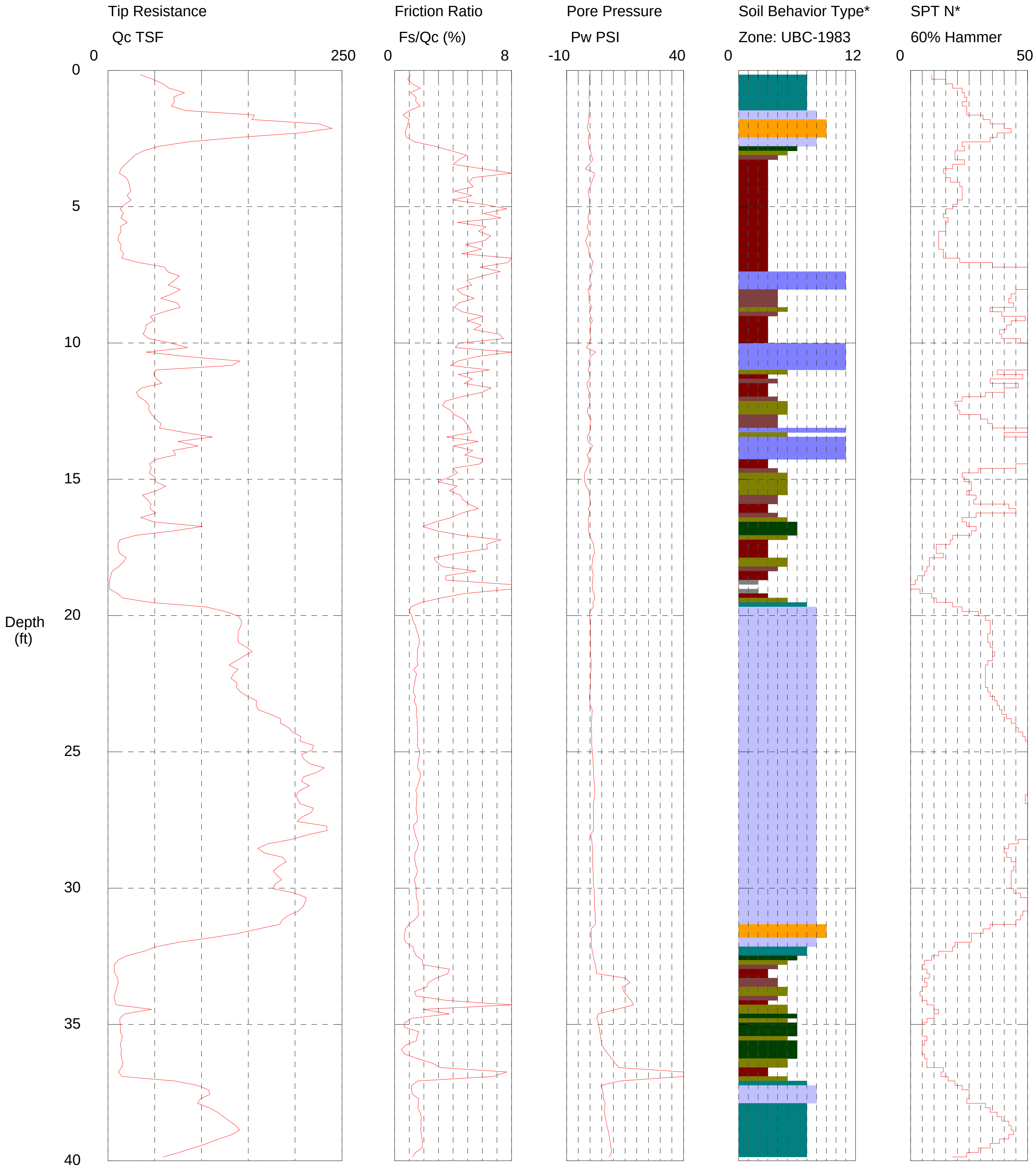
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-34
Cone Used: DSG1079

CPT Date/Time: 9/23/2008 3:14:50 PM
Location: B & L Wood Waste
Job Number: BL RIM 1306



Maximum Depth = 46.42 feet

Depth Increment = 0.164 feet

⬜ 1 sensitive fine grained
⬛ 2 organic material
🟥 3 clay

🟫 4 silty clay to clay
🟩 5 clayey silt to silty clay
🟩 6 sandy silt to clayey silt

🟦 7 silty sand to sandy silt
🟪 8 sand to silty sand
🟧 9 sand

🟥 10 gravelly sand to sand
🟦 11 very stiff fine grained (*)
🟦 12 sand to clayey sand (*)

Test is through cap and waste pile.

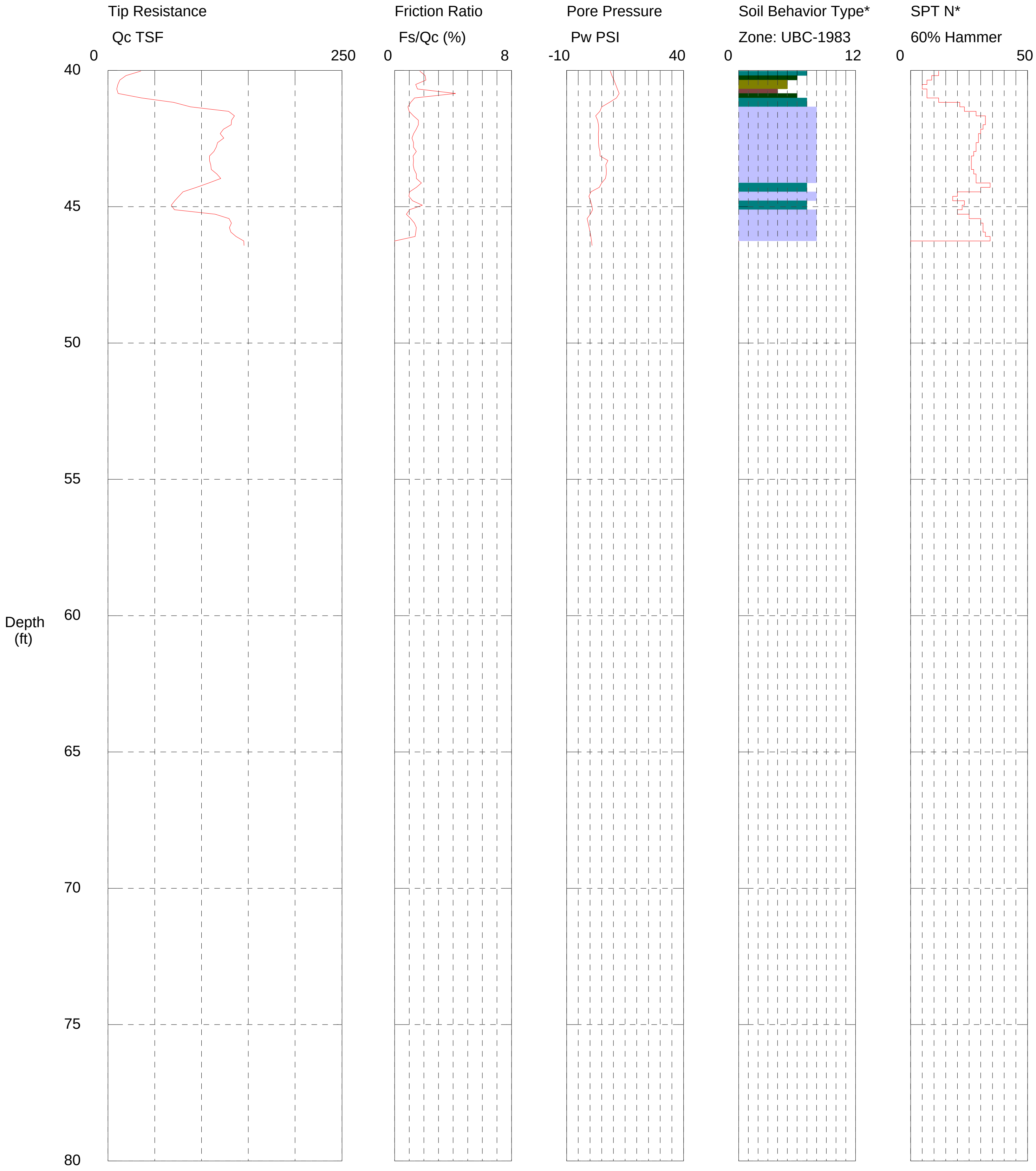
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-34
Cone Used: DSG1079

CPT Date/Time: 9/23/2008 3:14:50 PM
Location: B & L Wood Waste
Job Number: BL RIM 1306



Maximum Depth = 46.42 feet

Depth Increment = 0.164 feet

- ■ 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- ■ 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey sand (*)

Test is through cap and waste pile.

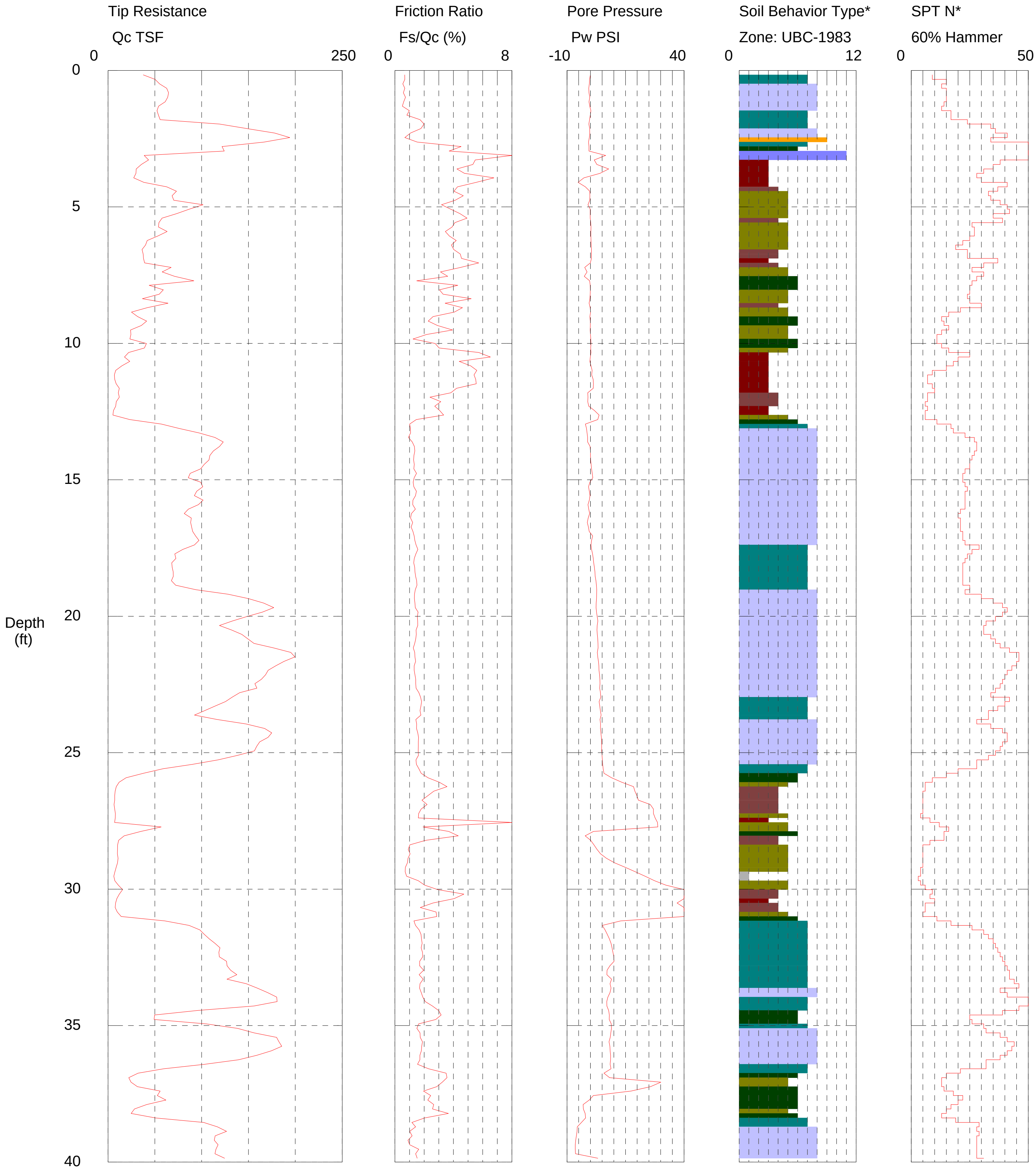
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-35
Cone Used: DSG1079

CPT Date/Time: 9/25/2008 9:11:42 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 42.65 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay

■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt

■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand

■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Test is through cap and waste pile.

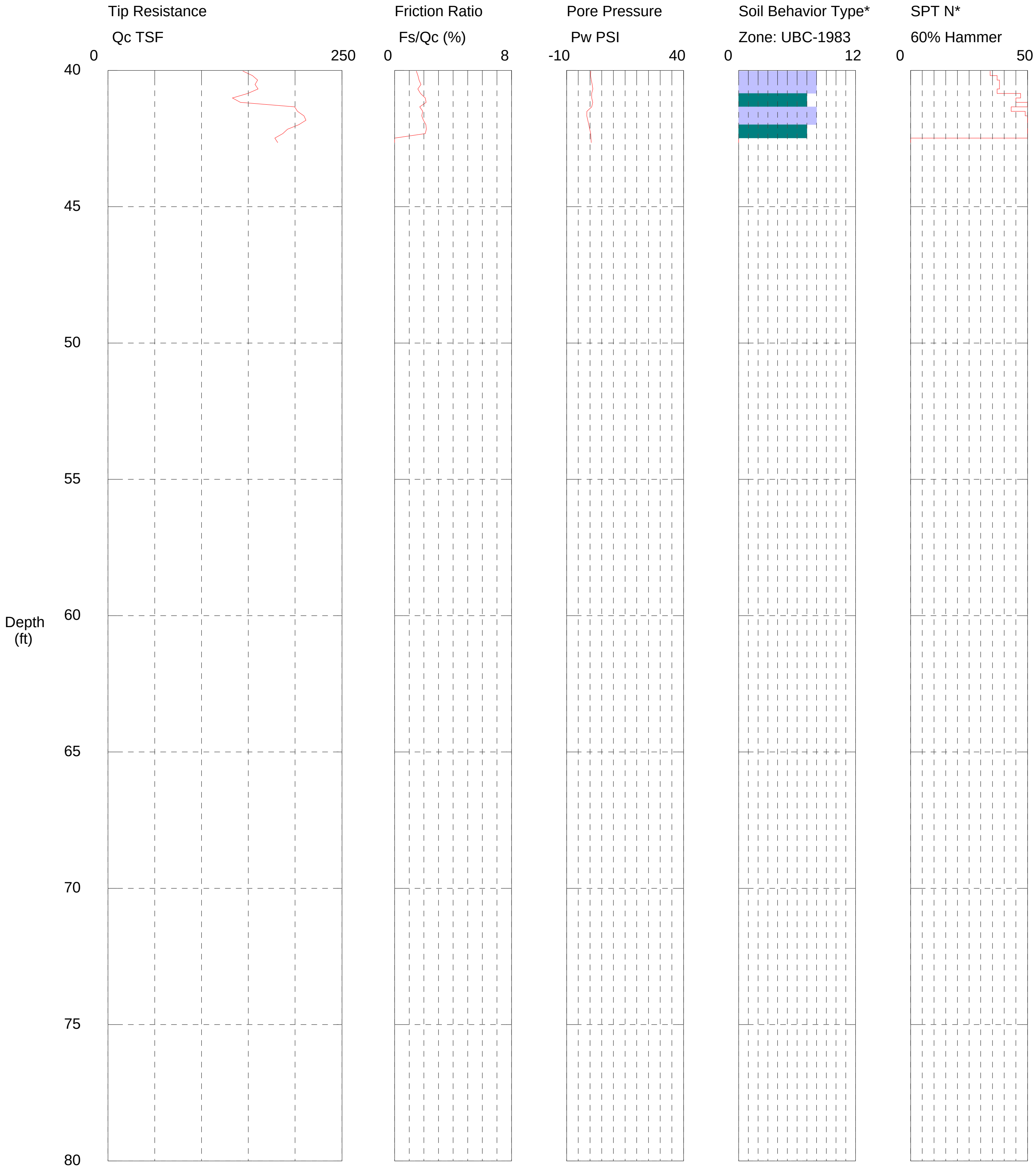
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-35
Cone Used: DSG1079

CPT Date/Time: 9/25/2008 9:11:42 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 42.65 feet

Depth Increment = 0.164 feet

- ■ 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- ■ 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey sand (*)

Test is through cap and waste pile.

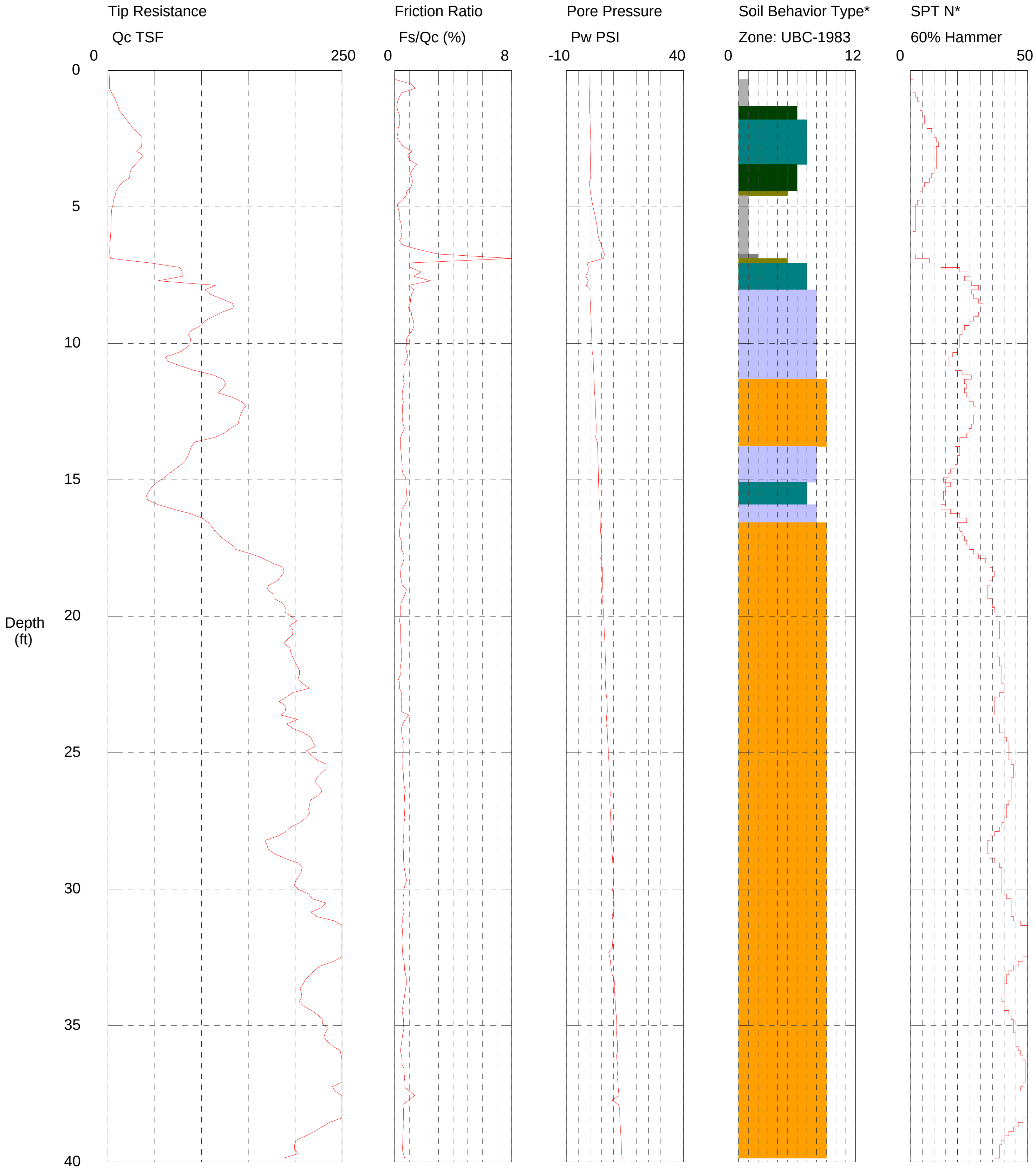
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-36
Cone Used: DSG1029

CPT Date/Time: 9/24/2008 1:09:44 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 42.98 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Pre-drilled top 7 feet and backfilled.

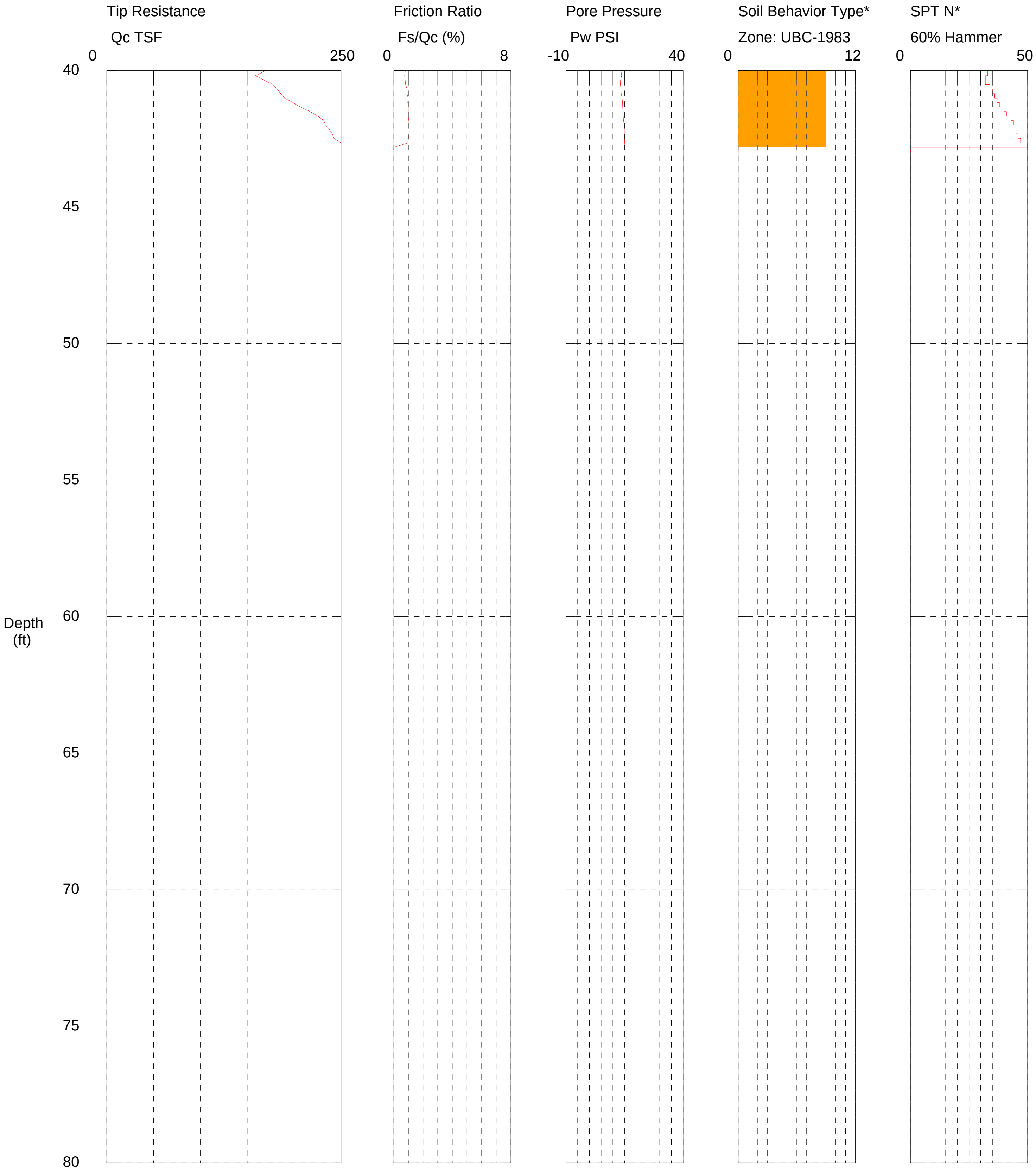
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Brown
Sounding: CPT-36
Cone Used: DSG1029

CPT Date/Time: 9/24/2008 1:09:44 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 42.98 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Pre-drilled top 7 feet and backfilled.

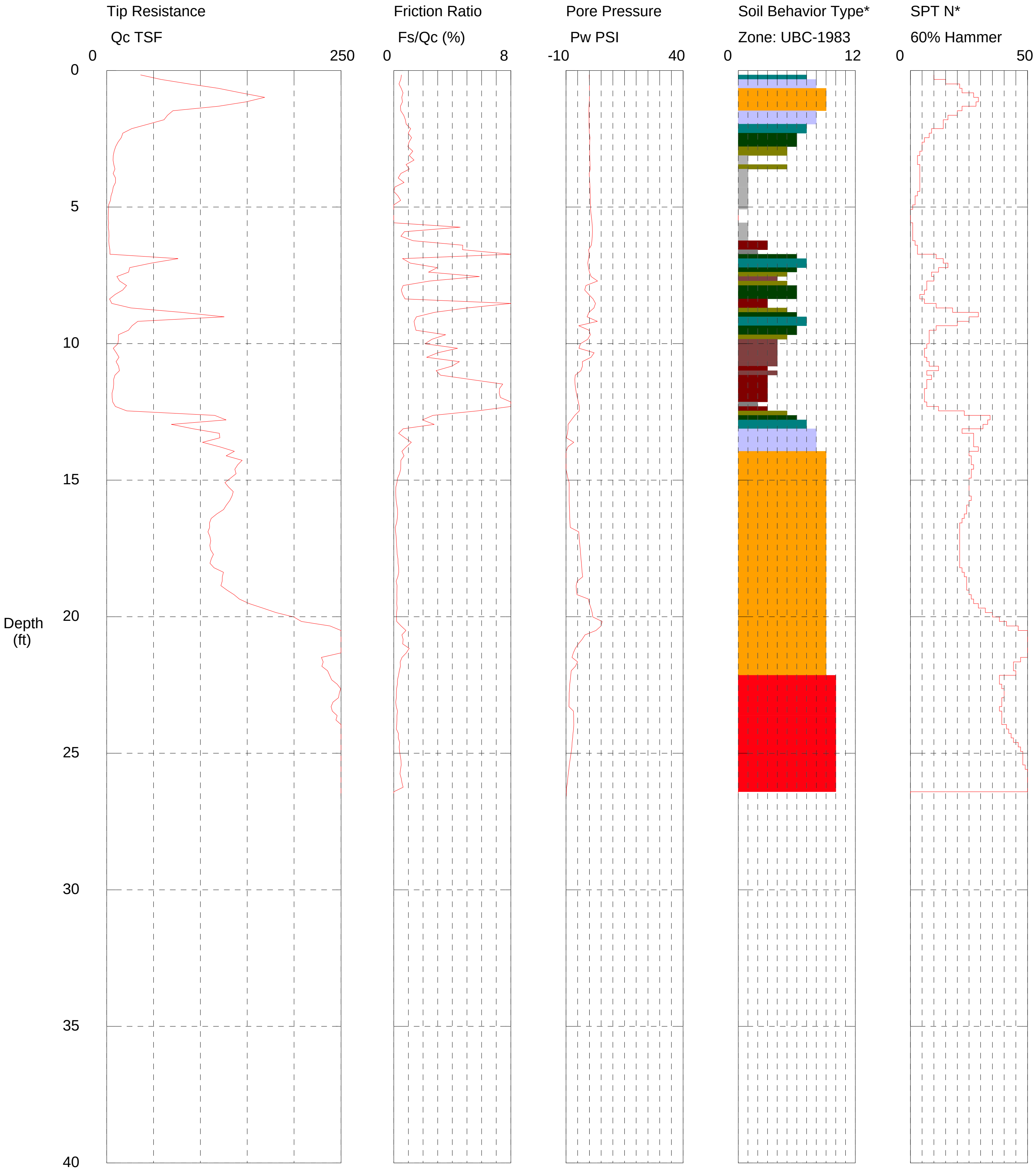
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-37
Cone Used: DSG1015

CPT Date/Time: 9/29/2008 11:12:32 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 26.57 feet

Depth Increment = 0.164 feet

⬜ 1 sensitive fine grained
⬛ 2 organic material
🟥 3 clay
🟫 4 silty clay to clay
🟩 5 clayey silt to silty clay
🟩 6 sandy silt to clayey silt
🟦 7 silty sand to sandy silt
🟪 8 sand to silty sand
🟧 9 sand
🟥 10 gravelly sand to sand
🟦 11 very stiff fine grained (*)
🟦 12 sand to clayey sand (*)

Top 7 feet pre-drilled and backfilled with sand.

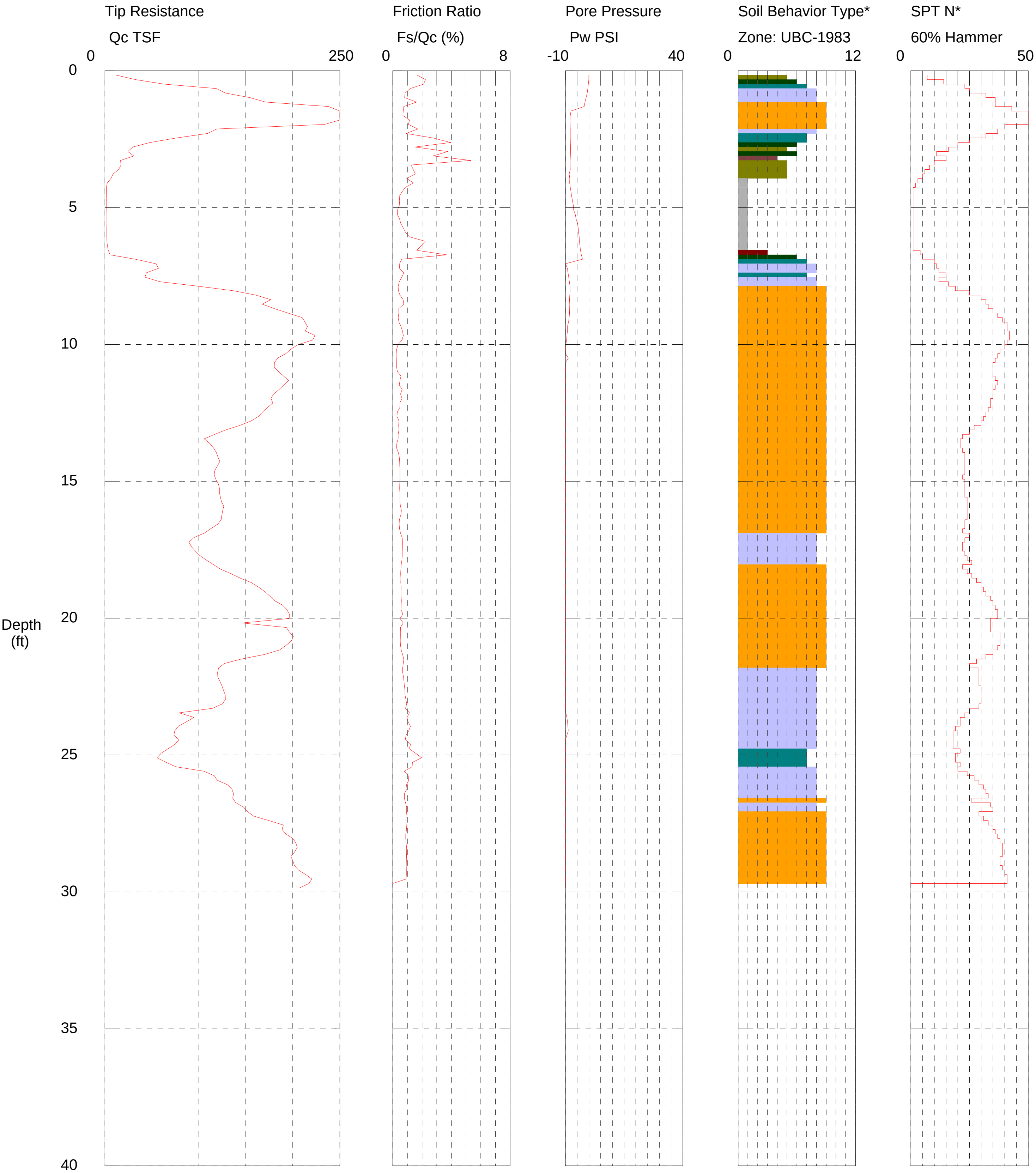
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-38
Cone Used: DSG1015

CPT Date/Time: 9/29/2008 9:44:08 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 29.86 feet

Depth Increment = 0.164 feet

- ▨ 1 sensitive fine grained
- ▨ 2 organic material
- ▨ 3 clay
- ▨ 4 silty clay to clay
- ▨ 5 clayey silt to silty clay
- ▨ 6 sandy silt to clayey silt
- ▨ 7 silty sand to sandy silt
- ▨ 8 sand to silty sand
- ▨ 9 sand
- ▨ 10 gravelly sand to sand
- ▨ 11 very stiff fine grained (*)
- ▨ 12 sand to clayey sand (*)

Top 7 feet pre-drilled and backfilled with sand.

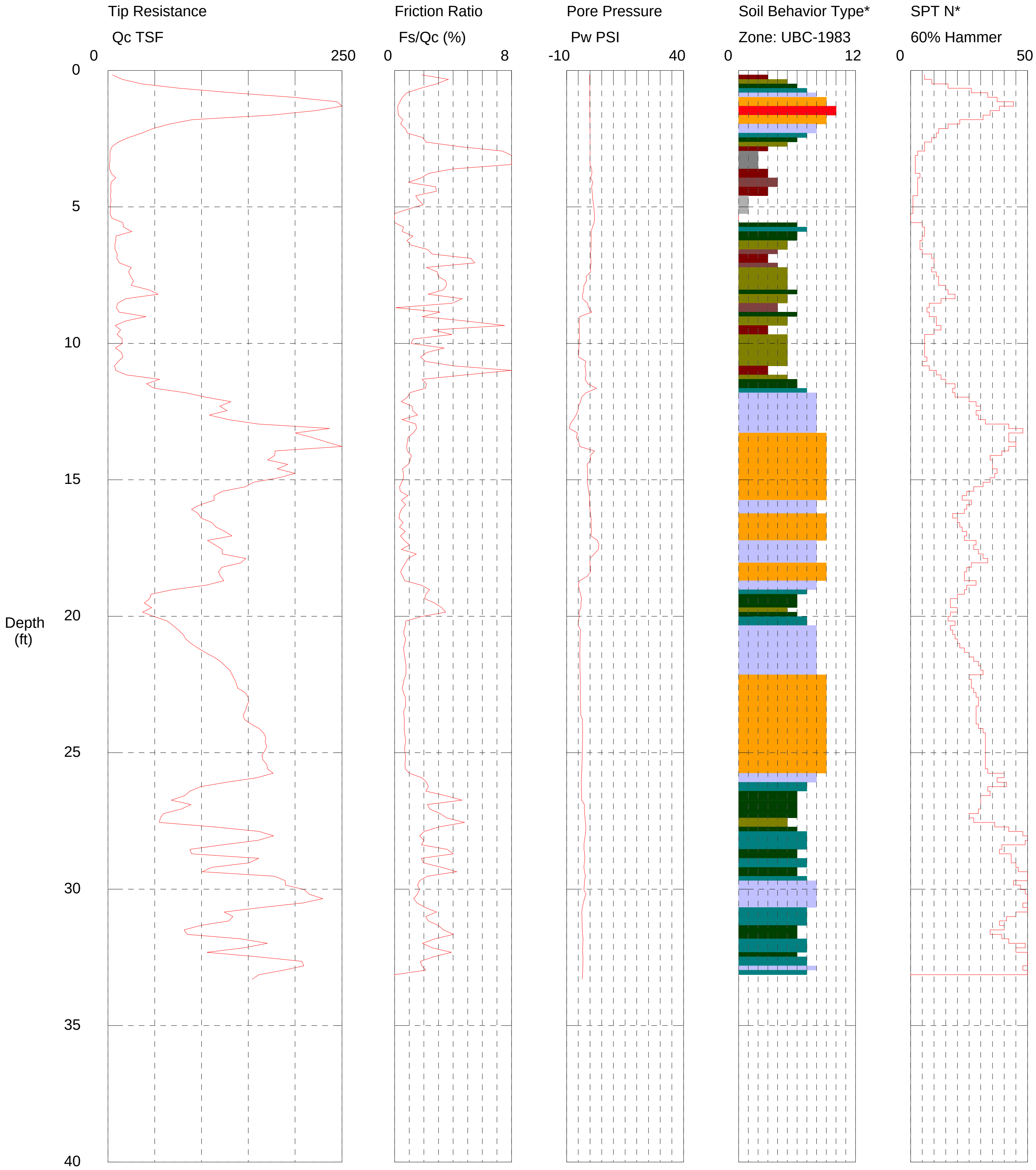
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-39
Cone Used: DSG1015

CPT Date/Time: 9/29/2008 10:20:13 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 33.30 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Top 7 feet pre-drilled and backfilled with sand.

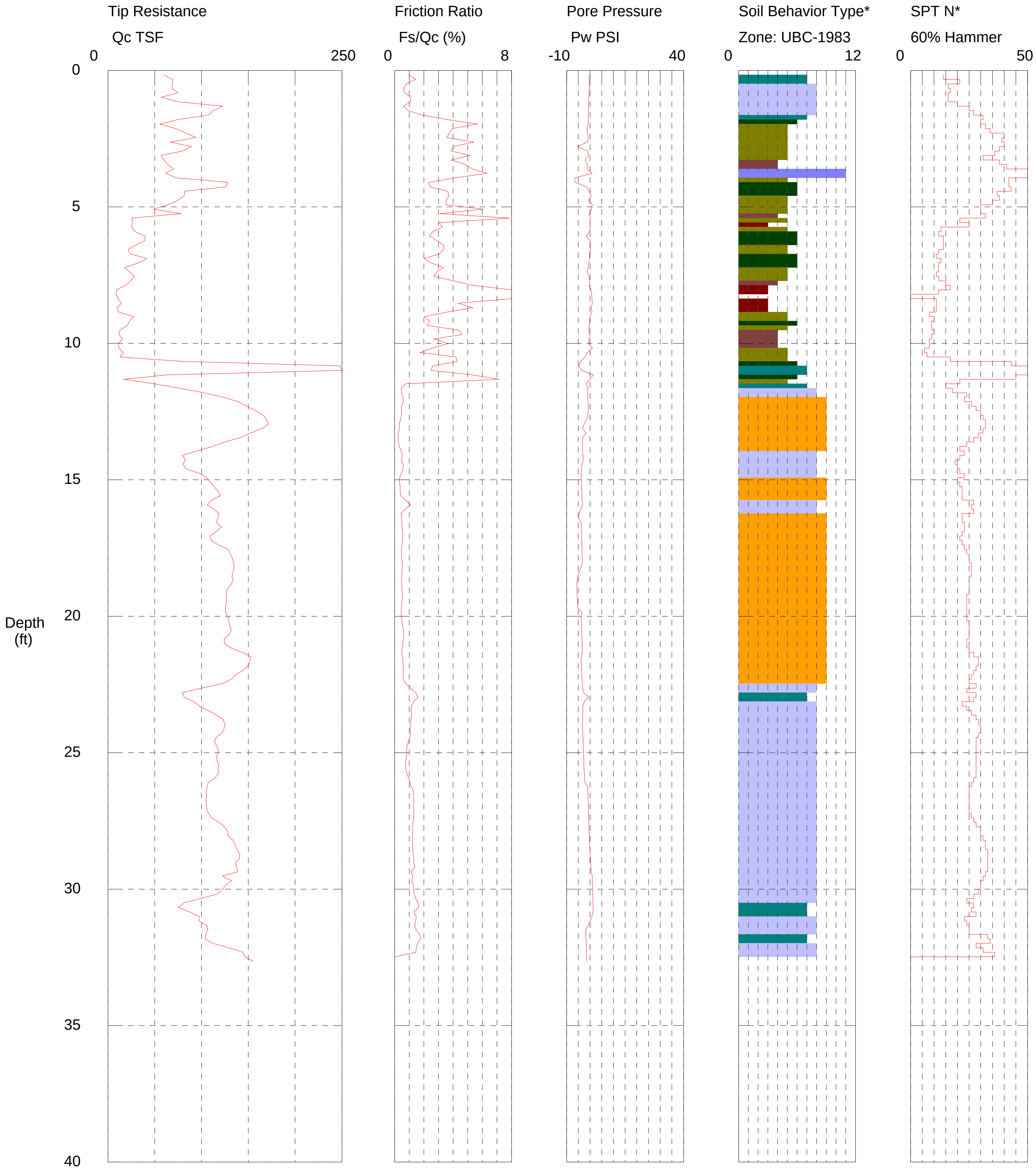
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-40
Cone Used: DSG1079

CPT Date/Time: 9/29/2008 1:36:21 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 32.64 feet

Depth Increment = 0.164 feet

- ⬜ 1 sensitive fine grained
- ⬛ 2 organic material
- 🟥 3 clay
- 🟫 4 silty clay to clay
- 🟩 5 clayey silt to silty clay
- 🟩 6 sandy silt to clayey silt
- 🟦 7 silty sand to sandy silt
- 🟪 8 sand to silty sand
- 🟧 9 sand
- 🟥 10 gravelly sand to sand
- 🟦 11 very stiff fine grained (*)
- 🟦 12 sand to clayey sand (*)

Test was performed with track rig through cap over wood waste pile.

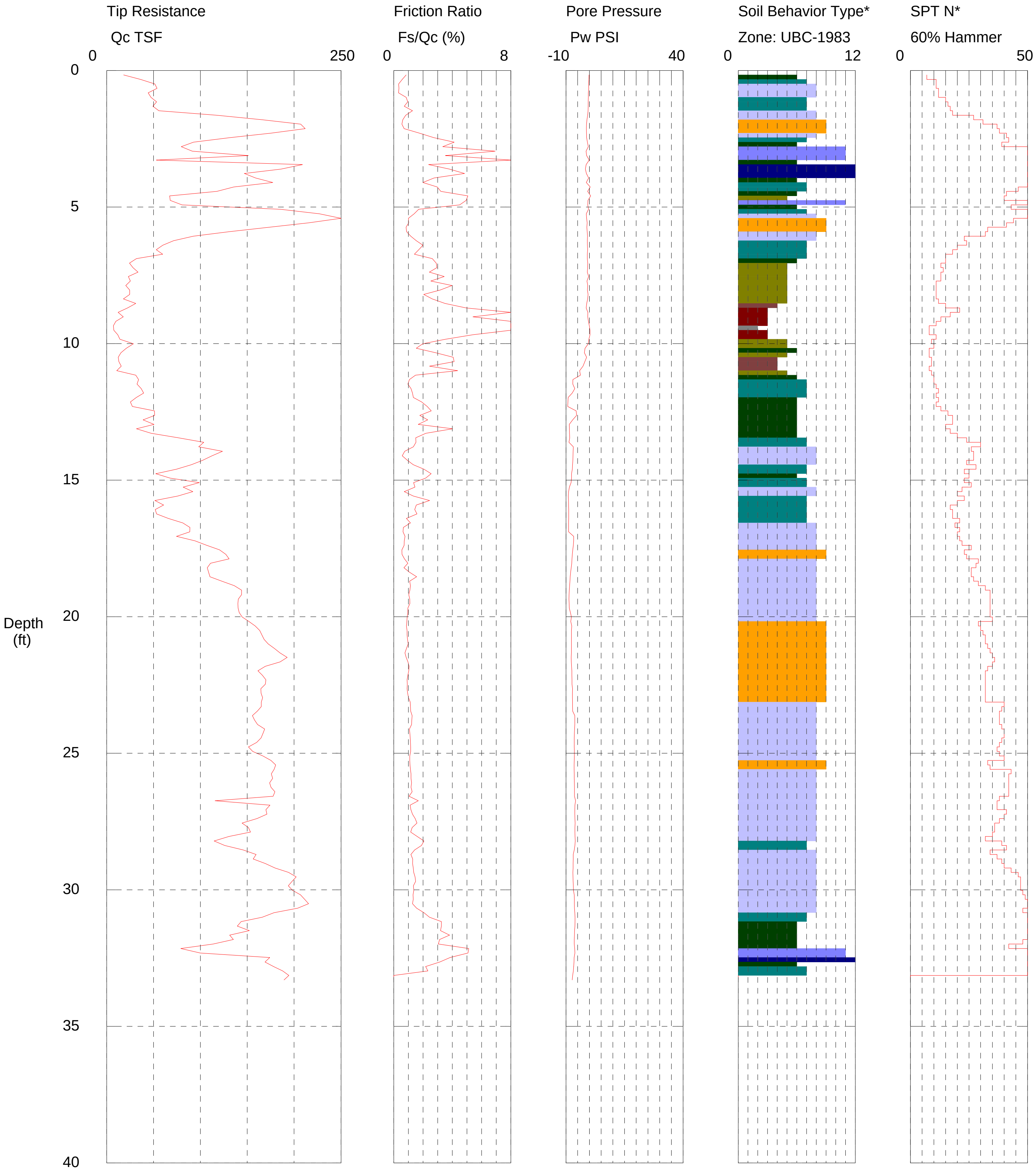
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-41
Cone Used: DSG1079

CPT Date/Time: 9/29/2008 2:14:45 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 33.30 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained	■ 4 silty clay to clay	■ 7 silty sand to sandy silt	■ 10 gravelly sand to sand
■ 2 organic material	■ 5 clayey silt to silty clay	■ 8 sand to silty sand	■ 11 very stiff fine grained (*)
■ 3 clay	■ 6 sandy silt to clayey silt	■ 9 sand	■ 12 sand to clayey sand (*)

Test was performed with track rig through cap over wood waste pile.

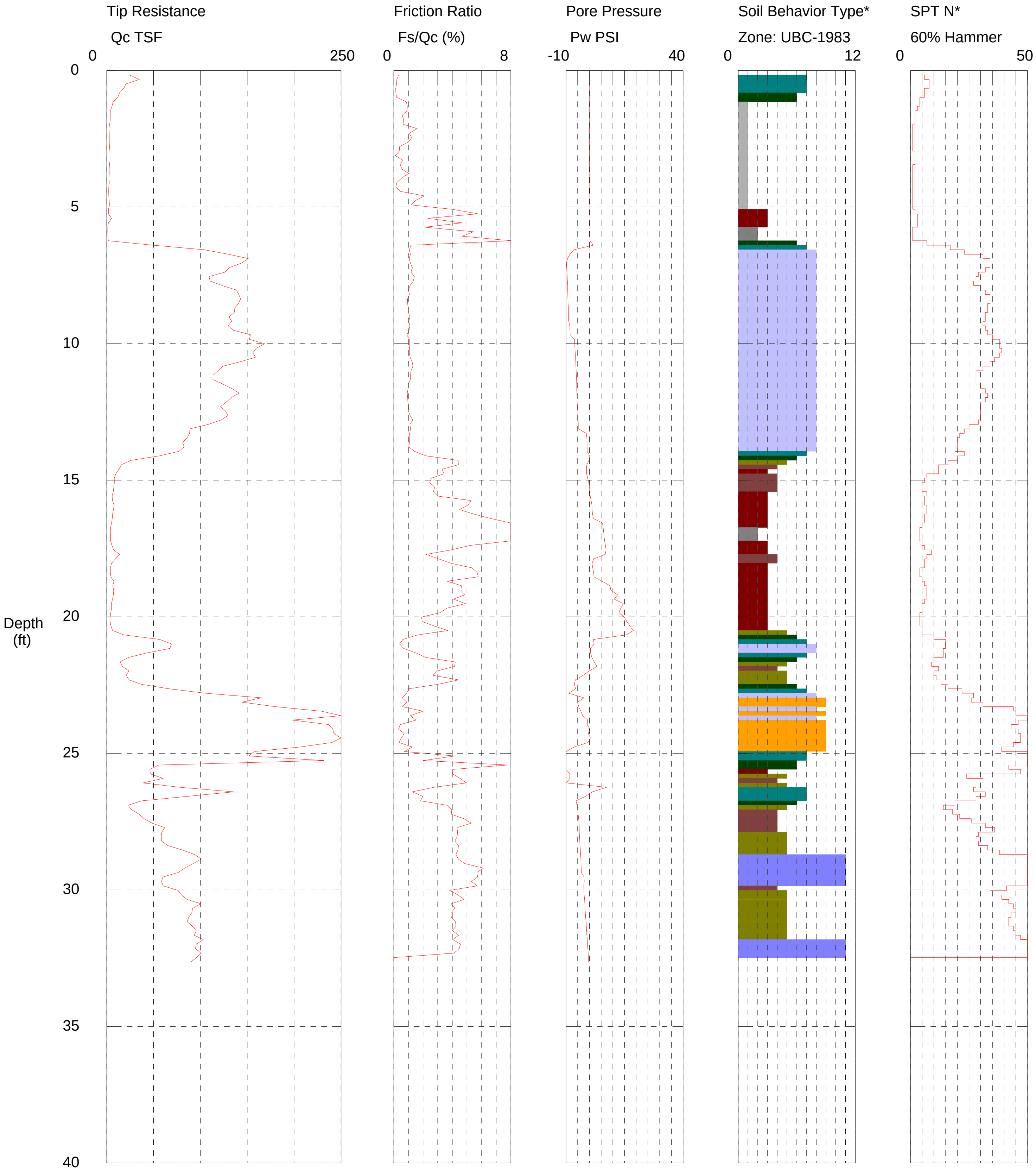
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-42
Cone Used: DSG1015

CPT Date/Time: 9/30/2008 11:35:10 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 32.64 feet

Depth Increment = 0.164 feet

- ▨ 1 sensitive fine grained
- ▨ 2 organic material
- ▨ 3 clay
- ▨ 4 silty clay to clay
- ▨ 5 clayey silt to silty clay
- ▨ 6 sandy silt to clayey silt
- ▨ 7 silty sand to sandy silt
- ▨ 8 sand to silty sand
- ▨ 9 sand
- ▨ 10 gravelly sand to sand
- ▨ 11 very stiff fine grained (*)
- ▨ 12 sand to clayey sand (*)

Top 7 feet was pre-drilled and backfilled with sand.

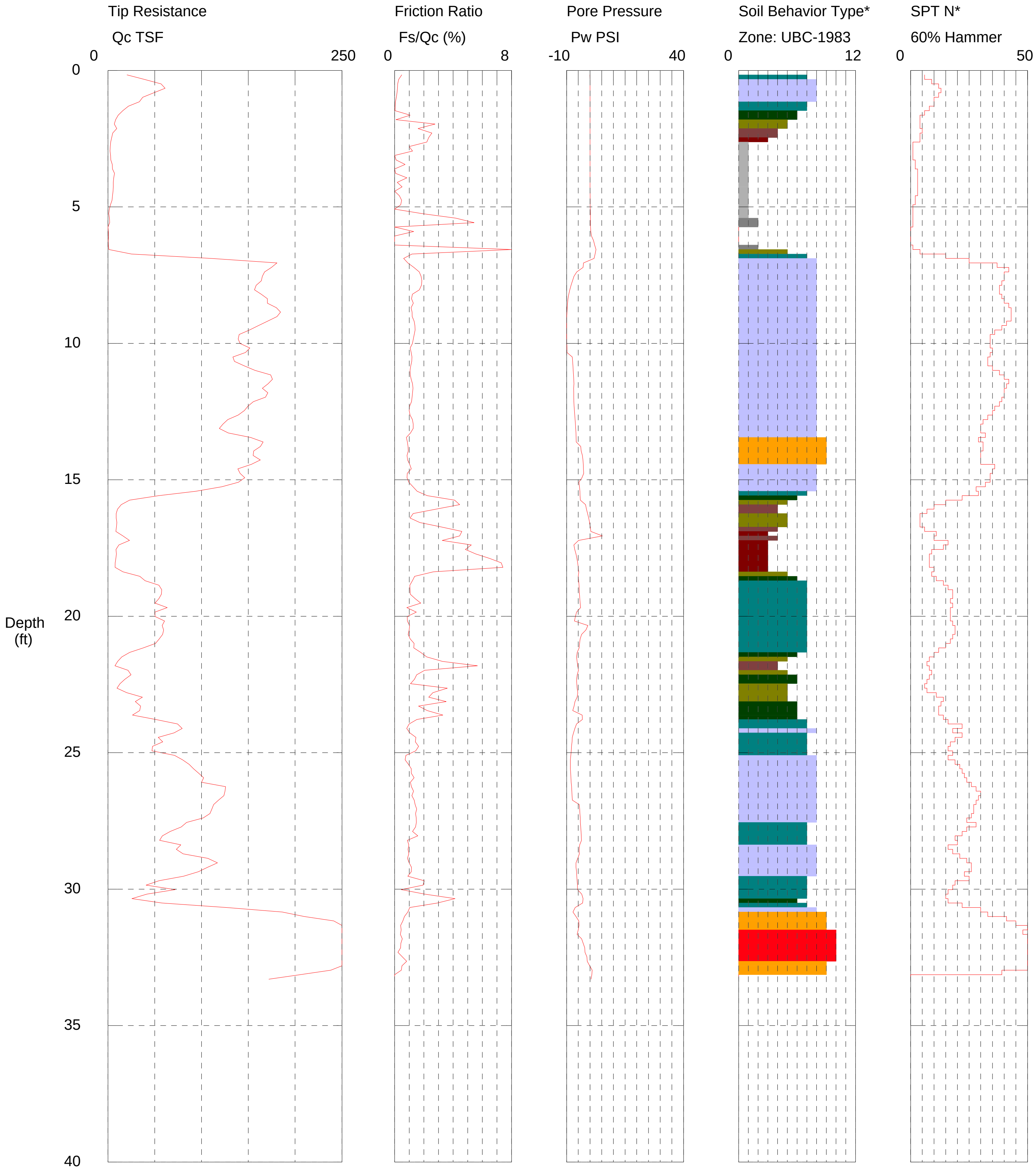
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-43
Cone Used: DSG1015

CPT Date/Time: 9/30/2008 10:51:41 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 33.30 feet

Depth Increment = 0.164 feet

- ▨ 1 sensitive fine grained
- ▨ 2 organic material
- ▨ 3 clay
- ▨ 4 silty clay to clay
- ▨ 5 clayey silt to silty clay
- ▨ 6 sandy silt to clayey silt
- ▨ 7 silty sand to sandy silt
- ▨ 8 sand to silty sand
- ▨ 9 sand
- 🟥 10 gravelly sand to sand
- ▨ 11 very stiff fine grained (*)
- ▨ 12 sand to clayey sand (*)

Top 7 feet was pre-drilled and backfilled with sand.

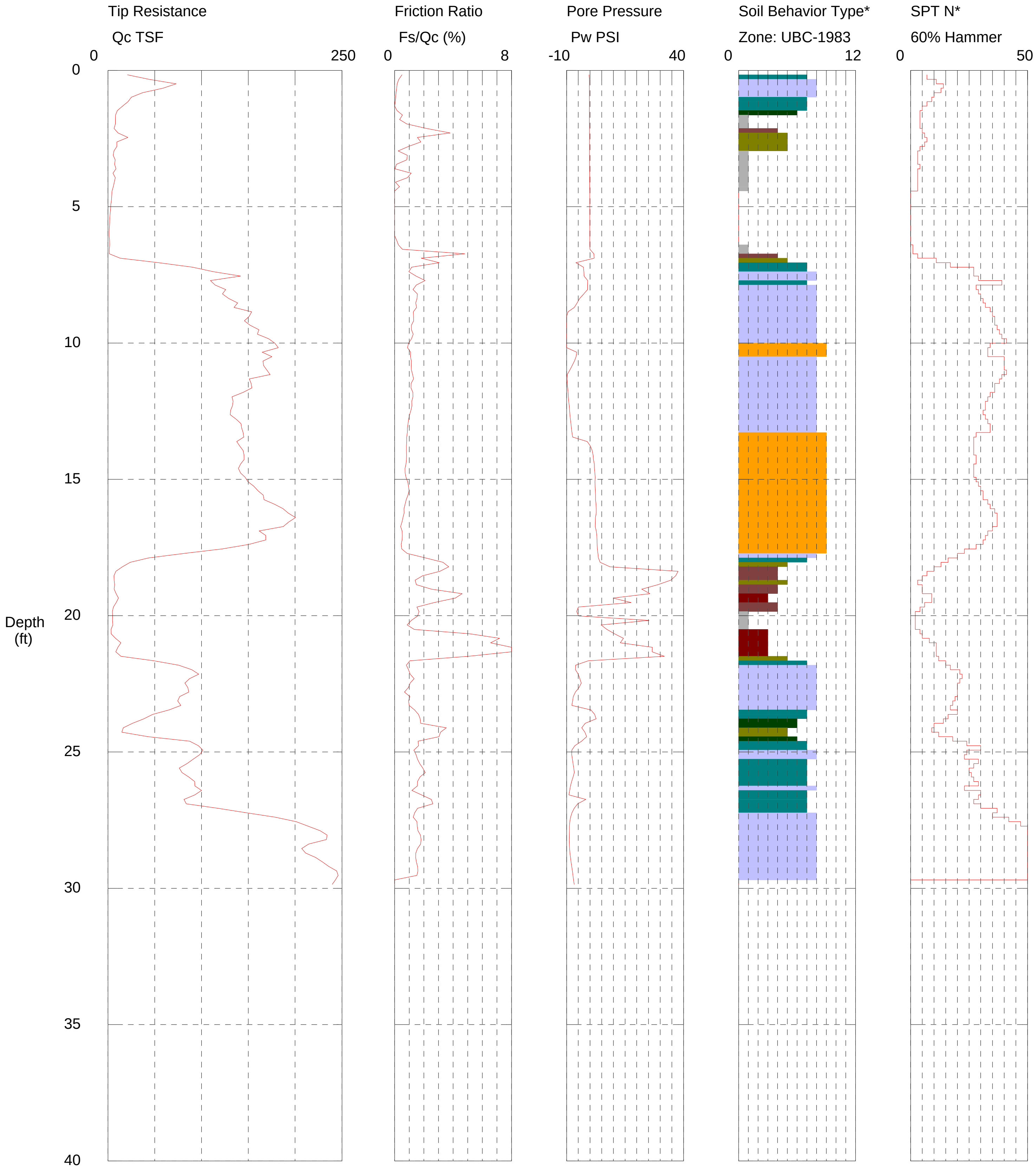
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-44
Cone Used: DSG1015

CPT Date/Time: 9/30/2008 9:57:22 AM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 29.86 feet

Depth Increment = 0.164 feet

■	1 sensitive fine grained	■	4 silty clay to clay	■	7 silty sand to sandy silt	■	10 gravelly sand to sand
■	2 organic material	■	5 clayey silt to silty clay	■	8 sand to silty sand	■	11 very stiff fine grained (*)
■	3 clay	■	6 sandy silt to clayey silt	■	9 sand	■	12 sand to clayey sand (*)

Top 7 feet was pre-drilled and backfilled with sand.

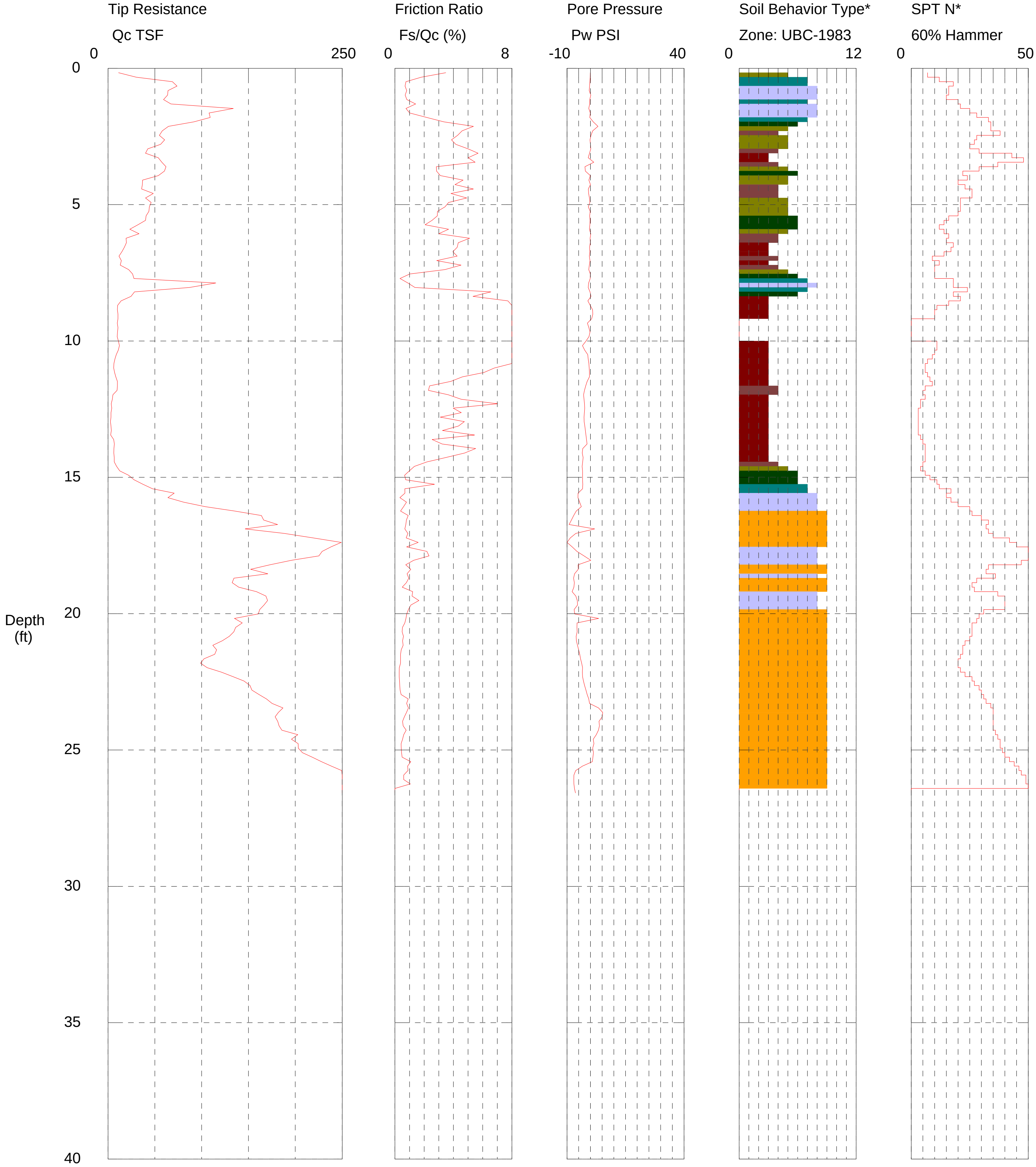
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-45
Cone Used: DSG1079

CPT Date/Time: 9/29/2008 12:54:39 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 26.57 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay

■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt

■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand

■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Top 7 feet pre-drilled and backfilled with sand.

In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-46
Cone Used: DSG1079

CPT Date/Time: 9/29/2008 2:53:44 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304

Maximum Depth = 30.18 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Test was performed with track rig through cap over wood waste pile.

In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-47
Cone Used: DSG1079

CPT Date/Time: 9/29/2008 3:58:08 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304

Maximum Depth = 32.97 feet

Depth Increment = 0.164 feet

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

Test was performed with track rig through cap over wood waste pile.

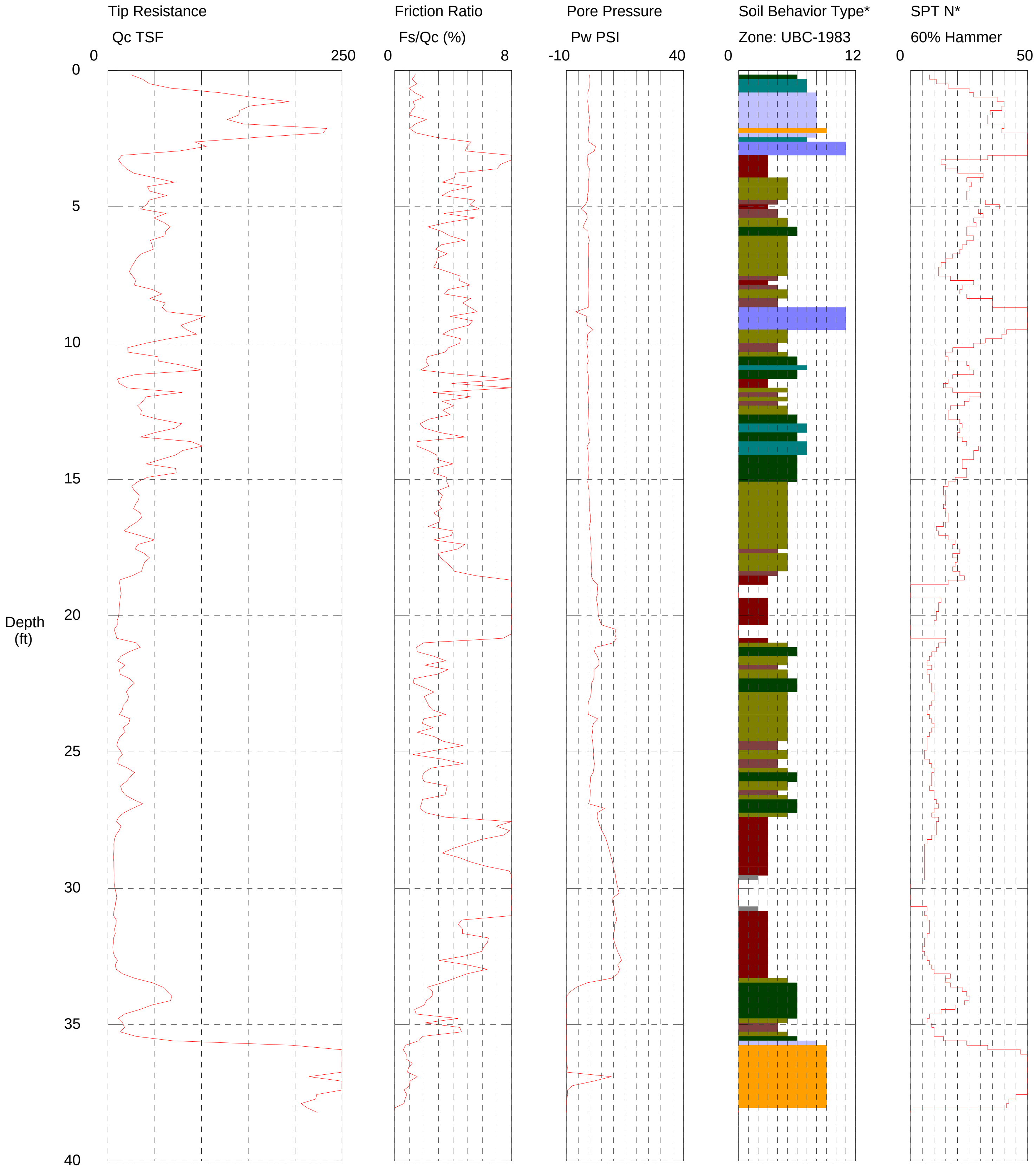
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-48
Cone Used: DSG1079

CPT Date/Time: 9/30/2008 12:54:17 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 38.22 feet

Depth Increment = 0.164 feet

- ■ 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- ■ 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey sand (*)

The test was performed with a track rig pushing through the cap over the wood

In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-49
Cone Used: DSG1079

CPT Date/Time: 9/30/2008 1:31:35 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304

Maximum Depth = 28.87 feet

Depth Increment = 0.164 feet

- ■ 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- ■ 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey sand (*)

The test was performed with a track rig pushing through the cap over the wood

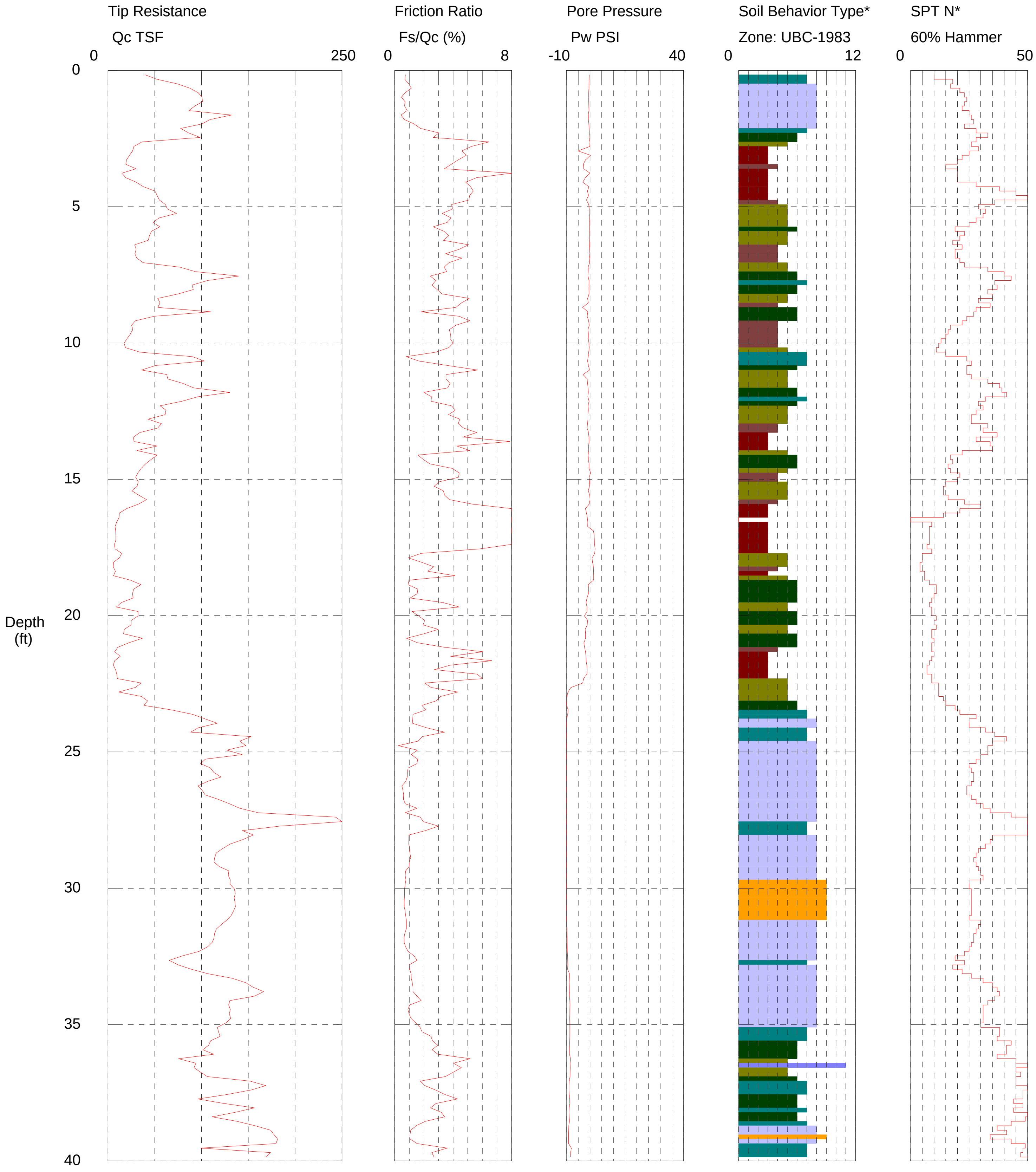
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-50
Cone Used: DSG1079

CPT Date/Time: 9/30/2008 2:04:39 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 40.52 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

The test was performed with a track rig pushing through the cap over the wood

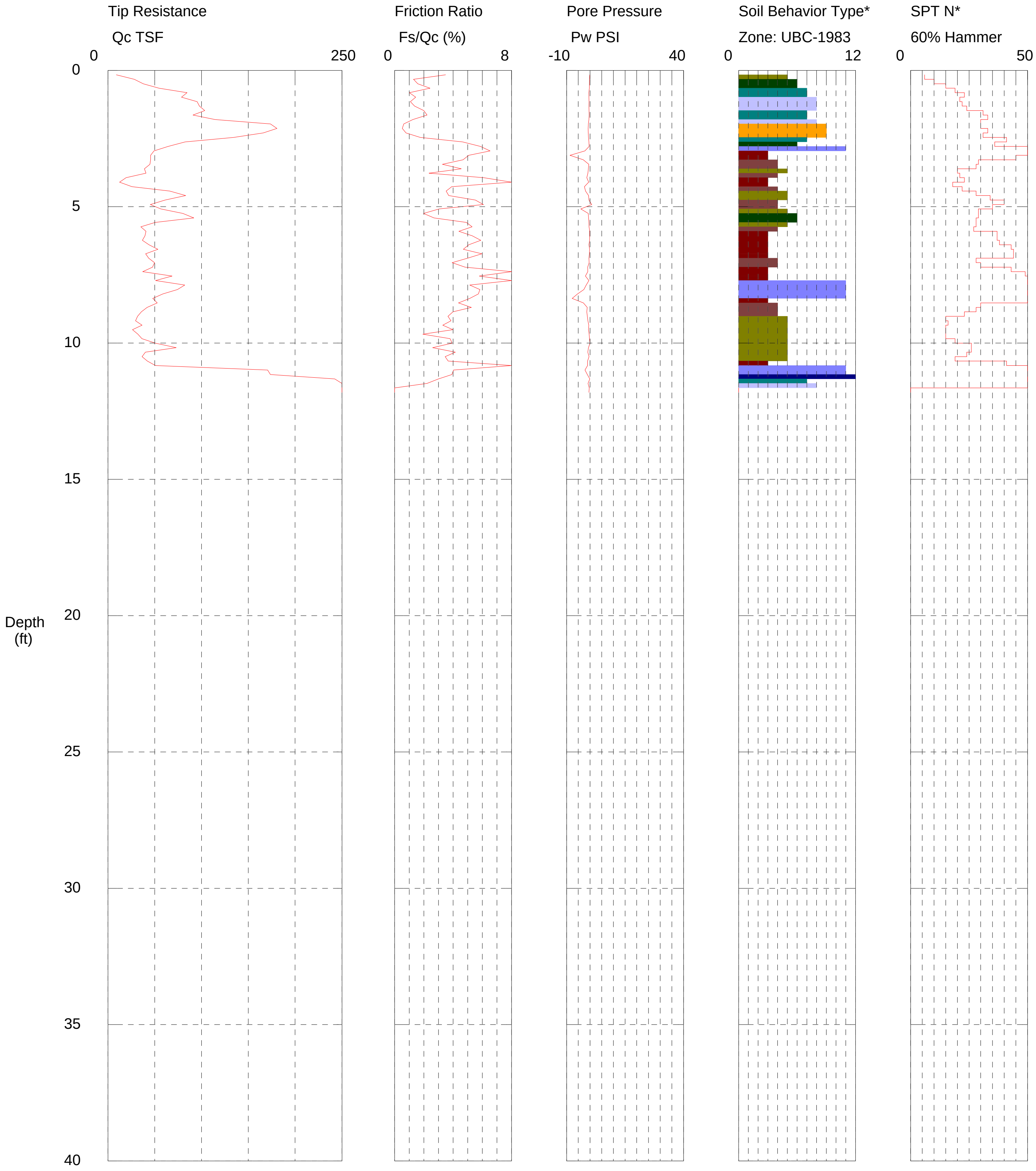
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-51
Cone Used: DSG1079

CPT Date/Time: 9/30/2008 2:54:03 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 11.81 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay

■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt

■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand

■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

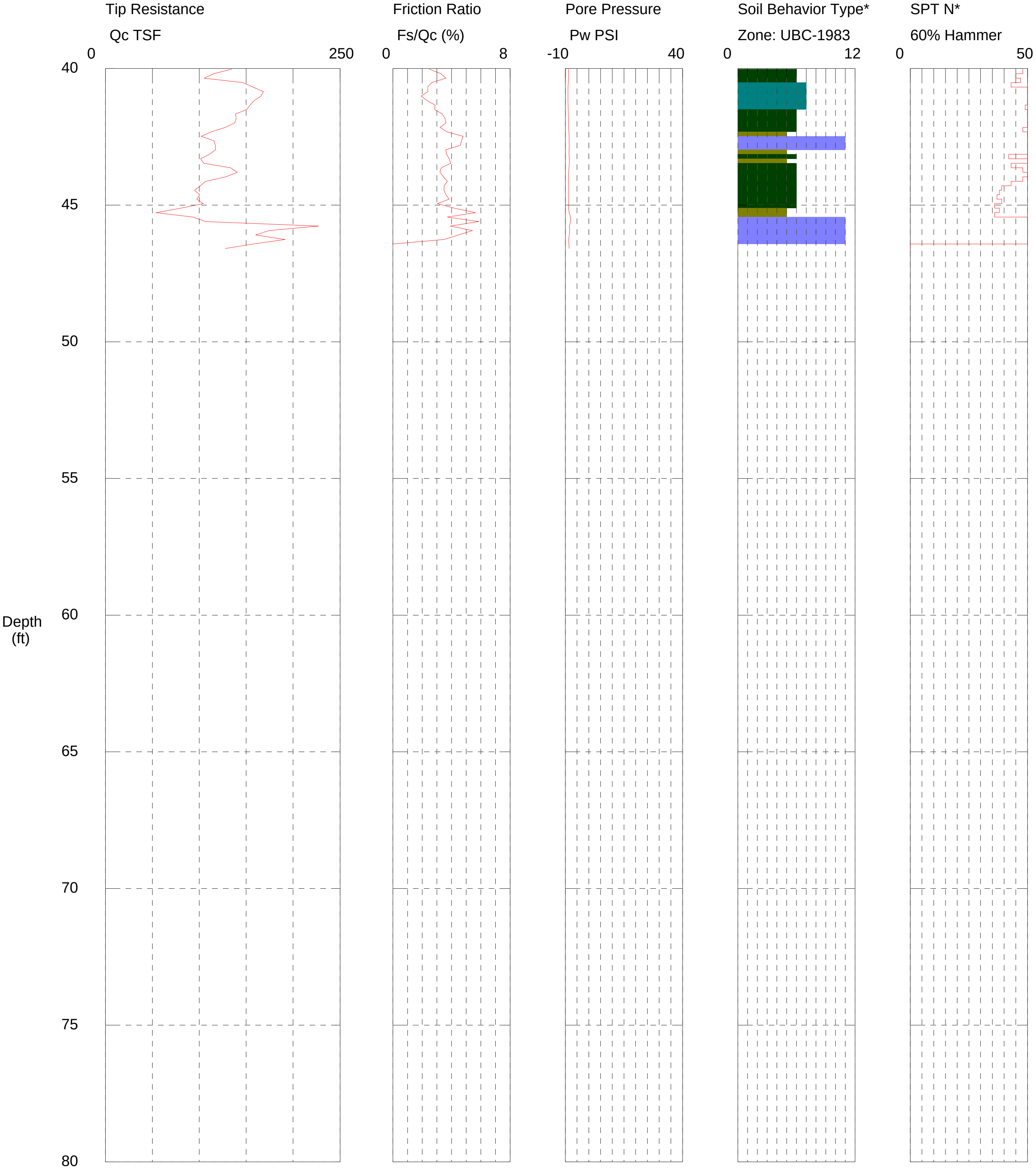
The test was performed with a track rig pushing through the cap over the woodIn Situ Engineeringd at 11 feet.

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-51a
Cone Used: DSG1079

CPT Date/Time: 9/30/2008 3:10:24 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 46.59 feet

Depth Increment = 0.164 feet

■	1 sensitive fine grained	■	4 silty clay to clay	■	7 silty sand to sandy silt	■	10 gravelly sand to sand
■	2 organic material	■	5 clayey silt to silty clay	■	8 sand to silty sand	■	11 very stiff fine grained (*)
■	3 clay	■	6 sandy silt to clayey silt	■	9 sand	■	12 sand to clayey sand (*)

The test was performed with a track rig pushing through the cap over the wood

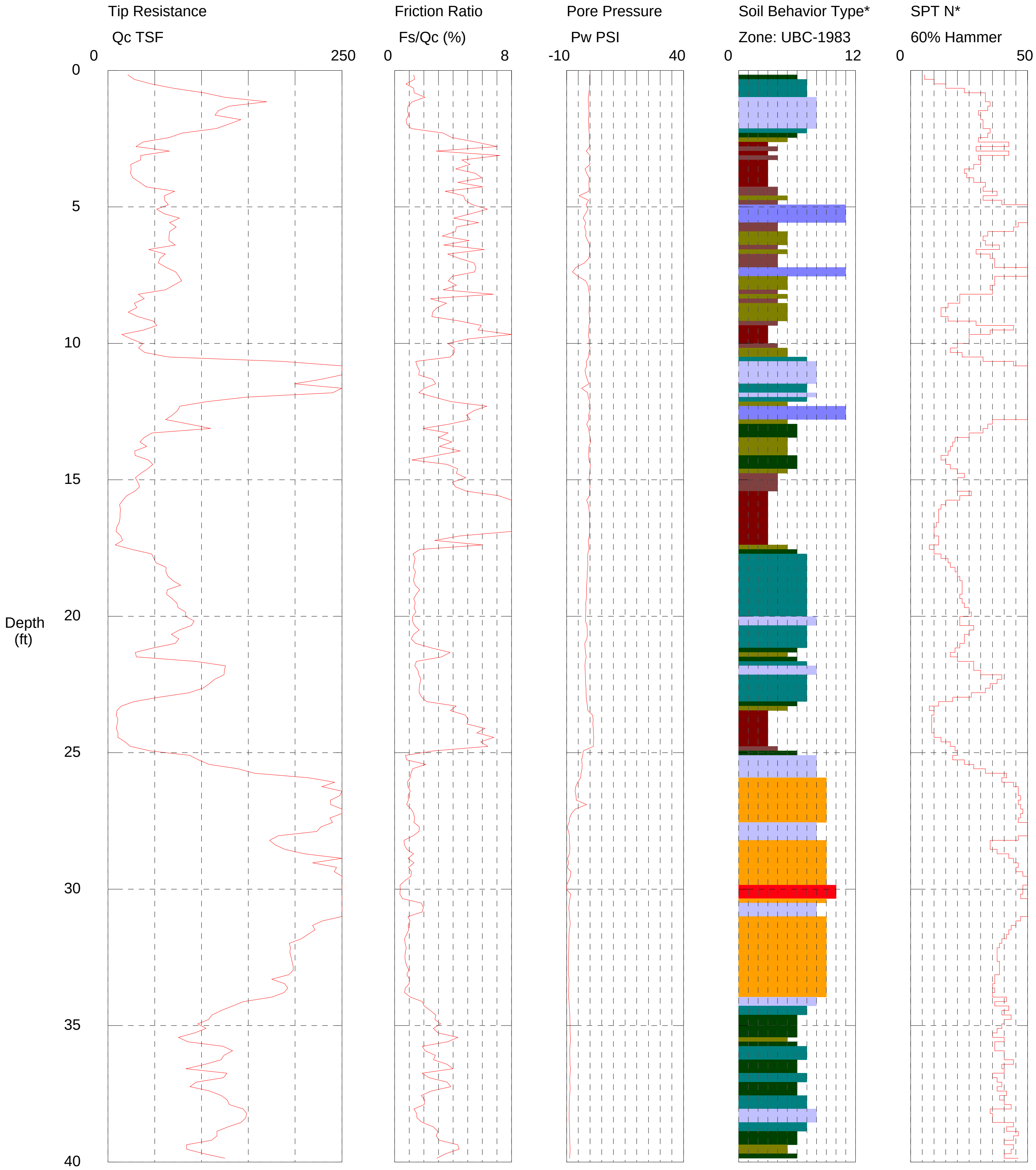
In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-51a
Cone Used: DSG1079

CPT Date/Time: 9/30/2008 3:10:24 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 46.59 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

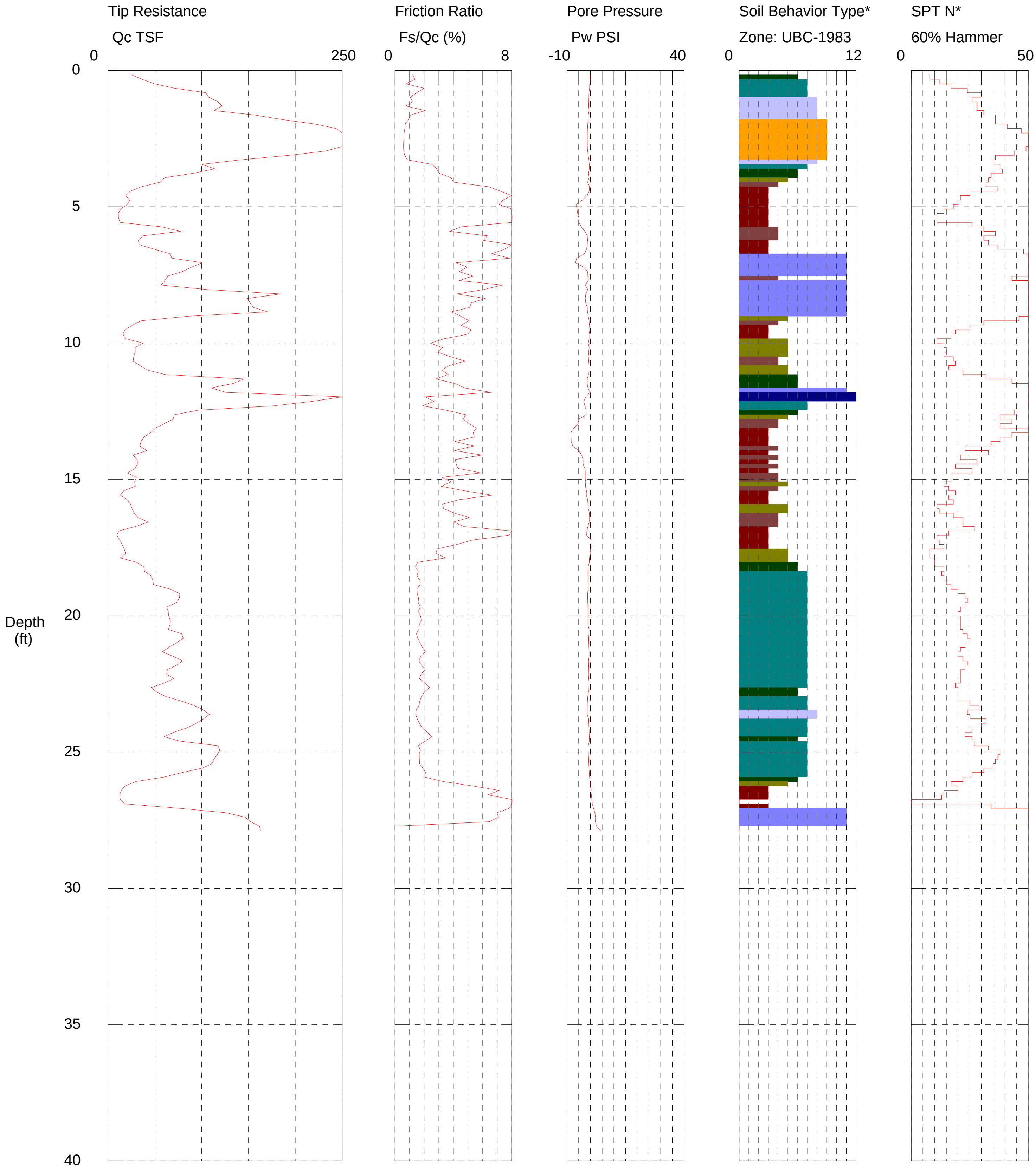
The test was performed with a track rig pushing through the cap over the wood In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

Floyd Snider Amec Team

Operator: Nowak
Sounding: CPT-52
Cone Used: DSG1079

CPT Date/Time: 9/30/2008 3:58:13 PM
Location: B & L Wood Waste Site
Job Number: BL RIM 304



Maximum Depth = 27.89 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

The test was performed with a track rig pushing through the cap over the wood

In Situ Engineering

*Soil behavior type and SPT based on data from UBC-1983

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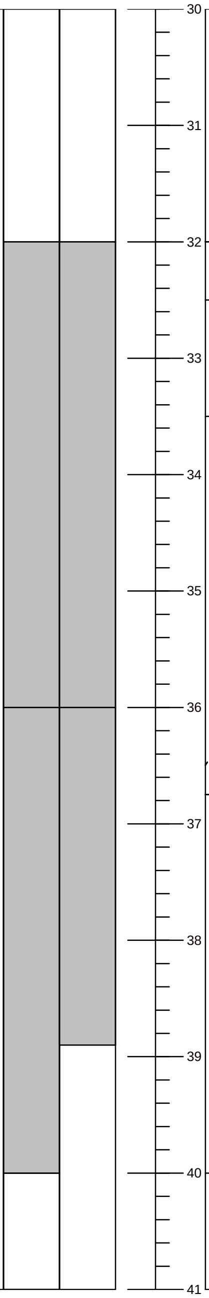
Boring ID: A-1a

Drill Date: August 25, 2008
Logged By: John LaManna
Drilled By: Eli Floyd / Cascade Drilling
Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 48" macrocore
Boring Diameter: 2 inches
Boring Depth (ft bgs): 40 ft. bgs
Groundwater ATD (ft bgs): Unknown

Coordinate System: NAD 83/98
Ground Surface Elevation: 25.70, NAVD 88
Latitude/Northing: 701851
Longitude/Easting: 1185795
Boring Location: Landfill Cap

Client: B&L Custodial Trust
Project: B&L RIM
Task:
Address: B&L Woodwaste
Pierce County, WA

Remarks: Ground surface consists of landfill cap. Partly cloudy, breezy, warm.



OIL INDICATORS	SAMPLE ID	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
		30–32	NA	No samples collected; drilled to targeted depth of 32 ft bgs and then collected samples.
		32–32.5	SP-SM	Black, wet, fine SAND with silt. Approximately 20% of sample consists of brown fibrous wood which quickly turns black upon exposure to air.
		32.5–33.5	CL	Gray, moist-wet, CLAY. Clay material is very soft, highly plastic, and faintly laminated and contains approximately 10% peat particles that are coarse sand-sized.
		33.5–36.5	SP	Black, wet, poorly graded fine-medium SAND with trace silt.
		36.5–36.75	PT-CL	Brown, wet PEAT and CLAY. Disturbed sample.
		36.75–40	SP	Black, wet, poorly-graded fine-medium SAND with trace silt. Piece of wood noted at 37.3 ft bgs.
		40		Bottom of Excavation: 40.0 feet BGS.

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System, modified from ASTM D2488
= denotes groundwater table

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Boring ID: A-1b

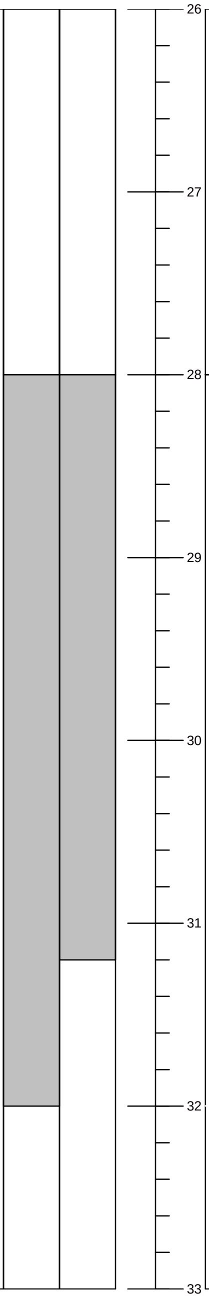
Drill Date: August 25, 2008
Logged By: John LaManna
Drilled By: Eli Floyd / Cascade Drilling
Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 32 ft. bgs
Groundwater ATD (ft bgs): Unknown

Coordinate System: NAD 83/98
Ground Surface Elevation: 25.70 ft. NAVD88
Latitude/Northing: 701850
Longitude/Easting: 1185794
Boring Location: Landfill Cap

Client: B&L Custodial Trust
Project: B&L RIM
Task:
Address: B&L Woodwaste
Pierce County, WA

Remarks: Ground surface consists of landfill cap. Second location approximately 1ft south of first A-1(a) location.

OIL INDICATORS	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
			26		No samples collected; drilled to targeted depth of 28 ft bgs and then collected samples.
			28	SP/PT	Black, wet, poorly-graded fine-medium SAND with WOOD/PEAT. Approximately 20%-30% of sample consists of wood and peat. Wood is light yellowish brown in color when initially uncovered but turns gray upon exposure to air. One piece of black shale > 2.0" diameter encountered at 28.7' BGS.
			32		Bottom of Excavation: 32.0 feet BGS.



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System, modified from ASTM D2488
= denotes groundwater table

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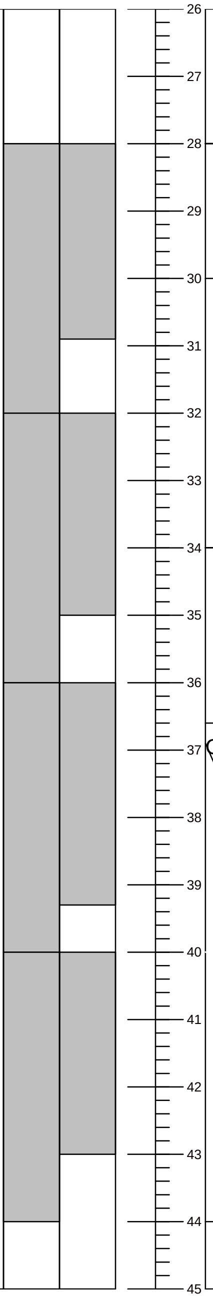
Boring ID: A-2

Drill Date: August 25, 2008
Logged By: John LaManna
Drilled By: Eli Floyd / Cascade Drilling
Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 48" macrocore
Boring Diameter: 2 inches
Boring Depth (ft bgs): 44 FT BGS
Groundwater ATD (ft bgs): Unknown

Coordinate System: NAD 83/98
Ground Surface Elevation: 25.79 ft. NAVD 88
Latitude/Northing: 701779
Longitude/Easting: 1185795
Boring Location: Landfill Cap

Client: B&L Custodial Trust
Project: B&L RIM
Task:
Address: B&L Woodwaste
Pierce County, WA

Remarks: Ground surface consists of landfill cap. Partly cloudy, calm, warm.



OIL INDICATORS	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
			26		No samples collected; drilled to targeted depth of 28 FT BGS and then collected samples.
			28	SP	Black, wet, poorly graded fine-medium SAND with trace gravel.
			30	SW/SP	Black, wet, well-graded, fine-coarse SAND with coarse, well-rounded gravel. Interbeds of fine-medium sand through drive. Trace scattered pieces of clay.
			34	SP	Black, wet, poorly-graded fine-medium SAND.
			37	CL/SP/OL	Lens of grey CLAY over black, well-graded SAND over grey CLAY over dark brown, organic SILT. Clay is dominant unit of this thin bedding sequence.
				SP	Black, wet, poorly-graded fine-medium SAND.
			40		Grades to poorly-graded, fine-medium SAND with gravel from 40-43 FT BGS.
			44		Bottom of Excavation: 44.0 FT BGS

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System, modified from ASTM D2488
= denotes groundwater table

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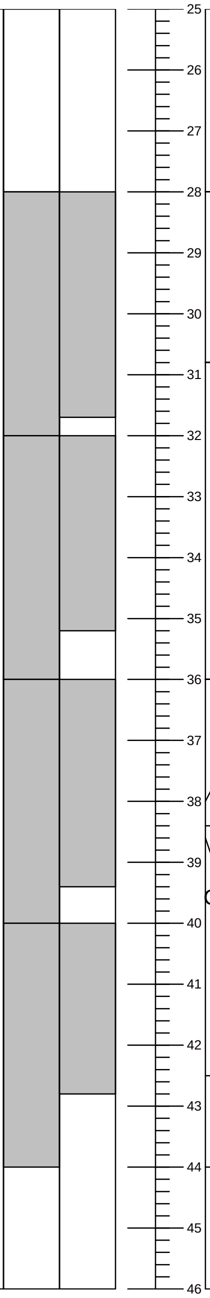
Boring ID: A-3

Drill Date: August 25, 2008
Logged By: John LaManna
Drilled By: Eli Floyd / Cascade Drilling
Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 48" macrocore
Boring Diameter: 2 inches
Boring Depth (ft bgs): 44 FT BGS
Groundwater ATD (ft bgs): Unknown

Coordinate System: NAD 83/98
Ground Surface Elevation: 36.06 ft., NAVD 88
Latitude/Northing: 701787
Longitude/Easting: 1185905
Boring Location: Landfill Cap

Client: B&L Custodial Trust
Project: B&L RIM
Task:
Address: B&L Woodwaste
Pierce County, WA

Remarks: Ground surface consists of landfill cap. Overcast, slight breeze, cool.



OIL INDICATORS	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
					No samples collected; drilled to targeted depth of 28 FT BGS and then began sampling.
				SM	Dark gray, wet, silty, fine SAND. Grades to dark gray, wet, fine sand with silt with increasing depth. Branch fragments noted in drive.
				SP-SM	Dark gray, wet, fine SAND with silt. Interbeds of fine-medium sand near bottom of drive.
				SP	Dark gray, wet, poorly-graded fine-medium SAND. Pumice noted as sand constituent.
				ML	Dark, gray, moist SILT with fine sand.
				PT/ML	Black, wet, PEATand SILT.
				CL-CH/OL	Gray, moist-wet, moderate-high plasticity CLAY. Interbedded with dark gray, moist, clay with black plant matter.
				SP/PT	Dark gray, wet, fine SAND with peat.
					Bottom of Excavation: 44.0 FT BGS

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System, modified from ASTM D2488
= denotes groundwater table

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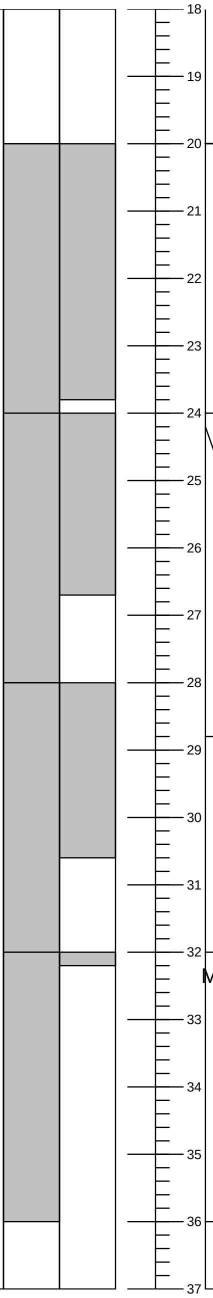
Boring ID: A-4 (a)

Drill Date: August 22, 2008
Logged By: John LaManna
Drilled By: Eli Floyd / Cascade Drilling
Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 48" macrocore
Boring Diameter: 2 inches
Boring Depth (ft bgs): 36 ft bgs
Groundwater ATD (ft bgs): Unknown

Coordinate System: NAD 83/98
Ground Surface Elevation: 29.35 ft., NAVD 88
Latitude/Northing: 701715
Longitude/Easting: 1185907
Boring Location: Landfill Cap

Client: B&L Custodial Trust
Project: B&L RIM
Task:
Address: B&L Woodwaste
Pierce County, WA

Remarks: Ground surface consists of landfill cap. A-4 (a) is first attempt to get to 36ft bgs; refer to log for boring A-4(b).



OIL INDICATORS	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
					No samples collected; drilled to targeted depth of 20 FT BGS and then collected samples.
				SP	Black, wet, poorly-graded SAND, fine-medium.
				SW	Black, wet, well-graded SAND, fine-coarse.
				SP	Black, wet, poorly-graded SAND, fine-medium. Interbed (0.02 ft. thick) of sandy silt at 26.2 FT BGS. Wood fragments noted at 28.8' BGS.
				CL/ML	Gray, moist, highly plastic, soft CLAY. Grades to gray, non-plastic, medium stiff SILT at 30.3 FT BGS. Clay and silt are faintly laminated with traces of organic matter.
				ML/WOOD	Limited recovery. Sample shoe contains wood that turns black on exposure to air and black, wet, poorly-graded sand, fine-medium. Wood fragment lodged in sample shoe prevented adequate recovery of undisturbed sample material spanning entire drive. Difficult advancement of geoprobe from 33 to 35 FT BGS due to presence of wood through this depth interval.
					Bottom of Excavation: 36.0 FT BGS

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System, modified from ASTM D2488
= denotes groundwater table

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Boring ID: A-4 (b)

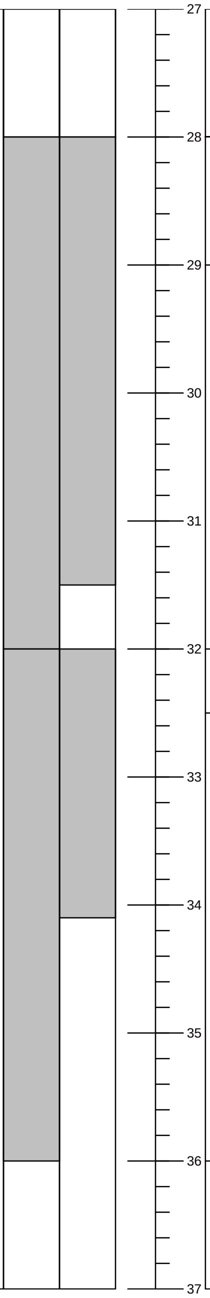
Drill Date: August 25, 2008
Logged By: John LaManna
Drilled By: Eli Floyd / Cascade Drilling

Coordinate System: NAD 83/98
Ground Surface Elevation: 29.35 ft., NAVD 88
Latitude/Northing: 701715
Longitude/Easting: 1185907
Boring Location: Landfill Cap

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 48" macrocore
Boring Diameter: 2 inches
Boring Depth (ft bgs): 36 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task:
Address: B&L Woodwaste
Pierce County, WA

Remarks: Ground surface consists of landfill cap. A-4 (b) is located 2 ft west of A-4 (a). Partly sunny, damp. calm.



OIL INDICATORS	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
					No samples collected; drilled to targeted depth of 28 FT BGS and then began collecting samples.
				SP	Black, wet, poorly-graded SAND, fine to medium. Trace wood and plant stem at 28.8 FT BGS.
				CL/ML	Gray, moist, CLAY, soft, highly plastic, and massive. Grades to gray, moist, clayey SILT, stiff, medium plasticity, and laminated. Organic matter fragments throughout drive
				PT	Dark brown, moist, fibrous PEAT.
				SP	Black, wet, poorly-graded SAND, fine to medium.
					Bottom of Excavation: 36.0 FT BGS

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System, modified from ASTM D2488
= denotes groundwater table

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Boring ID: A-5

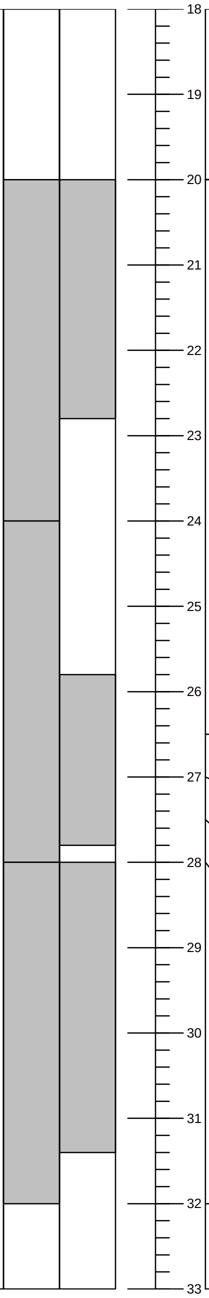
Drill Date: August 22, 2008
Logged By: John LaManna
Drilled By: Eli Floyd / Cascade Drilling

Coordinate System: NAD 83/91
Ground Surface Elevation: 23.11 ft., NAVD 88
Latitude/Northing: 701660
Longitude/Easting: 1185953
Boring Location: Landfill Cap

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 48" macrocore
Boring Diameter: 2 inches
Boring Depth (ft bgs): 32 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task:
Address: B&L Woodwaste
Pierce County, WA

Remarks: Ground surface consists of landfill cap.



OIL INDICATORS	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
			18		No samples collected; drilled to targeted depth of 20 and then began collecting samples.
			20	SP	Black, wet, poorly-graded SAND, fine to medium. Trace coarse sand, 5-10% rounded gravel, < 5% silt observed in sample. Wood fragments encountered at 21.3 FT BGS.
			24		During 24.0 - 28.0 drive, material fell out of sample tube during extraction. Thus, recovery is estimated for black, SP material observed.
					Black, wet, poorly-graded SAND, fine to medium. <5% silt observed in sample.
				ML	Greenish-gray, wet, SILT with sand, low plasticity, soft to medium stiff. <30% sand present in sample.
				OL	Dark brown, organic SILT with peat, medium-high plasticity. 10-20% peat observed in sample.
				SM	Dark gray, moist to wet, silty SAND, fine, non-plastic. Pooly graded.
				SP	Black, wet, poorly-graded SAND, fine to medium. <5% silt, <5% black plant fibers , trace coarse sand observed in sample. Two beds of SP-SM (5-10% silt) observed from 29.3-29.7 FT BGS.
			32		Bottom of Excavation: 32.0 FT BGS

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System, modified from ASTM D2488
= denotes groundwater table

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Boring ID: A-6

Drill Date: August 22, 2008
Logged By: John LaManna
Drilled By: Eli Floyd / Cascade Drilling

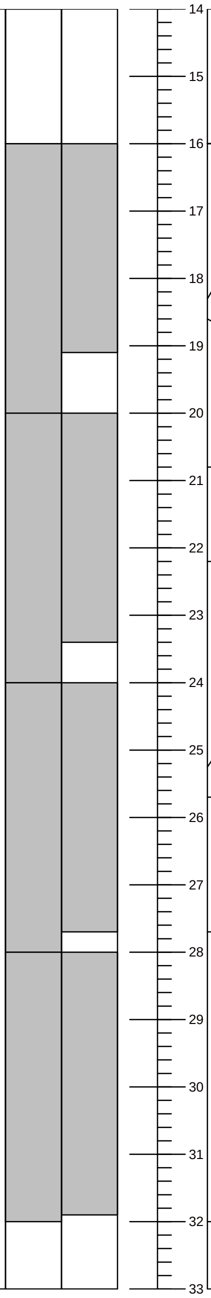
Coordinate System: NAD 83/98
Ground Surface Elevation: 20.54 ft., NAVD 88
Latitude/Northing: 701615
Longitude/Easting: 1186080
Boring Location: Landfill Cap

Drill Type: Track Geoprobe 6620DT
Sample Method: 2" x 48" macrocore
Boring Diameter: 2 inches
Boring Depth (ft bgs): 32 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task:
Address: B&L Woodwaste
Pierce County, WA

Remarks: Ground surface consists of landfill cap. Partly cloudy, 65-70 degrees, calm.

OIL INDICATORS | SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
	No samples collected; drilled to targeted depth of 16 ft bgs and then began collecting samples.
SP	Black, wet, poorly-graded SAND, fine to medium. <5% silt, <5% decaying wood frags, and trace coarse sand observed in sample.
SM	Dark gray, wet, silty SAND, fine.
CL	Gray, moist, CLAY-SILTY CLAY, high plasticity, soft. Brown peat layer (0.03 ft thick) interbedded with unit. Grades to gray to dark gray, moist-wet, CLAY-CLAYEY SILT with sand, massive, high plasticity, soft. <20% sand observed in sample.
ML/OL	Dark reddish-brown, organic SILT with peat/wood. Peat/wood constitutes 10-15% of sample, has some laminations, and turns black when exposed to air.
SM	Very dark gray, moist to wet, silty SAND, fine. Grades to poorly-graded fine sand with 5-10% silt with increasing depth.
ML	Dark gray, moist to wet, SILT with sand. 20-30% sand, 5-10% plant fibers (peat), low plasticity.
SM	Very dark gray, wet, silty SAND, fine. 5-10% silt, 5% organic matter, non-plastic, grows sandier with depth, displays medium-fast dilatancy.
SP-SM	Dark gray, wet, poorly-graded SAND with silt, fine. 5-10% silt, displays rapid dilatency, non-plastic.
	Bottom of Excavation: 32.0 FT BGS

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System, modified from ASTM D2488
= denotes groundwater table

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Boring ID: A-7

Drill Date: August 27, 2008
Logged By: Lisa Meoli
Drilled By: Eli Floyd / Cascade Drilling

Coordinate System: NAD 83/98
Ground Surface Elevation: 25.00 ft., NAVD 88
Latitude/Northing: 701673
Longitude/Easting: 1185985
Boring Location: Landfill Cap

Drill Type: Track Mounted Geoprobe
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 28 FT BGS
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task:
Address: B&L Woodwaste
Pierce County, WA

Remarks: Ground surface consists of landfill cap.

OIL INDICATORS	SAMPLE ID	DRIVEN /	RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
		▨		18 19		No samples collected; drilled to targeted depth of 20 ft bgs and then began sample collection.
		▨	▨	20 21 22 23	SP	Black, moist, poorly-graded, SAND, fine. Reddish-white flecks present. No gravel or pebbles present.
		▨	▨	24 25 26	CL	Grey, dry, clayey SILT, tight, high plasticity. Some small woody debris present.
		▨	▨	27	PT/SM	Moist, WOOD/PEAT. Grades to black, moist, fine silty SAND.
				28 29		Bottom of Excavation: 28.0 FT BGS

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System, modified from ASTM D2488
= denotes groundwater table

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Boring ID: A-8

Drill Date: August 29, 2008
Logged By: Lisa Meoli
Drilled By: Eli Floyd / Cascade Drilling

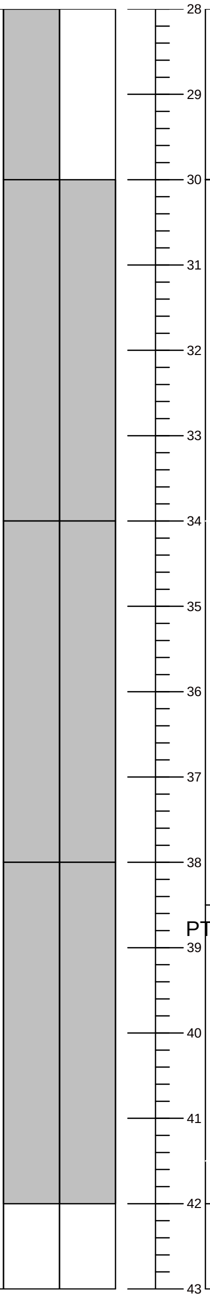
Coordinate System: NAD 83/98
Ground Surface Elevation: 36.02 ft., NAVD 88
Latitude/Northing: 701847
Longitude/Easting: 1185883
Boring Location: Landfill Cap

Drill Type: Track Mounted Geoprobe
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 42 FT BGS
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task:
Address: B&L Woodwaste
Pierce County, Washington

Remarks: Ground surface consists of landfill cap.

OIL INDICATORS	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
	No samples collected; drilled to targeted depth of 30 ft bgs and then began sample collection.
SP-SM	Dark gray, moist, poorly-sorted silty SAND, fine. Natural woody debris noted at 32 FT BGS.
SP	Grades to dark gray-black, moist, poorly-sorted SAND, fine, with reddish-white flecks. Organic woody debris and vegetation noted at 36.5 FT BGS.
PT/SM/ML-CL	Moist, WOOD-PEAT grading to clayey-silty SAND over damp, greenish-gray, SILT-CLAY of high plasticity. (Aquitard).
PT	Grades back to moist, PEAT.
	Bottom of Excavation: 42 FT BGS

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System, modified from ASTM D2488
= denotes groundwater table

Attachment B2

Investigation-derived Waste Documentation

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) CI2102361-001 PPW 01/10/2008 Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: WAH000033454
2. Page 1 of 3
3. Emergency Response Phone: (800) 483-3718
4. Manifest Tracking Number: 001782666 FLE

5. Generator's Name and Mailing Address
B & L Woodwaste Site
552-817 Fife Way , Milton/Fife
Unicorporated Pierce Co., WA 98354
Generator's Phone: 206 852-7556
Generator's Site Address (if different than mailing address)

6. Transporter 1 Company Name: Clean Harbors Environmental Services Inc
U.S. EPA ID Number: MAD039322250

7. Transporter 2 Company Name: Clean Harbors Env. Services Inc
U.S. EPA ID Number: MAD039322250

8. Designated Facility Name and Site Address
Clean Harbors Buttonwillow LLC
2500 West Lokern Road
Buttonwillow, CA, 93206
Facility's Phone: (661) 762-6200
U.S. EPA ID Number: CAD980675276

GENERATOR

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers		11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
		No.	Type					
X	1. RQ, UN3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S., (ARSENIC), 9, PG III (D004)	002	DM	1600	P	611	D004	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1. CH324981 2x85 DM ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: BRETT BEAULIEU
Signature: Brett Beaulieu
Month Day Year: 10 17 08

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Michael A. West
Signature:
Month Day Year: 10 17 08

Transporter 2 Printed/Typed Name: Danny Chavez
Signature:
Month Day Year: 10 27 8

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:

18b. Alternate Facility (or Generator)
U.S. EPA ID Number
Facility's Phone:

18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H132			

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: Charles Terry
Signature: Charles Terry
Month Day Year: 11 14 08

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

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

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)

21. Generator ID Number WAH 000033454

22. Page 2

23. Manifest Tracking Number 001782666 FLE

24. Generator's Name B&L Woodwaste site

25. Transporter 3 Company Name Clean Harbors Env. Services Inc U.S. EPA ID Number MAD039322250

26. Transporter 4 Company Name Clean Harbors U.S. EPA ID Number MAD039322250

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	28. Containers Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes

32. Special Handling Instructions and Additional Information

GENERATOR

33. Transporter 3 Acknowledgment of Receipt of Materials

Printed/Typed Name Mandy Monday Signature Mandy Monday Month Day Year 10 30 08

34. Transporter 4 Acknowledgment of Receipt of Materials

Printed/Typed Name Ray Turner Signature Month Day Year 11 5 08

TRANSPORTER

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

DESIGNATED FACILITY

EPA Form 8700-22A (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

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

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)

21. Generator ID Number WAH000033454

22. Page 3 of 3

23. Manifest Tracking Number 001782666 FLE

24. Generator's Name B&L Woodwaste Site

25. Transporter 5 Company Name Clean Harbors Env. Services U.S. EPA ID Number MAD039322250

26. Transporter ______ Company Name U.S. EPA ID Number

GENERATOR

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	28. Containers Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes

TPO

32. Special Handling Instructions and Additional Information

TRANSPORTER

33. Transporter 5 Acknowledgment of Receipt of Materials

Printed/Typed Name Gabriel Rodriguez Signature Month 11 Day 13 Year 08

34. Transporter ______ Acknowledgment of Receipt of Materials

Printed/Typed Name Signature Month Day Year

DESIGNATED FACILITY

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

EPA Form 8700-22A (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) ✓ ID: 2085933 REV 01/15/2008 Form Approved. OMB No. 2050-0039

GENERATOR

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: WAH000033454

2. Page 1 of 3 +

3. Emergency Response Phone: (800) 483-3718

4. Manifest Tracking Number: 001725971 FLE

5. Generator's Name and Mailing Address
B & L Woodwaste Site
552-517 Fife Way Milton/Fife
Unincorporated Pierce Co., WA 98354
Generator's Phone: 206 252-7566

Generator's Site Address (if different than mailing address)

6. Transporter 1 Company Name: Clean Harbors Environmental Services Inc
U.S. EPA ID Number: MAD039322250

7. Transporter 2 Company Name: Clean Harbors Env. Services Inc
U.S. EPA ID Number: MAD039322250

8. Designated Facility Name and Site Address
Clean Harbors Buttonwillow LLC
2500 West Lokern Road
Buttonwillow, CA 93206
Facility's Phone: (661) 762-6200
U.S. EPA ID Number: CAD980675276

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. UN3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S., (ARSENIC), 9, PG III	8	DM	4000	P	611 D004
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1. CH324981 ERG#171 8 x 55

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true

Generator's/Offeror's Printed/Typed Name: BRETT BEAULIEU
Signature:
Month 9 Day 23 Year 08

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: ED JOHNSON
Signature: Edward Johnson
Month 9 Day 23 Year 08

Transporter 2 Printed/Typed Name: Danny Chavez
Signature:
Month 10 Day 2 Year 8

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:

18b. Alternate Facility (or Generator)
U.S. EPA ID Number
Facility's Phone:

18c. Signature of Alternate Facility (or Generator)
Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1. H132	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: ~~CHARLES R. RAQU~~ Charles Terry
Signature: Charles Terry
Month ~~10~~ 10 Day ~~22~~ 27 Year ~~08~~ 08

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

Clean Harbors has the appropriate permits for and will accept the waste the generator is shipping

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

Form Approved. OMB No. 2050-0039

GENERATOR

UNIFORM HAZARDOUS WASTE MANIFEST
(Continuation Sheet)

21. Generator ID Number WAH000033454

22. Page 2 of 2

23. Manifest Tracking Number 001725971 FLE

24. Generator's Name B+L Woodwaste Site

25. Transporter 3 Company Name Clean Harbors Env. Svcs. U.S. EPA ID Number MAD039322250

26. Transporter 4 Company Name SCT Express U.S. EPA ID Number UTR000007708

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	28. Containers Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes

32. Special Handling Instructions and Additional Information

TRANSPORTER

33. Transporter 3 Acknowledgment of Receipt of Materials

Printed/Typed Name KEVIN BENEDICT Signature Kevin Benedict Month 10 Day 10 Year 08

34. Transporter 4 Acknowledgment of Receipt of Materials

Printed/Typed Name Robert DuBose Signature Month 10 Day 17 Year 08

DESIGNATED FACILITY

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

EPA Form 8700-22A (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

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

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)

21. Generator ID Number: WAH000033454

22. Page: 3

23. Manifest Tracking Number: 001725971FLE

24. Generator's Name: B & L WOODWASTE SITE

25. Transporter 5 Company Name: CLEAN HARBORS U.S. EPA ID Number: MAD039322250

26. Transporter 6 Company Name: clean Harbors Env. Services U.S. EPA ID Number: MAD 039322250

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	28. Containers Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes

32. Special Handling Instructions and Additional Information

GENERATOR

33. Transporter 5 Acknowledgment of Receipt of Materials

Printed/Typed Name: MOISES SILVA Signature: Moises Silva Month 10 Day 20 Year 08

34. Transporter 6 Acknowledgment of Receipt of Materials

Printed/Typed Name: Gabriel Rodrigues Signature: Month 10 Day 27 Year 08

TRANSPORTER

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

DESIGNATED FACILITY

EPA Form 8700-22A (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

CI2102381-001
PPW 01/10/2008

NON-HAZARDOUS WASTE MANIFEST

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

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. W A H 0 0 0 0 3 3 4 5 4

Manifest Document No. 023661

2. Page 1 of 1

3. Generator's Name and Mailing Address
B & L Woodwaste Site
552-817 Fife Way
Unicorporated Pierce Count, WA 98354
, Milton/Fife
SAME

CR
FS

4. Generator's Phone (206 852-7556

5. Transporter 1 Company Name: **Clean Harbors Environmental Services Inc**
6. US EPA ID Number: M A D 0 3 9 3 2 2 2 5 0
A. State Transporter's ID
B. Transporter 1 Phone (781) 792-5000

7. Transporter 2 Company Name: SLT ~~Frei~~ Expressway Inc
8. US EPA ID Number: UTR000007708
C. State Transporter's ID
D. Transporter 2 Phone

9. Designated Facility Name and Site Address
Clean Harbors Grassy Mountain LLC
3 Miles East 7 Miles North of Knolls
Grantsville, UT, 84029
10. US EPA ID Number: U T D 9 9 1 3 0 1 7 4 8
E. State Facility's ID
F. Facility's Phone (435) 884-8900

11. WASTE DESCRIPTION	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt./Vol.
a. N/A, NON D.O.T. REGULATED, NONE	016	DM	6750	P
b.				
c.				
d.				

GENERATOR

G. Additional Descriptions for Materials Listed Above
(L)

H. Handling Codes for Wastes Listed Above
03/A132

15. Special Handling Instructions and Additional Information
A: CH333395 ~~15 x~~ MAW 14 x 55 DM
1 x 85 DM

EMERGENCY PHONE #: (800) 483-3718

16. **GENERATOR'S CERTIFICATION:** I hereby certify that the contents of this shipment are fully and accurately described and are in all respects in proper condition for transport. The materials described on this manifest are not subject to federal hazardous waste regulations.

Printed/Typed Name: BRETT BEAULIEU
Signature:
Date Month 10 Day 17 Year 08

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Michael A. West
Signature:
Date Month 10 Day 17 Year 08

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: Jan Miller
Signature: Jan Miller
Date Month 10 Day 24 Year 08

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of the waste materials covered by this manifest, except as noted in item 19.
2008005160
Printed/Typed Name: Ellene DeZeeuw
Signature: Ellene DeZeeuw
Date Month 11 Day 05 Year 08

NON-HAZARDOUS WASTE

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

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)

21. Generator ID Number WDH000334154

22. Page 9OF9

23. Manifest Tracking Number 02361

GENERATOR

24. Generator's Name B&L Woodwaste Site

25. Transporter 3 Company Name Clean Harbors U.S. EPA ID Number MAD039322250

26. Transporter 4 Company Name CleanHarbor U.S. EPA ID Number MAD039322250

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	28. Containers Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes

32. Special Handling Instructions and Additional Information

TRANSPORTER

33. Transporter 3 Acknowledgment of Receipt of Materials
Printed/Typed Name Mandy Hendry Signature Mandy Hendry Month Day Year 10 27 08

34. Transporter 4 Acknowledgment of Receipt of Materials
Printed/Typed Name Steve Poi Signature Month Day Year 11 05 08

DESIGNATED FACILITY

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

EPA Form 8700-22A (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

ALLIED WASTE

GENERATOR WASTE PROFILE SHEET

Requested Disposal Facility: Roosevelt Regional MSW LF WA 178

an Allied Waste Company

Waste Profile #

AWI Sales Rep:

Date: 9/3/08

I. Generator Information

Generator Name: B&L Woodwaste Custodial Trust			
Generator Site Address: 2201 6th Avenue			
City: Milton	County: Pierce	State: Washington	Zip: 98354
State ID/Reg No: N/A	State Approval/Waste Code: N/A (if applicable)		SIC Code:
Generator Mailing Address (if different): Trustee, Daniel J. Silver, 606 Columbia St Ste 212			
City: Olympia	County: Thurston	State: Washington	Zip: 98501
Generator Contact Name: Daniel J. Silver		Email:	
Phone Number: (360) 754-9343		Fax Number:	

IIa. Transporter Information

Transporter Name: Clearcreek Contractors, Inc.		Contact Name: Jay Wilcox	
Transporter Address: 3203 15th Street			
City: Everett	County: Snohomish	State: WA	Zip: 98201
Phone Number: (425) 252-5800	Fax Number: (425) 252-1093	State Transportation Number: NA	

IIb. Billing Information

Bill To: Clearcreek Contractors, Inc.		Contact Name: Kim Curnett		
Billing Address: 3203 15th Street			Email: Kim@clearcreekcon.com	
City: Everett	State: WA	Zip: 98201	Phone: (425) 252-5800	Fax: (425) 252-1093

III. Waste Stream Information

Name of Waste: drill cuttings from geotechnical hollow stem auger borings H1 through H-15

Process Generating Waste: drill cuttings from site investigation activities

Type of Waste ☐ INDUSTRIAL PROCESS WASTE or ☑ POLLUTION CONTROL WASTE

Physical State: ☑ SOLID ☐ SEMI-SOLID ☐ POWDER ☐ LIQUID ☐ OTHER: _____

Method of Shipment: ☑ BULK ☐ DRUM ☐ BAGGED ☐ OTHER:

Estimated Annual Volume: ☐ CUBIC YARDS: _____ ☑ TONS: 12 ☐ GALLONS _____ ☐ POUNDS: _____ ☐ DRUMS: _____

Frequency: ☑ ONE TIME ☐ ANNUAL

Special Handling Instructions: None

IV. Representative Sample Certification

☐ NO SAMPLE TAKEN

Is the representative sample collected to prepare this profile and laboratory analysis, collected in accordance with U.S. EPA 40 CFR 261.20(c) guidelines or equivalent rules? ☑ YES or ☐ NO

Sample Date: 08/19/2008	Type of Sample: ☑ COMPOSITE SAMPLE ☐ GRAB SAMPLE
Laboratory: Fremont Analytical	Sampler's Employer: Floyd Snider, Inc.
Sample ID Numbers: WP 12-3, WP 4-8, WP 9-11	
Sampler's Name (printed): Brett Beaulieu	Signature:

ALLIED WASTE

GENERATOR WASTE PROFILE SHEET (continued)

Waste Profile #

V. Physical Characteristics of Waste

Characteristic Components	% by Weight (range)
1. Soil	95.000
2. Debris	5.000
3.	
4.	
5.	

Color	Odor (describe)	Free Liquids	% Solids	pH:	Flash Point	Phenol
Grey	None	☐ YES or ☑ NO Content ____%	100.00	7-9	N/A ____ °F	N/A ____ppm

Attach Laboratory Analytical Report (and/or Material Safety Data Sheet) Including Required Parameters Provided for this Profile

Does this waste or generating process contain regulated concentrations of the following Pesticides and/or Herbicides: Chlordane, Endrin, Heptachlor (and it epoxides), Lindane, Methoxychlor, Toxaphene, 2,4-D, or 2,4,5-TP Silvex as defined in 40 CFR 261.33?	☐ Yes or ☑ No
Does this waste or generating process cause it to exceed OSHA exposure limits from high levels of Hydrogen Sulfide or Hydrogen Cyanide as defined in 40 CFR 261.23?	☐ Yes or ☑ No
Does this waste contain regulated concentrations of Polychlorinated Biphenyls (PCBs) as defined in 40 CFR Part 761?	☐ Yes or ☑ No
Does this waste contain regulated concentrations of listed hazardous wastes defined in 40 CFR 261.31, 261.32, 261.33, including RCRA F-Listed Solvents?	☐ Yes or ☑ No
Does this waste contain regulated concentrations of 2,3,7,8-Tetrachlorodibenzodioxin (2,3,7,8-TCCD), or any other dioxin as defined in 40 CFR 261.31?	☐ Yes or ☑ No
Is this a regulated Toxic Material as defined by Federal and/or State regulations?	☐ Yes or ☑ No
Is this a regulated Radioactive Waste as defined by Federal and/or State regulations?	☐ Yes or ☑ No
Is this a regulated Medical or Infectious Waste as defined by Federal and/or State regulations?	☐ Yes or ☑ No
Is this waste generated at a Federal Superfund Clean Up Site?	☐ Yes or ☑ No

VI. Generator Certification

I hereby certify that to the best of my knowledge and belief, the information contained herein is a true, complete and accurate description of the waste material being offered for disposal and all known or suspected hazards have been disclosed. All Analytical Results/Material Safety Data Sheets submitted are truthful and complete and are representative of the waste. I further certify that by utilizing this profile, neither myself nor any other employee of the company will deliver for disposal or attempt to deliver for disposal any waste which is classified as toxic waste, hazardous waste or infectious waste, or any other waste material this facility is prohibited from accepting by law. I shall immediately give written notice of any change or condition pertaining to the waste not provided herein. Our company hereby agrees to fully indemnify this disposal facility against any damages resulting from this certification being inaccurate or untrue. I further certify that the company has not altered the form or content of this profile sheet as provided by Allied Waste.

Daniel J. Silver
Authorized Representative Name And Title (Printed)

Dan Silver Associates
Company Name

Authorized Representative Signature

09/03/2008
Date

VII. Allied Waste Decision

Approved ☐ Rejected ☐ Exiration Date:

Conditions:

Name, Title

Signature

Date

Fremont Analytical

2930 Westlake Ave N Suite 100
Seattle, WA 98109
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste Site
Fremont Project No: CHM080819-3
Floyd | Snider Project No: B&L RIM

August 25th, 2008

Brett:

Enclosed are the analytical results for the ***B & L Woodwaste*** soil samples delivered to Fremont Analytical on August 19th, 2008.

The samples were received in good condition – in the proper containers (8oz soil jars), properly sealed, labeled and within holding time. The cooler temperature upon receipt was 5°C, which is within the laboratory recommended cooler temperature range (4°C - 10°C). The samples were extracted and stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C. There were no sample receipt issues to report.

Examination was conducted for the presence of the following:

- ***Total Metals (As, Pb, Ni, Zn, Cd, Cu) in Soil by EPA Method 6020***

This application was performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

EPA Method 6020 Notations:

1. ***The Relative Percent Difference (RPD%) for Nickel and Zinc*** – The RPD for the Matrix Spike (MS) and MS Duplicate exceed laboratory QC limits. The Laboratory Control Sample (LCS), MS and MSD were within QC range, proving the analysis in control.

If you have any questions about the results, please contact the laboratory.

Thank you for using Fremont Analytical!

Sincerely,

M. Y. Clements

Michelle Clements
Sr. Chemist / Lab Manager
mclements@fremontanalytical.com

Analysis of Total Metals in Soil by EPA Method 6020

Project: B&L Woodwaste Site
Client: Floyd | Snider
Client Project #:
Lab Project #: CHM080819-3

EPA 6020 (mg/kg)	**MRL**	**Method Blank**	**LCS**	**PD 108 5-7'**	**PD 108 10-12'**	**PD 107 5-7'**	**PD 107 12-14'**
Date Extracted		8/20/08	8/20/08	8/20/08	8/20/08	8/20/08	8/20/08
Date Analyzed		8/22/08	8/22/08	8/22/08	8/22/08	8/22/08	8/22/08
Matrix		Soil		Soil	Soil	Soil	Soil
Arsenic (As)	2.0	nd	114%	**102**	**152**	**230**	**278**
Lead (Pb)	4.0	nd	110%	**26**	**309**	**214**	**352**
Cadmium (Cd)	2.0	nd	101%	nd	**6.8**	nd	nd
Copper (Cu)	10.0	nd	92%	**36**	**150**	**227**	**423**
Nickel (Ni)	10.0	nd	91%	**11**	**17**	**16**	**13**
Zinc (Zn)	5.0	nd	109%	**72**	**702**	**404**	**662**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%
Spiked Soil Concentrations:
As = 50 mg/kg
Pb = 50 mg/kg
Cu = 50 mg/kg
Ni = 50 mg/kg
Cd = 50 mg/kg
Zn = 50 mg/kg

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Total Metals in Soil by EPA Method 6020

Project: B&L Woodwaste Site
Client: Floyd | Snider
Client Project #:
Lab Project #: CHM080819-3

					Duplicate		MS	MSD	
EPA 6020 (mg/kg)	**MRL**	**WP 12-3**	**WP 4-8**	**WP 9-11**	**WP 9-11**	**RPD**	**WP 9-11**	**WP 9-11**	**RPD**
Date Extracted		8/20/08	8/20/08	8/20/08	8/20/08	%	8/20/08	8/20/08	%
Date Analyzed		8/22/08	8/22/08	8/22/08	8/25/08		8/22/08	8/22/08	
Matrix		Soil	Soil	Soil	Soil		Soil	Soil	
Arsenic (As)	2.0	**3.3**	nd	**2.9**	**2.6**	11%	74%	81%	9%
Lead (Pb)	4.0	nd	nd	nd	nd		105%	109%	4%
Cadmium (Cd)	2.0	nd	nd	nd	nd		87%	91%	4%
Copper (Cu)	10.0	**11**	nd	**12**	**9.8**	20%	68%	90%	28%
Nickel (Ni)	10.0	nd	nd	**14**	**12**	14%	62%	102%	49%
Zinc (Zn)	5.0	**20**	**18**	**24**	**18**	30%	91%	130%	35%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD, MS, MSD: 65% to 135%

Spiked Soil Concentrations:
As = 50 mg/kg
Pb = 50 mg/kg
Cu = 50 mg/kg
Ni = 50 mg/kg
Cd = 50 mg/kg
Zn = 50 mg/kg

Fremont Analytical

2930 Westlake Ave. N. Suite 100
Seattle, WA 98109

Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record

Date: 8/19/08 Page: 1 of: 1

Client: FLOYD SNIDER
Address: 601 UNION ST. SUITE 600
City, State, Zip: SEATTLE, WA 98117 Tel: 206 292 2078
Reports To (PM): brettbeaulieu@floydsnider.com Fax: Email:

Project Name: B+L WOODWASTE SITE
Location:
Collected by: BTB, EM, LM
Project No: B+L RIM

	Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS: As, Pb, Ni, Zn, Cd, Cu	Metals: MTCA-5	Metals: RCRA-8			Comments/Depth
1	PD 108 5-7'	10:30	SOIL	1 x 8oz	8/18/08											X					RESERVE VOLUME FOR TCLP
2	PD 108 10-12'	10:45	SOIL	1 x 8oz												X					RESERVE VOLUME FOR TCLP
3	PD 108 15'	11:00	SOIL	1 x 8oz																	HOLD
4	PD 108 12-14	10:50	SOIL	1 x 8oz																	HOLD
5	PD 108 18-20	11:05	SOIL	1 x 8oz																	HOLD
6	PD 107 5-7	1400	SOIL	1 x 8oz												X					RESERVE VOLUME FOR TCLP
7	PD 107 12-14	1405	SOIL	1 x 8oz												X					RESERVE VOLUME FOR TCLP
8	WP 12-3	15:20	SOIL	2 x 8oz												X					Composite } RESERVE
9	WP 4-8	16:30	SOIL	2 x 8oz												X					Composite } VOLUME FOR
10	WP 9-11	17:00	SOIL	2 x 8oz	↓											X					Composite } TCLP

Relinquished x	Date/Time 8/19/08	Received x	Date/Time: 8/19/08 15:20	**Sample Receipt:**	
				Good?	Y
				Temperature:	5°C
Relinquished x	Date/Time	Received x	Date/Time 8/19/08 16:00	Seals Intact?:	Y
				Total Number of Containers:	13

Special Remarks
NOTE HOLDS AND POTENTIAL ADD'L TCLP ANALYSES.

TAT --> 24HR 48HR [✓ Standard]

Distribution: White - Lab, Yellow - File, Pink - Originator

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Seattle, WA 98109
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F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste Site
Fremont Project No: CHM080926-1

October 1st, 2008

Brett:

Enclosed are the analytical results for the ***B & L Woodwaste*** water samples delivered to Fremont Analytical on September 26th, 2008.

The samples were received in good condition – in a cooler with wet ice, in the proper containers (500mL Polys), properly sealed, labeled and within holding time. The cooler temperature upon receipt was 5.4°C, which is within the laboratory recommended cooler temperature range (<4°C - 10°C). The samples were extracted and stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C. There were no sample analysis or sample receipt issues to report.

Examination was conducted for the presence of the following:

- ***Dissolved Metals (As) in Water by EPA Method 6020***
- ***Total Metals (As) in Water by EPA Method 6020***

These applications were performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

If you have any questions about the results, please contact the laboratory.

Thank you for using Fremont Analytical!

Sincerely,

M Clements

Michelle Clements
Lab Manager / Sr. Chemist
mclements@fremontanalytical.com

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

					Duplicate	
EPA 6020 (mg/L)	**MRL**	**Method Blank**	**LCS**	**BLW-D4-PD31-9F**	**BLW-D4-PD31-9F**	**RPD**
Date Extracted		9/29/08	9/29/08	9/29/08	9/29/08	%
Date Analyzed		9/30/08	9/30/08	9/30/08	9/30/08	
Matrix		Water		Water	Water	
Arsenic (As)	0.002	nd	86%	**0.18**	**0.16**	12%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD31-14-F**	**BLW-D4-PD30-9-F**	**BLW-D4-PD34-8-F**
Date Extracted		9/29/08	9/29/08	9/29/08
Date Analyzed		9/30/08	9/30/08	9/30/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	nd	**0.004**	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD34-14-F**	**BLW-D4-PD29-8F**	**BLW-D4-PD29-13F**
Date Extracted		9/29/08	9/29/08	9/29/08
Date Analyzed		9/30/08	9/30/08	9/30/08
Matrix		Water	Water	Water
Arsenic (As)	0.002	**0.027**	nd	**0.012**

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

		MS	MSD	
EPA 6020 (mg/L)	**MRL**	**BLW-D4-PD31-9F**	**BLW-D4-PD31-9F**	**RPD**
Date Extracted		9/29/08	9/29/08	%
Date Analyzed		9/30/08	9/30/08	
Matrix		Water	Water	
Arsenic (As)	0.002	88%	89%	1%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

EPA 6020 (mg/L)	**MRL**	**Method Blank**	**LCS**	**Decon 4**	**Decon 3**	**Decon 2**	**Decon 1**	Duplicate **Decon 1**
Date Extracted		9/29/08	9/29/08	9/29/08	9/29/08	9/29/08	9/29/08	9/29/08
Date Analyzed		9/30/08	9/30/08	9/30/08	9/30/08	9/30/08	9/30/08	9/30/08
Matrix		Water		Water	Water	Water	Water	Water
Arsenic (As)	0.002	nd	86%	nd	nd	nd	nd	nd

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
MS, MSD, LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

Analysis of Total Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: N/A
Lab Project #: CHM080926-1

		MS	MSD	
EPA 6020 (mg/L)	**MRL**	**Decon 1**	**Decon 1**	**RPD**
Date Extracted		9/29/08	9/29/08	%
Date Analyzed		9/30/08	9/30/08	
Matrix		Water	Water	
Arsenic (As)	0.002	94%	95%	1%

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
MS, MSD, LCS, LCSD: 65% to 135%

Spike Concentrations:
As = 100µg/L

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Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record

Date: 9/26/08

Page: 1 of:

Client: FLOYD|SNIDER
Address: 601 UNION ST, SUITE 600
City, State, Zip SEATTLE, WA 98101
Tel: 206 292 2078

Project Name: B+L WOOD WASTE
Location:
Collected by: BRETT BEAULIEU

Reports To (PM):
Fax:
Email:
Project No:

Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	NWTPH-HCID	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	Cl HERBICIDES 8151A	METALS:	Metals: MTCA-5	Metals: RCRA-8	ARSENIC TO 0.002 mg/L		Comments/Depth
1 BLW-D4-PD31-9F	9:00	W	500 mL Poly	9/26/08														X		FIELD FILTERED -> DISSOLVED
2 BLW-D4-PD31-14-F	9:30																	X		ARSENIC
3 BLW-D4-PD30-9-F	10:30																	X		
4 BLW-D4-PD34-8F	11:00																	X		
5 BLW-D4-PD34-14-F	11:45																	X		
6 BLW-D4-PD29-8F	13:00																	X		
7 BLW-D4-PD29-13F	13:30																	X		
8 DECON 4	16:00																	X		TOTAL As/UNFILTERED
9 DECON 3	16:05																	X		
10 DECON 2	16:10																	X		
11. DECON 1	16:15																	X		

Relinquished x	Date/Time 9/26/08	Received x	Date/Time: 9/26/08 1740	Sample Receipt:	
				Good?	Y
				Temperature:	5.4°C
Relinquished x	Date/Time	Received x	Date/Time:	Seals Intact?:	Y
				Total Number of Containers:	11

Special Remarks
11 SAMPLES

TAT --> 24HR 48HR [✓ Standard]

Distribution: White - Lab, Yellow - File, Pink - Originator

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Attachment B3

Laboratory Test Reports

LABORATORY SERVICE REQUEST FORM/SAMPLE TESTING PROGRAM

SOIL
TECHNOLOGY™
INNOVATIVE SOLUTIONS

Project Name: B&L Landfill	Soil Technology Job Number:	Sample Arrival Date:		Page 2 of 2
Client Name: AMEC Geomatrix	Contact Name:	Deliverables Due Date:		
Project No.:	Telephone No.	Electronic Deliverables?	Yes or No	
Purchase Order No.:	Email Address	Number of Samples:		

Notes/ Special Instructions:

Boring No.	Sample No.	Sample Depth	Moisture Content (ASTM D2216)	Sieve Analysis (D-422)	Combined Analysis (D-422)	Percent Passing #200 (D1140)	Atterberg Limits (D4318)	Specific Gravity (D-854)	Standard Proctor (D-698)	Modified Proctor (D-1557)	Organic Content ASTM D-2437	California Bearing Ratio (CBR) (ASTM D-1883)	Triaxial: Unconfined Compression (QU) ASTM D-2166	Triaxial: Unconsolidation Undrained (UU,Q) (ASTM D-285	Consolidated Undrained (CU) (ASTM D-4767)	Triaxial: Unconsolidated Undrained (UU) (ASTM D-2850)	Trimming or Remolding of Sample	Shelby Tube Extrusion and Visual Classification (D-2488)	One Dimensional Consolidation (ASTM D-2435)	With secondary compression	Remolding of Sample	Hydraulic Conductivity in flexible-wall (ASTM D-5084) Permeability	Rigid Wall Hydraulic Conductivity (ASTM D-2434	Other:	Please return remaining sample to corresponding composite bucket.
Discrete	H-10-13-15	13-15	X	X																					East
Discrete	H-11-13-15	13-15	X	╲																					East
Discrete.	H-11-33-35	33-35	X	X																					
Shelby	~~H5~~ H-4-25-27	25-27					X							X								X			
Shelby	H-8-21-23	21-23					X							X											
Shelby	H-11-23-25	23-25					X							X								X			
Shelby	H-6-13-15	13-15					X							X											
Composite	North Composite	5 gal. bucket																							
Composite	East Composite	5 gal. bucket																							
Composite	South Composite	5 gal. bucket																							
H2O	Site Water	2x5 gal. buck.																							

Samples Relinguished by:	Sample Received by:	Samples Relinguished by:
Date & Time:	Date & Time: 8/22/08 2:20pm	Date & Time:

LABORATORY SERVICE REQUEST FORM/SAMPLE TESTING PROGRAM

SOIL
TECHNOLOGY™
INNOVATIVE SOLUTIONS

Project Name: B&L Landfill
Client Name: AMEC Geomatrix
Project No.:
Purchase Order No.:
Soil Technology Job Number:
Contact Name: Zanna Satterwhite
Telephone No. 206-342-1760
Email Address zsatterwhite@geomatrix.com
Sample Arrival Date:
Deliverables Due Date:
Electronic Deliverables? Yes or No
Number of Samples:
Page 1 of 2
Notes/ Special Instructions:

Boring No.	Sample No.	Sample Depth	Moisture Content (ASTM D2216)	Sieve Analysis (D-422)	Combined Analysis (D-422)	Percent Passing #200 (D1140)	Atterberg Limits (D4318)	Specific Gravity (D-854)	Standard Proctor (D-698)	Modified Proctor (D-1557)	Organic Content ASTM D-2437	California Bearing Ratio (CBR) (ASTM D-1883)	Triaxial: Unconfined Compression (QU) ASTM D-2166	Triaxial: Unconsolidation Undrained (UU,Q) (ASTM D-285	Consolidated Undrained (CU) (ASTM D-4767)	Triaxial: Unconsolidated Undrained (UU) (ASTM D-2850)	Trimming or Remolding of Sample	Shelby Tube Extrusion and Visual Classification (D-2488)	One Dimensional Consolidation (ASTM D-2435)	With secondary compression	Remolding of Sample	Hydraulic Conductivity in flexible-wall (ASTM D-5084)	Rigid Wall Hydraulic Conductivity (ASTM D-2434	Other:	Please return remaining sample to corresponding composite bucket
Disrete	H-12-7.5-9.0	7.5-9.0	X	X																					South
Discrete	H-12-15-17	15-17					X																		South
Discrete	H-13-11-13	11-13	X	X																					South
Discrete	H-13-17-19	17-19					X																		
Discrete	H-13-21-23	21-23	X	X																					
Discrete	H-14-23-25	23-25					X																		
Discrete	H-1-13-15	13-15	X	X																					
Discrete	H-3-17-19	17-19	X	X																					
Discrete	H-3-33-35	33-35					X																		
Discrete	H-5-11-13	11-13	X	X																					North
Discrete	H-5-23-25	23-25	X	X			X																		North
Discrete	H-6-5-7	5-7	X	X																					North
Discrete	H-6-31-33	31-33	X	X																					
Discrete	H-7-17-19	17-19	X	X																					North
Discrete	H-7-23-25	23-25					X																		
Discrete	H-8-23-25	23-25	X	X																					
Discrete	H-9-7-9	7-9	X	X																					East

Samples Relinguished by:
Date & Time:
Sample Received by:
Date & Time: 8/22/08 2:20pm
Samples Relinguished by:
Date & Time:

SOIL
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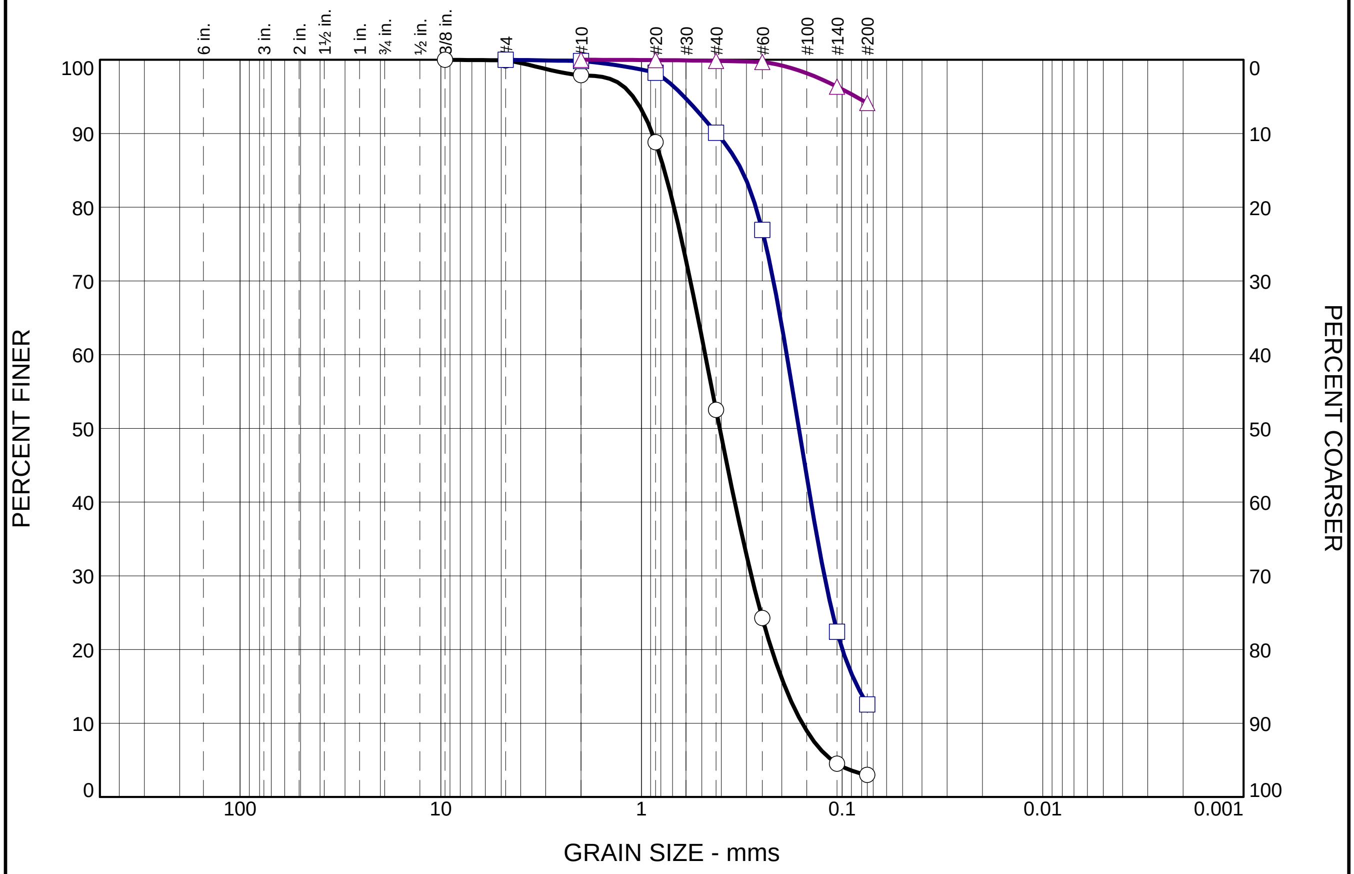
Physical Soil Testing Laboratory Report for B & L Woodwaste Site Project

Prepared for Floyd Snider
Two Union Square
601 Union Street, Suite 600
Seattle, WA 98101
and
AMEC Geomatrix
1201 Webster Street, 12th Floor
Oakland, CA 94612

Prepared by Soil Technology
7865 NE Day Road West
Bainbridge Island, WA 98110

Particle Size Distribution Report



	Cobbles	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	0.1	96.9	3.0		SP	A-3	NP	NV
□	0.0	0.0	87.4	12.6		SM	A-2-4(0)	NP	NV
△	0.0	0.0	5.9	94.1		ML	A-4(0)	NP	NV

SIEVE inches size	PERCENT FINER ○	□	△
.375	100.0		
	GRAIN SIZE		
D_{60}	0.4813	0.1889	
D_{30}	0.2832	0.1226	
D_{10}	0.1580		
	COEFFICIENTS		
C_c	1.05		
C_u	3.05		

SIEVE number size	PERCENT FINER ○	□	△
#4	99.9	100.0	
#10	97.9	99.8	100.0
#20	88.8	98.3	100.0
#40	52.5	90.1	99.9
#60	24.3	76.9	99.7
#140	4.5	22.4	96.4
#200	3.0	12.6	94.1

USC Classification

○ poorly graded sand

□ silty sand

△ silt

REMARKS:

○

□

△

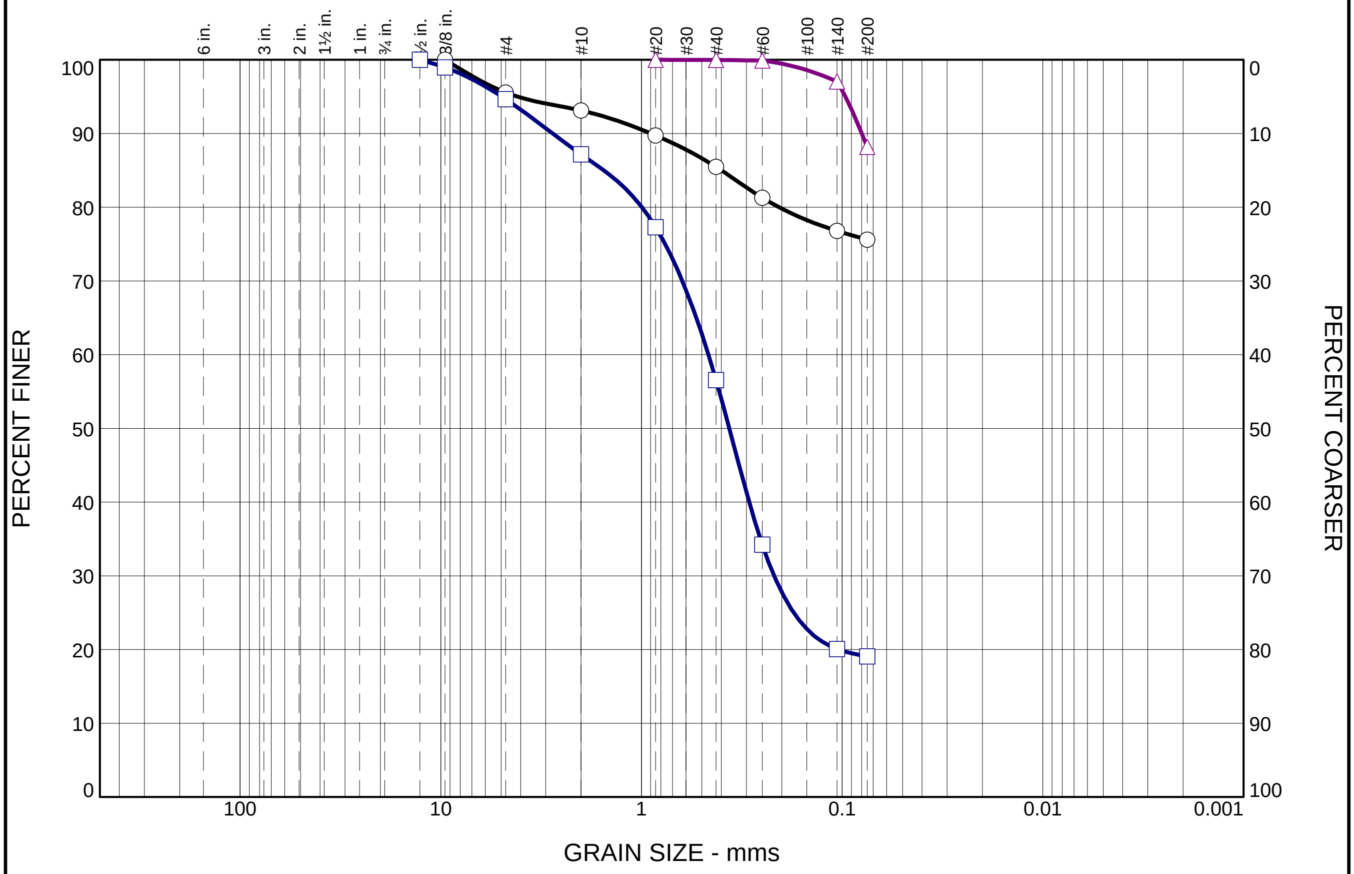
○ Source of Sample: Discrete Depth: 13.0-15.0 Sample Number: H-1
□ Source of Sample: Discrete Depth: 17-19 Sample Number: H-3
△ Source of Sample: Discrete Depth: 11.0-13.0 Sample Number: H-5

SOIL TECHNOLOGY

Bainbridge Island, WA

Client: Geomatrix
Project: B&L Landfill
Project No.: J-08-2284 Figure 1

Particle Size Distribution Report



	Cobbles	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	4.4	20.0	75.6		MH	A-7-5(11)	40	51
□	0.0	5.3	75.6	19.1		SM	A-2-4(0)	NP	NV
△	0.0	0.0	11.8	88.2		ML	A-4(0)	NP	NV

SIEVE inches size	PERCENT FINER ○	□	△
.5		100.0	
.375	100.0	99.0	
	GRAIN SIZE		
D60		0.4636	
D30		0.2182	
D10			
	COEFFICIENTS		
Cc			
Cu			

SIEVE number size	PERCENT FINER ○	□	△
#4	95.6	94.7	
#10	93.1	87.2	
#20	89.7	77.3	100.0
#40	85.5	56.5	100.0
#60	81.3	34.2	99.9
#140	76.8	20.1	97.0
#200	75.6	19.1	88.2

USC Classification

○ silt with sand

□ silty sand

△ silt

REMARKS:

○

□

△

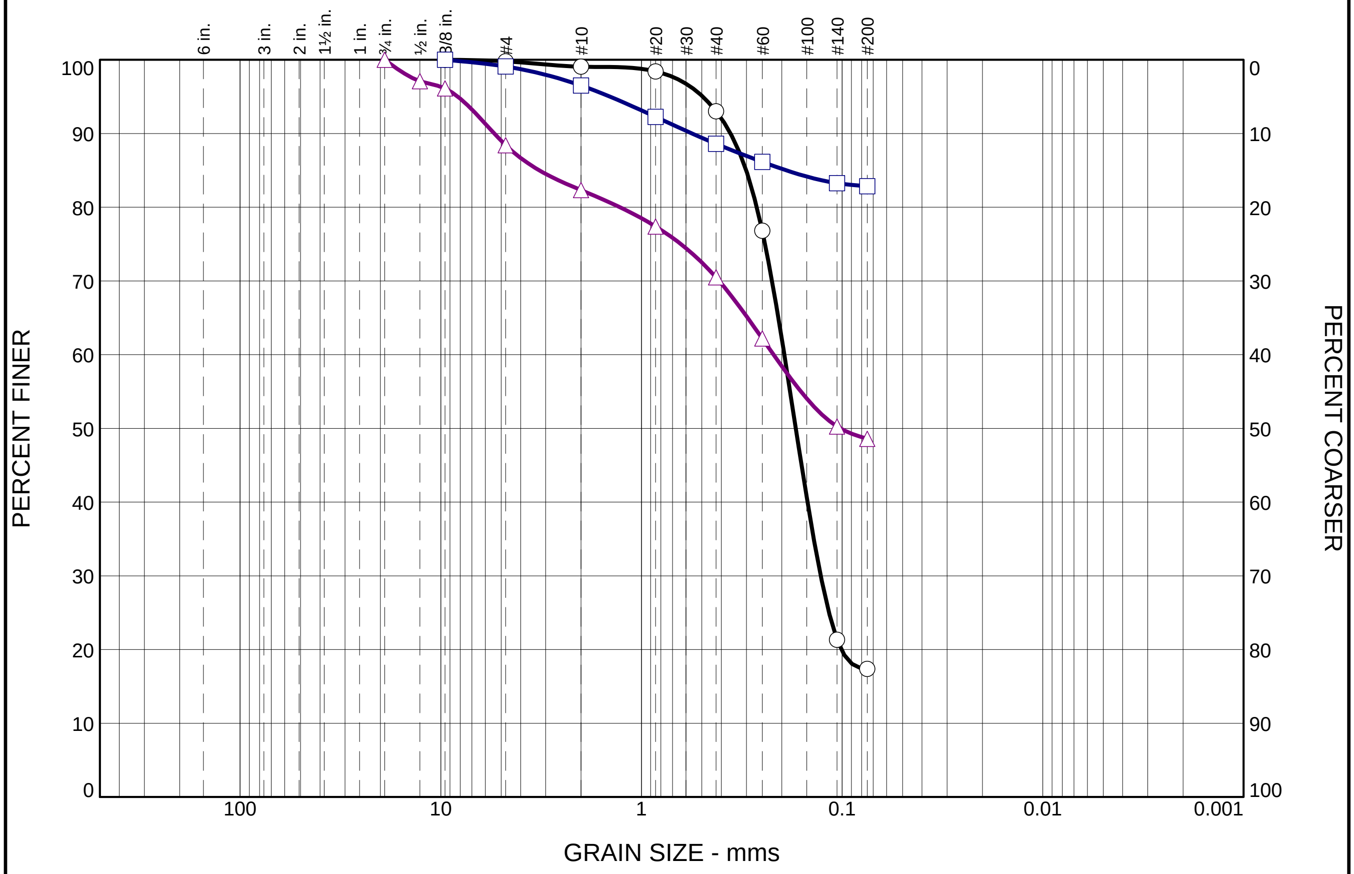
○ Source of Sample: Discrete Depth: 23.0-25.0 Sample Number: H-5
□ Source of Sample: Discrete Depth: 5.0-7.0 Sample Number: H-6
△ Source of Sample: Discrete Depth: 31.0-33.0 Sample Number: H-6

SOIL TECHNOLOGY

Bainbridge Island, WA

Client: Geomatrix
Project: B&L Landfill
Project No.: J-08-2284 Figure 2

Particle Size Distribution Report



	Cobbles	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	0.2	82.4	17.4		SM	A-2-4(0)	NP	NV
□	0.0	0.9	16.2	82.9		ML	A-4(0)	NP	NV
△	0.0	11.6	39.8	48.6		SM	A-4(0)	NP	NV

SIEVE	PERCENT FINER		
inches size	○	□	△
.75			100.0
.5			97.1
.375	100.0	100.0	96.1
	GRAIN SIZE		
D_{60}	0.1942		0.2196
D_{30}	0.1278		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE	PERCENT FINER		
number size	○	□	△
#4	99.8	99.1	88.4
#10	99.1	96.5	82.3
#20	98.4	92.3	77.4
#40	93.0	88.6	70.5
#60	76.8	86.2	62.2
#140	21.3	83.3	50.3
#200	17.4	82.9	48.6

USC Classification

○ silty sand

□ silt with sand

△ silty sand

REMARKS:

○

□

△

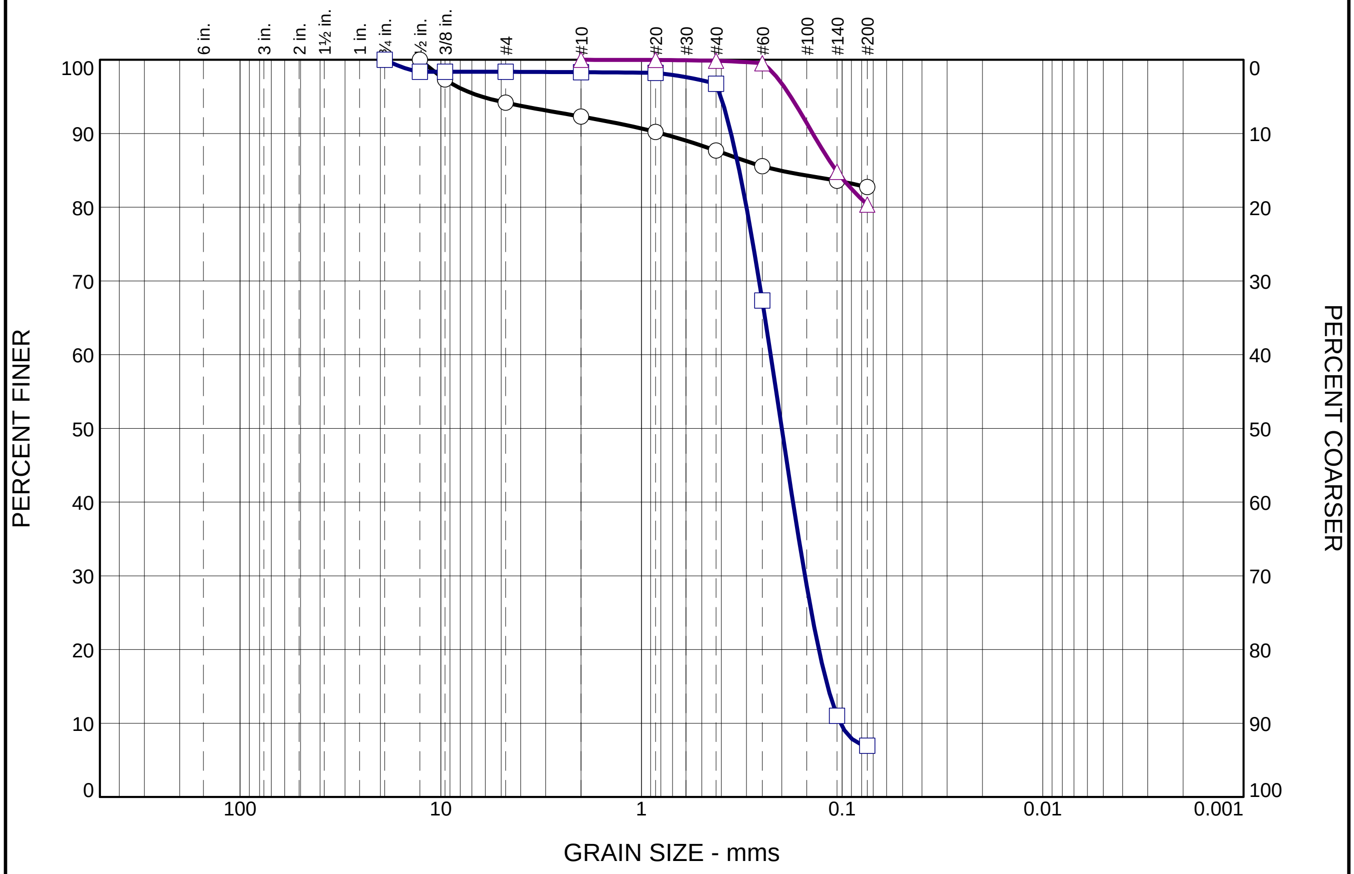
○ Source of Sample: Discrete Depth: 17.0-19.0 Sample Number: H-7
□ Source of Sample: Discrete Depth: 23.0-25.0 Sample Number: H-8
△ Source of Sample: Discrete Depth: 7.0-9.0 Sample Number: H-9

SOIL TECHNOLOGY

Bainbridge Island, WA

Client: Geomatrix
Project: B&L Landfill
Project No.: J-08-2284 Figure 3

Particle Size Distribution Report



	Cobbles	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	5.8	11.5	82.7		ML	A-4(0)	NP	NV
□	0.0	1.6	91.5	6.9		SP-SM	A-3	NP	NV
△	0.0	0.0	19.6	80.4		ML	A-4(0)	NP	NV

SIEVE inches size	PERCENT FINER ○	□	△
.75		100.0	
.5	100.0	98.4	
.375	97.3	98.4	
	GRAIN SIZE		
D_{60}		0.2271	
D_{30}		0.1532	
D_{10}		0.1020	
	COEFFICIENTS		
C_c		1.01	
C_u		2.23	

SIEVE number size	PERCENT FINER ○	□	△
#4	94.2	98.4	
#10	92.3	98.3	100.0
#20	90.2	98.2	100.0
#40	87.7	96.7	99.9
#60	85.6	67.3	99.5
#140	83.6	11.0	84.8
#200	82.7	6.9	80.4

USC Classification

○ silt with sand

□ poorly graded sand with silt

△ silt with sand

REMARKS:

○

□

△

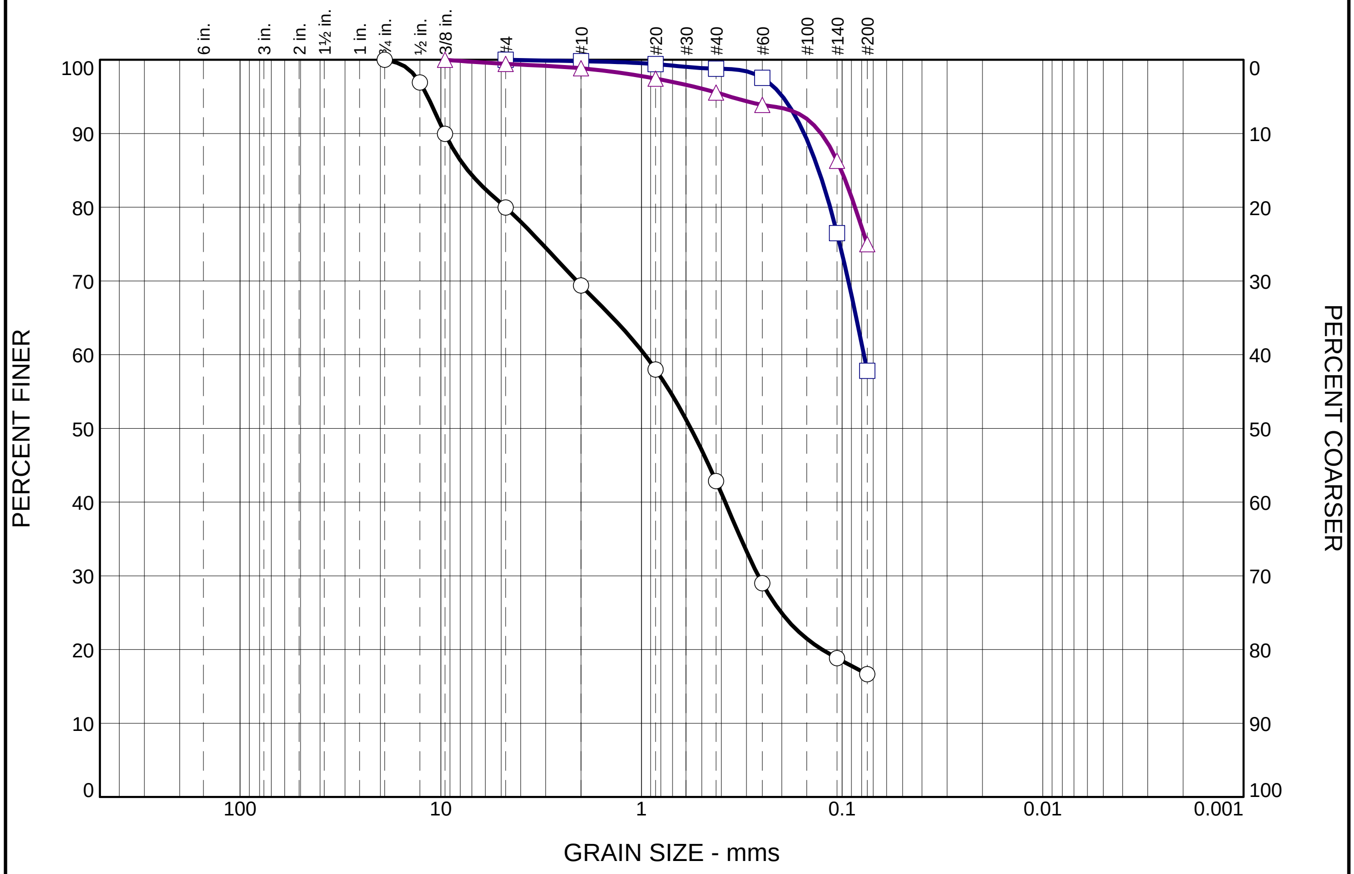
○ Source of Sample: Discrete Depth: 13.0-15.0 Sample Number: H-10
□ Source of Sample: Discrete Depth: 13.0-15.0 Sample Number: H-11
△ Source of Sample: Discrete Depth: 33.0-35.0 Sample Number: H-11

SOIL TECHNOLOGY

Bainbridge Island, WA

Client: Geomatrix
Project: B&L Landfill
Project No.: J-08-2284 Figure 4

Particle Size Distribution Report



	Cobbles	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	20.0	63.3	16.7		SM	A-1-b	NP	NV
□			42.2	57.8		ML	A-4(0)	NP	NV
△	0.0	0.6	24.4	75.0		ML	A-4(0)	NP	NV

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □	PERCENT FINER △
.75	100.0		
.5	96.9		
.375	89.9		100.0
	GRAIN SIZE		
D_{60}	0.9626	0.0779	
D_{30}	0.2616		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	PERCENT FINER □	PERCENT FINER △
#4	80.0	100.0	99.4
#10	69.4	99.8	98.9
#20	58.0	99.4	97.4
#40	42.9	98.8	95.6
#60	29.0	97.5	93.9
#140	18.8	76.5	86.3
#200	16.7	57.8	75.0

USC Classification

○ silty sand with gravel

□ sandy silt

△ silt with sand

REMARKS:

○

□

△

○ Source of Sample: Discrete Depth: 7.5-9.0 Sample Number: H-12

□ Source of Sample: Discrete Depth: 11.0-13.0 Sample Number: H-13

△ Source of Sample: Discrete Depth: 21.0-23.0 Sample Number: H-13

SOIL TECHNOLOGY

Bainbridge Island, WA

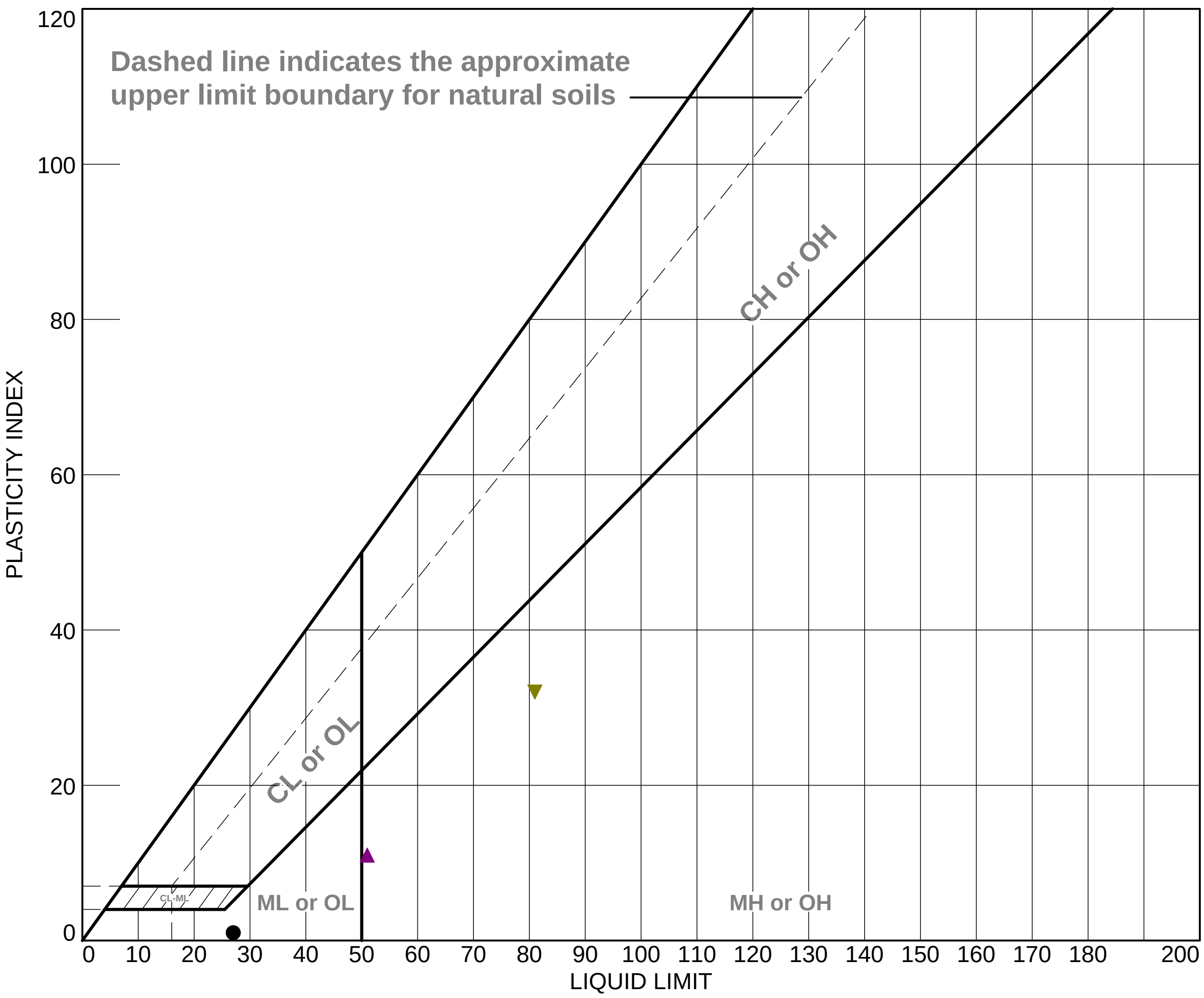
Client: Geomatrix

Project: B&L Landfill

Project No.: J-08-2284

Figure 5

Atterberg Limits Test Report ASTM D-4318



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Discrete	H-3	33.0-35.0	5	26	27	1	ML
■	Discrete	H-4	25.4-25.9	206	249	301	52	OH
▲	Discrete	H-5	23.0-25.0	56	40	51	11	MH
◆	Discrete	H-6	13.4-13.9	34	NP	NV	NP	ML
▼	Discrete	H-7	23.0-25.0	91	49	81	32	OH

SOIL TECHNOLOGY

Bainbridge Island, WA

Client: Geomatrix

Project: B&L Landfill

Project No.: J-08-2284

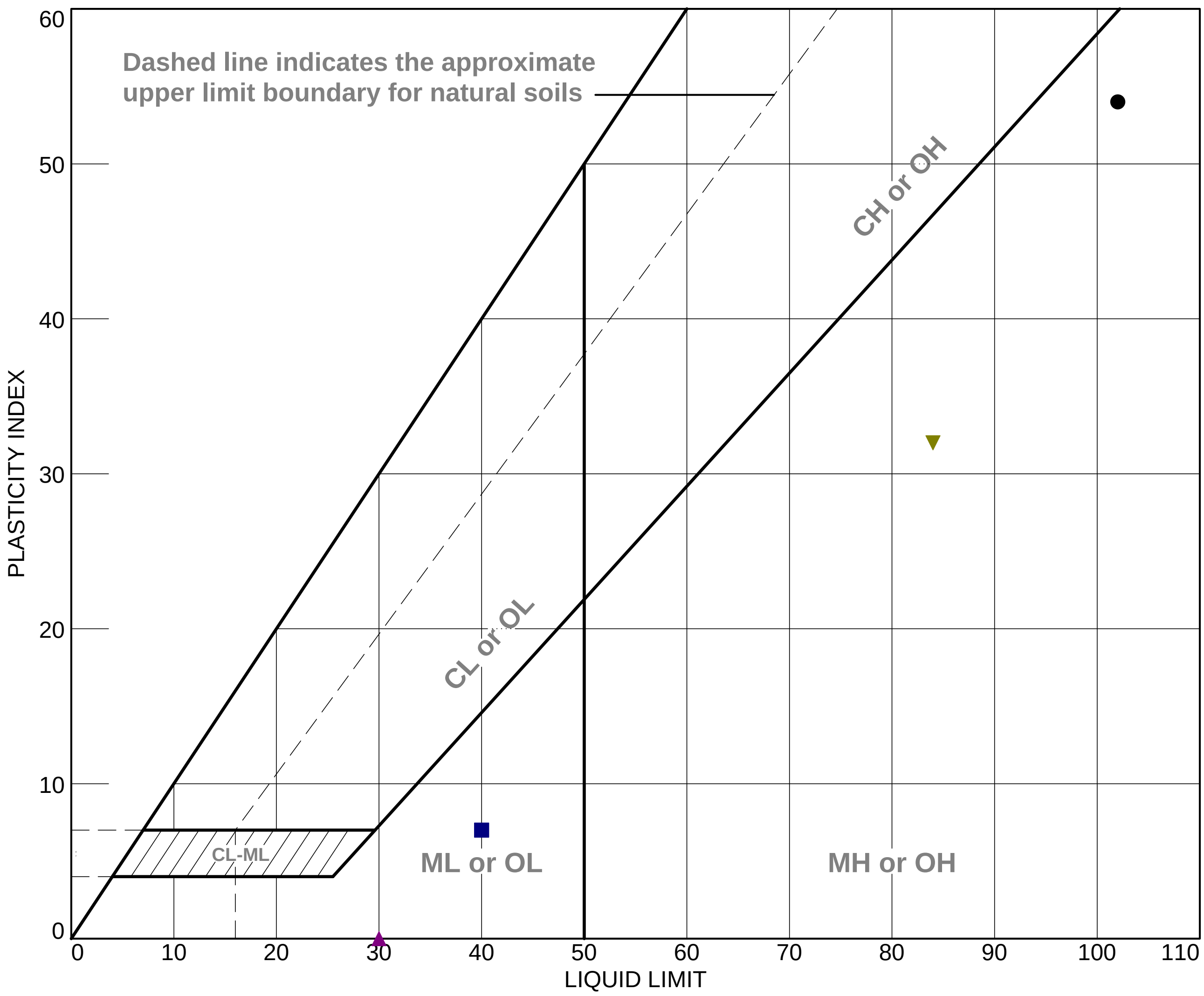
Figure 6

Tested By: CJE

Checked By: AJA

NP = Non-Plastic, NV = Non-Viscous

Atterberg Limits Test Report ASTM D-4318



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Discrete	H-8	21.7-22.2	121	48	102	54	OH
■	Discrete	H-11	24-24.5	42	33	40	7	ML
▲	Discrete	H-12	15.0-17.0	36	30	30	0	ML
◆	Discrete	H-14	23.0-25.0	29	NP	NV	NP	ML
▼	Discrete	H-13	17.0-19.0	79	52	84	32	OH

SOIL TECHNOLOGY

Bainbridge Island, WA

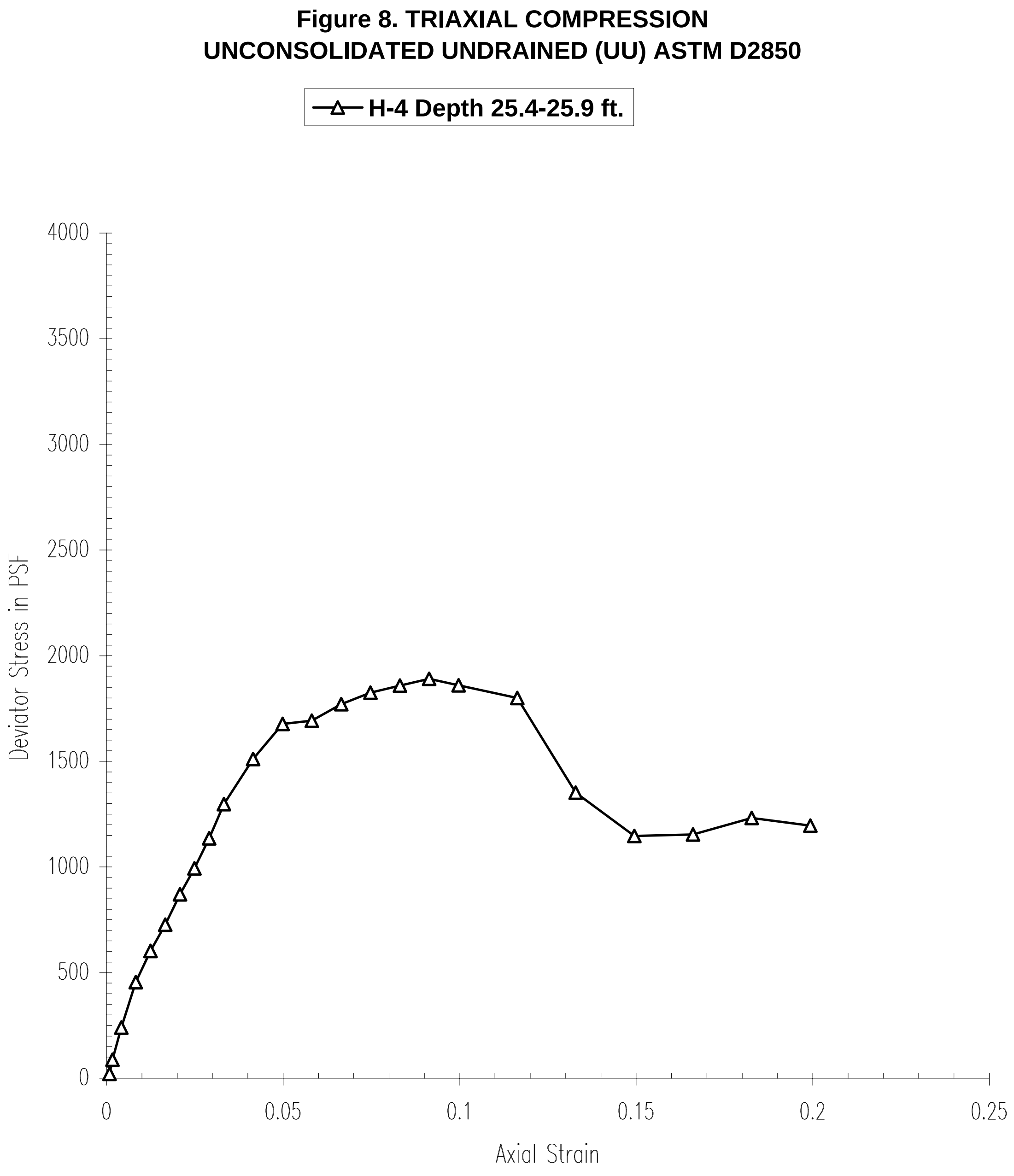
Client: Geomatrix
Project: B&L Landfill

Project No.: J-08-2284 **Figure 7**

Tested By: ● CJE ■ CJE ▲ CJE ▼ AJA **Checked By:** AJA

NP = Non-Plastic, NV = Non-Viscous

B & L Woodwaste Site
Prepared for Floyd Snider/GeoMatrix



Symbol	Boring Number	Sample Number	Depth ft	Water Content in Percent				Unit Weight		Cell Pressure psi
				Natural	Liquid Limit	Plastic Limit	Plasticity Index	Wet pcf	Dry pcf	
Δ	H-4	Shelby	25.4-25.9	206	301	249	52	74	24	22.2

B & L Woodwaste Site
AMEC / Geomatrix

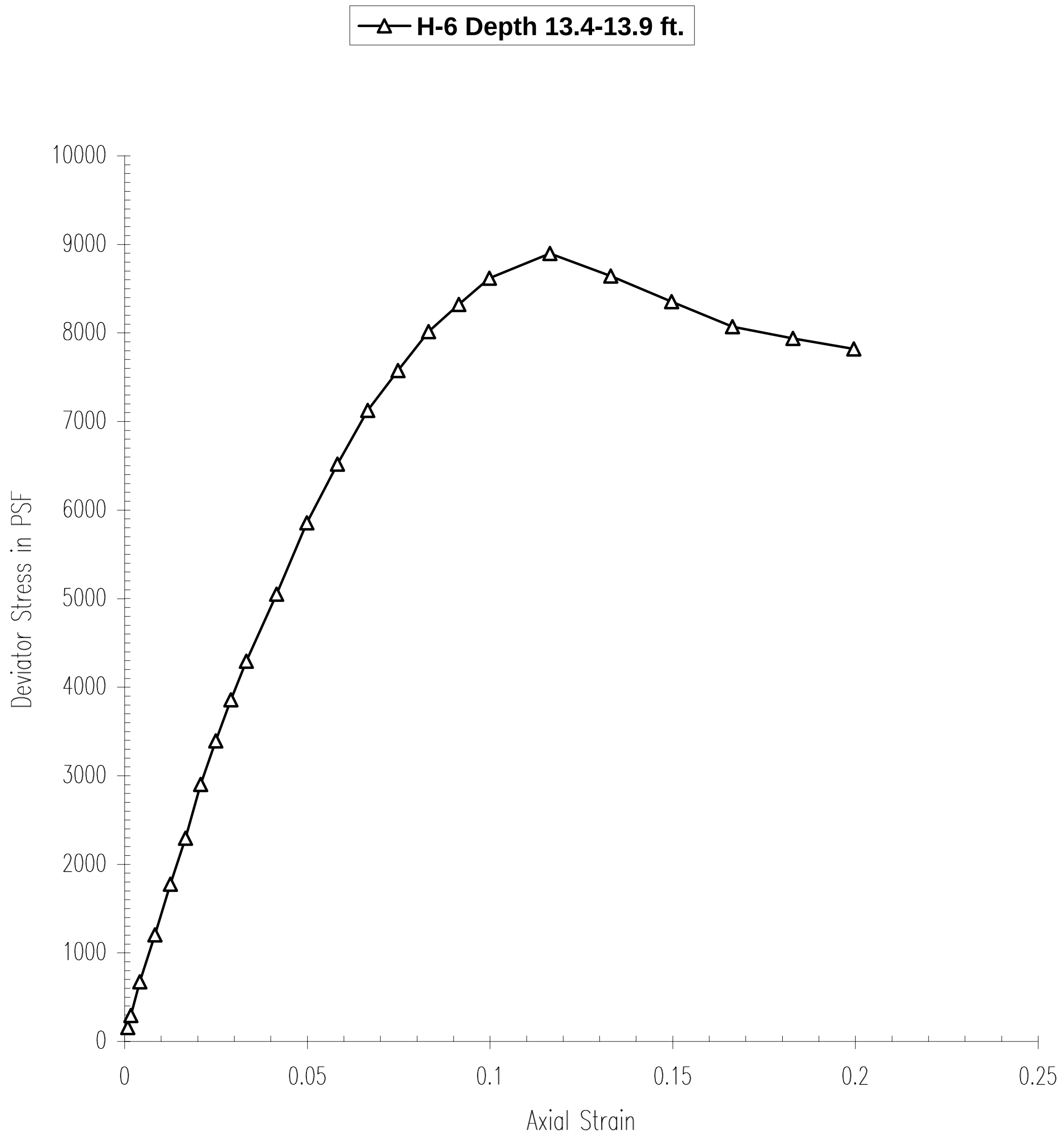
Job #	J-08-2284
Exploration #	H-4
Sample ID #	Shelby
Sample Depth (ft)	25.4-25.9
Type of Test	UU
Cell Pressure (psi)	22.2
Strain Rate (in/min)	0.06
Initial Platen Reading (mm)	0
Initial Load Cell Reading (lbs)	7
Date	10/14/2008
Test by	RGS
Initial Length (in)	6.02
Area (ft**2)	0.0446128
Youngs Modulus for membrane(lbs/in2)	200
Membrane Thickness in.	0.012

Deflection READ	Load Read lb	Strain Ratio	Deviator Stress psf
5	8	0.000831	21
10	11	0.001661	87
25	18	0.004153	240
50	28	0.008306	455
75	35	0.012458	603
100	41	0.016611	726
125	48	0.020764	871
150	54	0.024917	993
175	61	0.02907	1135
200	69	0.033223	1298
250	80	0.041528	1511
300	89	0.049834	1678
350	91	0.05814	1693
400	96	0.066445	1771
450	100	0.074751	1825
500	103	0.083056	1858
550	106	0.091362	1890
600	106	0.099668	1860
700	106	0.116279	1800
800	86	0.13289	1352
900	78	0.149502	1147
1000	81	0.166113	1154
1100	88	0.182724	1231
1200	89	0.199336	1196

H-4 Depth 25.4-25.9 ft.

B L Woodwaste Site
AMEC/Geomatrix

Figure 9. TRIAXIAL COMPRESSION
UNCONSOLIDATED UNDRAINED (UU) ASTM D-2850



Symbol	Boring Number	Sample Number	Depth ft	Water Content in Percent				Unit Weight		Cell Pressure psi
				Natural	Liquid Limit	Plastic Limit	Plasticity Index	Wet pcf	Dry pcf	
Δ	H-6	Shelby	13.4-13.9	34	GNP	GNP	GNP	117	87	12.2

B L Woodwaste Site
AMEC / Geomatrix

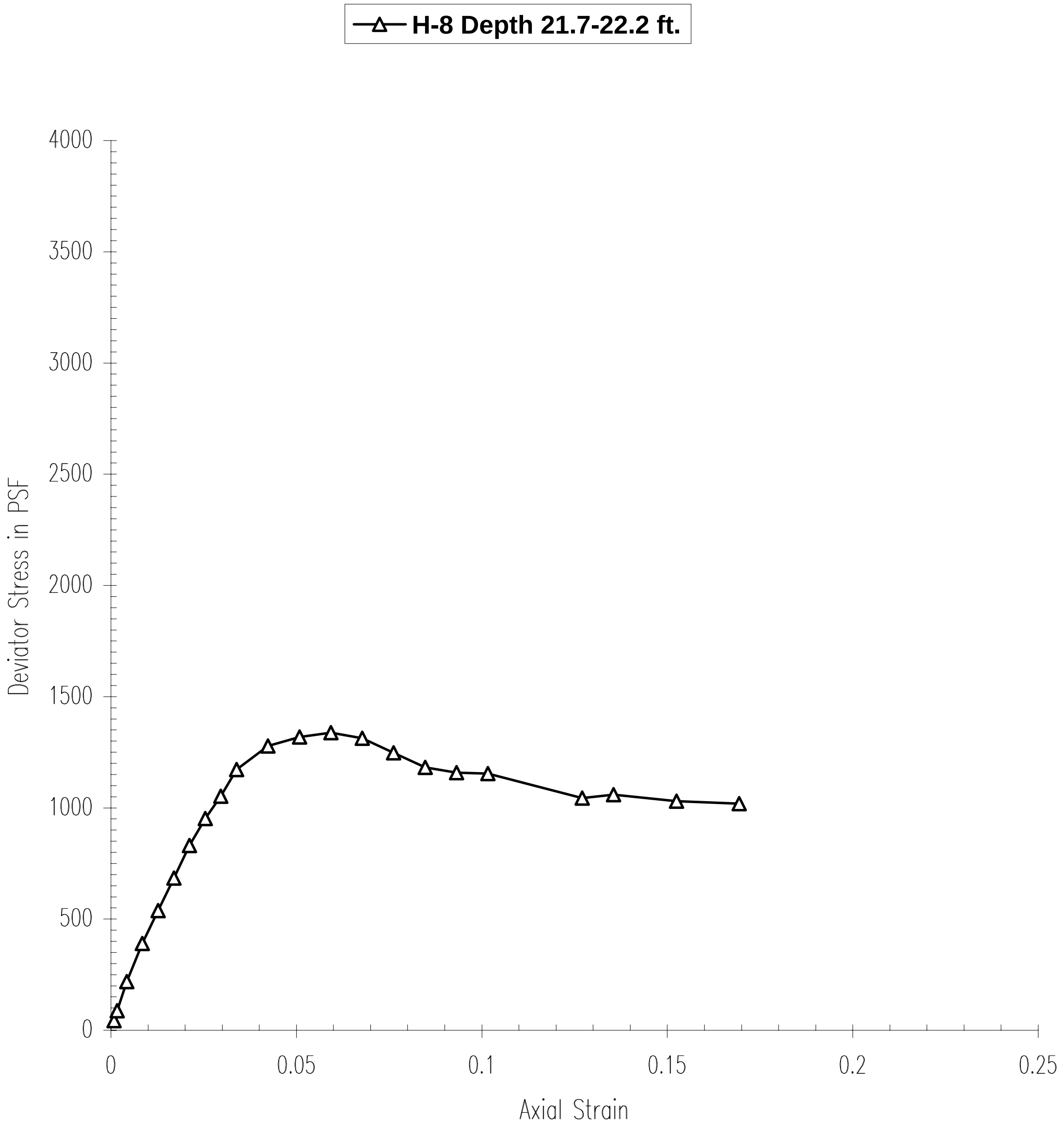
Job # J-08-2284
Exploration # H-6
Sample ID # Shelby
Sample Depth (ft) 13.4-13.9
Type of Test UU
Cell Pressure (psi) 12.2
Strain Rate (in/min) 0.06
Initial Platen Reading (mm) 0
Initial Load Cell Reading (lbs) 2
Date 10/20/2008
Test by RGS
Initial Length (in) 6.01333
Area (ft**2) 0.0440943
Youngs Modulus for membrane(lbs/in2) 200
Membrane Thickness in. 0.012

H-6 Depth 13.4-13.9 ft.

Deflection READ	Load Read lb	Strain Ratio	Deviator Stress psf
5	9	0.000831	157
10	15	0.001663	292
25	32	0.004157	672
50	56	0.008315	1203
75	82	0.012472	1774
100	106	0.01663	2296
125	134	0.020787	2903
150	157	0.024945	3393
175	179	0.029102	3857
200	200	0.033259	4295
250	237	0.041574	5050
300	277	0.049889	5857
350	311	0.058204	6519
400	343	0.066519	7127
450	368	0.074834	7576
500	393	0.083149	8015
550	412	0.091463	8321
600	431	0.099778	8620
700	454	0.116408	8897
800	451	0.133038	8644
900	446	0.149667	8355
1000	441	0.166297	8070
1100	444	0.182927	7937
1200	448	0.199557	7820

B & L Woodwaste Site
AMEC/Geomatrix

Figure 10. TRIAXIAL COMPRESSION
UNCONSOLIDATED UNDRAINED (UU) ASTM D-2850



Symbol	Boring Number	Sample Number	Depth ft	Water Content in Percent				Unit Weight		Cell Pressure psi
				Natural	Liquid Limit	Plastic Limit	Plasticity Index	Wet pcf	Dry pcf	
Δ	H-8	Shelby	21.7-22.2	121	102	48	54	85	39	18.8

B L Woodwaste Site
AMEC / Geomatrix

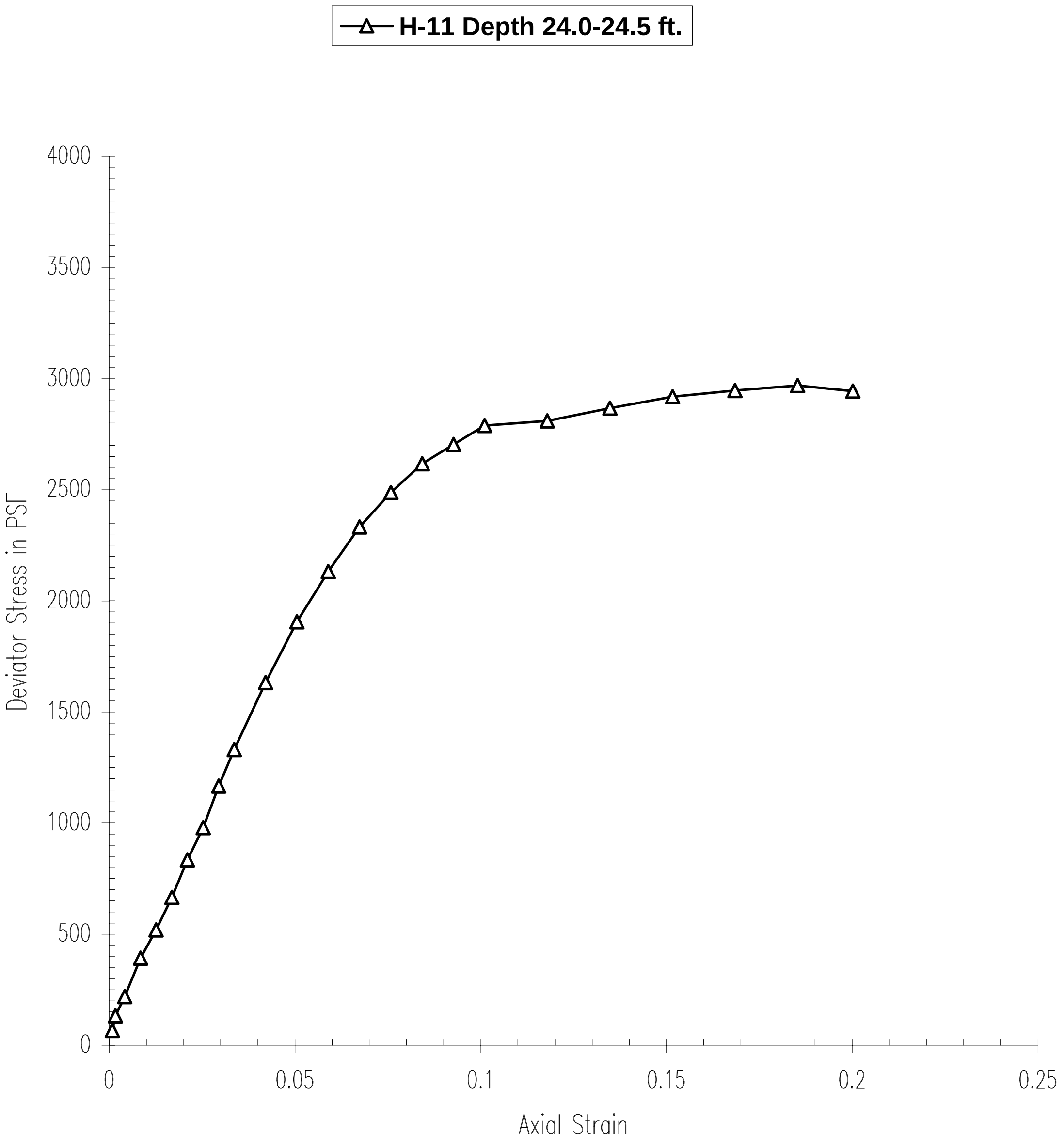
Job #	J-08-2284
Exploration #	H-8
Sample ID #	Shelby
Sample Depth (ft)	21.7-22.2
Type of Test	UU
Cell Pressure (psi)	18.8
Strain Rate (in/min)	0.059
Initial Platen Reading (mm)	0
Initial Load Cell Reading (lbs)	4
Date	10/17/2008
Test by	RGS
Initial Length (in)	5.9033
Area (ft**2)	0.044405
Youngs Modulus for membrane(lbs/in2)	200
Membrane Thickness in.	0.012

Deflection READ	Load Read lb	Strain Ratio	Deviator Stress psf
5	6	0.000847	44
10	8	0.001694	88
25	14	0.004235	218
50	22	0.00847	390
75	29	0.012705	538
100	36	0.01694	685
125	43	0.021175	830
150	49	0.02541	953
175	54	0.029644	1052
200	60	0.033879	1172
250	66	0.042349	1279
300	69	0.050819	1319
350	71	0.059289	1337
400	71	0.067759	1313
450	69	0.076229	1247
500	67	0.084698	1182
550	67	0.093168	1158
600	68	0.101638	1154
750	66	0.127048	1043
800	68	0.135517	1059
900	69	0.152457	1030
1000	71	0.169397	1019

H-8 Depth 21.7-22.2 ft.

B & L Woodwaste Site
AMEC/Geomatrix

Figure 11. TRIAXIAL COMPRESSION
UNCONSOLIDATED UNDRAINED (UU) ASTM D-2850



Symbol	Boring Number	Sample Number	Depth ft	Water Content in Percent				Unit Weight		Cell Pressure psi
				Natural	Liquid Limit	Plastic Limit	Plasticity Index	Wet pcf	Dry pcf	
Δ	H-11	Shelby	24.0-24.5	42	40	33	7	112	79	20.1

B & L Woodwaste Site
AMEC / Geomatrix

Job #	J-08-2284
Exploration #	H-11
Sample ID #	Shelby
Sample Depth (ft)	24.0-24.5
Type of Test	UU
Cell Pressure (psi)	20.1
Strain Rate (in/min)	0.059
Initial Platen Reading (mm)	0
Initial Load Cell Reading (lbs)	5
Date	10/16/2008
Test by	RGS
Initial Length (in)	5.9366
Area (ft**2)	0.044209
Youngs Modulus for membrane(lbs/in2)	200
Membrane Thickness in.	0.012

H-11 Depth 24.0-24.5 ft.

Deflection READ	Load Read lb	Strain Ratio	Deviator Stress psf
5	8	0.000842	67
10	11	0.001684	133
25	15	0.004211	219
50	23	0.008422	392
75	29	0.012633	519
100	36	0.016845	666
125	44	0.021056	834
150	51	0.025267	979
175	60	0.029478	1167
200	68	0.033689	1330
250	83	0.042112	1632
300	97	0.050534	1906
350	109	0.058956	2132
400	120	0.067379	2333
450	129	0.075801	2487
500	137	0.084223	2618
550	143	0.092646	2704
600	149	0.101068	2788
700	154	0.117913	2810
800	161	0.134757	2867
900	168	0.151602	2918
1000	174	0.168447	2946
1100	180	0.185291	2969
1188	183	0.200115	2944

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B & L Woodwaste Site
Prepared for Floyd Snider/GeoMatrix

Table 1
Moisture Contents

Sample Number	Sample Depth (ft)	Moisture Content %
H-1	13.0-15.0	22
H-3	17.0-19.0	24
H-3	33.0-35.0	5
H-5	11.0-13.0	31
H-5	23.0-25.0	56
H-6	5.0-7.0	11
H-6	31.0-33.0	37
H-7	17.0-19.0	26
H-7	23.0-25.0	91
H-8	23.0-25.0	73
H-9	7.0-9.0	23
H-10	13.0-15.0	42
H-11	13.0-15.0	27
H-11	33.0-35.0	34
H-12	7.5-9.0	10
H-12	15.0-17.0	34
H-13	11.0-13.0	31
H-13	17.0-19.0	79
H-13	21.0-23.0	41
H-14	23.0-25.0	29

Table 2
Moisture Contents and
Percent Passing U.S. Sieve No. 200, 75 Micron

Sample Number	Sample Depth (ft)	Moisture Content %	Percent Passing U.S. Sieve No. 200% 75 Micron
H-6	13.4-13.9	34	85
H-12	15.0-17.0	34	74
H-14	23.0-25.0	29	63

B & L Woodwaste Site
Prepared for Floyd Snider/GeoMatrix

Table 3
Flexible Wall Hydraulic Conductivity of Shelby Tube Specimens, ASTM D5084

Sample Identification	Sample Depth (FT)	Water Content %		Wet Density (Pcf)		Porosity		Saturation[1] %		Hydraulic Conductivity [2] cm/sec
		Before	After	Before	After	Before	After	Before	After	
H-4, 25-27	25.9-26.2	373	301	66	68	0.86	0.82	0.98	1.0	7 X 10^{-8}
H-11, 23-25	24.5-24.8	44	41	112	115	0.54	0.52	1.0	1.0	4 X 10^{-6}

[1] Specific gravity assumed for H-4 = 1.6, H-11 = 2.7
[2] Average saturated hydraulic conductivity using de-aired tap water.

Table 4
Flexible Wall Hydraulic Conductivity Test Parameters

Sample Identification	Sample Depth (FT)	Gradient (i)	Triaxial Pressure (psi)			Average Effective Confining Stress (psi)
			Cell	HW	TW	
H-4, 25-27	25.9-26.2	10.7	44.6	30.5	29.5	14.6
H-11, 23-25	24.5-24.8	3.2	43.5	30	30	13.5

HW = Head Water; TW = Tail Water; *i* = h/l

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B & L Woodwaste Site
Prepared for Floyd Snider/GeoMatrix
Chemical Compatibility Test

Table 5. Flexible Wall Hydraulic Conductivity of Remolded 28 Day Cure Slurry Wall Design Specimens
ASTM Method D-5084

Sample Identification	Water Content %		Wet Density (Pcf)		Porosity		Saturation[1] %		Hydraulic Conductivity [2] cm/sec	Hydraulic Conductivity [3] cm/sec
	Before	After	Before	After	Before	After	Before	After	With Tapwater	With Groundwater
Soil/Bentonite 3%	39	25	112	130	0.52	0.38	0.97	1.0	5 X 10^{-8}	5 X 10^{-8}
Soil/Bentonite 7%	51	29	97	121	0.62	0.45	0.85	1.0	<1 x 10^{-8}	<1 x 10^{-8}
Soil/Cement 7%/Bentonite 3%	50	51	107	108	0.58	0.57	1.0	1.0	6 X 10^{-7}	3 X 10^{-7}
Soil/Cement 7%/Bentonite 6%	65	64	100	100	0.64	0.64	1.0	1.0	3 X 10^{-7}	1 X 10^{-7}
95%cement/5%Bentonite	327	323	74	74	0.90	0.90	1.0	1.0	4 X 10^{-6}	9 X 10^{-7}

[1] Specific gravity assumed to be 2.7

[2] Average saturated hydraulic conductivity using de-aired tapwater.

[3] Average Saturated hydraulic conductivity using as received site groundwater, 4-week analysis period for compatibility test

Table 6. Flexible Wall Hydraulic Conductivity Test Parameters

Sample Identification	Gradient (i)	Triaxial Pressure (psi)			Average Effective Confining Stress
		Cell	HW	TW	(psi)
Soil/Bentonite 3%	11.9	40.0	30.5	29.5	10.0
Soil/Bentonite 7%	12.9	40.0	30.5	29.5	10.0
Soil/Cement 7%/Bentonite 3%	3.1	40.0	30.0	30.0	10.0
Soil/Cement 7%/Bentonite 6%	2.6	40.0	30.0	30.0	10.0
95%cement/5%Bentonite	3.9	40.0	30.0	30.0	10.0

HW = Head Water; TW = Tail Water; *i* = h/l

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B & L Woodwaste Site
Prepared for Floyd Snider/GeoMatrix

Slurry Wall Mix Design and Compatibility Testing

The mix designs for the chemical compatibility testing were prepared at the Soil Technology laboratory using a site soil composite, Hydrogel Wyoben Bentonite, Type I-II Ashgrove Cement and MI Drilling Fluids Spersene CF. Four mix designs were prepared using a site soil composite, and one mix design was prepared using only the grout mixture materials. Site water was used for the slurry mix designs, identified as: City of Milton, Public Works-Kent St., ID = Milton #1, Date 8/18/08 at 10:00 am. The groundwater used in hydraulic conductivity analysis for compatibility testing was identified as: PD-107-W-30’ 8/29/08 at 11:00 am.

Site Soil Sample Composite

On 10/28/08, the site soil samples were composited. The following soil samples, received in small plastic bags, were homogenized to prepare the composite:
H5, 11-13 feet
H5, 23-25 feet
H6, 5-7 feet
H7, 17-19 feet
H9, 7-9 feet
H10, 13-15 feet
H11, 13-15 feet
H12, 7.5-9 feet
H12, 15-17 feet
H13, 11-13 feet

Soil Composite and Bentonite Mixtures

On 10/22/08, a bentonite slurry was made as 64.3 grams dry bentonite per liter of site water by weight. The slurry was homogenized and allowed to hydrate. On 10/29/08 the bentonite slurry was a 40-second-slurry using the Marsh funnel. The 40-second-slurry was used on 10/20/08 to prepare a 3% dry bentonite to dry site soil composite mixture and a 7% dry bentonite to site soil composite mixture. The slump was 5.75 to 6-inches for the soil composite with 3% bentonite mixture. Molds were prepared and subsequently allowed to cure for 28-days in a cool and humid environment. Then a chemical compatibility test was performed on the mixture using site groundwater.

Soil Composite, Bentonite and Cement Mixtures

Using the bentonite slurry from 10/22/08, a site soil composite with bentonite and cement mix design was prepared on 10/31/08. A cement slurry was prepared on 10/30/08 as 65g water per 100 g dry cement. Spersene was added at 0.8 percent dry of the dry cement weight. Two mixes were prepared, both containing 7 % cement by dry weight of dry site soil composite however varying in bentonite percentage. One containing 3% and the other at 6% dry weight bentonite to dry weight of site soil composite. The bentonite was also added by slurry. The slump was 5.5 to 6-inches for the Soil with 7% cement and 3% bentonite mixture and 5.5-inches for the soil with 7% cement and 6% bentonite mixture. Molds were prepared and subsequently allowed to cure for 28-days in a cool and humid environment. Then a chemical compatibility test was performed on the mixture using site groundwater.

Grout Mixture Preparation

On 11/12/08, a slurry was prepared using site water at 5 % dry bentonite to site water by weight and 0.14% dry spersene to site water by weight. The slurry was allowed to hydrate for 24-hours. Then the cement was added as 20% dry weight to site water. Using the Marsh funnel the slurry was at 42-seconds. The mixture was subsequently allowed to cure for 28-days in a cool and humid environment. Then a chemical compatibility test was performed on the mixture using site groundwater.

Fremont Analytical

2930 Westlake Ave N Suite 100
Seattle, WA 98109
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste Site
Fremont Project No: CHM080829-1
Floyd | Snider Project No: B&L RIM

September 12th, 2008

Brett:

Enclosed are the analytical results for the ***B & L Woodwaste*** water samples delivered to Fremont Analytical on August 29th, 2008.

The samples were received in good condition – in a cooler with wet ice, in the proper containers, properly sealed, labeled and within holding time. The cooler temperature upon receipt was 2°C, which is within the laboratory recommended cooler temperature range (2°C - 10°C). The samples were extracted and stored in refrigeration units at the USEPA-recommended temperature of 4°C ± 2°C. There were no sample receipt issues to report.

Examination was conducted for the presence of the following:

- ***Dissolved Metals (As, Ca, Fe, Mg, Na) in Water by EPA Method 6020***
- ***pH by SM 4500-H***
- ***Nitrate by SM 4500-NO3-E***
- ***Chloride by EPA Method 300*****
- ***Total Organic Carbons by SM 5310-B*****
- ***Total Alkalinity by SM 2320-B*****

These applications were performed under Washington State Department of Ecology accreditation parameters. All appropriate Quality Assurance / Quality Control method parameters have been applied.

**Analysis performed by Edge Analytical

2930 Westlake Ave N Suite 100
Seattle, WA 98109
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Attn: Brett Beaulieu
601 Union St., Ste 600
Seattle, WA 98101

RE: B & L Woodwaste Site
Fremont Project No: CHM080829-1
Floyd | Snider Project No: B&L RIM

EPA Method 6020 Notations:

- *Metals samples were received in preserved bottles. The Chain of Custody indicated that the samples were "field filtered." Samples PD-107-W-30 and PDD10A-16F had visible sediment and were laboratory filtered before analysis*
- *Matrix spike and matrix spike duplicate for sample " PD-107-W-30 " could not be determined for Ca, Fe, Mg and Na due to the concentration of these analytes in the sample relative to the concentration of these analytes in the spike solution*
- *Recoveries for the matrix spike and matrix spike duplicate were low for As due to the concentration of this analyte in the sample.*
- *The LCS recoveries for all analytes were within QC Limits providing Batch QC.*

If you have any questions about the results, please contact the laboratory.

Thank you for using Fremont Analytical!

Sincerely,

Michael Dee
Principal / Sr. Chemist
mikedee@fremontanalytical.com

**Analysis performed by Edge Analytical

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080829-1

EPA 6020 (mg/L)	**MRL**	**Method Blank**	**LCS**	**PD-107-W-30'**	Duplicate **PD-107-W-30'**	**RPD**	**BLW-D4-PDD10A-13F**
Date Extracted		9/3/08	9/3/08	9/3/08	9/3/08	%	9/3/08
Date Analyzed		9/5/08	9/5/08	9/5/08	9/5/08		9/5/08
Matrix		Water		Water	Water		Water
Arsenic (As)	0.002	nd	93%	**2.7**	**2.3**	16%	**0.4**
Calcium (Ca)	0.02	nd	89%	**107**	**83**	25%	*N/A*
Iron (Fe)	0.1	nd	100%	**38**	**31**	20%	*N/A*
Magnesium (Mg)	0.1	nd	97%	**75**	**69**	8%	*N/A*
Sodium (Na)	0.5	nd	80%	**29**	**25**	15%	*N/A*

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%
Spike Concentration:
As, Fe, Mg, Na, Ca = 100µg/L
Fe = 200 µg/L

Analysis of Dissolved Metals in Water by EPA Method 6020

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080829-1

EPA 6020 (mg/L)	**MRL**	**BLW-D4-PDD10A-16F**	MS **PD-107-W-30'**	MSD **PD-107-W-30'**	**RPD**
Date Extracted		9/3/08	9/3/08	9/3/08	%
Date Analyzed		9/5/08	9/5/08	9/5/08	
Matrix		Water	Water	Water	
Arsenic (As)	0.002	**0.1**	62%	42%	38%
Calcium (Ca)	0.02	*N/A*			
Iron (Fe)	0.1	*N/A*			
Magnesium (Mg)	0.1	*N/A*			
Sodium (Na)	0.5	*N/A*			

"nd" Indicates no detection at the listed reporting limits
"int" Indicates that interference prevents determination
"J" Indicates estimated value
"N/A" Analysis not requested
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample
"MS" Indicates Matrix Spike
"MSD" Indicates Matrix Spike Duplicate
"RPD" Indicates Relative Percent Difference

Acceptable RPD is determined to be less than 30%
Acceptable Recovery Limits:
LCS, LCSD: 65% to 135%
Spike Concentration:
As, Fe, Mg, Na, Ca = 100µg/L
Fe = 200 µg/L

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of Nitrate by SM 4500 - N0$_3^-$E

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080829-1

SM 4500-NO$_3^-$E (mg NO$_3^-$-N/L)	**MRL**	**Method Blank**	**LCS**	**PD-107-W-30'**	Duplicate **PD-107-W-30'**	**RPD %**
Date Analyzed		9/1/08	9/1/08	9/1/08	9/1/08	
Matrix		Water		Water	Water	
Nitrate	0.8	nd	70%	**10.2**	**10.5**	3%

"nd" Indicates not detected at listed reporting limit
"MRL" Indicates Method Reporting Limit
"LCS" Indicates Laboratory Control Sample

Acceptable RPD is determined to be less than 20%

2930 Westlake Ave. N., Suite 100
Seattle, WA 98109

T: 206.352.3790
F: 206.352.7178
email: info@fremontanalytical.com

Analysis of pH in Water by SM4500-H

Project: B&L Woodwaste
Client: Floyd | Snider
Client Project #: B&L RIM
Lab Project #: CHM080829-1

		Duplicate
SM 4500-H	**PD-107-W-30'**	**PD-107-W-30'**
Date Analyzed	9/1/08	9/1/08
Matrix	Water	Water
pH	**6.3**	**6.3**

"int" Indicates that interference prevents determination

EDGE ANALYTICAL LABORATORIES

Burlington WA | 1620 S Walnut St - 98233
Corporate Office | 800.755.9295 • 360.757.1400 • 360.757.1402fax
Bellingham WA | 805 Orchard Dr Suite 4 - 98225
Microbiology | 360.671.0688 • 360.671.1577fax

Data Report

Client Name: Fremont Analytical
2930 Westlake Ave N #100
Seattle, WA 98109

Report Date: 9/4/2008
Reference Number: 08-12499
Project: BTL Woodwaste

Collected By:

Date Received: 9/3/2008
Peer Review:

Lab Number: 26275 Sample Description: PD-107 W 30 Sample Date: 8/29/2008

CAS ID#	Analyte	Result	PQL	MDL	Units	DF	Method	Analyzed	Analyst	Batch	Comments
E-14506	**ALKALINITY**	**648**	5.0	2	mg/L	1.0	SM2320 B	9/4/2008	CCN	ALK_080904	
16887-00-6	**CHLORIDE**	**68**	10.0	0.012	mg/L	100.0	300.0	9/3/2008	BJ	I080903A	
E-10195	**TOTAL ORGANIC CARBON**	**29.6**	0.50	0.0981	mg/L	1.0	SM5310 B	9/3/2008	BJ	TOC_080903	

PQL = Practical Quantitation Limit is the lowest level that can be acheived within specified limits of precision and accuracy during routine laboratory operating conditions.
ND = Not detected above the listed practical quantitation limit (PQL) or not above the Method Detection Limit (MDL), if requested.
D.F. - Dilution Factor

WSDOE Lab C1251
WSDOH Lab 046

EDGE ANALYTICAL LABORATORIES

Burlington WA
Corporate Office
1620 S Walnut St - 98233
800.755.9295 • 360.757.1400 • 360.757.1402fax

Bellingham WA
Microbiology
805 Orchard Dr Suite 4 - 98225
360.671.0688 • 360.671.1577fax

QUALITY CONTROL REPORT

Duplicate and Matrix Spike/Matrix Spike Duplicate Report

Reference Number: 08-12499

Report Date: 9/4/2008

Duplicate

Batch	Sample	Analyte	Result	Duplicate Result	Units	%RPD	Limits	QC Qualifier	Comments
ALK_080904									
	26275	ALKALINITY	648	645	mg/L	**0.5**	0-45	DUP	
I080903A									
	26292	CHLORIDE	51	51	mg/L	**0.0**	0-45	DUP	
	26311	CHLORIDE	28	28	mg/L	**0.0**	0-45	DUP	
	26341	CHLORIDE	6	6	mg/L	**0.0**	0-45	DUP	
TOC_080903									
	26057	TOTAL ORGANIC CARBON	1.06	1.06	mg/L	**0.0**	0-50	DUP	
	26318	TOTAL ORGANIC CARBON	4.81	4.81	mg/L	**0.0**	0-50	DUP	

%RPD = Relative Percent Difference

NA = Indicates %RPD could not be calculated

Matrix Spike (MS)/Matrix Spike Duplicate (MSD) analyses are used to determine the accuracy (MS) and precision (MSD) of a analytical method in a given sample matrix. Therefore, the usefulness of this report is limited to samples of similar matrices analyzed in the same analytical batch.

Only Duplicate sample with detections are listed in this report

Matrix Spike

Batch	Sample	Analyte	Result	Spike Result	Duplicate Spike Result	Spike Conc	Units	Percent Recovery MS	Percent Recovery MSD	Limits	%RPD	Limits	QC Qualifier	Comments
I080903A														
	26292	CHLORIDE	51	51		1.00	mg/L	**0**	**NA**	80-120	**NA**	0-60	S	LFM
	26311	CHLORIDE	28	28		1.00	mg/L	**0**	**NA**	80-120	**NA**	0-60	S	LFM
	26341	CHLORIDE	6	7.1		1.00	mg/L	**110**	**NA**	80-120	**NA**	0-60		LFM
TOC_080903														
	26318	TOTAL ORGANIC CARBON	4.81	8.82	8.93	4.00	mg/L	**100**	**103**	65-135	**2.7**	0-70		LFM

%RPD = Relative Percent Difference

NA = Indicates %RPD could not be calculated

Matrix Spike (MS)/Matrix Spike Duplicate (MSD) analyses are used to determine the accuracy (MS) and precision (MSD) of a analytical method in a given sample matrix. Therefore, the usefulness of this report is limited to samples of similar matrices analyzed in the same analytical batch.

Only Duplicate sample with detections are listed in this report

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SAMPLE INDEPENDENT QUALITY CONTROL REPORT

Laboratory Fortified Blank

Reference Number: 08-12499
Report Date: 09/04/08

Batch	Analyte	Result	True Value	Units	Method	% Recovery	Limits	QC Qualifier	Type*	Comment
alk_080904	ALKALINITY	108	100	mg/L	SM2320 B	108	80-120		LFB	
alk_080904	ALKALINITY	108	100	mg/L	SM2320 B	108	80-120		LFB	
TOC_080903	TOTAL ORGANIC CARBON	0.99	1.00	mg/L	SM5310 B	99	90-110		LFB	

---

*Notation:

% Recovery = (Result of Analysis)/(True Value) * 100

NA = Indicates % Recovery could not be calculated.

QCS: Quality Control Sample, a solution containing known concentrations of method analytes which is used to fortify an aliquot of reagent matrix. The QCS is obtained from an external source and is used to check lab performance.

LFB: Laboratory Fortified Blank, an aliquot of reagent matrix to which known quantities of method analytes are added in the lab. The LFB is analyzed exactly like a sample, and its purpose is to determine whether method performance is within accepted control limits.

MB or LRB: Method Blank or Laboratory Reagent Blank, an aliquot of reagent matrix is analyzed exactly like a sample, and its purpose is to determine if there is background contamination.

SAMPLE INDEPENDENT QUALITY CONTROL REPORT

Laboratory Reagent Blank

Reference Number: 08-12499
Report Date: 09/04/08

Batch	Analyte	Result	True Value	Units	Method	% Recovery	Limits	QC Qualifier	Type*	Comment
I080903A	CHLORIDE	ND		mg/L	300.0		0.10000		LRB	

---

*Notation:

% Recovery = (Result of Analysis)/(True Value) * 100

NA = Indicates % Recovery could not be calculated.

QCS: Quality Control Sample, a solution containing known concentrations of method analytes which is used to fortify an aliquot of reagent matrix. The QCS is obtained from an external source and is used to check lab performance.

LFB: Laboratory Fortified Blank, an aliquot of reagent matrix to which known quantities of method analytes are added in the lab. The LFB is analyzed exactly like a sample, and its purpose is to determine whether method performance is within accepted control limits.

MB or LRB: Method Blank or Laboratory Reagent Blank, an aliquot of reagent matrix is analyzed exactly like a sample, and its purpose is to determine if there is background contamination.

SAMPLE INDEPENDENT QUALITY CONTROL REPORT

Method Blank

Reference Number: 08-12499
Report Date: 09/04/08

Batch	Analyte	Result	True Value	Units	Method	% Recovery	Limits	QC Qualifier	Type*	Comment
TOC_080903	TOTAL ORGANIC CARBON	ND		mg/L	SM5310 B		0.12000		MB	

---

*Notation:

% Recovery = (Result of Analysis)/(True Value) * 100

NA = Indicates % Recovery could not be calculated.

QCS: Quality Control Sample, a solution containing known concentrations of method analytes which is used to fortify an aliquot of reagent matrix. The QCS is obtained from an external source and is used to check lab performance.

LFB: Laboratory Fortified Blank, an aliquot of reagent matrix to which known quantities of method analytes are added in the lab. The LFB is analyzed exactly like a sample, and its purpose is to determine whether method performance is within accepted control limits.

MB or LRB: Method Blank or Laboratory Reagent Blank, an aliquot of reagent matrix is analyzed exactly like a sample, and its purpose is to determine if there is background contamination.

SAMPLE INDEPENDENT
QUALITY CONTROL REPORT

Quality Control Sample

Reference Number: 08-12499
Report Date: 09/04/08

Batch	Analyte	Result	True Value	Units	Method	% Recovery	Limits	QC Qualifier	Type*	Comment
I080903A	CHLORIDE	29.4	30.0	mg/L	300.0	98	80-120		QCS	
TOC_080903	TOTAL ORGANIC CARBON	2.13	2.22	mg/L	SM5310 B	96	90-110		QCS	

---

*Notation:

% Recovery = (Result of Analysis)/(True Value) * 100

NA = Indicates % Recovery could not be calculated.

QCS: Quality Control Sample, a solution containing known concentrations of method analytes which is used to fortify an aliquot of reagent matrix. The QCS is obtained from an external source and is used to check lab performance.

LFB: Laboratory Fortified Blank, an aliquot of reagent matrix to which known quantities of method analytes are added in the lab. The LFB is analyzed exactly like a sample, and its purpose is to determine whether method performance is within accepted control limits.

MB or LRB: Method Blank or Laboratory Reagent Blank, an aliquot of reagent matrix is analyzed exactly like a sample, and its purpose is to determine if there is background contamination.

Qualifier Definitions

Reference Number: 08-12499
Report Date: 09/04/08

Qualifier	Definition
M	Matrix induced bias assumed.
S	Spiking amount was lower than the 5:1 spike to background (sample amount) basis for performance criteria. The reported criteria does not apply due to increased errors in measurement of both sample and spike concentration.

Note: Some qualifier definitions found on this page may pertain to results or QC data which are not printed with this report.

Fremont Analytical

2930 Westlake Ave. N. Suite 100
Seattle, WA 98109

Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record

Date: 8/29/08

Page: 1 of: 1

Client: FLOYD/SNIDER
Address: 601 UNION ST. SUITE 600
City, State, Zip SEATTLE WA 98101
Tel: 206 292 2078

Project Name: BHL WOODWASTE
Location:
Collected by: ERIN MURRAY/ BRETT BEAULIEU LISA MEOLI

Reports To (PM):
Fax:
Email:
Project No: BHL RIM

	Sample Name	Time	Sample Type	Container Type	Date of Collection	VOA 8260	VOA 8021B BTEX	NWTPH-Gx	~~NWTPH-HCID~~ ARSENIC	NWTPH-Dx Ext.	SEMI VOL 8270C	PAH 8270	PCBs 8082	Cl PESTICIDES 8081	~~Cl HERBICIDES 8151A~~ pH 150.1	METALS: As, Ca (6010) Fe, Mg, Na	~~Metals: MTCA5~~ Chloride 325.2	~~Metals: RCRA8~~ Sulfide 325.2	ORGANIC CARBON 415.1	Total Alkalinity 310.1	Comments/Depth
1	PD-107-W-30'	11:00	W	3x 500 mL Poly 1x 500 mL Amber	8/29/08										X	X	X	X	X	X	ORGANIC CARBON SAMPLE
2	~~PD-10A-13'~~	~~12:40~~	~~W~~	~~2x 500 mL Poly~~																	FIELD-FILTERED
3	~~PD-10A~~	SB	8/29/08																		
4	BLW-DY-PDD10A-13F	12:40	W	1x 500 mL Poly	8/27/08				X												FIELD-FILTERED
5	BLW-DY-PDD10A-16F	11:00	W	1x 500 mL Poly	8/27/08				X												FIELD-FILTERED
6																					
7																					
8																					
9																					
10																					

Relinquished x Lisa Meoli Date/Time 8/29/08 1600 Received x Date/Time: 8/29/08 1600

Relinquished x Date/Time Received x Date/Time:

Sample Receipt:

Good?
Temperature:
Seals Intact?:
Total Number of Containers:

Special Remarks

TAT --> 24HR 48HR Standard

B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR)

Appendix C
Phase 1 Hydrogeologic Study Report

FINAL

Table of Contents

List of Tables

List of Figures

List of Attachments

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1.0 Introduction

This Hydrogeologic Study Report (Report) has been prepared to support implementation of the 2008 Cleanup Action Plan (CAP) for the B&L Woodwaste Site (Site). The hydrogeologic model described in this report will be used to support the phased implementation of the CAP. The CAP addresses the B&L Woodwaste Landfill (Landfill) that is located on the B&L Property. A plume of contaminated groundwater extends downgradient from the Landfill. Additional groundwater contamination is present on the B&L Property and extending onto the adjacent upgradient property and the property located to the west of the Landfill. Additionally, sediments in nearby agricultural drainage ditches have been affected by arsenic releases from the Landfill. All affected properties and media comprise the Site that is addressed by this Report. For convenience in describing the remedy, the Site has been subdivided into several areas. The following Cleanup Action Areas (CAAs) and remedy components have been defined for implementation of the 2008 CAP:

- Landfill/Ditch CAA. Installation of a perimeter slurry wall around the Landfill that is tied into both the existing landfill cap and a low-permeability soil unit located below the Landfill, the diversion of clean surface water and groundwater before it reaches the slurry wall, and the extraction and treatment of leachate from within the slurry wall to maintain hydraulic control by creating an inward hydraulic flow gradient. Once the slurry wall is installed, contaminated sediments in the adjacent agricultural drainage ditches will be excavated and disposed of at a permitted landfill.

- Wetlands CAA. A groundwater pump and treat system will be used to remove arsenic from the groundwater plume in the Wetlands CAA. Performance-based criteria will be used to assure compliance with MTCA requirements. It is anticipated that up to 120 million gallons of water may require treatment.

- End-of-Plume CAA. In-situ treatment will be used to precipitate out dissolved arsenic followed by monitored natural attenuation of groundwater that reaches 12th Street East. Performance-based criteria will be used to assure compliance with Model Toxics Control Act (MTCA) requirements. Only a thin layer of arsenic-contaminated groundwater remains above the cleanup level in the End-of-Plume CAA; without treatment this area would likely come into compliance as the effect of cleanups in the Landfill and Wetlands CAAs reached the End-of-Plume CAA. Treatment in the End-of-Plume CAA is, therefore, intended to reduce the restoration time frame by bringing the area into compliance within 2 to 5 years although treatment will be continued as long as needed based on the performance criteria.

The 2008 CAP was issued by the Washington State Department of Ecology (Ecology) and requires implementation of several cleanup actions that comprehensively address remediation of the Site. The 2008 CAP is being implemented in a phased program as follows:

- Phase 1: Part 1 focuses on source control on the Landfill site itself and includes the construction of the slurry wall containment system and associated structures such as the interceptor trench.

- Phase 1: Part 2 focuses on the End-of-Plume CAA and is intended to halt the migration of arsenic at 12th Street East.

- Phase 2: This phase addresses remediation of groundwater contamination that exists outside the footprint of the Landfill (where source control has now blocked future releases) and upgradient of the End-of-Plume CAA (where further migration has also been blocked). Specific components of Phase 2 include the following:

- Installation of a groundwater extraction system both within the contained area of the Landfill and in areas outside the Landfill.

- Installation, start-up, and optimization of a treatment system for the extracted groundwater.

- Cleanup of the contaminated agricultural ditch.

- Development of a long-term operations, maintenance, and ,monitoring program, including installation of new monitoring wells.

- Implementation of institutional controls, including deed restrictions.

Upon completing Phase 2, long-term operation and maintenance of the cleanup action will commence under Ecology. Hydrogeologic modeling will support the work to be completed during Phases 1 and 2. This report summarizes tasks performed as part of Phase 1 activities described in the Hydrogeologic Study Work Plan (HSWP) found in the Groundwater Remediation Work Plan (GWRP; Floyd|Snider/AMEC 2009). This includes hydrogeologic and surface water data collection, the refinement of the existing conceptual hydrogeologic model, and the construction and operation of a numerical groundwater model. Results for the calibrated groundwater model are presented in this Report, while simulations incorporating the containment barrier and interceptor trench are presented in Addendum 1 of the Engineering Design Report (EDR). Subsequent reports will be prepared to document additional data collection and modeling to be performed as implementation of the 2008 CAP proceeds. The model domain is shown in Figure C.1.

2.0 Data Collection

The following descriptions of data collection are based on work performed during the 2008 predesign activities, as described in the HSWP.

2.1 MEASUREMENT LOCATIONS

2.1.1 Piezometer and Well Installation

A network of 38 piezometers and 5 wells was installed within the model domain area as part of the study. Additional wells were installed for other predesign study data objectives (refer to the GWRP). Well and piezometer installation and construction began in August 2008 and was completed in November 2008 by Cascade Drilling, Inc. of Woodinville, Washington. The following changes were made to the proposed network of measurement stations described in HSWP:

- PD-217 was eliminated due to access issues associated with active agricultural operations. It was determined that adequate coverage existed in this area with the addition of GW-1 and GW-2 (described below).
- PD-209A, PD-209B, GW-1, and GW-2 are existing wells within the hydrogeologic model boundary that were installed by others. These wells, for which construction details are unavailable, were named, surveyed, and incorporated into the study network.
- Pumping Well PD-104 was added due to field indications that the initial interceptor trench area pumping test well, PD-103, was located in an area of low transmissivity. The PD-104 location was thought to be more representative of groundwater entering the Landfill area from the adjacent uplands.
- PD-108, a boring located in the southwest portion of the Landfill intended to initially serve as a piezometer and potentially as an extraction well in Phase 2, was not completed as a monitoring well due to its proximity to an alternative barrier wall alignment. The boring was completed to its target depth, logged, and backfilled, and the hole in the protective cap was re-sealed in accordance with the HSWP.
- PD-72 was eliminated due to redundancy with PD-70 and PD-71 as pumping test observation wells.

Additional description and rationale for measurement locations can be found in the HSWP.

Piezometer and well construction and installation were conducted in accordance with procedures outlined in the HSWP and Samping Analysis Plan/Quality Assurance Project Plan (SAP/QAPP; refer to Appendix B of the GRWP: Floyd|Snider 2009). Borings for all constructed wells were logged to characterize subsurface geology and constrain model input parameters. Boring logs are included as Attachment C.1.

Following construction, all installations were surveyed by Barghausen Consulting Engineers, Inc. in November and December of 2008. Locations and elevations were surveyed using the North American Datum of 1983 (NAD 83/98) and the North American Vertical Datum of 1988 (NAVD 88). Refer to Figure C.2 and Table C.1 for construction details and location information for the entire hydrogeologic monitoring network, including monitoring wells installed prior to 2008.

2.1.2 Staff Gauges

In addition to piezometers and wells, 15 staff gauges were installed in the locations proposed in the HSWP as part of the August–November field work; the staff gauges were installed in accordance with the HSWP. Bank head pins were installed for staff gauges in the agricultural ditch system (PD-212, PD-214, PD-215, and PD-225), Hylebos Creek (PD-210 and PD-211), and Surprise Lake Drain (PD-216, PD-213, and PD-225) intended as discharge measurement stations (refer to Section 2.2.2). All staff gauges and head pins were surveyed by Barghausen Consulting Engineers, Inc. using the NAD 83/98 and NAVD 88. Refer to Figure C.2 and Table C.1 for installation specifications and staff gauge locations. Staff gauges SG-210, SG-211, and SG-225 were damaged during flooding in November 2008, and were reinstalled with reinforced posts and subsequently re-surveyed the following month.

2.1.3 Transducer Installation

Eleven 7/8-inch diameter unvented transducers (Solinst 3001 LT Levellogger Junior, M5/15) were installed in wells and transducers along an approximate flow path from the interceptor trench area through the Landfill, Wetlands, and End-of-Plume CAAs to Hylebos Creek (see Figure C.2 for location of transducers). Installation and calibration relative to water level measurements collected by hand were completed in accordance with the HSWP on October 30, 2008.

Additionally, one barometric logger (Solinst 3001 LT Barologger Gold, M1.5/F5) was installed in Well PD-109 within the Landfill to provide barometric compensation data. Per the HSWP, the transducer corresponding to SG-211 was installed in a PVC stilling well (PD-211TD) located in Hylebos Creek adjacent to SG-211.

The 11 transducers and the barometric logger were connected to a laptop computer to verify their functionality and that their battery capacity was full prior to their deployment. The clocks of all 11 transducers and the barometric logger were synchronized using a laptop computer. Each transducer was then suspended within the PVC casing of its respective piezometer, well, or stilling well using a static 0.025-inch diameter steel wire to ensure that a fixed distance was maintained between the transducer and the top of the piezometer, well, or stilling well casing. The barometric logger was suspended outside of the PVC casing but within the protective steel monument of PD-109 to shield it from the effects of wind and rain using steel wire as well.

2.1.4 Investigation-Derived Waste

Investigation-derived waste (IDW) was handled in accordance with the SAP/QAPP) as summarized below. IDW, including soil cuttings and water from well and piezometer installation borings within the Landfill, was containerized in Department of Transportation (DOT) approved 55-gallon drums for temporary storage prior to off-site disposal. Soil cuttings from borings outside areas of contaminated soil were placed at the ground surface in accordance with the SAP/QAPP. Containers were labeled with the date on which the waste was placed in the container and the boring(s) from which they were obtained. Containers were transferred to a designated temporary storage area and managed in accordance with applicable regulations and standards.

IDW was characterized relative to Dangerous Waste criteria by analytical sampling of representative samples submitted to Fremont Analytical in Seattle, Washington. IDW from borings advanced through the landfill cap was designated for off-site disposal based on analytical results (samples PD 107 5-7', PD-107 12-14', PD 108 5-7', and PD-108 10-12'). The IDW generated was disposed off-site along with other waste from the predesign investigations as dangerous (hazardous) and non-regulated waste, as applicable based on the waste characterization results. The waste characterization analytical laboratory results and waste manifests are included in Appendix B to this EDR as Attachment B.2.

2.2 REGULAR DATA COLLECTION

2.2.1 Water Level Measurements

A program of regular measurement of water levels in piezometers, monitoring wells and staff gauges was implemented to meet the hydrologic data objectives described in the HSWP. Water levels were measured in accordance with the HSWP and following standard procedures described in the SAP/QAPP. Water levels were measured during monthly field events, beginning in October 2008. Water levels will continue to be measured monthly on an ongoing basis throughout Phase 1.

Water level measurements observed in the field between October 2008 and February 2009 are presented in Table C.2. Upper and Lower Sand Aquifer potentiometric surface maps created from depth to water measured during the October 2008 through February 2009 monthly monitoring events are presented in Figures C.3 through C.12.

2.2.2 Discharge Monitoring

Surface water discharge measurements and synoptic runs were completed as part of quarterly events in October 2008 and February 2009. Discharge data were collected from multiple locations along Hylebos Creek (PD-210 and PD-211), Surprise Lake Drain (PD-216, PD-213, and PD-225), and the agricultural ditch system (PD-212, PD-214, PD-215, and PD-225). Discharge measurements were conducted in accordance with the HSWP and following standard U.S. Geological Survey (USGS) methods for streamflow gauging. The discharge measurements consisted of measuring depth and flow velocity across stream transects perpendicular to the flow direction. All stream transect locations are clearly marked by bank head pins. Depth and flow velocity were measured at 1-foot intervals across stream transects with a Marsh-McBirney flow meter. A summary of discharge measurement results is presented in Table C.3 and discharge measurement worksheets are included as Attachment C2.

Data from discharge measurements were used to perform synoptic runs, or comparisons of streamflow discharge at points along a stream to evaluate whether a given reach of a stream is gaining (i.e., receiving water from adjacent groundwater) or losing (i.e., discharging water into adjacent groundwater) at the time of the discharge measurement. This evaluation was performed as part of numerical model construction and calibration.

Data collected to date are insufficient to support development of stage-discharge rating curves. Data will continue to be collected to support development of stage-discharge rating curves.

2.2.3 Transducer Upload

The internal data loggers in the transducers record a water level measurement once per hour and the internal data logger in the barometric logger records a barometric pressure reading once per hour. Hourly data dating back to the time of installation was transferred from the 11 transducers and the barometric logger to a laptop during the November 2008 and January 2009 water level measurement events. The transducers and the barometric logger were inspected during data load events and their remaining battery and storage capacity verified and recorded on field forms. All 11 transducers and the barometric logger appear to be fully functional and are free of damage following these two events.

2.3 HYDROGEOLOGIC TESTING

2.3.1 Pumping Tests

Pumping tests were conducted in wells located near the anticipated interceptor trench alignment and in the End-of-Plume area on October 7, 2008 and October 8, 2008, respectively, to provide estimates of aquifer characteristics. The two pumping tests were completed in general accordance with the HSWP, and following standard methods for constant-rate discharge tests, American Society for Testing and Materials (ASTM) Method D4050-96 (ASTM 2008). Pump test results are summarized in Table C.4 and the data analyses are included as Attachment C3.

A variable-speed 4-inch Grundfos submersible pump with 20 gallons per minute (gpm) capacity was employed for both pumping tests, and pumping rates were measured by filling a graduated container and measuring the filling time. Based on detailed characterization of areas of contaminated groundwater (refer to the Arsenic Characterization Study, Appendix A to the EDR), the groundwater from the pumping well was deemed suitable for discharge to the ground surface in accordance with the HSWP. During pumping, water was conveyed by a hose to locations approximately 100-feet cross-gradient from the pumping well and discharged onto the ground.

Electronic data was logged continuously for the duration of the pumping tests. Aquifer transmissivity and storativity were calculated from pump test drawdown and recovery data using the Theis approximation for unconfined aquifers. (USACE, 1999) Analyses of both drawdown and recovery data were performed using Aquifer Win 32 software Version 3.28 by Environmental Simulations, Inc.

In consultation with Ecology, the pumping test planned for PD-103 was instead conducted at PD-104 due to apparent anomalously low transmissivity at PD-103 based on soil classification. Additionally, drawdown data could not be collected from PD-104 during the interceptor trench area pumping test due to a transducer malfunction apparently caused by interference from the pump motor. Recovery data were collected from PD-104 during this pumping test using a backup transducer.

For the pumping test that was carried out as planned in PD-101, drawdown and recovery data from observation wells PD-70 and PD-71 were nearly identical. Consequently, only PD-70 was used as the observation well for estimating aquifer characteristics for the End-of-Plume area.

Based on pumping test results, estimates of hydraulic conductivity were between approximately 0.30 to 11 ft/d (1.0 x 10-4 to 3.7 X 10-3 cm/s) in the area upgradient of the Landfill and 54 to 220 ft/d (1.9 x 10-2 to 7.8 X 10-2 cm/s) in the End-of-Plume area of the Wetlands. These results are consistent with previous estimates of aquifer characteristics at the Site.

2.3.2 Infiltration Tests

A basin flooding test was performed in the stormwater pond to assess infiltration capacity, as described in the HSWP. The test was conducted on September 18, 2008, at which time the stormwater pond was dry. The test basin was constructed and installed according to the HSWP and following procedures outlined by the U.S. Environmental Protection Agency (USEPA 1981 and 1984). The 3-meter diameter, circular basin was constructed by placing aluminum flashing into a narrow, 6-inch deep excavated trench at the test basin perimeter. The trench was backfilled using the excavated sediments. Bentonite was also used to improve the seal between the aluminum flashing of the basin and the backfilled sediments.

Water was pumped from a clean, upgradient monitoring well (D-11A) into a 500-gallon tank and transferred into the constructed basin on September 17, 2008 for pre-test sediment saturation. On September 18, 2008, only a few inches of water remained in the basin; water level readings (Table C.5) were collected over about an hour, showing no change in basin water level. The test basin was refilled with water from the tank. Water levels were then monitored and recorded from two staff gauge locations within the basin, one along the south sidewall and one within the basin center, at 3- to 15-minute intervals for a total duration of 3 hours. As shown by the data of Table C.5, initial readings showed negligible infiltration. Subsequent readings showed a measurable drop in water level; however, leakage from the side of the basin was noted. Leakage was partially plugged later in the test. It appears that the measurements were affected by leakage from the basin ring.

The rate of infiltration from the existing detention pond appears to be very low, based on the negligible drop in water level that occurred over the first 1.25 hours of measurements on

September 18, 2008. Based on these observations, it was concluded that the infiltration rate from the detention pond is substantially lower than the rate needed for the pond to function as an infiltration site for the groundwater interceptor system. It was decided to terminate testing rather than repair the ring for extended test runs. The very low infiltration rate is consistent with observed stormwater basin sediments throughout the detention pond. These sediments generally include compacted silty sand and sand with silt with coarse gravel and cobbles. Test data indicate that modifications to the pond are needed to support infiltration.

3.0 Conceptual Site Model

3.1 HYDROSTRATIGRAPHY AND AQUIFER PROPERTIES

Field investigations performed during the 2008 predesign activities provided hydrogeologic information that led to refinements of the Site conceptual model. Data collected during the study allowed accurate delineation of major hydrostratigraphic units, including the Upper Sand Aquifer and the Lower Silt Aquitard, as well as characterization of aquifer properties within the Landfill and Wetlands areas. Information contained in boring logs detailing the spatial extent and depth of the Upper Sand Aquifer and Lower Silt Aquitard were incorporated directly into the numerical groundwater model geometry. Likewise, parameters derived from aquifer pump tests provided confidence in hydraulic conductivity values in the model for locations upgradient of the Landfill and in wetlands areas. Additionally, the 2008 predesign investigations confirmed gaps in the Lower Silt Aquitard in both the southwest corner and the eastern side of the Landfill, which were also represented in the model design (refer to Section 5.3.2 through Section 5.3.3).

A full description of the site conceptual model is provided in the EDR Section 3.1.1. Detailed cross-sections were developed for key portions of the model area and are presented in Addendum 1 to the EDR.

3.2 GROUNDWATER FLOW DIRECTIONS AND GRADIENTS

Depth to groundwater measured in wells between October 2008 and February 2009 were used to calculate groundwater elevations and generate potentiometric surface maps (Figures C.3 through C.12). Groundwater flow directions in the Upper Sand Aquifer are generally north-northwesterly, from the upland bluff east of the Landfill to the Wetlands area north and west of the Landfill. North and east of the Landfill, groundwater flows westerly towards Hylebos Creek.

Horizontal groundwater gradients are steeper in areas of the upland bluff east of the Landfill and flatten beneath the Landfill and in the Wetlands. Horizontal gradients in the Upper Sand Aquifer range from approximately 0.0025 to 0.005 in the vicinity of the Landfill. Horizontal gradients beneath the Wetlands are generally less than 0.001. Horizontal gradients in the transition area between the upland bluff and the Landfill are typically greater than 0.006.

Vertical gradients between the Lower and Upper Sand Aquifers are generally neutral or slightly downward in the areas upgradient of the Landfill and transition to neutral followed by increasingly strong (0.1) upward gradients on the north side of the Landfill in the Wetlands areas.

3.3 SURFACE WATER AND GROUNDWATER INTERACTIONS

Streamflow data gathered from the agricultural ditch network, Hylebos Creek, and Surprise Lake Drain indicate that the shallow groundwater system and surface water are in hydraulic communication within the model domain. Furthermore, a single reach may change between gaining or losing depending on a variety of factors including changes in seasonal groundwater elevation and surface water stage.

The limited data available indicate that there are both gaining and losing surface water reaches across the model domain. Because only one round of discharge data was available, accurately determining the magnitude of the flux between surface water and shallow groundwater has proven problematic. Surface water discharge data collected in October 2008 contains irregularities due to near-zero velocity eddies in Hylebos Creek, Surprise Lake Drain, and in the ditches adjacent to the Landfill. Changes in volumetric flow calculated from streamflow data suggest that neighboring reaches within these drainage networks transition from gaining to losing conditions (or losing to gaining) over short distances. While the presence of gaining and losing reaches within the model domain area is likely, the abrupt transitions between adjacent reaches as well as the magnitude of the calculated groundwater-surface water fluxes between surface water features and the Upper Sand Aquifer are not likely. This issue will continue to be evaluated as work proceeds for the hydrogeologic study.

3.4 STEADY-STATE WATER BALANCE

A comprehensive water budget for the model was developed using estimates for recharge, evapotranspiration (ET), and groundwater flux into and out of the model domain. However, only very limited surface water stream gauging data was available for drainages within the model domain. The data available only encompassed one season; ttherefore, calculations based upon the data indicated unreasonable fluxes between surface water and shallow groundwater. Field measurements also indicated volumetric surface storage of water in the stream network (i.e., stream velocity equal to zero), which did not support the development of a steady-state water balance model. Consequently, flux estimates for groundwater-surface water interactions were used in development of the water balance model.

4.0 Numerical Model Development

The project team developed a numerical model to simulate groundwater flow conditions for the B&L Landfill study area. The numerical groundwater model is designed based on the current conceptual model. The model is intended to serve as a decision-making tool to help understand the physical flow system and advective transport, evaluate various remedial design scenarios, and assess potential effects of the remedial actions specified in the CAP on water resources.

4.1 NUMERICAL MODEL CODE

The USGS Modular Three-Dimensional Finite-Difference Groundwater Flow Model (MODFLOW-2000) was selected to simulate groundwater flow within the Site. In order to represent surface water drainages, the DRAIN and RIVER head dependent boundary conditions within MODFLOW were used to simulate the agricultural ditches, Surprise Lake Drain, and Hylebos Creek (Refer to Section 4.5). MODFLOW (McDonald and Harbaugh 1988, Harbaugh and McDonald 1996, and Harbaugh et al. 2000 [2000 Version]) is a well-documented program that is publically available and extensively used in the environmental industry to characterize and assess groundwater flow. MODLFOW has been used successfully to simulate groundwater flow in many subsurface environments similar to that within the model domain for this project. The code was developed by the USGS to simulate groundwater flow in a three-dimensional, heterogeneous, and anisotropic medium. MODFLOW uses a block-centered finite difference approach for the numerical solution of the three-dimensional partial differential equation for flow through a saturated porous media with constant fluid density.

Advective groundwater movement was simulated using the particle tracking code MODPATH Version 3.0 (Pollock, 1994). MODPATH is a three-dimensional, particle-tracking code that uses output from MODFLOW to calculate particle velocity changes over time in three dimensions. MODPATH also calculates groundwater seepage velocities and groundwater flow directions, which allows comparisons between observed and simulated flow fields during the model calibration process.

4.2 MODEL DOMAIN

The model domain encompasses an area of approximately 290 acres and includes the B&L Property. Figure C.1 shows the entire model domain, which includes the Landfill/Ditch CAA, the Wetlands CAA, and the End-of-Plume CAA, and the surrounding areas, encompassing Hylebos Creek and the Surprise Lake Drain. External model boundaries were selected to ensure that simulated internal stresses would not inappropriately impact prescribed boundary conditions. The eastern model boundary generally parallels a north-south trending bluff and is located adjacent to Fife Way where alluvial valley deposits contact the base of the hillslope. All other model boundaries were located outward from their original locations proposed in the HSWP.

The northern model boundary was extended outward from its proposed location in the HSWP to coincide with a more suitable topographic boundary just below the confluence of East and West Hylebos Creek. The northwestern boundary was relocated to so that it paralleled the bluff located to the west of Hylebos Creek. The repositioning of the northwestern boundary allows numerical representation of potential throughflow beneath Hylebos Creek in the Upper Sand Aquifer. The southwestern model boundary was moved outward from its original location along Surprise Lake Drain. The increased area within this portion of the model domain allows numerical representation of throughflow beneath Surprise Lake Drain. The southern model boundary was relocated southward to orient the model boundary parallel to observed flow directions.

4.3 MODEL DISCRETIZATION AND GROUND SURFACE ELEVATION

The numerical model has a uniform horizontal grid spacing of 20 by 20 feet. This high-resolution grid spacing allows accurate representation of curvature in potentiometric surfaces, recharge and discharge to surface water features, and aquifer response due to pumping (Anderson and Woessner 2002). Despite using a high-grid resolution, the calibrated steady-state model maintained acceptable computation times.

Boring logs (Attachment C.1) were examined to construct model geometry consistent with major hydrostratigraphic units within the domain area. Based upon an interpretation of available lithologic data, model Layers 1 through 3 represent the Landfill, Upper Sand Aquifer, and Lower Silt Aquitard, respectively. The Lower Sand Aquifer is divided into two identical 15-feet thick units. Division of the Lower Sand Aquifer unit into two layers allows representation of the hanging barrier wall design within the numerical model (refer to Addendum 1). The table below provides a summary of each respective model layer and the corresponding hydrostratigraphic unit.

Layer	Unit Representation
1	Landfill
2	Upper Sand Aquifer
3	Lower Silt Aquitard
4	Lower Sand Aquifer
5	Lower Sand Aquifer

The vertical extent of the Lower Sand Aquifer could not be determined from the boring logs; therefore, the model bottom was set to 30-feet below the bottom of Lower Silt Aquitard. This depth was considered sufficient to minimize any boundary effects caused by the bottom of the model domain.

Light detection and ranging (LIDAR) bare-earth topographic data at approximately 6 x 6 foot resolution was obtained from the Puget Sound LIDAR Consortium (2008) for the entire model domain (available online at http://pugetsoundlidar.ess.washington.edu). The LIDAR data product was resampled to 20 x 20 foot spaced intervals and used to establish the ground surface elevation for the numerical model.

4.4 INITIAL MODEL PROPERTY ESTIMATES

4.4.1 Recharge and Evapotranspiration (ET)

Local precipitation data were used as the basis for estimating areal recharge in model calibration. Monthly precipitation totals between 1919 and 2008 were obtained for two weather stations in Tacoma, Washington (1919 to 1981: Tacoma #1, COOP ID 458278; and 1982 to 2008: Tacoma City Hall, COOP ID 458286). These two stations were selected because of their proximity to the Landfill and, when combined, provided nearly complete coverage of the available precipitation record. The data for the period of January 1919 through August 2008 were obtained from the National Climatic Data Center (National Climatic Data Center 2009). The data for September 2008 through December 2008 were provided by the Western Regional Climate Center through e-mail communication (Western Regional Climate Center 2009).

The average annual precipitation was calculated from the composite monthly dataset and used to estimate recharge rates for the numerical model. The annual average did not include years where at least one month contained missing data. These years included 1946, 1947, 1960, 1961, 1982, 1997, 1998, 2000, and 2002. The only exception is year 1996 when the monthly precipitation for June was missing. Because precipitation during the month of June is typically low, the missing data is not expected to significantly affect the annual precipitation total for 1996. Figure C.13 shows yearly totals and the average annual precipitation from 1919 to 2008. According to the data, the average annual precipitation is 36.7 inches. The maximum annual precipitation was 53.3 inches.

The model domain was divided into two different groundwater recharge zones to represent areas with different precipitation recharge potential: the Landfill and the remaining model domain. Over the Landfill, recharge was set to zero to reflect the presence of the Resource Conservation and Recovery Act (RCRA) cap. For the remaining model domain, the recharge rate was estimated as a fraction of the annual average precipitation. The initial recharge rate was estimated as 10 percent of the average annual precipitation rate. Through the calibration process, recharge was assigned as 8 percent of the annual average precipitation.

An ET rate of 20 inches/year with a root extinction depth of 3 feet was assigned to the Wetland area located north of the Landfill. Within the MODFLOW ET package, the ET rate occurs at a maximum when the water table rises to the top of a layer. ET decreases linearly to zero over the vertical length defined by the root extinction depth (McDonald and Harbaugh 1988). The ET rate was initially estimated based on annual average pan evaporation values for the region (KJC and AGI 1990) and then adjusted as part of model calibration process.

4.4.2 Hydraulic Conductivity

Initial hydraulic conductivity values were assigned based on results from available pump test data and interpretation of lithologic logs. Estimates of hydraulic conductivity from pump test data were between approximately 0.3 to 220 ft/d (1.04 x 10-4 to 7.8 x 10-2 cm/s) with lower values corresponding to areas upgradient of the Landfill and higher values characteristic of the Upper Sand Aquifer in the Wetlands areas. To represent anisotropy in the model, vertical hydraulic conductivity values were scaled to one tenth (1/10) of the hydraulic conductivity in the horizontal direction. Following model runs using initial parameter values, hydraulic conductivity values were adjusted as part of model calibration so that model output matched observed heads and flow directions (refer to Section 5.0).

Boring logs, aquifer tests, and contaminant concentration contours from predesign and previous site investigation activities were used to identify areas of higher hydraulic conductivity within Layer 2, the Upper Sand Aquifer. Two northwest-trending features that correspond to depositional sand channels were identified: a sand channel that intersects the southwest corner of the Landfill, and a sand channel at the eastern side of the Landfill that extends into the wetlands (refer to Section 5.3.2).

4.5 BOUNDARY CONDITIONS

Boundary conditions were assigned based on groundwater flow directions and gradients inferred from groundwater contour maps and the steady-state water balance model developed for the model domain area. The Landfill layer (Layer 1) consists of active cells in the area of the Landfill footprint surrounded by a no-flow boundary condition (not shown). Under this construction, saturation of the wood waste occurs as the water table rises from beneath the Landfill.

Figure C.14 shows constant head and constant flux boundary type distribution assigned to the remaining model layers. In Layer 2 (the Upper Sand Aquifer), a constant flux boundary condition and a constant head boundary condition were used to introduce water into the model domain as throughflow from both the north, northwest, east, and southeast (Figure C.14). A constant head boundary was assigned to cells in the southwest corner of the model so that groundwater would exit the model domain either as groundwater contributions to surface flow in Hylebos Creek and Surprise Lake Drain or as groundwater throughflow towards the southwest.

In Layer 3, a constant flux boundary was assigned along the east side of the model domain (Figure C.14). The flux into the model was minimal relative to fluxes used in the overlying Upper Sand Aquifer and underlying Lower Sand Aquifer. The constant flux boundary in Layer 3, however, allowed numerical representation of the low transmissivity typical for a silt aquitard.

Both Layers 4 and 5 represent the Lower Sand Aquifer and have identical boundary conditions. In each layer, a combination of constant flux boundaries and constant head boundaries allows groundwater to enter the model domain as throughflow from the north, northwest, east, and southeast. A constant head boundary, located along the southwest edge of the model, allows groundwater in the Lower Sand Aquifer to exit the domain as throughflow (Figure C.14).

Hylebos Creek, Surprise Lake Drain, and certain portions of the agricultural ditch network were simulated using the RIVER package of MODFLOW. For modeling purposes, the bottom elevation of each drainage was established using surveyed elevation data for each staff gauge location. Surface water staff gauge measurements were used to define stage elevation for each drainage reach in the numerical model. Stream Conductance parameters within the RIVER package were used to match simulated groundwater-surface water fluxes to reasonable values and to match observed and simulated heads for piezometer measurements adjacent to surface drainages. Stream Conductance for each river reach is calculated as,

$$C = \frac{K * L * W}{D}$$

where C is conductance (ft2/d), K is stream bed hydraulic conductivity (ft/d), L is length of each river reach (ft), W is stream width (ft), and D is thickness of the bed material (ft). Because the model was developed with uniform grid spacing, the length of each river reach was 20 ft. Stream width values were well constrained based upon data collected during stream gauging activities. Stream bed hydraulic conductivity values were estimated based upon observed streambed properties. Estimates were used for the thickness of the bed material considering the size and discharge of each drainage. Stream bed conductance values ranged from 28 to 1,000 ft2/d in the calibrated steady state numerical model.

The MODFLOW DRAIN package was used to simulate the reach of the agricultural ditch due north of the Landfill as well as the agricultural drain due west of the Autumn Village Apartments. These reaches were simulated using the DRAIN package in the model because field observations indicated these reaches are often dry during parts of the year. The DRAIN package assigns a head-dependent boundary condition that removes water from the aquifer once the simulated water table is higher than the drain head (Harbaugh and McDonald 1996). Conductance values, calculated using the same approach as with the RIVER package, varied from 20 to 200 ft2/d.

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5.0 Model Calibration

5.1 CALIBRATION TARGETS

The model was calibrated to match simulated potentiometric heads with observed groundwater level data at 62 calibration target locations (55 targets in Layer 2; 7 targets in Layer 4). Groundwater elevations and surface water stage data collected during the months of October 2008 through December 2008 were averaged to provide calibration targets for the steady state numerical model. Table C.6 provides a list of the target locations used during model calibration.

Due to issues with streamflow data and surface storage discussed in Sections 3.3 and 3.4, target fluxes could not be established for stream reaches. As a result, model calibration focused on matching simulated and observed heads as well as flow directions while field-measured surface water stage data were used to maintain appropriate water elevations in the model's river boundary package.

Differences between the observed heads and simulated heads at calibration targets were used to calculate statistics for model residuals. Residual (R) is the difference between simulated and measured groundwater elevations at specific locations in the model domain (62 targets were used for calibration). During the calibration process, model parameter values were varied over an acceptable range to minimize calibration statistics such as the residual mean (RM), absolute residual mean (ARM), residual standard deviation (RSD), and residual sum of squares (RSS; Duffield et al. 1990). The ratio of the RSD to the range of observed head values across the entire model domain should be minimal for a calibrated model, indicating that the residual errors are a small component of the model response. A ratio of less than 10 percent is considered acceptable for groundwater flow and solute transport applications (Anderson and Woessner 2002).

5.2 CALIBRATION GOALS

Steady-state model calibration was evaluated both quantitatively and qualitatively using a suite of different criteria. Criteria included:

- visual comparison between groundwater elevation contour maps based on measured and simulated heads,
- visual evaluation of a scatter plot comparing measured and simulated heads,
- statistical evaluation of residuals,
- acceptable water balance error (less than 1 percent),
- ratio of RSD to the total head change across the domain of less than 10 percent,
- comparison of advective transport to observed plume dimensions.

5.3 RESULTS

5.3.1 Observed vs. Simulated Heads and Flow Paths

Figure C.15 shows simulated groundwater contours and particle tracking for Layer 2 (Upper Sand Aquifer) produced by the calibrated steady-state model. Generally, contours calculated by the numerical model reflect observed groundwater elevations and flow directions (Figure C.3 through C.12). To the north of 12th Street East, groundwater flows from northeast to southwest. In the south region of the model, including the area around the Landfill, groundwater flows to the northwest but gradually bends toward the west in the central and western portions of the model domain. Particle tracking, using release points in suspected constituent source areas, demonstrates that simulated advective transport replicates observed arsenic plume dimensions, as shown in Figure C.15.

Table C.6 provides calibration target values as well as the simulated groundwater heads and calculated residuals. Figure C.16 shows a scatter plot of simulated versus observed groundwater elevations. A correlation coefficient of 0.96 indicates a strong positive relationship between observed and simulated heads. A correlation coefficient equal to 1 would be the result of a model that perfectly replicates observed heads.

Calibration statistics based on residuals are shown in Table C.7. The average residual is minus 0.37 ft. The average absolute value of the residuals is 0.54 ft. The standard deviation of the difference between observed and simulated groundwater elevations is 0.50 ft. The model error, provided by the RSD divided by the total range in observed head, is 3.2 percent. The water balance error was minus 4.7 x 10-4 percent (not shown). Based upon statistical analyses of groundwater elevations and comparison of observed and simulated flow paths, the calibration results are considered acceptable.

5.3.2 Calibrated Parameter Distribution

Model calibration focused primarily on the adjustment of hydraulic conductivity to match observed and simulated groundwater elevations. In Layer 1 (the Landfill), a uniform conductivity of 0.1 ft/d was used to parameterize the wood waste (not shown). Figure C.17 shows calibrated hydraulic conductivity values for the Upper Sand Aquifer (Layer 2), the Lower Silt Aquitard (Layer 3), and the Lower Sand Aquifer (Layers 4 and 5). The Upper Sand Aquifer has a background hydraulic conductivity of 50 ft/d. The eastern sand channel has a conductivity value of 150 ft/d, whereas the southwestern sand channel feature has a conductivity value of 95 ft/d. The Lower Silt Aquitard (Layer 3) has a background conductivity of 0.23 ft/d. Areas where the sand channels cut through the Lower Silt Aquitard were parameterized with the same hydraulic conductivity values used in Upper Sand Aquifer (Layer 2). The Lower Sand Aquifer has a background hydraulic conductivity of 50 ft/d across the majority of the modeling domain.

Currently, the model is calibrated for only a steady-state condition. Once sufficient field data have been collected that include an entire wet through dry season cycle, a transient verification will be performed. The transient model will require estimates of additional parameters including storativity (S). Storativity will be estimated based on aquifer test results and literature values, and will be adjusted as part of the model calibration process so that seasonal changes in groundwater elevation and fluxes are accurately captured by the transient numerical model.

5.4 UNCERTAINTY AND SENSITIVITY ANALYSIS

Numerical models always contain uncertainty due to the both the inability to accurately estimate the magnitude and timing of system stresses as well as an inability to accurately quantify both spatial and temporal distribution of parameter values (Anderson and Woessner 2002). As an example, while pump tests are often performed to quantify hydraulic conductivity in known critical areas, hydraulic conductivity is rarely homogeneous throughout the entire model domain. Additionally, depending on the pumping rate and aquifer properties, tests may stress the aquifer over a limited spatial extent. As a result, conductivity values derived from aquifer tests may be indicative of the physical system only in areas where the pump test occurred.

For the Site numerical model, while conductivity is well characterized in areas where pump tests were performed, there remains uncertainty in other regions of the model domain. Consequently, hydraulic conductivity in portions of the model, such as the Lower Sand Aquifer or far northern areas of the domain, required parameter estimation based upon either lithological descriptions from available borings logs or the extrapolation of hydrostratigraphy from well characterized areas within the model domain.

Similarly, measurements of recharge to groundwater are typically unavailable for modeling exercises. Therefore, a standard approach is to calculate recharge using a constant proportion of precipitation and in the absence of other data begin with 10 percent of precipitation (Anderson and Woessner 2002). This fractionation approach accounts for potential recharge losses including precipitation runoff and evapotranspiration. Because it is not easily measured, recharge may be varied from the initial estimate during model calibration exercises to improve simulated results.

While it is impossible to completely characterize parameter distributions in both time and space, analyses can be performed to quantify model sensitivity due to the uncertainty associated with a given parameter. Results for sensitivity analyses, including both hydraulic conductivity and recharge rates, were performed for the Site model and are presented in Section 5.4.1.

5.4.1 Sensitivity Analysis

The calibrated groundwater model is not a unique solution. It is possible that the model would calibrate using different combinations of boundary conditions and parameter values. Sensitivity analyses were performed to assess the sensitivity of the model calibration to certain model inputs by adjusting the inputs within a plausible range and observing the effect on model error. Parameters and boundary condition analyzed to assess sensitivity included the background hydraulic conductivity for the Upper Sand Aquifer, the Lower Silt Aquitard, the Lower Sand Aquifer, the east sand channel, the southwest sand channel as well as recharge, and flux boundaries. Results are shown in Figures C.17 through C.23 and discussed below.

Sensitivity analysis was performed for the background hydraulic conductivity of the Upper Sand Aquifer by scaling the calibrated hydraulic conductivity by factors of 0.1, 0.5, 1, 1.5, and 2 where a scaling factor equal to 1 reproduces results from the calibrated model. The metric used to quantify model sensitivity in each run is the RSD divided by the observed range in head. As discussed in Section 5.3.1, this statistical metric provides quantification of model error. The same analysis was performed for background conductivity in layers corresponding to the Lower Silt Aquitard (Layer 3), the Lower Sand Aquifer (Layers 4 and 5), the east sand channel, and the southwest sand channel.

Sensitivity analyses indicate that model calibration is especially sensitive to decreases in hydraulic conductivity in the Upper Sand Aquifer (Layer 2; Figure C.16). In addition, model error also increases with increasing background hydraulic conductivity in both the Upper Sand Aquifer (Layer 2; Figure C.17) and the Lower Sand Aquifer (Layer 4 and 5; Figure C.18). In addition, both increases and decreases in hydraulic conductivity for the eastern sand channel result in an increase in model error (Figure C.19). However, the model is insensitive to changes in the hydraulic conductivity associated with the southwest sand channel (Figure C.20). Likewise, model results do not vary significantly in response to changes in the background hydraulic conductivity of the Lower Silt Aquitard (Layer 3; Figure C.21). In each of the previous cases, the lowest model error was associated with the hydraulic conductivity value used in the calibrated version of the model.

As with hydraulic conductivity, the calibrated recharge rate was scaled prior to running a suite of five simulations. Scaling factors applied to the calibrated recharge rate were .5, 0.75, 1, 1.25, and 1.875, respectively. The calculated error for each simulation was used to determine model sensitivity to changes in the model recharge rate. Results presented in Figure C.22 indicate the model is insensitive to changes in recharge over the evaluated range. Again, the lowest model error was associated with the recharge value used in the calibrated version of the model

Constant flux boundaries were also evaluated for influence on model sensitivity. Scaling factors applied to flux boundaries were 0.5, 0.95, 1, 1.05, and 1.5, respectively. Because different flux magnitudes are used in different portions of the model, the error metric is plotted as a function of the scaling factor. Results indicate that the model is sensitive to both increases and decreases in the flux boundary (Figure C.23). In this case, the 1.05 multiplier provides a slightly lower model error than the calibrated model; however, the difference is so small that the overall model results are not influenced.

5.4.2 Model Limitations

Calibration of the groundwater model demonstrates that it is capable of simulating groundwater flow under steady-state conditions for the model area within a reasonable range of error. Inherent in any numerical groundwater modeling effort is a degree of uncertainty. For example, there is a fair degree of uncertainty associated with the hydraulic conductivity of some units. In addition, transient verification of the model has not yet been completed and would improve confidence in the model's predictive capabilities. Transient calibration will be completed during the next phase of modeling and presented in future addenda to the EDR.

The numerical model described in this report is appropriate for use in decision making regarding design parameters for the barrier wall and interceptor trench.

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6.0 Barrier Wall and Interceptor Trench Representation

The containment barrier around the Landfill perimeter was represented using MODFLOW's Flow Barrier Package. Within the numerical model, the barrier wall was assigned a thickness of 2 feet and a hydraulic conductivity of 0.0003 ft/d (1 x 10-7 cm/s). This hydraulic conductivity is consistent with likely values for the permeability of the barrier wall. The groundwater interceptor trench on the upgradient side of the Landfill was simulated using MODFLOW's Drain Package (a head-dependent boundary). Model runs incorporating the barrier wall and interceptor trench were conducted for evaluation of these remedial measures and are presented in Addendum 1 to the EDR.

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Appendix C Tables
Phase 1 Hydrogeologic Study Report

FINAL

Table C.1
Water Level Measurement Location Construction Details

Location	Monument Type	Diameter (inches)	Northing (ft. NAD 83/98)	Easting (ft. NAD 83/98)	Measuring Point Elevation (NAVD88)	Ground Surface Elevation (NAVD88)	Depth to Top of Screen (ft. bgs)	Depth to Bottom of Screen (ft. bgs)	Aquifer or Water Body
North End and Hylebos Creek									
PD-210	Above ground piezo	1	703817.762	1185259.758	19.154	15.714	8.00	18.00	Upper Sand
SG-210	Staff gauge	NA	703819.587	1185254.116	15.576	8.884	NA	NA	Hylebos Creek
PD-211	Above ground piezo	1	703281.052	1185150.092	16.774	13.994	6.00	16.00	Upper Sand
SG-211	Staff gauge	NA	703286.154	1185137.093	15.181	11.361	NA	NA	Hylebos Creek
PD-211TD	Above ground piezo	1	703285.856	1185137.236	16.880	11.361	NA	NA	Hylebos Creek
PD-200	Above ground piezo	1	703432.233	1185702.110	15.864	12.864	3.00	18.00	Upper Sand
PD-209A	Above ground well	2	702899.187	1185072.731	17.131	15.574	NA	NA	Upper Sand
PD-209B	Above ground well	2	702896.569	1185068.508	17.062	15.672	NA	NA	Unknown
Fife Way									
PD-201	Flush	1	703536.077	1187254.520	40.049	40.049	12.00	27.00	Upper Sand
PD-202	Flush	1	702529.017	1187128.079	56.305	56.305	4.00	24.00	Upper Sand
PD-65	Flush	1	701319.661	1186546.326	30.924	30.924	4.00	24.00	Upper Sand
PD-203	Flush	1	700959.817	1186418.866	37.896	37.896	5.00	25.00	Upper Sand
Autumn Village Apartments									
GW-1	Flush	2	701562.790	1186475.029	19.052	19.052	NA	NA	Upper Sand
GW-2	Flush	2	701449.977	1186364.768	18.754	18.754	NA	NA	Upper Sand
SG-217	Staff gauge	NA	701294.301	1186165.519	18.981	NA	NA	NA	Drainage Ditch
Wetlands Approach from 12th Street									
PD-204	Above ground well	2	702917.316	1186546.417	17.566	14.936	15.00	25.00	Upper Sand
PD-101	Above ground well	4	702916.209	1186071.438	17.011	14.150	7.00	22.00	Upper Sand
PD-70	Flush	2	702918.212	1186061.179	14.283	14.283	5.20	20.20	Upper Sand
PD-71	Flush	2	702923.295	1186058.151	14.410	14.410	5.00	20.00	Upper Sand
PD-120	Flush	1	702915.097	1185943.911	13.856	13.856	11.00	21.00	Upper Sand
PD-121	Flush	1	702915.554	1185934.462	13.934	13.934	11.00	21.00	Upper Sand
PD-122	Flush	1	702915.129	1185924.186	13.863	13.863	11.00	21.00	Upper Sand
PD-130	Above ground piezo	1	702935.618	1185819.200	15.187	12.802	12.00	22.00	Upper Sand
PD-131	Above ground piezo	1	702938.177	1185889.610	14.532	12.502	12.00	22.00	Upper Sand
PD-132	Above ground piezo	1	702939.626	1185948.769	15.352	12.942	11.00	21.00	Upper Sand
PD-105	Above ground piezo	2	702914.152	1185899.584	16.162	13.511	12.00	22.00	Upper Sand
PD-106	Above ground piezo	2	702914.618	1185953.824	16.742	14.156	11.00	21.00	Upper Sand
MW-31A	Above ground well	2	702917.222	1185835.899	16.482	14.057	17.00	22.00	Upper Sand
MW-31B	Above ground well	2	702916.222	1185840.565	16.322	14.057	35.00	40.00	Lower Sand
PD-4	Above ground piezo	1	702994.798	1185895.931	15.297	12.292	5.00	20.00	Upper Sand
PD-6	Above ground piezo	1	703003.140	1185989.093	15.642	12.812	6.00	21.00	Upper Sand
MW-16	Above ground well	2	702799.199	1186173.741	15.799	13.364	10.00	15.00	Upper Sand
MW-17	Above ground well	2	702857.742	1185983.458	15.197	12.472	10.00	15.00	Upper Sand
PD-1A	Above ground piezo	1	702948.758	1185729.253	16.167	12.667	5.00	7.50	Upper Sand
PD-1B	Above ground piezo	1	702948.583	1185725.946	15.732	12.617	8.00	13.00	Upper Sand
PD-1C	Above ground piezo	1	702948.550	1185722.528	15.932	12.617	13.00	18.00	Upper Sand

Table C.1
Water Level Measurement Location Construction Details

Location	Monument Type	Diameter (inches)	Northing (ft. NAD 83/98)	Easting (ft. NAD 83/98)	Measuring Point Elevation (NAVD88)	Ground Surface Elevation (NAVD88)	Depth to Top of Screen (ft. bgs)	Depth to Bottom of Screen (ft. bgs)	Aquifer or Water Body
Wetlands Approach from Interurban Trail									
D-1U	Above ground well	2	702581.1467	1186263.532	15.154	13.764	8.10	13.10	Upper Sand
D-1L	Above ground well	2	702586.7477	1186260.328	15.084	13.514	25.30	30.30	Lower Sand
D-5U	Above ground well	2	702321.4743	1185708.409	17.364	13.339	8.50	13.50	Upper Sand
D-5L	Above ground well	2	702330.3977	1185710.997	17.189	13.589	25.30	30.30	Lower Sand
SG-219	Staff gauge	NA	702316.6903	1185698.609	17.199	13.019	NA	NA	Wetlands Surface Water
D-6A	Above ground well	2	702465.581	1185996.456	14.128	13.094	10.00	15.00	Upper Sand
D-6B	Above ground well	2	702460.2	1185997.9	14.541	13.044	28.00	33.00	Lower Sand
MW-13	Above ground well	2	702573.9139	1186104.435	15.434	13.304	9.50	14.50	Upper Sand
SG-218	Staff gauge	NA	702575.8661	1186101.037	17.109	12.904	NA	NA	Wetlands Surface Water
MW-14	Above ground well	2	702656.6904	1185883.564	15.201	12.746	10.00	15.00	Upper Sand
MW-15	Above ground well	2	702717.8081	1186011.709	15.319	12.754	10.00	15.00	Upper Sand
SG-220	Staff gauge	NA	702721.0418	1186008.695	16.064	12.134	NA	NA	Wetlands Surface Water
PD-50	Above ground piezo	1	702820.1843	1185778.645	14.766	12.296	7.00	17.00	Upper Sand
SG-221	Staff gauge	NA	702813.4476	1185791.855	16.046	11.946	NA	NA	Wetlands Surface Water
PD-51	Above ground piezo	1	702695.0286	1185752.702	15.199	12.129	5.00	15.00	Upper Sand
PD-52A	Above ground piezo	1	702501.0168	1185675.209	15.044	12.499	5.00	7.50	Upper Sand
PD-52B	Above ground piezo	1	702497.9331	1185674.567	15.104	12.299	8.00	13.00	Upper Sand
PD-52C	Above ground piezo	1	702494.3809	1185673.518	15.039	12.389	14.00	19.00	Upper Sand
Ditch along Interrurban Trail									
MW-30	Flush	0.75	702394.4934	1186126.763	18.516	18.516	16.00	21.00	Upper Sand
SG-227	Staff gauge	NA	702411.5585	1186120.317	17.594	13.504	NA	NA	Drainage Ditch
PD-212	Above ground	1	702003.3593	1185274.184	17.791	15.461	4.70	19.70	Upper Sand
SG-212	Staff gauge	NA	702015.8783	1185267.173	15.79	11.481	NA	NA	Drainage Ditch
Landfill and Perimeter Area									
PD-107	Extraction Well	6	702223.955	1186121.226	32.769	30.579	19.00	33.70	Upper Sand
PD-109	Extraction Well	6	701795.046	1186484.494	30.667	28.916	18.00	28.00	Upper Sand
SUMP	Sump	12	702118.073	1186206.479	50.896	48.126	NA	NA	Fill
SG-224	Staff gauge	NA	702370.460	1186139.077	18.464	14.564	NA	NA	Stormwater Pond
D-7A	Above ground well	2	702190.9768	1185698.422	15.854	15.269	9.50	14.50	Upper Sand
D-7B	Above ground well	2	702196.2509	1185699.323	16.429	15.169	28.00	33.00	Lower Sand
D-8A	Above ground well	2	701886.3802	1185691.527	16.174	14.954	10.00	15.00	Upper Sand
D-8B	Above ground well	2	701881.042	1185691.089	16.179	14.784	28.00	33.00	Lower Sand
SG-214	Staff gauge	NA	701843.8845	1185681.476	17.299	13.084	NA	NA	Drainage Ditch
PD-214	Above ground	1	701842.8007	1185673.02	17.674	15.564	5.00	20.00	Upper Sand
PD-215	Above ground	1	701558.881	1185850.799	19.324	16.609	4.20	19.20	Upper Sand
SG-215	Staff gauge	NA	701573.7788	1185851.475	17.634	13.059	NA	NA	Drainage Ditch
D-9A	Above ground well	2	701581.3487	1186172.041	17.164	15.514	8.50	13.50	Upper Sand

Table C.1
Water Level Measurement Location Construction Details

Location	Monument Type	Diameter (inches)	Northing (ft. NAD 83/98)	Easting (ft. NAD 83/98)	Measuring Point Elevation (NAVD88)	Ground Surface Elevation (NAVD88)	Depth to Top of Screen (ft. bgs)	Depth to Bottom of Screen (ft. bgs)	Aquifer or Water Body
Area East of Landfill									
MW-11A	Above ground well	2	702114.962	1186710.323	19.890	17.925	10.00	15.00	Upper Sand
MW-11B	Above ground well	2	702110.806	1186706.361	19.934	17.985	25.00	30.00	Lower Sand
PD-60	Above ground piezo	1	701995.337	1186678.210	20.134	17.096	4.00	19.00	Upper Sand
PD-61	Above ground piezo	1	702087.890	1186909.415	27.291	24.215	4.50	17.00	Upper Sand
PD-62	Above ground piezo	1	701824.995	1186617.214	20.365	17.636	5.00	20.00	Upper Sand
PD-104	Above ground well	4	701841.895	1186655.373	18.761	16.952	5.00	20.00	Upper Sand
PD-63A	Above ground piezo	1	701673.909	1186543.412	19.751	16.729	5.00	7.50	Upper Sand
PD-63B	Above ground piezo	1	701681.257	1186548.409	18.848	16.771	8.00	13.00	Upper Sand
PD-63C	Above ground piezo	1	701677.691	1186546.219	19.503	16.749	15.00	20.00	Upper Sand
PD-64	Above ground piezo	1	701620.047	1186657.786	22.285	19.544	5.00	20.00	Upper Sand
PD-38	Above ground piezo	1	701806.207	1186803.104	21.635	18.998	5.00	20.00	Upper Sand
PD-40	Above ground piezo	1	701719.309	1186767.139	22.531	19.670	5.00	20.00	Upper Sand
MW-23	Above ground well	2	701768.884	1186707.686	20.474	17.264	7.28	17.28	Upper Sand
D-10A	Above ground well	2	701754.648	1186794.841	21.534	19.501	10.00	15.00	Upper Sand
PD-80	Above ground piezo	1	701659.555	1186590.030	20.361	16.932	5.00	20.00	Upper Sand
PD-81	Above ground piezo	1	701641.860	1186594.973	20.568	17.393	5.00	20.00	Upper Sand
PD-82	Above ground piezo	1	701641.322	1186613.563	20.447	17.373	5.00	20.00	Upper Sand
PD-103	Above ground well	4	701644.963	1186604.073	18.617	17.095	4.15	16.50	Upper Sand
Agricultural Fields and Ditches									
PD-216	Above ground	1	700921.424	1185663.481	20.449	17.364	2.50	17.50	Upper Sand
SG-216	Staff gauge	NA	700922.658	1185643.972	17.264	12.534	NA	NA	Surprise Lake Drain
PD-213	Above ground	1	701411.858	1185013.037	18.254	15.724	5.00	15.00	Upper Sand
SG-213	Staff gauge	NA	701412.808	1185002.323	16.114	11.574	NA	NA	Surprise Lake Drain
SG-225	Staff gauge	NA	701481.300	1184602.442	16.092	11.626	NA	NA	Surprise Lake Drain/ Drainage Ditch

Abbreviations:

bgs	Below ground surface
ft	Feet
NA	Not applicable or not available

Table C.2
Water Level Measurements

	October 2008			Transducer Install Event			November 2008			December 2008			January 2009			February 2009		
Location	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]
North End and Hylebos Creek																		
PD-210	10/3/2008	NA	5.94	NA	NA	NA	11/6/2008	13:26	4.81	12/4/2008	10:56	5.46	1/16/2009	12:45	4.45	2/25/2009	13:20	5.40
SG-210	10/3/2008	10:40	0.98	NA	NA	NA	11/6/2008	13:26	2.58	12/4/2008	10:56	1.19	1/16/2009	12:45	2.11	2/25/2009	13:20	2.01
PD-211	10/3/2008	NA	4.15	10/30/2008	15:05	3.73	11/6/2008	13:34	2.87	12/4/2008	10:58	3.20	1/16/2009	12:58	2.40	2/25/2009	13:25	3.02
SG-211	10/3/2008	NA	1.85	NA	NA	NA	11/6/2008	13:35	2.68	12/4/2008	10:58	1.50	1/16/2009	12:57	2.39	2/25/2009	13:25	2.22
PD-211TD	NA	NA	NA	10/30/2008	15:56	4.20	11/6/2008	13:35	2.72	12/4/2008	NA	NA	1/16/2009	13:10	3.34	NA	NA	NA
PD-200	10/3/2008	NA	3.48	NA	NA	NA	11/6/2008	13:35	1.50	12/4/2008	11:07	2.32	1/16/2009	13:00	1.53	2/25/2009	14:00	2.50
PD-209A	NA	NA	NA	NA	NA	NA	NA	NA	NA	12/4/2008	11:00	3.6	1/16/2009	13:03	2.67	2/25/2009	13:00	3.52
PD-209B	NA	NA	NA	NA	NA	NA	NA	NA	NA	12/4/2008	11.02	2.73	1/16/2009	13:04	1.99	2/25/2009	13:00	2.4
Fife Way																		
PD-201	10/2/2008	NA	21.25	NA	NA	NA	11/6/2008	10:27	20.89	12/4/2008	11:29	19.95	1/15/2009	10:25	17.95	2/24/2009	14:23	19.95
PD-202	39724.0	NA	28.1	NA	NA	NA	39758.0	0.4	28.1	12/4/2008	11:36	28.9	1/15/2009	10:38	28.1	2/24/2009	14:26	28.12
PD-65	10/3/2008	NA	13.95	NA	NA	NA	11/6/2008	10:42	13.85	12/4/2008	11:50	13.36	1/15/2009	10:55	12.04	2/24/2009	14:36	12.54
PD-203	10/3/2008	NA	16.00	NA	NA	NA	11/6/2008	10:53	15.86	12/4/2008	11:59	15.66	1/15/2009	10:58	14.88	2/24/2009	14:42	15.40
Autumn Village Apartments																		
GW-1	NA	NA	NA	NA	NA	NA	11/7/2008	13:45	NA[2]	12/4/2008	11:41	1.50	1/15/2009	10:38	0.80	2/24/2009	14:11	1.08
GW-2	NA	NA	NA	NA	NA	NA	11/7/2008	13:57	NA[2]	12/4/2008	11:48	0.06	1/15/2009	10:44	0.62	2/24/2009	14:18	1.08
SG-217	NA	NA	NA	NA	NA	NA	11/6/2008	11:27	1.02	12/4/2008	11:42	1.20	1/15/2009	10:40	0.99	2/24/2009	14:15	0.73
Wetlands Approach from 12th Street																		
PD-204	10/2/2008	NA	4.24	NA	NA	NA	11/6/2008	9:05	3.73	12/4/2008	14:33	3.55	1/16/2009	10:30	2.72	2/24/2009	12:54	3.01
PD-101	10/2/2008	NA	5.00	NA	NA	NA	11/6/2008	9:10	3.83	12/4/2008	14:17	3.87	1/16/2009	10:40	2.32	2/24/2009	12:57	3.90
PD-70[4]	10/2/2008	NA	1.81	NA	NA	NA	11/6/2008	9:15	0.66[3]	12/4/2008	NA	NA	NA	NA	NA	NA	NA	NA
PD-71[4]	10/2/2008	NA	2.14	NA	NA	NA	11/6/2008	9:14	0.89	12/4/2008	NA	NA	NA	NA	NA	NA	NA	NA
PD-120[4]	NA	NA	NA	NA	NA	NA	11/6/2008	9:22	0.40[3]	12/4/2008	NA	NA	NA	NA	NA	NA	NA	NA
PD-121[4]	NA	NA	NA	NA	NA	NA	11/6/2008	9:20	0.45[3]	12/4/2008	NA	NA	NA	NA	NA	NA	NA	NA
PD-122[4]	NA	NA	NA	NA	NA	NA	11/6/2008	9:36	0.39	12/4/2008	NA	NA	NA	NA	NA	NA	NA	NA
PD-130	NA	NA	NA	NA	NA	NA	11/6/2008	10:02	1.98	12/4/2008	14:13	2.05	1/16/2009	11:00	1.36	2/24/2009	13:14	2.10
PD-131	NA	NA	NA	NA	NA	NA	11/6/2008	9:46	1.34	12/4/2008	14:14	0.04	1/16/2009	10:56	0.69	2/24/2009	13:05	1.35
PD-132	NA	NA	NA	NA	NA	NA	11/6/2008	9:40	2.19	12/4/2008	14:15	2.22	1/16/2009	10:47	1.56	2/24/2009	13:10	2.24
PD-105	10/1/2008	NA	4.29	NA	NA	NA	11/6/2008	9:44	2.97	12/4/2008	14:05	3.02	1/16/2009	10:51	2.33	2/24/2009	13:08	3.08
PD-106	10/1/2008	NA	4.83	NA	NA	NA	11/6/2008	9:47	3.58	12/4/2008	14:00	3.62	1/16/2009	10:46	2.95	2/24/2009	13:09	3.65
MW-31A	10/1/2008	NA	4.61	10/30/2008	14:04	4.10	11/6/2008	9:50	3.23	12/4/2008	14:10	3.23	1/16/2009	11:01	2.67	2/24/2009	13:10	3.40
MW-31B	10/1/2008	NA	2.83	10/30/2008	14:06	2.41	11/6/2008	9:53	1.95	12/4/2008	14:11	2.02	1/16/2009	11:02	1.37	2/24/2009	13:10	1.91
PD-4	10/2/2008	NA	3.41	NA	NA	NA	11/6/2008	10:20	2.08	12/4/2008	14:04	2.12	1/16/2009	11:00	1.51	2/24/2009	13:05	2.20
PD-6	10/2/2008	NA	3.73	NA	NA	NA	11/6/2008	10:25	2.43	12/4/2008	14:06	2.47	1/16/2009	10:56	1.85	2/24/2009	13:00	2.53
MW-16	10/2/2008	NA	3.38	NA	NA	NA	11/10/2008	10:28	1.03	12/4/2008	14:36	2.42	1/16/2009	10:46	1.85	2/24/2009	13:35	2.56
MW-17	10/1/2008	NA	3.30	NA	NA	NA	11/10/2008	10:08	0.63	12/4/2008	14:21	2.07	1/16/2009	11:17	1.57	2/24/2009	13:30	2.10
PD-1A	10/2/2008	NA	4.40	NA	NA	NA	11/6/2008	10:10	2.91	12/4/2008	13:59	2.96	1/16/2009	11:07	2.38	2/24/2009	13:15	3.03
PD-1B	10/2/2008	NA	3.96	NA	NA	NA	11/6/2008	10:12	2.55	12/4/2008	13:59	2.54	1/16/2009	11:08	1.95	2/24/2009	13:15	2.63
PD-1C	10/2/2008	NA	4.85	NA	NA	NA	11/6/2008	10:14	2.80	12/4/2008	14:00	2.75	1/16/2009	11:09	1.73	2/24/2009	13:15	2.82
Wetlands Approach from Interurban Trail																		
D-1U	9/29/2008	NA	3.27	NA	NA	NA	11/6/2008	16:21	2.41[2]	12/4/2008	13:43	0.82	1/15/2009	14:58	1.19	2/24/2009	12:50	2.01
D-1L	9/29/2008	NA	1.15	NA	NA	NA	11/6/2008	16:20	0.35	12/4/2008	13:43	0.42	1/15/2009	14:58	NA[2]	2/24/2009	12:50	0.03
D-5U	9/29/2008	NA	5.00	NA	NA	NA	11/6/2008	15:19	4.06	12/4/2008	12:57	3.99	1/15/2009	18:34	3.30	2/24/2009	11:20	4.08
D-5L	9/29/2008	NA	3.65	NA	NA	NA	11/6/2008	15:18	2.60	12/4/2008	12:58	2.82	1/15/2009	13:38	1.76	2/24/2009	11:20	2.53
SG-219	10/1/2008	NA	0.00	NA	NA	NA	11/6/2008	15:19	0.00	12/4/2008	12:56	NA	1/15/2009	13:35	0.74	2/24/2009	11:20	0.00
D-6A	9/29/2008	NA	1.95	10/30/2008	11:51	1.51	11/6/2008	15:00	1.06	12/4/2008	13:24	0.86	1/15/2009	10:15	0.35	2/24/2009	12:10	0.96
D-6B	9/29/2008	NA	0.80	10/30/2008	11:53	0.58	11/6/2008	15:05	NA[2]	12/4/2008	13:23	0.25	1/15/2009	10:14	NA[2]	2/24/2009	12:10	0.0 [2]
MW-13	9/30/2008	NA	3.49	NA	NA	NA	11/6/2008	16:00	3.80	12/4/2008	13:29	2.23	1/15/2009	14:41	1.49	2/24/2009	12:40	2.31
SG-218	10/2/2008	NA	0.00	NA	NA	NA	11/6/2008	13:00	0.00	12/4/2008	13:29	0.04	1/15/2009	14:41	0.81	2/24/2009	12:40	0.02
MW-14	10/2/2008	NA	2.96	NA	NA	NA	11/10/2008	10:47	0.75	12/4/2008	13:15	1.40	1/15/2009	14:25	1.37	2/24/2009	11:50	1.70

Table C.2
Water Level Measurements

	October 2008			Transducer Install Event			November 2008			December 2008			January 2009			February 2009		
Location	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]
MW-15	10/1/2008	NA	3.39	NA	NA	NA	11/10/2008	10:00	0.75	12/4/2008	13:28	2.20	1/15/2009	14:46	1.40	2/25/2009	9:00	2.09
SG-220	10/2/2008	NA	0	NA	NA	NA	11/10/2008	10:00	2.57	12/4/2008	13:16	1.10	1/15/2009	14:38	1.89	2/25/2009	9:00	1.09
PD-50	10/2/2008	NA	2.95	NA	NA	NA	11/6/2008	15:20	1.75	12/4/2008	13:05	1.65	1/15/2009	14:10	0.75	2/24/2009	11:26	1.71
SG-221	10/2/2008	NA	0	NA	NA	NA	11/10/2008	15:23	0.92	12/4/2008	13:05	1.10	1/15/2009	14:10	1.88	2/24/2009	11:26	0.00
PD-51	10/2/2008	NA	3.49	NA	NA	NA	11/6/2008	15:22	2.24	12/4/2008	13:00	2.70	1/15/2009	14:06	1.24	2/24/2009	11:41	2.12
PD-52A	10/2/2008	NA	3.32	NA	NA	NA	11/6/2008	15:25	2.07	12/4/2008	13:06	1.86	1/15/2009	13:48	0.70	2/24/2009	11:26	1.92
PD-52B	10/2/2008	NA	3.33	NA	NA	NA	11/6/2008	15:25	2.17	12/4/2008	13:05	1.90	1/15/2009	13:48	1.14	2/24/2009	11:26	1.96
PD-52C	10/2/2008	NA	3.23	NA	NA	NA	11/6/2008	15:26	1.99	12/4/2008	13:03	1.81	1/15/2009	13:47	1.05	2/24/2009	11:26	1.87
Ditch along Interurban Trail																		
MW-30	10/1/2008	NA	5.65	NA	NA	NA	11/6/2008	14:35	4.76	12/4/2008	13:38	4.26	1/15/2009	14:37	0.39	2/24/2009	11:15	0.01
SG-227	10/2/2008	NA	0.00	NA	NA	NA	11/6/2008	14:35	0.90	12/4/2008	13:36	0.59	1/15/2009	14:35	0.81	2/242009	11:13	0.68
PD-212	10/3/2008	NA	4.59	NA	NA	NA	11/6/2008	14:59	3.35	12/4/2008	12:47	3.90	1/15/2009	12:54	3.25	2/25/2009	14:05	3.71
SG-212	10/2/2008	NA	0.75	NA	NA	NA	11/6/2008	14:56	1.49	12/4/2008	12:48	0.87	1/15/2009	12:53	1.10	2/25/2009	14:05	0.80
Landfill and Perimeter Area																		
PD-107	10/2/2008	NA	19.28	10/30/2008	11:05	18.76	11/6/2008	11:43	18.47	12/4/2008	9:33	17.85	1/16/2009	9:32	17.17	2/24/2009	9:45	17.51
PD-109	10/2/2008	NA	15.26	10/30/2008	9:55	14.97	11/6/2008	11:26	15.04	12/4/2008	9:21	14.94	1/16/2009	9:13	14.46	2/24/2009	9:37	14.26
SUMP	NA	NA	NA	NA	NA	NA	11/6/2008	12:40	35.65	12/4/2008	9:28	35.54	1/15/2009	9:42	35.13	2/242009	9:42	35.08
SG-224	NA	NA	NA	NA	NA	NA	11/6/2008	11:05	1.40	12/4/2008	9:27	NA	1/15/2009	9:47	NA	2/24/2009	9:50	NA
D-7A	9/30/2008	NA	3.00	NA	NA	NA	11/6/2008	11:57	2.05	12/4/2008	9:44	2.19	1/15/2009	9:52	1.75	2/24/2009	9:58	2.19
D-7B	9/30/2008	NA	2.82	NA	NA	NA	11/6/2008	11:58	3.16	12/4/2008	9:45	2.41	1/15/2009	9:54	2.10	2/24/2009	10:00	2.19
D-8A	9/30/2008	NA	2.50	10/30/2008	13:34	2.09	11/6/2008	11:56	1.27	12/4/2008	9:20	1.65	1/16/2009	9:43	1.35	2/24/2009	10:04	1.68
D-8B	9/30/2008	NA	2.38	10/30/2008	13:37	2.08	11/6/2008	11:57	1.27	12/4/2008	9:22	1.68	1/16/2009	9:47	1.32	2/24/2009	10:04	1.67
SG-214	10/2/2008	NA	0.90	NA	NA	NA	11/6/2008	12:07	1.05	12/4/2008	9:55	0.83	1/15/2009	9:59	0.90	2/24/2009	10:04	0.72
PD-214	10/3/2008	NA	3.81	NA	NA	NA	11/6/2008	12:06	2.76	12/4/2008	9:58	3.19	1/15/2009	10:00	2.78	2/24/2009	10:06	3.17
PD-215	10/3/2008	NA	4.84	NA	NA	NA	11/6/2008	12:10	3.75	12/4/2008	10:03	4.26	1/15/2009	10:09	3.83	2/24/2009	10:28	4.22
SG-215	10:00	NA	0.98	NA	NA	NA	11/6/2008	12:10	1.30	12/4/2008	10:04	1.17	1/15/2009	10:09	1.20	2/24/2009	10:30	0.90
D-9A	9/30/2008	NA	2.45	NA	NA	NA	11/6/2008	12:20	1.30	12/4/2008	9:58	1.59	1/15/2009	10:10	1.21	2/24/2009	10:35	1.52
Area East of Landfill																		
MW-11A	9/29/2008	NA	3.52	NA	NA	NA	11/6/2008	9:05	3.54	12/4/2008	9:00	3.06	1/15/2009	9:20	1.84	2/24/2009	11:10	2.25
MW-11B	9/29/2008	NA	3.70	NA	NA	NA	11/6/2008	9:05	3.60	12/4/2008	8:59	3.13	1/15/2009	9:19	1.90	2/24/2009	11:08	2.32
PD-60	10/2/2008	NA	4.80	NA	NA	NA	11/6/2008	9:15	4.56	12/4/2008	8:56	4.09	1/15/2009	9:16	3.26	2/24/2009	9:15	2.97
PD-61	10/2/2008	NA	10.83	NA	NA	NA	11/6/2008	9:21	10.72	12/4/2008	9:03	10.24	1/15/2009	9:24	8.96	2/24/2009	9:20	9.41
PD-62	10/2/2008	NA	4.91	NA	NA	NA	11/6/2008	9:02	4.70	12/4/2008	8:54	4.32	1/15/2009	9:07	3.62	2/24/2009	9:02	3.40
PD-104	10/2/2008	NA	3.33	NA	NA	NA	11/6/2008	10:05	3.11	12/4/2008	8:56	2.71	1/15/2009	9:12	2.00	2/24/2009	9:10	1.76
PD-63A	10/2/2008	NA	4.11	NA	NA	NA	11/6/2008	9:41	3.86	12/4/2008	8:33	3.58	1/15/2009	9:11	2.91	2/24/2009	9:05	2.98
PD-63B	10/2/2008	NA	3.18	NA	NA	NA	11/6/2008	9:42	2.91	12/4/2008	8:30	2.65	1/15/2009	9:14	1.96	2/24/2009	9:00	2.10
PD-63C	10/2/2008	NA	3.33	NA	NA	NA	11/6/2008	9:42	3.32	12/4/2008	8:32	2.84	1/15/2009	9:13	2.05	2/24/2009	9:02	2.15
PD-64	10/2/2008	NA	6.11	NA	NA	NA	11/6/2008	9:57	6.05	12/4/2008	8:51	5.59	1/15/2009	9:17	4.49	2/24/2009	9:10	4.71
PD-38	10/2/2008	NA	5.31	NA	NA	NA	11/6/2008	9:37	5.00	12/4/2008	8:46	4.67	1/15/2009	9:29	3.40	2/24/2009	9:16	3.79
PD-40	10/2/2008	NA	6.28	NA	NA	NA	11/6/2008	9:07	5.95	12/4/2008	8:44	5.60	1/15/2009	9:24	4.32	2/24/2009	9:12	4.61
MW-23	9/30/2008	NA	4.80	NA	NA	NA	11/6/2008	9:39	4.36	12/4/2008	8:49	3.91	1/15/2009	9:25	3.20	2/24/2009	9:15	2.91
D-10A	9/29/2008	9:10	5.12	10/30/2008	11:24	5.10	11/6/2008	11:06	4.79	12/4/2008	9:06	4.56	1/16/2009	10:01	3.21	2/24/2009	9:17	3.66
PD-80[4]	10/3/2008	NA	4.49	NA	NA	NA	11/6/2008	10:15	4.24	12/4/2008	8:41	3.92	NA	NA	NA	NA	NA	NA
PD-81[4]	10/3/2008	NA	4.63	NA	NA	NA	11/6/2008	10:17	4.40	12/4/2008	8:43	4.51	NA	NA	NA	NA	NA	NA
PD-82[4]	10/3/2008	NA	4.40	NA	NA	NA	11/6/2008	10:18	4.22	12/4/2008	8:50	3.86	NA	NA	NA	NA	NA	NA
PD-103	10/3/2008	NA	2.66	NA	NA	NA	11/6/2008	10:20	2.34	12/4/2008	8:45	2.05	1/15/2009	9:15	1.21	2/24/2009	9:07	1.35

Table C.2
Water Level Measurements

	October 2008			Transducer Install Event			November 2008			December 2008			January 2009			February 2009		
Location	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]	Date Taken	Time	Water Level (DTW or stage height in feet)[1]
Agricultural Fields and Ditches																		
PD-216	10/3/2008	NA	4.83	NA	NA	NA	11/6/2008	12:49	3.80	12/4/2008	10:15	4.35	1/15/2009	11:11	4.00	2/25/2009	11:08	4.16
SG-216	10/3/2008	13:40	0.72	NA	NA	NA	11/6/2008	12:49	1.72	12/4/2008	10:15	0.77	1/15/2009	11:10	3.55	2/25/2009	11:08	1.85
PD-213	10/3/2008	14:00	7.78	NA	NA	NA	11/6/2008	13:05	4.19	12/4/2008	10:25	4.88	1/15/2009	11:15	4.25	2/25/2009	11:30	4.73
SG-213	10/3/2008	9:30	0.14	NA	NA	NA	11/6/2008	13:05	1.28	12/4/2008	10:23	0.29	1/15/2009	11:15	0.92	2/25/2009	11:30	0.40
SG-225	10/3/2008	14:50	0.5	NA	NA	NA	11/6/2008	13:12	1.55	12/4/2008	10:33	0.16	1/15/2009	11:32	0.52	2/25/2009	11:40	0.25

Notes:

1 For wells and piezometers, water levels are depth to water from the measuring point. Staff gauge measurements are reported as distance from the bottom of the gauge (not necessarily ground surface).
2 Water level not consistent and unable to be accurately measured due to rapidly rising water level and/or water level rising above the measuring point.
3 Water level approximate due to instrument limitations; depth to water was less than 1 foot.
4 Locations were intended for other predesign data collection and were removed from the regular monitoring network due to redundancy.

Abbreviations:

DTW Depth to water
NA Not applicable or not available

Table C.3
Discharge Estimates (cfs)[1]

Location	**October 2008**	**February 2009**
Hylebos Creek		
SG-210	5.860	21.070
SG-211	6.090	22.380
Ditch System		
SG-212	0.126	0.239
SG-214	0.167	0.256
SG-215	0.033	0.190
Surprise Lake Drain		
SG-216	0.757	1.505
SG-213	0.555	1.789
Ditch System and Surprise Lake Drain		
SG-225	0.429	2.826

Note:

1 The difference between stations SG-212/SG-213 and SG-225 is assumed to be within the margin of error for discharge measurements and does not indicate the reach is a losing stream.

Abbreviations:

cfs Cubic feet per second

Table C.4
Pumping Test Results

		S[1]	T[1]	b[2]	K_h[3]		Solution
Observation Well	**Pumping Well**		**ft²/day**	**ft**	**ft/day**	**cm/s**	
PD-104	PD-104	NA	5.039	17	0.30	1.04E-04	Theis Recovery
PD-62	PD-104	NA	181.6	17	10.68	3.74E-03	Theis Recovery
PD-62	PD-104	0.0012	98.28	17	5.78	2.02E-03	Theis
PD-70	PD-101	NA	1961	21	93.38	3.27E-02	Theis Recovery
PD-70	PD-101	NA	1131	21	53.86	1.89E-02	Theis
FS-22	MW-17	NA	4230	19	222.63	7.79E-02	Theis Recovery
FS-22	MW-17	0.026	3405	19	179.21	6.27E-02	Theis

Notes:

1 Values for S, T from pump test solutions (refer to attachment C.2).
2 Values for b from boring logs and water level measurements.
3 Values for K_h (ft/day) calculated using $T = K_h*b$.

Abbreviations:

b	Saturated zone thickness
cm/s	Centimeters per second
ft	Feet
K_h	Horizontal hydraulic conductivity
S	Storativity
T	Transmissivity

Table C.5
Infiltration Test Results

Time	DTW (feet)[1] Basin Wall	DTW (feet)[1] Staff Gauge	Elapsed time (minutes)	Comments
Pre-test Measurements				
10:48	0.96	3.07	NA	Static water from pre-test overnight saturation.
10:58	0.96	3.07	NA	
11:08	0.96	3.07	NA	
11:19	0.96	3.07	NA	
11:28	0.96	3.07	NA	
11:38	0.96	3.07	NA	
11:46	0.96	3.07	NA	
Basin-flooding Measurements				
12:37	0.63	2.74	0	Initial readings after refilling basin.
12:40	0.63	2.74	3.0	
12:46	0.63	2.74	9	
12:53	0.63	2.74	16	
13:02	0.64	2.76	25	Level readings after observing small leak in basin near sheeting overlap at 13:02.
13:12	0.65	2.77	35	
13:16	0.665	2.775	39	
13:20	0.665	2.78	43	
13:25	0.67	2.785	48	
13:30	0.675	2.79	53	
13:35	0.68	2.80	58	
13:40	0.685	2.80	63	
13:45	0.695	2.81	68	
13:50	0.70	2.82	73	Level readings following repair with bentonite which reduced leakage rate.
13:55	0.71	2.82	78	
14:00	0.715	2.825	83	
14:05	0.715	2.825	88	
14:15	0.72	2.83	98	
14:25	0.73	2.84	108	
14:35	0.735	2.85	118	
14:50	0.745	2.86	133	
15:01	0.755	2.87	144	
15:15	0.765	2.88	158	
15:30	0.775	2.89	173	

Notes:

1 Water levels were measured from graduated marks on basin sheeting wall and central staff gauge for redundancy.

Abbreviations:

DTW Depth to water
NA Not applicable or not available

Table C.6
Steady-state Calibration Targets, Target Values, and Target Hydrostratigraphic Units

Well ID	Target Value (feet)	Hydrostratigraphic Unit	Simulated Groundwater Elevation (feet)	Residual (feet)
D-1U	12.99	Upper Sand Aquifer	14.03	-1.04
D-1L	14.44	Lower Sand Aquifer	14.77	-0.33
D-5U	13.01	Upper Sand Aquifer	13.70	-0.69
D-5L	14.17	Lower Sand Aquifer	13.96	0.21
D-6A	12.84	Upper Sand Aquifer	13.99	-1.15
D-6B	14.02	Lower Sand Aquifer	14.40	-0.38
D-7A	13.44	Upper Sand Aquifer	13.69	-0.25
D-7B	13.63	Lower Sand Aquifer	13.95	-0.32
D-8A	14.37	Upper Sand Aquifer	14.12	0.25
D-8B	14.40	Lower Sand Aquifer	14.14	0.26
D-9A	15.38	Upper Sand Aquifer	15.22	0.16
D-10A	16.71	Upper Sand Aquifer	17.23	-0.52
D-11A	16.52	Upper Sand Aquifer	16.08	0.44
D-11B	16.46	Lower Sand Aquifer	16.06	0.40
MW-13	12.26	Upper Sand Aquifer	13.96	-1.70
MW-14	13.50	Upper Sand Aquifer	13.54	-0.04
MW-15	13.21	Upper Sand Aquifer	13.83	-0.62
MW-16	13.52	Upper Sand Aquifer	13.93	-0.41
MW-17	13.20	Upper Sand Aquifer	13.72	-0.52
MW-23	16.12	Upper Sand Aquifer	16.95	-0.83
MW-30	13.63	Upper Sand Aquifer	14.10	-0.47
MW-31A	12.79	Upper Sand Aquifer	13.46	-0.67
MW-31B	14.06	Lower Sand Aquifer	13.37	-0.65
PD-1B	12.72	Upper Sand Aquifer	14.26	-0.20
PD-4	13.20	Upper Sand Aquifer	13.51	-0.31
PD-6	12.77	Upper Sand Aquifer	13.62	-0.85
PD-38	16.64	Upper Sand Aquifer	17.03	-0.39
PD-40	16.59	Upper Sand Aquifer	17.34	-0.75
PD-50	12.65	Upper Sand Aquifer	13.39	-0.74
PD-51	12.39	Upper Sand Aquifer	13.35	-0.96
PD-52B	12.64	Upper Sand Aquifer	13.31	-0.67
PD-60	15.65	Upper Sand Aquifer	16.12	-0.47
PD-61	16.69	Upper Sand Aquifer	17.14	-0.45
PD-62	15.72	Upper Sand Aquifer	16.23	-0.51
PD-63B	15.93	Upper Sand Aquifer	16.45	-0.52
PD-64	16.37	Upper Sand Aquifer	17.07	-0.70
PD-65	17.20	Upper Sand Aquifer	17.48	-0.28
PD-70	13.05	Upper Sand Aquifer	13.76	-0.72
PD-71	12.90	Upper Sand Aquifer	13.76	-0.86
PD-80	16.14	Upper Sand Aquifer	16.93	-0.79
PD-81	16.05	Upper Sand Aquifer	16.96	-0.91
PD-82	16.29	Upper Sand Aquifer	16.98	-0.69
PD-101	12.78	Upper Sand Aquifer	13.78	-1.00
PD-103	16.27	Upper Sand Aquifer	16.97	-0.70
PD-104	15.71	Upper Sand Aquifer	16.43	-0.72
PD-105	12.74	Upper Sand Aquifer	13.53	-0.79
PD-106	12.73	Upper Sand Aquifer	13.63	-0.90
PD-107	14.23	Upper Sand Aquifer	14.47	-0.24
PD-109	15.59	Upper Sand Aquifer	15.66	-0.07
PD-200	13.43	Upper Sand Aquifer	13.77	-0.34
PD-201	19.35	Upper Sand Aquifer	19.43	-0.08
PD-202	28.00	Upper Sand Aquifer	27.27	0.73
PD-203	22.05	Upper Sand Aquifer	22.23	-0.18
PD-204	13.73	Upper Sand Aquifer	14.45	-0.72
PD-209A	13.53	Upper Sand Aquifer	13.26	0.27
PD-210	13.75	Upper Sand Aquifer	13.59	0.16
PD-211	13.37	Upper Sand Aquifer	13.12	0.25
PD-212	13.84	Upper Sand Aquifer	13.27	0.57
PD-213	12.64	Upper Sand Aquifer	12.61	0.03
PD-214	14.42	Upper Sand Aquifer	14.16	0.26
PD-215	15.04	Upper Sand Aquifer	14.74	0.30
PD-216	16.12	Upper Sand Aquifer	15.10	1.02

Table C.7
Steady-state Model Calibration Statistics

Calibration Statistic	Value
Residual Mean (RM)	-0.37 (ft)
Absolute Residual Mean (ARM)	0.54 (ft)
Resdiual Standard Deviation (RSD)	0.50 (ft)
Residual Sum of Squares (RSS)	24.5 (ft^2)
RSD / Total Head Change	0.032 (unitless)

Abbreviation:

ft	Feet

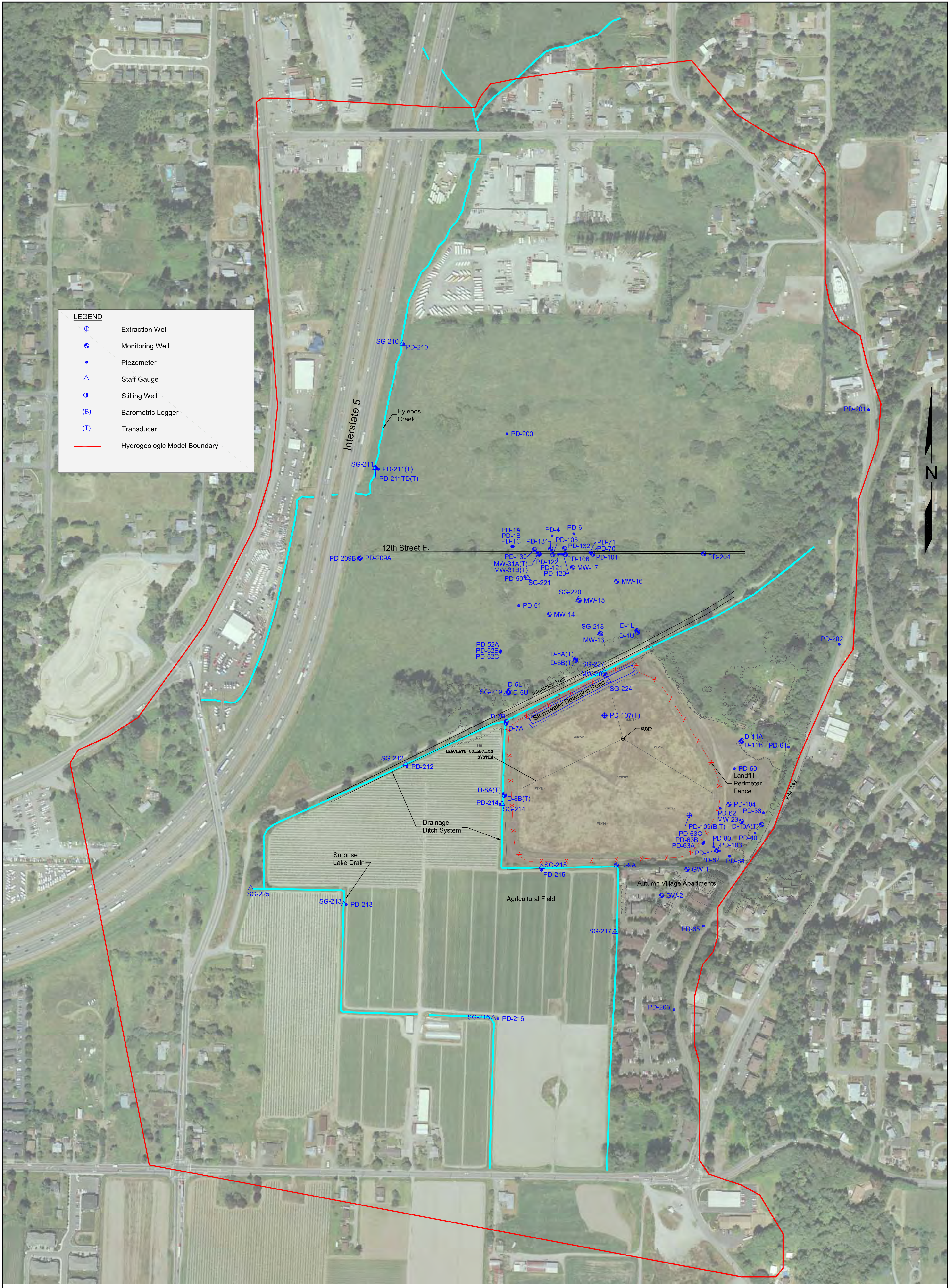
B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR)

Appendix C Figures
Phase 1 Hydrogeologic Study Report

FINAL

DWG NAME: G:\project\Clients\Floyd and Snider\BandL\BandL060.dwg
DATE: 3/27/2009 1:33 PM



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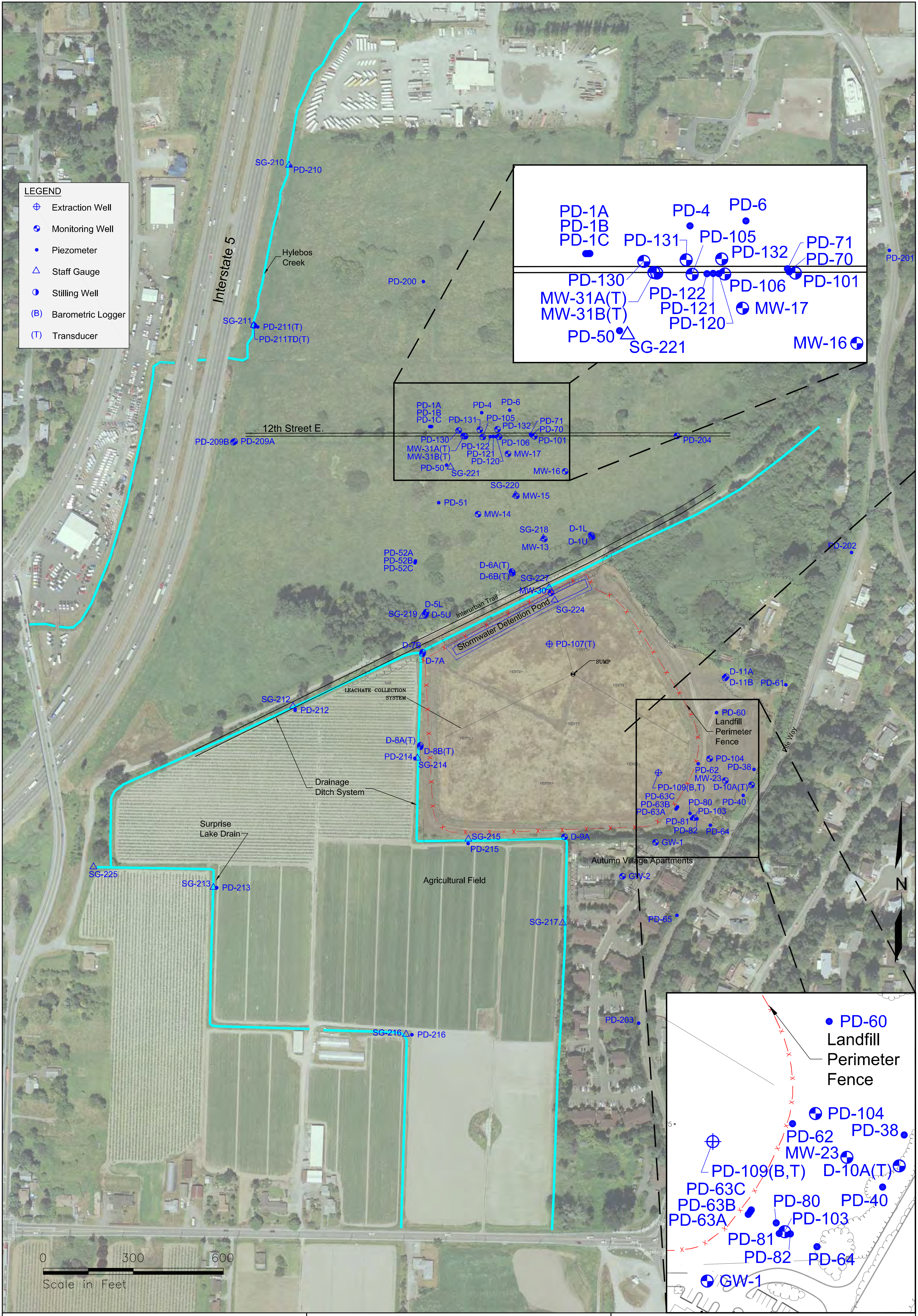
Phase 1 Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.1
Phase 1 Hydrogeologic Study
Model Domain

DWG NAME: G:\project\Clients\Floyd and Snider\BandL\BandL061.dwg
DATE: 3/27/2009 1:38 PM



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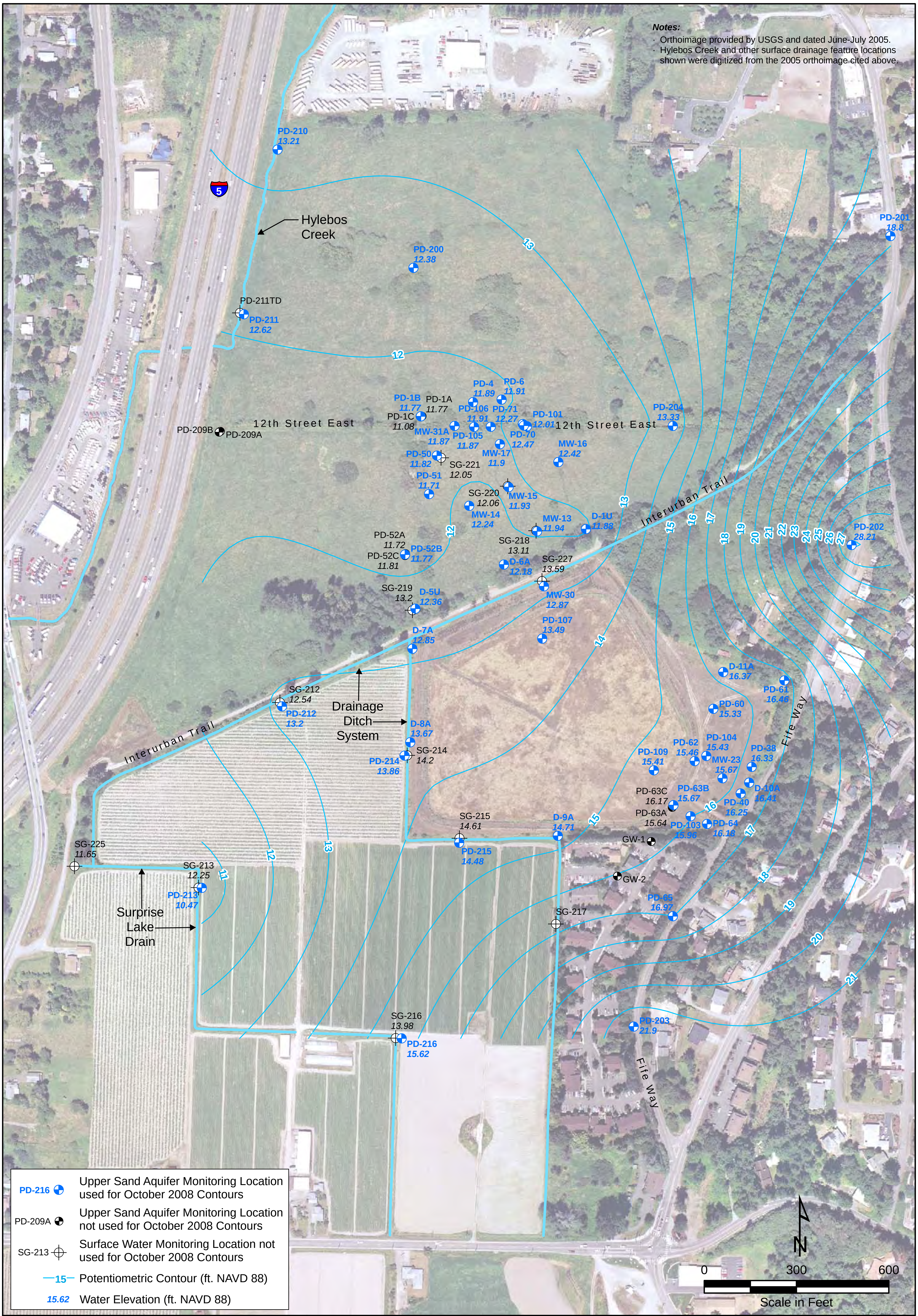
Phase 1 Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.2
Phase 1 Hydrogeologic
Monitoring Points



Notes:
- Orthoimage provided by USGS and dated June-July 2005.
- Hylebos Creek and other surface drainage feature locations shown were digitized from the 2005 orthoimage cited above.

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Phase I Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.3
October 2008
Upper Sand Aquifer
Potentiometric Contours

File: F:\projects\B&L RIM\GIS\MXD\EDR March 2009\Figure C.3 (Upper Sand Aquifer GW Elevations and Contours Sept- Oct 2008).mxd
3/27/2009

Notes:

- Orthoimage provided by USGS and dated June-July 2005.
- Hylebos Creek and other surface drainage feature locations shown were digitized from the 2005 orthoimage cited above.

D-7B ●	Lower Sand Aquifer Monitoring Location used for October 2008 Contours
–14.8–	Potentiometric Contour (ft. NAVD 88)
13.61	Water Elevation (ft. NAVD 88)

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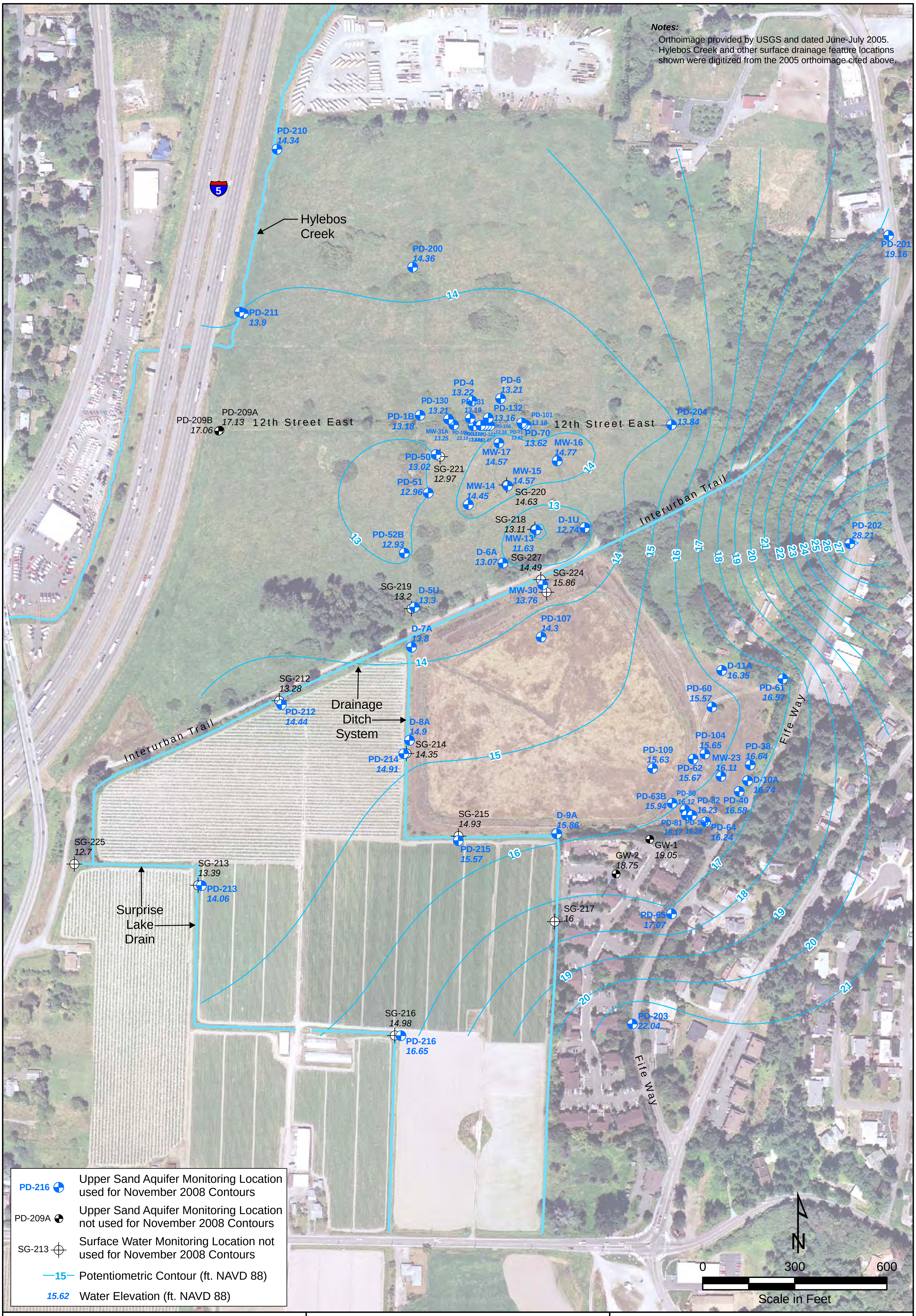
Phase I Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.4
October 2008
Lower Sand Aquifer
Potentiometric Contours

File: F:\projects\B&L RIM\GIS\MXD\EDR March 2009\Figure C.4 (Lower Sand Aquifer GW Elevations and Contours Sept- Oct 2008).mxd
3/27/2009



Notes:

- Orthoimage provided by USGS and dated June-July 2005.
- Hylebos Creek and other surface drainage feature locations shown were digitized from the 2005 orthoimage cited above.

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Phase I Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.5
November 2008
Upper Sand Aquifer
Potentiometric Contours

File: F:\projects\B&L RIM\GIS\MXD\EDR March 2009\Figure C.5 (Upper Sand Aquifer GW Elevations and Contours Nov 2008).mxd
3/27/2009

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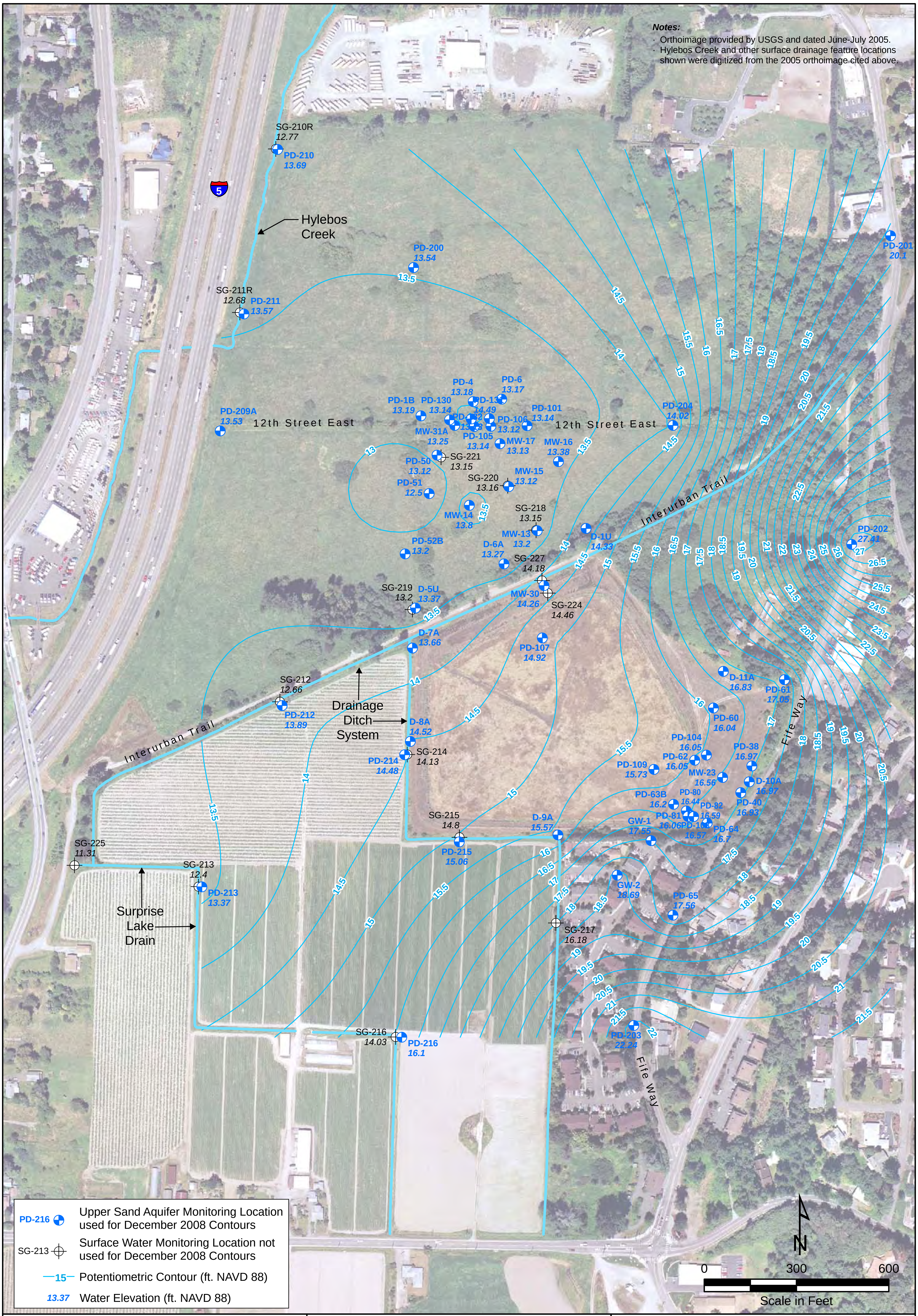
Phase I Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.6
November 2008
Lower Sand Aquifer
Potentiometric Contours

File: F:\projects\B&L RIM\GIS\MXD\EDR March 2009\Figure C.6 (Lower Sand Aquifer GW Elevations and Contours Nov 2008).mxd
3/27/2009



Notes:

- Orthoimage provided by USGS and dated June-July 2005.
- Hylebos Creek and other surface drainage feature locations shown were digitized from the 2005 orthoimage cited above.

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Phase I Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.7
December 2008
Upper Sand Aquifer
Potentiometric Contours

File: F:\projects\B&L RIM\GIS\MXD\EDR March 2009\Figure C.7 (Upper Sand Aquifer GW Elevations and Contours Dec 2008).mxd
3/27/2009

Notes:

- Orthoimage provided by USGS and dated June-July 2005.
- Hylebos Creek and other surface drainage feature locations shown were digitized from the 2005 orthoimage cited above.

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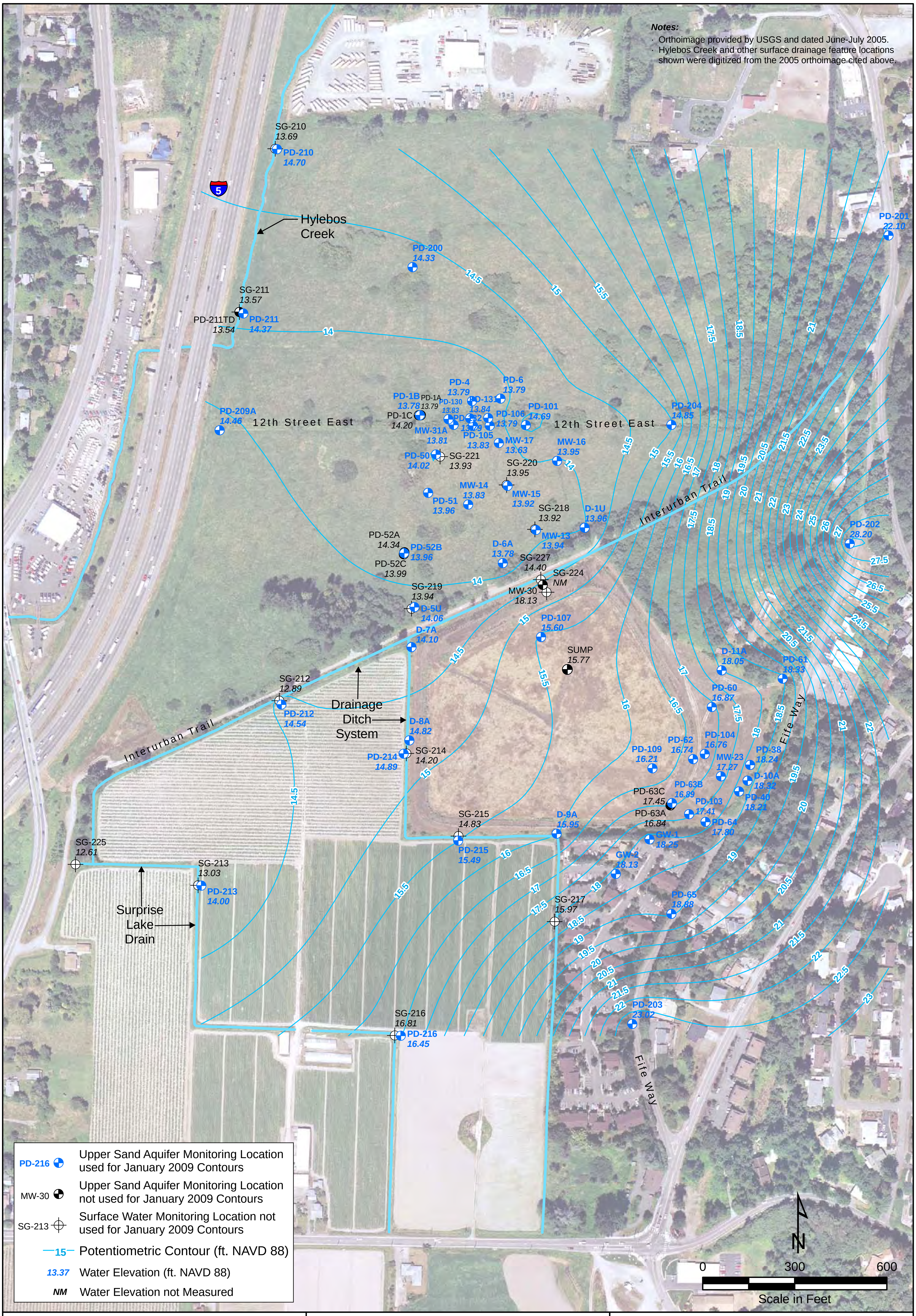
Figure C.8
December 2008
Lower Sand Aquifer
Potentiometric Contours

File: F:\projects\B&L RIM\GIS\MXD\EDR March 2009\Figure C.8 (Lower Sand Aquifer GW Elevations and Contours Dec 2008).mxd
3/27/2009



Notes:

- Orthoimage provided by USGS and dated June-July 2005.
- Hylebos Creek and other surface drainage feature locations shown were digitized from the 2005 orthoimage cited above.

PD-216 ◐	Upper Sand Aquifer Monitoring Location used for January 2009 Contours
MW-30 ◐	Upper Sand Aquifer Monitoring Location not used for January 2009 Contours
SG-213 ⌖	Surface Water Monitoring Location not used for January 2009 Contours
—15—	Potentiometric Contour (ft. NAVD 88)
13.37	Water Elevation (ft. NAVD 88)
NM	Water Elevation not Measured

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Phase I Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.9
January 2009
Upper Sand Aquifer
Potentiometric Contours

File: F:\projects\B&L RIM\GIS\MXD\EDR March 2009\Figure C.9 (Upper Sand Aquifer GW Elevations and Contours Jan 2009).mxd
3/27/2009

Notes:
- Orthoimage provided by USGS and dated June-July 2005.
- Hylebos Creek and other surface drainage feature locations shown were digitized from the 2005 orthoimage cited above.

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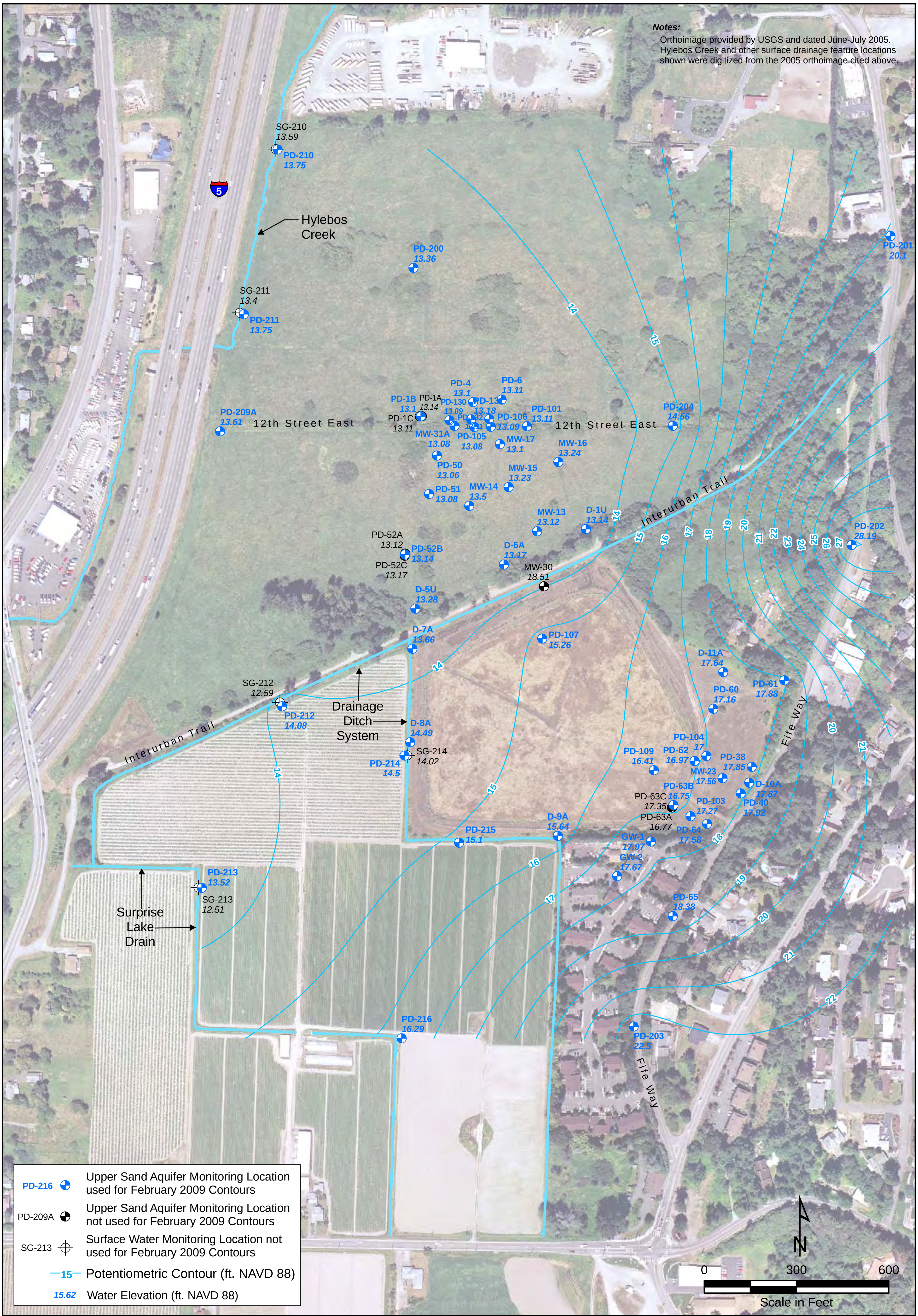
Phase I Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.10
January 2009
Lower Sand Aquifer
Potentiometric Contours

File: F:\projects\B&L RIM\GIS\MXD\EDR March 2009\Figure C.10 (Lower Sand Aquifer GW Elevations and Contours Jan 2009).mxd
3/27/2009



Notes:

- Orthoimage provided by USGS and dated June-July 2005.
- Hylebos Creek and other surface drainage feature locations shown were digitized from the 2005 orthoimage cited above.

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Phase I Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.11
February 2009
Upper Sand Aquifer
Potentiometric Contours

File: F:\projects\B&L RIM\GIS\MXD\EDR March 2009\Figure C.11 (Upper Sand Aquifer GW Elevations and Contours Feb 2009).mxd
3/27/2009

Notes:

- Orthoimage provided by USGS and dated June-July 2005.
- Hylebos Creek and other surface drainage feature locations shown were digitized from the 2005 orthoimage cited above.

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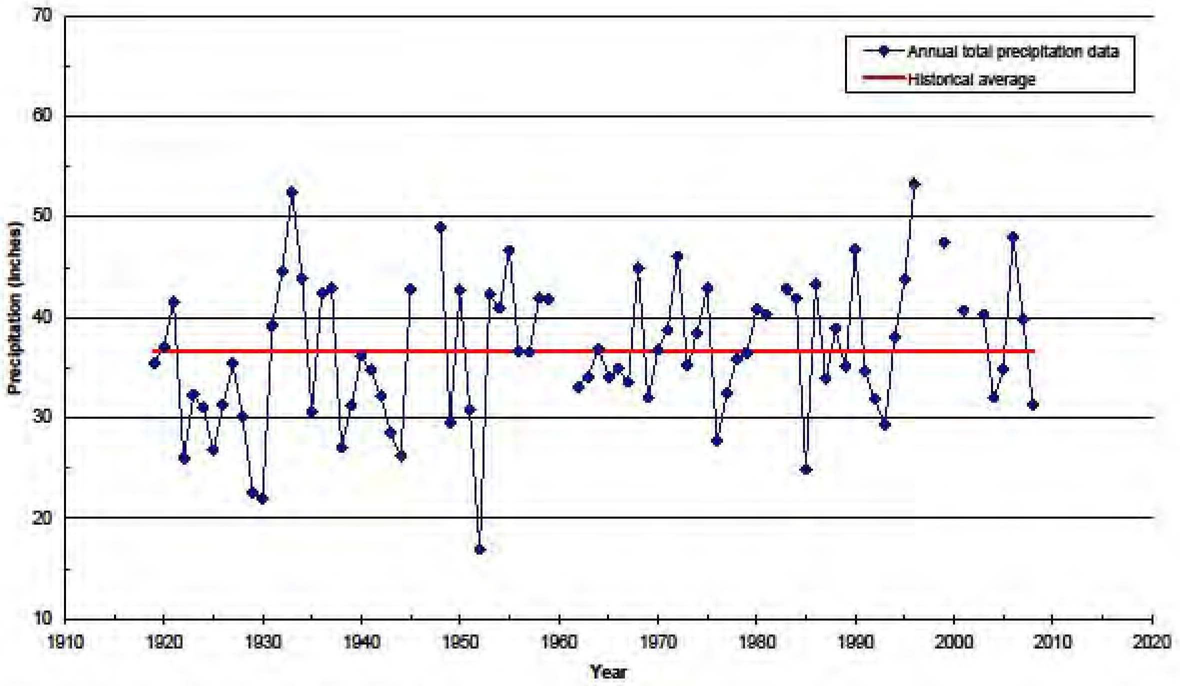
Phase I Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.12
February 2009
Lower Sand Aquifer
Potentiometric Contours

File: F:\projects\B&L RIM\GIS\MXD\EDR March 2009\Figure C.12 (Lower Sand Aquifer GW Elevations and Contours Feb 2009).mxd
3/27/2009



Notes: 1.) Data Source: Precipitation data were obtained from two weather stations in Tacoma, WA (1919 to 1981: Tacoma #1, COOP ID 458278; and 1982 to 2008: Tacoma City Hall, COOP ID 458286). Data for Jan 1919 through August 2008 were provided by the National Climatic Data Center. Data for September 2008 through December 2008 were provided by the Western Regional Climate Center.

2.) Annual precipitation is not plotted for years that have at least 1 month of missing precipitation data. This includes years 1946, 1947, 1960, 1961, 1982, 1997, 1998, 2000, and 2002.

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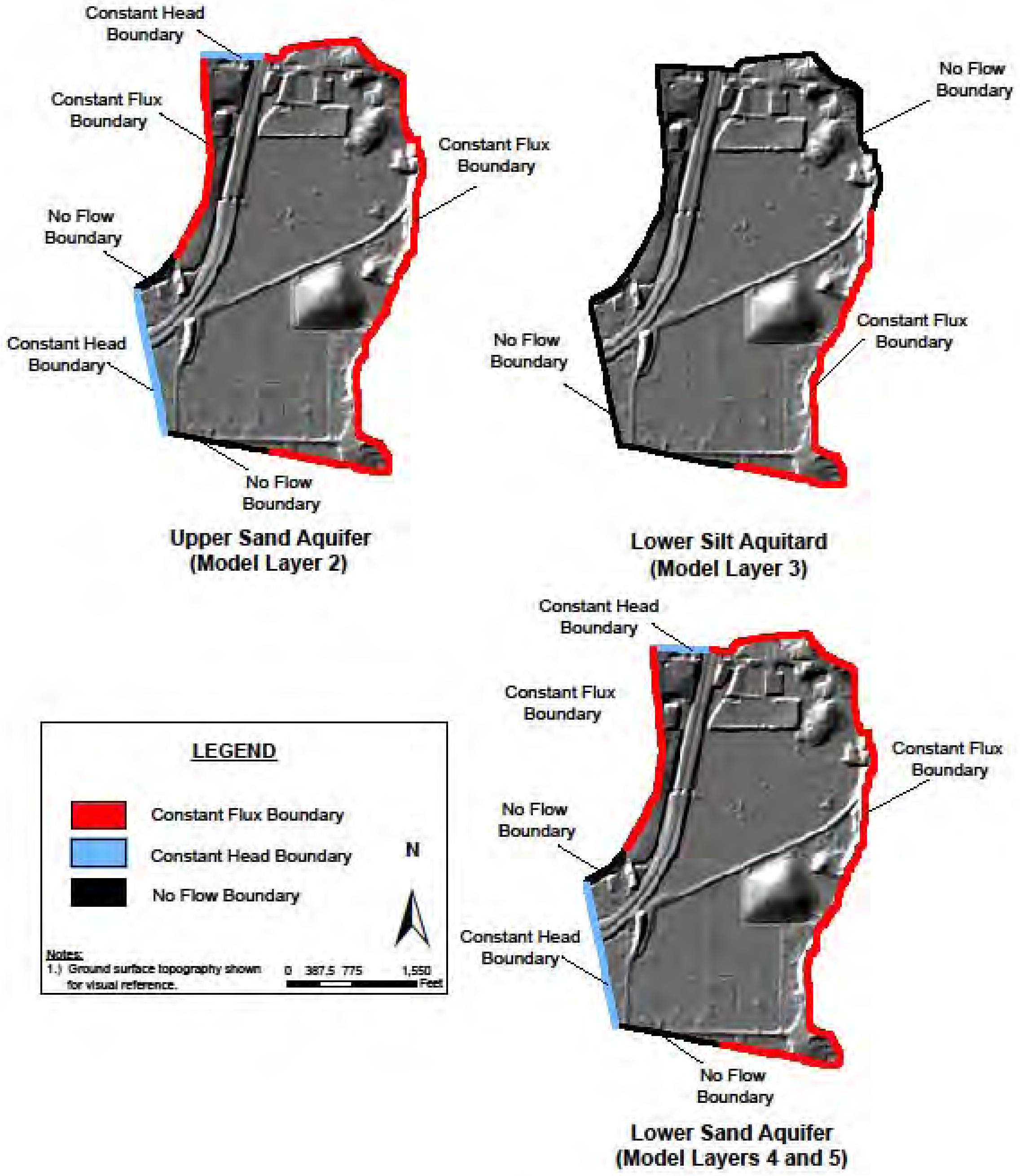
Phase 1 Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.13
Annual Average and
Total Precipitation Values



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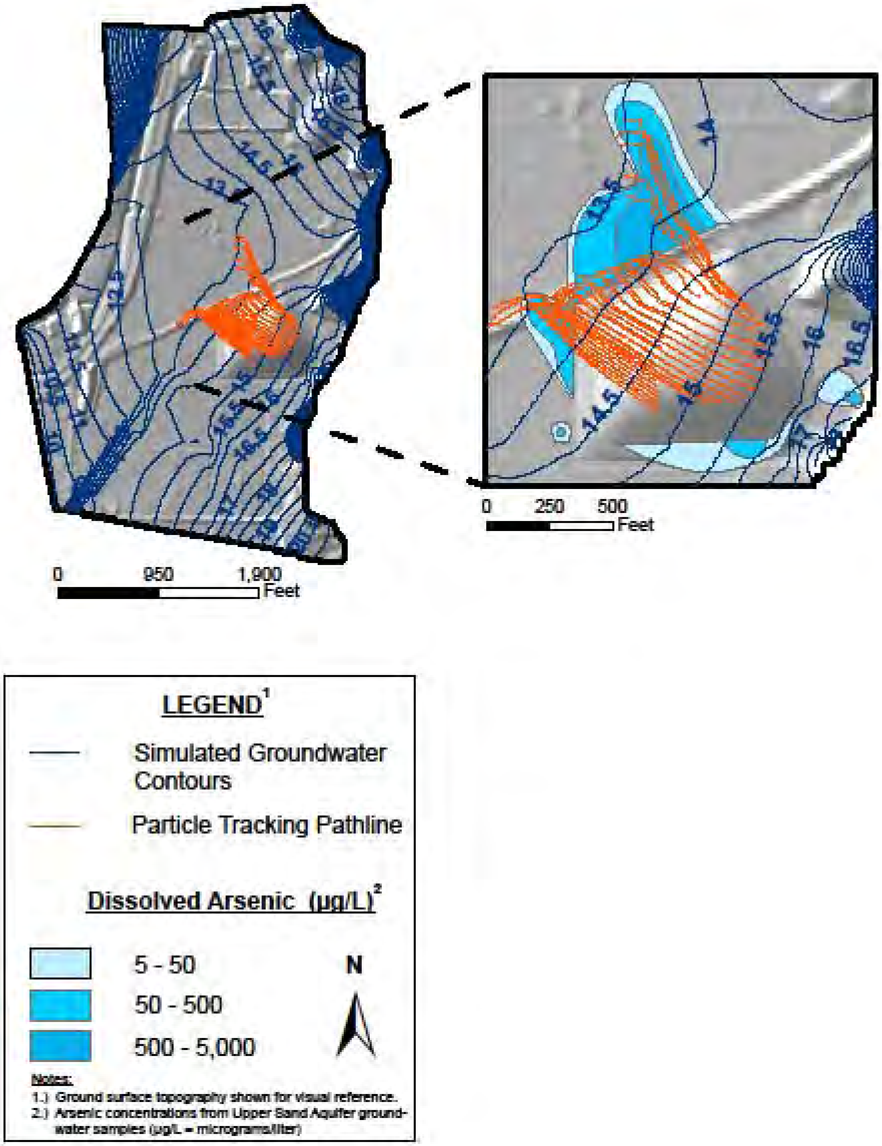
Phase 1 Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.14
Numerical Model Select Boundary Condition Types



Notes:
1.) Ground surface topography shown for visual reference.
2.) Arsenic concentrations from Upper Sand Aquifer groundwater samples (µg/L = micrograms/liter)

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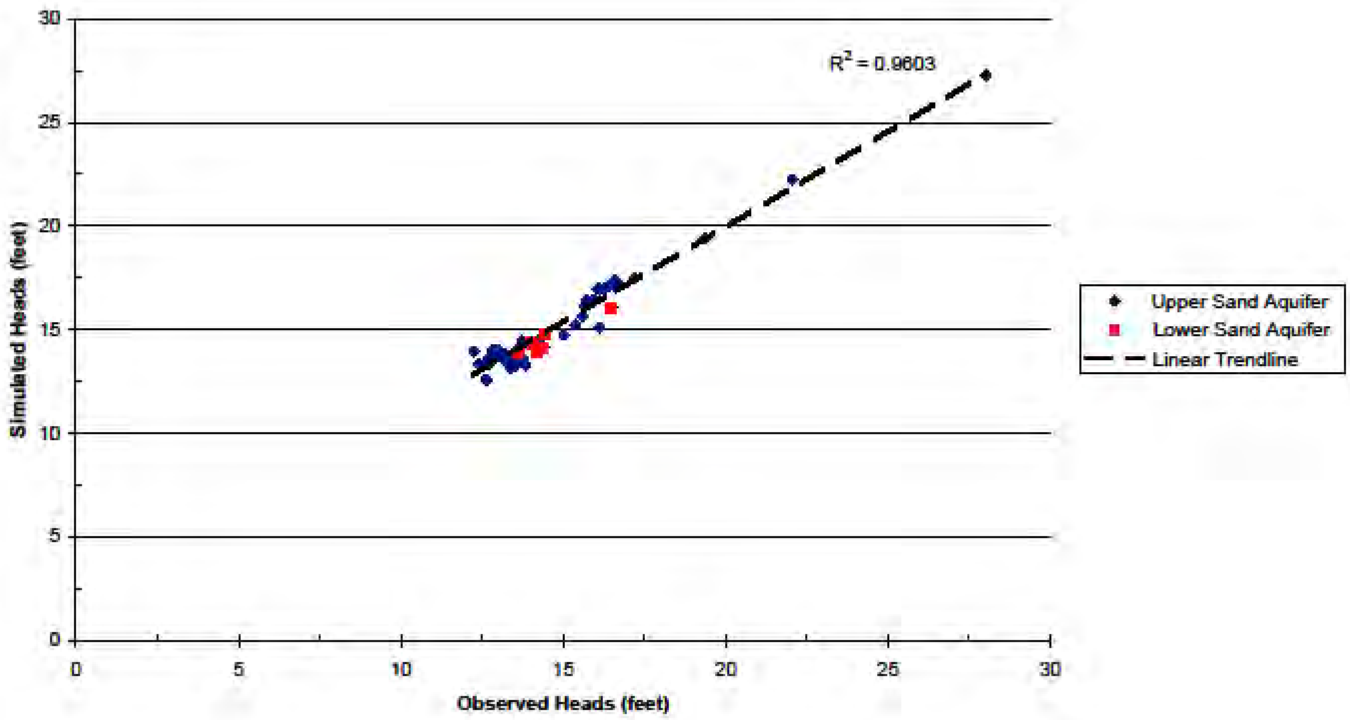
**Phase 1 Hydrogeologic
Study Report
B&L Woodwaste Site
Pierce County, Washington**

Figure C.15
Simulated Groundwater Contours and
Advective Transport from
Suspected Source Area



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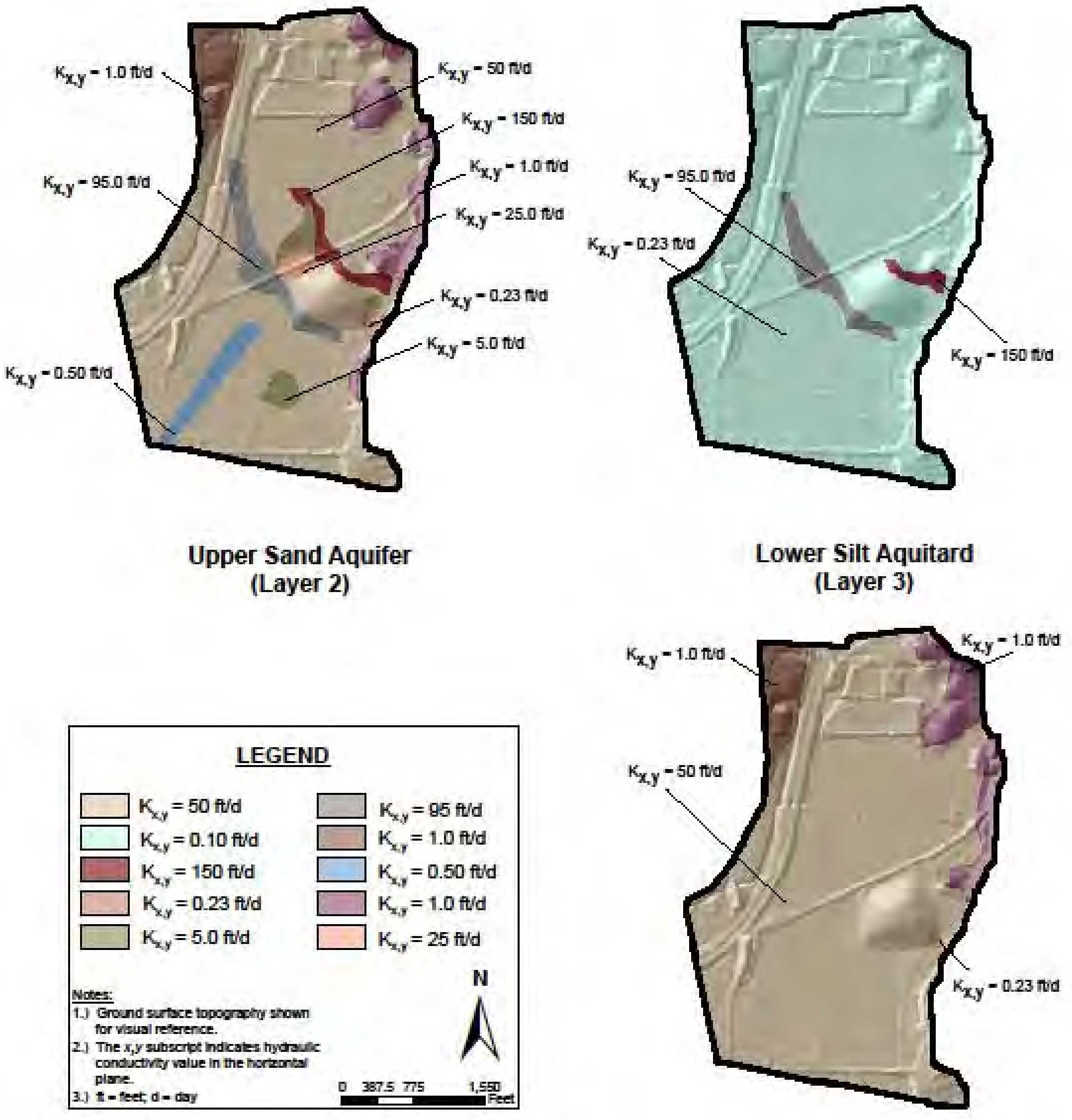
Phase 1 Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.16
Observed vs. Simulated Heads



Upper Sand Aquifer
(Layer 2)

Lower Silt Aquitard
(Layer 3)

Lower Sand Aquifer
(Layer 4 and 5)

Notes:
1.) Ground surface topography shown for visual reference.
2.) The x,y subscript indicates hydraulic conductivity value in the horizontal plane.
3.) ft = feet; d = day

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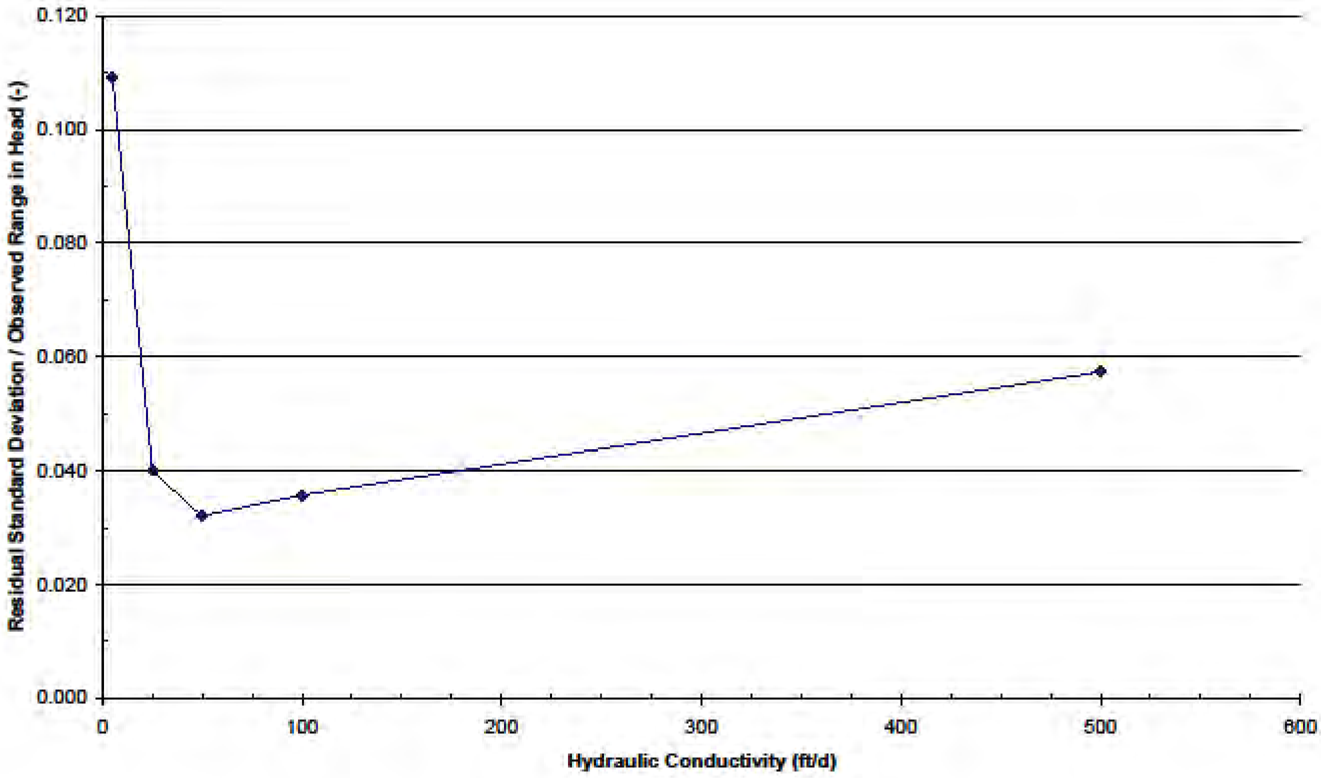
**Phase 1 Hydrogeologic
Study Report
B&L Woodwaste Site
Pierce County, Washington**

Figure C.17
Numerical Model Hydraulic
Conductivities



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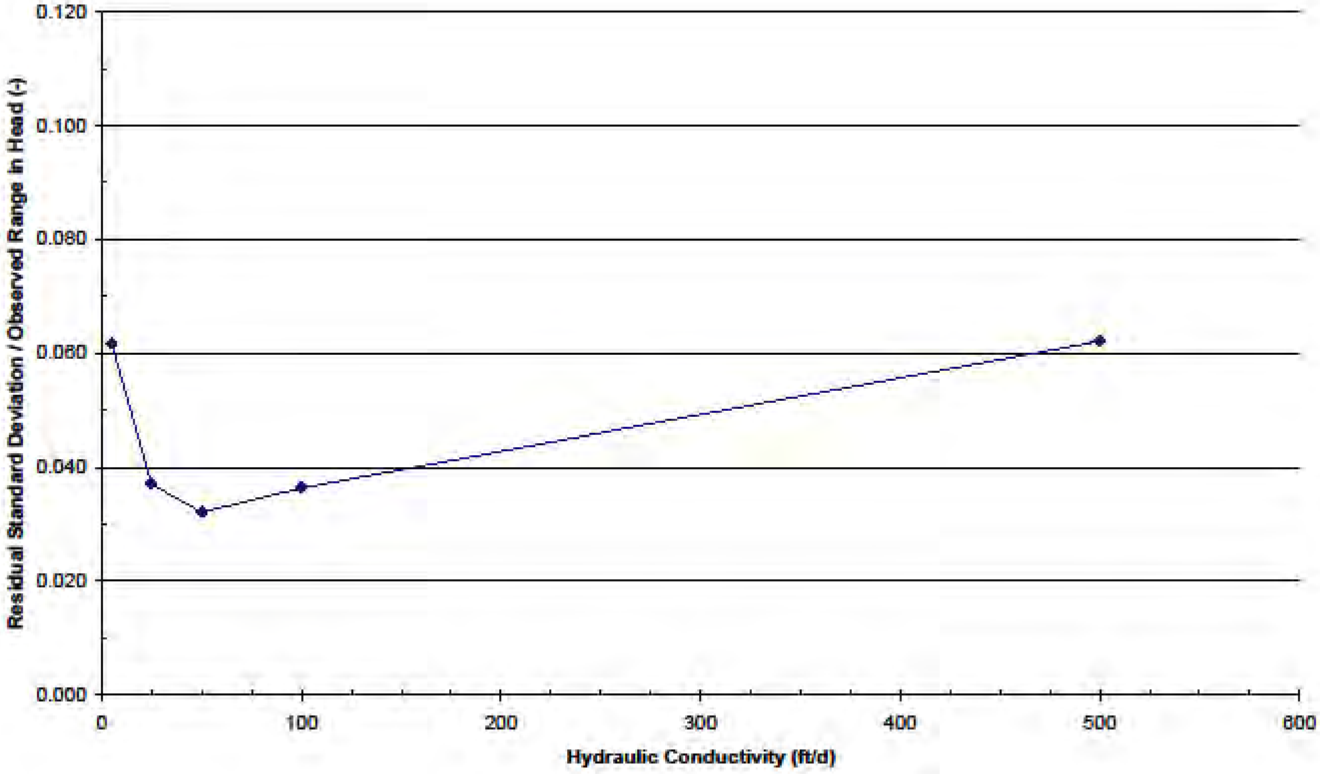
Phase 1 Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.18
Upper Sand Aquifer (Layer 2) Background Hydraulic Conductivity Sensitivity Analysis



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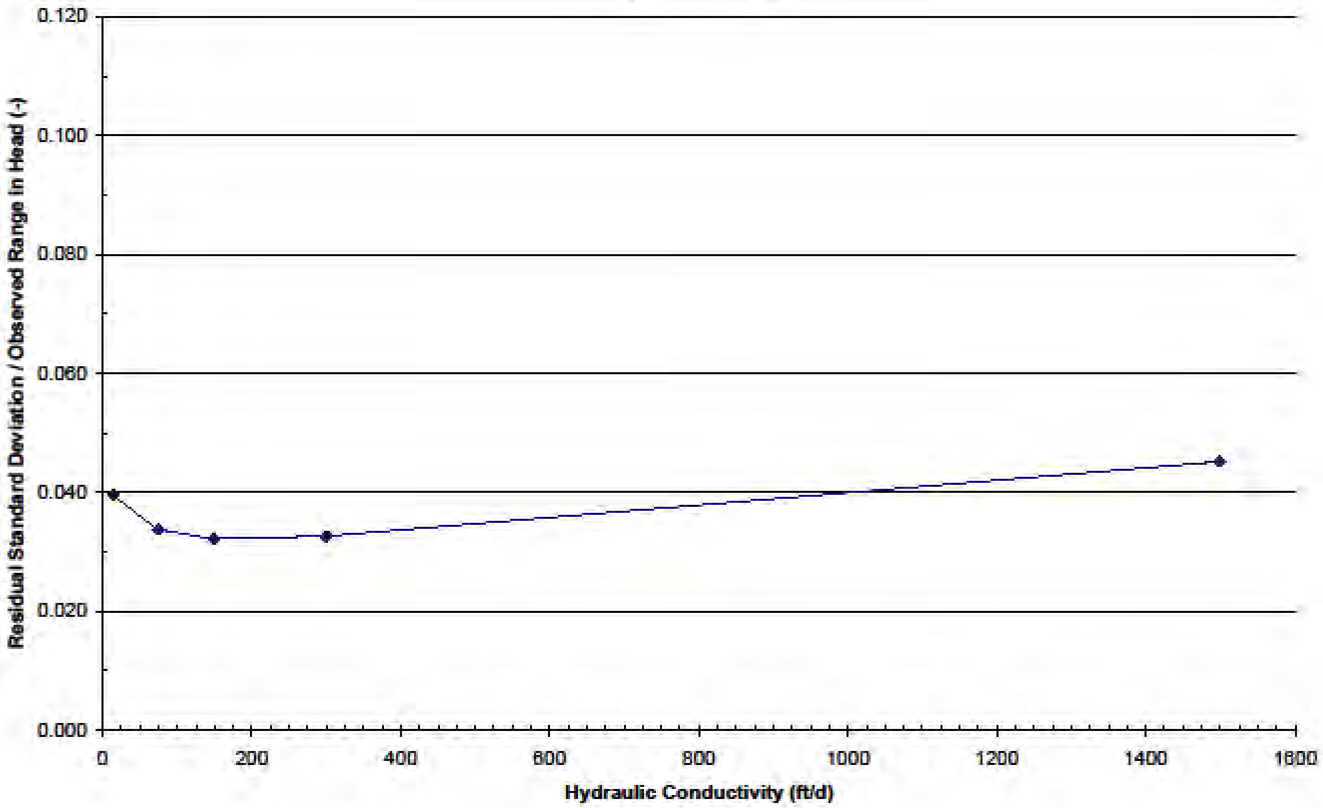
Phase 1 Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.19
Lower Sand Aquifer (Layer 4 and 5) Background
Hydraulic Conductivity Sensitivity Analysis



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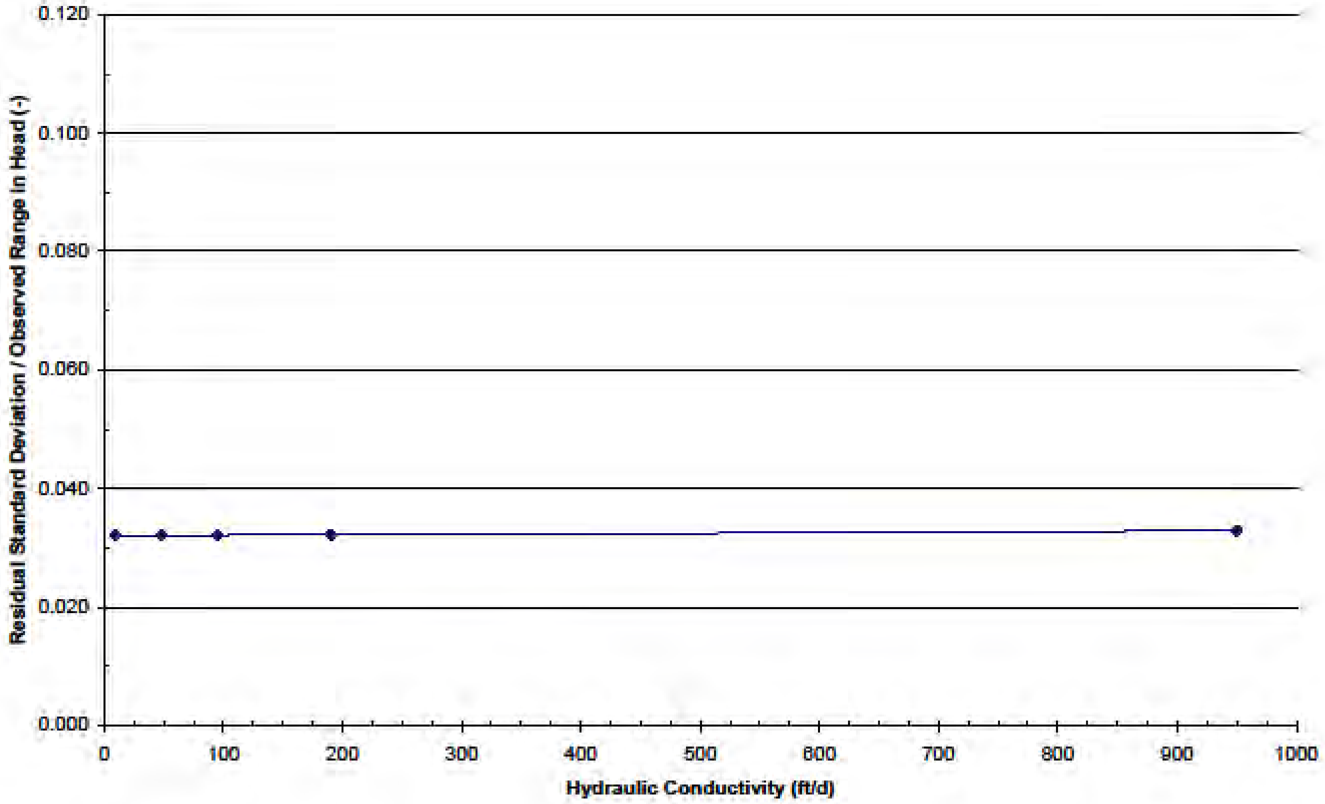
Phase 1 Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.20
East Sand Channel Hydraulic
Conductivity Sensitivity Analysis



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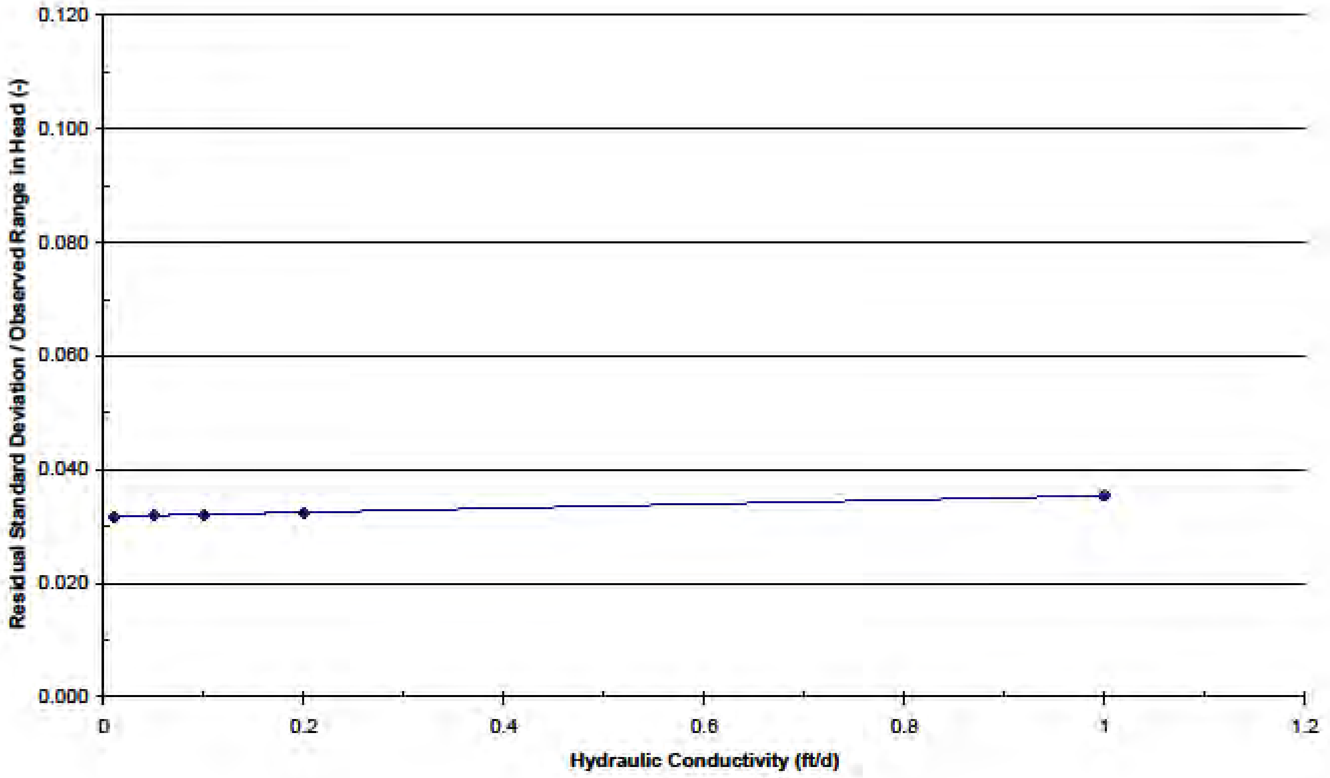
Phase 1 Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.21
Southwest Sand Channel Hydraulic
Conductivity Sensitivity Analysis



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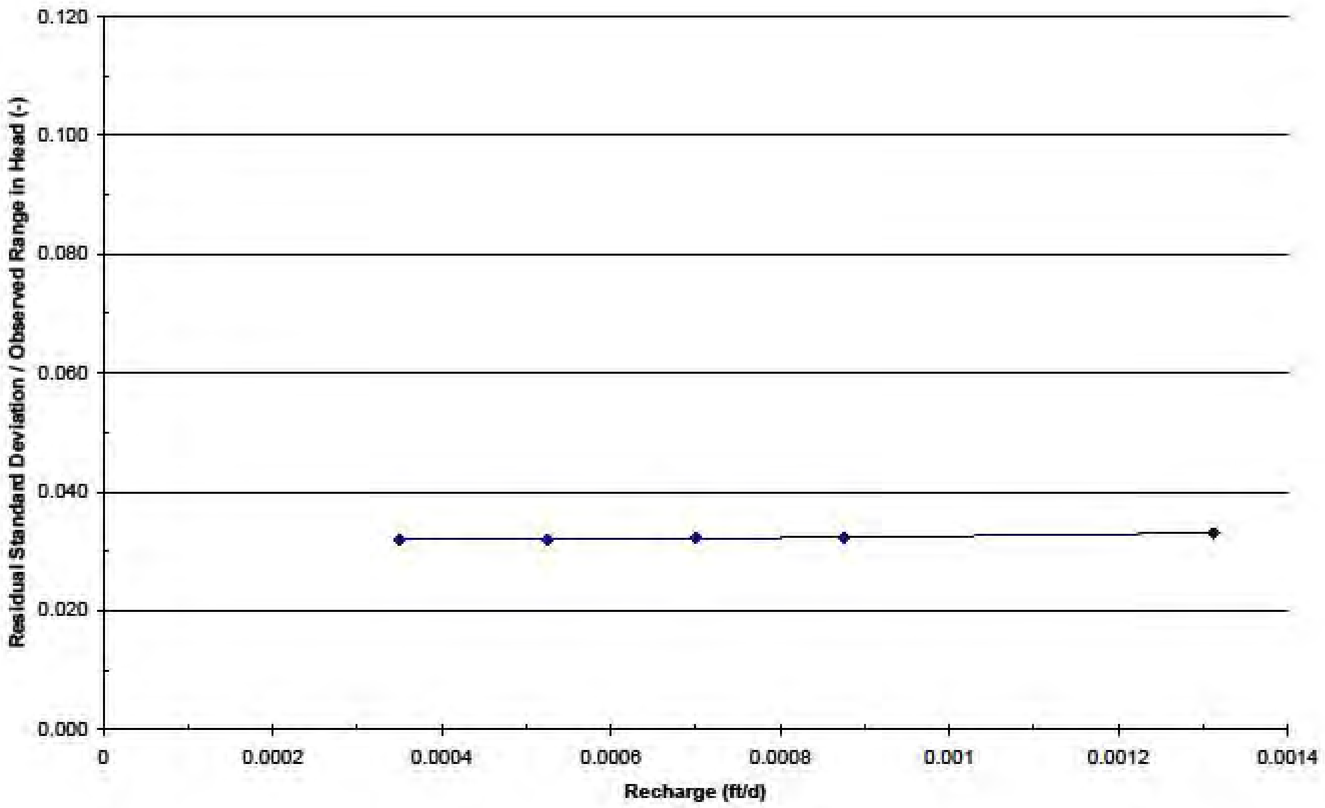
Phase 1 Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.22
Lower Silt Aquitard (Layer 3) Background
Hydraulic Conductivity Sensitivity Analysis



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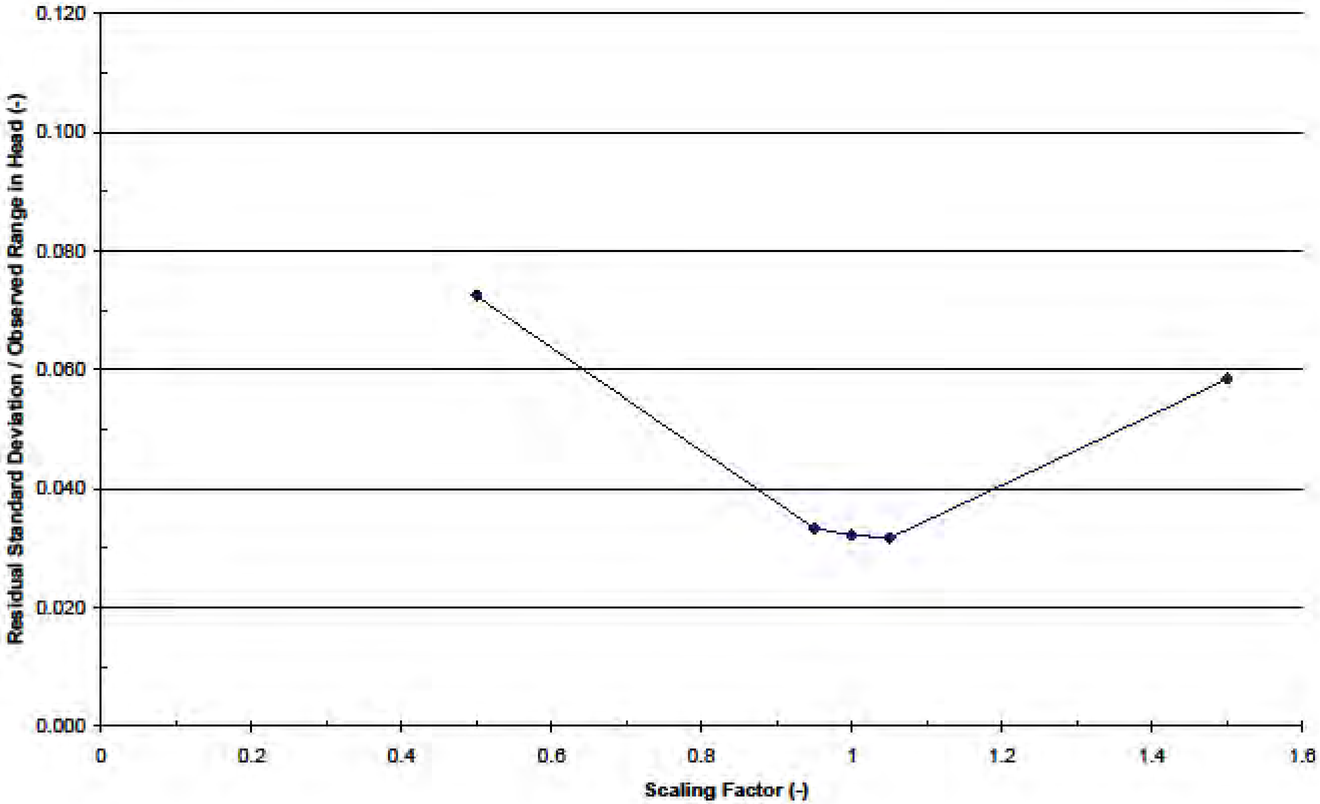
B&L Woodwaste Site
Pierce County, Washington

Figure C.23
Recharge Sensitivity Analysis



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Phase 1 Hydrogeologic Study Report
B&L Woodwaste Site
Pierce County, Washington

Figure C.24
Flux Boundary Sensitivity Analysis

B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR)

Attachment C1
Phase 1 Hydrogeologic Study Report
Boring Logs

FINAL

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Boring Location: PD-1a

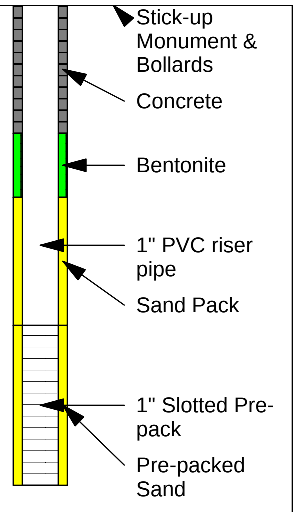
Drill Date: August 15, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 12.667, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702948.758
Longitude/Easting: 1185729.253
Casing Elevation: 16.167, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 7.5 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Shallow well screen. First of three.
No logging was done.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	WELL COMPLETION DETAIL (If Applicable)
		0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-1b

Drill Date: August 15, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

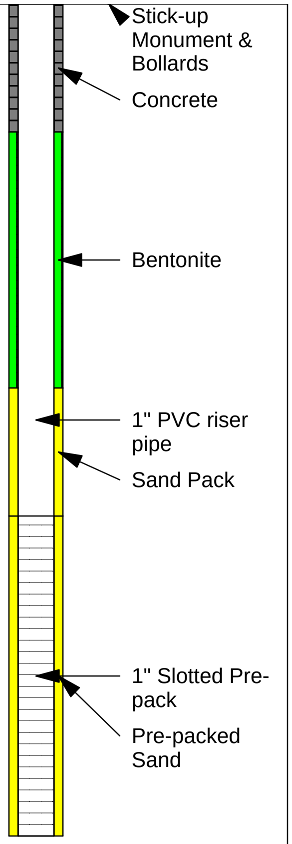
Ground Surf Elev. & Datum: 12.617, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702948.583
Longitude/Easting: 1185725.946
Casing Elevation: 15.732, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 13 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Intermediate well screen. 2 of 3.
No logging was done.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			
		8			
		9			
		10			
		11			
		12			
		13			
		14			
		15			
		16			
		17			
		18			
		19			
		20			



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-1c

Drill Date: August 15, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

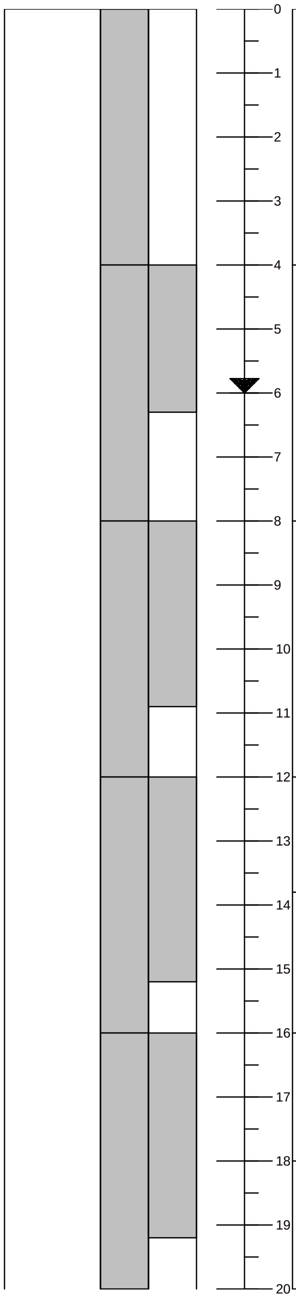
Ground Surf Elev. & Datum: 12.617, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702948.758
Longitude/Easting: 1185722.528
Casing Elevation: 15.932, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24 ft bgs
Groundwater ATD (ft bgs): 6' bgs

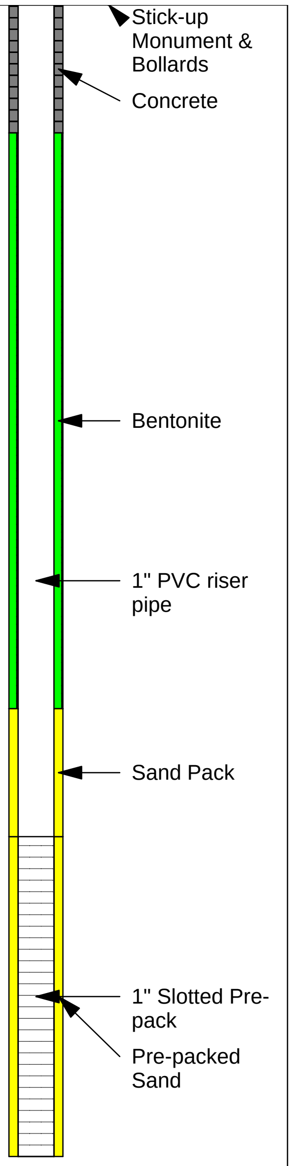
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Deep well screen. Third of three.
Sunny, hot.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
				Very soft and heaving.
			SM/ML	Top 1 inch woody roots grading down to dark gray, moist, poorly graded silty sand, fine. Silt <15%. At 6.0 inches becomes silt.
			SM	Dark gray, wet, poorly graded silty sand, fine. Pieces of wood interbedded.
			SM	Medium gray, wet, poorly graded, silty sand, fine.
			SP	Dark gray, wet, poorly graded sand, fine-medium. Little to no silt.
			SM	Dark gray, wet, poorly graded silty sand, fine.
			ML/CL /PT/ML	Medium gray, moist, poorly graded silt. Grading down to peat mixed with silt, then grading back to silt.



WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-1c

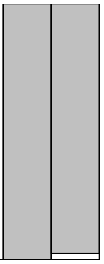
Drill Date: August 15, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 12.617, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702948.758
Longitude/Easting: 1185722.528
Casing Elevation: 15.932, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24 ft bgs
Groundwater ATD (ft bgs): 6' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Deep well screen. Third of three.
Sunny, hot.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		20 21 22 23 24	PT/ML/PT	Large woody chunks. At 21.0 mottled gray and brown clayey silt with interbedded organics. At 21.3 turns to peat and then grades to clayey silt with medium plasticity.	

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-4

Drill Date: August 14, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

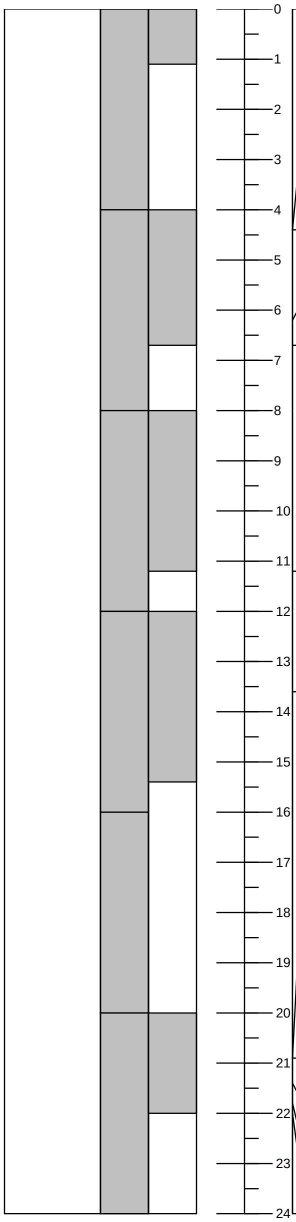
Ground Surf Elev. & Datum: 12.29 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702994.8
Longitude/Easting: 1185895.9
Casing Elevation: 15.30 NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24 FT BGS
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

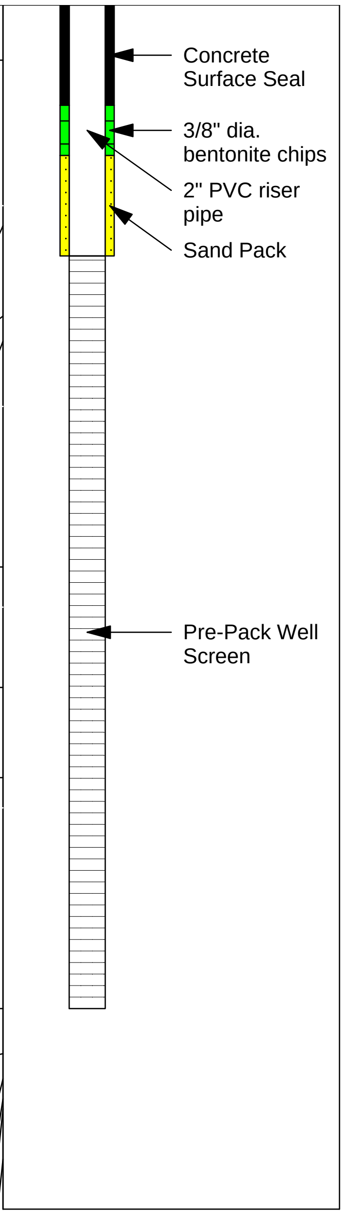
Remarks: Boring log and groundwater sample in wetland.

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
PT	Dark brown, moist, silty peat, wood.
PT	Dark brown peat mixed with silt <15%
SM	Grades to silty sand with organic debris interbedded; grading down to fine sandy silt.
SM/SP	Medium gray, poorly graded sand, fine and medium, silt < 5%.
SM/SP	Medium and dark gray, wet, poorly graded sand, fine and medium, little silt.
SM/SP	Medium and dark gray, wet, poorly graded sand, fine and medium, little silt.
SP	Dark gray, poorly graded clean sand, medium, no silt.
SP	Liner stuck in sampler but fine and medium sand in top and bottom of liner based on observation.
	Dark gray, poorly graded clean sand, medium, no silt.
SM	Medium and dark gray, wet, poorly graded sand, fine and medium, little silt.
ML	Medium gray, clayey silt.
PT	Peat interbedded with clayey silt.
	Bottom of Excavation: 22.0 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
= denotes groundwater table

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Boring Location: PD-6

Drill Date: August 15, 2008
Logged By: Lisa Meoli
Drilled By: Eli Floyd/Cascade Drilling

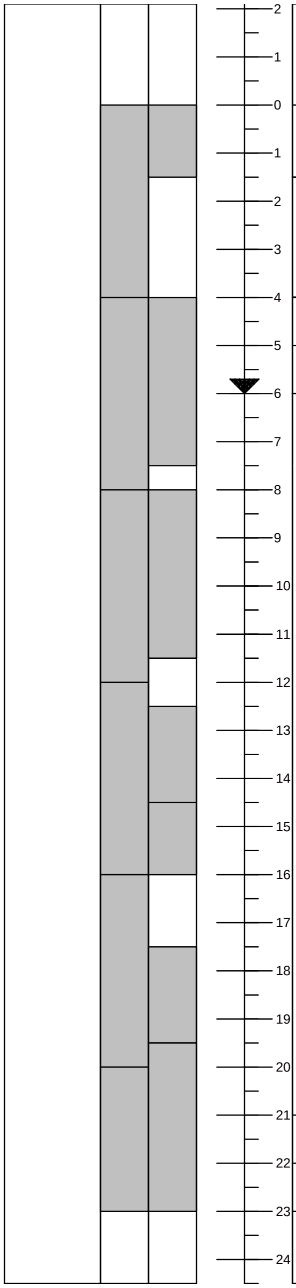
Ground Surf Elev. & Datum: 12.81 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 703003.1
Longitude/Easting: 1185989.1
Casing Elevation: 15.64 NAVD 88

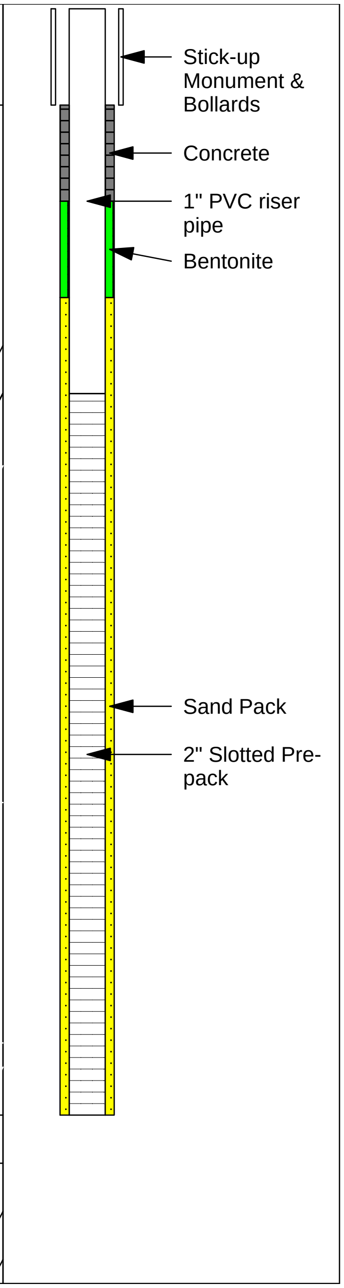
Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 23 FT BGS
Groundwater ATD (ft bgs): 6 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			OL/PT	Medium brown, moist, organic silty PEAT with woody debris and roots.	
				No recovery.	
			PT/ML	Brown, moist, PEAT mixed with silt, grading to silty sand at 5' bgs.	
			SM	Dark gray, moist, silty SAND, fine.	
			SP	Grades to dark grey, wet, poorly graded sand, fine, with <5% silt.	
				Dark gray, wet, poorly graded SAND, medium.	
				Dark grey, poorly-graded, SAND, slightly silty.	
			ML/CL	Dark grey, clayey SILT (aquitard).	
			PT/ML	Dark brown, organic rich PEAT, becomes organic silt at 22.5' bgs with interbedded peat at 23'.	
				BOE: 23.0 FT BGS	





Notes:
FT BGS = feet below ground surface
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Boring Location: PD-38

Drill Date: August 7, 2008
Logged By: Brett Beaulieu
Drilled By: Casey Goble / Cascade Drilling

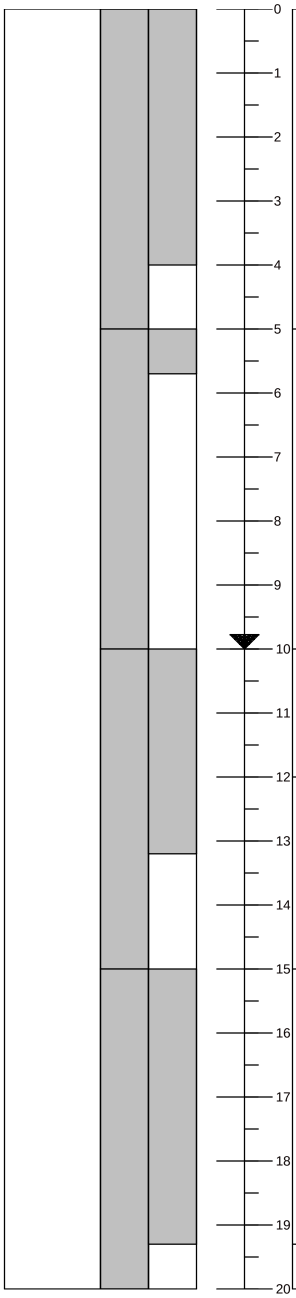
Ground Surf Elev. & Datum: 18.998, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701806.207
Longitude/Easting: 1186803.104
Casing Elevation: 21.635, NAVD 88

Drill Type: Truck Geoprobe 6600
Sample Method: Dual Tube/Macro Core
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 10' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

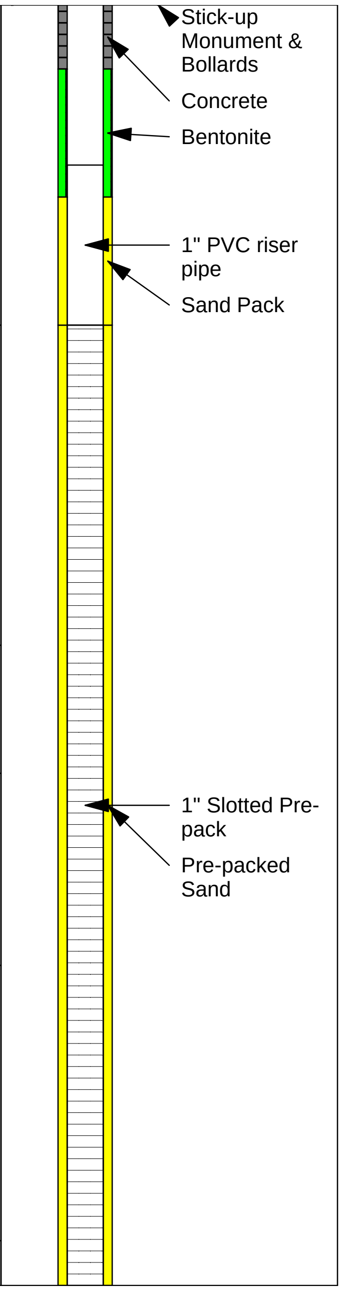
Remarks: Driller reports difficulty with 3 1/4" dual-tube due to large cobbles. Switched to 2" x 5' macro core. Log is a composite of two drives. 5 gallons of water added during piezometer installation.

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
SM	Light brown, dry, silty sand with gravel and fines. Gravel rounded and angular 25%. Broken cobbles. Grades down to darker brown, moist, then mottled gray, silty sand with gravel and fines. Trace coarse sand. Gravel rounded 30% with > 15% silt.
ML	Brownish gray, moist, silt with organics. 5% woody debris.
SM	Brownish gray, moist, silty sand with gravels and fines. Gravel 15%, silt 15%. Medim stiff. Cobbles at 11'. Becoming very stiff at 11.5, orange and gray mottled.
ML	Gray, dry, very stiff/hard silt with gravel (20%), fine and medium, plastic, with rounded cobbles.
SM	Light brownish gray, moist, silty sand with gravel (30%). Medium dense, fine to coarse with mottled brown and gray sections. Wet sandy sections at 18' for 4 to 6".

WELL COMPLETION DETAIL (If Applicable)



Notes:
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Boring Location: PD-40

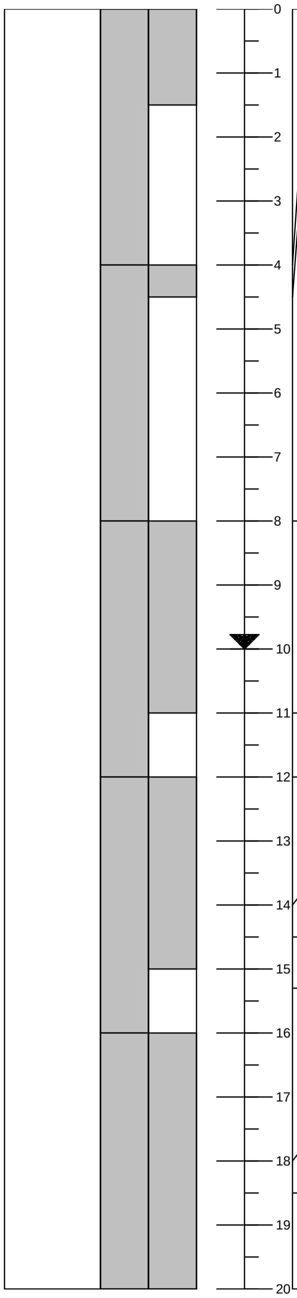
Drill Date: August 6, 2008
Logged By: Brett Beaulieu
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 19.670 NAVD88
Coordinate System: NAD 83/98
Latitude/Northing: 701719.308704
Longitude/Easting: 1186767.139073
Casing Elevation: 22.531 NAVD88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 10' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	WELL COMPLETION DETAIL (If Applicable)
			SM	Light brown, dry, silty sand with gravel, fine. Gravel, medium-coarse, approximately 25% rounded.	
			SW/SM	Dark grey, moist, silt, plastic, trace fine sand, woody debris <5%.	
			ML	Dark grey, moist, silt, plastic, trace fine sand, woody debris <5%	
			ML	Same as above, increasing woody content.	
			PT	Dark reddish brown woody peat with wood debris.	
			ML/CL	Light grey, clayey silt, trace organics and wood debris.	
			PT	Dark reddish brown, wet, peat, with solid wood up to 3", fades to grey-green in air, some organic silt.	
			SM	Grey and brown, wet, silty sand with gravel, fine to medium, gravel fine to medium and rounded, some woody debris.	
			PT	Dark reddish brown, wet, peat, fades to grey-green in air, some organic silt.	

Notes:
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Boring Location: PD-50

Drill Date: August 19, 2008
Logged By: Lisa Meoli
Drilled By: Cascade Drilling

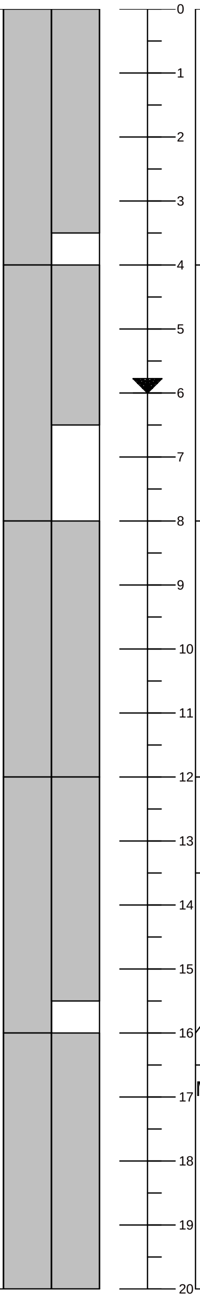
Ground Surf Elev. & Datum: 12.296
Coordinate System: NAV83/98
Latitude/Northing: 702820.184
Longitude/Easting: 1185778.645
Casing Elevation: 14.766

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 6' bgs

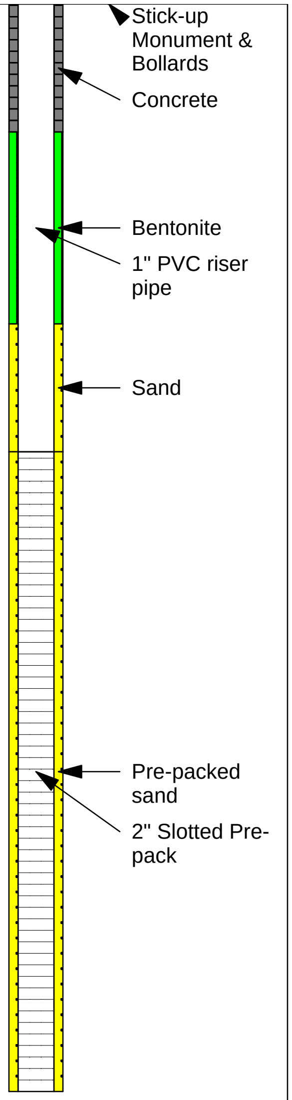
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Boring log and groundwater sample in wetland.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
			OL	Dark brown, moist, organic silt with roots and peat like woody debris.
			ML	Dark grey, wet, clayey silt, very fine.
			SM	Dark grey, wet, silty sand.
			SM	Same as above.
			SP	Grades to dark brownish-black and red and white grains, wet, poorly graded sand, medium.
			SM	Dark brown, moist, silty sand.
			ML/CL/PT	Grades to clayey, silty, sand with interbedded peat.



WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
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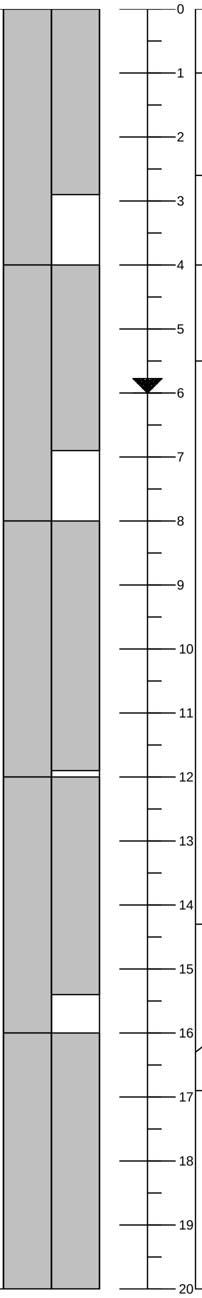
Boring Location: PD-51

Drill Date: August 19, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 12.129, NAVD 88	**Drill Type:** Track Geoprobe 6620DT	**Client:** B&L Custodial Trust
Coordinate System: NAD 83/98	**Sample Method:** Dual Tube	**Project:** B&L RIM
Latitude/Northing: 702695.029	**Boring Diameter:** 2 inches	**Task Number:**
Longitude/Easting: 1185752.702	**Boring Depth (ft bgs):** 20 ft bgs	**Site Location:** B&L Woodwaste
Casing Elevation: 15.199, NAVD 88	**Groundwater ATD (ft bgs):** 6' bgs	Pierce County, WA

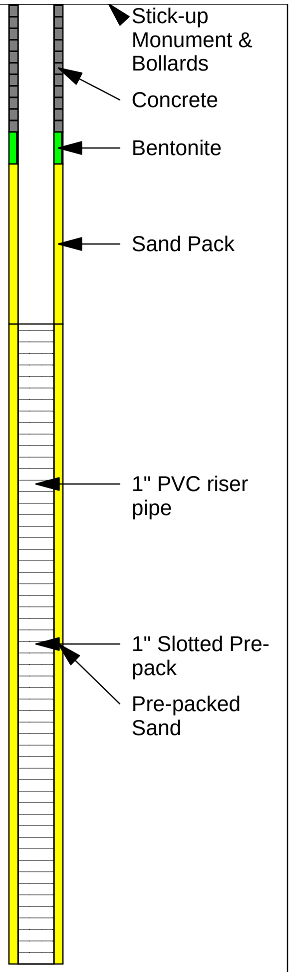
Remarks:

Sunny, hot.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
			ML	Medium brown/mottled, moist, clayey silt mixed with organics.
			PT	Peat with lense of silty clay at 2.3.
			ML	Medium gray, moist, clayey silt.
			ML/SM	Dark bluish gray, wet, poorly graded, clayey silt. Grading down to wet, silty sand.
			SM	Dark gray, wet, poorly graded silty sand, fine. At 1.4' bgs is a lense of woody debris.
			SP	Dark gray, wet, poorly graded sand, medium.
			ML	Gray, moist, clayey silt.
			PT/ML/PT	Peat grading down to clayey silt and back to peat.

WELL COMPLETION DETAIL (If Applicable)



Notes:
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ppm = parts per million
USCS = Unified Soil Classification System
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Boring Location: PD-52a

Drill Date: August 19, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

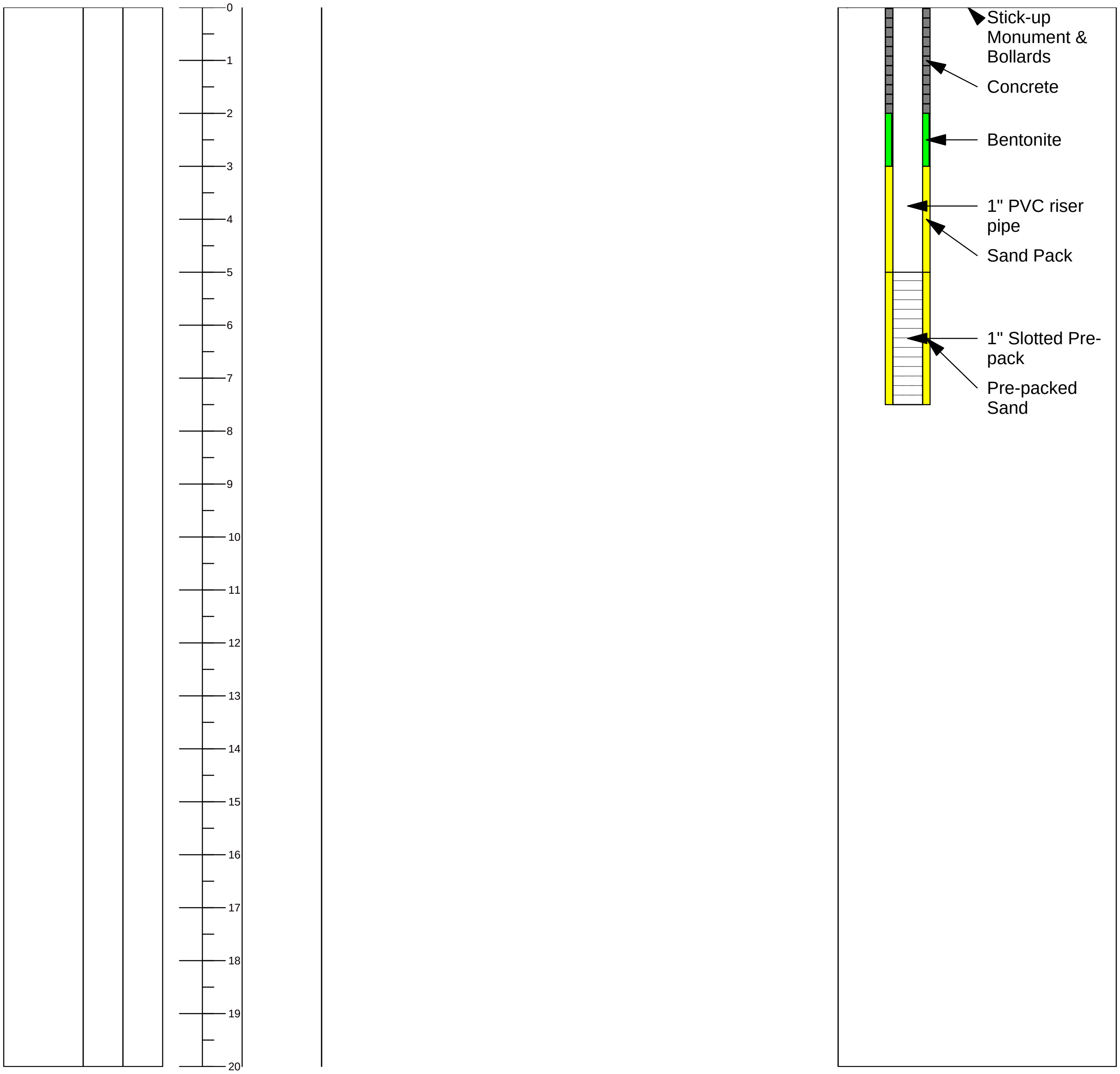
Ground Surf Elev. & Datum: 12.499, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702501.017
Longitude/Easting: 1185675.209
Casing Elevation: 15.044, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 7.5 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Shallow well screen. First of three.
No logging was done.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: PD-52b

Drill Date: August 19, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

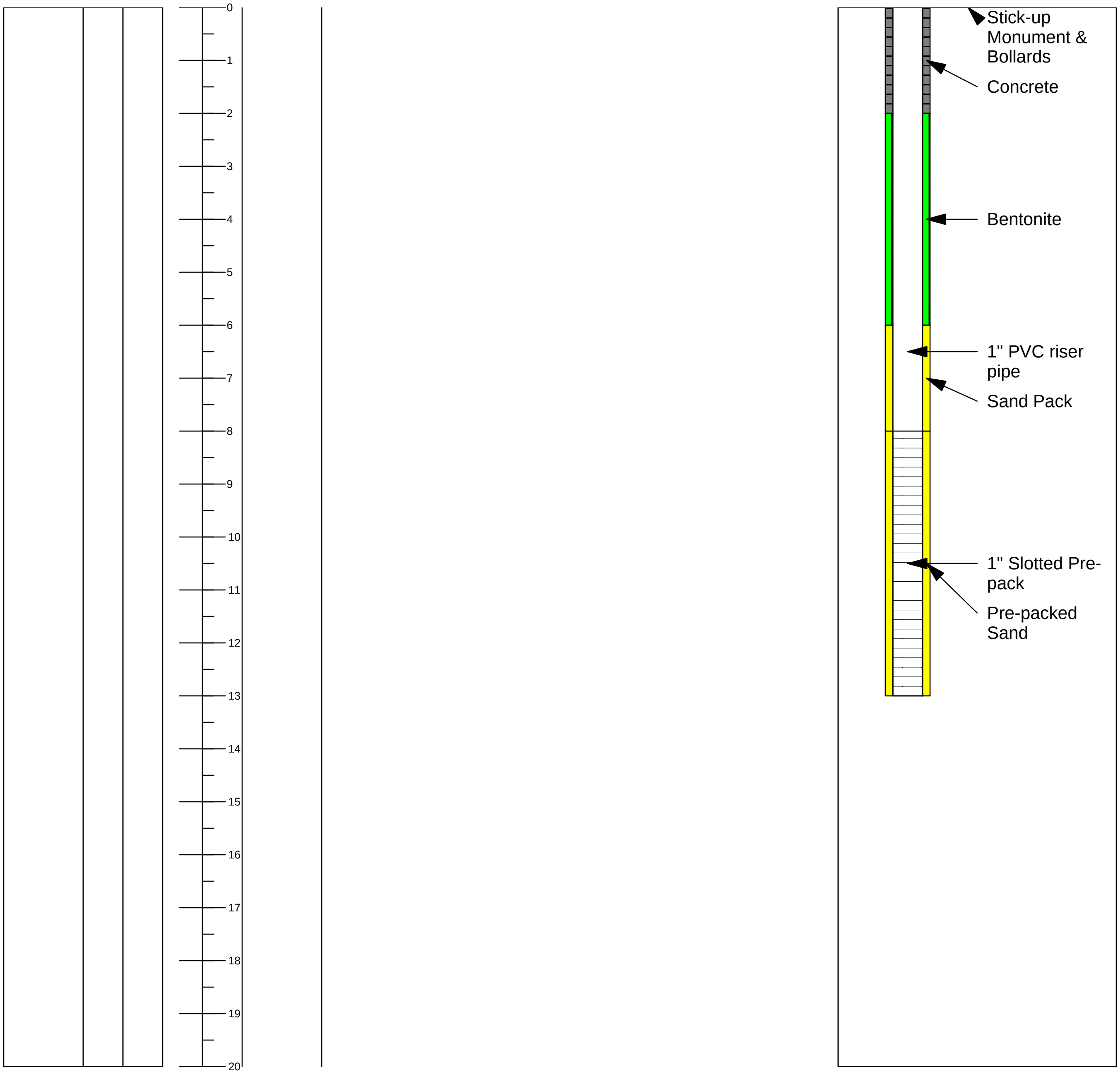
Ground Surf Elev. & Datum: 12.299, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702497.933
Longitude/Easting: 1185674.567
Casing Elevation: 15.104, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 13 ft bgs
Groundwater ATD (ft bgs): Unknown

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Intermediate well screen. 2 of 3.
No logging was done.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



Notes:
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ppm = parts per million
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▼ = denotes groundwater table

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Boring Location: PD-52c

Drill Date: August 19, 2008
Logged By: Erin Murray
Drilled By: Eli Floyd / Cascade Drilling

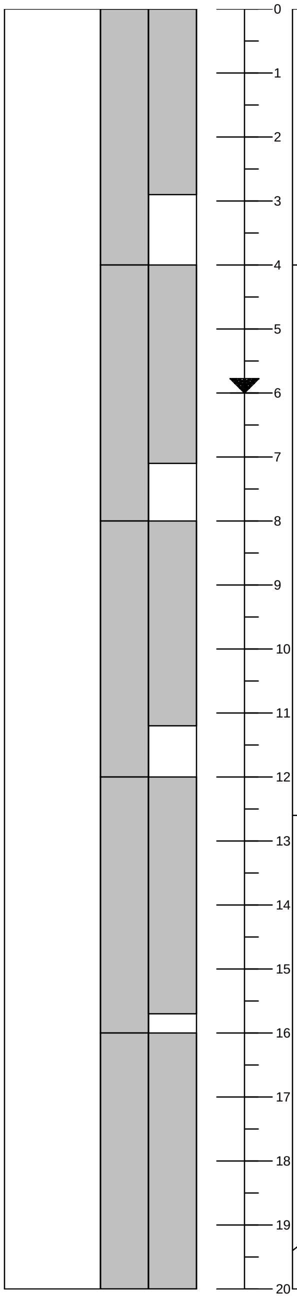
Ground Surf Elev. & Datum: 12.389, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702494.381
Longitude/Easting: 1185673.518
Casing Elevation: 15.039, NAVD 88

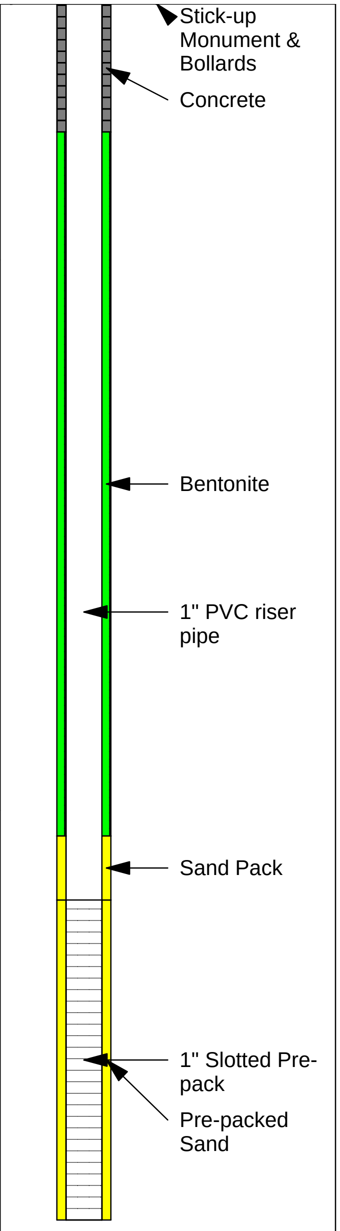
Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 ft bgs
Groundwater ATD (ft bgs): 6' bgs

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Deep well screen. Third of three.
Cloudy, warm.

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			PT/ML	Peat mixed with silt. At .6 becomes motteled, moist, clayey silt mixed with organics. At 2.3 becomes medium gray, moist, clayey silt with little to no organics.	
			SM	Medium gray, wet, poorly graded silty sand.	
			SP	Gray, wet, poorly graded sand with silt < 15%. At 14.4 becomes dark gray, wet, poorly graded sand, medium.	
			ML/PT	Gray, moist to dry, clayey silt grading down to peat.	





Notes:
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Boring Location: PD-60

Drill Date: August 7, 2008
Logged By: John LaManna
Drilled By: Casey Goble / Cascade Drilling

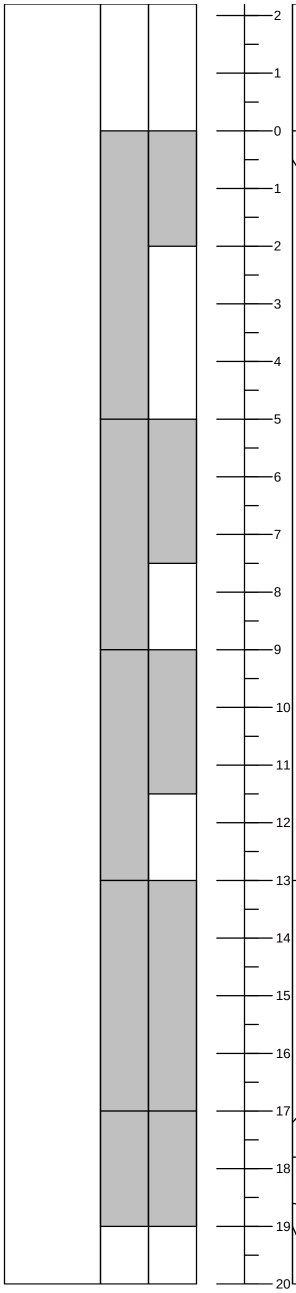
Ground Surf Elev. & Datum: 17.10, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701995
Longitude/Easting: 1186678
Casing Elevation: 20.13, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 19 FT BGS
Groundwater ATD (ft bgs): 6.5 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

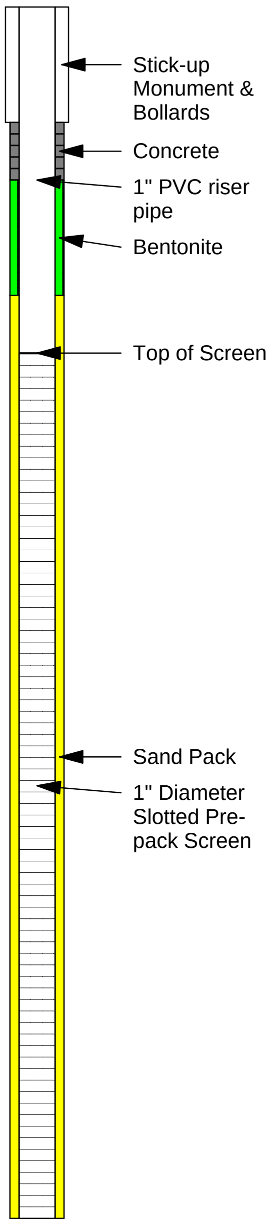
Remarks:

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
	Ground surface.
GP	Gray, dry, poorly-graded GRAVEL with sand.
SM	Dark blue-gray, moist, silty SAND with gravel. Some olive-gray mottling noted.
	Dark gray, moist, silty SAND with gravel. Some dark grayish mottling noted. Grades to wet at 6.5 FT BGS.
ML-OL	Dark grayish-brown, wet, SILT or ORGANIC SILT, massive. Wood fibers observed from 15-17 FT BGS.
PT	Black, wet, PEAT-Wood Fibers.
CL	Dark brown CLAY, very soft, massive, with trace peat fibers.
PT	Dark brown, wet, PEAT-Wood Fibers. Sample material turns black following exposure to air.

WELL COMPLETION DETAIL (If Applicable)



Notes:
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ppm = parts per million
USCS = Unified Soil Classification System
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Boring Location: PD-61

Drill Date: August 8, 2008
Logged By: John LaManna
Drilled By: Eli Floyd / Cascade Drilling

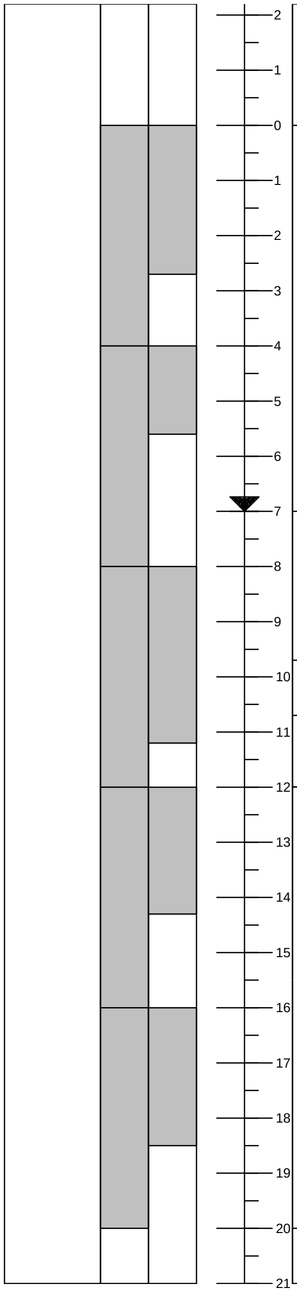
Ground Surf Elev. & Datum: 24.22, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702088
Longitude/Easting: 1186909
Casing Elevation: 27.29, NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20 FT BGS
Groundwater ATD (ft bgs): 6-8 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

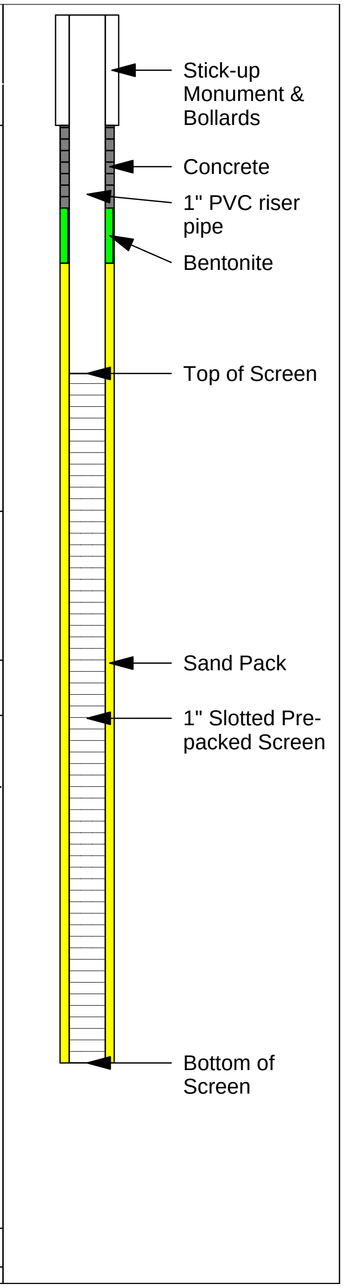
Remarks: This is the second attempt. Refusal at 8 ft bgs on first attempt.

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
	Ground Surface
SW	Brown, dry grading down to moist, well-graded SAND with gravel (15-25%), silt approximately 5%.
SP	Dark grayish-brown, wet, poorly-graded SAND with gravel, fine and medium. Gravel approximately 5%, silt 5%.
GW	Dark, grayish-brown, wet, well-graded GRAVEL with sand, fine and course. Sand less than 15%, silt less than 5%.
SP	Dark grayish-brown, wet, poorly-graded SAND, fine and medium. Trace gravel; silt less than 5%.
SW	Grades to dark, grayish-brown, wet, well-graded SAND with gravel, fine and course. Gravel 15-35%, silt 2-5%. Stratified with 0.3-0.4 ft thick layers. Grades to dark grayish brown, wet, well-graded SAND with gravel (25-40%). Silt less than 5%.
	Bottom of Excavation: 20.0 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
ppm = parts per million
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= denotes groundwater table

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Boring Location: PD-62

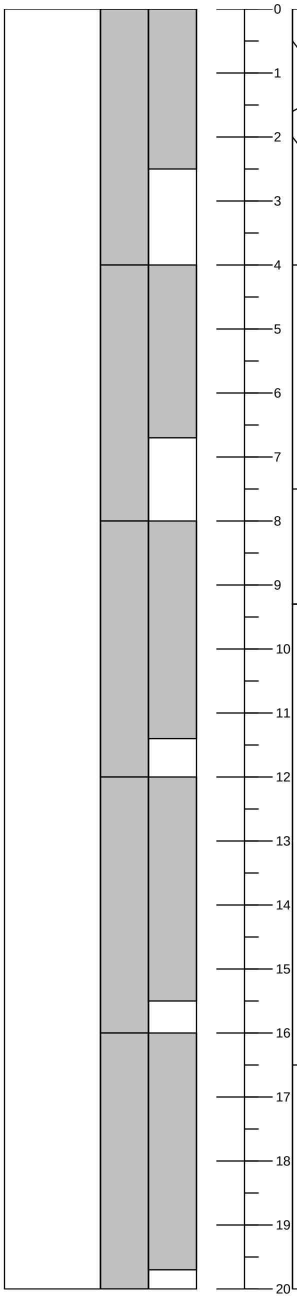
Drill Date: August 11, 2008
Logged By: John LaManna
Drilled By: Eli Floyd / Cascade Drilling
Drill Type: Track Geoprobe 6620DT
Sample Method: Direct Push, 2" X 4'
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20.0 FT BGS
Groundwater ATD (ft bgs): 5.5 FT BGS

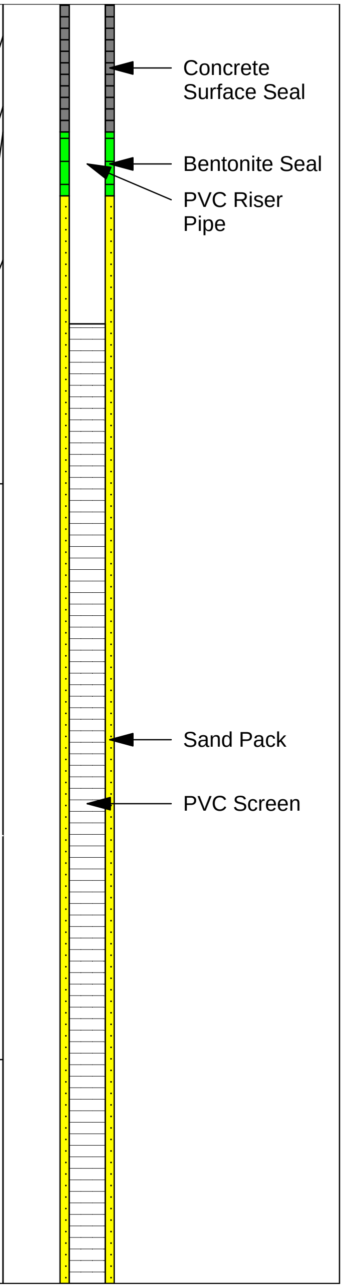
Ground Surf Elev. & Datum: 17.64 NAVD88
Coordinate System: NAD 83/98
Latitude/Northing: 701825
Longitude/Easting: 1186617
Casing Elevation: 20.37 NAVD88

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			SP	Grayish brown, dry, poorly-graded SAND, fine-medium, with gravel (10%) and silt (5%). (FILL)	
			SW	Dark brown, moist, well-graded SAND, with gravel (20%) and silt (7%).	
			GW	Light gray, moist, well-graded GRAVEL with sand (20%) and brick fragments.	
			SW-SM	Dark gray, wet, poorly-graded SAND, fine-medium, with silt (10%) and gravel (25-35%).	
			GW-GM	Gray to dark gray, wet, well-graded GRAVEL with silt (10-15%) and sand (25-35%).	
			SP	Very dark gray, wet, poorly-graded SAND, fine-medium, with trace gravel and silt. Organic fibers/fragments present in drive.	
			SM	Very dark gray, wet, silty SAND, fine. 15-20% silt noted.	
			SM	Very dark gray, wet, silty SAND, fine. 15-40% silt noted. Silt interbeds noted.	
			ML/SM	Very dark gray, wet, SILT with sand (10-60%) and organic fibers (5-10%). Silt dominates drive.	
				Bottom of Excavation: 20.0 FT BGS	





Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
= denotes groundwater table

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Boring Location: PD-63a

Drill Date: August 12, 2008
Logged By: Brett Beaulieu
Drilled By: Eli Floyd / Cascade Drilling

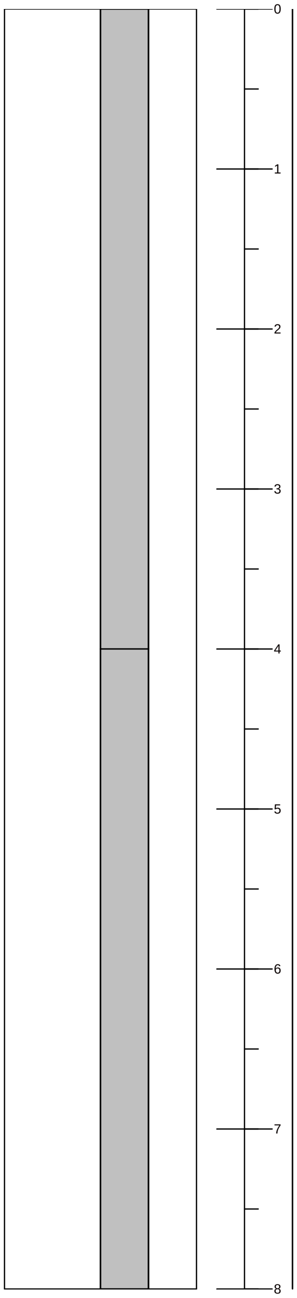
Ground Surf Elev. & Datum: 16.73 FT, NAVD88
Coordinate System: NAD 83/98
Latitude/Northing: 701674
Longitude/Easting: 1186543
Casing Elevation: 19.75 FT, NAVD88

Drill Type: Track Geoprobe 6620DT
Sample Method: Direct Push, 2" X 4'
Boring Diameter: 2 inches
Boring Depth (ft bgs): 7.5 FT BGS
Groundwater ATD (ft bgs): NA

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Sunny

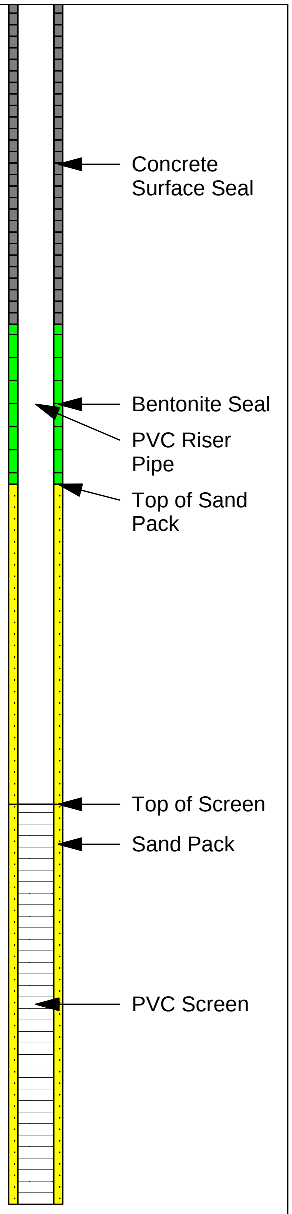
SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



Did not sample. Advanced borehole to target depth and proceeded with well installation.

Refer to log of PD-63c for geologic reference.

Bottom of Excavation: 7.5 FT BGS



Notes:
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ppm = parts per million
USCS = Unified Soil Classification System
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Boring Location: PD-63B

Drill Date: August 12, 2008
Logged By: Brett Beaulieu
Drilled By: Eli Floyd / Cascade Drilling

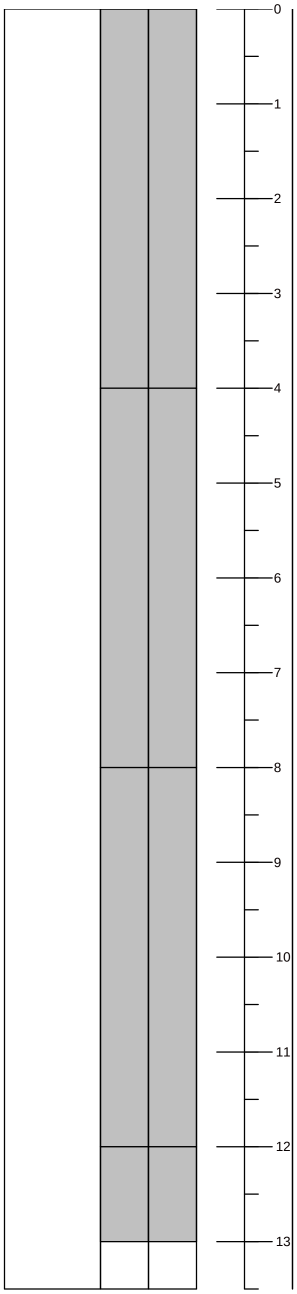
Ground Surf Elev. & Datum: 16.77 NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701681
Longitude/Easting: 1186548
Casing Elevation: 18.85 NAVD 88

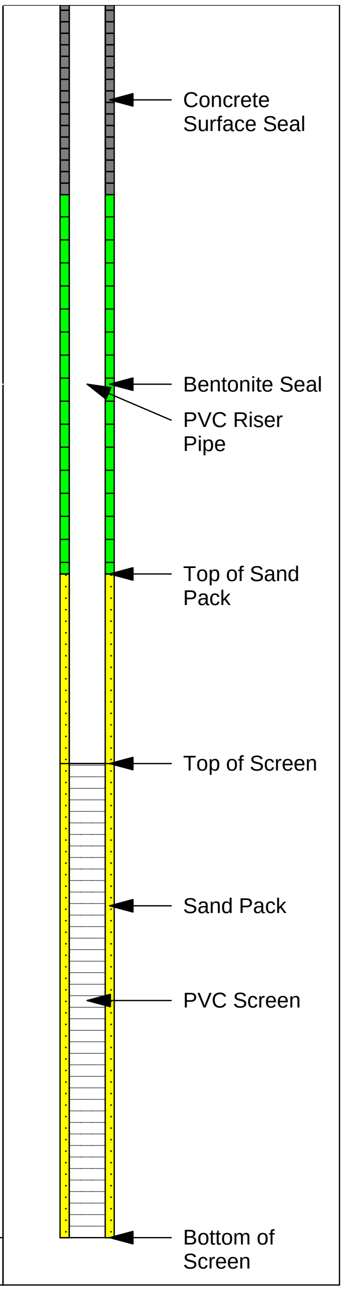
Drill Type: Track Geoprobe 6620DT
Sample Method: Direct Push, 2" X 4'
Boring Diameter: 2 inches
Boring Depth (ft bgs): 13
Groundwater ATD (ft bgs): NA

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Sunny

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
				Did not sample. Advanced borehole to target depth and proceeded with well installation. Refer to log of PD-63c for geologic reference. Bottom of Excavation: 13.0 FT BGS	





Notes:
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ppm = parts per million
USCS = Unified Soil Classification System
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Boring Location: PD-63C

Drill Date: August 12, 2008
Logged By: Brett Beaulieu
Drilled By: Eli Floyd / Cascade Drilling

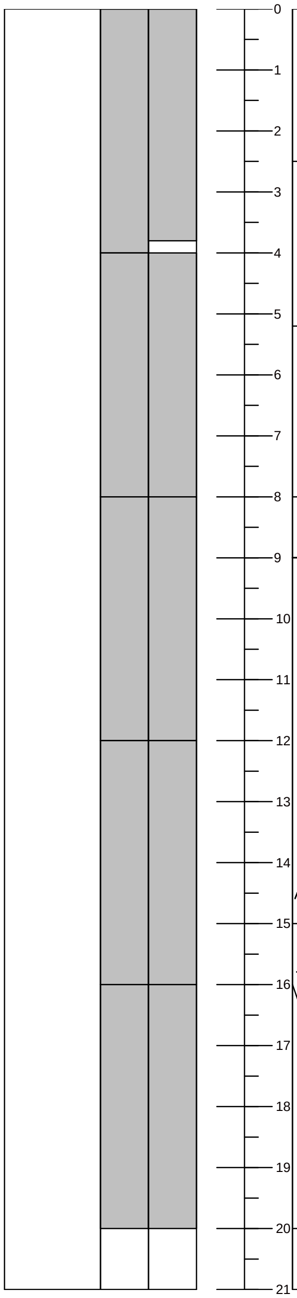
Ground Surf Elev. & Datum: 16.75 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701678
Longitude/Easting: 1186546
Casing Elevation: 19.50, FT NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Direct Push, 2" X 4'
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20.0 FT BGS
Groundwater ATD (ft bgs): NA

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

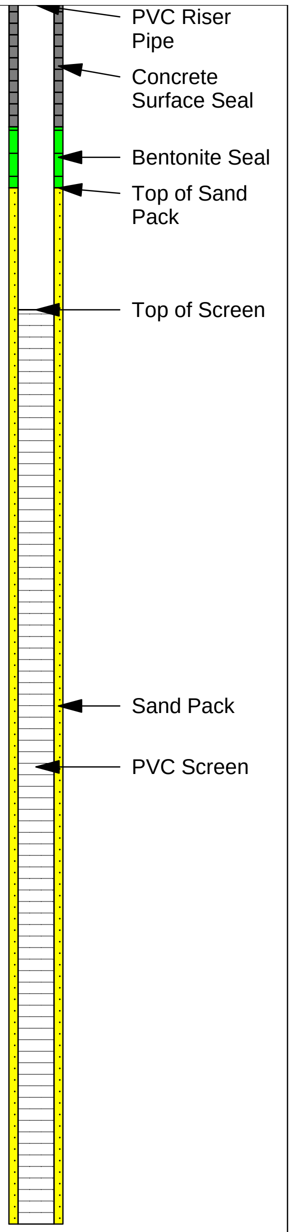
Remarks: Driller unable to set well on first attempt due to heave.
10 gal water added to reduce heave and enable installation of well.

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
SW	Brown, dry-moist, well-graded SAND, fine-medium, with gravel (20%) and silt (<15%).
SM-SW	Light gray, moist, silty SAND with gravel. (>30% silt and >30% rounded gravel) Grades to gray, moist to wet, well-graded SAND, fine-medium, with silt (<10%) and gravel (10%).
SM	Dark brownish gray, wet, silty SAND with woody debris (5%). Silt component varies from 15-30% depending on depth and expresses high dilatency and transmissivity.
ML	Dark, grayish-brown, moist, plastic SILT with sand (~49%) and organics (~5%).
SM	Dark grayish-brown, wet, silty SAND (15-25% silt). Grows finer from 14.5 FT BGS downward.
ML	Dark, grayish-brown, moist, plastic SILT with sand (~49%) and organics (~5%).
PT/OL	Dark reddish-brown PEAT with wood fragments. Grades downward to 2-inch layer of plastic organic silt.
ML	Gray, moist, plastic SILT with organics.
PT	Dark reddish-brown PEAT with wood fragments. Grades downward to plastic organic silt.
	Bottom of Excavation: 20.0 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
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Boring Location: PD-64

Drill Date: August 11, 2008
Logged By: John Lamanna
Drilled By: Eli Floyd / Cascade Drilling

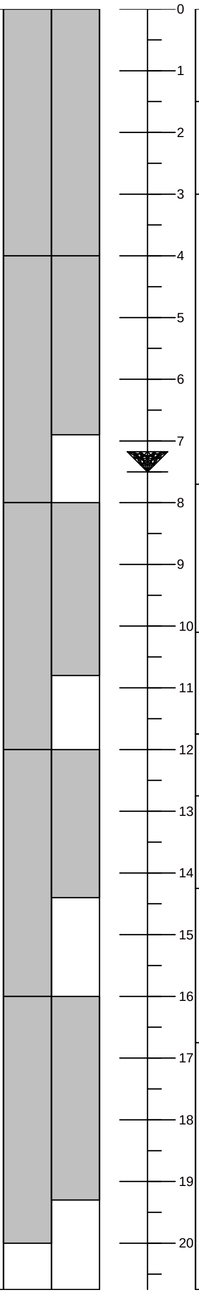
Ground Surf Elev. & Datum: 19.54 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701620
Longitude/Easting: 1186657
Casing Elevation: 22.29, FT NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Direct Push, 2" X 4'
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20.0 FT BGS
Groundwater ATD (ft bgs): 7-8 FT BGS

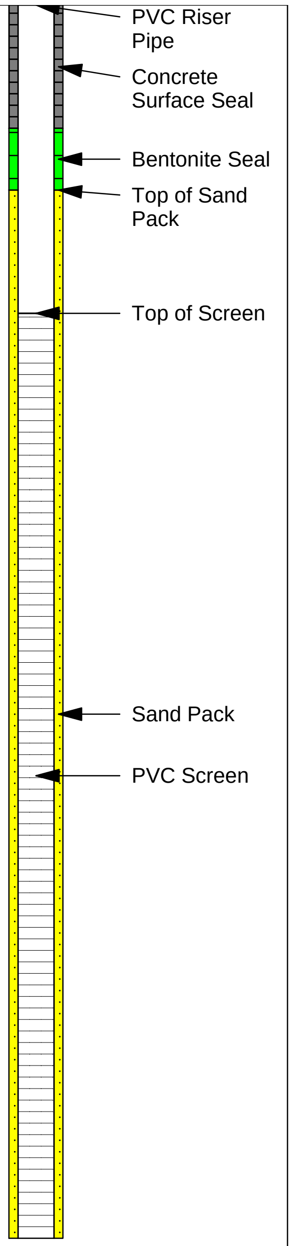
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
			SW	Brown to dark brown, dry to moist, well-graded SAND with gravel (FILL).
			GW	Gray, moist, well-graded GRAVEL with sand (30-40%) and silt (<5%) (FILL). Trace asphalt and brick fragments and tree roots.
			GW-GM	Gray, moist, well-graded GRAVEL with sand (30-40%) and silt (5-10%). Grades to dark gray - grayish brown color and shows slight increase in silt content with increasing depth. Partially-decayed wood fragments noted at 5.6 FT BGS.
			SP	Dark gray to black, moist to wet, poorly-graded SAND, fine-medium. <5% silt noted.
			SM/ML	Dark gray, wet, silty SAND, fine, and sandy silt. No gravel noted. Disturbed sample.
			SP	Dark gray, wet, SAND, fine to medium. Possibly heave.
			SM-ML	Dark gray to grayish-brown, wet, silty SAND, fine, grading with increasing depth to sandy SILT, soft, with organic flecks (5-10%). Silt grows clayey and peaty near end of drive.
			CL	Pinkish-gray to brown, wet, CLAY, medium plasticity and soft, with peat.
			PT	Dark reddish brown, wet, PEAT. Turns black upon exposure to air. One large rounded gravel in sample.
				Bottom of Excavation: 20.0 FT BGS



WELL COMPLETION DETAIL (If Applicable)



Notes:
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Boring Location: PD-65

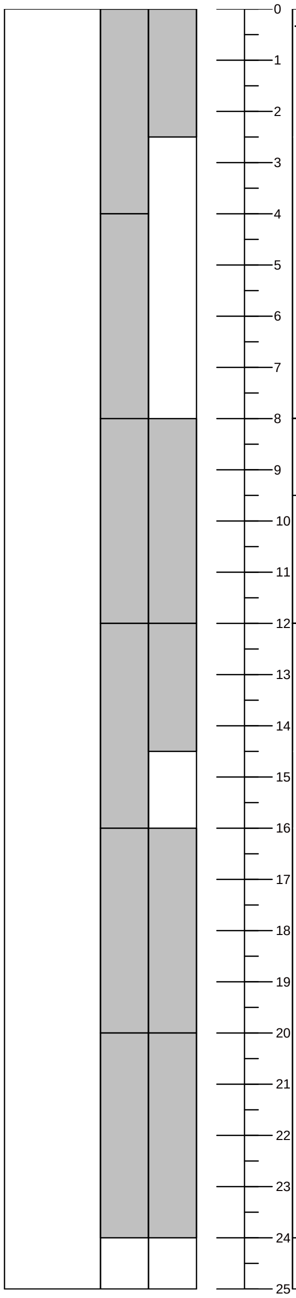
Drill Date: August 26, 2008
Logged By: Lisa Meoli
Drilled By: Cascade Drilling

Ground Surf Elev. & Datum: 30.92 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701320
Longitude/Easting: 1186546
Casing Elevation: 30.92 FT, NAVD 88

Drill Type: Geoprobe/Direct Push
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24.0 FT BGS
Groundwater ATD (ft bgs): NA

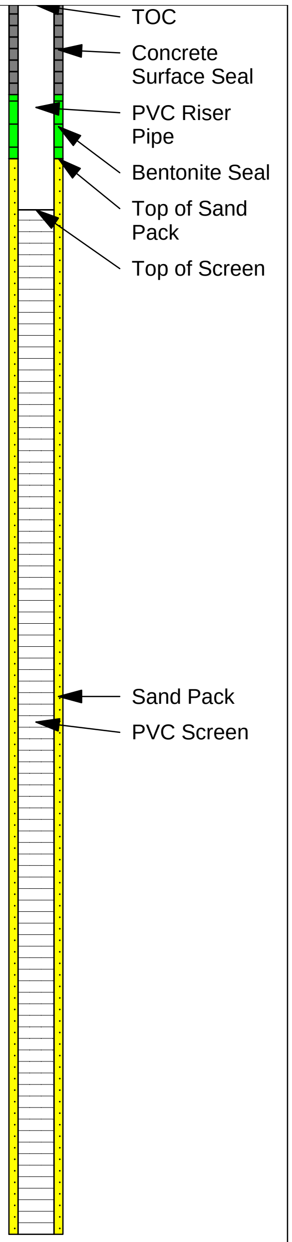
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
TOPSOIL	Dark brown, dry, topsoil, grass, woody fragments, and roots. No recovery from 2.5 to 8 FT BGs.
PT	Dark brown, damp, PEAT with vegetation and woody debris.
SM	Brown, moist, silty SAND with trace 1/4 in. pebbles.
SP	Brown, wet, SAND, fine to medium, and gravel (10%), fine to coarse. No recovery from 14.5 to 16 FT BGS. Brown, wet, SAND, fine to medium, with gravel (10%). Brown, wet, SAND, fine to medium. Gravel not present.
	Bottom of Excavation: 24.0 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
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Boring Location: PD-70

Drill Date: September 24, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling

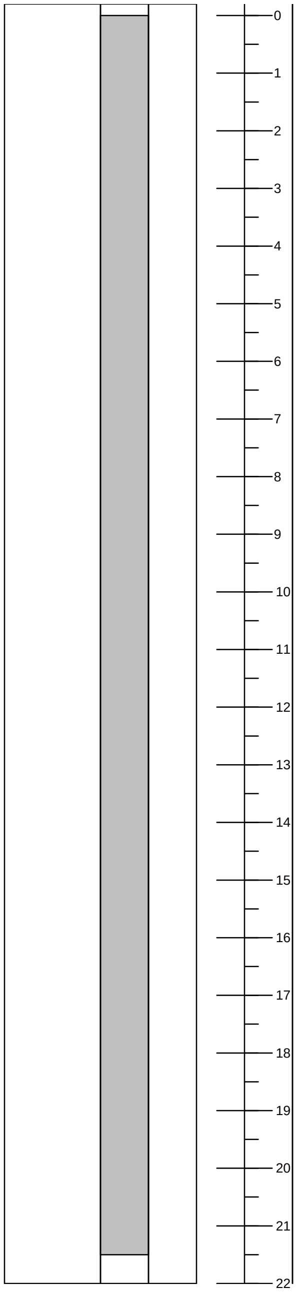
Ground Surf Elev. & Datum: 14.28 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702918
Longitude/Easting: 1186061
Casing Elevation: 14.28, FT NAVD 88

Drill Type: CME 55 Ltd Access
Sample Method: 3.0" D&M w/ 140lb Hmr
Boring Diameter: 0.7 FT
Boring Depth (ft bgs): 21.5 FT BGS
Groundwater ATD (ft bgs): NA

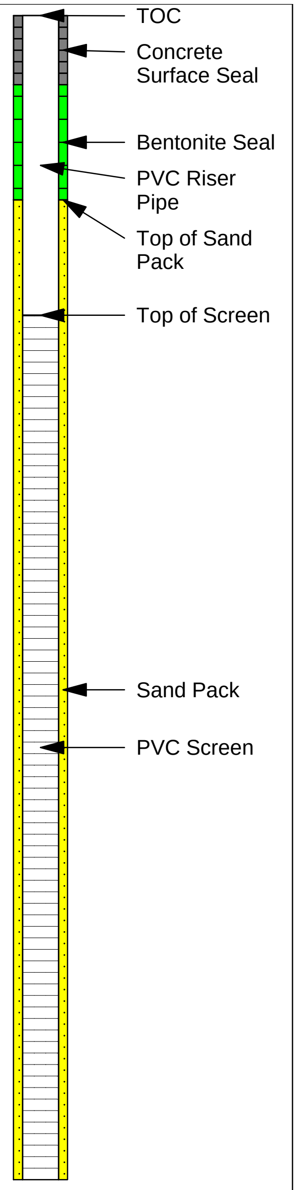
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



Refer to boring log of PD-71 for geologic reference.
No samples collected.
Drilled to depth of 21.5 FT BGS and proceeded with installation of groundwater monitoring well.



Bottom of Excavation: 21.5 FT BGS

Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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Boring Location: PD-71

Drill Date: September 24, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling

Ground Surf Elev. & Datum: 14.41 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702923
Longitude/Easting: 1186058
Casing Elevation: 14.41, FT NAVD 88

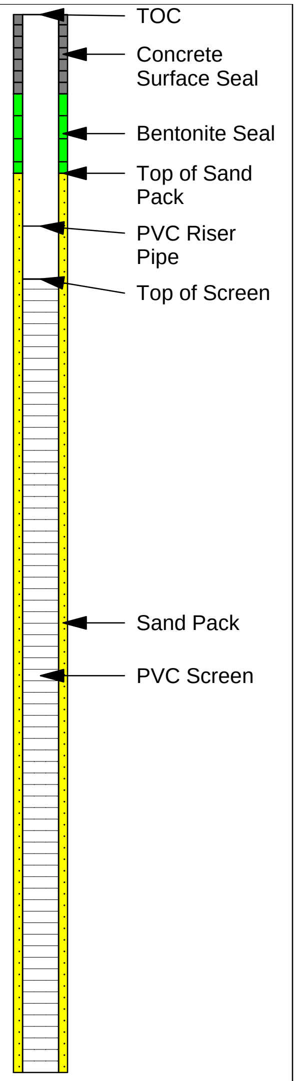
Drill Type: CME 55 Ltd Access
Sample Method: 3.0" D&M w/ 140lb Hmr
Boring Diameter: 2 inches
Boring Depth (ft bgs): 21.5 FT BGS
Groundwater ATD (ft bgs): 10 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
		0		Drill to depth of 5 FT BGS and begin sampling.
		5	PT-OL	Brown, moist PEAT grading to peaty SILT.
		6	ML	Gray, moist, slightly sandy SILT.
		10	SP	Dark gray, moist SAND, fine to medium. Rusty colored grains noted.
		15	SP-SW	Dark gray, wet, SAND, fine to medium. (Majority of sample appears to be disturbed slough).
		18	NA	No recovery.
		20	SW	Dark gray, wet, SAND, fine to coarse, with gravel.
		21	ML	Gray, wet, fine sandy SILT with scattered wood fragments.
		22	PT-OL	Brown, wet, PEAT with peaty SILT.
		23		Bottom of Excavation: 21.5 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
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▼ = denotes groundwater table

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Boring Location: PD-80

Drill Date: August 11, 2008
Logged By: Brett Beaulieu
Drilled By: Eli Floyd / Cascade Drilling

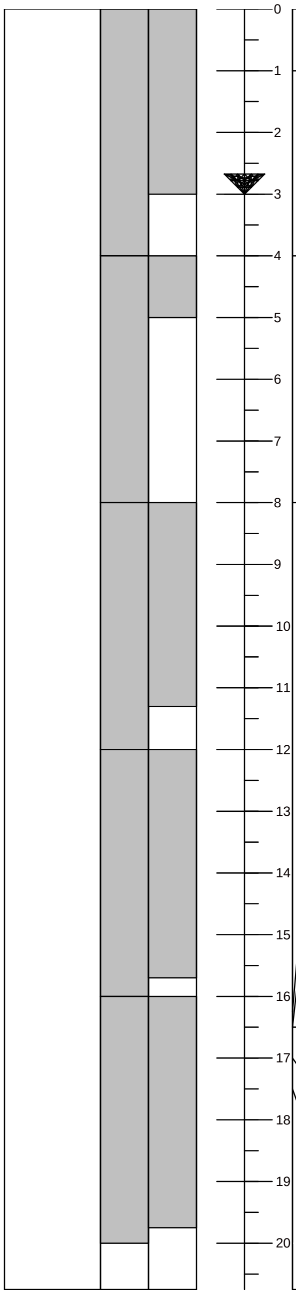
Ground Surf Elev. & Datum: 16.93 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701660
Longitude/Easting: 1186590
Casing Elevation: 20.36, FT NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Direct Push, 2" X 4'
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20.0 FT BGS
Groundwater ATD (ft bgs): 3.0

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

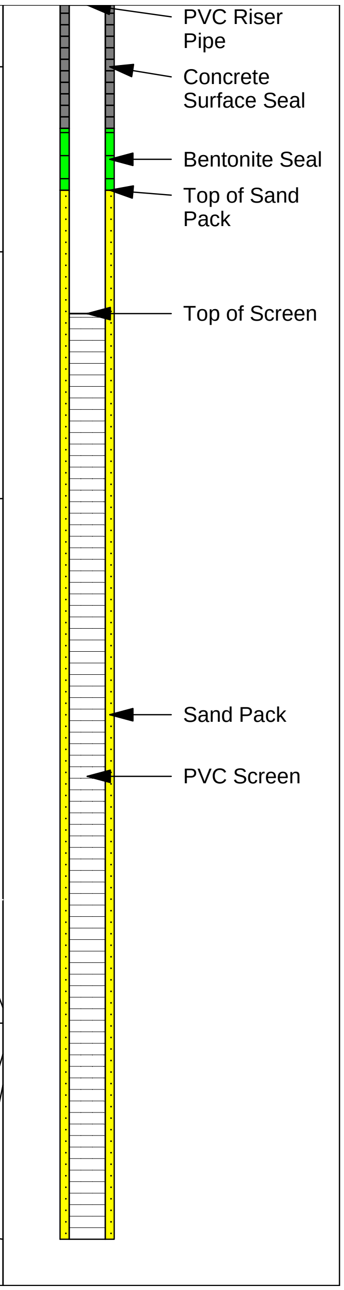
Remarks:

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
SW-SM	Brown, dry, SAND with gravel (30%) and silt (<15%).
SW	Gray, moist, well-graded SAND, fine-medium, with gravel (30%), medium-coarse, and silt (<10%).
NA	No recovery.
SM	Dark brownish gray, wet, silty SAND, fine. >15% silt noted. Low plasticity / high dilatency silt with large chunks of woody debris and organic fines noted in sample. Wet, very transmissive zone observed from 14 to 15 FT BGS.
PT	Dark reddish brown PEAT with woody debris.
ML	Light gray, moist, SILT, plastic, with sand (<15%). Organic fines and woody debris noted in sample.
PT/ML	Alternating 2" thick layers of the peat and silt described above.
PT	Dark reddish brown PEAT with woody debris, seeds, and roots. Trace silt noted 17.5 - 18.0 FT BGS.
	Bottom of Excavation: 20.0 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
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ppm = parts per million
USCS = Unified Soil Classification System
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Boring Location: PD-81

Drill Date: August 11, 2008
Logged By: John Lamanna
Drilled By: Eli Floyd / Cascade Drilling

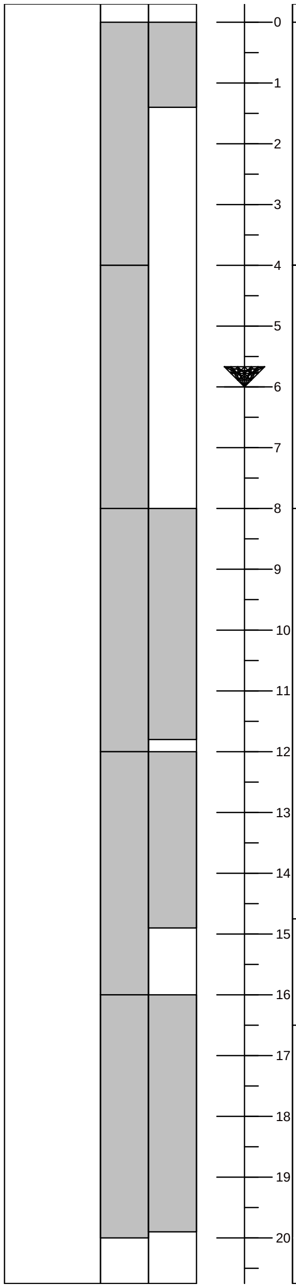
Ground Surf Elev. & Datum: 17.39 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701642
Longitude/Easting: 1186595
Casing Elevation: 20.57, FT NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Direct Push, 2" X 4'
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20.0 FT BGS
Groundwater ATD (ft bgs): 4-8 FT BGS

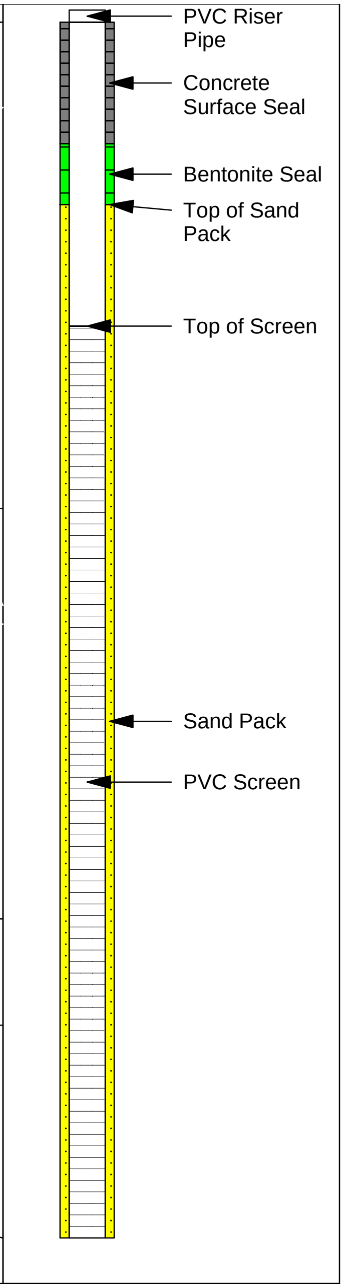
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS | USCS SYMBOL | SOIL DESCRIPTION AND OBSERVATIONS | **WELL COMPLETION DETAIL (If Applicable)**



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
GW	Grayish brown, moist to wet, well-graded GRAVEL with sand (35%) and <5% silt. Tree roots noted at 0-0.2 FT BGS and trace brick fragments noted at 0.7 FT BGS.
NA	No recovery.
SM	Dark gray, wet, silty SAND, fine, with organic fragments (5%). Sandy silt layer noted from 9.6 to 9.9 FT BGS.
ML	Dark gray, moist - wet, SILT with sand (15-30%), fine and dark brown clay (5-10%), soft.
PT	Dark brown to black, wet, PEAT. Turns black upon exposure to air. Bedding noted 18.5 - 19.5 FT BGS.
	Bottom of Excavation: 20.0 FT BGS



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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Boring Location: PD-82

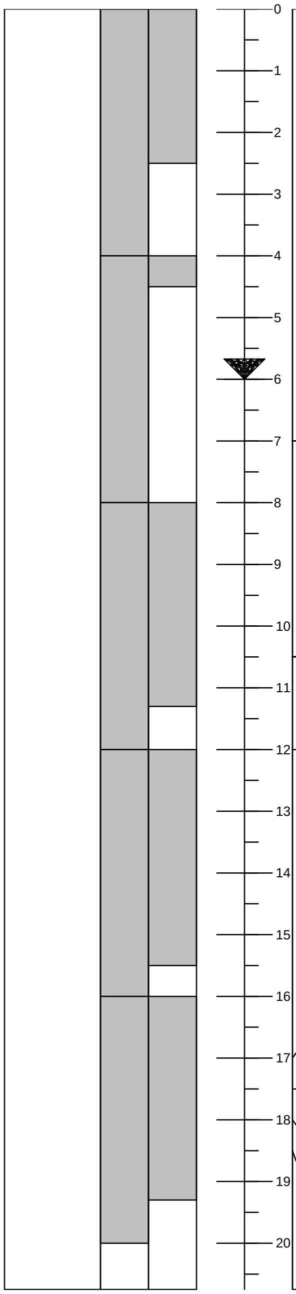
Drill Date: August 11, 2008
Logged By: John Lamanna
Drilled By: Eli Floyd / Cascade Drilling

Ground Surf Elev. & Datum: 17.37 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701641
Longitude/Easting: 1186614
Casing Elevation: 20.45, FT NAVD 88

Drill Type: Track Geoprobe 6620DT
Sample Method: Direct Push, 2" X 4'
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20.0 FT BGS
Groundwater ATD (ft bgs): 4-8 FT BGS

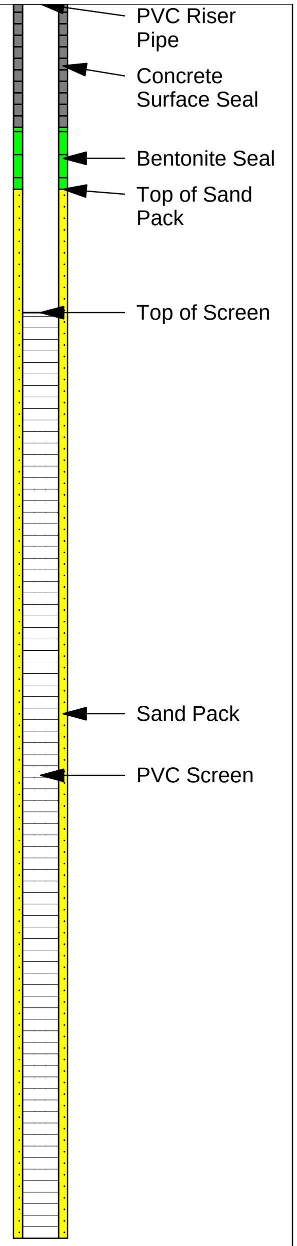
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
			SW-SM	Brown, dry-moist, well-graded SAND with gravel (10-15%) and silt (~5%). Grades dark to blueish-gray color and increasing gravel content (~30%) with increasing depth. Grows wet and siltier (~15% silt) at 4 FT BGS.
			SM	Dark gray to dark brown, wet, silty SAND, fine. Piece of undecayed wood noted at 9.8 FT BGS.
			ML	Grades to dark brown, wet, sandy silt.
			SM	Dark gray, wet, silty SAND, fine, with silt (15-25%). Small beds of sandy silt noted noted through drive.
			ML	ML: Very dark gray SILT.
			PT	PT: Dark brown PEAT.
			CL	CL: CLAY, soft, laminated.
			CL-PT	CL-PT: PEAT and CLAY with organic material *10-15%).
				Bottom of Excavation: 20.0 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
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Boring Location: PD-101

Drill Date: September 25, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling

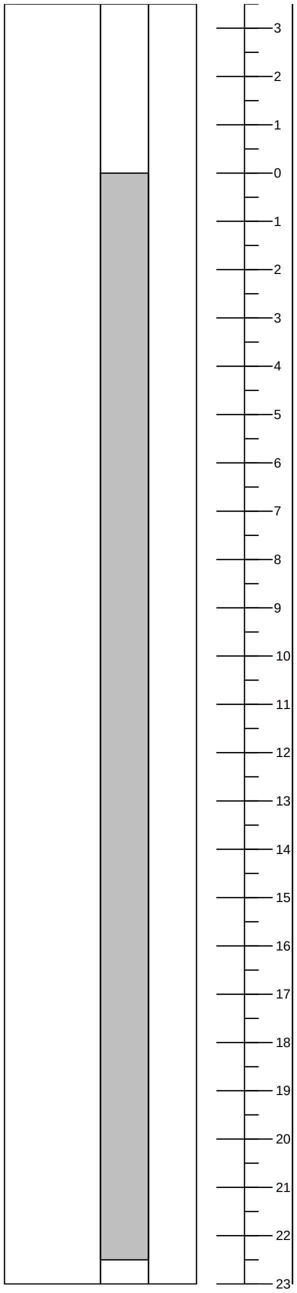
Ground Surf Elev. & Datum: 14.15 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702916
Longitude/Easting: 1186071
Casing Elevation: 17.01, FT NAVD 88

Drill Type: CME 55 Ltd Access
Sample Method: 3.0" D&M w/ 140lb Hmr
Boring Diameter: 0.9 Feet
Boring Depth (ft bgs): 22.5 FT BGS
Groundwater ATD (ft bgs): NA

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

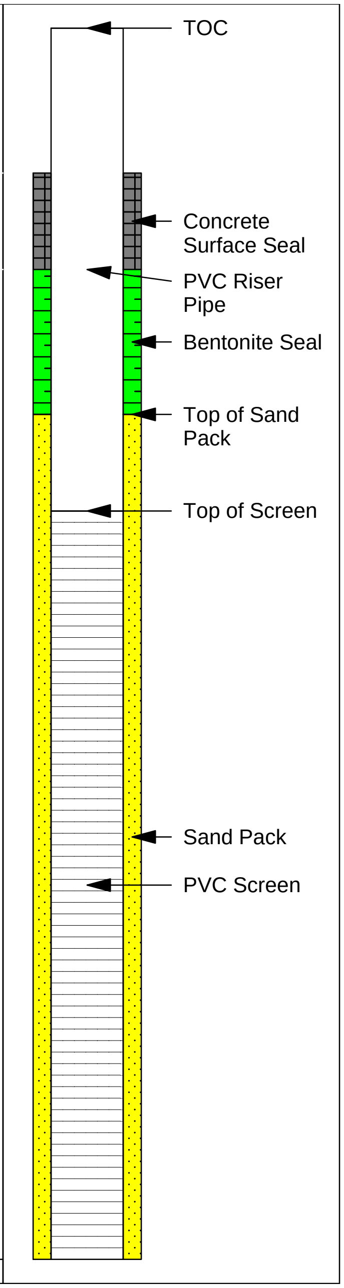
Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	WELL COMPLETION DETAIL (If Applicable)



Did not sample soil during boring installation.
Refer to log for PD-71 for geologic reference of this boring.
4" ID well installed at this location.

Bottom of Excavation: 22.5 FT BGS



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
= denotes groundwater table

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Boring Location: PD-103

Drill Date: August 20, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling

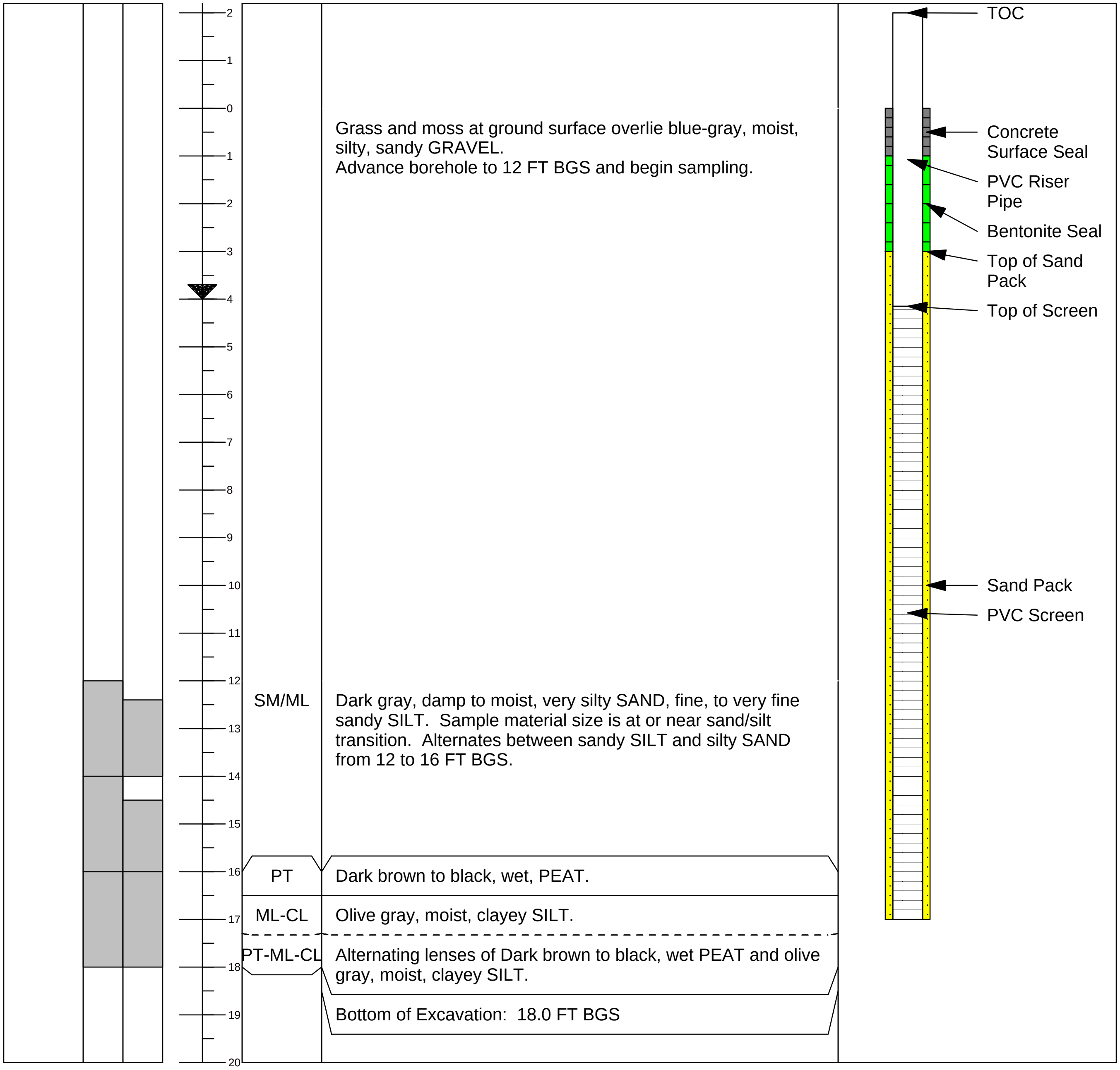
Ground Surf Elev. & Datum: 17.10 FT NAVD88
Coordinate System: NAD 83/98
Latitude/Northing: 701645
Longitude/Easting: 1186604
Casing Elevation: 18.62 FT NAVD88

Drill Type: CME 75
Sample Method: Split spoon /140lb Hmr
Boring Diameter: 8"/12" final
Boring Depth (ft bgs): 18 FT BGS
Groundwater ATD (ft bgs): 4 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number: Task No. 1308
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



Grass and moss at ground surface overlie blue-gray, moist, silty, sandy GRAVEL.
Advance borehole to 12 FT BGS and begin sampling.

SM/ML — Dark gray, damp to moist, very silty SAND, fine, to very fine sandy SILT. Sample material size is at or near sand/silt transition. Alternates between sandy SILT and silty SAND from 12 to 16 FT BGS.

PT — Dark brown to black, wet, PEAT.

ML-CL — Olive gray, moist, clayey SILT.

PT-ML-CL — Alternating lenses of Dark brown to black, wet PEAT and olive gray, moist, clayey SILT.

Bottom of Excavation: 18.0 FT BGS

Notes:
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Boring Location: PD-104

Drill Date: September 22, 2008
Logged By: Brett Beaulieu
Drilled By: Cascade Drilling

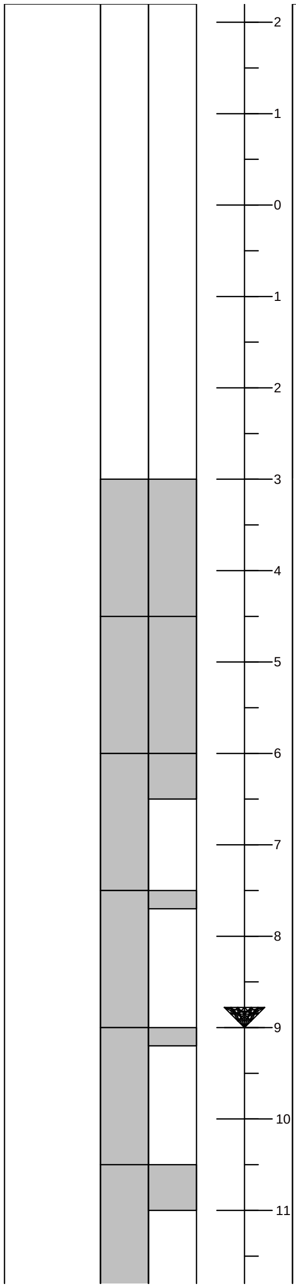
Ground Surf Elev. & Datum: 16.95 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701842
Longitude/Easting: 1186655
Casing Elevation: 18.76, FT NAVD 88

Drill Type: CME 55 Ltd Access
Sample Method: 3.0" D&M w/ 140lb Hmr
Boring Diameter: 0.7 FT
Boring Depth (ft bgs): 20 FT BGS
Groundwater ATD (ft bgs): 9 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



SM

Drilled to 3 FT BGS and began sampling.

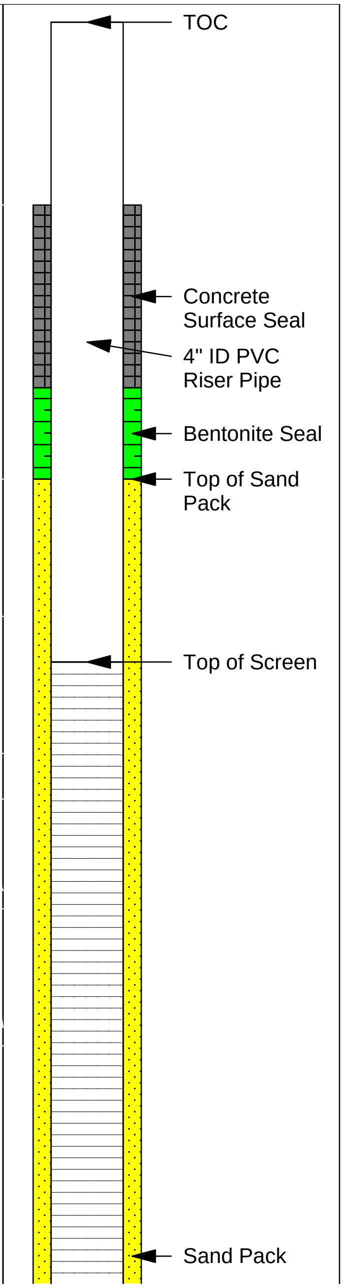
Gray and mottled brown, moist, silty SAND, fine, with gravel (25-35%). Gravels are sub-rounded, medium coarse, with cobbles. Silt comprises 10-20% of sample material.

Same as above with slight increase in plasticity and increased silt content.

Same as above -- limited (6") recovery.

Same as above -- limited (2") recovery.

Gray, wet, silty SAND, fine, with gravel (15%). Silt constitutes ~20 % sample material. Gravels are medium size and subrounded.



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
= denotes groundwater table

Boring Location: PD-104

Drill Date: September 22, 2008
Logged By: Brett Beaulieu
Drilled By: Cascade Drilling

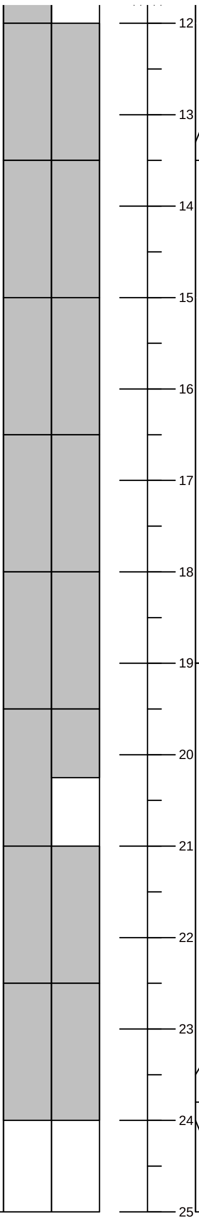
Ground Surf Elev. & Datum: 16.95 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701842
Longitude/Easting: 1186655
Casing Elevation: 18.76, FT NAVD 88

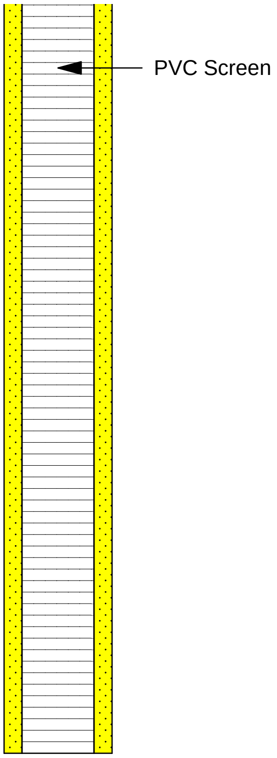
Drill Type: CME 55 Ltd Access
Sample Method: 3.0" D&M w/ 140lb Hmr
Boring Diameter: 0.7 FT
Boring Depth (ft bgs): 20 FT BGS
Groundwater ATD (ft bgs): 9 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			SP	Dark gray, wet, poorly-graded SAND, fine, with trace coarse sand. Sand unit is interbedded with two distinct 1-2" tihck lenses of gray, wet, plastic SILT with CLAY. Final 5" of drive contain woody material (~5%).	
			PT	1" thick lens of PEAT.	
			SP	Dark gray, wet. poorly-graded SAND.	
			SM	Dark gray, wet, poorly-graded SAND with varying silt. Silt content ranges from 5-25%. Sand content grows coarser around 16 and 18 FT BGS. 10% gravel noted in sample at 18 FT BGS.	
			SM/ML	Dark gray, wet, SILT with sand. Alternates between sand rich/silt rich composition throughout interval between 19 and 23.5 FT BGS. Trace woody material noted at ~23 FT BGS.	
			PT	Dark reddish brown, wet, PEAT with seeds. Turns black upon exposure to air.	
			ML/OL	Light gray to brown clayey SILT expressing high plasticity. 5-10% woody organic debris, some organic silt present.	
				Bottom of Excavation: 24.0 FT BGS	





Notes:
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Boring Location: PD-107

Drill Date: August 18, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling

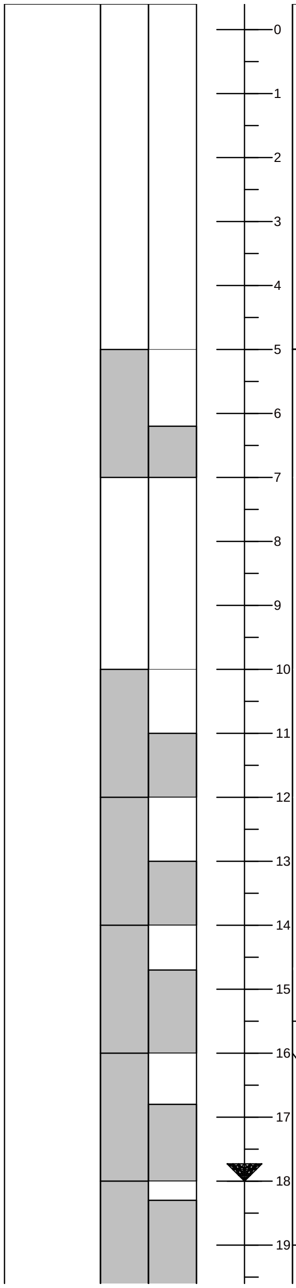
Ground Surf Elev. & Datum: 30.58 FT NAVD88
Coordinate System: NAD 83/98
Latitude/Northing: 702224
Longitude/Easting: 1186121
Casing Elevation: 32.77 FT NAVD88

Drill Type: CME 75
Sample Method: Split spoon /140lb Hmr
Boring Diameter: 8"/12" final
Boring Depth (ft bgs): 38 FT BGS
Groundwater ATD (ft bgs): 18 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number: Task No. 1308
Site Location: B&L Woodwaste
Pierce County, WA

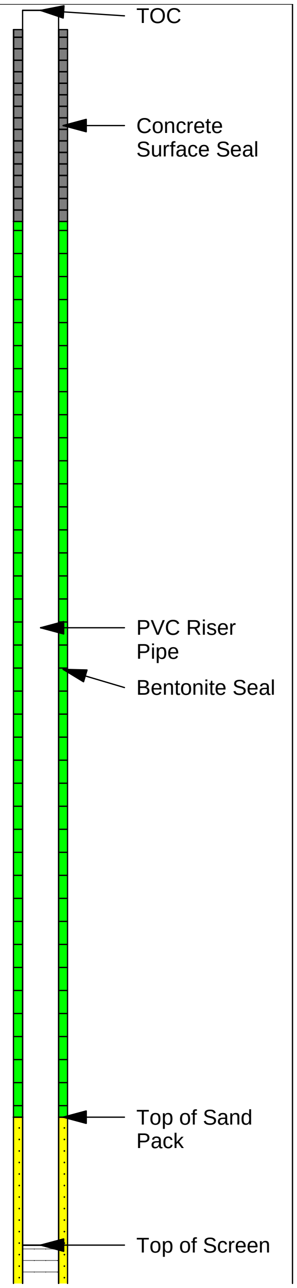
Remarks: Excavated cautiously down to 2' bgs and cut through geotex, PVC and cap liner.

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
	Advanced boring to 5 FT BGS and began sampling.
WOOD WASTE	Dark brown to black, damp, WOOD WASTE with gravel (1" diameter). Approximately 6" recovery.
	No samples collected from 7 to 10 FT BGS.
WOOD WASTE	Dark brown to black, damp, WOOD WASTE with scattered gravels (1" diameter). 70% wood; 30% gravels.
	Same material noted above. Wood fragments turn dark gray upon exposure to air.
WOOD WASTE	Continuous layer of WOOD WASTE (no sand or gravel noted).
GW	Dark gray, moist, GRAVEL with sand, fine to coarse, and slag. Gravels ~ 0.5" maximum in size. Odor noted in sample.
WOOD WASTE	Brown to dark brown, damp to moist, WOOD WASTE.
SM-ML	Dark gray, moist, fine sandy SILT grading to SAND, fine.

WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring Location: **PD-107**

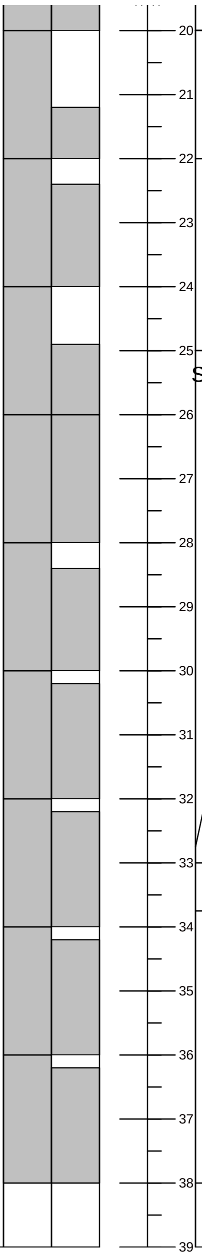
Drill Date: August 18, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling

Ground Surf Elev. & Datum: 30.58 FT NAVD88
Coordinate System: NAD 83/98
Latitude/Northing: 702224
Longitude/Easting: 1186121
Casing Elevation: 32.77 FT NAVD88

Drill Type: CME 75
Sample Method: Split spoon /140lb Hmr
Boring Diameter: 8"/12" final
Boring Depth (ft bgs): 38 FT BGS
Groundwater ATD (ft bgs): 18 FT BGS

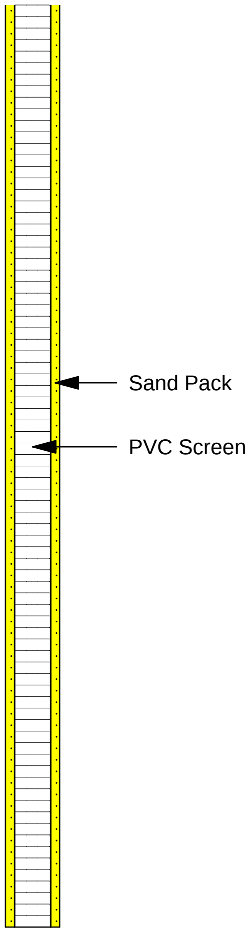
Client: B&L Custodial Trust
Project: B&L RIM
Task Number: Task No. 1308
Site Location: B&L Woodwaste
Pierce County, WA

Remarks: Excavated cautiously down to 2' bgs and cut through geotex, PVC and cap liner.



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
		20	ML	Gray, moist, fine sandy SILT. Wood waste slough from 20 - 21 FT BGS in sampler.
		22	SP	Dark gray, wet, SAND, fine. Very consistent material throughout drive.
		25	SP-SM-ML	Dark gray, wet, SAND, fine, to fine sandy SILT. Alternating zones of sand-dominant and silt-dominant material from 25 to 32.75 FT BGS.
		32	WOOD WASTE	Brown, wet, WOOD WASTE. Turns dark brown when exposed to air.
		33	SP	Dark gray, wet SAND with rusty red specs.
		34	ML-CL	Dark gray, moist SILT. Grades to dark gray to brown, damp to moist clayey SILT with scattered wood fragments at ~35 FT BGS that extends to bottom of excavation.
		38		Bottom of Excavation: 38.0 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
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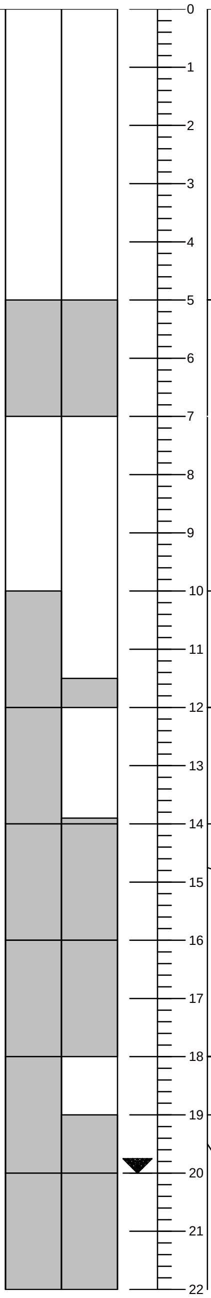
Boring ID: PD-108

Drill Date: August 18, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling
Drill Type: CME Track Rig
Sample Method: 140 lbs auto hammer
Boring Diameter: 8 inches
Boring Depth (ft bgs): 38 FT BGS
Groundwater ATD (ft bgs): 20 FT BGS

Coordinate System: NAD 83/98
Ground Surface Elevation: 29.00
Latitude/Northing: 701709
Longitude/Easting: 1185937
Boring Location:

Client: B&L Custodial Trust
Project: B&L RIM
Task: Task No. 1308
Address: B&L Woodwaste
Pierce County, Washington

Remarks: No monitoring well installed at this location due to proximity to proposed slurry wall.



PID (ppm)	OIL INDICAT.	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
				0		Cautious excavation of initial 2.0 feet of boring to protect landfill cap material. At 2.0 feet depth, encounter the landfill cap, comprised of geotextile fabric followed by PVC followed by burlap. Carefully cut away the cap components to facilitate future cap repair.
				5	ML	Dark brown-gray, damp-moist, SILT with trace gravel (0.5" diameter) and scattered wood chips. Increasing wood content near end of drive.
				10	WOOD	Dark brown-black, damp-moist, decaying WOOD with trace gravel (0.5" diameter). Limited recovery (~5").
				12		Slough (mix of silt, wood, etc.) Too little recovery to classify (~2").
				14	ML	Brown, damp, sandy SILT.
					SP	Dark gray-black, wet, SAND, fine-medium, with reddish specks. Grades to dark gray, wet, sand, fine, with abundant felsic grains from 17-18 FT BGS.
				18	SM	Dark gray-brown, wet, silty SAND, fine
				19	WOOD	Lens of wood.
					SP	Dark brown-black, Sand, Fine. Scattered fragments of soggy, decayed wood from 20-24 FT BGS.

Notes:
FT BGS = feet below ground surface
ppm = parts per million
--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Classification System
= denotes groundwater table

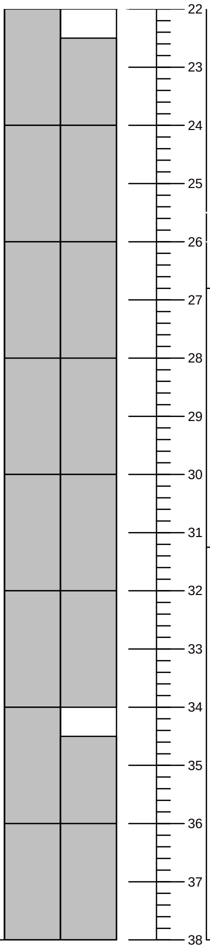
Boring ID: PD-108

Drill Date: August 18, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling
Drill Type: CME Track Rig
Sample Method: 140 lbs auto hammer
Boring Diameter: 8 inches
Boring Depth (ft bgs): 38 FT BGS
Groundwater ATD (ft bgs): 20 FT BGS

Coordinate System: NAD 83/98
Ground Surface Elevation: 29.00
Latitude/Northing: 701709
Longitude/Easting: 1185937
Boring Location:

Client: B&L Custodial Trust
Project: B&L RIM
Task: Task No. 1308
Address: B&L Woodwaste
Pierce County, Washington

Remarks: No monitoring well installed at this location due to proximity to proposed slurry wall.



PID (ppm)	OIL INDICAT.	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
						Becomes dark gray, wet, well-graded SAND, fine-medium, with red and white sand grains.
					ML-CL	Becomes dark gray, wet, poorly-graded SAND, fine, with red and white sand grains. Wood fragments present in sample that turn dark gray upon exposure to air. Gray, moist-wet, clayey SILT. Wood fragments present at 28 FT BGS that turn dark gray upon exposure to air..
					ML-SP	Dark brown, moist-wet, SILT with fine SAND. Wood fragments present at 32 FT BGS. Grain size of majority of sample material appears to be at/near sand to silt transition from 33 FT BGS through remainder of drive. Scattered thin lenses of silt with low sand content from 34-37 FT BGS. Grades to gray, wet, poorly-graded SAND, fine, at end of drive.

Notes:
FT BGS = feet below ground surface
ppm = parts per million
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Boring Location: PD-109

Drill Date: August 19, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling

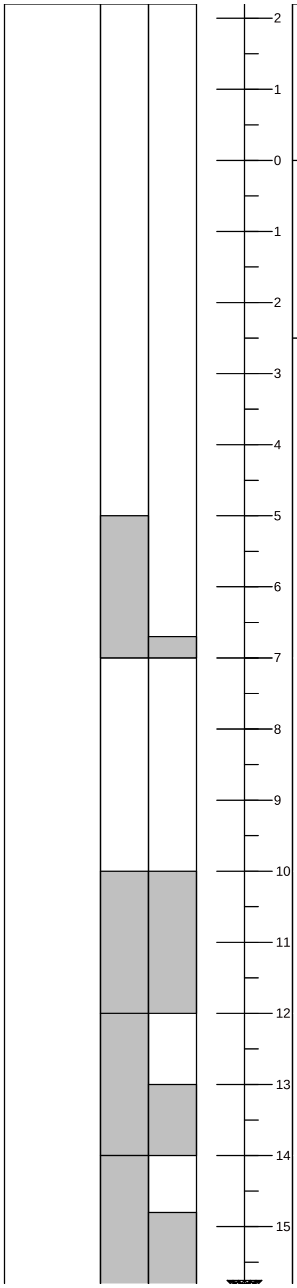
Ground Surf Elev. & Datum: 28.92 FT NAVD88
Coordinate System: NAD 83/98
Latitude/Northing: 701795
Longitude/Easting: 1186484
Casing Elevation: 30.67 FT NAVD88

Drill Type: CME Track Rig
Sample Method: 140 lbs auto hammer
Boring Diameter: 4.25/8"; 12" final
Boring Depth (ft bgs): 30 FT BGS
Groundwater ATD (ft bgs): 16 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number: Task No. 1308
Site Location: B&L Woodwaste
Pierce County, WA

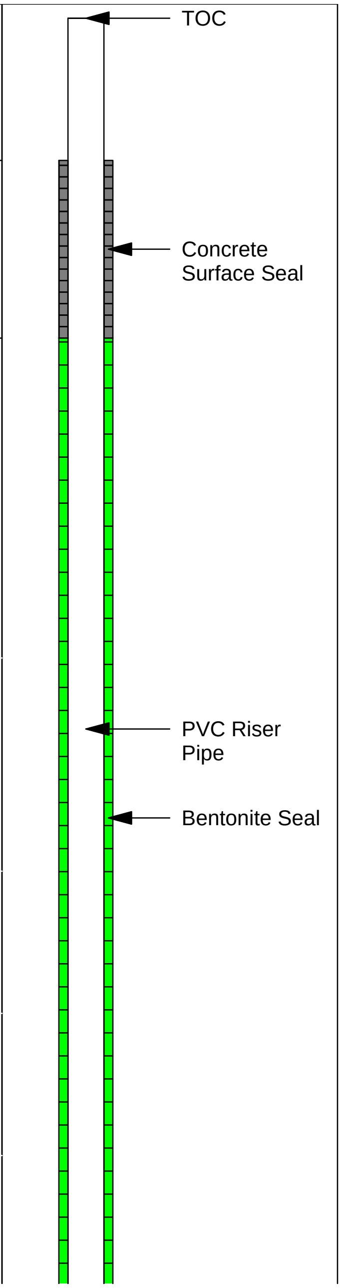
Remarks:

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
SP-SM	Grass and moss at ground surface overlie light brown, dry, poorly-graded silty SAND with 0.5" diameter gravels capping the underlying geotextile liner. Cautiously excavated to liner and cut hole using utility knife and removed three ply cap liner.
WOOD WASTE	Dark brown to black, damp WOOD WASTE with sand and gravel (0.3" diameter). Limited recovery from 5 to 7 FT BGS.
	Inferred wood waste zone - did not sample from 7-10 FT BGS.
WOOD WASTE	Dark brown to black, damp, trace gravelly WOOD WASTE.
WOOD WASTE	Dark brown to black, moist to wet, WOOD WASTE with gravel (15% and 1" diam).

WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
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Boring Location: PD-109

Drill Date: August 19, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling

Ground Surf Elev. & Datum: 28.92 FT NAVD88
Coordinate System: NAD 83/98
Latitude/Northing: 701795
Longitude/Easting: 1186484
Casing Elevation: 30.67 FT NAVD88

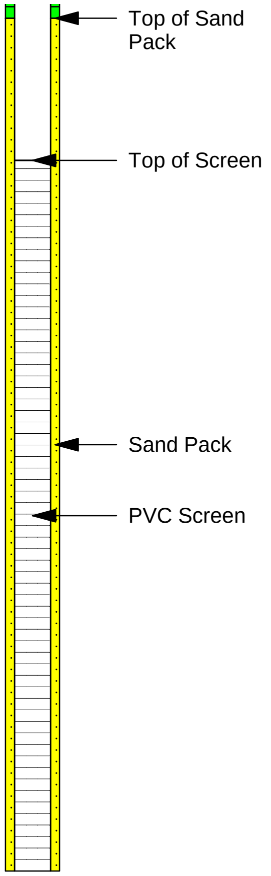
Drill Type: CME Track Rig
Sample Method: 140 lbs auto hammer
Boring Diameter: 4.25/8"; 12" final
Boring Depth (ft bgs): 30 FT BGS
Groundwater ATD (ft bgs): 16 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number: Task No. 1308
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
		16	WOOD WASTE	Brown, wet decaying WOOD WASTE which turns dark gray upon exposure to air. Gravel now absent in sample material.
			ML	Gray, damp, slightly sandy SILT.
		18	ML/SM	Gray, moist, sandy SILT to very silty SAND, fine. Material size is at or near sand/silt transition.
		20	ML	Gray, damp to moist, trace gravelly sandy SILT with scattered wood fragments. Material size is at or near sand/silt transition.
		22		Grades to damp to moist sandy SILT without wood fragments.
		27	WOOD WASTE	Moist, decaying WOOD WASTE.
			ML-CL	Olive gray, moist, clayey SILT with wood fragments. Resembles aquitard layer observed in boreholes PD-108 and PD-107.
		29	ML-CL-PT	Olive gray, moist to wet, clayey SILT grading to brown clayey SILT with abundant peat fragments near end of drive.
		30		Bottom of Excavation: 30.0 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
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Boring Location: PD-200

Drill Date: August 18, 2008
Logged By: Erin Murray
Drilled By: Cascade Drilling

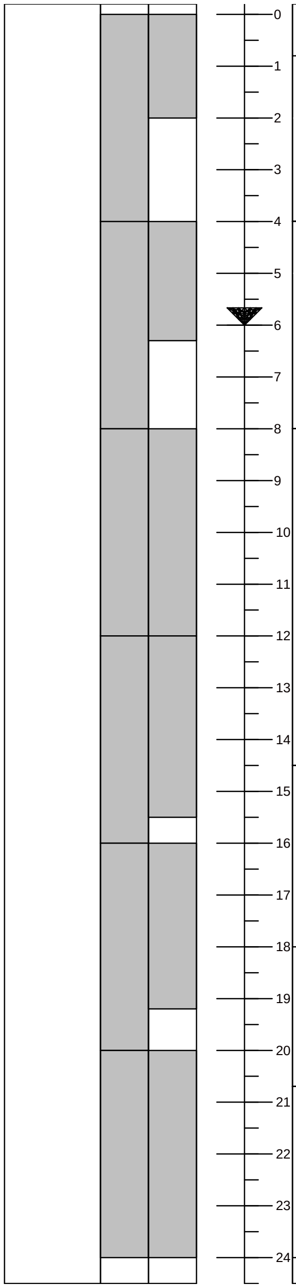
Ground Surf Elev. & Datum: 12.86 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 703432
Longitude/Easting: 1185702
Casing Elevation: 15.86, FT NAVD 88

Drill Type: Geoprobe/Direct Push
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 24.0 FT BGS
Groundwater ATD (ft bgs): 6 FT BGS

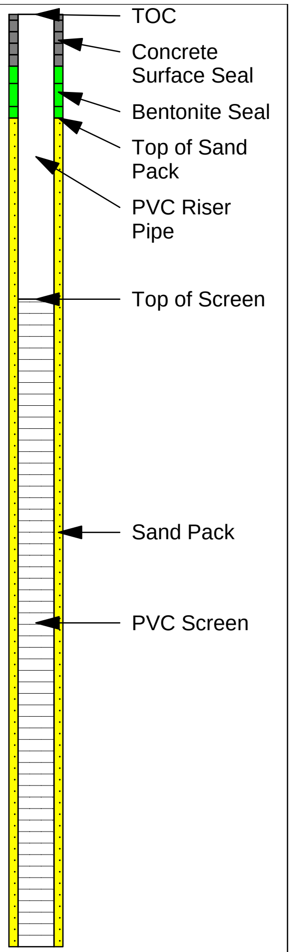
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
				Silty organic matter at surface.
			PT/ML	Brown, moist, PEAT with silt.
			ML	Gray, SILT with organic material.
			SM	Gray, moist, poorly-graded silty SAND, fine.
			SP	Gray, moist to wet, poorly-graded SAND, fine to medium.
			ML-PT	Alternating layers of Silty/Clayey material and Peaty material.
			PT	Brown, wet, PEAT.
				Bottom of Excavation: 24.0 FT BGS



WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
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Boring Location: PD-201

Drill Date: August 26, 2008
Logged By: Lisa Meoli
Drilled By: Cascade Drilling

Ground Surf Elev. & Datum: 40.05 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 703536
Longitude/Easting: 1187255
Casing Elevation: 40.05, FT NAVD 88

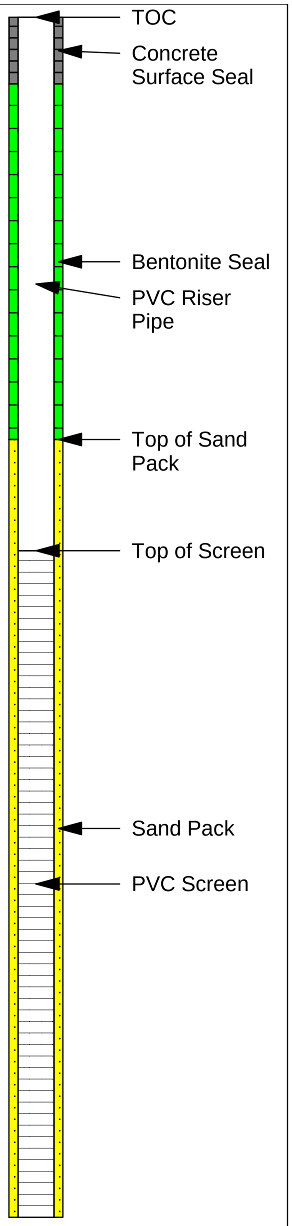
Drill Type: Geoprobe
Sample Method: Dual Tube
Boring Diameter: 2.0"
Boring Depth (ft bgs): 27 FT BGS
Groundwater ATD (ft bgs): NA

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
GP	Brown, dry, gravelly topsoil (FILL). No recovery
SW	Brown , dry, SAND, fine, with gravel (10%).
SM	Grades to reddish-brown and light brown, moist, silty SAND, motteled.
SC	Reddish-brown and light brown, dry, clayey silty SAND, with gravel (5%).
SM	Dry, silty sand lens with gravel.
SC	Grades to reddish brown and light brown clayey silty SAND. Then grades to light brown, dry, silty SAND
SP	Lens of dry, light brown, SAND, fine.
SM	Grades to light brown, slightly moist, silty SAND.
SP	Light brown, wet, SAND, fine.
SM	Light brown and reddish brown, dry to moist, silty SAND, fine, mottled. Becomes wet at 24 FT BGS.
SC	At 26 FT BGS grades to light brown clayey silty SAND. At 27 FT BGS becomes hard, compacted, reddish colored, dry, silty SAND (sandstone like). Hit refusal at 27 FT BGS.
	Bottom of Excavation: 27 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
= denotes groundwater table

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Boring Location: PD-202

Drill Date: August 26, 2008
Logged By: Lisa Meoli
Drilled By: Cascade Drilling

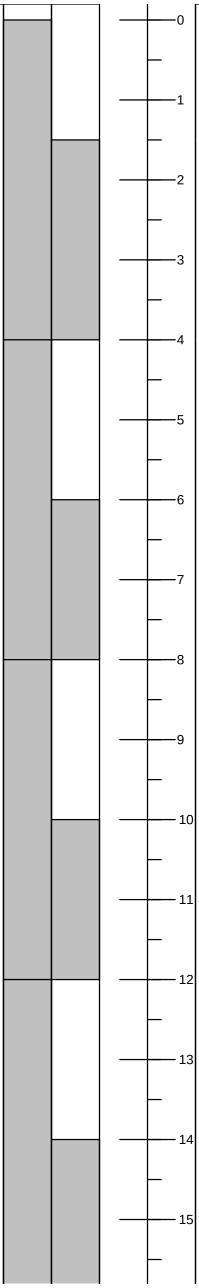
Ground Surf Elev. & Datum: 56.31 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702529
Longitude/Easting: 1187128
Casing Elevation: 56.31, FT NAVD 88

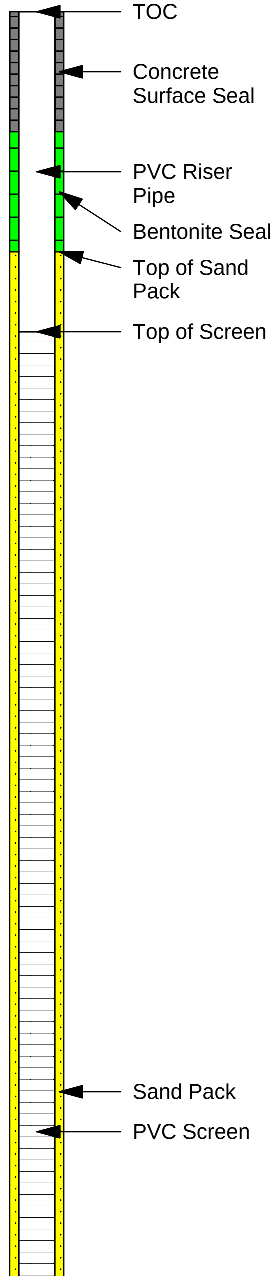
Drill Type: Geoprobe/Direct Push
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 29.0 FT BGS
Groundwater ATD (ft bgs): NA

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	WELL COMPLETION DETAIL (If Applicable)
				No recovery from 0 to 1.5 FT BGS.	
			SW-GW	Brown, dry SAND and GRAVEL with vegetation debris (FILL).	
			SW-GW	Brown, dry SAND, medium, and GRAVEL (fine to coarse).	
			SW-GW	Brown, dry SAND, medium, and GRAVEL (fine). Grades to finer gravel fraction at ~15 FT BTS.	





Notes:
FT BGS = feet below ground surface
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= denotes groundwater table

Boring Location: PD-202

Drill Date: August 26, 2008
Logged By: Lisa Meoli
Drilled By: Cascade Drilling

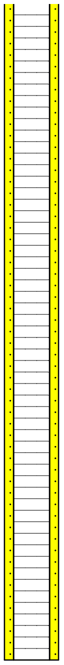
Ground Surf Elev. & Datum: 56.31 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702529
Longitude/Easting: 1187128
Casing Elevation: 56.31, FT NAVD 88

Drill Type: Geoprobe/Direct Push
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 29.0 FT BGS
Groundwater ATD (ft bgs): NA

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
		16			
		17			
		18	SW	Grades to brown, moist, SAND, fine, with no gravel present.	
		19		Grades to brown, moist, SAND, medium, with no gravel present.	
		20		Grades to brown, moist, SAND, fine, with no gravel present.	
		21			
		22			
		23			
		24		Grades to brown, moist, SAND, fine, with trace gravel, fine.	
		25			
		26			
		27			
		28		Grades to brown, moist, SAND, fine, with no gravel present.	
		29		Bottom of Excavation: 29.0 FT BGS	
		30			



Notes:
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Boring Location: PD-203

Drill Date: August 27, 2008
Logged By: Lisa Meoli
Drilled By: Cascade Drilling

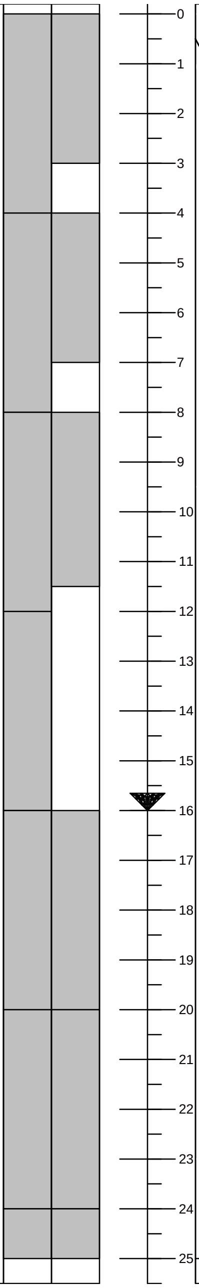
Ground Surf Elev. & Datum: 37.90 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 700960
Longitude/Easting: 1186419
Casing Elevation: 37.90 FT, NAVD 88

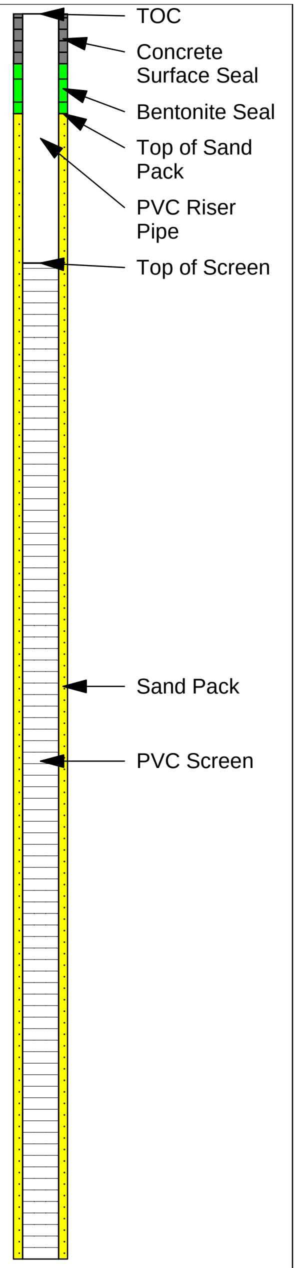
Drill Type: Geoprobe/Direct Push
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 25.0 FT BGS
Groundwater ATD (ft bgs): 16 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	WELL COMPLETION DETAIL (If Applicable)
			FILL	Asphalt and Gravel.	
			SP	Dark brown, dry, SAND, medium, with gravel (10%), fine to coarse. Grades to light brown, dry, SAND, medium. Grades to light reddish brown, dry, SAND, fine. Grades to light reddish brown, moist, SAND, coarse, with gravel (~10%), fine. Grades to light brown, wet, SAND, fine. As above, becoming poorly-graded and wet.	
			SP	Bottom of Excavation: 25.0 FT BGS	





Notes:
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Boring Location: PD-204

Drill Date: September 25, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling

Ground Surf Elev. & Datum: 14.94 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702917
Longitude/Easting: 1186546
Casing Elevation: 17.57, FT NAVD 88

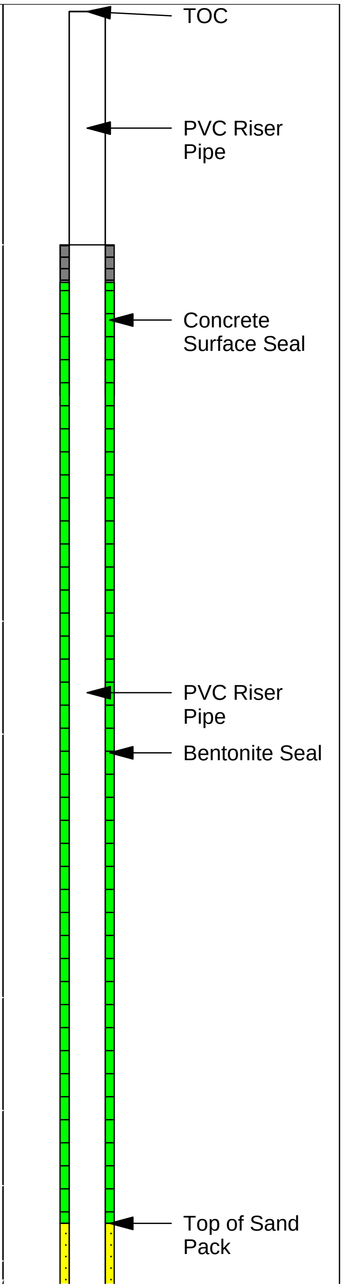
Drill Type: CME 55 Ltd Access
Sample Method: 3.0" D&M w/ 140lb Ham
Boring Diameter: 2 inches
Boring Depth (ft bgs): 26.5 FT BGS
Groundwater ATD (ft bgs): NA

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
				Drill to depth of 5 FT BGS and begin sampling.
			PT	Brown, damp to wet PEAT. (Entirely woody peat with no visible silt.)
			ML	Gray, damp fine sandy SILT. Peaty slough present in split spoon at 10 FT BGS.
			ML	Gray, damp fine sandy SILT.
			PT	Brown, damp to wet PEAT.

WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
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Boring Location: PD-204

Drill Date: September 25, 2008
Logged By: Chris Gardner
Drilled By: Cascade Drilling

Ground Surf Elev. & Datum: 14.94 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702917
Longitude/Easting: 1186546
Casing Elevation: 17.57, FT NAVD 88

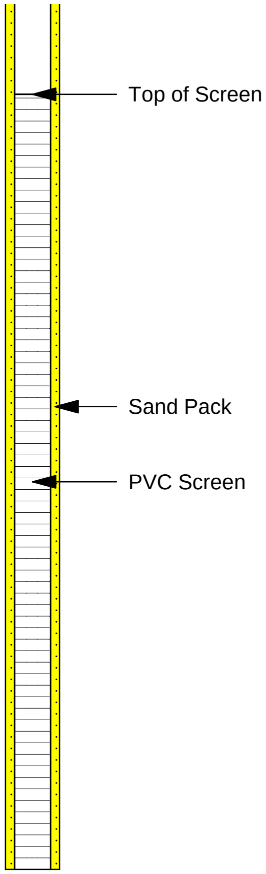
Drill Type: CME 55 Ltd Access
Sample Method: 3.0" D&M w/ 140lb Ham
Boring Diameter: 2 inches
Boring Depth (ft bgs): 26.5 FT BGS
Groundwater ATD (ft bgs): NA

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
		14	ML/CL	Olive gray, damp clayey SILT.
	▨	15	ML/CL	Olive gray, damp clayey SILT.
	▨	16	PT	Brown, damp PEAT
			OH-PT	Light gray, damp clayey SILT. Grades to peat at 16.5 FT BGS.
		17		
	▨	18	PT-CL-OH	Light brown, damp to moist, PEAT and peaty SILT grading to light gray clayey SILT.
		19	ML	Moist, fine sandy SILT to silty SAND, fine.
	▨	20	ML/SM	Gray, damp fine-sandy SILT to silty SAND, fine. Material is at sand/silt transition in size.
	▨	21		
		22		
	▨	23	ML/SM	Gray, damp fine-sandy SILT to silty SAND, fine. Material is at sand/silt transition in size.
		24		
	▨	25	ML/SM	Gray, damp fine-sandy SILT to silty SAND, fine. Material is at sand/silt transition in size.
	▨	26		
		27		Bottom of Excavation: 26.5 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
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Boring Location: PD-210

Drill Date: August 16, 2008
Logged By: Lisa Meoli
Drilled By: Cascade Drilling

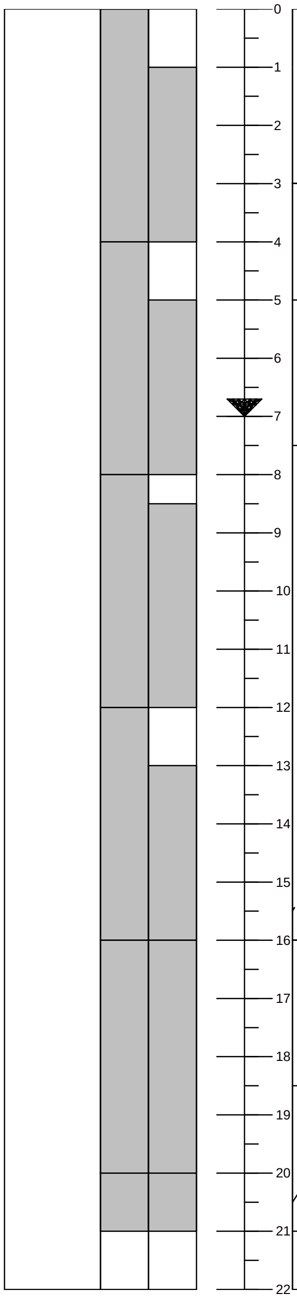
Ground Surf Elev. & Datum: 15.71 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 703818
Longitude/Easting: 1185260
Casing Elevation: 19.15 FT, NAVD 88

Drill Type: Geoprobe/Direct Push
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 21.0 FT BGS
Groundwater ATD (ft bgs): 7 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

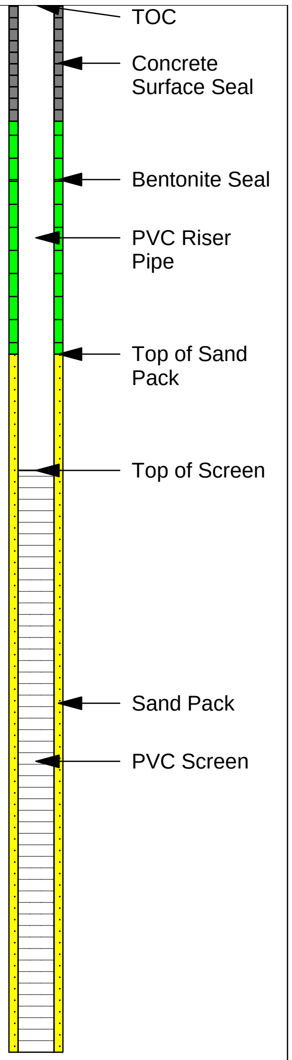
Remarks:

SAMPLE ID | DRIVEN / RECOVERED | DEPTH FT BGS



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
SP	Brown, dry, SAND, fine, with roots throughout sample.
SM	Grades to gray and brown, moist, silty SAND, fine and mottled.
OL-PT	Dark brown, moist, SILT and PEAT with organic material including wood chunks and roots.
SM	Dark gray and mottled, wet, silty SAND, fine, with wood chunks.
ML	Dark gray, clayey SILT. (Small lens of silt between layers of silty sand)
SM	Dark gray, wet, silty SAND, fine.
PT	Dark brown, wet, PEAT.
SM-SC	Gray, wet, silty, clayey SAND.
	Bottom of Excavation: 21.0 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
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Boring Location: PD-211

Drill Date: August 18, 2008
Logged By: Lisa Meoli
Drilled By: Cascade Drilling

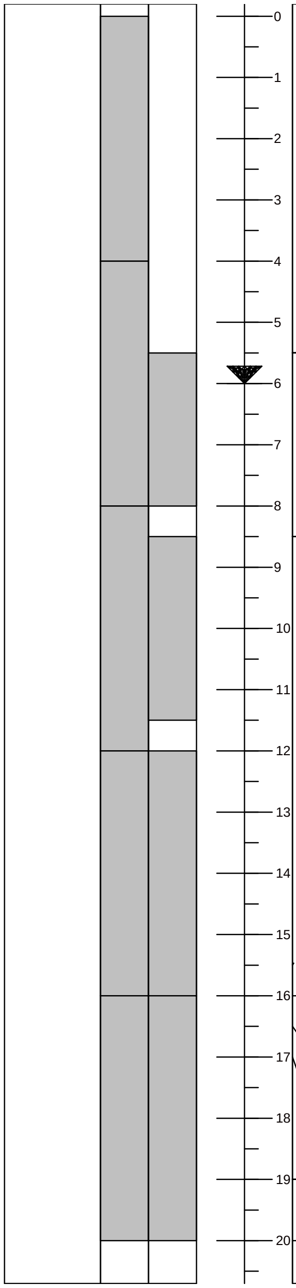
Ground Surf Elev. & Datum: 13.99 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 703281
Longitude/Easting: 1185150
Casing Elevation: 16.77, FT NAVD 88

Drill Type: Geoprobe/Direct Push
Sample Method: Dual Tube
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20.0 FT BGS
Groundwater ATD (ft bgs): 6 FT BGS

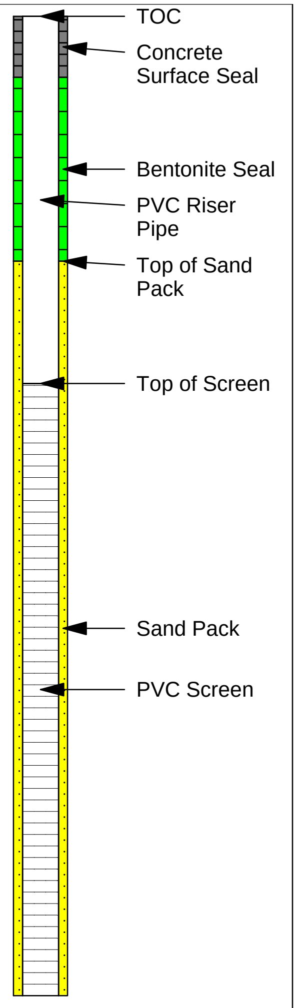
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
	No recovery from ground surface to 5.5 FT BGS.
ML-SM	Silty organic material with vegetation and roots. Grades to dark gray clayey SILT to silty SAND, very fine.
SP	Dark gray, wet, SAND, fine
	Grades to Dark gray, wet, SAND, fine to medium.
	Grades to dark brown, wet, poorly-graded SAND, fine to medium, with red and white specks.
SM	Dark gray, wet, silty SAND, fine.
ML	Dark gray, wet, clayey SILT (Aquitard material).
PT	Dark brown, wet PEAT.
ML	Gray, dry, clayey SILT with some vegetation
ML-PT	Dark brown, interbedded PEAT and SILT.
	Bottom of Excavation: 20.0 FT BGS



Notes:
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▼ = denotes groundwater table

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Boring Location: PD-212

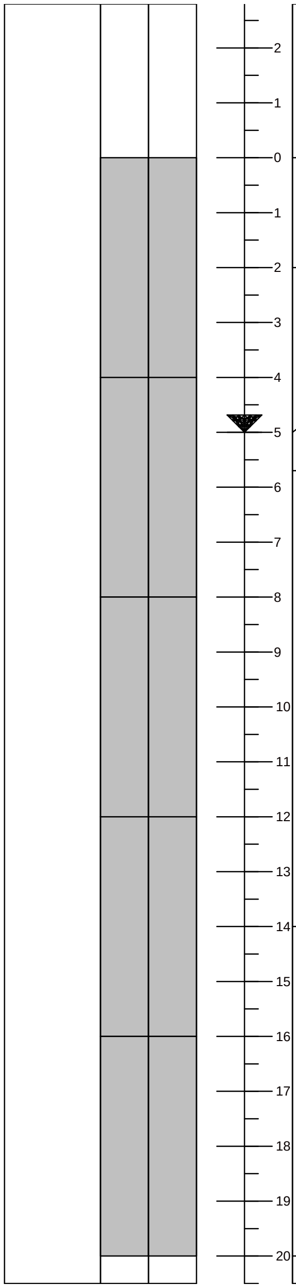
Drill Date: September 30, 2008
Logged By: Chris Gardner
Drilled By: ESN Northwest
Drill Type: Geoprobe
Sample Method: Stanley BR-107 Hmr
Boring Diameter: 2 inches
Boring Depth (ft bgs): 20.0 FT BGS
Groundwater ATD (ft bgs): 5.0 FT BGS

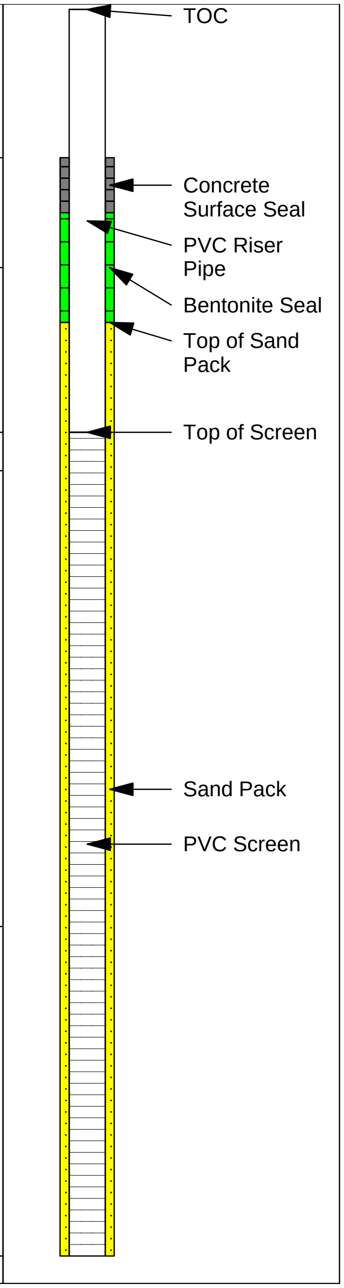
Ground Surf Elev. & Datum: 15.46 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 702003
Longitude/Easting: 1185274
Casing Elevation: 17.79, FT NAVD 88

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS	**WELL COMPLETION DETAIL (If Applicable)**
			OL	Brown, damp organic SILT with abundant roots.	
			ML-CL	Gray, damp slightly sandy SILT. Becomes moist and plastic toward end of drive, grading to silty clay. Zones of dark brown to rusty colored material noted.	
			SP	Gray, wet SAND, fine.	
			SP-ML	Gray, wet SAND, very fine, to fine sandy SILT. Sand is clean but particle size is at the sand/silt transition.	
			SP-SW	Dark gray, wet, SAND, fine, grading to fine-medium sand with increasing depth. Rusty specs noted in sample material from 14.5 - 20 FT BGS.	
				Bottom of Excavation: 20.0 FT BGS	





Notes:
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Boring Location: PD-213

Drill Date: September 25, 2008
Logged By: Chris Gardner
Drilled By: ESN Northwest

Ground Surf Elev. & Datum: 15.72 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701412
Longitude/Easting: 1185013
Casing Elevation: 18.25, FT NAVD 88

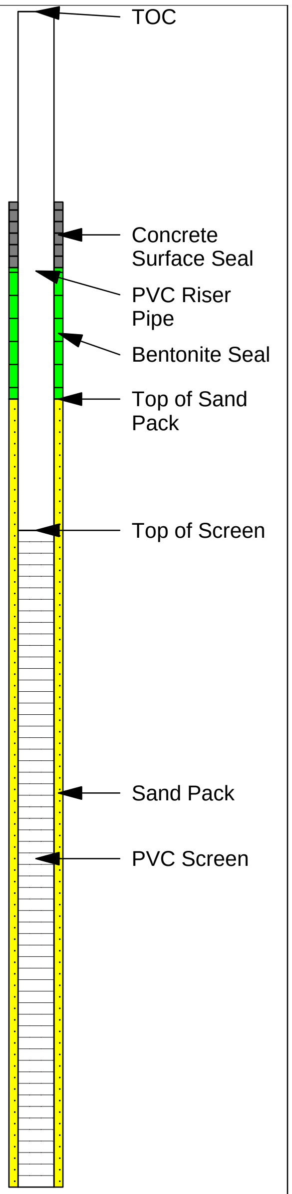
Drill Type: Geoprobe
Sample Method: Stanley BR-187
Boring Diameter: 2.0"
Boring Depth (ft bgs): 16 FT BGS
Groundwater ATD (ft bgs): 3.75 FT BGS

Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
ML-CL	Damp, gray-brown, fine sandy SILT to clayey silt. Abundant vertical and horiztonal streamers of rusty-brown zones. Some rooty fragments present in upper 2.0 feet of drive.
SM-ML	Gray, wet, silty SAND, fine, to very fine sandy SILT.
SP-ML	Gray, wet, SAND, fine. Material size is at or near sand/silt transition.
SP-SW	Gray, wet, SAND, fine. Grades to fine-medium sand near end of drive. Small punch of decayed wood in sample core at 11.5 FT BGS
SM/ML - SP	Gray, wet fine-sandy SILT to SAND, fine, with silt. Material size is at or near sand/silt transition. Grades to fine sand toward bottom of drive.
ML-CL	Greenish-gray, moist, clayey SILT.
	Bottom of Excavation: 16.0 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
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Boring Location: PD-214

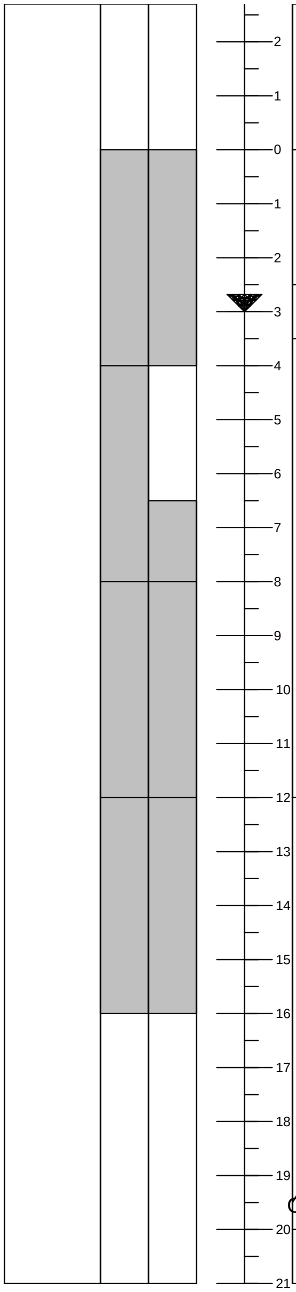
Drill Date: October 1, 2008
Logged By: Chris Gardner
Drilled By: ESN Northwest

Ground Surf Elev. & Datum: 15.56 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701843
Longitude/Easting: 1185673
Casing Elevation: 17.67, FT NAVD 88

Drill Type: Geoprobe
Sample Method: Stanley BR-187
Boring Diameter: 2.0"
Boring Depth (ft bgs): 20 FT BGS
Groundwater ATD (ft bgs): 3 FT BGS

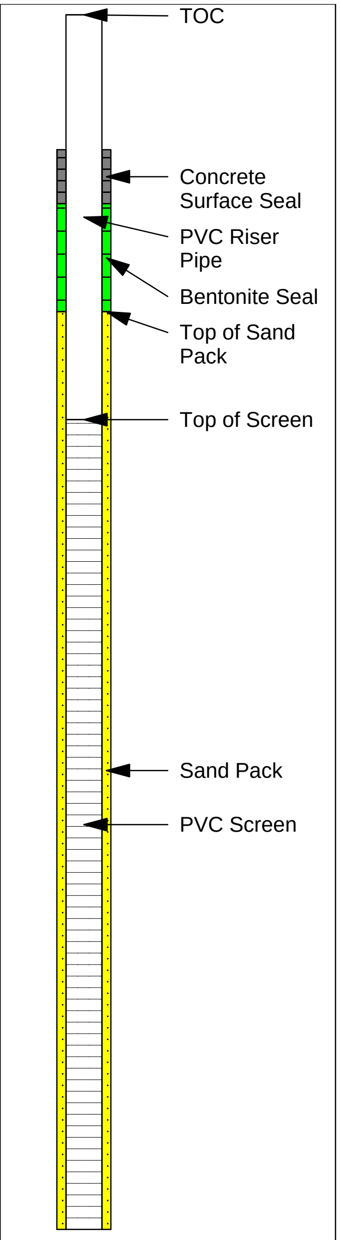
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:



SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
			OL-ML	Brown, damp, SILT with sand. Grades to gray, damp SILT, slightly plastic. Abundant grassy roots noted.
			WOOD	Brown, damp, decaying WOOD. Wood does not appear to darken upon exposure to air.
			SP	Dark gray, wet, SAND, fine to medium, with abundant rusty colored specs.
			SP-SW	Dark gray, wet, SAND, fine to medium, with scattered gravels (0.3" diameter). Zones containing fine-coarse sand are present throughout drive but fine-medium sand dominates.
			OH-CL-MH	Greenish gray to brown, moist, clayey SILT. Abundant wood fragments present within sample that turn black upon exposure to air.
				Bottom of Excavation: 20.0 FT BGS

WELL COMPLETION DETAIL (If Applicable)



Notes:
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Boring Location: PD-215

Drill Date: October 1, 2008
Logged By: Chris Gardner
Drilled By: ESN Northwest

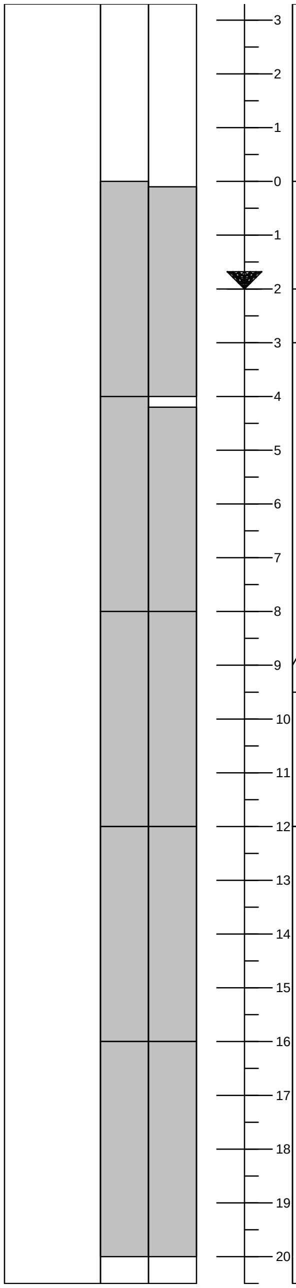
Ground Surf Elev. & Datum: 16.61 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 701559
Longitude/Easting: 1185851
Casing Elevation: 19.32, FT NAVD 88

Drill Type: Geoprobe
Sample Method: Stanley BR-187
Boring Diameter: 2.0"
Boring Depth (ft bgs): 20 FT BGS
Groundwater ATD (ft bgs): 2 FT BGS

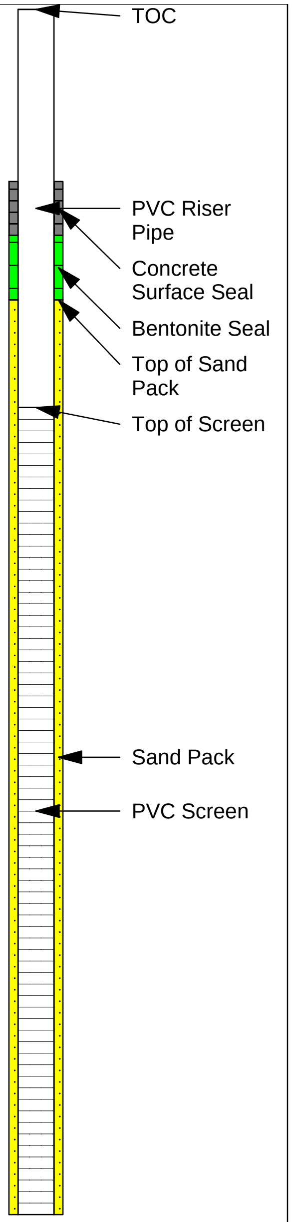
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:

SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
			OL	Brown, damp, fine sandy SILT with abundant roots near the surface.
			ML	Gray, damp, fine sandy SILT
			SP	Gray, wet SAND, fine. Grades to very fine sand from 4 to 6 FT BGS. Grades back to fine sand from 6 to 8 FT BGS.
			SW	Gray, wet SAND, fine to medium, with abundant red specs.
			SP	Gray, wet, poorly-graded SAND, very fine. Small (2.0" thick) lens of silt-sized material at 9.6 FT BGS in sample.
			SW	Gray, wet, SAND, fine to coarse, with abundant rusty specs.
				Bottom of Excavation: 20.0 FT BGS



WELL COMPLETION DETAIL (If Applicable)



Notes:
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Boring Location: PD-216

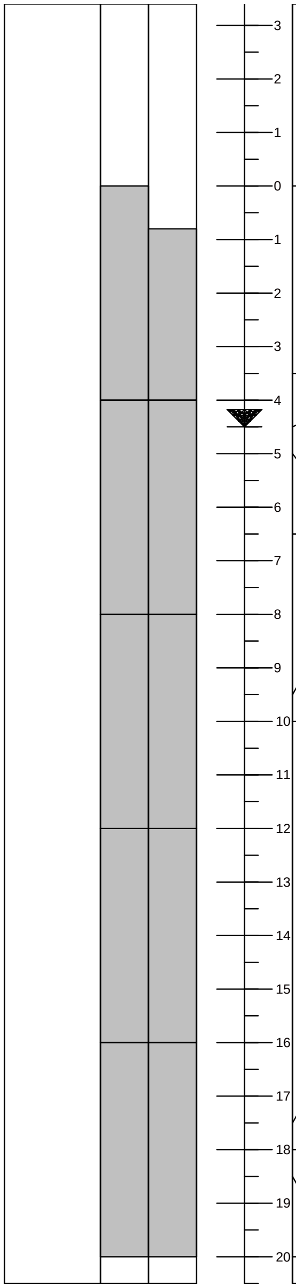
Drill Date: September 30, 2008
Logged By: Chris Gardner
Drilled By: ESN Northwest

Ground Surf Elev. & Datum: 17.36 FT, NAVD 88
Coordinate System: NAD 83/98
Latitude/Northing: 700921
Longitude/Easting: 1185663
Casing Elevation: 20.45, FT NAVD 88

Drill Type: Geoprobe
Sample Method: Stanley BR-187
Boring Diameter: 2.0"
Boring Depth (ft bgs): 20 FT BGS
Groundwater ATD (ft bgs): 4.5 FT BGS

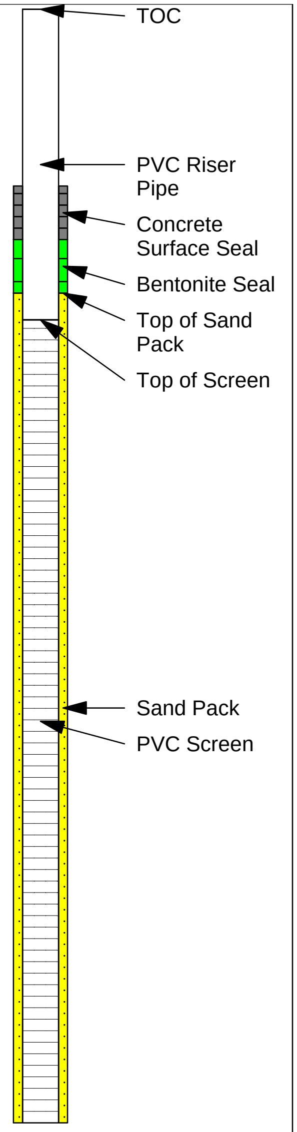
Client: B&L Custodial Trust
Project: B&L RIM
Task Number:
Site Location: B&L Woodwaste
Pierce County, WA

Remarks:



USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
OL-ML	Light brown to brown, damp, SILT with fine sand and abundant small roots.
ML-CL	Brown to gray, damp SILT with fine sand. Grades to silty CLAY toward end of drive.
PT	Brown, wet PEAT.
SM-ML	Gray, wet, silty SAND, fine, to sandy SILT.
SP	Dark gray, wet SAND, fine. Grades to coarser sand at 8 FT BGS.
SM-ML	Gray, wet, silty SAND to sandy SILT.
SP-SW	Gray, wet, SAND, fine to coarse, with red specs.
ML-CL	Greenish gray, moist-wet, clayey SILT.
SP-SM	Gray, wet, silty SAND, fine.
ML-CL	Gray, moist, fine sandy SILT to clayey SILT. Alternating zones of sandy silt and clayey silt through drive.

WELL COMPLETION DETAIL (If Applicable)



Notes:
FT BGS = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
= denotes groundwater table

B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR)

Attachment C2
Phase 1 Hydrogeologic Study Report
Discharge Calculation Worksheets

FINAL

B&L Trust RIM

Stream: Hylebos **Station:** #210 **Staff gage:** 0.98 **Piezo:** **Date/Time:** 10/3/2008 1040

Total Distance: 10.7 **Flow:** 5.85875 **Flow Crew:** TG/EM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
2	2.15		0.13			1.075	0.130	0.14	LWE
3	2.45		0.32			2.45	0.320	0.784	
4	2.6		0.43			2.6	0.430	1.118	
5	2.5		0.44			2.5	0.440	1.1	
6	2.4		0.38			2.4	0.380	0.912	
7	2.25		0.39			2.25	0.390	0.878	
8	2.3		0.23			2.3	0.230	0.529	
9	2.3		0.11			2.3	0.110	0.253	
10	2.45		0.03			2.45	0.030	0.074	Behind Vegetation
11	2.4		0.03			2.4	0.030	0.072	Behind Vegetation
12	1.3		0			1.105	0.000	0	
12.7	0.7		0			0.245	0.000	0	RWE
12.7						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 5.859 Computed by:

Notes:

B&L Trust RIM

Stream: Hylebos **Station:** #211 **Staff gage:** 1.2 **Piezo:** **Date/Time:** 10/3/2008 1115

Total Distance: 9.2 Replaced fencepost- old sg reading 1.85 **Flow:** 6.0852 **Flow Crew:** TG/EM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
0.6	1.95		0.2			0.39	0.200	0.078	LWE
1.0	2.2		0.31			1.54	0.310	0.477	
2.0	2.25		0.38			2.25	0.380	0.855	
3.0	2.05		0.54			2.05	0.540	1.107	
4.0	2		0.7			2	0.700	1.4	
5.0	1.8		0.47			1.8	0.470	0.846	
6.0	1.55		0.45			1.55	0.450	0.698	
7.0	1.4		0.33			1.4	0.330	0.462	
8.0	1.2		0.13			1.2	0.130	0.156	Behind Vegetation
9.0	0.35		0.02			0.315	0.020	0.006	Behind Vegetation
9.8	0.45		0			0.18	0.000	0	
9.8						0	0.000	0	RWE
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 6.085 Computed by:

Notes:

B&L Trust RIM

Stream: Ag ditch b/t field & Interurban **Station:** #212 **Staff Gage** 0.75 Piezo: 4.59 **Date/Time:** 10/2/2008 855

Total Distance: 6.6 **Flow:** 0.126 **Flow Crew:** TG/EM

		Velocity				Flow Calculations			
Station	Depth	0.2	0.6	0.8	Angle	Area	Avg Vel	Flow	Notes
7.5	0		0			0	0	0	LWE at 7.5 (10/02)
7.6	0.1		0			0.025	0.000	0	
8	0.5		0.1			0.35	0.100	0.035	Thick layer of muck
9	0.6		0.07			0.6	0.070	0.042	Thick layer of muck
10	0.7		0.06			0.7	0.060	0.042	0.3 ft of muck
11	0.7		0.01			0.7	0.010	0.007	sitting on top of veg
12	0.7		0			0.7	0.000	0	sitting on top of veg
13	0.4		0			0.4	0.000	0	
14	0.1		0			0.055	0.000	0	RWE in veg (10/02)
14.1	0					0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	on small boulder (8/02)
						0	0.000	0	on small boulder (8/02)
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 0.126 Computed by:

Notes:

B&L Trust RIM

Stream: Surprise Lake Drain - Upstream **Station:** #213 **Staff gage:** 0.14 **Piezo:** **Date/Time:** 10/3/2008 1400

Total Distance: 4.0 **Flow:** 0.5552 **Flow Crew:** TG/EM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
0.9	0.7		-0.7			0.385	-0.700	-0.27	LWE at bulkhead
2.0	0.55		0.6			0.5775	0.600	0.347	
3.0	0.6		0.74			0.6	0.740	0.444	
4.0	0.3		0.12			0.285	0.120	0.034	
4.9	0.1		0			0.045	0.000	0	RWE
4.9						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 0.555 Computed by:

Notes:

B&L Trust RIM

Stream: Ag ditch b/t LF & Pumpkins **Station:** #214 **Staff gage:** 0.9 **Piezo:** 3.81 **Date/Time:** ####### 930

Total Distance: 7.3 **Flow:** 0.1667 **Flow Crew:** TG/EM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
1.6	0		0			0	0.000	0	LWE at 1.6 lotsa veg (10/02)
3	1.1		0			1.32	0.000	0	1.5' of veg no flow
4	1.4		0.01			1.4	0.010	0.014	may be an eddy at higher flow
5	1.4	0		0.21		1.4	0.105	0.147	dense veg on bottom, most flow
6	1.2		0			1.2	0.000	0	same lotsa veg
7	0.7		0			0.7	0.000	0	same lotsa veg
8	0.3		0.02			0.285	0.020	0.006	
8.9	0		0			0	0.000	0	RWE in veg (10/02)
	0		0			0	0.000	0	
	0					0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 0.167 Computed by:

Notes:

B&L Trust RIM

Stream: Ag ditch b/t LF & Pumpkins **Station:** #215 **Staff gage:** 0.98 **Piezo:** 4.84 **Date/Time:** 10/2/2008 1049

Total Distance: 8.5 **Flow:** 0.033 **Flow Crew:** TG/EM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
7	0		0			0	0.000	0	LWE at 705 (10/02)
8	0.1		0			0.1	0.000	0	Lotsa veg (reed canary crass)
9	0.4		0.03			0.4	0.030	0.012	Veg right in front
10	0.8		0			0.8	0.000	0	Veg
11	0.7		0.02			0.7	0.020	0.014	sitting on top of veg
12	0.1		0.04			0.1	0.040	0.004	sitting on top of veg
13	0.3		0.01			0.3	0.010	0.003	
14	0		0			0	0.000	0	Veg
15	0		0			0	0.000	0	Veg
15.5	0					0	0.000	0	RWE in veg (10/02)
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	LBHP = 0
						0	0.000	0	RBHP = 17
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 0.033 Computed by:

Notes:

B&L Trust RIM

Stream: Fife Ag Ditch **Station:** #216 **Staff gage:** 0.72 **Piezo:** **Date/Time:** 10/3/2008 1340

Total Distance: 4.4 **Flow:** 0.75728 **Flow Crew:** TG/EM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
2.3	1		0			0.35	0.000	0	LWE, in vegetation
3.0	1.15		0			0.9775	0.000	0	~4" of muck at the bottom
4.0	0.95		0.27			0.95	0.270	0.257	
5.0	0.95		0.25			0.95	0.250	0.238	
6.0	0.8		0.32			0.68	0.320	0.218	
6.7	0.45		0.29			0.1575	0.290	0.046	RWE
6.7						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 0.757 Computed by:

Notes:

B&L Trust RIM

Stream: Surprise lake Drain @ Culvert **Station:** #225 **Staff gage:** 0.5 **Piezo:** None **Date/Time:** 10/3/2008 1450

Total Distance: 5.7 **Flow:** 0.4294 **Flow Crew:** TG/EM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
0.6	0.5		0			0.1	0.000	0	LWE, behind vegetation
1.0	0.2		-0.8			0.14	-0.800	-0.112	
2.0	0.5		-0.5			0.5	-0.500	-0.25	
3.0	0.45		0.23			0.45	0.230	0.104	
4.0	0.6		0.72			0.6	0.720	0.432	
5.0	0.4		0.5			0.4	0.500	0.2	
6.0	0.2		0.43			0.13	0.430	0.056	
6.3	0.05		0			-0.15	0.000	0	RWE
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 0.429 Computed by:

Notes:

B&L Trust RIM

Stream: Hylebos **Station:** #210 **Staff gage:** 2.01 **Piezo:** 5.4 **Date/Time:** 2/25/2009

Total Distance: 11 **Flow:** 20.1472 **Flow Crew:** TG/LM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
20	3.15		0.02			1.575	0.020	0.032	LWE in vegetaton
21	3.5		0.55			3.5	0.550	1.925	
22	3.4		0.59			3.4	0.590	2.006	
23	3.5		0.69			3.5	0.690	2.415	
24	3		0.9			3	0.900	2.7	
25	2.9		0.96			2.9	0.960	2.784	
26	2.9		0.9			2.9	0.900	2.61	
27	2.8		0.82			2.8	0.820	2.296	
28	2.7		0.72			2.7	0.720	1.944	
29	2.8		0.56			2.8	0.560	1.568	
30	2.75		0.03			2.75	0.030	0.083	Behind vegetation and in center of eddy.
31	2.7		-0.02			2.7	-0.020	-0.054	Same as above.
32	2.1		-0.08			1.89	-0.080	-0.151	Same as above.
32.8	1.2		-0.02			0.48	-0.020	-0.01	Same as above.
32.8	0		0			0	0.000	0	Same as above; RWE.
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 20.15 Computed by:

Notes:

B&L Trust RIM

Stream: Hylebos **Station:** #210 **Staff gage:** 2.01 **Piezo:** 5.4 **Date/Time:** 2/25/2009

Total Distance: 11 **Flow:** 21.0658 **Flow Crew:** TG/LM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
20	3.15		0.05			1.575	0.050	0.079	LWE
21	3.5		0.55			3.5	0.550	1.925	
22	3.4		0.62			3.4	0.620	2.108	
23	3.3		0.8			3.3	0.800	2.64	
24	2.8		0.91			2.8	0.910	2.548	
25	3		0.95			3	0.950	2.85	
26	3		0.98			3	0.980	2.94	
27	2.85		0.85			2.85	0.850	2.423	
28	2.7		0.77			2.7	0.770	2.079	
29	2.8		0.6			2.8	0.600	1.68	
30	2.8		0.05			2.8	0.050	0.14	Behind vegetation, in center of eddy.
31	2.65		-0.08			2.65	-0.080	-0.212	Same as above.
32	2.15		-0.05			2.15	-0.050	-0.108	Same as above.
33	1.3		-0.04			0.65	-0.040	-0.026	RWE, Same as above.
33	0		0			0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 21.07 Computed by:

Notes:

B&L Trust RIM

Stream: Hylebos **Station:** #211 **Staff gage:** 2.22 **Piezo:** 3.02 **Date/Time:** 2/25/2009

Total Distance: 9.5 Replaced fencepost- old sg reading 1.85 **Flow:** 21.1088 **Flow Crew:** TG/LM

			Velocity				**Flow Calculations**		
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
17.5	1.95		-0.8			0.4875	-0.800	-0.39	LWE, lots of vegetation.
18.0	2.3		0.27			1.725	0.270	0.466	
19.0	2.6		1.04			2.6	1.040	2.704	
20.0	2.75		1.35			2.75	1.350	3.713	
21.0	2.5		1.32			2.5	1.320	3.3	
22.0	2.2		1.32			2.2	1.320	2.904	
23.0	1.9		1.35			1.9	1.350	2.565	
24.0	1.6		1.37			1.6	1.370	2.192	
25.0	1.5		1.24			1.5	1.240	1.86	
26.0	1.5		0.85			1.5	0.850	1.275	
27.0	1.65		0.25			1.65	0.250	0.413	
28.0	1.35		0.16			0.675	0.160	0.108	RWE, in vegetation.
28	0					0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 21.11 Computed by:

Notes:

B&L Trust RIM

Stream: Hylebos **Station:** #211 **Staff gage:** 2.22 **Piezo:** 3.02 **Date/Time:** 2/25/2009 11:45

Total Distance: 9.5 Replaced fencepost-
old sg reading 1.85 **Flow:** 22.3801 **Flow Crew:** TG/LM

		Velocity				Flow Calculations			Notes
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	
17.5	1.9		0.06			0.475	0.060	0.029	LWE
18.0	2.15		0.33			1.6125	0.330	0.532	
19.0	2.7		0.97			2.7	0.970	2.619	
20.0	2.65		1.44			2.65	1.440	3.816	
21.0	2.5		1.31			2.5	1.310	3.275	
22.0	2		1.42			2	1.420	2.84	
23.0	1.95		1.43			1.95	1.430	2.789	
24.0	1.7		1.44			1.7	1.440	2.448	
25.0	1.6		1.18			1.6	1.180	1.888	
26.0	1.6		1.02			1.6	1.020	1.632	
27.0	1.7		0.25			1.7	0.250	0.425	
28.0	1.6		0.11			0.8	0.110	0.088	RWE
28	0					0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 22.38 Computed by:

Notes:

B&L Trust RIM

Stream: Ag ditch b/t field & Interurban **Station:** #212 **Staff Gage** 0.8 Piezo: 3.71 **Date/Time:** 2/25/2009

Total Distance: 6.5 **Flow:** 0.2389 **Flow Crew:** TG/LM

Station	Depth	Velocity 0.2	Velocity 0.6	Velocity 0.8	Angle	Flow Calculations Area	Flow Calculations Avg Vel	Flow Calculations Flow	Notes
7.5	0.1		0			0	0	0	LWE at 7.5
7.6	0.4		-0.02			0.1	-0.020	-0.002	
8	0.7		0.01			0.49	0.010	0.005	Reading on top of sediment at 1.4.
9	0.8		0.04			0.8	0.040	0.032	Reading on top of sediment at 1.4.
10	0.9		0.05			0.9	0.050	0.045	Reading on top of sediment at 1.4.
11	0.9		0.11			0.9	0.110	0.099	Reading on top of sediment at 1.4.
12	0.8		0.08			0.8	0.080	0.064	Reading on top of sediment at 1.0.
13	0.55		0			0.55	0.000	0	Reading at 1.0 on top of vegetation.
14	0.4		-0.02			0.2	-0.020	-0.004	RWE, reading at 0.7.
14						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 0.239 Computed by:

Notes:

B&L Trust RIM

Stream: Surprise Lake Drain - Upstream **Station:** #213 **Staff gage:** 0.4 **Piezo:** 4.73 **Date/Time:** 2/25/2009 11:30

Total Distance: 3.9 **Flow:** 1.7597 **Flow Crew:** TG/LM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
0.9	1		0.29			0.55	0.290	0.16	LWE at bulkhead
2.0	1.1		0.66			1.155	0.660	0.762	Reading taken behind staff guage, may influence rate of flow.
3.0	0.9		0.76			0.9	0.760	0.684	
4.0	0.9		0.19			0.81	0.190	0.154	Reading at 45 degree angle away from right b
4.8	0		0			0	0.000	0	RWE
4.8						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 1.76 Computed by:

Notes:

B&L Trust RIM

Stream: Surprise Lake Drain - Upstream **Station:** #213 **Staff gage:** 0.4 **Piezo:** 4.73 **Date/Time:** 2/25/2009 11:30

Total Distance: 3.9 **Flow:** 1.7885 **Flow Crew:** TG/LM

Station	Depth	Velocity				Flow Calculations			Notes
		0.2	0.6	0.8	Angle	Area	Avg Vel	Flow	
0.9	1		0.38			0.55	0.380	0.209	LWE at bulkhead
2.0	1.1		0.6			1.155	0.600	0.693	Reading taken behind staff guage, may influence rate of flow.
3.0	0.9		0.94			0.9	0.940	0.846	
4.0	0.9		0.05			0.81	0.050	0.041	
4.8	0		0			0	0.000	0	RWE
4.8						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 1.789 Computed by:

Notes:

B&L Trust RIM

Stream: Ag ditch b/t LF & Pumpkins **Station:** #214 **Staff gage:** 0.72 **Piezo:** 3.17 **Date/Time:** 2/25/2009

Total Distance: 7 **Flow:** 0.2039 **Flow Crew:** TG/LM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
1.9	0		0			0	0.000	0	LWE at 1.9 lot of vegetation (2/25)
3	1		0.01			1.05	0.010	0.011	
4	1.25		0			1.25	0.000	0	6" of sed
5	1.45		-0.01			1.45	-0.010	-0.015	6" of sed, elevated meter to get out of sed
6	1.4		0.13			1.4	0.130	0.182	6" of sed, elevated meter to get out of sed
7	1.45		0.01			1.45	0.010	0.015	6" of sed, elevated meter to get out of sed
8	0.4		0.03			0.38	0.030	0.011	on top of veg
8.9	0					0	0.000	0	RWE in veg
						0	0.000	0	
	0					0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
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						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 0.204 Computed by:

Notes:

B&L Trust RIM

Stream: Ag ditch b/t LF & Pumpkins **Station:** #214 **Staff gage:** 0.72 **Piezo:** 3.17 **Date/Time:** 2/25/2009

Total Distance: 6.1 **Flow:** 0.256 **Flow Crew:** LM/TG

		Velocity				Flow Calculations			
Station	Depth	0.2	0.6	0.8	Angle	Area	Avg Vel	Flow	Notes
1.9	0		0			0	0.000	0	LWE at 1.9 lot of vegetation (2/25)
3	1		0			1.05	0.000	0	
4	1.25		0			1.25	0.000	0	6" of sed
5	1.4		-0.01			1.4	-0.010	-0.014	6" of sed, elevated meter to get out of sed
6	1.45		0.17			1.45	0.170	0.247	6" of sed, elevated meter to get out of sed
7	1.5		0.01			1.5	0.010	0.015	6" of sed, elevated meter to get out of sed
8	0.5		0.02			0.425	0.020	0.009	on top of veg
8.7	0					0	0.000	0	RWE in veg at 8.7'
						0	0.000	0	
	0					0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
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						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 0.256 Computed by:

Notes:

B&L Trust RIM

Stream: Ag ditch b/t LF & Pumpkins **Station:** #215 **Staff gage:** 0.9 **Piezo:** 4.22 **Date/Time:** 2/25/2009

Total Distance: 8.5 **Flow:** 0.19 **Flow Crew:** TG/LM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
7	0		0			0	0.000	0	LWE at 7.04
8	0.4		0.02			0.4	0.020	0.008	Reading on top of sed at 0.9
9	0.6		0.02			0.6	0.020	0.012	Reading on top of sed at 0.7
10	1.6		0.07			1.6	0.070	0.112	Reading on top of sed at 3.1
11	1.5		0.01			1.5	0.010	0.015	Reading on top of veg at 2.8
12	0.65		0.02			0.65	0.020	0.013	Reading on top of veg at 1.4
13	0.9		0.03			0.9	0.030	0.027	Reading on top of veg at 0.4
14	0.3		0.01			0.3	0.010	0.003	Reading on top of veg
15	0		0			0	0.000	0	
15.5			0			0	0.000	0	RWE, on top of veg
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	LBHP = 0
						0	0.000	0	RBHP = 17
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Calc. Flow: 0.19 Computed by:

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Notes:

B&L Trust RIM

Stream: Fife Ag Ditch **Station:** #216 **Staff gage:** 1.85 **Piezo:** 4.16 **Date/Time:** 2/25/2009 11:08

Total Distance: 4.0 **Flow:** 1.7224 **Flow Crew:** TG/LM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
2.3	1		0.3			0.35	0.300	0.105	LWE, in vegetation
3.0	1.1		0.44			0.935	0.440	0.411	
4.0	1.1		0.5			1.1	0.500	0.55	
5.0	1		0.5			1	0.500	0.5	
6.0	0.6		0.4			0.39	0.400	0.156	
6.3			0			0	0.000	0	RWE
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 1.722 Computed by:

Notes:

B&L Trust RIM

Stream: Fife Ag Ditch **Station:** #216 **Staff gage:** 1.85 **Piezo:** 4.16 **Date/Time:** 2/25/2009 11:08

Total Distance: 4.1 **Flow:** 1.50495 **Flow Crew:** TG/LM

Station	Depth	Velocity				Flow Calculations			Notes
		0.2	0.6	0.8	Angle	Area	Avg Vel	Flow	
2.2	1		0.2			0.4	0.200	0.08	LWE, in vegetation
3.0	1.25		0.35			1.125	0.350	0.394	
4.0	1.1		0.5			1.1	0.500	0.55	
5.0	1		0.45			1	0.450	0.45	
6.0	0.8		0.06			0.52	0.060	0.031	
6.3			0			0	0.000	0	RWE
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 1.505 Computed by:

Notes:

B&L Trust RIM

Stream: Surprise lake Drain @ Culvert **Station:** #225 **Staff gage:** 0.25 **Piezo:** None **Date/Time:** 2/25/2009 1140

Total Distance: 6.2 **Flow:** 2.8257 **Flow Crew:** TG/LM

		Velocity				Flow Calculations			
Station	**Depth**	**0.2**	**0.6**	**0.8**	**Angle**	**Area**	**Avg Vel**	**Flow**	**Notes**
0.4	0.01		0			0.003	0.000	0	LWE, behind vegetation
1.0	0.4		-0.03			0.32	-0.030	-0.01	behind vegetation
2.0	0.65		0.03			0.65	0.030	0.02	behind vegetation
3.0	0.7		0.87			0.7	0.870	0.609	
4.0	0.75		1.24			0.75	1.240	0.93	
5.0	0.7		1.2			0.7	1.200	0.84	
6.0	0.65		0.84			0.52	0.840	0.437	
6.6			0			0	0.000	0	RWE
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
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						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	
						0	0.000	0	RWE (9/26)

Angle	Cosine
0	1.000
15	0.966
30	0.866
45	0.707
60	0.500
75	0.259
90	0.000
105	-0.259
120	-0.500
135	-0.707
150	-0.866
165	-0.966
180	-1.000

Calc. Flow: 2.826 Computed by:

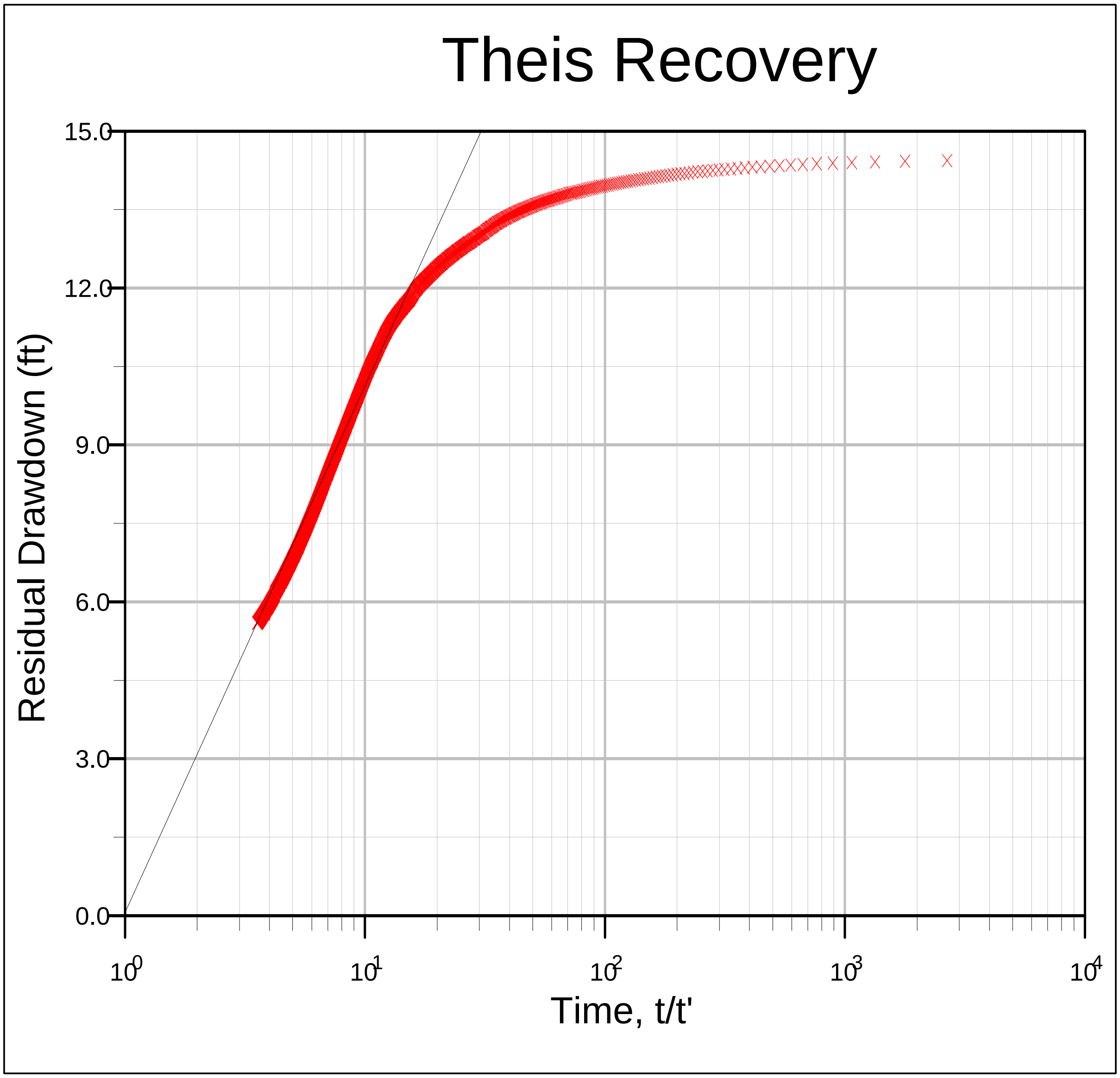
Notes:

B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR)

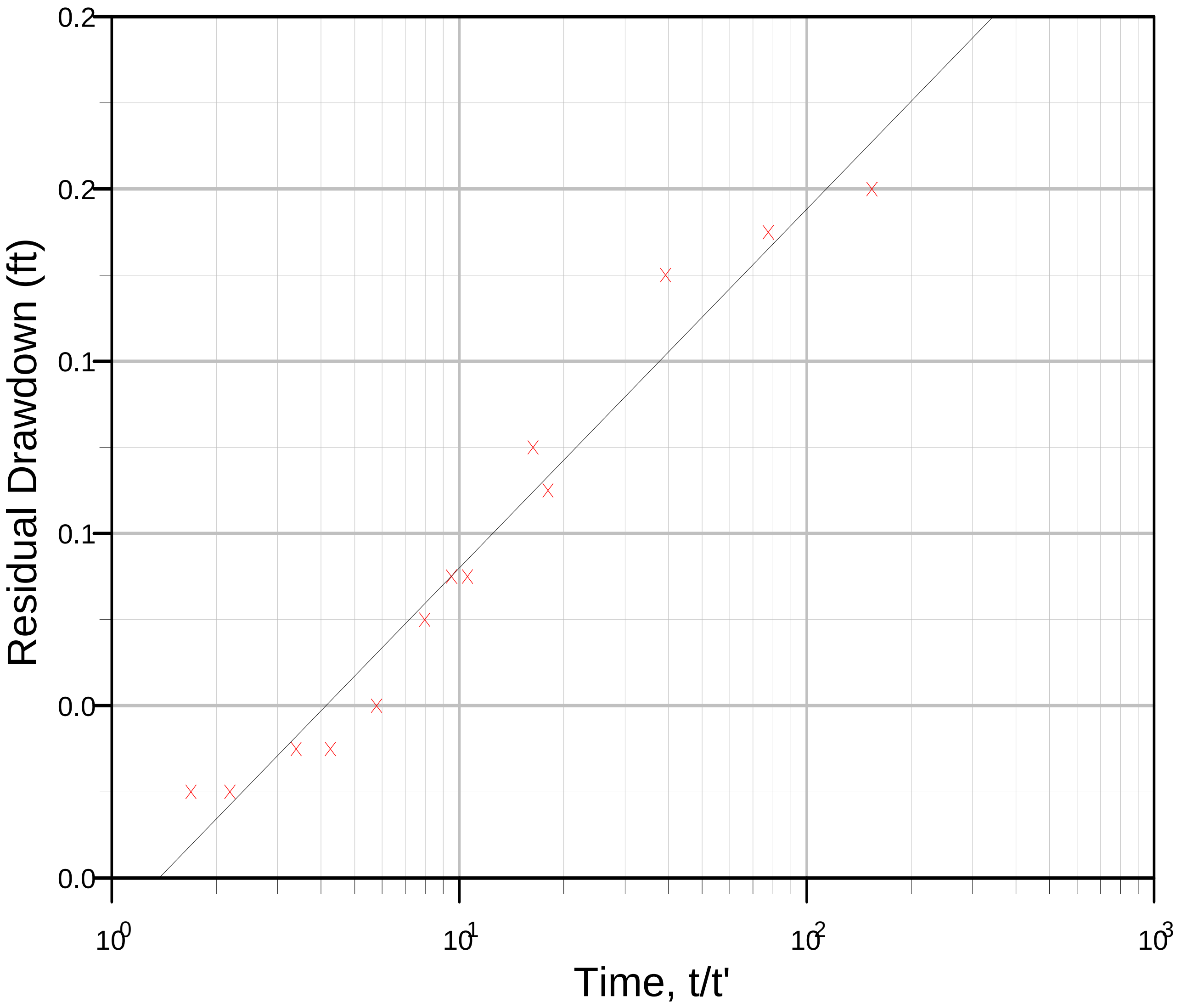
Attachment C3
Phase 1 Hydrogeologic Study Report
Aquifer Test Solutions

FINAL

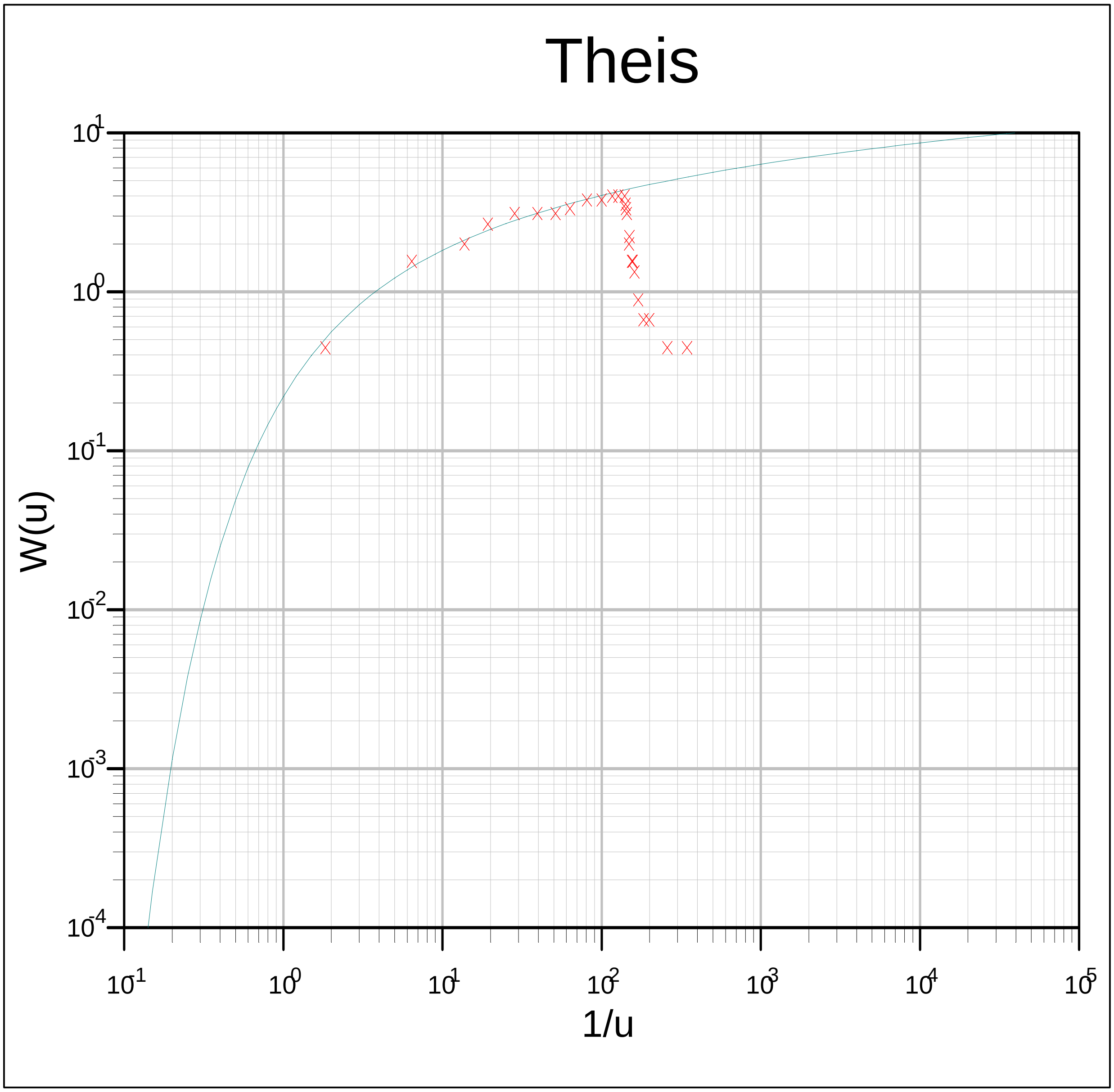


Pumping Well:	PD-104	**Solution:**	Theis Recovery
Observation Well:	PD-104	**Transmissivity:**	5.039 ft^2/day
Radial Distance:	0	**Storativity:**	NA
Pumping Rate:	1.45 gpm		

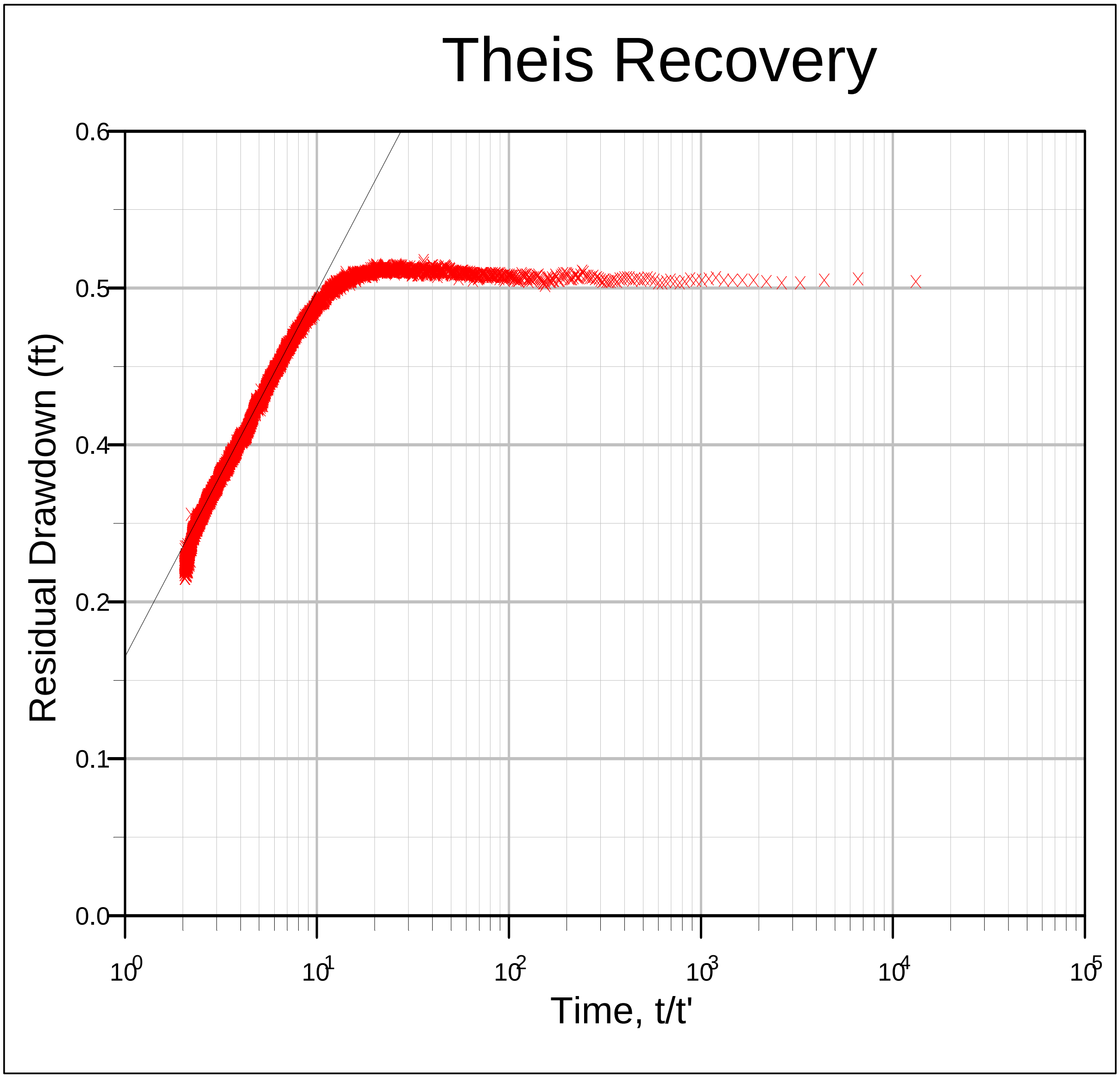
Theis Recovery



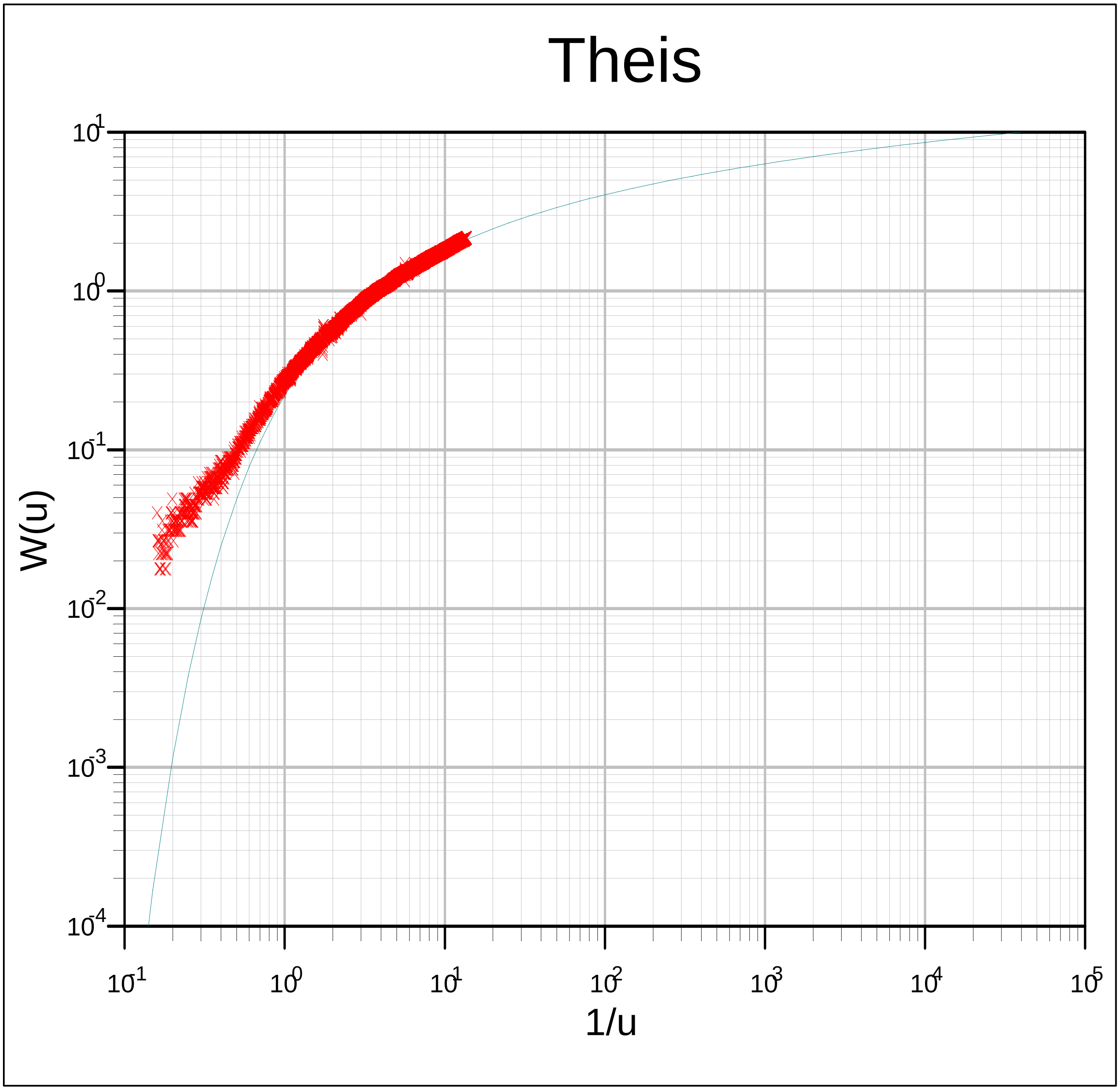
Pumping Well:	MW-17	**Solution:**	Theis Recovery
Observation Well:	FS-22	**Transmissivity:**	4230 ft^2/day
Radial Distance:	19 feet	**Storativity:**	NA
Pumping Rate:	10 gpm		



Pumping Well:	MW-17	**Solution:**	Theis Unconfined
Observation Well:	FS-22	**Transmissivity:**	3405 ft^2/day
Radial Distance:	19 feet	**Storativity:**	0.028
Pumping Rate:	10 gpm		

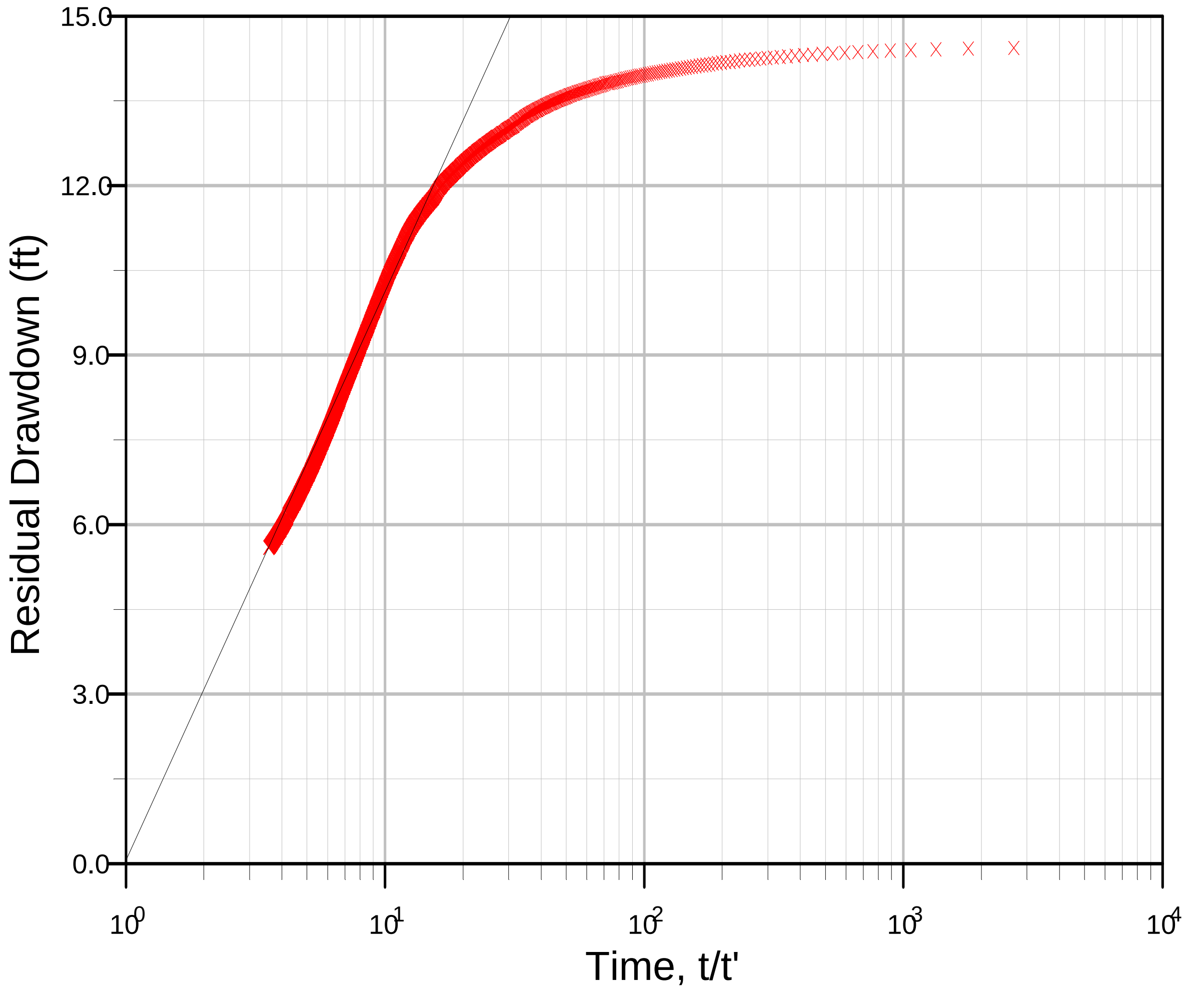


Pumping Well:	PD-62	**Solution:**	Theis Recovery
Observation Well:	PD-104	**Transmissivity:**	181.6 ft^2/day
Radial Distance:	42.2	**Storativity:**	NA
Pumping Rate:	1.45 GPM		

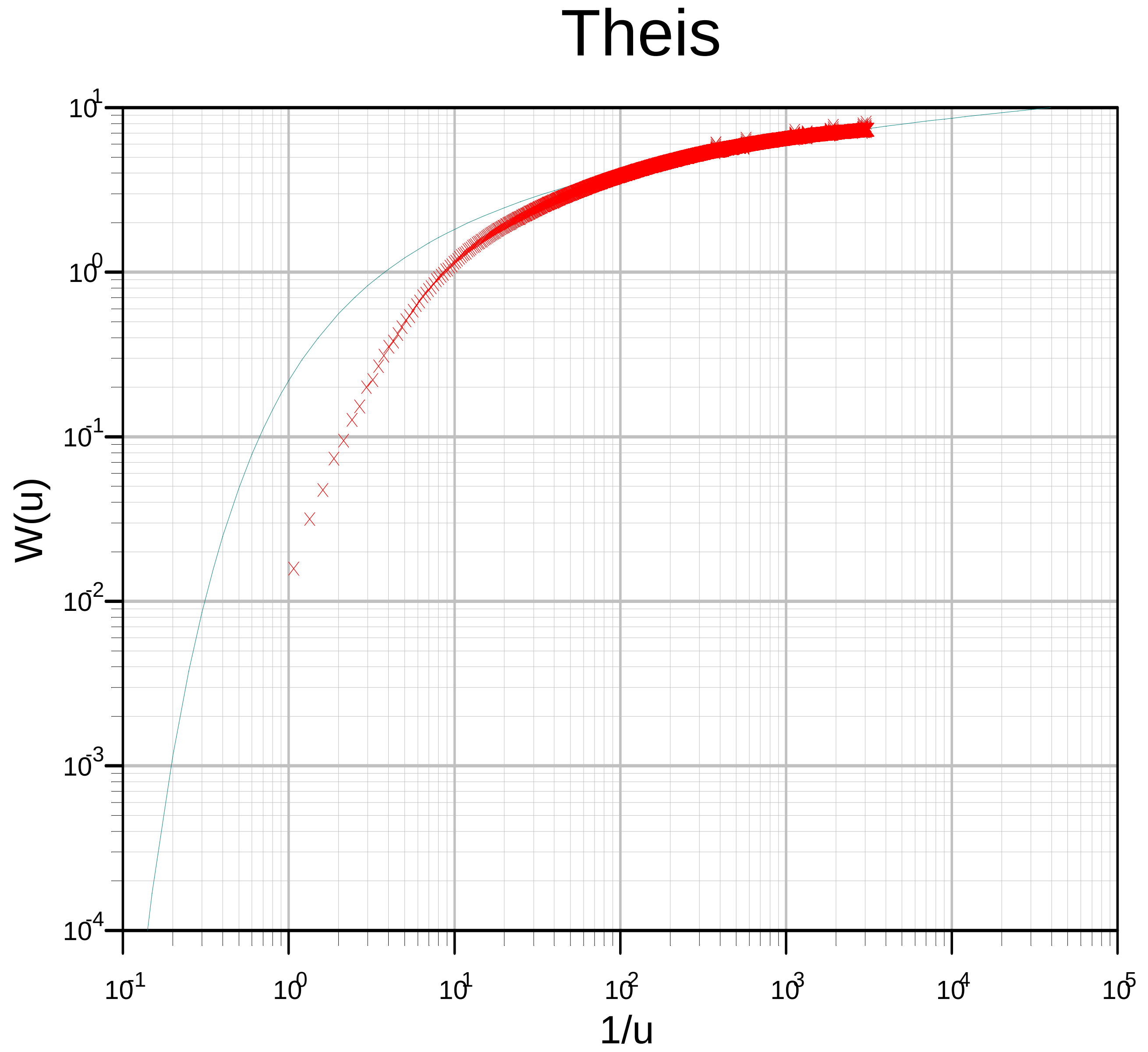


Pumping Well:	PD-62	**Solution:**	Theis
Observation Well:	PD-104	**Transmissivity:**	98.28 ft^2/day
Radial Distance:	42.2	**Storativity:**	0.0012
Pumping Rate:	1.45 GPM		

Theis Recovery



Pumping Well:	PD-101	**Solution:**	Theis Recovery
Observation Well:	PD-70	**Transmissivity:**	1961 ft^2/day
Radial Distance:	10.55 ft	**Storativity:**	NA
Pumping Rate:	14 gpm		



Pumping Well:	PD-101	**Solution:**	Theis Unconfined
Observation Well:	PD-70	**Transmissivity:**	1131 ft^2/day
Radial Distance:	10.55 ft	**Storativity:**	NA
Pumping Rate:	14 gpm		

B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR)

Appendix D
Critical Areas Study

FINAL

B&L Woodwaste Site

Critical Areas Study

Prepared by

FLOYD | SNIDER

601 Union Street, Suite 600
Seattle, WA 98101

Geomatrix

3500 - 188th Street S.W., Suite 600
Lynnwood, WA 98037-4763

Review Draft
June 30, 2008

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List of Acronyms and Abbreviations

Acronym/Abbreviation	Definition
AMEC	AMEC Geomatrix, Inc.
Asarco	ASARCO, LLC
bgs	Below ground surface
CAP	Cleanup Action Plan
CAS	Critical Areas Study
Consent Decree	B&L Landfill Consent Decree
dtw	Depth to water table
Ecology	Washington State Department of Ecology
FAC	Facultative
FACU	Facultative upland
FACW	Facultative wetland
FMC	City of Fife Municipal Code
FWS	Free water surface
Landfill	B&L Woodwaste Landfill
MMC	City of Milton Municipal Code
Murray	Murray Pacific Corporation
NWI	National Wetlands Inventory
OBL	Obligate wetland
PLP	Potentially liable party
Project Team	Floyd|Snider and AMEC Geomatrix, Inc.
SEPA	State Environmental Policy Act
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WDWP	Wetlands Delineation Work Plan
WDFW	Washington State Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

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1.0 Introduction

On May 7, 2008, Floyd|Snider and AMEC Geomatrix, Inc. (AMEC, the Project Team), conducted an investigation to determine the presence and extent of critical areas in the vicinity of the existing B&L Woodwaste Landfill (Landfill). The area extends over several parcels located within the cities of Milton and Fife and in unincorporated Pierce County. Parcel addresses include 552 through 817 Fife Way, in Milton and Fife, Washington. The Landfill property is located in Township 20 North, Range 4 East, Section 5, in Pierce County (Figure 1). The Landfill was used from the mid-1970s until the early 1980s. Wood waste originating from log sort yards in Commencement Bay, mixed with soil and Asarco, Inc. (Asarco) smelter slag (used as a base material for the log sort yards), were taken to the Landfill for disposal. The Asarco slag leached arsenic into soils and groundwater.

In 1992, the Washington State Department of Ecology (Ecology) issued an Enforcement Order requiring Asarco, and other potentially responsible parties (Murray Pacific, Louisiana-Pacific, and Executive Bark) to consolidate the wood waste into an 11-acre landfill, construct a multilayer capping system, and install and operate a groundwater monitoring well system. In the years following implementation of this remedy, an extensive study of the wetland area north of the landfill was conducted. The study found that dissolved arsenic levels in the groundwater in the wetland were greater than applicable cleanup standards and required additional evaluation.

In the meantime, Asarco filed for bankruptcy and Murray Pacific Corporation (Murray) stepped in as lead potentially liable party (PLP) for the site. As part of the B&L Woodwaste Site Consent Decree (Consent Decree) currently under public review, Murray has agreed to perform certain elements of the remedial action defined in the 2008 Final Cleanup Action Plan (CAP). Upon completion of these elements, the State of Washington will assume responsibility for the site, including the operation, maintenance, and monitoring requirements of the remedy, which comprise the remaining remedial actions specified in the CAP.

Implementation of the remedial action specified in the CAP will occur in three major phases, with MURRAY performing Phases 1 and 2. Phase 3, to be performed by Ecology, includes operation, maintenance, and monitoring of the remedy after completion of all work required to be performed by Murray under the Consent Decree.

Phase 1 includes design and construction of the physical containment and in-situ treatment components of the remedy. Work to be completed includes investigations necessary to complete the design and permitting processes, and an archaeological assessment of the site. Phase 1 construction is comprised of three major elements that will be performed concurrently:

1. Pilot testing, design, and implementation of the remedy needed for the area at the leading end of the arsenic plume.
2. Design, permitting, and construction of a barrier wall and upgradient interceptor trench to contain the area immediately beneath the Landfill.
3. Design, permitting, and construction of an interim system to recover and treat groundwater from the hotspot area within the wetlands.

This approach will complete the physical containment for the landfill, will treat the leading edge of the plume to reduce arsenic concentration and mobility, and will include an expedited mass-removal action to begin remediation of the wetlands. The End-of-Plume remedial action will allow downgradient restoration projects by others (for example, relocation of Hylebos Creek) to proceed independent of remediation work for the B&L Woodwaste Site.

Phase 2 will include additional hydrogeologic studies to fully characterize Site groundwater and support design of the hydraulic control components specified in the CAP. Phase 2 work will commence as Phase 1 work is completed. Phase 2 construction will include the following:

1. Permitting and excavation of contaminated sediments in the ditches designated in the CAP, followed by restoration of the ditches.
2. Permitting and construction of a groundwater recovery and collection system beneath the landfill in the areas defined in the CAP as the “Halo”.
3. Permitting and construction of a groundwater remediation system for the wetlands area immediately north of the Landfill.
4. Permitting and construction of a groundwater treatment system capable of removing groundwater contaminants to regulatory levels.
5. Permitting and construction of a system for infiltration and/or discharge of treated groundwater.

Following construction, the recovery, treatment, and discharge systems will be commissioned and started up to confirm that the systems meet design specifications and achieve design requirements. After systems have been proven operable and the requirements specified in the Consent Decree have been met and approved by Ecology, Phase 3, which consists of long-term operation and maintenance, will commence.

The remediation area that will potentially be affected by implementation of the CAP remedy is shown in Figure 3. Phase 1 work is projected for completion in the fall of 2009 and Phase 2 work is projected for completion by the end of 2012. Since designs have not been completed, it is not possible to identify the full nature of the work that will be performed and, consequently, the area that must be disturbed. However, the areas that will be disturbed this year for completing the pre-design studies have been determined. This Critical Areas Study (CAS) describes the identified wetland locations and boundaries, and characterizes wetlands located within the remediation area that will be affected by work to be completed in 2008; this area has been designated the 2008 work area for the purposes of this report.

The Project Team delineated four wetlands within the 2008 work area and identified two wetland areas from the National Wetland Inventory (NWI) that are close to but outside of the remediation area. The wetlands located within the 2008 work area are classified as Category I, III, and IV wetlands in accordance with the Ecology wetland rating system. The delineated wetland outside of the remediation area is likely classified as Category II wetland (Hruby 2004). Hylebos Creek, a Type F stream, is located to the northwest of the remediation area (Washington State Department of Natural Resources 2008).

As described in the Web Soil Survey for Township 20 North, Range 4 East, Section 5, Washington (Natural Resource Conservation Service 2008), most of the soils of the properties within the 2008 work area are mapped as Semiahmoo muck. Soils in the southwestern portion of the area are mapped as Shalar muck, Sultan silt loam, and Tisch silt. The Semiahmoo and Shalar muck series are very poorly-drained hydric soils, with a depth to water (dtw) of 0 to 12 inches. The Sultan silt loam series is a moderately well-drained non-hydric soil, with a dtw of 18 to 24 inches. The Tisch silt series is a very poorly-drained non-hydric soil, with a dtw of 0 to 12 inches.

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2.0 Methods

2.1 DELINEATION

Project Team scientists delineate wetlands based on best professional judgment, existing site conditions during field analysis, and information from previous environmental site investigations. Wetland boundaries were delineated using the Routine Determinations method described in the U.S. Army Corps of Engineers (USACE) Wetland Determination Manual (USACE 1987), to comply with Pierce County and federal regulations. USACE requires that three characteristics be present for an area to be identified as a wetland: (1) hydrophytic vegetation, (2) hydric soil, and (3) wetland hydrology. The methods used to determine the presence of each characteristic are described in Appendix A. A total of six test plots (TP1, TP2, etc.) were used to describe the wetland and upland characteristics. Test plots consist of a 10- to 30-foot circular plot centered on an 18-inch-deep pit. The circular plot is used to characterize the dominant plant species in the area. The pit is used to characterize the soil and hydrologic characteristics of the area. Delineated and surveyed wetland boundaries are subject to verification and approval by jurisdictional agencies.

2.2 WETLAND RATING

Project Team scientists determined wetland ratings using the Washington State Wetland Rating System for Western Washington (Hruby 2004) to assess the resource value of the identified wetlands. This rating system is based on the wetland functions and values, sensitivity to disturbance, rarity, and irreplaceability.

Category I wetlands are generally considered uncommon wetlands that have one or more of the following characteristics:

- Provide life support for threatened or endangered species
- Are on file in databases maintained by state agencies
- Are not hydrologically isolated (e.g., connected to estuarine water or tidal fresh water)
- Represent a high-quality example of a rare wetland; are rare within a given region
- Are relatively undisturbed and contain ecological attributes that are impossible to replace within a human lifetime

Examples of Category I wetlands are mature forested wetlands, estuarine wetlands, kelp beds, bogs, and fens.

Category II wetlands have one or more of the following characteristics:

- Occur more commonly than Category I wetlands
- Provide habitat for very sensitive or important wildlife of plant species

- Are partially or completely hydrologically isolated
- Are difficult to replace
- Provide very high functions, particularly for wildlife

Examples of Category II wetlands are bogs and fens less than 0.5 acre in size and wetlands with high wildlife functions but have human-related disturbances such as diking, ditching, or grazing.

Category III wetlands have one or more of the following characteristics

- Provide habitat for a variety of wildlife
- Occur more commonly than Category I or II wetlands
- Are smaller, less diverse, and more hydrologically isolated than Category II wetlands

Examples of Category III wetlands are hydrologically-isolated scrub-shrub or emergent wetlands with moderate wildlife functions.

Category IV wetlands have the following characteristics

- Are less than 1 acre in size with one dominant vegetation class by one species
- Are less than 2 acres in size with one dominant vegetation class by one species by invasive or exotic species
- Are hydrologically isolated

Examples of Category IV wetlands are hydrologically-isolated wetlands dominated by reed canarygrass.

3.0 Results

3.1 WETLANDS

The areas identified as wetlands met all three jurisdictional wetland criteria (hydrophytic vegetation, hydric soils, and wetland hydrology). The wetland determination forms and wetland rating forms supporting this determination are provided in Appendices B and C, respectively. Table 1 lists the plant species found in the wetlands and their associated wetland indicator status (Reed 1988; Reed et al. 1993). Figure 2 presents the location and extent of wetlands. Site photographs are provided in Appendix D.

3.1.1 Wetland A

Wetland A, approximately 0.2 acre in area, is located just east of the southeast corner of the Landfill (Figure 2). All of Wetland A is within the 2008 work area. The southwestern corner of Wetland A drains into an unnamed ditch, which is connected to the ditch that runs along the Interurban Trail. The ditch that runs along the Interurban Trail drains into the Surprise Lake Drain, which discharges into Hylebos Creek, a “Water of the U.S.”, as defined by USACE. Thus, there is a surface water connection between Wetland A and a “Water of the U.S.”.

Wetland A is classified as a seasonally-saturated, emergent wetland with persistent vegetation (PEM1R), per the Cowardin classification system (Cowardin et al. 1979). As described in the Ecology rating system, this wetland is a Category IV wetland (Table 2; Appendix C). Test Plot 1 (TP1) is representative of Wetland A, which is dominated by soft rush (Juncus effusus), fox sedge (Carex vulpinoidea), velvetgrass (Holcus lanatus), Pacific willow (Salix lucida), Scouler’s willow (Salix scouleriana), white clover (Trifolium repens), and red fescue (Festuca rubra). Because more than 50 percent of the dominant plant species have an indicator status of facultative (FAC), facultative wetland (FACW), or obligate wetland (OBL), vegetation in Wetland A meets the wetland vegetation criterion (Table 1).

One soil test pit was dug in Wetland A. The surface horizon (A horizon) extends to 18 inches and is a saturated, dark grayish brown (10YR 4/2) sand with gravel (highly compacted fill material) and very few, small, distinct, yellowish brown (10YR 5/6) mottles. A low chroma value (i.e., the last digit of the Munsell™ soil color is a 1 without mottles or a 2 with mottles) in soil 2 inches below the A horizon is a positive indicator of hydric soils, thus meeting the hydric soils criterion.

Primary indicators of wetland hydrology observed included areas of 1 to 2 inches of inundation and saturated soils at the surface. Secondary indicators of wetland hydrology observed included a positive FAC neutral test, water-stained vegetation, and drainage patterns. A positive FAC neutral test is defined as when the number of species with indicator status of FACW- or wetter is greater than the number of species with indicator status of facultative upland (FACU)+ or drier. The presence of two primary and three secondary indicators meets the wetland hydrology criterion.

The wetland boundary was identified based on the defined contour of the drainage pattern, and a distinct vegetation shift from soft rush and white clover dominated vegetation (characteristic of wetland habitat) to the presence of red clover (Trifolium pratense) and hairy cat's ear (Hypochaeris radicata) (characteristic of upland habitat).

3.1.2 Wetland B

Wetland B, approximately 0.7 acre in area, is located northeast of Wetland A, just east of the northeast corner of the landfill (Figure 2). All of Wetland B is within the 2008 work area. The northern end of Wetland B drains via a stormwater pond with stand pipe into the ditch that runs along the Interurban Trail. Thus, there is a surface water connection between Wetland B and a "Water of the U.S.".

Wetland B is classified as a seasonally-saturated, emergent wetland with persistent vegetation (PEM1R), according to the Cowardin classification system (Cowardin et al. 1979). In accordance with the Ecology rating system, this wetland is a Category III wetland (Table 2; Appendix C). Test Plot 4 (TP4) is representative of Wetland B. Wetland B is dominated by soft rush, black cottonwood (Populus balsamifera ssp. trichocarpa), hooker willow (Salix hookeriana), red clover, redtop (Agrostis gigantea), reed canarygrass (Phalaris arundinacea), and unidentified grass. Because more than 50 percent of the dominant plant species have an indicator status of FAC, FACW, or OBL, vegetation in Wetland B meets the wetland vegetation criterion (Table 1).

One soil test pit was dug in Wetland B. The surface horizon (A horizon) extends to 6 inches and is a saturated, very dark gray (7.5YR 3/1) sand with many fine root masses and without mottles. The B horizon extends from 6 to 18 inches and is a saturated, dark gray (2.5Y 4/1) sand with a little gravel and without mottles. A low chroma value (i.e., the last digit of the Munsell™ soil color is a 1 without mottles or a 2 with mottles) in soil 2 inches below the A horizon is a positive indicator of hydric soils, thus meeting the hydric soils criterion.

Primary indicators of wetland hydrology observed included areas of 1 to 2 inches of inundation, saturated soils at the surface, and free water at the surface in the test pit. Secondary indicators of wetland hydrology observed included a positive FAC neutral test, local soil survey characteristics, and drainage patterns. The presence of two primary and three secondary indicators meets the wetland hydrology criterion.

The wetland boundary was identified based on the defined contour of the inundation and saturated surface soils, drainage pattern, and a distinct vegetation shift from soft rush dominated vegetation (characteristic of wetland habitat) to the presence of red clover and hairy cat's ear (characteristic of upland habitat).

3.1.3 Wetland C

Wetland C, approximately 59 acres in area, is located north of the Landfill and the Interurban Trail. Approximately 7 acres of Wetland C is within the 2008 work area. The 12th Street E. unimproved road grade bisects Wetland C (Figure 2). Hylebos Creek flows west along the northern and western edges of the wetland before crossing west under Interstate 5. A ditch flows north along the southwestern edge of Wetland C and discharges into Hylebos Creek, where it flows under Interstate 5. A small portion of Wetland C located northeast of the lower section was designated on the NWI, as noted on Figure 2. This area appears contiguous with the wetland that continues to the north of 12th Street E.

Wetland C is classified as a seasonally-saturated, scrub-shrub, emergent wetland with persistent vegetation (PSS/EM1R) (Cowardin et al. 1979). Under the Ecology rating system, this wetland is a Category I wetland (Table 2; Appendix C). Test Plot 5 (TP5) is representative of Wetland C. Wetland C is dominated by reed canarygrass, Sitka willow (Salix sitchensis), and Pacific willow. Because more than 50 percent of the dominant plant species have an indicator status of FAC, FACW, or OBL, vegetation in Wetland C meets the wetland vegetation criterion (Table 1).

One soil test pit was dug in Wetland C. The surface horizon (A horizon) extends to 8 inches and is a saturated, very dark gray (7.5YR 3/1), silt loam without mottles. The B horizon extends from 8 to 17 inches and is a saturated, very dark gray (7.5YR 3/1), silt loam with common, medium, distinct gray (5YR 5/1) mottles. The C horizon extends from 17 to 18 inches and is a saturated, very dark grayish brown (10YR 3/2) loam with peat. A low chroma value (i.e., the last digit of the Munsell™ soil color is a 1 without mottles or a 2 with mottles) in soil 2 inches below the A horizon is a positive indicator of hydric soils, thus meeting the hydric soils criterion.

Primary indicators of wetland hydrology observed included areas of more than 6 inches of inundation, saturated soils at the surface, and free water at the surface in the test pit. Secondary indicators of wetland hydrology observed included a positive FAC neutral test, local soil survey characteristics, watermarks, local soils survey characteristics, water-stained leaves, and drainage patterns. The presence of the two primary and the five secondary indicators meets the wetland hydrology criterion.

The northern, eastern, and southern wetland boundaries were identified on-site based on the drainage pattern (i.e., slopes associated with the Interurban Trail and 12th Street E. road grade). The western wetland boundary was not identified because the wetland continued west, off site.

3.1.4 Wetland D

For purposes of this report, a wetland originally identified and designated as Wetland D was merged into Wetland C and therefore does not appear in this CAS.

3.1.5 Wetland E

Wetland E, approximately 4.25 acres in area, is located north of Wetland B, northeast of the Landfill, and south of the ditch that runs along the Interurban Trail (Figure 2). All of Wetland E is outside of the remediation area. A portion of Wetland E was identified by the NWI (Figure 2). Wetland delineation flagging dated 12/15/2005 was observed hanging on vegetation along the southwest and northwest edges of the wetland.

Wetland E is classified as a seasonally-saturated, forested and emergent wetland with persistent vegetation (PFO/EM1R) (Cowardin et al. 1979). Under the Ecology rating system, this wetland is a Category II wetland (Table 2; Appendix C). Because Wetland E is off-site, no test plot was established. Dominant vegetation was based on observations made from the Interurban Trail. Wetland E is dominated by black cottonwood, willow, and hawthorne (Crataegus douglasii). Because more than 50 percent of the dominant plant species have an indicator status of FAC, FACW, or OBL, vegetation in Wetland E meets the wetland vegetation criterion (Table 1).

No soil test pit was dug in Wetland E. According to the Web Soil Survey for Township 20 North, Range 4 East, Section 5, Washington (NRCS, 2008), Wetland E soils are mapped as Semiahmoo muck, a hydric soil. Because of the observed inundation, observed wetland delineation flagging, observed hydrophytic vegetation, and the area being mapped as a hydric soil, it is assumed the hydric soils criterion is met.

Primary indicators of wetland hydrology observed included areas of up to 8 inches of inundation and saturated soils at the surface. Secondary indicators of wetland hydrology observed included a positive FAC neutral test, local soils survey characteristics, water-stained leaves, and drainage patterns. The presence of two primary and four secondary indicators meets the wetland hydrology criterion.

Because the wetland is located off site, only the wetland boundaries along the southwestern and northwestern side could be estimated. The southwestern and northwestern wetland boundaries were identified on-site based on the existing wetland delineation flagging observed and the drainage pattern (i.e., slopes associated with the Interurban Trail and an access road along the landfill). The eastern and southern wetland boundaries were not identified because the entire wetland is off site.

3.1.6 Wetland F

Wetland F, approximately 0.05 acre in area, is located just west of the northwest corner of the Landfill (Figure 2). All of Wetland F is within the remediation area. The northern edge of Wetland F is adjacent to the ditch that runs along the Interurban Trail and the eastern edge is adjacent to the unnamed ditch. Thus, there is a surface water connection between Wetland F and a “Water of the U.S.”.

Wetland F is located mostly within an agricultural field. The edge is classified as a seasonally-saturated, emergent wetland with persistent vegetation (PEM1R), per the Cowardin classification system (Cowardin et al. 1979). Under the Ecology rating system, this wetland is a Category IV wetland (Table 2; Appendix C). Test Plot 8 (TP8) is representative of Wetland F. Wetland F is dominated by reed canarygrass, field bindweed (Convolvulus arvensis), and stinging nettle (Urtica dioica). Because more than 50 percent of the dominant plant species have an indicator status of FAC, FACW, or OBL, vegetation in Wetland F meets the wetland vegetation criterion (Table 1).

One soil test pit was dug in Wetland F. The surface horizon (A horizon) extends to 6 inches and is a moist, very dark grayish brown (10YR 3/2), silt loam with common, small, faint, brown (7.5YR 4/4) mottles. The B horizon extends from 6 to 18 inches and is a moist, very dark grayish brown (10YR 3/2), silt loam with many, small to medium, faint, dark brown (7.5YR 3/4) mottles. A low chroma value (i.e., the last digit of the Munsell™ soil color is a 1 without mottles or a 2 with mottles) in soil 2 inches below the A horizon is a positive indicator of hydric soils, thus meeting the hydric soils criterion.

No primary indicators of wetland hydrology were observed. Secondary indicators of wetland hydrology observed included oxidized rhizospheres, a positive FAC neutral test, and drainage patterns. The presence of three secondary indicators meets the wetland hydrology criterion.

The wetland is bounded to the north and east by agricultural ditches. Due to the lack of vegetation, the southern wetland boundary was based on the presence (characteristic of wetland habitat) or the absence (characteristic of upland habitat) of mottles within the top 12 inches of soil.

3.2 DITCHES

3.2.1 Unnamed Ditch

A small ditch flows west from the western edge of Wetland A into an agricultural ditch. This agricultural ditch drains into the ditch that runs along the Interurban Trail near the northwestern corner of the Landfill. The ditch is approximately 3 to 5 feet wide and 6 feet deep. Water in the ditch was approximately 8 inches deep at the time of the survey.

3.2.2 Interurban Trail Ditch

The ditch that runs along the Interurban Trail is located on the southern edge of the Interurban Trail and flows westward into the Surprise Lake Drain. The ditch is approximately 6 to 10 feet wide and 4 to 5 feet deep. Water in the ditch was approximately 2 inches deep at the time of the survey.

3.2.3 Surprise Lake Drain

The Surprise Lake Drain, which flows from Surprise Lake into Hylebos Creek on the west side of Interstate 5, is a tributary to Hylebos Creek. Within and near the remediation area, the Surprise Lake Drain is about 8 feet wide and 6 feet deep. Water in the Drain was approximately 4 to 6 inches deep at the time of the survey. The Surprise Lake Drain is designated as a Type F stream (Washington State Department of Natural Resources [DNR] 2008).

3.2.4 Landfill Ditch

Along the base of the Landfill Cap, a ditch collects surface water runoff. This ditch discharges into a primary stormwater detention pond located along the northern edge of the Landfill (Figure 2). When surface water in the primary detention pond is high enough, it overflows into a secondary detention pond northeast of the Landfill and to the ditch along the Interurban Trail. Flow from the secondary detention pond is via a stand pipe located in the western portion of the pond. The Landfill cap drainage ditch is approximately 3 to 4 feet wide and 2 feet deep. No water was observed in the ditch at the time of the survey. The cap drainage system, comprised of the ditch and the two detention ponds, is designed to keep the cap ditches dry except during extreme rainfall conditions.

3.3 STREAMS

Hylebos Creek flows southward along Interstate 5 just northwest of the remediation area before crossing beneath the freeway. Riparian conditions along the creek are dominated by reed canarygrass. This section of Hylebos Creek is on the Washington State 303(d) list for fecal coliform (Ecology, 2004). Hylebos Creek is designated as a Type F stream (DNR 2008). Fall Chinook, fall chum, coho, pink salmon, and winter steelhead are known to use Hylebos Creek (Washington State Department of Fish and Wildlife 2008).

3.4 UPLANDS

The upland areas lack indicators of hydrophytic vegetation, hydric soils, and/or wetland hydrology. Three test plots were evaluated in upland areas (Figure 2).

Test Plot 2 (TP2) is located south of TP1 (Wetland A). TP2 is dominated by red clover, white clover, velvetgrass, hairy cat's ear, redtop, and Himalayan blackberry (Rubus armeniacus). Because less than 50 percent of the dominant vegetation has an indicator status of FAC, FACW, or OBL, the hydrophytic vegetation criterion is not met. The surface horizon (A horizon) extends to 18 inches and is a dark grayish brown (2.5Y 4/2), sandy loam with gravel (compacted fill material) and without mottles. There are no indicators of hydric soils 10 inches below ground surface (bgs); therefore, the hydric soil criterion is not met. Primary indicators of wetland hydrology included saturated soils in the top 3 inches in the test pit. Below 3 inches, soils were moist to dry. No secondary indicators were observed. The wetland hydrology criterion is not met. Because all three wetland criteria were not met, the area represented by TP2 is considered upland.

Test Plot 3 (TP3) is located northeast of TP2, on the north side of the access road off of Fife Way. TP3 is dominated by red clover, white clover, velvetgrass, hairy cat's ear, redtop, and soft rush. Because more than 50 percent of the dominant vegetation has an indicator status of FAC, FACW, or OBL, the hydrophytic vegetation criterion is met. The surface horizon (A horizon) extends to 7 inches and is a gray (2.5Y 5/1), sandy loam with gravel (compacted fill material) and with many distinct, medium to large, strong brown (7.5YR 4/6) mottles. The B horizon extends from 7 to 18 inches and is a grayish brown (10YR 5/2) sand with gravel (compacted fill material) and without mottles. There are no indicators of hydric soils 2 inches below the A horizon; therefore, the hydric soil criterion is not met. Primary indicators of wetland hydrology were not observed. One secondary indicator, oxidized rhizospheres, was observed. The wetland hydrology criterion is not met. Because all three wetland criteria were not met, the area represented by TP3 is considered upland.

Test Plot 6 (TP6) is located along the 12th Street E unimproved road grade, north of the landfill. TP6 is dominated by red clover, white clover, reed canarygrass, common tansy (Tanacetum vulgare), redtop, Douglas spiraea (Spiraea douglasii), black cottonwood, Himalayan blackberry, and yellow sweetclover (Melilotus sp.). Because more than 50 percent of the dominant vegetation has an indicator status of FAC, FACW, or OBL, the hydrophytic vegetation criterion is met. The surface horizon (A horizon) extends to 18 inches and is a brown (10YR 5/3) sand with gravel and cobbles (very compacted fill material) and without mottles. There are no indicators of hydric soils 10 inches bgs; therefore, the hydric soil criterion is not met. No primary or secondary indicators of wetland hydrology were observed. Therefore, the wetland hydrology criterion is not met. Because all three wetland criteria were not met, the area represented by TP6 is considered upland.

Test Plot 7 (TP7) is located at the edge of an agricultural field, just south of the south-central edge of the landfill. TP7 is dominated by reed canarygrass, field bindweed, field horsetail (Equisetum arvense), giant horsetail (Equisetum telmateia), and common vetch (Vicia sativa). Because more than 50 percent of the dominant vegetation has an indicator status of FAC, FACW, or OBL, the hydrophytic vegetation criterion is met. The surface horizon (A horizon) extends to 18 inches and is a slightly moist to dry, dark brown (7.5YR 3/2), silt loam without mottles. There are no indicators of hydric soils 10 inches or more bgs; therefore, the hydric soil criterion is not met. No primary indicators of wetland hydrology were observed. Secondary indicators of wetland hydrology included drainage patterns and a positive FAC neutral test. Because all three wetland criteria were not met, the area represented by TP7 is considered upland.

Test Plot 9 (TP9) is located in an agricultural field just south of Wetland F (TP8). TP9 is dominated by reed canarygrass, field bindweed, creeping buttercup (Ranunculus repens), Himalayan blackberry, and hairy cat's ear. Because less than 50 percent of the dominant vegetation has an indicator status of FAC, FACW, or OBL, the hydrophytic vegetation criterion is not met. The surface horizon (A horizon) extends to 3 inches and is a moist, very dark grayish brown (10YR 3/2), silt loam without mottles. The B horizon extends from 3 to 8 inches and is a moist to dry, brown (7.5YR 4/4), silt loam without mottles. Large portions of the B horizon soils are stained to a very dark grayish brown (10YR 3/2) by an unknown contaminant that smells like hydrocarbons and has a metallic sheen. The C horizon extends from 8 to 18 inches and is a dry, dark brown (7.5YR 3/2), silt loam without mottles. There are no indicators of hydric soils 2 inches below the A horizon; therefore, the hydric soil criterion is not met. No primary indicators of wetland hydrology were observed. Only one secondary indicator, drainage pattern, was observed. Therefore, the wetland hydrology criterion is not met. Because all three wetland criteria were not met, the area represented by TP9 is considered upland.

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4.0 REGULATORY CONSIDERATIONS

4.1 CITY OF MILTON

The City of Milton regulates wetlands, streams, and their buffers through the Milton Municipal Code (MMC) Title 18. As specified in the MMC, wetland categories are exempt from the City of Milton regulations as follows:

- Category I—no exemptions
- Category II—no exemptions
- Category III—wetlands less than 1,000 square feet, not part of a wetland mosaic or riparian area, and determined to be isolated
- Category IV—wetlands less than 1,000 square feet, not part of a wetland mosaic or riparian area, and determined to be isolated

None of the wetlands identified meet the exemption criteria and, therefore, are not exempt from the City of Milton regulations. For regulated wetlands, the City of Milton requires the following buffers for:

- Category I, II, or III—ranges from 60 to 300 feet, depending on adjacent land use and habitat function score
- Category IV—ranges from 40 to 50 feet, depending on adjacent land use

The 2008 work would impact only Wetland C, which is not located within the limits of the City of Milton. Although potential impacts cannot be determined at this point in the project, future work to be completed in 2009 and 2011-2012 may impact Wetlands A, B, C, and F and the buffers of Wetlands A, B, C, E, and F. Impacting regulated wetlands or their buffers may require mitigation. If mitigation is required, a conceptual mitigation plan would need to be prepared and accepted by The City of Milton prior to permits being issued.

The Washington Department of Natural Resources has defined Hylebos Creek as a Type F stream (DNR, 2008). MMC Code (18.16.640) requires a 150-foot buffer landward from ordinary high water on a Type F stream. Because the remediation area is approximately 500 feet away from Hylebos Creek, construction activities within the remediation area would not impact the Creek or its buffer.

4.2 CITY OF FIFE

The City of Fife regulates wetlands, streams, and their buffers through the Fife Municipal Code (FMC) Title 17. As specified in the FMC, wetland categories are exempt from the City Fife regulations as follows:

- Category I—no exemptions
- Category II—wetlands 2,500 square feet or less

- Category III—wetlands less than 2,500 square feet or less
- Category IV—wetlands less than 10,000 square feet or less

Wetlands A and F meet exemption criteria and, therefore, are exempt from the City of Fife regulations. For regulated wetlands, the City of Fife requires the following buffers for:

- Category I—150 feet
- Category II—100 feet
- Category III—50 feet
- Category IV—25 feet

The 2008 work would impact Wetland C, which is not located within limits of the City of Fife. Although potential impacts cannot be determined at this point in the project, future work to be completed in 2009 and 2011-2012 may impact Wetlands A, B, C, and F and the buffers of Wetlands A, B, C, E, and F. Impacting regulated wetlands or their buffers may require mitigation. If mitigation is required, a conceptual mitigation plan would need to be prepared and accepted by the City of Fife prior to permits being issued.

The Washington Department of Natural Resources has defined Hylebos Creek as a Type F stream (DNR 2008). FMC Code (17.15.050) states that "the width of the buffers shall be determined on a case-by-case basis by the community development director based on the required habitat assessment and on the criteria established in this chapter." Because the remediation area is approximately 500 feet away from Hylebos Creek, construction activities within the remediation area would not impact the Creek or its buffer.

4.3 PIERCE COUNTY

Pierce County regulates wetlands, streams, and their buffers through the Pierce County Code Title 18. As specified in the County, the wetlands exemptions from Pierce County regulations are as follows:

- Category I—no exemptions
- Category II—no exemptions
- Category III—wetlands less than 2,500 square feet, not part of a wetland mosaic, and determined to be isolated
- Category IV—wetlands less than 10,000 square feet, not part of a wetland mosaic, and determined to be isolated

None of the wetlands identified meet exemption criteria and, therefore, are not exempt from Pierce County regulations. For regulated wetlands, Pierce County requires the following buffers:

- Category I—150 feet
- Category II—100 feet

- Category III—50 feet
- Category IV—25 feet

The 2008 work would impact Wetland C, which is located within the limits of Pierce County. Although potential impacts cannot be determined at this point in the project, future work to be completed in 2009 and 2011-2012 may impact Wetlands A, B, C, and F and the buffers of Wetlands A, B, C, E, and F. Impacting regulated wetlands or their buffers may require mitigation. If mitigation is required, a conceptual mitigation plan would need to be prepared and accepted by Pierce County prior to permits being issued.

The Washington Department of Natural Resources has defined Hylebos Creek as a Type F stream (DNR, 2008). Pierce County Code (18E.40.060) requires a 150-foot buffer landward from ordinary high water on a Type F stream. Because the remediation area is approximately 500 feet away from Hylebos Creek, construction activities within the remediation area would not impact the Creek or its buffer.

4.4 U.S. ARMY CORPS OF ENGINEERS

USACE has regulatory jurisdiction over "Waters of the U.S." (33 CFR Part 328). Hylebos Creek is classified as a "Water of the U.S.". The ditches and wetlands within the remediation area may also classify as "Waters of the U.S.". A jurisdictional determination from USACE is required to determine which, if any, ditch or wetland is regulated by the USACE. Any alteration to a USACE jurisdictional wetland or ditch will require a federal permit from the USACE.

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B&L Woodwaste Site

Critical Areas Study

Tables

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TABLE 1

Plant Species Found on the Project Site

Cover Class	Common Name	Scientific Name	Wetland Indicator Status
Trees	black cottonwood	*Populus balsamifera* ssp. *trichocarpa*	FAC
	Pacific willow	*Salix lucida*	FACW+
Shrubs	Douglas spiraea	*Spiraea douglasii*	FACW
	hawthorne	*Crataegus douglasii*	FAC
	Himalayan blackberry	*Rubus armeniacus*	FACU
	hooker willow	*Salix hookeriana*	FACW-
	Scouler's willow	*Salix scouleriana*	FAC
	Sitka willow	*Salix sitchensis*	FACW
Herbs	common tansy	*Tanacetum vulgare*	NI
	common vetch	*Vicia sativa*	UPL
	creeping buttercup	*Ranunculus repens*	FACW
	field bindweed	*Convolvulus arvensis*	NI
	field horsetail	*Equisetum arvense*	FAC
	fox sedge	*Carex vulpinoidea*	OBL
	giant horsetail	*Equisetum telmateia*	FACW
	hairy cat's ear	*Hypochaeris radicata*	FACU*
	red clover	*Trifolium pratense*	FACU
	red fescue	*Festuca rubra*	FAC+
	redtop	*Agrostis gigantea*	NI
	reed canarygrass	*Phalaris arundinacea*	FACW
	soft rush	*Juncus effusus*	FACW
	stinging nettle	*Urtica dioica*	FAC+
	unidentified grass		
	velvetgrass	*Holcus lanatus*	FAC
	white clover	*Trifolium repens*	FAC*
	yellow sweetclover	*Melilotus* sp.	FACU

\+ A plus (+) sign or minus (-) sign is used with the facultative indicator categories to more specifically define the regional frequency of occurrence in wetlands. The + indicates a more frequent occurrence.

* An asterisk (*) identifies a tentative assignment based on limited information.

TABLE 2

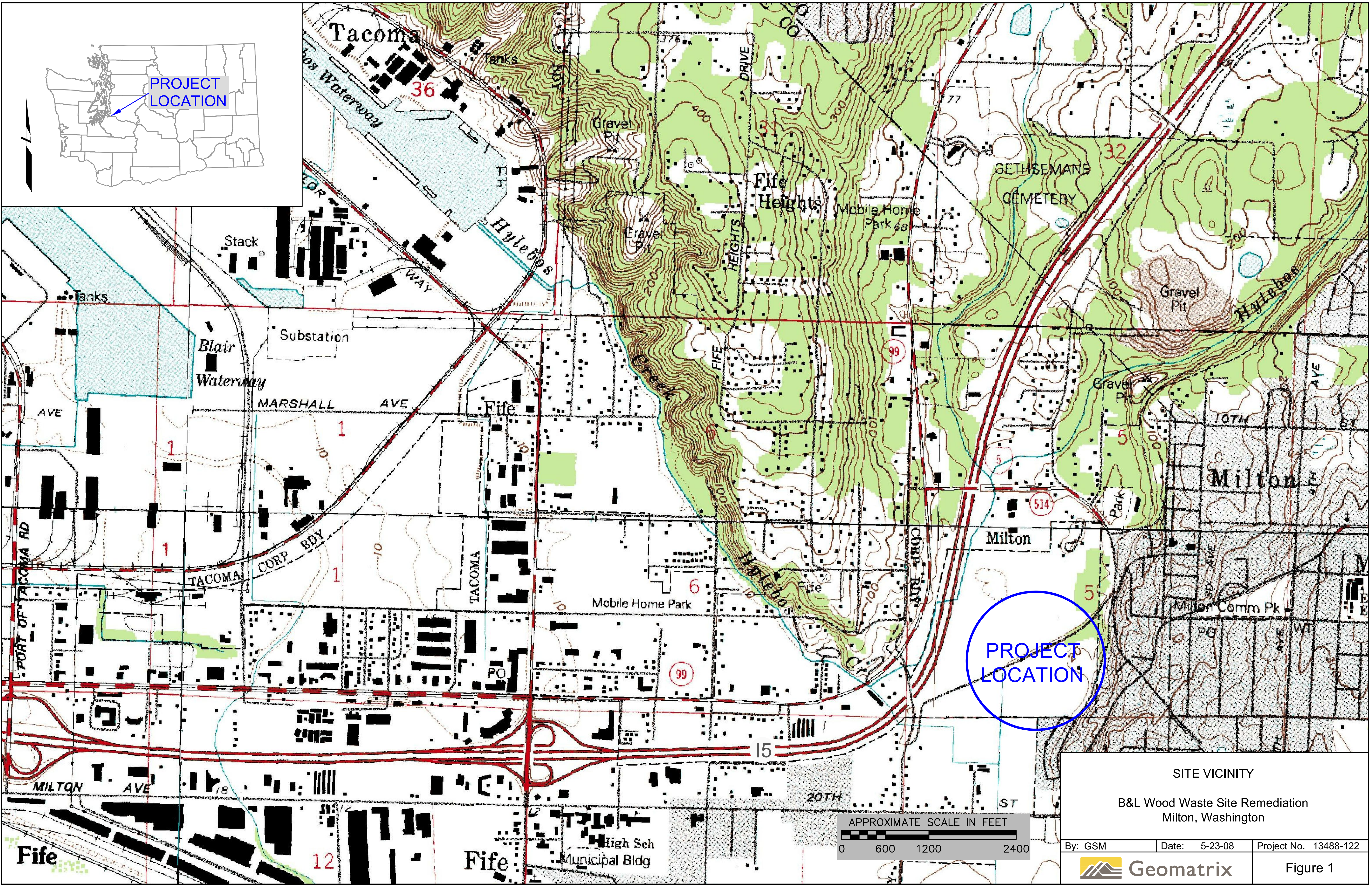
WETLAND RATING SCORES

Wetland	Size (acre)	Functional Score			Total	Wetland Rating
		Water Quality	Hydrologic	Habitat		
A	0.2	14	4	10	28	IV
B	0.71	18	4	13	35	III
C	59	28	24	21	73	I
E	4.25	26	16	15	57	II
F	0.05	12	0	6	18	IV

B&L Woodwaste Site

Critical Areas Study

Figures

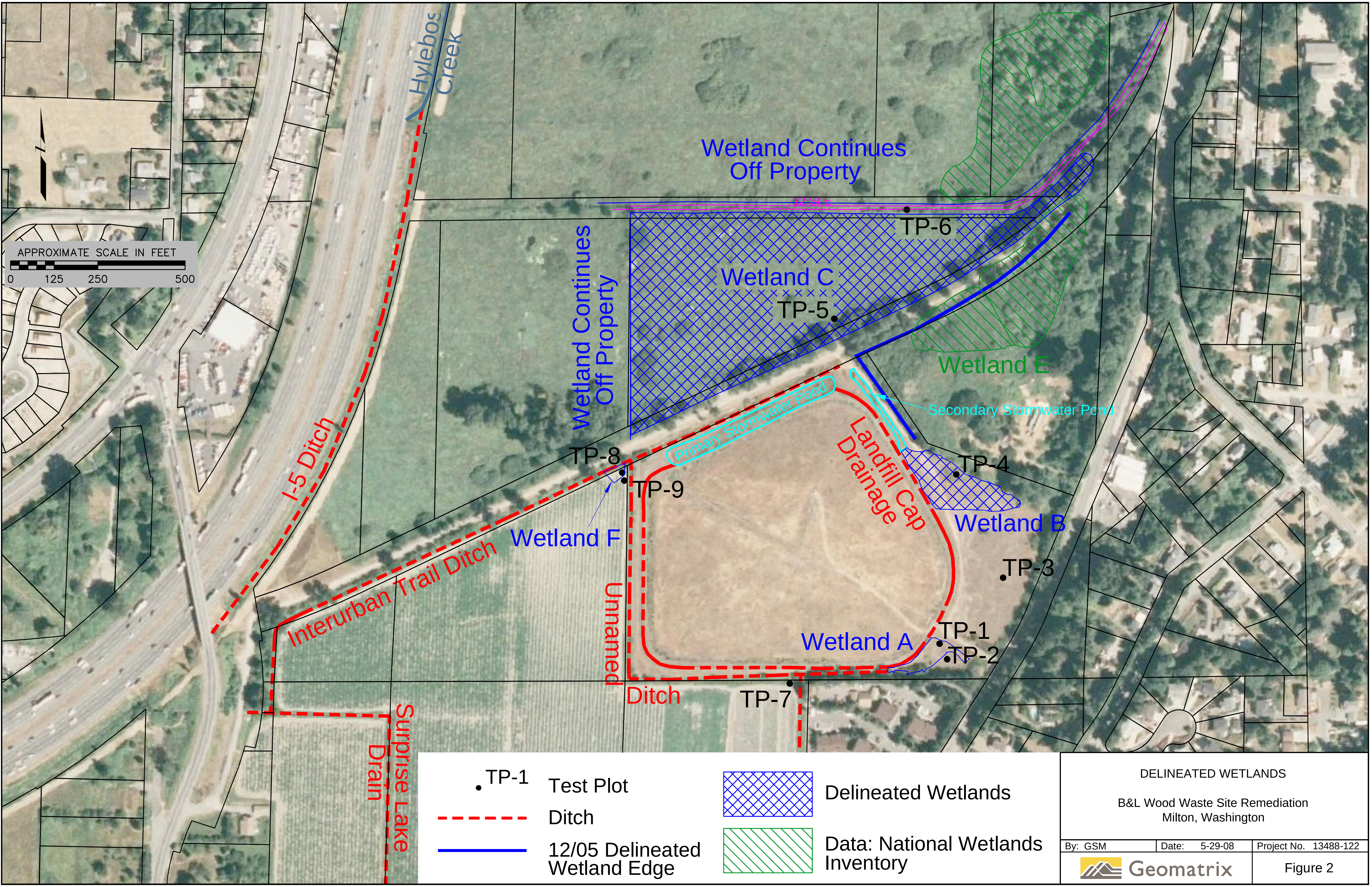


SITE VICINITY

B&L Wood Waste Site Remediation
Milton, Washington

By: GSM	Date: 5-23-08	Project No. 13488-122
Geomatrix		Figure 1

Plot Date: 05/23/08 - 1:49pm, Plotted by: gmaxwell
Drawing Path: Z:\Floyd_Snider\13488-122 B&L Landfill\17000 CAD\Wetland Delineation\, Drawing Name: B and L Landfill Wetland Delineation.dwg



DELINEATED WETLANDS

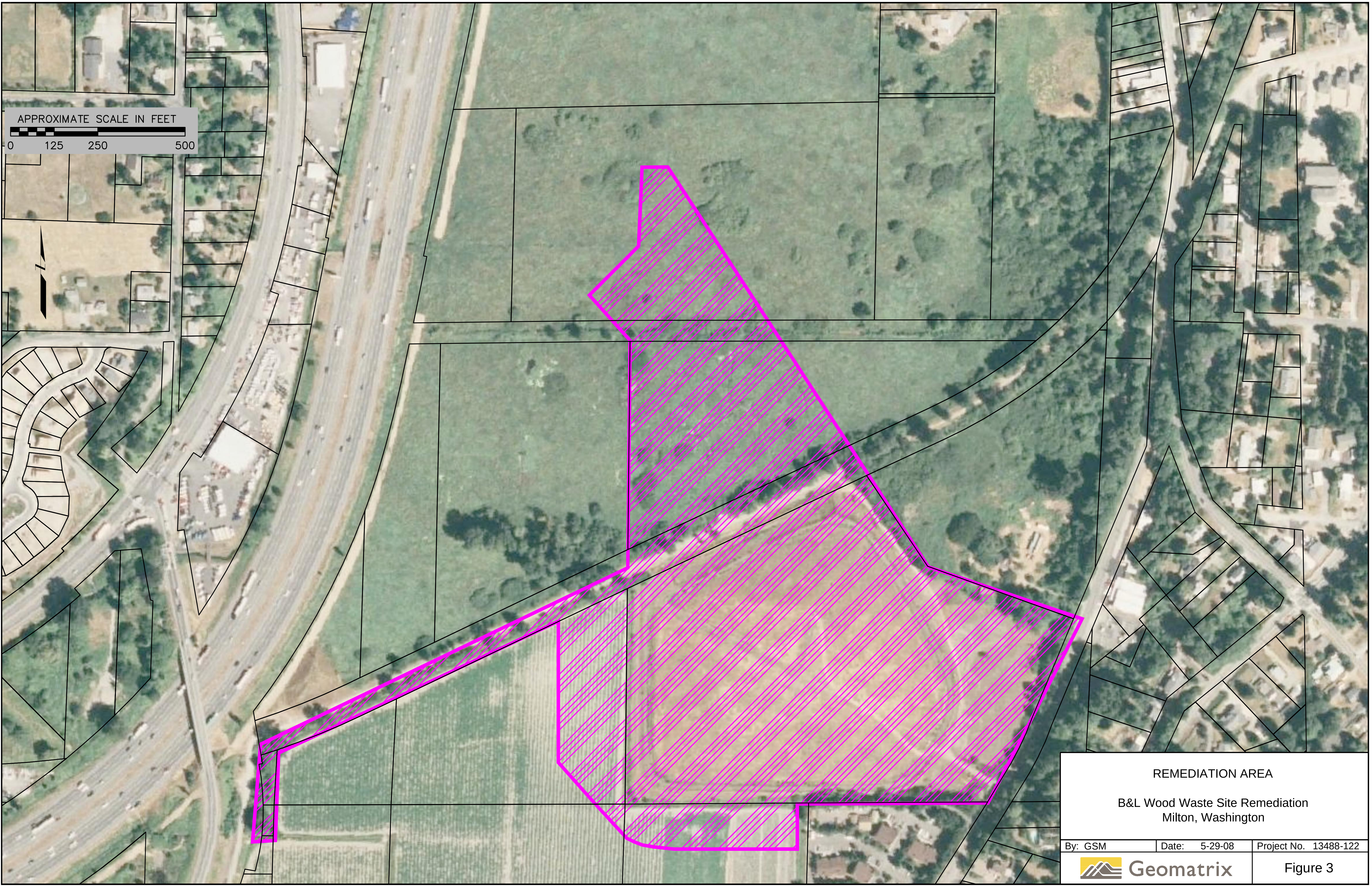
B&L Wood Waste Site Remediation
Milton, Washington

By: GSM | Date: 5-29-08 | Project No. 13488-122

Geomatrix

Figure 2

Plot Date: 05/29/08 - 8:50am, Plotted by: gmaxwell
Drawing Path: Z:\Floyd_Snider\13488-122 B&L Landfill\17000 CAD\Wetland Delineation\, Drawing Name: B and L Landfill Wetland Delination.dwg



REMEDIATION AREA

B&L Wood Waste Site Remediation
Milton, Washington

By: GSM	Date: 5-29-08	Project No. 13488-122
Geomatrix		Figure 3

Plot Date: 05/29/08 - 8:47am, Plotted by: gmaxwell
Drawing Path: Z:\Floyd_Snider\13488-122 B&L Landfill\17000 CAD\Wetland Delineation\, Drawing Name: B and L Landfill Wetland Delination.dwg

B&L Woodwaste Site

Critical Areas Study

Appendix A
Wetland Determination Methods

Appendix A

METHODS OF DETERMINING WETLAND CHARACTERISTICS AND CLASSIFICATION

WETLAND CHARACTERISTICS

The U.S. Army Corps of Engineers (Corps 1987) usually require that the following three characteristics be present for an area to be identified as a wetland: (1) hydrophytic vegetation, (2) hydric soil, and (3) wetland hydrology. The following subsections detail the methods we used to determine whether these characteristics are present on site.

Hydrophytic Vegetation

To determine whether an area has hydrophytic vegetation, the dominant plant species are identified. The Floyd|Snider AMEC-Geomatrix project team (Project Team) uses the method described in the 1989 Federal Manual for Wetland Identifying and Delineating Jurisdictional Wetlands (FICWD. 1989) to determine the dominant plants in each stratum. Dominant plants are those species that, when ranked in descending order of abundance and cumulatively totaled, immediately exceed 50 percent of the dominance threshold number, plus any additional species comprising 20 percent or more of the sum of the midpoints for a given stratum. The dominance threshold number is equal to 50 percent of the sum of the midpoints for a given stratum. Cover classes (and midpoints) are as follows: T = <1% (none), 1 to 5% (3.0), 6 to 15% (10.5), 16 to 25% (20.5), 26 to 50% (38.0), 51 to 75% (63.0), 76 to 95% (85.5), 95 to 100% (98.0). The PLANTS database (NRCS 2008) lists the wetland indicator status of plants based on the species' probability of occurring in wetlands (Table 1). A plant community dominated by species commonly found in wetlands (OBL, FACW, and FAC) meets the criteria for hydrophytic vegetation.

TABLE 1
KEY TO WETLAND INDICATOR STATUS

Code	Wetland Indicator Status	Probability of Occurrence in Wetland
OBL	Obligate wetland species	>99%
FACW	Facultative wet	67 to 99%
FAC	Facultative	34 to 66%
FACU	Facultative upland	1 to 33%
UPL	Obligate upland	<1%
NI	No indicator	—

Hydric Soil

To determine whether an area has hydric soil, test pits are dug and the soil color and other characteristics are examined. Soil in which any of the following indicators is present meets the criteria for hydric soil:

Low chroma matrix. Soil with a low chroma matrix typically develops when mineral soil is saturated or inundated for sufficient periods of time to result in anaerobic (oxygen less) conditions. Anaerobic conditions cause elements common in soil, particularly iron compounds, to exist in reduced forms that are usually bluish, greenish, or grayish in color. Soil colors are determined using a Munsell color chart (Kollmorgen, 1995), which uses abbreviations to describe colors; e.g., 10YR 2/1. In the abbreviation, the last number indicates the chroma; a chroma of 1 (without mottles) or 2 (with mottles) in the subsurface horizon is considered low. Soils with a matrix chroma of 2 are usually considered hydric when mottles are present.

Mottles. In seasonally saturated wetlands, fluctuating water levels can trap air bubbles in the soil. The air pockets allow magnesium and iron compounds in the soil to oxidize, forming rust colored mottles (spots or blotches). Mottles found in soil with a matrix chroma of 2 or less often indicate the soil is hydric.

High organic content. Organic soils form if inundation prevents decomposition and organic debris accumulates. Organic content is considered high if the soil is composed of more than 20 to 30 percent (range fluctuates depending upon other soil characters) organic material by weight in the upper 32 inches of the soil profile.

Other hydric indicators. Other positive indicators of hydric soils include histic epipedons, sulfide or “rotten egg” odor, aquic or peraquic moisture regimes, presence of soils listed as hydric soils, and presence of iron or manganese concretions.

WETLAND HYDROLOGY

To determine whether an area has wetland hydrology, the area is examined for inundation, soil saturation, or shallow groundwater tables, or for hydrologic indicators. In western Washington, an area in which soils are saturated to the surface for at least 12.5 percent of the growing season (30 days) meets the criteria for wetland hydrology; however, seasonal changes in water levels and immediacy of precipitation events must be considered when an area’s hydrology is evaluated. When wetland hydrology is not present at the time of the site visit, it can be inferred from the presence of any of the following hydrologic indicators: watermarks on vegetation, drift lines, sediment deposits, water stained leaves, surface scoured areas, wetland drainage patterns, oxidized root channels, or a positive FAC neutral test. A positive FAC neutral test is defined as when the number of species with indicator status of FACW- or wetter is greater than the number of species with indicator status FACU+ or drier. Presence of hydrophytic vegetation and hydric soils also are strong indicators that wetland hydrology is likely present.

CLASSIFICATION

Wetlands are classified according to Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979). Under the Cowardin classification scheme, wetlands and deepwater habitats are grouped into systems based on shared hydrologic factors. The systems described in Cowardin et al. are palustrine, marine, estuarine, riverine, and lacustrine.

The palustrine system includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, mosses and lichens, and all such wetlands that occur in tidal areas where the salinity due to ocean derived salts is below 5 parts per thousand. Wetlands included in the palustrine system are those commonly referred to as marshes, swamps, bogs, fens, prairies, seeps, and intermittent ponds.

Palustrine wetlands are divided into classes by the dominant vegetation: Forested wetlands are dominated by trees greater than approximately 20 feet tall with 30 percent cover, scrub shrub wetlands are dominated by woody shrubs, and emergent wetlands are dominated by nonwoody plants. Other common palustrine wetland classes include unconsolidated bottom (<30% plant cover) and aquatic bed. These latter two classes are usually permanently inundated areas and sometimes referred to as open water.

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B&L Woodwaste Site

Critical Areas Study

Appendix B
Wetland Delineation Forms

DATA FORM 1
Routine Wetland Determination
(WA State Wetland Delineation Manual or 1987 Corps Wetland Delineation Manual)

Project/Site: B&L Landfill	Date: 5/7/08
Applicant/owner: Floyd/Snider	County: Pierce State: WA
Investigator(s): KAM & KLW	S/T/R: 20N 4E 5
Do Normal Circumstances exist on the site? [✓ yes] no Is the site significantly disturbed (atypical situation)? yes [✓ no] Is the area a potential Problem Area? yes [✓ no]	Community ID: Wet A Transect ID: Plot ID: TP1

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
softrush	~~S~~ H	FACW	wh. clover	H	FAC
fox sedge	~~S~~ H	OBL	red fescue	H	FAC+
velvetgrass	H	FAC			
Pacific willow	T	FACW+			
Scouler willow	S	FAC			

HYDROPHYTIC VEGETATION INDICATORS:

% of dominants OBL, FACW, & FAC: 7/7

Check all indicators that apply & explain below:

Regional knowledge of plant communities X
Physiological or reproductive adaptations ____
Technical Literature ____
Wetland plant list (nat'l or regional) X
Morphological adaptations ____
Wetland Plant Data Base ____
OTHER ____

Hydrophytic vegetation present? [✓ **yes**] **no**
Rationale for decision/Remarks:

HYDROLOGY

Is it the growing season? [✓ yes] no
Based on:

Dept. of inundation: 1-2 inches w/in 10ft of hole

Depth to free water in pit: 0 inches

Depth to saturated soil: 0 inches

Water Marks: yes [✓ no]	Sediment Deposits: yes [✓ no]
Drift Lines: yes [✓ no]	Drainage Patterns: [✓ yes] no
Oxidized Root (live roots) Channels <12 in. yes [✓ no]	Local Soil Survey: yes [✓ no]
FAC Neutral: [✓ yes] no 3:0	Water-stained ~~Leaves:~~ veg. [✓ yes] no
Other:	

Check all that apply & explain below:
Stream, Lake or gage data: ____
Aerial photographs: ____
Other: ____

Wetland hydrology present? [✓ **yes**] **no**
Rationale for decision/Remarks:

SOILS

Map Unit Name Semiahmoo muck
(Series & Phase)

Taxonomy (subgroup) ______

Drainage Class Very poorly

Field observations confirm mapped type? Yes [✓ No]

Profile Description

Depth (inches)	Horizon	Matrix color (Munsell moist)	Mottle colors (Munsell moist)	Mottle abundance size & contrast	Texture, concretions, structure, etc.	Drawing of soil profile (match description)
18	A	10YR 4/2	10YR 5/6	Distinct small very few (<1%)	sand w/gravel	

Hydric Soil Indicators: (check all that apply)

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☑ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer of Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (explain in remarks)

Hydric soils present? [✓ **yes**] **no**

Rationale for decision/Remarks:
highly compacted fill material
motteling in a chroma 2

Wetland Determination (circle)

Hydrophytic vegetation present? [✓ yes] no
Hydric soils present? [✓ yes] no
Wetland hydrology present? [✓ yes] no

Is the sampling point within a wetland? [✓ yes] no

Rationale/Remarks:

NOTES:
TP1
~~[illegible]30[illegible].06 N~~
~~[illegible]212[illegible].30 E~~
701727.6 N
1546452.3 E

Flags A1 through A12
wet A drains into ditch btwn A8 + A9

SOILS

Map Unit Name (Series & Phase) Semiahmoo muck

Taxonomy (subgroup) __________

Drainage Class Very poorly

Field observations confirm mapped type? [✓ Yes] No

Profile Description

Depth (inches)	Horizon	Matrix color (Munsell moist)	Mottle colors (Munsell moist)	Mottle abundance size & contrast	Texture, concretions, structure, etc.	Drawing of soil profile (match description)
8	A	7.5YR3/1	—	~~distinct common med.~~ —	silt loam	mottles
17	B	7.5YR3/1	5YR5/1	distinct common med	~~peat~~ silt ~~w/peat~~ loam	
18	C	10YR3/2	—	—	loam w/ peat	

Hydric Soil Indicators: (check all that apply)

_____ Histosol
_____ Histic Epipedon
_____ Sulfidic Odor
_____ Aquic Moisture Regime
_____ Reducing Conditions
_____ Gleyed or Low-Chroma Colors

_____ Concretions
_____ High Organic Content in Surface Layer of Sandy Soils
_____ Organic Streaking in Sandy Soils
_____ Listed on Local Hydric Soils List
_____ Listed on National Hydric Soils List
_____ Other (explain in remarks)

Hydric soils present? [✓ **yes**] **no**

Rationale for decision/Remarks:

Wetland Determination (circle)

Hydrophytic vegetation present? [✓ yes] no
Hydric soils present? [✓ yes] no
Wetland hydrology present? [✓ yes] no

Is the sampling point within a wetland? [✓ yes] no

Rationale/Remarks:

NOTES: TP5
702658 N
1546152 E

Wet C not flagged. Bounded along S edge by interurban trail, N by 12th St. E road grade, W by I-5 [illegible], E by change in topo btwn 12th & trail about where indicated on map

No upland test pit dug associated w/ Wet. C b/c we could not assess property w/ uplands other than asphalt / road bed

DATA FORM 1
Routine Wetland Determination
(WA State Wetland Delineation Manual or
1987 Corps Wetland Delineation Manual)

Project/Site: B&L Landfill
Applicant/owner: Floyd/Snider
Investigator(s): KAM & KLW

Date: 5/7/08
County: Pierce
State: WA
S/T/R: 20N 4E 5

Do Normal Circumstances exist on the site? [✓ yes] no
Is the site significantly disturbed (atypical situation)? yes [✓ no]
Is the area a potential Problem Area? yes [✓ no]

Community ID: Upl near Wet A
Transect ID:
Plot ID: TP2

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
red clover	H	FACU	H. blackberry	S	FACU
wh. clover	H	FAC			
velvet grass	H	FAC			
hairy cat's ear	H	FACU *			
red top	H	FAC			

HYDROPHYTIC VEGETATION INDICATORS:

% of dominants OBL, FACW, & FAC: 3/6

Check all indicators that apply & explain below:

Regional knowledge of plant communities ____
Physiological or reproductive adaptations ____
Technical Literature ____
Wetland plant list (nat'l or regional) ____
Morphological adaptations ____
Wetland Plant Data Base ____
OTHER ____

Hydrophytic vegetation present? yes [✓ **no**]
Rationale for decision/Remarks:

HYDROLOGY

Is it the growing season? [✓ yes] no
Based on:

Dept. of inundation: 0 inches
Depth to free water in pit: 0 inches
Depth to saturated soil: top 3 inches only

Water Marks: yes [✓ no]
Drift Lines: yes [✓ no]
Oxidized Root (live roots) Channels <12 in. yes [✓ no]
FAC Neutral: yes [✓ no]
0 : 3

Sediment Deposits: yes [✓ no]
Drainage Patterns: yes [✓ no]
Local Soil Survey: yes [✓ no]
Water-stained Leaves: yes [✓ no]

Check all that apply & explain below:
Stream, Lake or gage data: ____
Aerial photographs: ____
Other: ____

Other:

Wetland hydrology present? yes [✓ **no**]
Rationale for decision/Remarks:

SOILS

Map Unit Name Semiahmoo Muck
(Series & Phase)

Taxonomy (subgroup) ____________

Drainage Class very poorly

Field observations confirm mapped type? Yes [✓ No]

Profile Description

Depth (inches)	Horizon	Matrix color (Munsell moist)	Mottle colors (Munsell moist)	Mottle abundance size & contrast	Texture, concretions, structure, etc.	Drawing of soil profile (match description)
	A	2.5Y4/2	—	—	sandy loam w/ gravel	

Hydric Soil Indicators: (check all that apply)

_____ Histosol
_____ Histic Epipedon
_____ Sulfidic Odor
_____ Aquic Moisture Regime
_____ Reducing Conditions
_____ Gleyed or Low-Chroma Colors
_____ Concretions
_____ High Organic Content in Surface Layer of Sandy Soils
_____ Organic Streaking in Sandy Soils
_____ Listed on Local Hydric Soils List
_____ Listed on National Hydric Soils List
_____ Other (explain in remarks)

Hydric soils present? yes [✓ no]

Rationale for decision/Remarks:

no motteling in a chroma 2
highly compacted fill material

Wetland Determination (circle)

Hydrophytic vegetation present? yes [✓ no]
Hydric soils present? yes [✓ no]
Wetland hydrology present? yes [✓ no]

Is the sampling point within a wetland? yes [✓ no]

Rationale/Remarks:

NOTES:

TP2 701683.8 N
154476.9 E

DATA FORM 1
Routine Wetland Determination
(WA State Wetland Delineation Manual or
1987 Corps Wetland Delineation Manual)

Project/Site: B& L Landfill
Applicant/owner: Floyd / Snider
Investigator(s): KAM & KLW
Date: 5/7/08
County: Pierce
State: WA
S/T/R: 20N 4E 5

Do Normal Circumstances exist on the site? [✓ yes] no
Is the site significantly disturbed (atypical situation)? yes [✓ no]
Is the area a potential Problem Area? yes [✓ no]
Community ID:
Transect ID:
Plot ID: TP3

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
velvet grass	H	FAC	red top	H	FAC
soft rush	H	FACW			
red clover	H	FACU			
hairy cats ear	H	FACU *			
white clover	H	FAC			

HYDROPHYTIC VEGETATION INDICATORS:

% of dominants OBL, FACW, & FAC: 4/6

Check all indicators that apply & explain below:

Regional knowledge of plant communities ✓
Physiological or reproductive adaptations ___
Technical Literature ___
Wetland plant list (nat'l or regional) ✓
Morphological adaptations ___
Wetland Plant Data Base ___
OTHER ___

Hydrophytic vegetation present? [✓ **yes**] **no**
Rationale for decision/Remarks:

HYDROLOGY

Is it the growing season? [✓ yes] no
Based on:
Dept. of inundation: 0 inches
Depth to free water in pit: 0 inches
Depth to saturated soil: 0 inches

Water Marks: yes [✓ no]
Drift Lines: yes [✓ no]
Oxidized Root (live roots) Channels <12 in [✓ yes] no
FAC Neutral: yes [✓ no]
1:2
Sediment Deposits: yes [✓ no]
Drainage Patterns: yes [✓ no]
Local Soil Survey: yes [✓ no]
Water-stained Leaves: yes [✓ no]

Check all that apply & explain below:
Stream, Lake or gage data: ___
Aerial photographs: ___
Other: ___
Other:

Wetland hydrology present? yes [✓ **no**]
Rationale for decision/Remarks: soils moist @ surface & dry @ 18". highly compacted fill w/ lots of tire tracks.

SOILS

Map Unit Name Semiahmoo muck
(Series & Phase)

Taxonomy (subgroup) ____________________

Drainage Class very poorly

Field observations confirm mapped type? Yes [✓ No]

Profile Description

Depth (inches)	Horizon	Matrix color (Munsell moist)	Mottle colors (Munsell moist)	Mottle abundance size & contrast	Texture, concretions, structure, etc.	Drawing of soil profile (match description)
7	A	2.5Y5/1	7.5YR4/6	many med-large distinct	Sandy loam w/ lots of gravel (fill)	
18	B	10YR5/2	—	—	sand w/ gravel (fill)	

Hydric Soil Indicators: (check all that apply)

_____ Histosol
_____ Histic Epipedon
_____ Sulfidic Odor
_____ Aquic Moisture Regime
_____ Reducing Conditions
_____ Gleyed or Low-Chroma Colors
_____ Concretions
_____ High Organic Content in Surface Layer of Sandy Soils
_____ Organic Streaking in Sandy Soils
_____ Listed on Local Hydric Soils List
_____ Listed on National Hydric Soils List
_____ Other (explain in remarks)

Hydric soils present? yes [✓ no]. Chroma 2 w/o mottles 2 in below A horizon
Rationale for decision/Remarks:
highly compacted fill

Wetland Determination (circle)

Hydrophytic vegetation present? [✓ yes] no
Hydric soils present? yes [✓ no]
Wetland hydrology present? yes [✓ no]

Is the sampling point within a wetland? yes [✓ no]

Rationale/Remarks:
very disturbed site on fill – lots of tire tracks (4x4'ing + donuts)

NOTES:

TP3 701914.5 N
1546634.7 E

DATA FORM 1
Routine Wetland Determination
(WA State Wetland Delineation Manual or 1987 Corps Wetland Delineation Manual)

Project/Site: B&L Landfill
Applicant/owner: Floyd|Snider
Investigator(s): KAM & KLW

Date: 5/7/08
County: Pierce
State: WA
S/T/R: 20N 4E 5

Do Normal Circumstances exist on the site? [✓ yes] no
Is the site significantly disturbed (atypical situation)? yes [✓ no]
Is the area a potential Problem Area? yes [✓ no]

Community ID: Wet B
Transect ID:
Plot ID: TP4

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
softrush	H	FACW	red clover	H	FACU
unid grass (no infloress.)	H	—	red top	H	FAC
Black cottonwood	S/T	FAC	reed canarygrass	H	FACW
red osier dogwood	S	FACW			
willow (Hookers)	S	FACW-			

HYDROPHYTIC VEGETATION INDICATORS:

% of dominants OBL, FACW, & FAC: 6/8

Check all indicators that apply & explain below:

Regional knowledge of plant communities X
Physiological or reproductive adaptations ____
Technical Literature ____
Wetland plant list (nat'l or regional) X
Morphological adaptations ____
Wetland Plant Data Base ____
OTHER ____

Hydrophytic vegetation present? [✓ **yes**] **no**
Rationale for decision/Remarks:

HYDROLOGY

Is it the growing season? [✓ yes] no
Based on:

Dept. of inundation: 1-2 inches
Depth to free water in pit: 0 inches
Depth to saturated soil: 0 inches

Water Marks: yes [✓ no]
Drift Lines: yes [✓ no]
Oxidized Root (live roots) Channels <12 in. yes [✓ no]
FAC Neutral: [✓ yes] no
4:1
Sediment Deposits: yes [✓ no]
Drainage Patterns: [✓ yes] no
Local Soil Survey: [✓ yes] no
Water-stained Leaves: yes [✓ no]

Check all that apply & explain below:
Stream, Lake or gage data: ____
Aerial photographs: ____
Other: ____

Other:

Wetland hydrology present? [✓ **yes**] **no**
Rationale for decision/Remarks:
H_2S odor   while digging pit free water @ surface; when we broke through the A horizon @ 6", H_2O in test pit dropped to 6 inches; H_2O coming in @ O/A inter

Map Unit Name Semiahmoo Muck
(Series & Phase)

Taxonomy (subgroup) ____________

Drainage Class Very poorly

Field observations confirm mapped type? [✓ Yes] No

Profile Description

Depth (inches)	Horizon	Matrix color (Munsell moist)	Mottle colors (Munsell moist)	Mottle abundance size & contrast	Texture, concretions, structure, etc.	Drawing of soil profile (match description)
6	[illegible]/A	7.5YR3/1	—	—	Sand w/ lots of fine root masses	
18	B	2.5Y4/1 ~~2.5Y4/2~~	—	—	Sand w/ little to no gravel	
	~~O~~	~~7.5YR5/1~~			Sand	

Hydric Soil Indicators: (check all that apply)

_____ Histosol
_____ Histic Epipedon
_____ Sulfidic Odor
_____ Aquic Moisture Regime
_____ Reducing Conditions
_____ Gleyed or Low-Chroma Colors
_____ Concretions
_____ High Organic Content in Surface Layer of Sandy Soils
_____ Organic Streaking in Sandy Soils
_____ Listed on Local Hydric Soils List
_____ Listed on National Hydric Soils List
_____ Other (explain in remarks)

Hydric soils present? [✓ **yes**] **no**

Rationale for decision/Remarks: low chroma. - soils of B horizon oxidized from 4/1 to 4/2 w/in 10 minutes of hitting air.

~~chroma 2 w/o mottles @ 2" below A~~

Wetland Determination (circle)

Hydrophytic vegetation present? [✓ yes] no
Hydric soils present? [✓ yes] ~~no~~
Wetland hydrology present? [✓ yes] no

Is the sampling point within a wetland? [✓ yes] no

Rationale/Remarks:

NOTES: TP4
702215.N
15465 04.4 E

Wet. B Flags B1-13
~~wet~~ btwn B9 & 10 = culvert/stand pipe that goes to ditch along inter urban trail

DATA FORM 1
Routine Wetland Determination
(WA State Wetland Delineation Manual or
1987 Corps Wetland Delineation Manual)

Project/Site: B+L Landfill
Applicant/owner: Floyd/Snider
Investigator(s): KAM/KLM

Date: 5/7/08
County: Pierce
State: WA
S/T/R: 20N 34E 5

Do Normal Circumstances exist on the site? [✓ yes] no
Is the site significantly disturbed (atypical situation)? yes [✓ no]
Is the area a potential Problem Area? yes [✓ no]

Community ID: Wet C
Transect ID:
Plot ID: TP5

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
reedcanarygrass	H	FACW			
Sitka willow	S	FACW			
Pac. willow	T	FACW+			

HYDROPHYTIC VEGETATION INDICATORS:

% of dominants OBL, FACW, & FAC: 3/3

Check all indicators that apply & explain below:

Regional knowledge of plant communities x
Physiological or reproductive adaptations ____
Technical Literature ____
Wetland plant list (nat'l or regional) ____
Morphological adaptations ____
Wetland Plant Data Base ____
OTHER ____

Hydrophytic vegetation present? [✓ yes] **no**
Rationale for decision/Remarks:

HYDROLOGY

Is it the growing season? [✓ yes] no
Based on:
Dept. of inundation: 6+ inches
Depth to free water in pit: 0 inches
Depth to saturated soil: 0 inches

Water Marks: [✓ yes] no
Drift Lines: yes [✓ no]
Oxidized Root (live roots) Channels <12 in. yes [✓ no]
FAC Neutral: [✓ yes] no
3:0

Sediment Deposits: yes [✓ no]
Drainage Patterns: [✓ yes] no
Local Soil Survey: yes no
Water-stained Leaves: [✓ yes] no

Check all that apply & explain below:
Stream, Lake or gage data: ____
Aerial photographs: ____
Other: ____

Other:

Wetland hydrology present? [✓ yes] **no**
Rationale for decision/Remarks:

DATA FORM 1
Routine Wetland Determination
(WA State Wetland Delineation Manual or 1987 Corps Wetland Delineation Manual)

Project/Site: B&L Landfill
Applicant/owner: Floyd/Snider
Investigator(s): KAM/KLW

Date: 5/7/08
County: Pierce
State: WA
S/T/R: 20N 4E 5

Do Normal Circumstances exist on the site? [✓ yes] no
Is the site significantly disturbed (atypical situation)? yes [✓ no]
Is the area a potential Problem Area? yes [✓ no]

Community ID: 12th St. Roadgrade
Transect ID:
Plot ID: TP6

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
white clover	H	FAC	Bk cottonwood	Sap.	FAC
reedcanary grass	H	FACW	red top	H	FAC
red clover	H	FACU	yellow sweet clover	H	FACU
common tansy	H	FACU	H. blackberry	S	FACU
Douglas spiraea	S	FACW			

HYDROPHYTIC VEGETATION INDICATORS:

% of dominants OBL, FACW, & FAC: 5/9

Check all indicators that apply & explain below:

Regional knowledge of plant communities ____
Physiological or reproductive adaptations ____
Technical Literature ____
Wetland plant list (nat'l or regional) ____
Morphological adaptations ____
Wetland Plant Data Base ____
OTHER ____

Hydrophytic vegetation present? [✓ **yes**] **no**
Rationale for decision/Remarks:

HYDROLOGY

Is it the growing season? [✓ yes] no
Based on:
Dept. of inundation: 0 inches
Depth to free water in pit: 0 inches
Depth to saturated soil: 0 inches

Water Marks: yes [✓ no]
Drift Lines: yes [✓ no]
Oxidized Root (live roots) Channels <12 in. yes [✓ no]
FAC Neutral: yes [✓ no]
2/4

Sediment Deposits: yes [✓ no]
Drainage Patterns: yes [✓ no]
Local Soil Survey: yes [✓ no]
Water-stained Leaves: yes [✓ no]

Check all that apply & explain below:
Stream, Lake or gage data: ____
Aerial photographs: ____
Other: ____

Other:

Wetland hydrology present? **yes** [✓ **no**]
Rationale for decision/Remarks:
on road grade btwn wetlands

DATA FORM 1

Routine Wetland Determination

(WA State Wetland Delineation Manual or
1987 Corps Wetland Delineation Manual)

Project/Site: B&L Landfill

Applicant/owner: Floyd/Snider

Investigator(s): KAM & KLW

Date: 5/19/08

County: Pierce

State: WA

S/T/R: 20N 4E 5

Do Normal Circumstances exist on the site? [✓ yes] no

Is the site significantly disturbed (atypical situation)? yes [✓ no]

Is the area a potential Problem Area? [✓ yes] ~~no~~

Community ID:

Transect ID:

Plot ID: TP7

VEGETATION

Ledge of ag field storm ditch up

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
reedcanarygrass	H	FACW			
field horsetail	H	FAC			
giant horsetail	H	FACW			
field bindweed	H	NI			
common vetch	H	UPL			

HYDROPHYTIC VEGETATION INDICATORS:

% of dominants OBL, FACW, & FAC: 3/5

Check all indicators that apply & explain below:

Regional knowledge of plant communities _____

Physiological or reproductive adaptations _____

Technical Literature _____

Wetland plant list (nat'l or regional) _____

Morphological adaptations _____

Wetland Plant Data Base _____

OTHER _____

Hydrophytic vegetation present? [✓ **yes**] **no**

Rationale for decision/Remarks:

HYDROLOGY

Is it the growing season? [✓ yes] no

Based on:

Dept. of inundation: 0 inches

Depth to free water in pit: 0 inches

Depth to saturated soil: 0 inches

Water Marks: yes [✓ no]

Drift Lines: yes [✓ no]

Oxidized Root (live roots) Channels <12 in. yes [✓ no]

FAC Neutral: [✓ yes] no 2:1

Sediment Deposits: yes [✓ no]

Drainage Patterns: [✓ yes] no

Local Soil Survey: ~~yes~~ [✓ no]

Water-stained Leaves: yes [✓ no]

Check all that apply & explain below:

Stream, Lake or gage data: _____

Aerial photographs: _____

Other: _____

Other:

Wetland hydrology present? yes [✓ **no**]

Rationale for decision/Remarks:

soils were slightly moist to dry

SOILS

Map Unit Name (Series & Phase) Semiahmoo Muck

Drainage Class Very poor

Taxonomy (subgroup) ____________

Field observations confirm mapped type? Yes [✓ No]

Profile Description

Depth (inches)	Horizon	Matrix color (Munsell moist)	Mottle colors (Munsell moist)	Mottle abundance size & contrast	Texture, concretions, structure, etc.	Drawing of soil profile (match description)
18	A	10YR5/3	—	—	Sand w/ gravel & Cobble (road bed)	

Hydric Soil Indicators: (check all that apply)

_____ Histosol
_____ Histic Epipedon
_____ Sulfidic Odor
_____ Aquic Moisture Regime
_____ Reducing Conditions
_____ Gleyed or Low-Chroma Colors
_____ Concretions
_____ High Organic Content in Surface Layer of Sandy Soils
_____ Organic Streaking in Sandy Soils
_____ Listed on Local Hydric Soils List
_____ Listed on National Hydric Soils List
_____ Other (explain in remarks)

Hydric soils present? **yes** [✓ **no**]

Rationale for decision/Remarks:

High chroma

Wetland Determination (circle)

Hydrophytic vegetation present? [✓ yes] no
Hydric soils present? yes [✓ no]
Wetland hydrology present? yes [✓ no]

Is the sampling point within a wetland? yes [✓ no]

Rationale/Remarks:

Not all 3 criteria met

NOTES:

TP6 702981 N
1546358 E

Map Unit Name Sultan Silt Loam
(Series & Phase)

Drainage Class Moderately well

Taxonomy (subgroup) ____________________

Field observations confirm mapped type? [✓ Yes] No

Profile Description

Depth (inches)	Horizon	Matrix color (Munsell moist)	Mottle colors (Munsell moist)	Mottle abundance size & contrast	Texture, concretions, structure, etc.	Drawing of soil profile (match description)
18	A	7.5YR3/2	—	—	Siltloam	

Hydric Soil Indicators: (check all that apply)

- _____ Histosol
- _____ Histic Epipedon
- _____ Sulfidic Odor
- _____ Aquic Moisture Regime
- _____ Reducing Conditions
- _____ Gleyed or Low-Chroma Colors
- _____ Concretions
- _____ High Organic Content in Surface Layer of Sandy Soils
- _____ Organic Streaking in Sandy Soils
- _____ Listed on Local Hydric Soils List
- _____ Listed on National Hydric Soils List
- _____ Other (explain in remarks)

Hydric soils present? yes [✓ no]

Rationale for decision/Remarks:

Wetland Determination (circle)

Hydrophytic vegetation present? [✓ yes] no
Hydric soils present? yes [✓ no]
Wetland hydrology present? yes [✓ no]

Is the sampling point within a wetland? yes [✓ no]

Rationale/Remarks:

NOTES: Testplot located in corner of 2 ditches just S. of SE corner of landfill took an auger test pit Δ 30' S. of TP7 + got a sandy loam 7.5 YR 3/2 w/o mottles; soils moist but not sat.

DATA FORM 1
Routine Wetland Determination
(WA State Wetland Delineation Manual or
1987 Corps Wetland Delineation Manual)

Project/Site: B2L Landfill
Applicant/owner: Floyd/Snider
Investigator(s): KAM & KLW

Date: 5/19/08
County: Pierce
State: WA
S/T/R: 20 N 4E 5

Do Normal Circumstances exist on the site? [✓ yes] no
Is the site significantly disturbed (atypical situation)? yes [✓ no]
Is the area a potential Problem Area? [✓ yes] no

Community ID:
Transect ID:
Plot ID: TP9

VEGETATION

4D in ag field next to ditch

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
reedcanarygrass	H	FACW			
field bindweed	H	NI ~~[illegible]~~			
creeping buttercup	H	FACW			
Him. blackberry	H/S	FACU			
hairy cat's ear	H	FACU			

HYDROPHYTIC VEGETATION INDICATORS:

% of dominants OBL, FACW, & FAC: 2/5

Check all indicators that apply & explain below:

Regional knowledge of plant communities ____
Physiological or reproductive adaptations ____
Technical Literature ____
Wetland plant list (nat'l or regional) ____
Morphological adaptations ____
Wetland Plant Data Base ____
OTHER ____

Hydrophytic vegetation present? yes [✓ no]
Rationale for decision/Remarks:

HYDROLOGY

Is it the growing season? [✓ yes] no
Based on:
Dept. of inundation: 0 inches
Depth to free water in pit: 0 inches
Depth to saturated soil: 0 inches

Water Marks: yes [✓ no]
Drift Lines: yes [✓ no]
Oxidized Root (live roots) Channels <12 in. yes [✓ no]
FAC Neutral: yes [✓ no]
2:2 or 2:3
Sediment Deposits: yes [✓ no]
Drainage Patterns: [✓ yes] no
Local Soil Survey: ~~yes~~ [✓ no]
Water-stained Leaves: yes [✓ no]

Check all that apply & explain below:
Stream, Lake or gage data: ____
Aerial photographs: ____
Other: ____

Other:

Wetland hydrology present? yes [✓ no]
Rationale for decision/Remarks:

Soils Moist ~~to~~ dry local soil Survey has H_2O table @ 18-24 inch

Map Unit Name Sultan silt loam
(Series & Phase)

Taxonomy (subgroup) ____________________

Drainage Class Mod. well

Field observations confirm mapped type? [✓ Yes] No

Profile Description

Depth (inches)	Horizon	Matrix color (Munsell moist)	Mottle colors (Munsell moist)	Mottle abundance size & contrast	Texture, concretions, structure, etc.	Drawing of soil profile (match description)
3	A	10YR 3/2	—	—	Silt loam	
8	B	10YR3/2 – stained w/ contaminants 7.5YR 4/4 –			silt loam w/ contaminants (metalic sheen)	
18	C	7.5YR 3/2	—	—	silt loam	

Hydric Soil Indicators: (check all that apply)

_____ Histosol
_____ Histic Epipedon
_____ Sulfidic Odor
_____ Aquic Moisture Regime
_____ Reducing Conditions
_____ Gleyed or Low-Chroma Colors
_____ Concretions
_____ High Organic Content in Surface Layer of Sandy Soils
_____ Organic Streaking in Sandy Soils
_____ Listed on Local Hydric Soils List
_____ Listed on National Hydric Soils List
_____ Other (explain in remarks)

Hydric soils present? **yes** [✓ **no**]
Rationale for decision/Remarks:

Wetland Determination (circle)

Hydrophytic vegetation present? yes [✓ no]
Hydric soils present? yes [✓ no]
Wetland hydrology present? yes [✓ no]

Is the sampling point within a wetland? yes [✓ no]

Rationale/Remarks:

NOTES: Soils smells like hydrocarbon @ 8–18" + has metalic sheen in spots

DATA FORM 1
Routine Wetland Determination
(WA State Wetland Delineation Manual or 1987 Corps Wetland Delineation Manual)

Project/Site: B&L Landfill
Applicant/owner: Floyd|Snider
Investigator(s): KMM + KLW

Date: 5/19/08
County: Pierce
State: WA
S/T/R: 30 N 4E

Do Normal Circumstances exist on the site? [✓ yes] no
Is the site significantly disturbed (atypical situation)? yes [✓ no]
Is the area a potential Problem Area? [✓ yes] no

Community ID: Wetland F
Transect ID:
Plot ID: TP8

VEGETATION

ag field in corner of 2 ditches

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
reedcanary grass	H	FACW			
field bindweed	H	~~FAC FACU~~ NI			
nettle	H	FAC+			

HYDROPHYTIC VEGETATION INDICATORS:

% of dominants OBL, FACW, & FAC: 2/3

Check all indicators that apply & explain below:

Regional knowledge of plant communities ____
Physiological or reproductive adaptations ____
Technical Literature ____
Wetland plant list (nat'l or regional) ____
Morphological adaptations ____
Wetland Plant Data Base ____
OTHER ____

Hydrophytic vegetation present? [✓ yes] **no**
Rationale for decision/Remarks:

HYDROLOGY

Is it the growing season? [✓ yes] no
Based on:
Dept. of inundation: 0 inches
Depth to free water in pit: 0 inches
Depth to saturated soil: 0 inches

Water Marks: yes [✓ no]
Drift Lines: yes [✓ no]
Oxidized Root (live roots) Channels <12 in. [✓ yes] no
FAC Neutral: [✓ yes] no
1:0
Sediment Deposits: yes [✓ no]
Drainage Patterns: [✓ yes] no
Local Soil Survey: ~~yes~~ [✓ no]
Water-stained Leaves: yes [✓ no]

Check all that apply & explain below:
Stream, Lake or gage data: ____
Aerial photographs: ____
Other: ____

Other:

Wetland hydrology present? [✓ yes] **no**
Rationale for decision/Remarks:
soils moist
local soil Surv

Map Unit Name Sultan Silt loam
(Series & Phase)

Taxonomy (subgroup) ______

Drainage Class Mod well

Field observations confirm mapped type? [✓ Yes] No

Profile Description

Depth (inches)	Horizon	Matrix color (Munsell moist)	Mottle colors (Munsell moist)	Mottle abundance size & contrast	Texture, concretions, structure, etc.	Drawing of soil profile (match description)
6	A	10YR3/2	7.5YR4/4	small, common, faint	Silt loam	
18	B	10YR3/2	7.5YR3/4	sm-med many	silt loam	

Hydric Soil Indicators: (check all that apply)

- ____ Histosol
- ____ Histic Epipedon
- ____ Sulfidic Odor
- ____ Aquic Moisture Regime
- ____ Reducing Conditions
- ____ Gleyed or Low-Chroma Colors
- ____ Concretions
- ____ High Organic Content in Surface Layer of Sandy Soils
- ____ Organic Streaking in Sandy Soils
- ____ Listed on Local Hydric Soils List
- ____ Listed on National Hydric Soils List
- ____ Other (explain in remarks)

Hydric soils present? [✓ **yes**] **no**

Rationale for decision/Remarks:

Wetland Determination (circle)

Hydrophytic vegetation present? [✓ yes] no
Hydric soils present? [✓ yes] no
Wetland hydrology present? [✓ yes] no

Is the sampling point within a wetland? [✓ yes] no

Rationale/Remarks:

NOTES:
soils have "metalic" concretions that smell like metals
can't hang flags b/c in ag ~~field~~ field
Flags F-1 & F-2 are hung on reed canarygrass @ edge of agg field Wetland F goes to ditch edge.

DATA FORM 1
Routine Wetland Determination
(WA State Wetland Delineation Manual or 1987 Corps Wetland Delineation Manual)

Project/Site: B+L Landfill
Applicant/owner: Floyd/Snider
Investigator(s): KAM/KLW

Date: 5/7/08
County: Pierce
State: WA
S/T/R: 20 N 4E 5

Do Normal Circumstances exist on the site? [✓ yes] no
Is the site significantly disturbed (atypical situation)? yes [✓ no]
Is the area a potential Problem Area? yes [✓ no]

Community ID: Wet D / Wet C
Transect ID:
Plot ID: N. of 12th St E.

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
reed canary grass	H	FACW			
willow	T/S	FACW			
douglas spiraea	S	FACW			

HYDROPHYTIC VEGETATION INDICATORS:

% of dominants OBL, FACW, & FAC:

Check all indicators that apply & explain below:

Regional knowledge of plant communities _____
Physiological or reproductive adaptations _____
Technical Literature _____
Wetland plant list (nat'l or regional) _____
Morphological adaptations _____
Wetland Plant Data Base _____
OTHER _____

Hydrophytic vegetation present? [✓ **yes**] **no**
Rationale for decision/Remarks:
3/3

HYDROLOGY

Is it the growing season? [✓ yes] **no**
Based on:

Dept. of inundation: 10-24 inches all along IU trail

Depth to free water in pit: ? inches

Depth to saturated soil: 0 inches

Water Marks: yes [✓ no]
Drift Lines: yes [✓ no]
Oxidized Root (live roots) Channels <12 in. yes no
FAC Neutral: [✓ yes] no
3:0

Sediment Deposits: yes [✓ no]
Drainage Patterns: [✓ yes] no
Local Soil Survey: [✓ yes] no
Water-stained Leaves: [✓ yes] no

Check all that apply & explain below:
Stream, Lake or gage data: _____
Aerial photographs: _____
Other: _____

Other:

Wetland hydrology present? yes **no**
Rationale for decision/Remarks:
No testpit was dug to look ~~at~~ for free water or OXI. roots.

IU = Interurban

Map Unit Name Semiahmoo muck
(Series & Phase)

Taxonomy (subgroup) ____________

Drainage Class very poor

Field observations confirm mapped type? Yes No

Profile Description

Depth (inches)	Horizon	Matrix color (Munsell moist)	Mottle colors (Munsell moist)	Mottle abundance size & contrast	Texture, concretions, structure, etc.	Drawing of soil profile (match description)

Hydric Soil Indicators: (check all that apply)

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer of Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☒ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (explain in remarks)

Hydric soils present? [✓ **yes**] **no**

Rationale for decision/Remarks:
assumed hydric soil based on local soil survey + FHA/WSDOT 2006 FEIS for SR167

Wetland Determination (circle)

Hydrophytic vegetation present? [✓ yes] no
Hydric soils present? [✓ yes] no
Wetland hydrology present? [✓ yes] no

Is the sampling point within a wetland? [✓ yes] no

Rationale/Remarks:

NOTES: Wetland D is ~~ass~~ located on WSDOT property that we do not have an access agreement to. Therefore veg. ID + hydrology indicators based on visual observations made from standing on the 12th St. road grade + on local soil survey info + on wetland characteristics described in WSDOT's FEIS for ~~[illegible]~~ SR167 Puyallup to SR509 Tier II Analysis

this is part of wet C b/c 12th St. does not bisect all the way across + ditch along IS a surface H2O connection btwn 2 areas.

DATA FORM 1
Routine Wetland Determination
(WA State Wetland Delineation Manual or 1987 Corps Wetland Delineation Manual)

Project/Site: B&L Land Fill
Applicant/owner: Floyd/Snider
Investigator(s): KAM/KLW

Date: 5/7/08
County: Pierce
State: WA
S/T/R: 20N 4E 5

Do Normal Circumstances exist on the site? [✓ yes] no
Is the site significantly disturbed (atypical situation)? yes [✓ no]
Is the area a potential Problem Area? yes [✓ no]

Community ID: Wetland E
Transect ID:
Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
hawthorne	T/S	FAC	reed canarygrass	H	FACW
black cottonwood	T	FAC			
willow (Hookers)	S	FACW			
~~redosier dogwood~~	~~S~~	~~FACW~~			
Pac. willow	T	FACW+			

HYDROPHYTIC VEGETATION INDICATORS:

% of dominants OBL, FACW, & FAC: 5/5

Check all indicators that apply & explain below:

Regional knowledge of plant communities ____
Physiological or reproductive adaptations ____
Technical Literature ____
Wetland plant list (nat'l or regional) ____
Morphological adaptations ____
Wetland Plant Data Base ____
OTHER ____

Hydrophytic vegetation present? [✓ yes] no
Rationale for decision/Remarks:

HYDROLOGY

Is it the growing season? [✓ yes] no
Based on:
Dept. of inundation: 0-8 inches
Depth to free water in pit: ? inches
Depth to saturated soil: 0 inches in places

Water Marks: yes [✓ no]
Drift Lines: yes [✓ no]
Oxidized Root (live roots) Channels <12 in. yes no ?
FAC Neutral: [✓ yes] no
5:0
Sediment Deposits: yes [✓ no]
Drainage Patterns: [✓ yes] no
Local Soil Survey: [✓ yes] no
Water-stained Leaves: [✓ yes] no

Check all that apply & explain below:
Stream, Lake or gage data: ____
Aerial photographs: ____
Other: ____

Other:

Wetland hydrology present? [✓ yes] no
Rationale for decision/Remarks:
No test pit dug

Map Unit Name Semiahmoo muck
(Series & Phase)

Taxonomy (subgroup) ____________

Drainage Class very poor

Field observations confirm mapped type? Yes No

Profile Description

Depth (inches)	Horizon	Matrix color (Munsell moist)	Mottle colors (Munsell moist)	Mottle abundance size & contrast	Texture, concretions, structure, etc.	Drawing of soil profile (match description)

Hydric Soil Indicators: (check all that apply)

_____ Histosol
_____ Histic Epipedon
_____ Sulfidic Odor
_____ Aquic Moisture Regime
_____ Reducing Conditions
_____ Gleyed or Low-Chroma Colors
_____ Concretions
_____ High Organic Content in Surface Layer of Sandy Soils
_____ Organic Streaking in Sandy Soils
__X__ Listed on Local Hydric Soils List
_____ Listed on National Hydric Soils List
_____ Other (explain in remarks)

Hydric soils present? [✓ **yes**] **no**
Rationale for decision/Remarks:
assumed hydric soil based on local soil survey + previous (12/15/05) delineation flaggings still in place

Wetland Determination (circle)

Hydrophytic vegetation present? [✓ yes] no
Hydric soils present? [✓ yes] no
Wetland hydrology present? [✓ yes] no

Is the sampling point within a wetland? [✓ yes] no

Rationale/Remarks:

NOTES: wetland edge based on wetland flags observed hanging (flags dated 12/15/05). Wetland is offsite & did not have access to property.
Flags marked "A-xx 12/15/05 GA"
sequential numbering

- outlet into Bush Road Ditch - constructed, perm. flowing

B&L Woodwaste Site

Critical Areas Study

Appendix C
Wetland Rating Forms

WETLAND RATING FORM – WESTERN WASHINGTON

Version 2 - Updated July 2006 to increase accuracy and reproducibility among users

Name of wetland (if known): Wetland A Date of site visit: 5/7/08

Rated by Kerrie McArthur Trained by Ecology? Yes ✓ No___ Date of training 11/2005.

SEC: 5 TWNSHP: 20N RNGE: 4E Is S/T/R in Appendix D? Yes___ No ✓

Map of wetland unit: Figure ____ Estimated size 8600 sf

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland

I___ II___ III___ IV ✓

Category I = Score >=70
Category II = Score 51-69
Category III = Score 30-50
Category IV = Score < 30

Score for Water Quality Functions	14
Score for Hydrologic Functions	4
Score for Habitat Functions	10
TOTAL score for Functions	28

Category based on SPECIAL CHARACTERISTICS of wetland

I___ II___ Does not Apply ✓

Final Category (choose the "highest" category from above) IV

Summary of basic information about the wetland unit

Wetland Unit has Special Characteristics		**Wetland HGM Class used for Rating**	
Estuarine		**Depressional**	✓
Natural Heritage Wetland		**Riverine**	
Bog		**Lake-fringe**	
Mature Forest		**Slope**	
Old Growth Forest		**Flats**	
Coastal Lagoon		**Freshwater Tidal**	
Interdunal			
None of the above	✓	Check if unit has multiple HGM classes present	☐

Does the wetland unit being rated meet any of the criteria below?

If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands That May Need Additional Protection (in addition to the protection recommended for its category)	**YES**	**NO**
SP1. *Has the wetland unit been documented as a habitat for any Federally listed Threatened or Endangered **animal or plant** species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.		✓
SP2. *Has the wetland unit been documented as habitat for any State listed Threatened or Endangered **animal** species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database. Note: Wetlands with State listed plant species are categorized as Category I Natural Heritage Wetlands (see p. 19 of data form).		✓
SP3. *Does the wetland unit contain individuals of Priority species listed by the WDFW for the state?*		✓
SP4. *Does the wetland unit have a local significance in addition to its functions?* For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.		✓

To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.

The hydrogeomorphic classification groups wetlands into those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

Wetland name or number A

Classification of Wetland Units in Western Washington

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?
[✓ NO – go to 2] **YES** – the wetland class is **Tidal Fringe**

If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)? **YES – Freshwater Tidal Fringe** **NO – Saltwater Tidal Fringe (Estuarine)**

If your wetland can be classified as a Freshwater Tidal Fringe use the forms for ***Riverine*** *wetlands. If it is Saltwater Tidal Fringe it is rated as an* ***Estuarine*** *wetland.* Wetlands that were called estuarine in the first and second editions of the rating system are called Salt Water Tidal Fringe in the Hydrogeomorphic Classification. Estuarine wetlands were categorized separately in the earlier editions, and this separation is being kept in this revision. To maintain consistency between editions, the term "Estuarine" wetland is kept. Please note, however, that the characteristics that define Category I and II estuarine wetlands have changed (see p.).

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.
[✓ NO – go to 3] **YES** – The wetland class is **Flats**

If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland unit **meet both** of the following criteria?
____The vegetated part of the wetland is on the shores of a body of permanent open water (without any vegetation on the surface) at least 20 acres (8 ha) in size;
____At least 30% of the open water area is deeper than 6.6 ft (2 m)?
[✓ NO – go to 4] **YES** – The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the entire wetland unit **meet all** of the following criteria?
____The wetland is on a slope (*slope can be very gradual*),
____The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
____The water leaves the wetland **without being impounded?**
NOTE: *Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3ft diameter and less than 1 foot deep).*
[✓ NO - go to 5] **YES** – The wetland class is **Slope**

5. Does the entire wetland unit **meet all** of the following criteria?

_____ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river

_____ The overbank flooding occurs at least once every two years.

NOTE: The riverine unit can contain depressions that are filled with water when the river is not flooding.

[✓ NO] - go to 6 **YES** – The wetland class is **Riverine**

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year. *This means that any outlet, if present, is higher than the interior of the wetland.*

NO – go to 7 [✓ **YES**] – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding. The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM clases. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within your wetland. NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM Classes within the wetland unit being rated	*HGM Class to Use in Rating*
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary	Depressional
Depressional + Lake-fringe	Depressional
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE under wetlands with special characteristics

If you are unable still to determine which of the above criteria apply to your wetland, or if you have more than 2 HGM classes within a wetland boundary, classify the wetland as **Depressional** for the rating.

Wetland name or number A

D	**Depressional and Flats Wetlands** **WATER QUALITY FUNCTIONS** - Indicators that the wetland unit functions to improve water quality	**Points** (only 1 score per box)
D	**D 1. Does the wetland unit have the potential to improve water quality?**	*(see p.38)*
D	D 1.1 Characteristics of surface water flows out of the wetland: Unit is a depression with no surface water leaving it (no outlet) points = 3 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 1 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* Provide photo or drawing	Figure ___ 2
D	S 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES points = 4 NO points = 0	0
D	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class) Wetland has persistent, ungrazed, vegetation > = 95% of area points = 5 Wetland has persistent, ungrazed, vegetation > = 1/2 of area points = 3 Wetland has persistent, ungrazed vegetation > = 1/10 of area points = 1 Wetland has persistent, ungrazed vegetation <1/10 of area points = 0 Map of Cowardin vegetation classes	Figure ___ 5
D	D1.4 Characteristics of seasonal ponding or inundation. *This is the area of the wetland unit that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 yrs.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0 Map of Hydroperiods	Figure ___ 0
D	**Total for D 1** *Add the points in the boxes above*	7
D	**D 2. Does the wetland unit have the opportunity to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* — Grazing in the wetland or within 150 ft ✓ Untreated stormwater discharges to wetland — Tilled fields or orchards within 150 ft of wetland — A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging ✓ Residential, urban areas, golf courses are within 150 ft of wetland — Wetland is fed by groundwater high in phosphorus or nitrogen — Other____________ [✓ YES] multiplier is 2 NO multiplier is 1	*(see p. 44)* multiplier 2
D	**TOTAL - Water Quality Functions** Multiply the score from D1 by D2 ***Add score to table on p. 1***	14

Wetland name or number A

D	**Depressional and Flats Wetlands** HYDROLOGIC FUNCTIONS - Indicators that the wetland unit functions to reduce flooding and stream degradation	**Points** (only 1 score per box)
	D 3. Does the wetland unit have the potential to reduce flooding and erosion?	*(see p.46)*
D	D 3.1 Characteristics of surface water flows out of the wetland unit Unit is a depression with no surface water leaving it (no outlet) points = 4 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 0	2
D	D 3.2 Depth of storage during wet periods *Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 The wetland is a "headwater" wetland" points = 5 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 Unit is flat (yes to Q. 2 or Q. 7 on key) but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft points = 0	0
D	D 3.3 Contribution of wetland unit to storage in the watershed *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire unit is in the FLATS class points = 5	0
D	**Total for D 3** *Add the points in the boxes above*	2
D	**D 4. Does the wetland unit have the opportunity to reduce flooding and erosion?** Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur. *Note which of the following indicators of opportunity apply.* — Wetland is in a headwater of a river or stream that has flooding problems ✓ Wetland drains to a river or stream that has flooding problems — Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems — Other____________________ [✓ **YES**] multiplier is 2 **NO** multiplier is **1**	*(see p. 49)* multiplier 2
D	**TOTAL - Hydrologic Functions** Multiply the score from D 3 by D 4 *Add score to table on p. 1*	4

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that unit functions to provide important habitat

Points
(only 1 score per box)

H 1. Does the wetland unit have the potential to provide habitat for many species?

H 1.1 Vegetation structure *(see p. 72)*

Check the types of vegetation classes present (as defined by Cowardin)- Size threshold for each class is ¼ acre or more than 10% of the area if unit is smaller than 2.5 acres.

____Aquatic bed
X Emergent plants
____Scrub/shrub (areas where shrubs have >30% cover)
____Forested (areas where trees have >30% cover)

If the unit has a forested class check if:

____The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon

Add the number of vegetation structures that qualify. If you have:

4 structures or more points = 4
3 structures points = 2
2 structures points = 1
1 structure points = 0

Map of Cowardin vegetation classes

Figure ___

0

H 1.2. Hydroperiods *(see p. 73)*

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ acre to count. (see text for descriptions of hydroperiods)

____Permanently flooded or inundated
X Seasonally flooded or inundated
____Occasionally flooded or inundated
____Saturated only
____ Permanently flowing stream or river in, or adjacent to, the wetland
____ Seasonally flowing stream in, or adjacent to, the wetland
____***Lake-fringe wetland* = 2 points**
____***Freshwater tidal wetland* = 2 points**

4 or more types present points = 3
3 types present points = 2
2 types present point = 1
1 type present points = 0

Map of hydroperiods

Figure ___

0

H 1.3. Richness of Plant Species *(see p. 75)*

Count the number of plant species in the wetland that cover at least 10 ft^2. *(different patches of the same species can be combined to meet the size threshold)*

You do not have to name the species.

Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle

If you counted:
> 19 species points = 2
5 - 19 species points = 1
< 5 species points = 0

List species below if you want to:

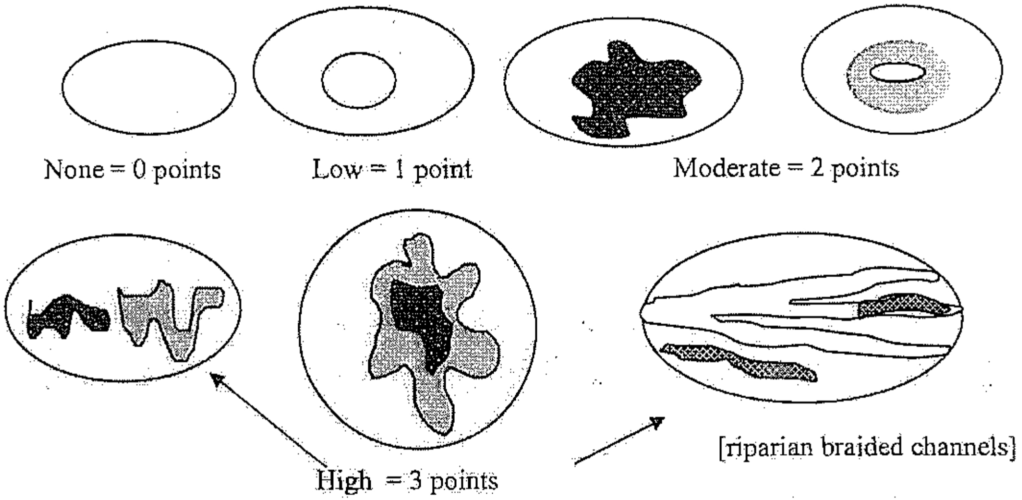
1

Total for page 1

H 1.4. Interspersion of habitats *(see p. 76)*

Figure ___

Decide from the diagrams below whether interspersion between Cowardin vegetation classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.



NOTE: If you have four or more classes or three vegetation classes and open water the rating is always "high". Use map of Cowardin vegetation classes

0

H 1.5. Special Habitat Features: *(see p. 77)*

Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.

____ Large, downed, woody debris within the wetland (>4in. diameter and 6 ft long).

____ Standing snags (diameter at the bottom > 4 inches) in the wetland

____ Undercut banks are present for at least 6.6 ft (2m) and/or overhanging vegetation extends at least 3.3 ft (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft (10m)

____ Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)*

____ At least ¼ acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated. *(structures for egg-laying by amphibians)*

✓ Invasive plants cover less than 25% of the wetland area in each stratum of plants

NOTE: The 20% stated in early printings of the manual on page 78 is an error.

1

H 1. TOTAL Score - potential for providing habitat
Add the scores from H1.1, H1.2, H1.3, H1.4, H1.5

2

Comments

Wetland name or number A

H 2. Does the wetland unit have the opportunity to provide habitat for many species?	
H 2.1 Buffers *(see p. 80)* *Choose the description that best represents condition of buffer of wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed."* — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% of circumference. No structures are within the undisturbed part of buffer. (relatively undisturbed also means no-grazing, no landscaping, no daily human use) **Points = 5** — 100 m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 50% circumference. **Points = 4** — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% circumference. **Points = 4** — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 25% circumference, . **Points = 3** — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water for > 50% circumference. **Points = 3** **If buffer does not meet any of the criteria above** — No paved areas (except paved trails) or buildings within 25 m (80ft) of wetland > 95% circumference. Light to moderate grazing, or lawns are OK. **Points = 2** — No paved areas or buildings within 50m of wetland for >50% circumference, Light to moderate grazing, or lawns are OK. **Points = 2** — Heavy grazing in buffer. **Points = 1** — Vegetated buffers are <2m wide (6.6ft) for more than 95% of the circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland **Points = 0.** [✓ — Buffer does not meet any of the criteria above. **Points = 1**] Aerial photo showing buffers	Figure ___ 1
H 2.2 Corridors and Connections *(see p. 81)* H 2.2.1 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150 ft wide, has at least 30% cover of shrubs, forest or native undisturbed prairie, that connects to estuaries, other wetlands or undisturbed uplands that are at least 250 acres in size? *(dams in riparian corridors, heavily used gravel roads, paved roads, are considered breaks in the corridor).* YES = **4 points** *(go to H 2.3)* [✓ NO =] go to H 2.2.2 H 2.2.2 Is the wetland part of a relatively undisturbed and ~~unbroken~~ vegetated corridor (either riparian or upland) that is at least 50ft wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands or undisturbed uplands that are at least 25 acres in size? **OR** a **Lake-fringe** wetland, if it does not have an undisturbed corridor as in the question above? YES = **2 points** *(go to H 2.3)* [✓ NO =] H 2.2.3 H 2.2.3 Is the wetland: within 5 mi (8km) of a brackish or salt water estuary OR within 3 mi of a large field or pasture (>40 acres) OR within 1 mi of a lake greater than 20 acres? [✓ YES = **1 point**] NO = **0 points**	1

Total for page 2

H 2.3 Near or adjacent to other priority habitats listed by WDFW *(see p. 82)*

Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*

These are DFW definitions. Check with your local DFW biologist if there are any questions.

____**Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

____**Aspen Stands:** Pure or mixed stands of aspen greater than 0.8 ha (2 acres).

____**Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft.

____**Old-growth forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age.

____**Mature forests:** Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less that 100%; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest.

____**Prairies:** Relatively undisturbed areas (as indicated by dominance of native plants) where grasses and/or forbs form the natural climax plant community.

____**Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

____**Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages

____**Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component of the stand is 25%.

✓___**Urban Natural Open Space:** A priority species resides within or is adjacent to the open space and uses it for breeding and/or regular feeding; and/or the open space functions as a corridor connecting other *priority habitats*, especially those that would otherwise be isolated; and/or the open space is an isolated remnant of natural habitat larger than 4 ha (10 acres) and is surrounded by urban development.

____**Estuary/Estuary-like:** Deepwater tidal habitats and adjacent tidal wetlands, usually semi-enclosed by land but with open, partly obstructed or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Estuarine habitat extends upstream and landward to where ocean-derived salts measure less than 0.5ppt. during the period of average annual low flow. Includes both estuaries and lagoons.

____**Marine/Estuarine Shorelines:** Shorelines include the intertidal and subtidal zones of beaches, and may also include the backshore and adjacent components of the terrestrial landscape (e.g., cliffs, snags, mature trees, dunes, meadows) that are important to shoreline associated fish and wildlife and that contribute to shoreline function (e.g., sand/rock/log recruitment, nutrient contribution, erosion control).

If wetland has **3 or more** priority habitats = **4 points**
If wetland has **2** priority habitats = **3 points**
If wetland has 1 priority habitat = **1 point** No habitats = 0 points

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list. Nearby wetlands are addressed in question H 2.4)

1

Wetland name or number A

H 2.4 Wetland Landscape *(choose the one description of the landscape around the wetland that best fits) **(see p. 84)*** There are at least 3 other wetlands within ½ mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development. points = 5 The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within ½ mile points = 5 There are at least 3 other wetlands within ½ mile, BUT the connections between them are disturbed points = 3 The wetland is Lake-fringe on a lake **with** disturbance and there are 3 other lake-fringe wetland within ½ mile points = 3 There is at least 1 wetland within ½ mile. points = 2 There are no wetlands within ½ mile. points = 0	5
H 2. TOTAL Score - opportunity for providing habitat *Add the scores from H2.1,H2.2, H2.3, H2.4*	8
TOTAL for H 1 from page 14	2
Total Score for Habitat Functions – add the points for H 1, H 2 and record the result on p. 1	10

Wetland name or number A

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

Wetland Type *Check off any criteria that apply to the wetland. Circle the Category when the appropriate criteria are met.*	**Category**
SC 1.0 Estuarine wetlands *(see p. 86)* Does the wetland unit meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt. YES = Go to SC 1.1 [✓ NO]	
SC 1.1 Is the wetland unit within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? YES = Category I NO go to SC 1.2	**Cat. I**
SC 1.2 Is the wetland unit at least 1 acre in size and meets at least two of the following three conditions? YES = Category I NO = Category II — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp. are the only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category I. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** **Cat. II** **Dual rating I/II**

SC 4.0 Forested Wetlands *(see p. 90)*

Does the wetland unit have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its functions.*

- — **Old-growth forests**: (west of Cascade crest) Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm) or more.

  NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter.

- — **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have average diameters (dbh) exceeding 21 inches (53cm); crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth.

YES = Category I NO ✓ not a forested wetland with special characteristics

Cat. I

SC 5.0 Wetlands in Coastal Lagoons *(see p. 91)*

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

- — The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks
- — The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)*

YES = Go to SC 5.1 NO ✓ not a wetland in a coastal lagoon

SC 5.1 Does the wetland meets all of the following three conditions?

- — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of invasive plant species (see list of invasive species on p. 74).
- — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.
- — The wetland is larger than 1/10 acre (4350 square feet)

YES = Category I NO = Category II

Cat. I

Cat. II

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Wetland name or number B

WETLAND RATING FORM – WESTERN WASHINGTON

Version 2 - Updated July 2006 to increase accuracy and reproducibility among users

Name of wetland (if known): Wetland B Date of site visit: 5/7/08

Rated by Kerrie McArthur Trained by Ecology? Yes ✓ No___ Date of training 1/2005

SEC: 5 TWNSHP: 20N RNGE: 4E Is S/T/R in Appendix D? Yes___ No ✓

Map of wetland unit: Figure ____ Estimated size 35,763 sf

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland

I___ II___ III ✓ IV___

Category I = Score >=70
Category II = Score 51-69
Category III = Score 30-50
Category IV = Score < 30

Score for Water Quality Functions	18
Score for Hydrologic Functions	4
Score for Habitat Functions	13
TOTAL score for Functions	35

Category based on SPECIAL CHARACTERISTICS of wetland

I___ II___ Does not Apply ✓

Final Category (choose the "highest" category from above) III

Summary of basic information about the wetland unit

Wetland Unit has Special Characteristics		**Wetland HGM Class used for Rating**	
Estuarine		**Depressional**	✓
Natural Heritage Wetland		**Riverine**	
Bog		**Lake-fringe**	
Mature Forest		**Slope**	
Old Growth Forest		**Flats**	
Coastal Lagoon		**Freshwater Tidal**	
Interdunal			
None of the above	✓	Check if unit has multiple HGM classes present	☐

Does the wetland unit being rated meet any of the criteria below?

If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands That May Need Additional Protection (in addition to the protection recommended for its category)	**YES**	**NO**
SP1. *Has the wetland unit been documented as a habitat for any Federally listed Threatened or Endangered* ***animal or plant*** *species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.		✓
SP2. *Has the wetland unit been documented as habitat for any State listed Threatened or Endangered* ***animal*** *species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database. Note: Wetlands with State listed plant species are categorized as Category I Natural Heritage Wetlands (see p. 19 of data form).		✓
SP3. *Does the wetland unit contain individuals of Priority species listed by the WDFW for the state?*		✓
SP4. *Does the wetland unit have a local significance in addition to its functions?* For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.		✓

To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.

The hydrogeomorphic classification groups wetlands into those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

Wetland name or number B

Classification of Wetland Units in Western Washington

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?

[✓ NO – go to 2]   **YES** – the wetland class is **Tidal Fringe**

If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)? **YES – Freshwater Tidal Fringe** **NO – Saltwater Tidal Fringe (Estuarine)**

If your wetland can be classified as a Freshwater Tidal Fringe use the forms for ***Riverine*** *wetlands. If it is Saltwater Tidal Fringe it is rated as an* ***Estuarine*** *wetland.* Wetlands that were called estuarine in the first and second editions of the rating system are called Salt Water Tidal Fringe in the Hydrogeomorphic Classification. Estuarine wetlands were categorized separately in the earlier editions, and this separation is being kept in this revision. To maintain consistency between editions, the term "Estuarine" wetland is kept. Please note, however, that the characteristics that define Category I and II estuarine wetlands have changed (see p.).

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

[✓ NO – go to 3]   **YES** – The wetland class is **Flats**

If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland unit **meet both** of the following criteria?

___The vegetated part of the wetland is on the shores of a body of permanent open water (without any vegetation on the surface) at least 20 acres (8 ha) in size;

___At least 30% of the open water area is deeper than 6.6 ft (2 m)?

[✓ NO – go to 4]   **YES** – The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the entire wetland unit **meet all** of the following criteria?

____The wetland is on a slope (*slope can be very gradual*),

____The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.

____The water leaves the wetland **without being impounded**?

NOTE: *Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3ft diameter and less than 1 foot deep).*

[✓ NO – go to 5]   **YES** – The wetland class is **Slope**

Wetland name or number B

5. Does the entire wetland unit **meet all** of the following criteria?

____ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river

____ The overbank flooding occurs at least once every two years.

NOTE: The riverine unit can contain depressions that are filled with water when the river is not flooding.

[✓ NO] – go to 6 **YES** – The wetland class is **Riverine**

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year. *This means that any outlet, if present, is higher than the interior of the wetland.*

NO – go to 7 [✓ **YES**] – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding. The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM clases. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within your wetland. NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM Classes within the wetland unit being rated	*HGM Class to Use in Rating*
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary	Depressional
Depressional + Lake-fringe	Depressional
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE under wetlands with special characteristics

If you are unable still to determine which of the above criteria apply to your wetland, or if you have more than 2 HGM classes within a wetland boundary, classify the wetland as **Depressional** for the rating.

Wetland name or number B

D	**Depressional and Flats Wetlands** **WATER QUALITY FUNCTIONS** - Indicators that the wetland unit functions to improve water quality	**Points** (only 1 score per box)
D	**D 1. Does the wetland unit have the <u>potential</u> to improve water quality?**	***(see p.38)***
D	D 1.1 Characteristics of surface water flows out of the wetland: Unit is a depression with no surface water leaving it (no outlet) points = 3 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 1 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* Provide photo or drawing	Figure ___ 2
D	S 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES points = 4 NO points = 0	0
D	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class) Wetland has persistent, ungrazed, vegetation > = 95% of area points = 5 Wetland has persistent, ungrazed, vegetation > = 1/2 of area points = 3 Wetland has persistent, ungrazed vegetation > = 1/10 of area points = 1 Wetland has persistent, ungrazed vegetation <1/10 of area points = 0 Map of Cowardin vegetation classes	Figure ___ 5
D	D1.4 Characteristics of seasonal ponding or inundation. *This is the area of the wetland unit that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 yrs.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0 Map of Hydroperiods	Figure ___ 2
D	**Total for D 1** *Add the points in the boxes above*	9
D	**D 2. Does the wetland unit have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* — Grazing in the wetland or within 150 ft ✓ Untreated stormwater discharges to wetland — Tilled fields or orchards within 150 ft of wetland — A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging ✓ Residential, urban areas, golf courses are within 150 ft of wetland — Wetland is fed by groundwater high in phosphorus or nitrogen — Other ___ [✓ **YES**] multiplier is 2 **NO** multiplier is 1	*(see p. 44)* multiplier 2
D	**<u>TOTAL</u> - Water Quality Functions** Multiply the score from D1 by D2 ***Add score to table on p. 1***	18

Wetland name or number B

D	**Depressional and Flats Wetlands** HYDROLOGIC FUNCTIONS - Indicators that the wetland unit functions to reduce flooding and stream degradation	**Points** (only 1 score per box)
	D 3. Does the wetland unit have the potential to reduce flooding and erosion?	***(see p.46)***
D	D 3.1 Characteristics of surface water flows out of the wetland unit Unit is a depression with no surface water leaving it (no outlet) points = 4 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 0	2
D	D 3.2 Depth of storage during wet periods *Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 The wetland is a "headwater" wetland" points = 5 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 Unit is flat (yes to Q. 2 or Q. 7 on key) but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft points = 0	0
D	D 3.3 Contribution of wetland unit to storage in the watershed *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire unit is in the FLATS class points = 5	0
D	**Total for D 3** *Add the points in the boxes above*	2
D	**D 4. Does the wetland unit have the opportunity to reduce flooding and erosion?** Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur. *Note which of the following indicators of opportunity apply.* — Wetland is in a headwater of a river or stream that has flooding problems ✓ Wetland drains to a river or stream that has flooding problems — Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems — Other ______________ [✓ YES] multiplier is 2 **NO** multiplier is 1	***(see p. 49)*** multiplier 2
D	**TOTAL - Hydrologic Functions** Multiply the score from D 3 by D 4 ***Add score to table on p. 1***	4

Wetland name or number B

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that unit functions to provide important habitat

Points
(only 1 score per box)

H 1. Does the wetland unit have the potential to provide habitat for many species?

H 1.1 Vegetation structure *(see p. 72)*

Check the types of vegetation classes present (as defined by Cowardin)- Size threshold for each class is ¼ acre or more than 10% of the area if unit is smaller than 2.5 acres.

____Aquatic bed
_✓_Emergent plants
____Scrub/shrub (areas where shrubs have >30% cover)
____Forested (areas where trees have >30% cover)

If the unit has a forested class check if:

____The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon

Add the number of vegetation structures that qualify. If you have:

4 structures or more	points = 4
3 structures	points = 2
2 structures	points = 1
1 structure	points = 0

Map of Cowardin vegetation classes

Figure ___

0

H 1.2. Hydroperiods *(see p. 73)*

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ acre to count. (see text for descriptions of hydroperiods)

____Permanently flooded or inundated
_✓_Seasonally flooded or inundated
____Occasionally flooded or inundated
_✓_Saturated only
____ Permanently flowing stream or river in, or adjacent to, the wetland
____ Seasonally flowing stream in, or adjacent to, the wetland
____***Lake-fringe wetland* = 2 points**
____***Freshwater tidal wetland* = 2 points**

4 or more types present	points = 3
3 types present	points = 2
2 types present	point = 1
1 type present	points = 0

Map of hydroperiods

Figure ___

2

H 1.3. Richness of Plant Species *(see p. 75)*

Count the number of plant species in the wetland that cover at least 10 ft^2. *(different patches of the same species can be combined to meet the size threshold)*

You do not have to name the species.

Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle

If you counted:

> 19 species	points = 2
5 - 19 species	points = 1
< 5 species	points = 0

List species below if you want to:

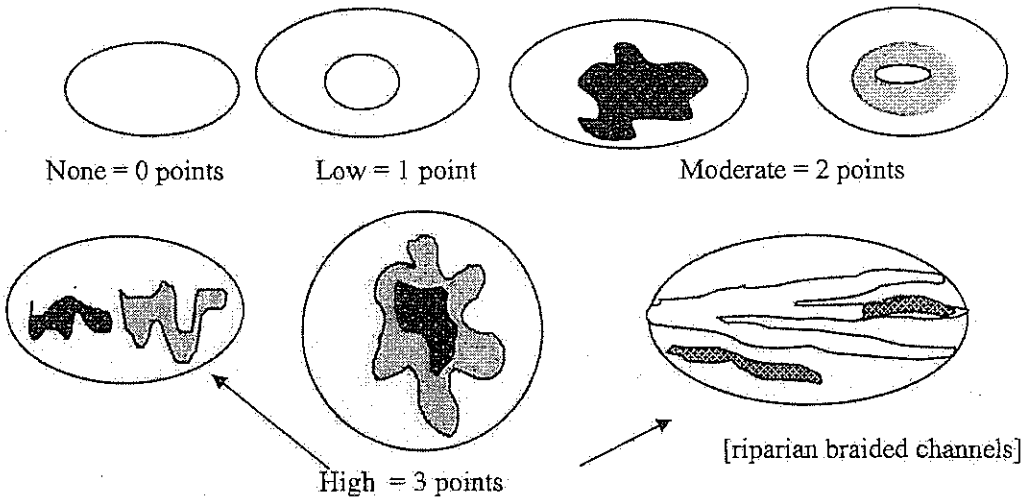
1

Total for page 3

H 1.4. Interspersion of habitats *(see p. 76)*

Decide from the diagrams below whether interspersion between Cowardin vegetation classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.

Figure ___



NOTE: If you have four or more classes or three vegetation classes and open water the rating is always "high". Use map of Cowardin vegetation classes

0

H 1.5. Special Habitat Features: *(see p. 77)*

Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.

____Large, downed, woody debris within the wetland (>4in. diameter and 6 ft long).

____Standing snags (diameter at the bottom > 4 inches) in the wetland

____Undercut banks are present for at least 6.6 ft (2m) and/or overhanging vegetation extends at least 3.3 ft (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft (10m)

____Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)*

____At least ¼ acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated.*(structures for egg-laying by amphibians)*

✓ Invasive plants cover less than 25% of the wetland area in each stratum of plants

NOTE: The 20% stated in early printings of the manual on page 78 is an error.

1

H 1. TOTAL Score - potential for providing habitat
Add the scores from H1.1, H1.2, H1.3, H1.4, H1.5

4

Comments

Wetland name or number B

H 2. Does the wetland unit have the opportunity to provide habitat for many species?

H 2.1 Buffers *(see p. 80)*

Figure ___

Choose the description that best represents condition of buffer of wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed."

- — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% of circumference. No structures are within the undisturbed part of buffer. (relatively undisturbed also means no-grazing, no landscaping, no daily human use) **Points = 5**
- — 100 m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 50% circumference. **Points = 4**
- — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% circumference. **Points = 4**
- — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 25% circumference, . **Points = 3**
- — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water for > 50% circumference. **Points = 3**

If buffer does not meet any of the criteria above

- [✓ — No paved areas (except paved trails) or buildings within 25 m (80ft) of wetland > 95% circumference. Light to moderate grazing, or lawns are OK. **Points = 2**]
- — No paved areas or buildings within 50m of wetland for >50% circumference. Light to moderate grazing, or lawns are OK. **Points = 2**
- — Heavy grazing in buffer. **Points = 1**
- — Vegetated buffers are <2m wide (6.6ft) for more than 95% of the circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland **Points = 0.**
- — Buffer does not meet any of the criteria above. **Points = 1**

Aerial photo showing buffers

2

H 2.2 Corridors and Connections *(see p. 81)*

H 2.2.1 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150 ft wide, has at least 30% cover of shrubs, forest or native undisturbed prairie, that connects to estuaries, other wetlands or undisturbed uplands that are at least 250 acres in size? *(dams in riparian corridors, heavily used gravel roads, paved roads, are considered breaks in the corridor).*

YES = 4 **points** *(go to H 2.3)* [✓ NO] = go to H 2.2.2

H 2.2.2 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 50ft wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands or undisturbed uplands that are at least 25 acres in size? **OR** a **Lake-fringe** wetland, if it does not have an undisturbed corridor as in the question above?

YES = 2 **points** *(go to H 2.3)* [✓ NO = H] 2.2.3

H 2.2.3 Is the wetland:

within 5 mi (8km) of a brackish or salt water estuary OR
within 3 mi of a large field or pasture (>40 acres) OR
within 1 mi of a lake greater than 20 acres?

[✓ YES = 1 **point**] NO = 0 **points**

/

Total for page 3

H 2.3 Near or adjacent to other priority habitats listed by WDFW *(see p. 82)*

Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*

These are DFW definitions. Check with your local DFW biologist if there are any questions.

____**Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

____**Aspen Stands:** Pure or mixed stands of aspen greater than 0.8 ha (2 acres).

____**Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft.

____**Old-growth forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age.

____**Mature forests:** Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less that 100%; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest.

____**Prairies:** Relatively undisturbed areas (as indicated by dominance of native plants) where grasses and/or forbs form the natural climax plant community.

____**Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

____**Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages

____**Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component of the stand is 25%.

✓ **Urban Natural Open Space**: A priority species resides within or is adjacent to the open space and uses it for breeding and/or regular feeding; and/or the open space functions as a corridor connecting other *priority habitats*, especially those that would otherwise be isolated; and/or the open space is an isolated remnant of natural habitat larger than 4 ha (10 acres) and is surrounded by urban development.

____**Estuary/Estuary-like:** Deepwater tidal habitats and adjacent tidal wetlands, usually semi-enclosed by land but with open, partly obstructed or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Estuarine habitat extends upstream and landward to where ocean-derived salts measure less than 0.5ppt. during the period of average annual low flow. Includes both estuaries and lagoons.

____**Marine/Estuarine Shorelines**: Shorelines include the intertidal and subtidal zones of beaches, and may also include the backshore and adjacent components of the terrestrial landscape (e.g., cliffs, snags, mature trees, dunes, meadows) that are important to shoreline associated fish and wildlife and that contribute to shoreline function (e.g., sand/rock/log recruitment, nutrient contribution, erosion control).

If wetland has 3 **or more** priority habitats = **4 points**
If wetland has 2 priority habitats = **3 points**
If wetland has **1** priority habitat = **1 point** No habitats = 0 points

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list. Nearby wetlands are addressed in question H 2.4)

1

H 2.4 Wetland Landscape *(choose the one description of the landscape around the wetland that best fits) (see p. 84)* There are at least 3 other wetlands within ½ mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development. points = 5 The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within ½ mile points = 5 There are at least 3 other wetlands within ½ mile, BUT the connections between them are disturbed points = 3 The wetland is Lake-fringe on a lake **with** disturbance and there are 3 other lake-fringe wetland within ½ mile points = 3 There is at least 1 wetland within ½ mile. points = 2 There are no wetlands within ½ mile. points = 0	5
H 2. TOTAL Score - opportunity for providing habitat *Add the scores from H2.1,H2.2, H2.3, H2.4*	9
TOTAL for H 1 from page 14	4
Total Score for Habitat Functions – add the points for H 1, H 2 and record the result on p. 1	13

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

Wetland Type *Check off any criteria that apply to the wetland. Circle the Category when the appropriate criteria are met.*	**Category**
SC 1.0 Estuarine wetlands *(see p. 86)* Does the wetland unit meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt. YES = Go to SC 1.1 NO ✓	
SC 1.1 Is the wetland unit within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? YES = Category I NO go to SC 1.2	**Cat. I**
SC 1.2 Is the wetland unit at least 1 acre in size and meets at least two of the following three conditions? YES = Category I NO = Category II — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp. are the only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category I. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** **Cat. II** **Dual rating I/II**

Wetland name or number B

SC 2.0 Natural Heritage Wetlands *(see p. 87)*
Natural Heritage wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state Threatened, Endangered, or Sensitive plant species.

Cat. I

SC 2.1 Is the wetland unit being rated in a Section/Township/Range that contains a Natural Heritage wetland? *(this question is used to screen out most sites before you need to contact WNHP/DNR)*

S/T/R information from Appendix D ___ or accessed from WNHP/DNR web site ✓

YES____ – contact WNHP/DNR (see p. 79) and go to SC 2.2 NO ✓

SC 2.2 Has DNR identified the wetland as a high quality undisturbed wetland or as or as a site with state threatened or endangered plant species?

YES = Category I NO ____not a Heritage Wetland

SC 3.0 Bogs *(see p. 87)*
Does the wetland unit (**or any part of the unit**) meet both the criteria for soils and vegetation in bogs? *Use the key below to identify if the wetland is a bog.* ***If you answer yes you will still need to rate the wetland based on its functions.***

1. Does the unit have organic soil horizons (i.e. layers of organic soil), either peats or mucks, that compose 16 inches or more of the first 32 inches of the soil profile? (See Appendix B for a field key to identify organic soils)? Yes - go to Q. 3 [✓ No] - go to Q. 2
2. Does the unit have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond?
   Yes - go to Q. 3 [✓ No] - Is not a bog for purpose of rating
3. Does the unit have more than 70% cover of mosses at ground level, AND other plants, if present, consist of the "bog" species listed in Table 3 as a significant component of the vegetation (more than 30% of the total shrub and herbaceous cover consists of species in Table 3)?
   Yes – Is a bog for purpose of rating No - go to Q. 4
   NOTE: If you are uncertain about the extent of mosses in the understory you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16" deep. If the pH is less than 5.0 and the "bog" plant species in Table 3 are present, the wetland is a bog.

1. Is the unit forested (> 30% cover) with sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemann's spruce, or western white pine, WITH any of the species (or combination of species) on the bog species plant list in Table 3 as a significant component of the ground cover *(> 30% coverage of the total shrub/herbaceous cover)?*

2. YES = Category I No___ Is not a bog for purpose of rating

Cat. I

SC 4.0 Forested Wetlands *(see p. 90)*

Does the wetland unit have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its functions.*

— **Old-growth forests**: (west of Cascade crest) Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm) or more.

NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter.

— **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have average diameters (dbh) exceeding 21 inches (53cm); crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth.

YES = Category I NO ✓ not a forested wetland with special characteristics

Cat. I

SC 5.0 Wetlands in Coastal Lagoons *(see p. 91)*

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

— The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks

— The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)*

YES = Go to SC 5.1 NO ✓ not a wetland in a coastal lagoon

SC 5.1 Does the wetland meets all of the following three conditions?

— The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of invasive plant species (see list of invasive species on p. 74).

— At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

— The wetland is larger than 1/10 acre (4350 square feet)

YES = Category I NO = Category II

Cat. I

Cat. II

SC 6.0 Interdunal Wetlands *(see p. 93)*

Is the wetland unit west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)?

YES - go to SC 6.1 NO ✓ not an interdunal wetland for rating

If you answer yes you will still need to rate the wetland based on its functions.

In practical terms that means the following geographic areas:

- Long Beach Peninsula- lands west of SR 103
- Grayland-Westport- lands west of SR 105
- Ocean Shores-Copalis- lands west of SR 115 and SR 109

SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is once acre or larger?

YES = Category II NO – go to SC 6.2

Cat. II

SC 6.2 Is the unit between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre?

YES = Category III

Cat. III

Category of wetland based on Special Characteristics

Choose the "highest" rating if wetland falls into several categories, and record on p. 1.

If you answered NO for all types enter "Not Applicable" on p.1

N/A

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Wetland name or number C

WETLAND RATING FORM – WESTERN WASHINGTON

Version 2 - Updated July 2006 to increase accuracy and reproducibility among users

Name of wetland (if known): Wetland C Date of site visit: 5/7/08

Rated by Kerrie McArthur Trained by Ecology? Yes ✓ No___ Date of training 11/2005

SEC: 5 TWNSHP: 20N RNGE: 4E Is S/T/R in Appendix D? Yes___ No ✓

Map of wetland unit: Figure ____ Estimated size [illegible]

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland

I ✓ II___ III___ IV___

Category I = Score >=70
Category II = Score 51-69
Category III = Score 30-50
Category IV = Score < 30

Score for Water Quality Functions	28
Score for Hydrologic Functions	24
Score for Habitat Functions	21
TOTAL score for Functions	73

Category based on SPECIAL CHARACTERISTICS of wetland

I___ II___ Does not Apply ✓

Final Category **(choose the "highest" category from above)** I

Summary of basic information about the wetland unit

Wetland Unit has Special Characteristics		**Wetland HGM Class used for Rating**	
Estuarine		**Depressional**	✓
Natural Heritage Wetland		**Riverine**	
Bog		**Lake-fringe**	
Mature Forest		**Slope**	
Old Growth Forest		**Flats**	
Coastal Lagoon		**Freshwater Tidal**	
Interdunal			
None of the above	✓	Check if unit has multiple HGM classes present	☐

Wetland name or number C

Does the wetland unit being rated meet any of the criteria below?

If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands That May Need Additional Protection (in addition to the protection recommended for its category)	**YES**	**NO**
SP1. *Has the wetland unit been documented as a habitat for any Federally listed Threatened or Endangered* ***animal or plant*** *species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.		
SP2. *Has the wetland unit been documented as habitat for any State listed Threatened or Endangered* ***animal*** *species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database. Note: Wetlands with State listed plant species are categorized as Category I Natural Heritage Wetlands (see p. 19 of data form).		
SP3. *Does the wetland unit contain individuals of Priority species listed by the WDFW for the state?*		
SP4. *Does the wetland unit have a local significance in addition to its functions?* For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.		

<u>To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.</u>

The hydrogeomorphic classification groups wetlands into those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

Wetland name or number C

Classification of Wetland Units in Western Washington

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?
[✓ NO] – go to 2 **YES** – the wetland class is **Tidal Fringe**

If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)? **YES – Freshwater Tidal Fringe** **NO – Saltwater Tidal Fringe (Estuarine)**

If your wetland can be classified as a Freshwater Tidal Fringe use the forms for ***Riverine*** *wetlands. If it is Saltwater Tidal Fringe it is rated as an* ***Estuarine*** *wetland.* Wetlands that were called estuarine in the first and second editions of the rating system are called Salt Water Tidal Fringe in the Hydrogeomorphic Classification. Estuarine wetlands were categorized separately in the earlier editions, and this separation is being kept in this revision. To maintain consistency between editions, the term "Estuarine" wetland is kept. Please note, however, that the characteristics that define Category I and II estuarine wetlands have changed (see p.).

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.
[✓ NO] – go to 3 **YES** – The wetland class is **Flats**

If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland unit **meet both** of the following criteria?
___The vegetated part of the wetland is on the shores of a body of permanent open water (without any vegetation on the surface) at least 20 acres (8 ha) in size;
___At least 30% of the open water area is deeper than 6.6 ft (2 m)?
[✓ NO] – go to 4 **YES** – The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the entire wetland unit **meet all** of the following criteria?
____The wetland is on a slope (*slope can be very gradual*),
____The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
____The water leaves the wetland **without being impounded**?
NOTE: *Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3ft diameter and less than 1 foot deep).*
[✓ NO] - go to 5 **YES** – The wetland class is **Slope**

5. Does the entire wetland unit **meet all** of the following criteria?

____ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river

____ The overbank flooding occurs at least once every two years.

NOTE: The riverine unit can contain depressions that are filled with water when the river is not flooding.

[✓ NO] - go to 6 **YES** – The wetland class is **Riverine**

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year. *This means that any outlet, if present, is higher than the interior of the wetland.*

NO – go to 7 [✓ **YES**] – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding. The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM clases. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within your wetland. NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM Classes within the wetland unit being rated	*HGM Class to Use in Rating*
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary	Depressional
Depressional + Lake-fringe	Depressional
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE under wetlands with special characteristics

If you are unable still to determine which of the above criteria apply to your wetland, or if you have more than 2 HGM classes within a wetland boundary, classify the wetland as **Depressional** for the rating.

Wetland name or number C

D	**Depressional and Flats Wetlands** **WATER QUALITY FUNCTIONS** - Indicators that the wetland unit functions to improve water quality	**Points** (only 1 score per box)
D	**D 1. Does the wetland unit have the <u>potential</u> to improve water quality?**	*(see p.38)*
D	D 1.1 Characteristics of surface water flows out of the wetland: Unit is a depression with no surface water leaving it (no outlet) points = 3 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 1 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* Provide photo or drawing	Figure ___ 1
D	S 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES points = 4 NO points = 0	4
D	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class) Wetland has persistent, ungrazed, vegetation > = 95% of area points = 5 Wetland has persistent, ungrazed, vegetation > = 1/2 of area points = 3 Wetland has persistent, ungrazed vegetation > = 1/10 of area points = 1 Wetland has persistent, ungrazed vegetation <1/10 of area points = 0 Map of Cowardin vegetation classes	Figure ___ 5
D	D1.4 Characteristics of seasonal ponding or inundation. *This is the area of the wetland unit that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 yrs.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0 Map of Hydroperiods	Figure ___ 4
D	**Total for D 1** *Add the points in the boxes above*	14
D	**D 2. Does the wetland unit have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* — Grazing in the wetland or within 150 ft ✓ Untreated stormwater discharges to wetland ✓ Tilled fields or orchards within 150 ft of wetland ✓ A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging ✓ Residential, urban areas, golf courses are within 150 ft of wetland — Wetland is fed by groundwater high in phosphorus or nitrogen — Other __________ [✓ **YES**] multiplier is **2** **NO** multiplier is **1**	*(see p. 44)* multiplier 2
D	<u>**TOTAL**</u> **- Water Quality Functions** Multiply the score from D1 by D2 ***Add score to table on p. 1***	28

Wetland name or number C

D	**Depressional and Flats Wetlands** HYDROLOGIC FUNCTIONS - Indicators that the wetland unit functions to reduce flooding and stream degradation	**Points** (only 1 score per box)
	D 3. Does the wetland unit have the <u>potential</u> to reduce flooding and erosion?	*(see p.46)*
D	D 3.1 Characteristics of surface water flows out of the wetland unit Unit is a depression with no surface water leaving it (no outlet) points = 4 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 0	2
D	D 3.2 Depth of storage during wet periods *Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 The wetland is a "headwater" wetland" points = 5 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 Unit is flat (yes to Q. 2 or Q. 7 on key) but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft points = 0	5
D	D 3.3 Contribution of wetland unit to storage in the watershed *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire unit is in the FLATS class points = 5	5
D	**Total for D 3** *Add the points in the boxes above*	12
D	**D 4. Does the wetland unit have the <u>opportunity</u> to reduce flooding and erosion?** Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur. *Note which of the following indicators of opportunity apply.* — Wetland is in a headwater of a river or stream that has flooding problems ✓— Wetland drains to a river or stream that has flooding problems — Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems — Other__________ [✓ YES] multiplier is 2 NO multiplier is 1	*(see p. 49)* multiplier 2
D	**TOTAL - Hydrologic Functions** Multiply the score from D 3 by D 4 *Add score to table on p. 1*	24

Wetland name or number C

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that unit functions to provide important habitat

Points (only 1 score per box)

H 1. Does the wetland unit have the potential to provide habitat for many species?

H 1.1 Vegetation structure *(see p. 72)*

Check the types of vegetation classes present (as defined by Cowardin)- Size threshold for each class is ¼ acre or more than 10% of the area if unit is smaller than 2.5 acres.

____ Aquatic bed
✓ Emergent plants
✓ Scruh/shrub (areas where shrubs have >30% cover)
✓ Forested (areas where trees have >30% cover)

If the unit has a forested class check if:

✓ The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon

Add the number of vegetation structures that qualify. If you have:

4 structures or more points = 4
3 structures points = 2
2 structures points = 1
1 structure points = 0

Map of Cowardin vegetation classes

Figure ____

4

H 1.2. Hydroperiods *(see p. 73)*

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ acre to count. (see text for descriptions of hydroperiods)

✓ Permanently flooded or inundated
✓ Seasonally flooded or inundated
____ Occasionally flooded or inundated
✓ Saturated only
✓ Permanently flowing stream or river in, or adjacent to, the wetland
____ Seasonally flowing stream in, or adjacent to, the wetland
____ ***Lake-fringe wetland* = 2 points**
____ ***Freshwater tidal wetland* = 2 points**

4 or more types present points = 3
3 types present points = 2
2 types present point = 1
1 type present points = 0

Map of hydroperiods

Figure ____

3

H 1.3. Richness of Plant Species *(see p. 75)*

Count the number of plant species in the wetland that cover at least 10 ft^2. *(different patches of the same species can be combined to meet the size threshold)*

You do not have to name the species.

Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle

If you counted:
> 19 species points = 2
5 - 19 species points = 1
< 5 species points = 0

List species below if you want to:

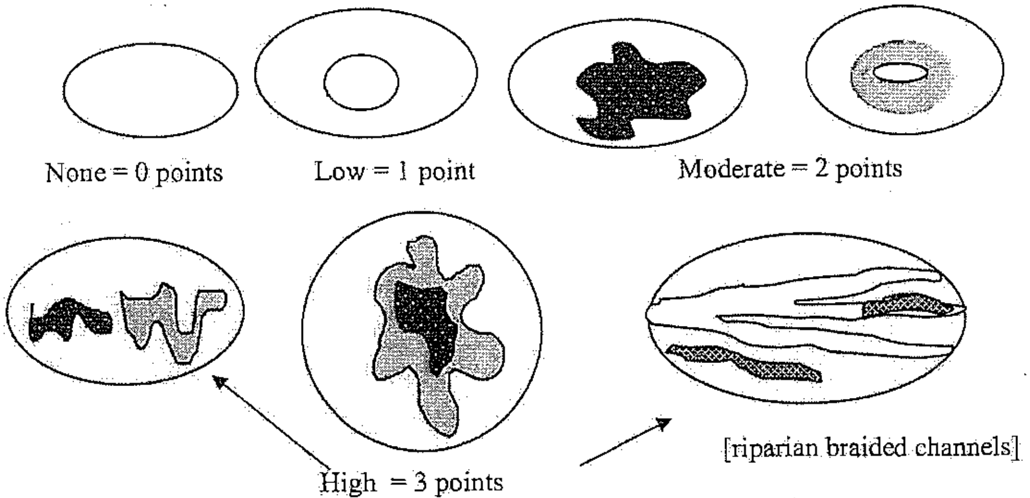
1

Total for page 8

H 1.4. Interspersion of habitats *(see p. 76)*

Figure ___

Decide from the diagrams below whether interspersion between Cowardin vegetation classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.



NOTE: If you have four or more classes or three vegetation classes and open water the rating is always "high". Use map of Cowardin vegetation classes

3

H 1.5. Special Habitat Features: *(see p. 77)*

Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.

✓ Large, downed, woody debris within the wetland (>4in. diameter and 6 ft long).

✓ Standing snags (diameter at the bottom > 4 inches) in the wetland

____ Undercut banks are present for at least 6.6 ft (2m) and/or overhanging vegetation extends at least 3.3 ft (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft (10m)

____ Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)*

✓ At least ¼ acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated.*(structures for egg-laying by amphibians)*

____ Invasive plants cover less than 25% of the wetland area in each stratum of plants

NOTE: The 20% stated in early printings of the manual on page 78 is an error.

3

H 1. TOTAL Score - potential for providing habitat
Add the scores from H1.1, H1.2, H1.3, H1.4, H1.5

14

Comments

Wetland name or number C

H 2. Does the wetland unit have the opportunity to provide habitat for many species?

H 2.1 Buffers *(see p. 80)*

Figure ___

Choose the description that best represents condition of buffer of wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed."

— 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% of circumference. No structures are within the undisturbed part of buffer. (relatively undisturbed also means no-grazing, no landscaping, no daily human use) **Points = 5**

— 100 m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 50% circumference. **Points = 4**

— 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% circumference. **Points = 4**

— 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 25% circumference, . **Points = 3**

— 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water for > 50% circumference. **Points = 3**

If buffer does not meet any of the criteria above

— No paved areas (except paved trails) or buildings within 25 m (80ft) of wetland > 95% circumference. Light to moderate grazing, or lawns are OK. **Points = 2**

— No paved areas or buildings within 50m of wetland for >50% circumference. Light to moderate grazing, or lawns are OK. **Points = 2**

— Heavy grazing in buffer. **Points = 1**

— Vegetated buffers are <2m wide (6.6ft) for more than 95% of the circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland **Points = 0.**

✓ Buffer does not meet any of the criteria above. **Points = 1**

Aerial photo showing buffers

1

H 2.2 Corridors and Connections *(see p. 81)*

H 2.2.1 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150 ft wide, has at least 30% cover of shrubs, forest or native undisturbed prairie, that connects to estuaries, other wetlands or undisturbed uplands that are at least 250 acres in size? *(dams in riparian corridors, heavily used gravel roads, paved roads, are considered breaks in the corridor).*

YES = 4 points *(go to H 2.3)* [✓ NO] = go to H 2.2.2

H 2.2.2 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 50ft wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands or undisturbed uplands that are at least 25 acres in size? **OR** a **Lake-fringe** wetland, if it does not have an undisturbed corridor as in the question above?

YES = 2 points *(go to H 2.3)* [✓ NO] = H 2.2.3

H 2.2.3 Is the wetland:

within 5 mi (8km) of a brackish or salt water estuary OR
within 3 mi of a large field or pasture (>40 acres) OR
within 1 mi of a lake greater than 20 acres?

[✓ YES] = **1 point** NO = 0 points

1

Total for page 2

H 2.3 Near or adjacent to other priority habitats listed by WDFW *(see p. 82)*

Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*

These are DFW definitions. Check with your local DFW biologist if there are any questions.

✓ **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

____**Aspen Stands:** Pure or mixed stands of aspen greater than 0.8 ha (2 acres).

____**Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft.

____**Old-growth forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age.

____**Mature forests:** Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less that 100%; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest.

____**Prairies:** Relatively undisturbed areas (as indicated by dominance of native plants) where grasses and/or forbs form the natural climax plant community.

____**Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

____**Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages

____**Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component of the stand is 25%.

✓ **Urban Natural Open Space**: A priority species resides within or is adjacent to the open space and uses it for breeding and/or regular feeding; and/or the open space functions as a corridor connecting other *priority habitats*, especially those that would otherwise be isolated; and/or the open space is an isolated remnant of natural habitat larger than 4 ha (10 acres) and is surrounded by urban development.

____**Estuary/Estuary-like:** Deepwater tidal habitats and adjacent tidal wetlands, usually semi-enclosed by land but with open, partly obstructed or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Estuarine habitat extends upstream and landward to where ocean-derived salts measure less than 0.5ppt. during the period of average annual low flow. Includes both estuaries and lagoons.

____**Marine/Estuarine Shorelines**: Shorelines include the intertidal and subtidal zones of beaches, and may also include the backshore and adjacent components of the terrestrial landscape (e.g., cliffs, snags, mature trees, dunes, meadows) that are important to shoreline associated fish and wildlife and that contribute to shoreline function (e.g., sand/rock/log recruitment, nutrient contribution, erosion control).

If wetland has **3 or more** priority habitats = **4 points**
If wetland has 2 priority habitats = **3 points**
If wetland has **1** priority habitat = **1 point** No habitats = 0 points

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list. Nearby wetlands are addressed in question H 2.4)

2

Wetland name or number C

H 2.4 <u>Wetland Landscape</u> *(choose the* ***one*** *description of the landscape around the wetland that best fits) (see p. 84)* There are at least 3 other wetlands within ½ mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development. points = 5 The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within ½ mile points = 5 There are at least 3 other wetlands within ½ mile, BUT the connections between them are disturbed points = 3 The wetland is Lake-fringe on a lake **with** disturbance and there are 3 other lake-fringe wetland within ½ mile points = 3 There is at least 1 wetland within ½ mile. points = 2 There are no wetlands within ½ mile. points = 0	3
H 2. TOTAL Score - opportunity for providing habitat *Add the scores from H2.1,H2.2, H2.3, H2.4*	7
TOTAL for H 1 from page 14	14
Total Score for Habitat Functions – add the points for H 1, H 2 and record the result on p. 1	21

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

Wetland Type *Check off any criteria that apply to the wetland. Circle the Category when the appropriate criteria are met.*	**Category**
SC 1.0 Estuarine wetlands *(see p. 86)* Does the wetland unit meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt. YES = Go to SC 1.1 NO ✓	
SC 1.1 Is the wetland unit within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? YES = Category I NO go to SC 1.2	**Cat. I**
SC 1.2 Is the wetland unit at least 1 acre in size and meets at least two of the following three conditions? YES = Category I NO = Category II — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp. are the only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category I. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** **Cat. II** **Dual rating I/II**

SC 2.0 Natural Heritage Wetlands *(see p. 87)*

Cat. I

Natural Heritage wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state Threatened, Endangered, or Sensitive plant species.

SC 2.1 Is the wetland unit being rated in a Section/Township/Range that contains a Natural Heritage wetland? *(this question is used to screen out most sites before you need to contact WNHP/DNR)*

S/T/R information from Appendix D ___ or accessed from WNHP/DNR web site ✓

YES____ – contact WNHP/DNR (see p. 79) and go to SC 2.2 NO ✓

SC 2.2 Has DNR identified the wetland as a high quality undisturbed wetland or as or as a site with state threatened or endangered plant species?

YES = Category 1 NO ____not a Heritage Wetland

SC 3.0 **Bogs** *(see p. 87)*

Does the wetland unit (**or any part of the unit**) meet both the criteria for soils and vegetation in bogs? *Use the key below to identify if the wetland is a bog.* ***If you answer yes you will still need to rate the wetland based on its functions.***

1. Does the unit have organic soil horizons (i.e. layers of organic soil), either peats or mucks, that compose 16 inches or more of the first 32 inches of the soil profile? (See Appendix B for a field key to identify organic soils)? Yes - go to Q. 3 [✓ No] - go to Q. 2
2. Does the unit have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond?

   Yes - go to Q. 3 [✓ No] Is not a bog for purpose of rating
3. Does the unit have more than 70% cover of mosses at ground level, AND other plants, if present, consist of the "bog" species listed in Table 3 as a significant component of the vegetation (more than 30% of the total shrub and herbaceous cover consists of species in Table 3)?

   Yes – Is a bog for purpose of rating No - go to Q. 4

   NOTE: If you are uncertain about the extent of mosses in the understory you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16" deep. If the pH is less than 5.0 and the "bog" plant species in Table 3 are present, the wetland is a bog.

1. Is the unit forested (> 30% cover) with sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemann's spruce, or western white pine, WITH any of the species (or combination of species) on the bog species plant list in Table 3 as a significant component of the ground cover *(> 30% coverage of the total shrub/herbaceous cover)?*

2\. YES = Category I No___ Is not a bog for purpose of rating

Cat. I

SC 4.0 Forested Wetlands *(see p. 90)*
Does the wetland unit have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its functions.*

— **Old-growth forests**: (west of Cascade crest) Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm) or more.

NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter.

— **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have average diameters (dbh) exceeding 21 inches (53cm); crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth.

YES = Category I   NO ✓ not a forested wetland with special characteristics

Cat. I

SC 5.0 Wetlands in Coastal Lagoons *(see p. 91)*
Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

— The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks

— The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)*

YES = Go to SC 5.1   NO ✓ not a wetland in a coastal lagoon

SC 5.1 Does the wetland meets all of the following three conditions?

— The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of invasive plant species (see list of invasive species on p. 74).

— At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

— The wetland is larger than 1/10 acre (4350 square feet)

YES = Category I   NO = Category II

Cat. I

Cat. II

SC 6.0 Interdunal Wetlands *(see p. 93)* Is the wetland unit west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? YES - go to SC 6.1 NO ✓ not an interdunal wetland for rating ***If you answer yes you will still need to rate the wetland based on its functions.*** In practical terms that means the following geographic areas: • Long Beach Peninsula- lands west of SR 103 • Grayland-Westport- lands west of SR 105 • Ocean Shores-Copalis- lands west of SR 115 and SR 109 SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is once acre or larger? YES = Category II NO – go to SC 6.2	**Cat. II**
SC 6.2 Is the unit between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre? YES = Category III	**Cat. III**
Category of wetland based on Special Characteristics *Choose the "highest" rating if wetland falls into several categories, and record on p. 1.* If you answered NO for all types enter "Not Applicable" on p.1	NA

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Wetland name or number E

WETLAND RATING FORM – WESTERN WASHINGTON

Version 2 - Updated July 2006 to increase accuracy and reproducibility among users

Name of wetland (if known): Wetland E Date of site visit: 5/7/08

Rated by Kerrie McArthur Trained by Ecology? Yes ✓ No___ Date of training 11/2005

SEC: 5 TWNSHP: 20N RNGE: 4E Is S/T/R in Appendix D? Yes___ No ✓

Map of wetland unit: Figure ____ Estimated size 4.25 acres

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland

I___ II ✓ III___ IV___

Category I = Score >=70
Category II = Score 51-69
Category III = Score 30-50
Category IV = Score < 30

Score for Water Quality Functions	26
Score for Hydrologic Functions	16
Score for Habitat Functions	15
TOTAL score for Functions	57

Category based on SPECIAL CHARACTERISTICS of wetland

I___ II___ Does not Apply ✓

Final Category (choose the "highest" category from above) II

Summary of basic information about the wetland unit

Wetland Unit has Special Characteristics		**Wetland HGM Class used for Rating**	
Estuarine		**Depressional**	✓
Natural Heritage Wetland		**Riverine**	
Bog		**Lake-fringe**	
Mature Forest		**Slope**	
Old Growth Forest		**Flats**	
Coastal Lagoon		**Freshwater Tidal**	
Interdunal			
None of the above	✓	Check if unit has multiple HGM classes present	☐

Wetland name or number L2

Does the wetland unit being rated meet any of the criteria below?

If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands That May Need Additional Protection (in addition to the protection recommended for its category)	**YES**	**NO**
SP1. *Has the wetland unit been documented as a habitat for any Federally listed Threatened or Endangered **animal or plant** species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.		
SP2. *Has the wetland unit been documented as habitat for any State listed Threatened or Endangered **animal** species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database. Note: Wetlands with State listed plant species are categorized as Category I Natural Heritage Wetlands (see p. 19 of data form).		
SP3. *Does the wetland unit contain individuals of Priority species listed by the WDFW for the state?*		
SP4. *Does the wetland unit have a local significance in addition to its functions?* For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.		

To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.

The hydrogeomorphic classification groups wetlands into those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

Wetland name or number E

Classification of Wetland Units in Western Washington

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?
[✓ **NO** – go to 2] **YES** – the wetland class is **Tidal Fringe**

If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)? **YES – Freshwater Tidal Fringe** **NO – Saltwater Tidal Fringe (Estuarine)**

If your wetland can be classified as a Freshwater Tidal Fringe use the forms for ***Riverine*** *wetlands. If it is Saltwater Tidal Fringe it is rated as an* ***Estuarine*** *wetland.* Wetlands that were called estuarine in the first and second editions of the rating system are called Salt Water Tidal Fringe in the Hydrogeomorphic Classification. Estuarine wetlands were categorized separately in the earlier editions, and this separation is being kept in this revision. To maintain consistency between editions, the term "Estuarine" wetland is kept. Please note, however, that the characteristics that define Category I and II estuarine wetlands have changed (see p.).

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.
[✓ **NO** – go to 3] **YES** – The wetland class is **Flats**

If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland unit **meet both** of the following criteria?
___The vegetated part of the wetland is on the shores of a body of permanent open water (without any vegetation on the surface) at least 20 acres (8 ha) in size;
___At least 30% of the open water area is deeper than 6.6 ft (2 m)?
[✓ **NO** – go to 4] **YES** – The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the entire wetland unit **meet all** of the following criteria?
____The wetland is on a slope (*slope can be very gradual*),
____The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
____The water leaves the wetland **without being impounded**?
NOTE: *Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3ft diameter and less than 1 foot deep).*
[✓ **NO** – go to 5] **YES** – The wetland class is **Slope**

5. Does the entire wetland unit **meet all** of the following criteria?

____ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river

____ The overbank flooding occurs at least once every two years.

NOTE: The riverine unit can contain depressions that are filled with water when the river is not flooding.

[✓ NO] – go to 6 **YES** – The wetland class is **Riverine**

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year. *This means that any outlet, if present, is higher than the interior of the wetland.*

NO – go to 7 [✓ **YES**] – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding. The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM clases. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within your wetland. NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM Classes within the wetland unit being rated	*HGM Class to Use in Rating*
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary	Depressional
Depressional + Lake-fringe	Depressional
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE under wetlands with special characteristics

If you are unable still to determine which of the above criteria apply to your wetland, or if you have more than 2 HGM classes within a wetland boundary, classify the wetland as **Depressional** for the rating.

D	**Depressional and Flats Wetlands** **WATER QUALITY FUNCTIONS** - Indicators that the wetland unit functions to improve water quality	**Points** (only 1 score per box)
D	**D 1. Does the wetland unit have the <u>potential</u> to improve water quality?**	*(see p.38)*
D	D 1.1 Characteristics of surface water flows out of the wetland: Unit is a depression with no surface water leaving it (no outlet) points = 3 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 1 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* Provide photo or drawing	**Figure** ___ 2
D	S 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES points = 4 NO points = 0	4
D	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class) Wetland has persistent, ungrazed, vegetation > = 95% of area points = 5 Wetland has persistent, ungrazed, vegetation > = 1/2 of area points = 3 Wetland has persistent, ungrazed vegetation > = 1/10 of area points = 1 Wetland has persistent, ungrazed vegetation <1/10 of area points = 0 Map of Cowardin vegetation classes	**Figure** ___ 5
D	D1.4 Characteristics of seasonal ponding or inundation. *This is the area of the wetland unit that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 yrs.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0 Map of Hydroperiods	**Figure** ___ 2
D	**Total for D 1** *Add the points in the boxes above*	13
D	**D 2. Does the wetland unit have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* — Grazing in the wetland or within 150 ft ✓ Untreated stormwater discharges to wetland — Tilled fields or orchards within 150 ft of wetland ✓ A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging — Residential, urban areas, golf courses are within 150 ft of wetland — Wetland is fed by groundwater high in phosphorus or nitrogen — Other___ [✓ YES] multiplier is 2 NO multiplier is 1	*(see p. 44)* multiplier 2
D	**<u>TOTAL</u> - Water Quality Functions** Multiply the score from D1 by D2 ***Add score to table on p. 1***	26

Wetland name or number E

D Depressional and Flats Wetlands

HYDROLOGIC FUNCTIONS - Indicators that the wetland unit functions to reduce flooding and stream degradation

Points (only 1 score per box)

D 3. Does the wetland unit have the <u>potential</u> to reduce flooding and erosion?

(see p.46)

D D 3.1 Characteristics of surface water flows out of the wetland unit

Unit is a depression with no surface water leaving it (no outlet)	points = 4
Unit has an intermittently flowing, OR highly constricted permanently flowing outlet	points = 2
Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow and **no obvious natural outlet** and/or outlet is a man-made ditch *(If ditch is not permanently flowing treat unit as "intermittently flowing")*	points = 1
Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)*	points = 0

Points: 2

D D 3.2 Depth of storage during wet periods

Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).

Marks of ponding are 3 ft or more above the surface or bottom of outlet	points = 7
The wetland is a "headwater" wetland"	points = 5
Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet	points = 5
Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet	points = 3
Unit is flat (yes to Q. 2 or Q. 7 on key) but has small depressions on the surface that trap water	points = 1
Marks of ponding less than 0.5 ft	points = 0

Points: 3

D D 3.3 Contribution of wetland unit to storage in the watershed

Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.

The area of the basin is less than 10 times the area of unit	points = 5
The area of the basin is 10 to 100 times the area of the unit	points = 3
The area of the basin is more than 100 times the area of the unit	points = 0
Entire unit is in the FLATS class	points = 5

Points: 3

D **Total for D 3** *Add the points in the boxes above* 8

D 4. Does the wetland unit have the <u>opportunity</u> to reduce flooding and erosion?

(see p. 49)

Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur.

Note which of the following indicators of opportunity apply.

- — Wetland is in a headwater of a river or stream that has flooding problems
- ✓ Wetland drains to a river or stream that has flooding problems
- — Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems
- — Other____________________________

[✓ YES] multiplier is 2 NO multiplier is 1

multiplier 2

D **TOTAL - Hydrologic Functions** Multiply the score from D 3 by D 4 *Add score to table on p. 1* 16

Wetland name or number E

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that unit functions to provide important habitat

Points (only 1 score per box)

H 1. Does the wetland unit have the potential to provide habitat for many species?

H 1.1 Vegetation structure *(see p. 72)*

Check the types of vegetation classes present (as defined by Cowardin)- Size threshold for each class is ¼ acre or more than 10% of the area if unit is smaller than 2.5 acres.

____Aquatic bed
✓ Emergent plants
____Scrub/shrub (areas where shrubs have >30% cover)
✓ Forested (areas where trees have >30% cover)

If the unit has a forested class check if:

✓ The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon

Add the number of vegetation structures that qualify. If you have:

4 structures or more	points = 4
3 structures	points = 2
2 structures	points = 1
1 structure	points = 0

Map of Cowardin vegetation classes

Figure ____

2

H 1.2. Hydroperiods *(see p. 73)*

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ acre to count. (see text for descriptions of hydroperiods)

____Permanently flooded or inundated
✓ Seasonally flooded or inundated
____Occasionally flooded or inundated
✓ Saturated only
____ Permanently flowing stream or river in, or adjacent to, the wetland
____ Seasonally flowing stream in, or adjacent to, the wetland
____ ***Lake-fringe wetland*** **= 2 points**
____ ***Freshwater tidal wetland*** **= 2 points**

4 or more types present	points = 3
3 types present	points = 2
2 types present	point = 1
1 type present	points = 0

Map of hydroperiods

Figure ____

1

H 1.3. Richness of Plant Species *(see p. 75)*

Count the number of plant species in the wetland that cover at least 10 ft^2. (*different patches of the same species can be combined to meet the size threshold)*

You do not have to name the species.

Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle

If you counted:

> 19 species	points = 2
5 - 19 species	points = 1
< 5 species	points = 0

List species below if you want to:

1

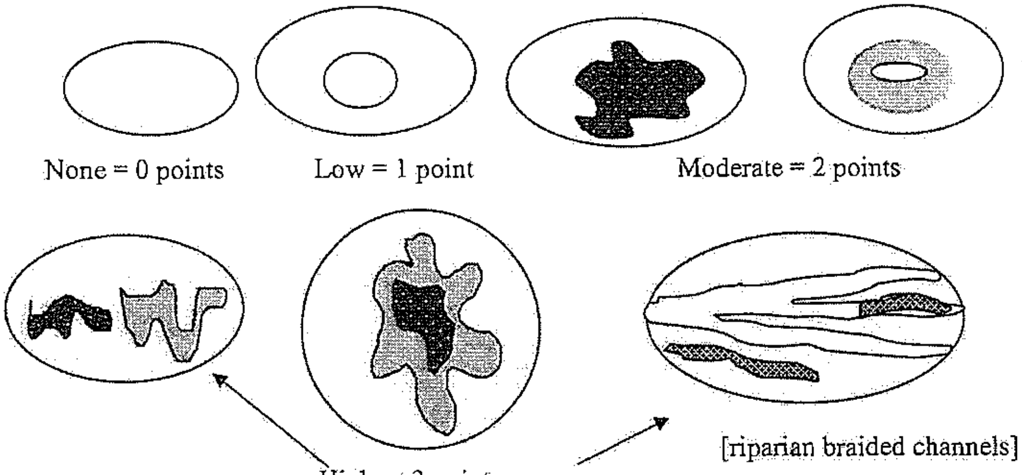
Total for page 4

Wetland name or number E

H 1.4. Interspersion of habitats *(see p. 76)*

Decide from the diagrams below whether interspersion between Cowardin vegetation classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.

Figure ___



None = 0 points

Low = 1 point

Moderate = 2 points

[riparian braided channels]

High = 3 points

NOTE: If you have four or more classes or three vegetation classes and open water the rating is always "high". Use map of Cowardin vegetation classes

2

H 1.5. Special Habitat Features: *(see p. 77)*

Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.

✓ Large, downed, woody debris within the wetland (>4in. diameter and 6 ft long).

____Standing snags (diameter at the bottom > 4 inches) in the wetland

____Undercut banks are present for at least 6.6 ft (2m) and/or overhanging vegetation extends at least 3.3 ft (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft (10m)

____Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)*

✓ At least ¼ acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated.*(structures for egg-laying by amphibians)*

____Invasive plants cover less than 25% of the wetland area in each stratum of plants

NOTE: The 20% stated in early printings of the manual on page 78 is an error.

2

H 1. TOTAL Score - potential for providing habitat
Add the scores from H1.1, H1.2, H1.3, H1.4, H1.5

8

Comments

H 2. Does the wetland unit have the opportunity to provide habitat for many species?	
H 2.1 Buffers *(see p. 80)* *Choose the description that best represents condition of buffer of wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed."* — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% of circumference. No structures are within the undisturbed part of buffer. (relatively undisturbed also means no-grazing, no landscaping, no daily human use) **Points = 5** — 100 m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 50% circumference. **Points = 4** — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% circumference. **Points = 4** — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 25% circumference, . **Points = 3** — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water for > 50% circumference. **Points = 3** **If buffer does not meet any of the criteria above** ✓ No paved areas (except paved trails) or buildings within 25 m (80ft) of wetland > 95% circumference. Light to moderate grazing, or lawns are OK. **Points = 2** — No paved areas or buildings within 50m of wetland for >50% circumference. Light to moderate grazing, or lawns are OK. **Points = 2** — Heavy grazing in buffer. **Points = 1** — Vegetated buffers are <2m wide (6.6ft) for more than 95% of the circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland **Points = 0.** — Buffer does not meet any of the criteria above. **Points = 1** Aerial photo showing buffers	**Figure ___** 2
H 2.2 Corridors and Connections *(see p. 81)* H 2.2.1 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150 ft wide, has at least 30% cover of shrubs, forest or native undisturbed prairie, that connects to estuaries, other wetlands or undisturbed uplands that are at least 250 acres in size? *(dams in riparian corridors, heavily used gravel roads, paved roads, are considered breaks in the corridor).* YES = **4 points** *(go to H 2.3)* [✓ NO] = go to H 2.2.2 H 2.2.2 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 50ft wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands or undisturbed uplands that are at least 25 acres in size? **OR** a **Lake-fringe** wetland, if it does not have an undisturbed corridor as in the question above? YES = **2 points** *(go to H 2.3)* [✓ NO] = H 2.2.3 H 2.2.3 Is the wetland: within 5 mi (8km) of a brackish or salt water estuary OR within 3 mi of a large field or pasture (>40 acres) OR within 1 mi of a lake greater than 20 acres? [✓ **YES = 1 point**] **NO = 0 points**	1

Total for page 3

H 2.3 Near or adjacent to other priority habitats listed by WDFW *(see p. 82)*

Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*

These are DFW definitions. Check with your local DFW biologist if there are any questions.

____**Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

____**Aspen Stands:** Pure or mixed stands of aspen greater than 0.8 ha (2 acres).

____**Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft.

____**Old-growth forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age.

____**Mature forests:** Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less that 100%; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest.

____**Prairies:** Relatively undisturbed areas (as indicated by dominance of native plants) where grasses and/or forbs form the natural climax plant community.

____**Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

____**Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages

____**Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component of the stand is 25%.

✓ **Urban Natural Open Space**: A priority species resides within or is adjacent to the open space and uses it for breeding and/or regular feeding; and/or the open space functions as a corridor connecting other *priority habitats*, especially those that would otherwise be isolated; and/or the open space is an isolated remnant of natural habitat larger than 4 ha (10 acres) and is surrounded by urban development.

____**Estuary/Estuary-like:** Deepwater tidal habitats and adjacent tidal wetlands, usually semi-enclosed by land but with open, partly obstructed or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Estuarine habitat extends upstream and landward to where ocean-derived salts measure less than 0.5ppt. during the period of average annual low flow. Includes both estuaries and lagoons.

____**Marine/Estuarine Shorelines**: Shorelines include the intertidal and subtidal zones of beaches, and may also include the backshore and adjacent components of the terrestrial landscape (e.g., cliffs, snags, mature trees, dunes, meadows) that are important to shoreline associated fish and wildlife and that contribute to shoreline function (e.g., sand/rock/log recruitment, nutrient contribution, erosion control).

If wetland has 3 **or more** priority habitats = **4 points**
If wetland has 2 priority habitats = **3 points**
If wetland has 1 priority habitat = **1 point** No habitats = 0 points

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list. Nearby wetlands are addressed in question H 2.4)

1

H 2.4 Wetland Landscape *(choose the one description of the landscape around the wetland that best fits) (see p. 84)* There are at least 3 other wetlands within ½ mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development. points = 5 The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within ½ mile points = 5 There are at least 3 other wetlands within ½ mile, BUT the connections between them are disturbed points = 3 The wetland is Lake-fringe on a lake **with** disturbance and there are 3 other lake-fringe wetland within ½ mile points = 3 There is at least 1 wetland within ½ mile. points = 2 There are no wetlands within ½ mile. points = 0	3
H 2. TOTAL Score - opportunity for providing habitat *Add the scores from H2.1,H2.2, H2.3, H2.4*	7
TOTAL for H 1 from page 14	8
Total Score for Habitat Functions – add the points for H 1, H 2 and record the result on p. 1	15

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

Wetland Type *Check off any criteria that apply to the wetland. Circle the Category when the appropriate criteria are met.*	**Category**
SC 1.0 Estuarine wetlands *(see p. 86)* Does the wetland unit meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt. YES = Go to SC 1.1 NO ✓	
SC 1.1 Is the wetland unit within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? YES = Category I NO go to SC 1.2	**Cat. I**
SC 1.2 Is the wetland unit at least 1 acre in size and meets at least two of the following three conditions? YES = Category I NO = Category II — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp. are the only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category I. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** **Cat. II** **Dual rating I/II**

SC 2.0 Natural Heritage Wetlands *(see p. 87)*

Cat. I

Natural Heritage wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state Threatened, Endangered, or Sensitive plant species.

SC 2.1 Is the wetland unit being rated in a Section/Township/Range that contains a Natural Heritage wetland? *(this question is used to screen out most sites before you need to contact WNHP/DNR)*

S/T/R information from Appendix D ___ or accessed from WNHP/DNR web site ✓

YES____ – contact WNHP/DNR (see p. 79) and go to SC 2.2 NO ✓

SC 2.2 Has DNR identified the wetland as a high quality undisturbed wetland or as or as a site with state threatened or endangered plant species?

YES = Category I NO ____not a Heritage Wetland

SC 3.0 Bogs *(see p. 87)*

Does the wetland unit (**or any part of the unit**) meet both the criteria for soils and vegetation in bogs? *Use the key below to identify if the wetland is a bog.* ***If you answer yes you will still need to rate the wetland based on its functions.***

1. Does the unit have organic soil horizons (i.e. layers of organic soil), either peats or mucks, that compose 16 inches or more of the first 32 inches of the soil profile? (See Appendix B for a field key to identify organic soils)? Yes - go to Q. 3 [✓ No] - go to Q. 2
2. Does the unit have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond?

   Yes - go to Q. 3 [✓ No] - Is not a bog for purpose of rating
3. Does the unit have more than 70% cover of mosses at ground level, AND other plants, if present, consist of the "bog" species listed in Table 3 as a significant component of the vegetation (more than 30% of the total shrub and herbaceous cover consists of species in Table 3)?

   Yes – Is a bog for purpose of rating No - go to Q. 4

   NOTE: If you are uncertain about the extent of mosses in the understory you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16" deep. If the pH is less than 5.0 and the "bog" plant species in Table 3 are present, the wetland is a bog.

1. Is the unit forested (> 30% cover) with sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemann's spruce, or western white pine, WITH any of the species (or combination of species) on the bog species plant list in Table 3 as a significant component of the ground cover *(> 30% coverage of the total shrub/herbaceous cover)?*

2. YES = Category I No___ Is not a bog for purpose of rating

Cat. I

SC 4.0 Forested Wetlands *(see p. 90)*

Does the wetland unit have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its functions.*

— **Old-growth forests**: (west of Cascade crest) Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm) or more.

NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter.

— **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have average diameters (dbh) exceeding 21 inches (53cm); crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth.

YES = Category I NO ✓ not a forested wetland with special characteristics

Cat. I

SC 5.0 Wetlands in Coastal Lagoons *(see p. 91)*

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

— The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks

— The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)*

YES = Go to SC 5.1 NO ✓ not a wetland in a coastal lagoon

SC 5.1 Does the wetland meets all of the following three conditions?

— The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of invasive plant species (see list of invasive species on p. 74).

— At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

— The wetland is larger than 1/10 acre (4350 square feet)

YES = Category I NO = Category II

Cat. I

Cat. II

SC 6.0 Interdunal Wetlands *(see p. 93)*

Is the wetland unit west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)?

YES - go to SC 6.1 NO [✓] not an interdunal wetland for rating

If you answer yes you will still need to rate the wetland based on its functions.

In practical terms that means the following geographic areas:

- Long Beach Peninsula- lands west of SR 103
- Grayland-Westport- lands west of SR 105
- Ocean Shores-Copalis- lands west of SR 115 and SR 109

SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is once acre or larger?

YES = Category II NO – go to SC 6.2 **Cat. II**

SC 6.2 Is the unit between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre?

YES = Category III **Cat. III**

Category of wetland based on Special Characteristics

Choose the "highest" rating if wetland falls into several categories, and record on p. 1.

If you answered NO for all types enter "Not Applicable" on p.1

NA

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WETLAND RATING FORM – WESTERN WASHINGTON

Version 2 - Updated July 2006 to increase accuracy and reproducibility among users

Name of wetland (if known): Wetland F Date of site visit: 5/19/08

Rated by Kerrie McArthur Trained by Ecology? Yes__No___ Date of training 11/2005

SEC: 5 TWNSHP: 20N RNGE: 4E Is S/T/R in Appendix D? Yes___ No ✓

Map of wetland unit: Figure ____ Estimated size ______

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland

I___ II___ III___ IV___

Category I = Score >=70
Category II = Score 51-69
Category III = Score 30-50
Category IV = Score < 30

Score for Water Quality Functions	12
Score for Hydrologic Functions	0
Score for Habitat Functions	6
TOTAL score for Functions	18

Category based on SPECIAL CHARACTERISTICS of wetland

I___ II___ Does not Apply ✓

Final Category (choose the "highest" category from above) IV

Summary of basic information about the wetland unit

Wetland Unit has Special Characteristics		**Wetland HGM Class used for Rating**	
Estuarine		**Depressional**	✓
Natural Heritage Wetland		**Riverine**	
Bog		**Lake-fringe**	
Mature Forest		**Slope**	
Old Growth Forest		**Flats**	
Coastal Lagoon		**Freshwater Tidal**	
Interdunal			
None of the above	✓	Check if unit has multiple HGM classes present	☐

Wetland name or number F

Does the wetland unit being rated meet any of the criteria below?

If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands That May Need Additional Protection (in addition to the protection recommended for its category)	**YES**	**NO**
SP1. *Has the wetland unit been documented as a habitat for any Federally listed Threatened or Endangered* ***animal or plant*** *species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.		✓
SP2. *Has the wetland unit been documented as habitat for any State listed Threatened or Endangered* ***animal*** *species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database. Note: Wetlands with State listed plant species are categorized as Category I Natural Heritage Wetlands (see p. 19 of data form).		✓
SP3. *Does the wetland unit contain individuals of Priority species listed by the WDFW for the state?*		✓
SP4. *Does the wetland unit have a local significance in addition to its functions?* For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.		✓

To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.

The hydrogeomorphic classification groups wetlands into those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

Wetland name or number F

Classification of Wetland Units in Western Washington

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?
[✓ NO] – go to 2 **YES** – the wetland class is **Tidal Fringe**

If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)? **YES – Freshwater Tidal Fringe** **NO – Saltwater Tidal Fringe (Estuarine)**

If your wetland can be classified as a Freshwater Tidal Fringe use the forms for ***Riverine*** *wetlands. If it is Saltwater Tidal Fringe it is rated as an* ***Estuarine*** *wetland.* Wetlands that were called estuarine in the first and second editions of the rating system are called Salt Water Tidal Fringe in the Hydrogeomorphic Classification. Estuarine wetlands were categorized separately in the earlier editions, and this separation is being kept in this revision. To maintain consistency between editions, the term "Estuarine" wetland is kept. Please note, however, that the characteristics that define Category I and II estuarine wetlands have changed (see p.).

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.
[✓ NO] – go to 3 **YES** – The wetland class is **Flats**

If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland unit **meet both** of the following criteria?
___The vegetated part of the wetland is on the shores of a body of permanent open water (without any vegetation on the surface) at least 20 acres (8 ha) in size;
___At least 30% of the open water area is deeper than 6.6 ft (2 m)?
[✓ NO] – go to 4 **YES** – The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the entire wetland unit **meet all** of the following criteria?
____The wetland is on a slope (*slope can be very gradual*),
____The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
____The water leaves the wetland **without being impounded**?
NOTE: *Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3ft diameter and less than 1 foot deep).*
[✓ NO] – go to 5 **YES** – The wetland class is **Slope**

5. Does the entire wetland unit **meet all** of the following criteria?

____ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river

____ The overbank flooding occurs at least once every two years.

NOTE: The riverine unit can contain depressions that are filled with water when the river is not flooding.

[✓ NO] – go to 6 **YES** – The wetland class is **Riverine**

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year. *This means that any outlet, if present, is higher than the interior of the wetland.*

NO – go to 7 [✓ **YES**] – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding. The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM clases. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within your wetland. NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM Classes within the wetland unit being rated	*HGM Class to Use in Rating*
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary	Depressional
Depressional + Lake-fringe	Depressional
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE under wetlands with special characteristics

If you are unable still to determine which of the above criteria apply to your wetland, or if you have more than 2 HGM classes within a wetland boundary, classify the wetland as **Depressional** for the rating.

Wetland name or number E

D	**Depressional and Flats Wetlands** **WATER QUALITY FUNCTIONS** - Indicators that the wetland unit functions to improve water quality	**Points** (only 1 score per box)
D	**D 1. Does the wetland unit have the <u>potential</u> to improve water quality?**	*(see p.38)*
D	D 1.1 Characteristics of surface water flows out of the wetland: Unit is a depression with no surface water leaving it (no outlet) points = 3 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 1 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* Provide photo or drawing	Figure ___ 1
D	S 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES points = 4 NO points = 0	0
D	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class) Wetland has persistent, ungrazed, vegetation > = 95% of area points = 5 Wetland has persistent, ungrazed, vegetation > = 1/2 of area points = 3 Wetland has persistent, ungrazed vegetation > = 1/10 of area points = 1 Wetland has persistent, ungrazed vegetation <1/10 of area points = 0 Map of Cowardin vegetation classes	Figure ___ 1
D	D1.4 Characteristics of seasonal ponding or inundation. *This is the area of the wetland unit that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 yrs.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0 Map of Hydroperiods	Figure ___ 4
D	**Total for D 1** *Add the points in the boxes above*	6
D	**D 2. Does the wetland unit have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* — Grazing in the wetland or within 150 ft — Untreated stormwater discharges to wetland ✓ Tilled fields or orchards within 150 ft of wetland — A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging — Residential, urban areas, golf courses are within 150 ft of wetland — Wetland is fed by groundwater high in phosphorus or nitrogen — Other________________ [✓ YES] multiplier is 2 NO multiplier is 1	*(see p. 44)* multiplier 2
D	**<u>TOTAL</u> - Water Quality Functions** Multiply the score from D1 by D2 ***Add score to table on p. 1***	12

Wetland name or number E

D	**Depressional and Flats Wetlands** HYDROLOGIC FUNCTIONS - Indicators that the wetland unit functions to reduce flooding and stream degradation	**Points** (only 1 score per box)
	D 3. Does the wetland unit have the potential to reduce flooding and erosion?	***(see p.46)***
D	D 3.1 Characteristics of surface water flows out of the wetland unit Unit is a depression with no surface water leaving it (no outlet) points = 4 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing.")* Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 0	0
D	D 3.2 Depth of storage during wet periods *Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 The wetland is a "headwater" wetland" points = 5 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 Unit is flat (yes to Q. 2 or Q. 7 on key) but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft - Per landowner observations points = 0	0
D	D 3.3 Contribution of wetland unit to storage in the watershed *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire unit is in the FLATS class points = 5	0
D	**Total for D 3** *Add the points in the boxes above*	0
D	**D 4. Does the wetland unit have the opportunity to reduce flooding and erosion?** Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur. *Note which of the following indicators of opportunity apply.* — Wetland is in a headwater of a river or stream that has flooding problems ✓ Wetland drains to a river or stream that has flooding problems — Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems — Other [✓ YES] multiplier is 2 NO multiplier is 1	***(see p. 49)*** multiplier 2
D	**TOTAL - Hydrologic Functions** Multiply the score from D 3 by D 4 ***Add score to table on p. 1***	0

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that unit functions to provide important habitat

Points (only 1 score per box)

H 1. Does the wetland unit have the potential to provide habitat for many species?

H 1.1 Vegetation structure *(see p. 72)*

Check the types of vegetation classes present (as defined by Cowardin)- Size threshold for each class is ¼ acre or more than 10% of the area if unit is smaller than 2.5 acres.

____Aquatic bed
✓ Emergent plants
____Scrub/shrub (areas where shrubs have >30% cover)
____Forested (areas where trees have >30% cover)

If the unit has a forested class check if:

____The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon

Add the number of vegetation structures that qualify. If you have:

Map of Cowardin vegetation classes	4 structures or more	points = 4
	3 structures	points = 2
	2 structures	points = 1
	1 structure	points = 0

Figure ___

0

H 1.2. Hydroperiods *(see p. 73)*

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ acre to count. (see text for descriptions of hydroperiods)

____Permanently flooded or inundated	4 or more types present	points = 3
✓ Seasonally flooded or inundated	3 types present	points = 2
____Occasionally flooded or inundated	2 types present	point = 1
____Saturated only	1 type present	points = 0

____ Permanently flowing stream or river in, or adjacent to, the wetland
____ Seasonally flowing stream in, or adjacent to, the wetland
____ ***Lake-fringe wetland*** **= 2 points**
____ ***Freshwater tidal wetland*** **= 2 points**

Map of hydroperiods

Figure ___

0

H 1.3. Richness of Plant Species *(see p. 75)*

Count the number of plant species in the wetland that cover at least 10 ft^2. *(different patches of the same species can be combined to meet the size threshold)*

You do not have to name the species.

Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle

If you counted:	> 19 species	points = 2
List species below if you want to:	5 - 19 species	points = 1
	< 5 species	points = 0

0

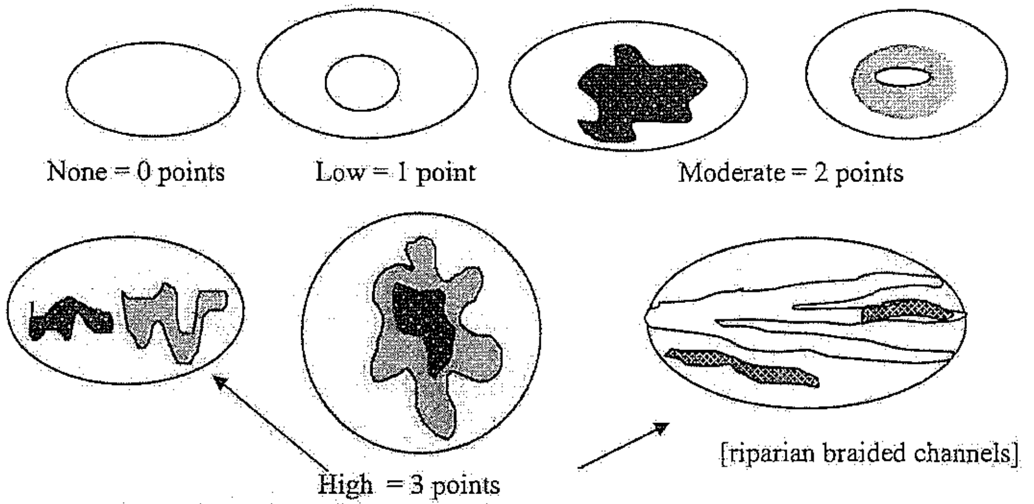
Total for page 0

Wetland name or number F

H 1.4. Interspersion of habitats *(see p. 76)*

Figure ___

Decide from the diagrams below whether interspersion between Cowardin vegetation classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.



NOTE: If you have four or more classes or three vegetation classes and open water the rating is always "high". Use map of Cowardin vegetation classes

0

H 1.5. Special Habitat Features: *(see p. 77)*

Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.

____Large, downed, woody debris within the wetland (>4in. diameter and 6 ft long).

____Standing snags (diameter at the bottom > 4 inches) in the wetland

____Undercut banks are present for at least 6.6 ft (2m) and/or overhanging vegetation extends at least 3.3 ft (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft (10m)

____Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)*

____At least ¼ acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)*

____ Invasive plants cover less than 25% of the wetland area in each stratum of plants

NOTE: The 20% stated in early printings of the manual on page 78 is an error.

0

H 1. TOTAL Score - potential for providing habitat
Add the scores from H1.1, H1.2, H1.3, H1.4, H1.5

0

Comments

H 2. Does the wetland unit have the opportunity to provide habitat for many species?

H 2.1 Buffers *(see p. 80)*

Choose the description that best represents condition of buffer of wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed."

- — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% of circumference. No structures are within the undisturbed part of buffer. (relatively undisturbed also means no-grazing, no landscaping, no daily human use) **Points = 5**
- — 100 m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 50% circumference. **Points = 4**
- — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% circumference. **Points = 4**
- — 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 25% circumference, . **Points = 3**
- — 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water for > 50% circumference. **Points = 3**

If buffer does not meet any of the criteria above

- — No paved areas (except paved trails) or buildings within 25 m (80ft) of wetland > 95% circumference. Light to moderate grazing, or lawns are OK. **Points = 2**
- — No paved areas or buildings within 50m of wetland for >50% circumference. Light to moderate grazing, or lawns are OK. **Points = 2**
- — Heavy grazing in buffer. **Points = 1**
- [✓ Vegetated buffers are <2m wide (6.6ft) for more than 95% of the circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland **Points = 0**]
- — Buffer does not meet any of the criteria above. **Points = 1**

Aerial photo showing buffers

Figure ___

0

H 2.2 Corridors and Connections *(see p. 81)*

H 2.2.1 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150 ft wide, has at least 30% cover of shrubs, forest or native undisturbed prairie, that connects to estuaries, other wetlands or undisturbed uplands that are at least 250 acres in size? *(dams in riparian corridors, heavily used gravel roads, paved roads, are considered breaks in the corridor).*

YES = **4 points** *(go to H 2.3)* [✓ NO] = go to H 2.2.2

H 2.2.2 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 50ft wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands or undisturbed uplands that are at least 25 acres in size? **OR** a **Lake-fringe** wetland, if it does not have an undisturbed corridor as in the question above?

YES = **2 points** *(go to H 2.3)* [✓ NO] = H 2.2.3

H 2.2.3 Is the wetland:

within 5 mi (8km) of a brackish or salt water estuary OR
within 3 mi of a large field or pasture (>40 acres) OR
within 1 mi of a lake greater than 20 acres?

[✓ YES] = **1 point** NO = **0 points**

1

Total for page 1

H 2.3 Near or adjacent to other priority habitats listed by WDFW *(see p. 82)*

Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*

These are DFW definitions. Check with your local DFW biologist if there are any questions.

✓ **Riparian:** The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

____**Aspen Stands:** Pure or mixed stands of aspen greater than 0.8 ha (2 acres).

____**Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft.

____**Old-growth forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age.

____**Mature forests:** Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less that 100%; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest.

____**Prairies:** Relatively undisturbed areas (as indicated by dominance of native plants) where grasses and/or forbs form the natural climax plant community.

____**Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

____**Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages

____**Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component of the stand is 25%.

✓ **Urban Natural Open Space:** A priority species resides within or is adjacent to the open space and uses it for breeding and/or regular feeding; and/or the open space functions as a corridor connecting other *priority habitats*, especially those that would otherwise be isolated; and/or the open space is an isolated remnant of natural habitat larger than 4 ha (10 acres) and is surrounded by urban development.

____**Estuary/Estuary-like:** Deepwater tidal habitats and adjacent tidal wetlands, usually semi-enclosed by land but with open, partly obstructed or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Estuarine habitat extends upstream and landward to where ocean-derived salts measure less than 0.5ppt. during the period of average annual low flow. Includes both estuaries and lagoons.

____**Marine/Estuarine Shorelines:** Shorelines include the intertidal and subtidal zones of beaches, and may also include the backshore and adjacent components of the terrestrial landscape (e.g., cliffs, snags, mature trees, dunes, meadows) that are important to shoreline associated fish and wildlife and that contribute to shoreline function (e.g., sand/rock/log recruitment, nutrient contribution, erosion control).

If wetland has **3 or more** priority habitats = **4 points**
If wetland has 2 priority habitats = **3 points**
If wetland has **1** priority habitat = **1 point** No habitats = 0 points

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list. Nearby wetlands are addressed in question H 2.4)

2

H 2.4 Wetland Landscape *(choose the one description of the landscape around the wetland that best fits) (see p. 84)* There are at least 3 other wetlands within ½ mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development. points = 5 The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within ½ mile points = 5 There are at least 3 other wetlands within ½ mile, BUT the connections between them are disturbed points = 3 The wetland is Lake-fringe on a lake **with** disturbance and there are 3 other lake-fringe wetland within ½ mile points = 3 There is at least 1 wetland within ½ mile. points = 2 There are no wetlands within ½ mile. points = 0	3
H 2. TOTAL Score - opportunity for providing habitat *Add the scores from H2.1,H2.2, H2.3, H2.4*	6
TOTAL for H 1 from page 14	0
Total Score for Habitat Functions – add the points for H 1, H 2 and record the result on p. 1	6

Wetland name or number F

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

Wetland Type *Check off any criteria that apply to the wetland. Circle the Category when the appropriate criteria are met.*	**Category**
SC 1.0 Estuarine wetlands *(see p. 86)* Does the wetland unit meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt. YES = Go to SC 1.1 NO ✓	
SC 1.1 Is the wetland unit within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? YES = Category I NO go to SC 1.2	**Cat. I**
SC 1.2 Is the wetland unit at least 1 acre in size and meets at least two of the following three conditions? YES = Category I NO = Category II — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp. are the only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category I. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** **Cat. II** **Dual rating I/II**

Wetland name or number F

SC 4.0 Forested Wetlands *(see p. 90)*

Does the wetland unit have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its functions.*

— **Old-growth forests**: (west of Cascade crest) Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm) or more.

NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter.

— **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have average diameters (dbh) exceeding 21 inches (53cm); crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth.

YES = Category I NO ✓ not a forested wetland with special characteristics

Cat. I

SC 5.0 Wetlands in Coastal Lagoons *(see p. 91)*

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

— The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks

— The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)*

YES = Go to SC 5.1 NO ✓ not a wetland in a coastal lagoon

SC 5.1 Does the wetland meets all of the following three conditions?

— The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of invasive plant species (see list of invasive species on p. 74).

— At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

— The wetland is larger than 1/10 acre (4350 square feet)

YES = Category I NO = Category II

Cat. I

Cat. II

SC 6.0 Interdunal Wetlands *(see p. 93)* Is the wetland unit west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? YES - go to SC 6.1 NO ✓ not an interdunal wetland for rating ***If you answer yes you will still need to rate the wetland based on its functions.*** In practical terms that means the following geographic areas: • Long Beach Peninsula- lands west of SR 103 • Grayland-Westport- lands west of SR 105 • Ocean Shores-Copalis- lands west of SR 115 and SR 109 SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is once acre or larger? YES = Category II NO – go to SC 6.2	**Cat. II**
SC 6.2 Is the unit between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre? YES = Category III	**Cat. III**
Category of wetland based on Special Characteristics *Choose the "highest" rating if wetland falls into several categories, and record on p. 1.* If you answered NO for all types enter "Not Applicable" on p.1	NA

B&L Woodwaste Site

Critical Areas Study

Appendix D
Site Photographs

This appendix provides photo documentation to supplement the Critical Areas Study. Photos were taken in May 2008.

Photo 1: Test Plot 1 in Wetland A

Photo 2: Pacific Chorus Frog in Wetland A

Photo 3: Test plot 2 in upland area

Photo 4: Test plot 3 in upland area

Photo 5: Test Plot 4 in Wetland B

Photo 6: South of road looking South toward Wetland B

Photo 7: South of Ditch Looking North Toward Wetland C

Photo 8: South of Ditch Looking North Toward Wetland C

Photo 9: Ditch facing Westward

Photo 10: View North to Wetland C from Trail

Photo 11: Test Plot 5 in Wetland C

Photo 12: Wetland E

Photo 13: Test Plot 6 on road across Wetland C

Photo 14: Ditch looking eastward

Photo 15: Culvert facing eastward

Photo 16: Test Plot 8 in Wetland F

Photo 17: Wetland F

Photo 18: Test Plot 9 in Upland Area

Photo 19: Test Plot 7

B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR)

Appendix E
Interim Compliance Monitoring Plan
(*Reserved*:)

Note: The Interim Compliance Monitoring Plan (ICMP) will be revised as the remedy is implemented (refer to Section 5.0 of this EDR). Revised ICMP versions will supersede and replace the initial January 2009 ICMP, which was included as Appendix A to the Groundwater Remediation Work Plan (Floyd|Snider/AMEC 2009).

FINAL