ENGINEERING DESIGN REPORT

Cleanup of Pulp and Tissue Mill Remedial Action Unit Georgia-Pacific West Site Bellingham, Washington

Volume 1: Soil Removal from Bunker C Subarea

Prepared for: Port of Bellingham

Project No. 140298-001-07 • May 14, 2015 Final

Aspect CONSULTING

earth + water

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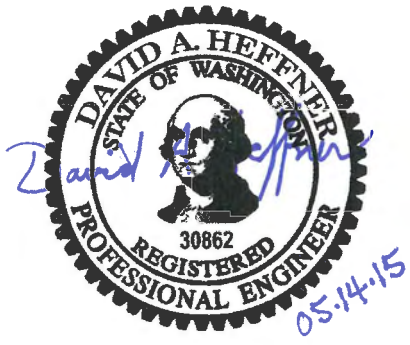
Aspect Consulting, LLC



Matthew von der Ahe, LG
Sr. Staff Geologist
mvonderahe@aspectconsulting.com

Dave Heffner, PE
Associate Remediation Engineer
dheffner@aspectconsulting.com

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1 Introduction

This report represents Volume 1 of the Engineering Design Report (EDR). This report describes the engineering concepts and design criteria for a portion of the final cleanup action selected by the Washington State Department of Ecology (Ecology) for the Pulp and Tissue Mill Remedial Action Unit (RAU) of the Georgia-Pacific West Site (Site) shown on Figure 1. The Pulp and Tissue Mill RAU is being cleaned up under the terms of Consent Decree No. 14207008 (Decree) between the Port of Bellingham (Port) and Ecology.

Based on the evaluation of RAU remedial alternatives relative to Model Toxics Control Act (MTCA) criteria in the Feasibility Study (FS; Aspect, 2014), Ecology's Cleanup Action Plan (CAP; Ecology, 2014) for the RAU selected a final cleanup action consisting of the following four elements shown on Figure 2:

1. **Soil Removal from the Bunker C Subarea.** In addition to soils that were removed from beneath the former Bunker C Tank in the completed (2011) interim action, the cleanup action includes removal of all remaining soils with concentrations of total petroleum hydrocarbons (TPH, specifically Bunker C fuel oil) exceeding 10,000 mg/kg from the Bunker C subarea. Note that the CAP defines 10,000 mg/kg TPH as the RAU-specific soil remediation level based on Bunker C oil residual saturation, and is protective of groundwater quality. The CAP also defines a more stringent RAU-specific soil cleanup level of 3,100 mg/kg TPH, which is protective of all exposure pathways including unrestricted direct contact.

2. **RAU-wide Capping**. Capping to control the soil direct-contact exposure and soil erosion pathways will consist of a combination of existing and new hard caps (pavement and building foundations), and new soil caps.

3. **Monitored Natural Attenuation (MNA) of Groundwater.** MNA will be applied to address residual contamination in groundwater that exceeds applicable groundwater cleanup levels within the Acid Plant subarea, the LP-MW01 subarea, and the Miscellaneous Dissolved Metals Exceedances area. Contingent actions will be considered for implementation if MNA fails to restore groundwater at a reasonable rate and is determined not to be protective of human health and the environment.

4. **Institutional Controls.** The Port and Ecology will develop an Institutional Controls Plan for the RAU which will:

    - Provide notification regarding the presence of residual contaminated materials, and regulate the disturbance/management of those materials and the cleanup action components;

    - Prohibit activities such as utility excavations or site grading that could cause preferential pathways for contaminant migration or run-off and sediment impacts to Whatcom Waterway;

- Prohibit extraction of groundwater for drinking or any other use;
- Provide for long-term monitoring and stewardship of the cleanup action; and
- Require that vapor intrusion (VI) potential be evaluated and/or VI controls constructed beneath future buildings in the LP-MW01 subarea if groundwater compliance monitoring indicates that volatile organic compound concentrations have not naturally attenuated to below cleanup levels in that subarea.

This Volume 1 of the EDR addresses only the Bunker C subarea soil removal. Under separate cover, Volume 2 of the EDR will cover engineering concepts, design criteria, and additional institutional controls for the RAU-wide surface capping. The EDR has been split into two volumes to allow the Bunker C soil removal and RAU-wide capping to be implemented as separate cleanup construction projects. The Bunker C soil-removal project is being accelerated relative to the Decree-required schedule so as to integrate and not interfere with Phase 1 cleanup construction for the adjacent Whatcom Waterway site.

Separate Construction Plans and Specifications and Compliance Monitoring Plans will be prepared, in accordance with the Decree, for the Bunker C soil removal and RAU-wide capping projects. In addition, a Cap Inspection and Maintenance Plan will describe inspection and maintenance protocols to ensure the long-term integrity of the RAU-wide cap, and a Groundwater MNA Compliance Monitoring Plan will outline the monitoring protocols to assess effectiveness of contaminant natural attenuation in reaching groundwater cleanup levels.

The sections of this EDR volume are as follows:

- Section 2 describes procedures for excavating and managing the TPH-contaminated soil, including construction dewatering and performance monitoring to determine compliance with the cleanup objective.
- Section 3 describes the requirements of applicable federal permits and procedurally exempt permits for the Bunker C soil removal component of the cleanup action.
- Section 4 describes the reporting to be conducted at completion of the soil removal.
- Section 5 presents the currently anticipated schedule milestones for the soil removal.
- Section 6 lists documents cited in this report.
- Appendix A presents results from the pre-design characterization soil sampling and analysis in the Bunker C subarea.
- Appendix B presents the aquifer hydraulic monitoring data collected during the pre-design characterization.

2 Soil Removal from the Bunker C Subarea

The cleanup work to be performed consists of the Port's Contractor mobilizing to the Site and preparing the Site for the work, excavating, segregating, and disposing of the Bunker C-contaminated soil, then backfilling the excavation and restoring the site. Prior to start

of construction, the Contractor will prepare for approval a Remedial Action Management Plan (RAMP) that proposes detailed construction means and methods for completing the cleanup action in compliance with the Construction Plans and Specifications. The RAMP will include the following:

- A Temporary Erosion and Sedimentation Control (TESC) Plan addressing erosion, sedimentation, and stormwater controls during construction;
- A Contingency Plan addressing environmental protection (e.g., controlling and preventing spills of hazardous materials);
- An Excavation and Backfilling Work Plan detailing the excavation and backfilling approach, including stockpiling of overburden soil for chemical testing, and excavation dewatering with water treatment and disposal; and
- A Waste Management Plan addressing the procedures to load, transport, and dispose of waste materials.

The construction-related activities for the Bunker C soil removal are outlined below.

2.1 Estimated Area and Quantity of Soil to be Removed

Figure 3 depicts the planned Bunker C soil excavation footprint, along with the explorations used to define that area. On Figure 3, borings with detected TPH concentrations above 10,000 mg/kg are denoted in red, while those with detected concentrations below 10,000 mg/kg are denoted in green. The results of the February 2015 pre-design soil quality characterization for this area are detailed in Appendix A.

During the Pre-Design Characterization phase, the soil borings in and around the planned excavation area encountered only silty sand fill and alluvial soil; no evidence of an aquitard unit was observed in any boring (see Appendix A). The contaminated soil occurs within or directly adjacent to the footprint of the former Steam Plant, and therefore considerable subsurface building elements will need to be removed to access and remove the contaminated soil. The structures requiring removal include large steel-reinforced concrete elements (e.g., slabs, grade beams, and pile caps), and numerous creosote-treated wood pilings that extend well below the bottom of the planned excavation.

For purposes of this project, excavated soil that field screening indicates contains TPH at concentrations above the remediation level will be termed “contaminated soil.” Excavated soil that field screening indicates likely contains TPH concentrations less than the remediation level will be termed “overburden.” During excavation, excavated soil will be segregated as contaminated or overburden based on field screening, as described in Section 2.3.

Figure 4 is a subsurface cross section oriented along the long axis of the planned excavation (section line shown on Figure 3). The cross section schematically depicts the inferred extents of contaminated soil and the approximately 6 to 8 feet of overburden above it. Within the planned excavation area, groundwater in the fill is hydraulically connected to the Waterway, and the water table depth fluctuates from approximately 10 to 15 feet below grade (Figure 4). Appendix B provides groundwater level monitoring data from subarea monitoring wells, which illustrate the tidal influence.

As noted on Figures 3 and 4, there are borings within the excavation footprint that had no detected TPH concentrations exceeding the remediation level. There are also borings that hit refusal on subsurface structure without confirming the depth at which soil meets the remediation level in these locations. As such, the excavation extents depicted on Figures 3 and 4 are planned based on existing information, and will be adjusted based on soil sampling and analysis conducted during excavation, as described below.

Note that if, upon completion of the soil removal project, the excavation area contains residual TPH greater than the 3,100 mg/kg TPH soil cleanup level defined in the CAP (either residual soil on the excavation sidewalls or bottom, or overburden used as backfill as described below), the area will be capped as part of the RAU-wide cap, which is the subject of EDR Volume 2 as described in Section 1.

Based on the existing information, we estimate that approximately 2,100 cubic yards (3,200 tons) of contaminated soil, and 3,100 cubic yards (4,700 tons) of overburden, will require excavation.

2.2 Mobilization and Site Preparation

Mobilization and Site preparation activities include:

- Mobilize construction equipment, materials, and utilities (e.g., electrical generators).
- Mobilize, install, and test a dewatering and water treatment system. The dewatering system will dewater the saturated contaminated soil to facilitate effective soil removal and handling and verification soil sampling. The treatment systems will remove settleable solids and separate-phase oil from excavation dewatering water and water accumulating in the soil stockpile areas. The water treatment system will include conveyance piping from the source areas to the treatment system inlet and from the treatment system outlet to the point of discharge to the Port's pump station to the Aeration and Settlement Basin (ASB).

  To assist the Contractor in designing the excavation dewatering system, Appendix B holds data from hydraulic testing of the water-table aquifer in and around the footprint of the excavation.
- Construct bermed and lined soil stockpile area(s) for contaminated soil and debris, as determined by field screening during excavation, and separate stockpile areas for overburden and for inert debris. Water collecting within stockpile areas will be treated and disposed of using the water treatment system described above.
- Construct erosion and sedimentation controls in accordance with the TESC Plan. In the northwestern corner of the planned excavation footprint, the ground surface is several feet below the bottom of the floor slab of the former Steam Plant building (i.e. there is a void space beneath the slab). In that area, to reduce the chance that sediment would be transported to the Whatcom Waterway, it may be necessary to establish erosion controls both on the slab and below it on the ground surface.

- Remove or reroute active utilities (e.g., stormwater infrastructure, overhead power lines and poles) that may be impacted by the cleanup activities. At the end of the cleanup action, utilities that were modified will be restored to their pre-construction function.
- Decommission monitoring wells that are in the footprint of the planned excavation. Decommissioning will be performed in accordance with the provisions of Chapter 173-160 WAC.

2.3 Excavation, Stockpiling, and Performance Monitoring

During excavation, visual and olfactory field screening techniques will be used to distinguish between excavated soil that is inferred to be above the remediation level of 10,000 mg/kg TPH and that inferred to be below the remediation level. The two soil streams will be segregated and managed separately, as described briefly below. Verification soil samples will be collected from the excavation sidewalls and floor, and will be analyzed for TPH by an Ecology-accredited laboratory, as described below. Details regarding soil segregation and verification soil sampling and analysis will be presented in the forthcoming Compliance Monitoring Plan (CMP) for the Bunker C Soil Removal, which will be reviewed and approved by Ecology prior to construction.

2.3.1 Overburden

Overburden soil (soil that, based on field screening, is anticipated to meet the remediation level) will be excavated and stockpiled. Overburden stockpiles will be sampled and chemically analyzed for the purpose of designation testing (below the remediation level or not). Stockpiles of overburden soil will not exceed 100 cubic yards in size for the purpose of designation testing for disposition, and each stockpile will have one representative composite sample to determine its disposition.

Overburden stockpiles containing a detected TPH concentration (sum of diesel- and oil-range concentrations) above the 10,000 mg/kg TPH soil remediation level will be properly disposed of off-Site as contaminated soil (described below). Stockpiles of overburden with a detected TPH concentration below the remediation level will be retained for backfilling the excavation, irrespective of geotechnical character. Because overburden may exceed cleanup levels and still meet the TPH remediation level, the ground surface in the areas established by the Contractor for stockpiling overburden soils will be sealed to prevent what may be contaminated soil from contacting underlying materials. The stockpiles of overburden soil will also be covered when not in use.

2.3.2 Contaminated Soil

Contaminated soil is expected to be encountered at depths between about 7 and 15 feet below grade (Figure 4). Contaminated soil will be stockpiled separately from overburden based on field screening. The ground surface in the areas for stockpiling contaminated soils will be sealed to prevent contaminated soil from contacting underlying materials. The stockpiles of contaminated soil will also be covered when not in use.

2.3.3 Debris

During excavation to remove contaminated soil, abundant subsurface structures will be encountered, such as concrete floor slabs, concrete grade beams, concrete pile caps,

vertical wood piles, and pipes of various sizes and materials. The structural materials will be removed only as needed to access contaminated soil, and will be broken or cut as needed so that they can be removed from the excavation, and stockpiled.

If visual and olfactory screening indicates that the removed debris is contaminated, it will be managed for off-site disposal consistent with the contaminated soil. If the removed debris does not appear to be contaminated, it will be designated as inert debris. Inert debris may be reused as excavation backfill above the water table or properly disposed of offsite.

The ground surface in the contaminated debris stockpile area must be sealed, and the stockpiles of contaminated debris must be covered when not in use. The ground surface in the inert debris stockpile area need not be sealed, and the inert debris stockpiles need not be covered unless needed to control dust.

2.3.4 Performance Monitoring and Over-Excavation

When field screening indicates that contaminated soils have been removed from a portion of the excavation to meet the remediation level, excavation sidewall and bottom verification soil samples will be collected for laboratory analysis to confirm compliance with the 10,000 mg/kg TPH remediation level. The soil samples will be collected from within the excavation using the excavator bucket, or by hand if safely accessible to a worker.

Where the concentration of TPH in an excavation sidewall sample exceeds the remediation level, the length of sidewall represented by the sample will be over-excavated at least 1 foot laterally, if practicable. If field screening at the new sidewall location indicates the remediation level is met, then a new sidewall verification sample will be collected at that location and submitted for analysis. Where the concentration of TPH in an excavation bottom sample exceeds the remediation level, the excavation will be deepened in the area represented by the sample by at least 1 foot, if practicable, followed by collection of a new bottom verification sample.

2.3.5 Protection of Shoreline Bulkhead

Mill-north of the planned excavation area there is a shoreline bulkhead that reportedly comprises rip-rap armoring and sheet piles stabilized by tieback anchors (Figure 3). The excavation will be conducted so as to not damage tiebacks if encountered. It is not expected that the excavation will extend close enough to the bulkhead to threaten its stability, but if it does, measures will be taken to mitigate the threat.

Measures that may be implemented to protect the bulkhead include one or more of the following strategies: shallow tied-back shoring or sheet piles, trench boxes, gravity walls, and/or caissons. Each of the strategies is subject to constraints that would be considered before the final option is specified.

2.3.6 Potential for Contingency Action

It may be necessary to limit the northward extent of the excavation if it is determined, with Ecology concurrence, that implementing bulkhead protection strategies would be either disproportionately costly or would have the potential to create greater environmental harm relative to conducting the desired additional excavation. If that

occurs, excavation would be completed to the maximum extent practicable as dictated by structural considerations. Verification soil samples would be collected as described above in Section 2.3.4 and exceedances of remediation levels would be documented. Then, in consultation with Ecology, a contingency action would be designed to be environmentally protective and protective of the functionality of the bulkhead. The RAU FS (Aspect, 2014) included i*n situ* solidification/stabilization as a contingent treatment option if it were determined to be impracticable to remove all soil containing TPH concentrations above the residual-saturation-based soil remediation level. *In situ* solidification/stabilization provides a means to lower the permeability of saturated soil, thus increasing the residual saturation concentration of the non-aqueous phase liquid (NAPL) and rendering it less mobile, which achieves the groundwater protection cleanup objective for this subarea.

2.4 Dewatering and Water Management

Construction dewatering will be conducted during the excavation to facilitate soil removal and handling and excavation verification soil sampling.

Means and methods for dewatering will be determined by the construction Contractor, and may include temporary sumps within the open excavation, well points outside the excavation, and/or groundwater cutoff technologies. Methods such as temporary shoring, trench boxes, etc. can also be employed to reduce water inflow and/or stabilize the excavations.

Groundwater pumped during dewatering will be conveyed to the Contractor's water treatment system where it will be pre-treated to reduce settleable solids and remove NAPL, then discharged to the ASB pump station in accordance with the Port's NPDES permit for the facility (see Section 3.1.2).

2.5 Soil Loading and Off-Site Disposal

Prior to start of construction, the contaminated soil to be excavated will be profiled for proper off-site disposal as non-hazardous waste at a permitted disposal facility. Data collected during the 2015 pre-design characterization confirm no concentrations of carcinogenic polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), or heavy metals exceeding criteria for designation of the contaminated soil as dangerous waste (refer to Appendix A).

The Contractor will be responsible for identifying the permitted off-site soil disposal facility, completing upfront waste profiling paperwork, and obtaining disposal facility acceptance of the waste. Aspect will provide analytical data to support the waste profiling. The Contractor will provide Aspect with copies of the certificates of disposal for material disposed of off-site, and Aspect will include them in the As-Built Cleanup Report documenting the cleanup action (refer to Section 4).

The truck route for the cleanup project will not use residential streets. Trucks hauling contaminated materials from the Site will remain covered from the time they leave the Site until they off-load at the designated facility.

2.6 Excavation Backfill and Site Restoration

The excavation will be backfilled to the approximate pre-construction grade with a combination of stockpiled overburden and virgin gravel borrow imported from a Washington State Department of Transportation (WSDOT)-approved source. Stockpiled overburden soil will be used preferentially over imported gravel borrow. Depending upon the condition of the subgrade material prior to backfill, quarry spalls and geotextile will likely be required as a base for the backfilled materials.

3 Permits and Substantive Requirements

In accordance with MTCA, the RAU cleanup action, being conducted under the Decree, is exempt from the procedural requirements of Chapters 70.94, 70.95, 70.105, 77.55, 90.48, and 90.58 of the Revised Code of Washington (RCW), and of any laws requiring or authorizing local government permits or approvals. However, the Port must still comply with the substantive requirements of such permits or approvals (WAC 173-340-520). In addition, the cleanup action is not exempt from federal permits and requirements presented in Exhibit F to the Decree.

The cleanup action complies with the State Environmental Policy Act (SEPA; RCW 43.21C and WAC 197-11-250 through -259). Concurrent with execution of the Decree, Ecology conducted the SEPA review process and issued a Determination of Non-Significance for the proposed RAU cleanup action. Ecology's SEPA process included a public comment period as required under SEPA.

The following sections outline the federal permit requirements, and then how substantive requirements of procedurally exempt permits will be met, during implementation of the Bunker C soil removal component of the RAU cleanup action. Note that a National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit is not required for the Bunker C soil removal component of the RAU cleanup action because it will disturb less than 1 acre. The subsequent RAU-wide capping component of the RAU cleanup will require a Construction Stormwater General Permit.

3.1 Federal Permit Requirement

3.1.1 NPDES Waste Discharge Permit

Stormwater and water from excavation dewatering from the cleanup action will be routed to the Port's ASB for treatment. The Port will comply with requirements of their NPDES Waste Discharge Permit for the ASB throughout the cleanup action. This includes, before start of discharge, providing written notification to the Ecology permit manager regarding the planned discharge in accordance with condition S6.A of the NPDES permit. In addition, it includes chemical testing of the water prior to its discharge to the ASB, and, after construction completion, providing to Ecology the chemical testing results and total volume of water discharged. That information will also be documented in the As-Built Cleanup Report for the project (Section 4).

3.2 Permit Substantive Requirements

The RAU cleanup action is generally subject to the following state and local requirements, but is procedurally exempt from them:

- City of Bellingham Shoreline Substantial Development Permit (Bellingham Municipal Code [BMC] Title 22);
- Major Grading Permit; City of Bellingham Grading Ordinance, BMC 16.70;
- Critical Areas Permit; City of Bellingham Critical Areas Ordinance, BMC 16.55; and
- City of Bellingham Stormwater Requirements, BMC 15.42.

The applicable substantive requirements of these state and local permits or approvals, and the manner in which the Bunker C soil removal component of the RAU cleanup action will meet them, are identified below. The Port will continue to coordinate with the City of Bellingham regarding implementation of the Bunker C soil removal project. This includes providing for City review the construction plans and specifications, such that the City will provide a letter concurring that the planned cleanup work will meet the substantive requirements of their permits listed below.

3.2.1 City of Bellingham Shoreline Substantial Development Permit

The Bunker C soil removal will occur within the regulated shoreline area designated by City of Bellingham Shoreline Master Program (SMP; BMC Title 22) as Waterfront District - Shoreline Mixed Use. The cleanup action must therefore meet the substantive requirements of a City Shoreline Substantial Development Permit (SSDP). To comply with the SSDP, the project must have no unreasonable adverse effects on the environment or other uses, no interference with public use of public shorelines, compatibility with surroundings, and no contradiction of purpose and intent of SMP designation.

3.2.2 City of Bellingham Major Grading Permit

Pursuant to the City of Bellingham Grading Ordinance (BMC 16.70.070), a Major Grading Permit is required from the City for grading projects that involve more than 500 cubic yards of grading. The permit-required standards and requirements will be integrated into the construction plans and specification for this cleanup action to ensure that the construction complies with the substantive requirements of the City grading ordinance. Those substantive requirements include: location and protection of potential underground hazards, proper vehicle access point to prevent tracking of soil off-site, erosion control, work hours and methods compatible with weather conditions and surrounding property uses, prevention of damage or nuisance, maintaining a safe and stable work site, compliance with noise ordinances and zoning provisions, and compliance with City traffic requirements when using City streets.

3.2.3 City of Bellingham Critical Areas Ordinance

City of Bellingham critical area substantive requirements are applied to activities taking place on shorelines through shoreline permitting. This cleanup action will occur on land designated as a “seismic” hazard area by BMC 16.55 Critical Areas because it occurs on

man-made fill. However, this soil removal project is not a development proposal and does not include construction of any improvements. The planned excavation and backfilling activities, and the final backfilled excavation condition, will not exacerbate seismic hazards within the excavation area or surrounding property. This is supported by the fact that the larger-scale Bunker C soil excavation completed during the 2011 interim action resulted in no measureable settlement of the historical wastewater clarifier structure located immediately adjacent to the excavation (Aspect, 2012). These observations from the nearly identical prior excavation activity meet the substantive requirements for a geological hazards assessment under BMC 16.55.

3.2.4 City of Bellingham Stormwater Requirements

Pursuant to the City of Bellingham Stormwater Management ordinance (BMC 15.42), the cleanup must meet the requirements of a City Stormwater Permit. This project does not include construction of any improvements, and the substantive requirements will be met by preparation of and compliance with a TESC Plan to prevent off-site runoff and treat runoff from the construction area, source control of pollution, preservation of natural drainage systems and outfalls, and system operations and maintenance. The outcome of the soil removal project will be replacement of impervious surface (concrete floor slabs) with uncontaminated, pervious backfill material.

4 Reporting of the Soil Removal Cleanup Action

Upon completion of the cleanup, a draft As-Built Cleanup Report describing the methods and outcome of the cleanup will be prepared and submitted to Ecology for review and comment. The data collected during the cleanup will be uploaded to Ecology's Environmental Information Management (EIM) database in accordance with the Decree.

5 Schedule for Soil Removal Cleanup

The preliminary anticipated schedule milestones for the Bunker C soil removal project are as follows:

- June-July 2015: Review and finalization of the Construction Plans and Specifications and the CMP for the soil removal.
- July 2015: Port solicits competitive construction bids for the soil removal.
- August 2015: Port awards contract to selected Contractor.
- September and October 2015: Complete removal and disposal of contaminated soil, excavation backfill, and site restoration.
- December 2015: Submit draft As-Built Cleanup Report to Ecology for review.

This schedule may be adjusted based on conditions encountered during cleanup, or other factors.

6 References

Aspect Consulting (Aspect), 2012, Bunker C Tank Interim Action Report, Georgia-Pacific West Site, Bellingham, Washington, February 24, 2012.

Aspect Consulting (Aspect), 2013, Remedial Investigation, Georgia-Pacific West Site, Bellingham, Washington, August 5, 2013, Volume 1 of RI/FS.

Aspect Consulting (Aspect), 2014, Feasibility Study, Pulp/Tissue Mill Remedial Action Unit, Vol. 2a of RI/FS, Georgia-Pacific West Site, Bellingham, Washington, October 27, 2014.

Aspect Consulting (Aspect), 2015, Pre-Design Characterization Plan, Pulp and Tissue Mill Remedial Action Unit, Georgia-Pacific West Site, Bellingham, Washington, February 6, 2015.

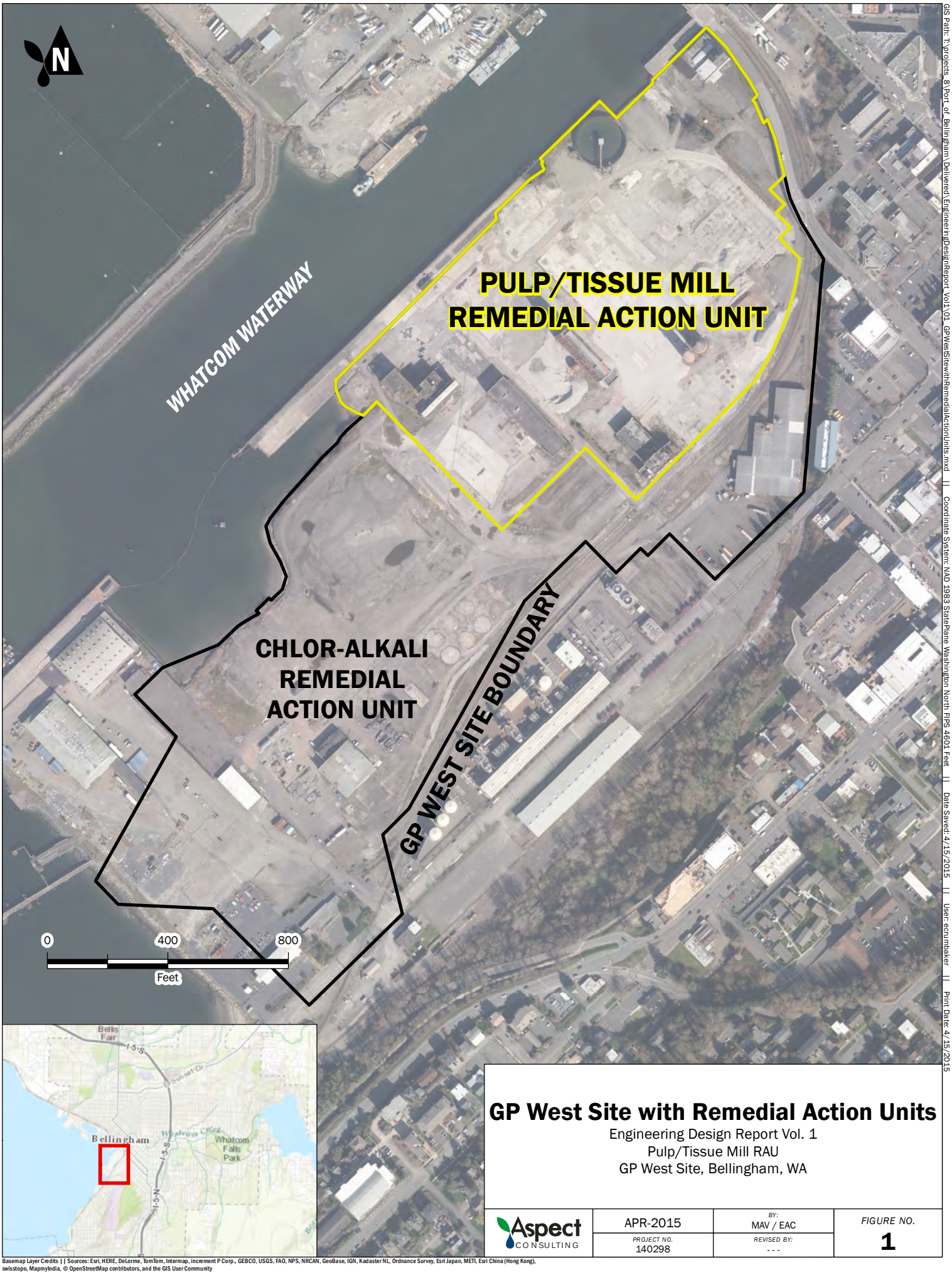
Washington State Department of Ecology (Ecology), 2014, Cleanup Action Plan, Pulp/Tissue Mill Remedial Action Unit, Georgia-Pacific West Site, Bellingham, Washington, Exhibit B to Consent Decree No. 14207008, October 30, 2014.

Limitations

Work for this project was performed for the Port of Bellingham (Client), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

FIGURES



GP West Site with Remedial Action Units

Engineering Design Report Vol. 1
Pulp/Tissue Mill RAU
GP West Site, Bellingham, WA

Aspect CONSULTING	APR-2015	BY: MAV / EAC	FIGURE NO. 1
	PROJECT NO. 140298	REVISED BY: ---	

GIS Path: T:\projects_8\Port_of_Bellingham\Delivered\EngineeringDesignReport_Vol1\01_GPWestSitewithRemedialActionUnits.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 4/15/2015 || User: ecrumbaker || Print Date: 4/15/2015

Whatcom Waterway

Acid Plant Subarea

Chlor-Alkili RAU

Miscellaneous Dissolved Metals Exceedances

LP-MW01 Subarea

BNSF

MILL NORTH

TRUE NORTH

45°

0 60 120 240 360 480 Feet

- Bunker C-contaminated soil removal (subject of this EDR volume)
- Capping and use restrictions
- Bunker C Tank Interim Action (2011) (no further action required)
- Groundwater Contamination to be Monitored
- Pulp/Tissue Mill RAU Boundary
- Property Boundaries from ALTA Survey (David Evans and Assoc., 2004)
- Whatcom Waterway Site Cleanup-Shoreline Cutback and Cap

Cleanup Action Areas for Pulp/Tissue Mill Remedial Action Unit

Engineering Design Report Vol. 1
Pulp/Tissue Mill RAU
GP West Site, Bellingham, WA

Aspect Consulting	APR-2015	BY: SJG / HRL	FIGURE NO. 2
	PROJECT NO. 140298	REVISED BY: MAV / EAC	

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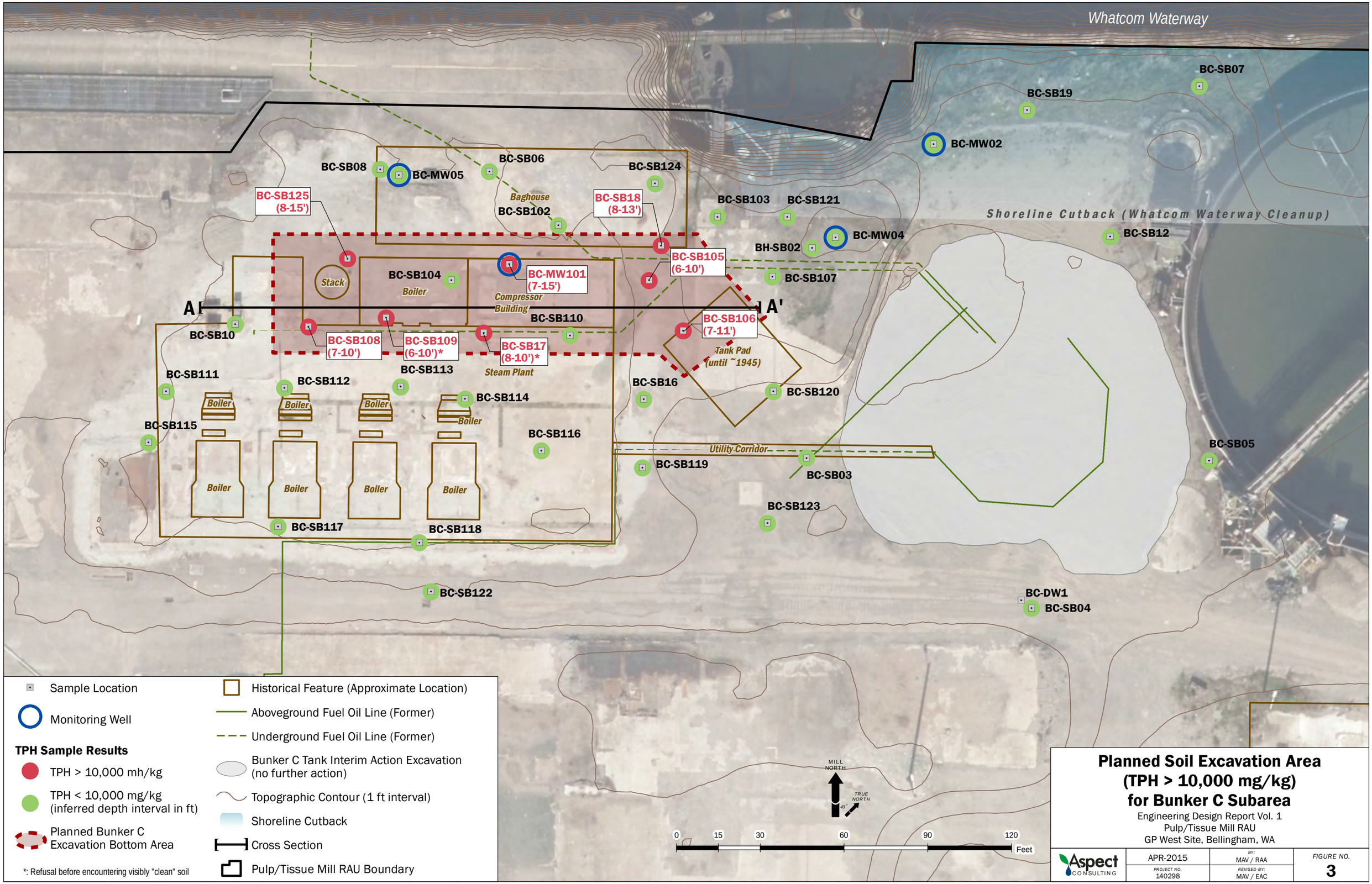

Sample Location

Monitoring Well

TPH Sample Results

TPH > 10,000 mh/kg

TPH < 10,000 mg/kg (inferred depth interval in ft)

Planned Bunker C Excavation Bottom Area

*: Refusal before encountering visibly "clean" soil

Historical Feature (Approximate Location)

Aboveground Fuel Oil Line (Former)

Underground Fuel Oil Line (Former)

Bunker C Tank Interim Action Excavation (no further action)

Topographic Contour (1 ft interval)

Shoreline Cutback

Cross Section

Pulp/Tissue Mill RAU Boundary

Planned Soil Excavation Area (TPH > 10,000 mg/kg) for Bunker C Subarea

Engineering Design Report Vol. 1
Pulp/Tissue Mill RAU
GP West Site, Bellingham, WA

Aspect Consulting	APR-2015	BY: MAV / RAA	FIGURE NO. 3
	PROJECT NO. 140298	REVISED BY: MAV / EAC	

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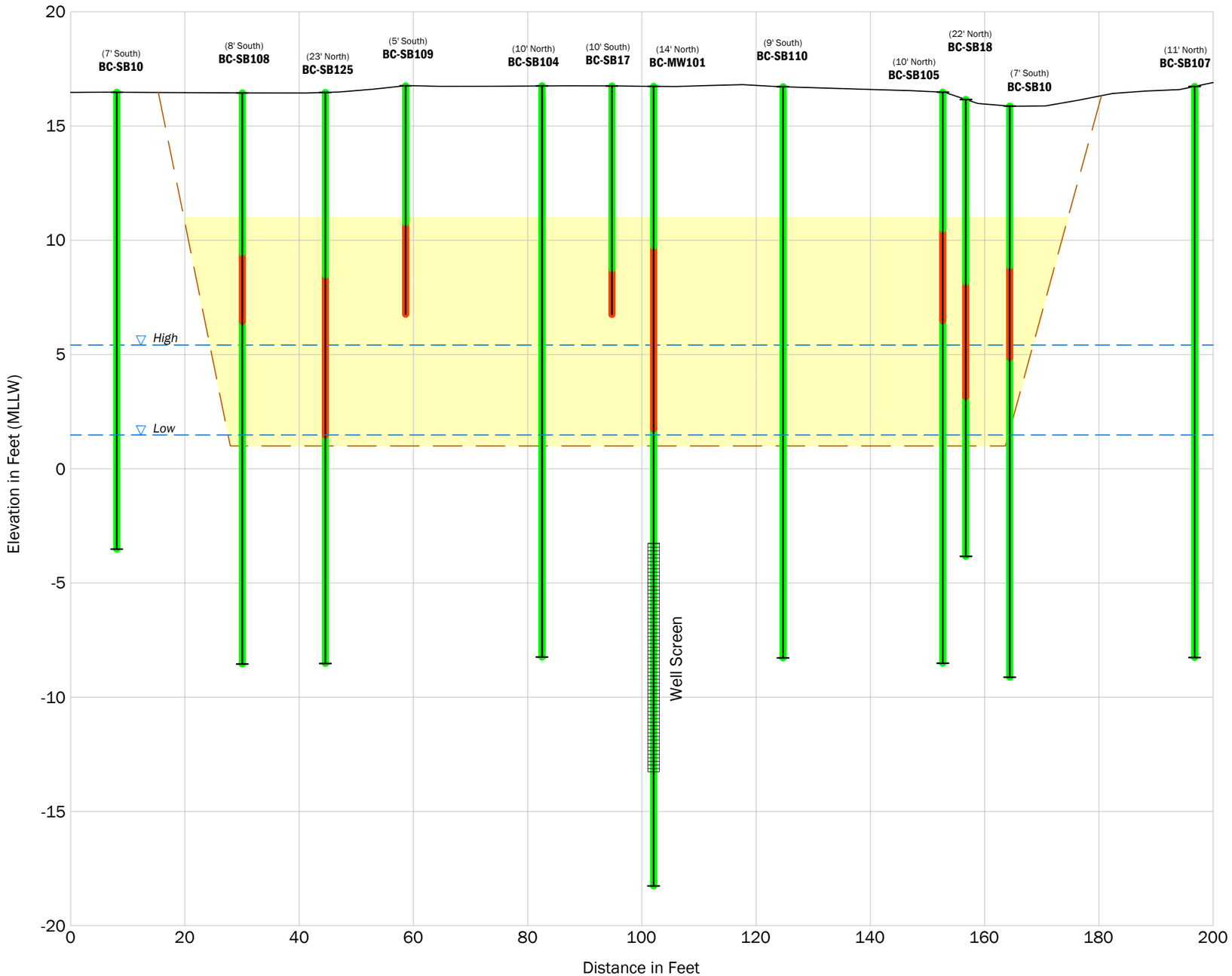


Legend

- Excavation Configuration (Schematic)
- TPH in Soil >10,000 mg/kg
- TPH in Soil <10,000 mg/kg
- Approximate Zone of TPH Contaminated Soil to be Removed*
- High / Low — Approximate Tidally-Influenced Water Table Depth Range (February 2015)

*Material to be removed to access contaminated soil will include abundant subsurface building elements, including steel-reinforced concrete slabs, beams, footings, and pile caps; treated wood pilings; and plastic, fiberglass, iron, and steel piping.

Horizontal Scale: 1" = 20'
Vertical Scale: 1" = 5'
Vertical Exaggeration 4x

0 20 40
Feet

Subsurface Cross Section A-A' through Planned Excavation Area

Engineering Design Report Vol. 1
Pulp/Tissue Mill RAU
GP West Site, Bellingham, Washington

Aspect Consulting	APR-2015	BY: MAV/SCC	FIGURE NO. 4
	PROJECT NO. 140298	REVISED BY: -	

CAD Path: Q:\Port of Bellingham\140298 Former GP Mill Property\2015-04 Engineering Design Report\140298-AA.dwg 11x17 Landscape || Coordinate System: NAD 1983 State Plane Washington North FIPS 4601 Feet || Date Saved: Apr 16, 2015 8:01am || User: scudd

APPENDIX A

Pre-Design Soil Quality Investigation Results, Bunker C Subarea

A. Pre-Design Soil Quality Investigation Results, Bunker C Subarea

To support preparation of this Engineering Design Report (EDR) Volume 1, Aspect Consulting (Aspect) completed additional soil sampling and analysis in and around the former Steam Plant and the oil conveyance pipelines to more accurately delineate, in three dimensions, the extent of Bunker C-contaminated soil requiring removal as a component of the Pulp/Tissue Mill Remedial Action Unit (RAU) cleanup action. The work was completed in accordance with the Pre-Design Characterization Plan (Aspect, 2015), which was reviewed and approved by Washington State Department of Ecology (Ecology).

The following sections briefly describe the investigation methods and results. The results are incorporated into the planned soil excavation area depicted on Figure 3 in the main body of this EDR.

A.1. Investigation Methods

In February 2015, 26 soil borings (BC-SB102 through BC-SB125, and BC-MW101; Figure 3 in main report) were drilled to a depth of 25 feet (typically) using direct-push methods. The monitoring well boring, BC-MW101, was drilled to a depth of 35 feet and refusal was encountered at a depth of 10 feet in boring BC-SB109. Up to five soil samples were collected from each boring determined based primarily on field conditions (visual and olfactory indications of petroleum). When petroleum contamination was indicated by field screening, we attempted to collect a sample of the apparent most-contaminated soil as well as soil vertically above and below the contamination in an attempt to bound petroleum concentrations greater than 10,000 mg/kg. The soil samples were submitted to an Ecology-accredited analytical laboratory (On-Site Environmental of Redmond, Washington) for analysis of diesel- and oil-range total petroleum hydrocarbons (TPH) with silica gel treatment (method NWTPH-Dx).

To characterize soil for the purposes of disposal facility pre-acceptance (waste profiling), four soil samples with TPH concentrations assumed to exceed 10,000 mg/kg (based on field screening) were also analyzed for the following additional analytes: polycylic aromatic hydrocarbons (PAHs by EPA Method 8270D), “RCRA 8” metals (Ag, As, Ba, Cd, Cr, Hg, Pb, and Se, by EPA Methods 6010C, 7470A), and polychlorinated biphenyls (PCBs by EPA Method 8082A).

Boring BC-SB101, planned for completion along an apparent subsurface fuel line in Aspect (2015), could not be drilled because void space and shoreline rip rap was present beneath the surface concrete slab. In addition, additional borings BC-SB124 and BC-SB125 were added to laterally bound the apparent extent of TPH soil concentrations exceeding 10,000 mg/kg, as contemplated in Aspect (2015).

Boring BC-MW101, located within the presumed area of excavation, was completed as a 2-inch-diameter monitoring well. The new well was constructed in accordance with the

requirements of Chapter 173-160 WAC. Well BC-MW101 is screened at a depth interval of 20 to 30 feet below grade, and was used for hydraulic conductivity testing of the Fill Unit aquifer as described in Appendix B. Well BC-MW101, located within the planned excavation footprint (Figure 3 in main report), will need to be properly decommissioned prior to start of excavation.

All of the borings encountered only fill and alluvial material; no evidence of an aquitard unit was observed in any boring. Boring logs for the February 2015 borings are included at the end of this appendix.

A.2. Investigation Results

The February 2015 soil quality investigation helped substantially in refining the area and depth of petroleum-contaminated soil to be excavated. Bunker C subarea boring locations (from current and prior investigations) with detected TPH concentrations exceeding the 10,000 mg/kg TPH soil remediation level are depicted with red symbols on Figure 3 in the main report, and are generally surrounded by borings with detected TPH concentrations below 10,000 mg/kg (green symbols on Figure 3). Likewise, the vertical extent of contaminated soil was also generally defined. Table A-1 presents the analytical data from the February 2015 soil sampling and analysis.

Concentrations of PAHs, PCBs, and metals in the TPH-contaminated soil are below criteria for designation as dangerous waste under Chapter 173-303 WAC. PCBs are not detected, and metals detections are orders of magnitude below concentrations of potential concern for being characteristic dangerous waste. Detected concentrations of PAHs are likewise orders of magnitude below the 1 percent total PAH criterion for designation as state-only persistent dangerous waste (WAC 173-303-100(6)). The PAH, PCB, and metals data are presented in Table A-2.

Consequently, the new data confirm that the TPH-contaminated soil, once excavated, will designate as non-hazardous waste for disposal.

Prior to start of the investigation, Georgia-Pacific historical drawings showing construction details for the former Steam Plant were reviewed to help site borings. The review also assisted with defining subsurface structures that are expected to require removal (as debris) to allow removal of contaminated soil, and this information will be integrated into the Construction Plans and Specifications for the Bunker C soil removal project.

Table A-1 - Pre-Design Soil Quality Data, Bunker C Subarea

Project No. 140298, Pulp/Tissue Mill RAU EDR Vol. 1

Chemical Name	Soil Cleanup Level for Unrestricted Land Use	Soil Remediation Level	BC-MW101 2/25/15 (6 ft.)	BC-MW101 2/25/15 (7.5 ft.)	BC-MW101 2/25/15 (19 ft.)	BC-MW101 2/25/15 (22 ft.)	BC-MW101 2/25/15 (35 ft.)	BC-SB102 2/24/15 (6.5 ft.)	BC-SB102 2/24/15 (16 ft.)	BC-SB102 2/24/15 (22 ft.)	BC-SB103 2/25/15 (7.5 ft.)	BC-SB103 2/25/15 (12.5 ft.)	BC-SB103 2/25/15 (14 ft.)	BC-SB103 2/25/15 (17.5 ft.)	BC-SB103 2/25/15 (25 ft.)	BC-SB104 2/26/15 (6 ft.)	BC-SB104 2/26/15 (11 ft.)	BC-SB104 2/26/15 (12.5 ft.)	BC-SB104 2/26/15 (22 ft.)
Total Petroleum Hydrocarbons (TPH)																			
Diesel Range Hydrocarbons in mg/Kg			27 U	10,000	32 U	32 U	29 U	31 U	35 U	27 U	28 U	630	1,900	370	30 U	33 U	350	31 U	34
Oil Range Hydrocarbons in mg/Kg			54 U	16,000	63 U	63 U	59 U	89	70 U	55 U	280	1,600	3,700	220	60 U	66 U	410	63 U	60 U
Total TPHs (D+O) in mg/Kg	3,100	10,000	ND	26,000	ND	ND	ND	100	ND	ND	290	2200	5,600	590	ND	ND	760	ND	64

Chemical Name	Soil Cleanup Level for Unrestricted Land Use	Soil Remediation Level	BC-SB105 2/24/15 (6 ft.)	BC-SB105 2/24/15 (7 ft.)	BC-SB105 2/24/15 (11 ft.)	BC-SB105 2/24/15 (21 ft.)	BC-SB106 2/24/15 (6 ft.)	BC-SB106 2/24/15 (8 ft.)	BC-SB106 2/24/15 (12 ft.)	BC-SB106 2/24/15 (22 ft.)	BC-SB107 2/24/15 (6.5 ft.)	BC-SB107 2/24/15 (13 ft.)	BC-SB107 2/24/15 (22 ft.)	BC-SB108 2/23/15 (6 ft.)	BC-SB108 2/23/15 (7.5 ft.)	BC-SB108 2/23/15 (11.5 ft.)	BC-SB108 2/23/15 (16 ft.)	BC-SB108 2/23/15 (21 ft.)
Total Petroleum Hydrocarbons (TPH)																		
Diesel Range Hydrocarbons in mg/Kg			29 U	25,000	31 U	32 U	46	25,000	31 U	32 U	33	100	32 U	28 U	10,000	32 U	30 U	31 U
Oil Range Hydrocarbons in mg/Kg			270	50,000	62 U	64 U	260	32,000	61 U	63 U	690	81	64 U	120	13,000	65 U	59 U	63 U
Total TPHs (D+O) in mg/Kg	3,100	10,000	280	75,000	ND	ND	310	57,000	ND	ND	720	180	ND	130	23,000	ND	ND	ND

Chemical Name	Soil Cleanup Level for Unrestricted Land Use	Soil Remediation Level	BC-SB109 2/24/15 (6-9 ft.)	BC-SB109 2/24/15 (9 ft.)	BC-SB110 2/25/15 (6 ft.)	BC-SB110 2/25/15 (8.5 ft.)	BC-SB110 2/25/15 (12 ft.)	BC-SB110 2/25/15 (20 ft.)	BC-SB111 2/23/15 (6.5 ft.)	BC-SB111 2/23/15 (13.5 ft.)	BC-SB111 2/23/15 (20 ft.)	BC-SB112 2/24/15 (6 ft.)	BC-SB112 2/24/15 (9.3 ft.)	BC-SB112 2/24/15 (11 ft.)	BC-SB112 2/24/15 (22 ft.)	BC-SB113 2/24/15 (6.5 ft.)	BC-SB113 2/24/15 (17 ft.)	BC-SB113 2/24/15 (25 ft.)
Total Petroleum Hydrocarbons (TPH)																		
Diesel Range Hydrocarbons in mg/Kg			64	6,000	28 U	31 U	34 U	31 U	29 U	30 U	31 U	29 U	39	30 U	29 U	31 U	34 U	33 U
Oil Range Hydrocarbons in mg/Kg			230	7,200	60	62 U	69 U	61 U	57 U	61 U	62 U	58 U	1,200	60 U	58 U	61 U	69 U	65 U
Total TPHs (D+O) in mg/Kg	3,100	10,000	290	13,000	74	ND	ND	ND	ND	ND	ND	ND	1,200	ND	ND	ND	ND	ND

Notes

Concentrations in shaded cells indicate value exceeds Soil Cleanup Level (Unrestricted Land Use).

Concentrations in cells with bold box indicate value exceeds Soil Remediation Level.

U - Analyte was not detected at or above the reported result.

Table A-1 - Pre-Design Soil Quality Data, Bunker C Subarea

Project No. 140298, Pulp/Tissue Mill RAU EDR Vol. 1

Chemical Name	Soil Cleanup Level for Unrestricted Land Use	Soil Remediation Level	BC-SB114 2/24/15 (6 ft.)	BC-SB114 2/24/15 (13.5 ft.)	BC-SB114 2/24/15 (21 ft.)	BC-SB115 2/23/15 (7 ft.)	BC-SB115 2/23/15 (18 ft.)	BC-SB115 2/23/15 (25 ft.)	BC-SB116 2/26/15 (6 ft.)	BC-SB116 2/26/15 (16 ft.)	BC-SB116 2/26/15 (22 ft.)	BC-SB117 2/23/15 (6 ft.)	BC-SB117 2/23/15 (10.5 ft.)	BC-SB117 2/23/15 (20 ft.)	BC-SB118 2/26/15 (6 ft.)	BC-SB118 2/26/15 (14.5 ft.)	BC-SB118 2/26/15 (21.5 ft.)
Total Petroleum Hydrocarbons (TPH)																	
Diesel Range Hydrocarbons in mg/Kg			64	33 U	29 U	27 U	31 U	31 U	32 U	38 U	29 U	30 U	32 U	30 U	35 U	32 U	29 U
Oil Range Hydrocarbons in mg/Kg			260	66 U	58 U	54 U	61 U	61 U	63 U	76 U	57 U	59 U	63 U	60 U	71 U	65 U	58 U
Total TPHs (D+O) in mg/Kg	3,100	10,000	320	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Chemical Name	Soil Cleanup Level for Unrestricted Land Use	Soil Remediation Level	BC-SB119 2/25/15 (6 ft.)	BC-SB119 2/25/15 (14 ft.)	BC-SB119 2/25/15 (22 ft.)	BC-SB120 2/26/15 (5 ft.)	BC-SB120 2/26/15 (16 ft.)	BC-SB120 2/26/15 (22 ft.)	BC-SB121 2/25/15 (6 ft.)	BC-SB121 2/25/15 (15 ft.)	BC-SB121 2/25/15 (18 ft.)	BC-SB121 2/25/15 (20 ft.)	BC-SB122 2/26/15 (5.5 ft.)	BC-SB122 2/26/15 (15 ft.)	BC-SB122 2/26/15 (22 ft.)	BC-SB123 2/26/15 (6.5 ft.)	BC-SB123 2/26/15 (17 ft.)	BC-SB123 2/26/15 (22.5 ft.)	BC-SB124 2/25/15 (6.5 ft.)
Total Petroleum Hydrocarbons (TPH)																			
Diesel Range Hydrocarbons in mg/Kg			31 U	31 U	33 U	30 U	29 U	28 U	85 U	390	740	30 U	33 U	32 U	28 U	71	32 U	30 U	53 U
Oil Range Hydrocarbons in mg/Kg			62 U	62 U	65 U	60 U	59 U	56 U	170 U	970	270	60 U	67 U	64 U	56 U	260	64 U	60 U	110 U
Total TPHs (D+O) in mg/Kg	3,100	10,000	ND	ND	ND	ND	ND	ND	ND	1400	1000	ND	ND	ND	ND	330	ND	ND	ND

Chemical Name	Soil Cleanup Level for Unrestricted Land Use	Soil Remediation Level	BC-SB125 2/26/15 (7 ft.)	BC-SB125 2/26/15 (8.5 ft.)	BC-SB125 2/26/15 (19 ft.)	BC-SB125 2/26/15 (22 ft.)
Total Petroleum Hydrocarbons (TPH)						
Diesel Range Hydrocarbons in mg/Kg			83	5,000	32 U	30 U
Oil Range Hydrocarbons in mg/Kg			530	21,000	64 U	60 U
Total TPHs (D+O) in mg/Kg	3,100	10,000	610	26,000	ND	ND

Notes

Concentrations in shaded cells indicate value exceeds Soil Cleanup Level (Unrestricted Land Use)

Concentrations in cells with bold box indicate value exceeds Soil Remediation Level

U - Analyte was not detected at or above the reported result.

Table A-2 - Pre-Design Soil Metals, PAH, and PCB Data, Bunker C Subarea

Project No. 140298, Pulp/Tissue Mill RAU EDR Vol. 1

Chemical Name	Saturated Soil - Unrestricted Land Use Screening Level	BC-MW101 2/25/15 (7.5 ft.)	BC-SB105 2/24/15 (7 ft.)	BC-SB106 2/24/15 (8 ft.)	BC-SB108 2/23/15 (7.5 ft.)
Total TPHs (D+O) in mg/Kg (for reference)	3,100	26,000	75,000	57,000	23,000
Total Metals					
Arsenic in mg/Kg	20	6.6 U	5.4 U	5.8 U	5.8 U
Cadmium in mg/Kg	1	0.66 U	0.54 U	2.9 J	0.58 U
Chromium (Total) in mg/Kg	260	26	25	17	23
Lead in mg/Kg	81	6.6 U	5.4 U	5.8 U	5.8 U
Mercury in mg/Kg	0.1	0.29	0.11 U	0.12 U	0.058 U
Selenium in mg/Kg	1	0.66 U	0.82	0.58 U	0.58 U
Silver in mg/Kg	0.02	0.17 U	0.14 U	0.15 U	0.15 U
Polycyclic Aromatic Hydrocarbons (PAHs)					
Acenaphthene in mg/Kg	0.26	24	2.3	2.2	1.7
Acenaphthylene in mg/Kg		5.6	0.44	0.87	0.53
Anthracene in mg/Kg	3.5	58	1.6	1.7	1.4
Benzo(g,h,i)perylene in mg/Kg		8.2	4.4	0.65	0.23
Benzo(j,k)fluoranthene in mg/Kg		3.5 U	0.46	0.28	0.077 U
Fluoranthene in mg/Kg	2.6	13	0.97	2	0.52
Fluorene in mg/Kg	0.37	35	2.5	4.2	3.5
Phenanthrene in mg/Kg		180	5.2	2	6.3
Pyrene in mg/Kg	16	68	7.6	5.8	2.1
1-Methylnaphthalene in mg/Kg	35	150	9.5	23	5.5
2-Methylnaphthalene in mg/Kg	320	190	0.29 U	0.077 U	2.9
Naphthalene in mg/Kg	1.6	24	0.42	3.9	2.2
Benz(a)anthracene in mg/Kg		37	3.4	2	0.7
Benzo(a)pyrene in mg/Kg		19	4.2	0.8	0.29
Benzo(b)fluoranthene in mg/Kg		8.1	1.9	0.58	0.19
Benzo(k)fluoranthene in mg/Kg		3.5 U	0.46	0.28	0.077 U
Chrysene in mg/Kg		58	5.8	4.1	1.7
Dibenzo(a,h)anthracene in mg/Kg		3.6	0.89	0.29	0.077 U
Indeno(1,2,3-cd)pyrene in mg/Kg		3.5 U	0.82	0.25	0.092
Total cPAHs TEQ in mg/Kg	0.14	25	5	1.2	0.41
Polychlorinated Biphenyls (PCBs)					
Aroclor 1016 in mg/Kg		0.27 U	0.22 U	0.23 U	0.23 U
Aroclor 1221 in mg/Kg		0.27 U	0.22 U	0.23 U	0.23 U
Aroclor 1232 in mg/Kg		0.27 U	0.22 U	0.23 U	0.23 U
Aroclor 1242 in mg/Kg		0.27 U	0.22 U	0.23 U	0.23 U
Aroclor 1248 in mg/Kg		0.27 U	0.22 U	0.23 U	0.23 U
Aroclor 1254 in mg/Kg		0.27 U	0.22 U	0.23 U	0.23 U
Aroclor 1260 in mg/Kg		0.27 U	0.22 U	0.23 U	0.23 U
Total PCBs in mg/Kg	1	ND	ND	ND	ND

Notes

Concentrations in shaded cells indicate value exceeds Saturated Soil - Unrestricted Land Use Screening Level.

J - Analyte was positively identified. The reported result is an estimate.

U - Analyte was not detected at or above the reported result.

APPENDIX B

Pre-Design Aquifer Testing Data, Bunker C Subarea

B. Pre-Design Aquifer Testing Data, Bunker C Subarea

To support preparation of this Engineering Design Report (EDR) Volume 1, Aspect Consulting (Aspect) collected data to further characterize the Fill Unit aquifer hydraulic characteristics in the vicinity of the planned Bunker C subarea excavation area. The objective of the data collection was to provide information to the Port of Bellingham's selected construction Contractor for their design and operation of a dewatering system for excavation (see Section 2.3 in the main body of this report). Locations of monitoring wells from which data were collected are depicted on Figure 3 in the main body of this EDR. The aquifer testing work was completed in accordance with the Pre-Design Characterization Plan (Aspect, 2015), which was reviewed and approved by Washington State Department of Ecology (Ecology).

The aquifer testing included slug tests in newly-installed well BC-MW01 to estimate Fill Unit aquifer hydraulic conductivity, and approximately 48 hours of continuous water level monitoring in wells BC-MW01, BC-MW02, BC-MW04, and BC-MW05 during a period of large tidal fluctuation (March 23 through 25, 2015), to document the magnitude of tidal influence on groundwater.

Figures B-1, B-2, and B-3 show the measured groundwater level fluctuations at the four monitoring wells, with the corresponding tidal fluctuation measured in the Whatcom Waterway, over the approximately 48 hours of monitoring.

Figures B-4 and B-5 shows water level response during the slug testing of BC-MW101. Based on analysis of the data using the Bouwer and Rice (1976, 1989) method[1], a hydraulic conductivity of 3×10^{-3} cm/sec is estimated for the water table aquifer at the BC-MW101 location. This is the same as determined from the 2011 pumping test[2] conducted in well BC-DW1 located mill-southeast of the current planned excavation area (BC-DW1 is shown on Figure 3 in main report). Table B-1 presents the hydraulic conductivity calculations.

[1] Bouwer, H., 1989, The Bouwer and Rice Slug Test – An Update, Groundwater, v. 27, no. 3, May-June 1989.
[2] Aspect, 2011, Pumping Test Results, Bunker C Tank Interim Action Area, GP West Site, July 29, 2011.

Table B-1 - Aquifer Hydraulic Conductivity Estimates from Slug Tests

140298 - Pulp and Tissue Mill RAU - Engineering Design Report

Monitoring Well	BC-MW101-1	BC-MW101-2	BC-MW101-3	BC-MW101-4	BC-MW101-5
Well Depth in Feet	**30.0**	**30.0**	**30.0**	**30.0**	**30.0**
Screen Length in Feet	**10.0**	**10.0**	**10.0**	**10.0**	**10.0**
Depth to Screen in Feet	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**
Depth to Aquitard in Feet	**100**	**100**	**100**	**100**	**100**
Depth to Water in Feet	**8.79**	**8.79**	**8.79**	**8.79**	**8.79**
Depth to Sandpack in Feet	**19.0**	**19.0**	**19.0**	**19.0**	**19.0**
Slug Displacement (H_o) in Feet	**1.77**	**1.35**	**2.06**	**2.31**	**1.79**
Porosity (n)	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**
Radius of Casing (r_c) in Feet	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**
Radius of Borehole (r_w) in Feet	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**
Saturated Aquifer Thickness (H) in Feet	91.2	91.2	91.2	91.2	91.2
Saturated Well Thinckness (L_w) in Feet	21.2	21.2	21.2	21.2	21.2
Effective Radius (r_{eff}) in Feet	0.083	0.083	0.083	0.083	0.083
Effective Screen Length (L_e) in Feet	10.0	10.0	10.0	10.0	10.0
Rising/Falling Head Test	Rising	Falling	Rising	Falling	Rising
Fully Submerged Sandpack	Yes	Yes	Yes	Yes	Yes
Transiently Exposed Sandpack	No	No	No	No	No
Transiently Exposed Screen	No	No	No	No	No
Partially Submerged Screen	No	No	No	No	No
Bouwer and Rice Parameters					
Normalized Head at t_1 (y_1) in Feet	0.98	1.00	0.86	0.56	0.97
Time - t_1 in Seconds	0.40	0.00	1.60	2.00	0.50
Normalized Head at t_2 (y_2) in Feet	0.37	0.36	0.31	0.12	0.45
Time - t_2 in Seconds	10.40	12.70	14.50	23.10	9.70
L_e/r_w	60.0	60.0	60.0	60.0	60.0
Coefficient A [a]	3.3	3.3	3.3	3.3	3.3
Coefficient B [a]	0.5	0.5	0.5	0.5	0.5
Coefficient C [a]	3.0	3.0	3.0	3.0	3.0
Partially Penetrating Well					
$\ln(R_e/r_w)$ [b]	3.0	3.0	3.0	3.0	3.0
K in cm/sec	**3.1E-03**	**2.5E-03**	**2.5E-03**	**2.3E-03**	**2.6E-03**
Fully Penetrating Well					
$\ln(R_e/r_w)$ [b]	3.6	3.6	3.6	3.6	3.6
K in cm/sec	**4E-03**	**3E-03**	**3E-03**	**3E-03**	**3E-03**
K in ft/day	9	7	7	6	7
Screened Interval Soil Type	SM	SM	SM	SM	SM

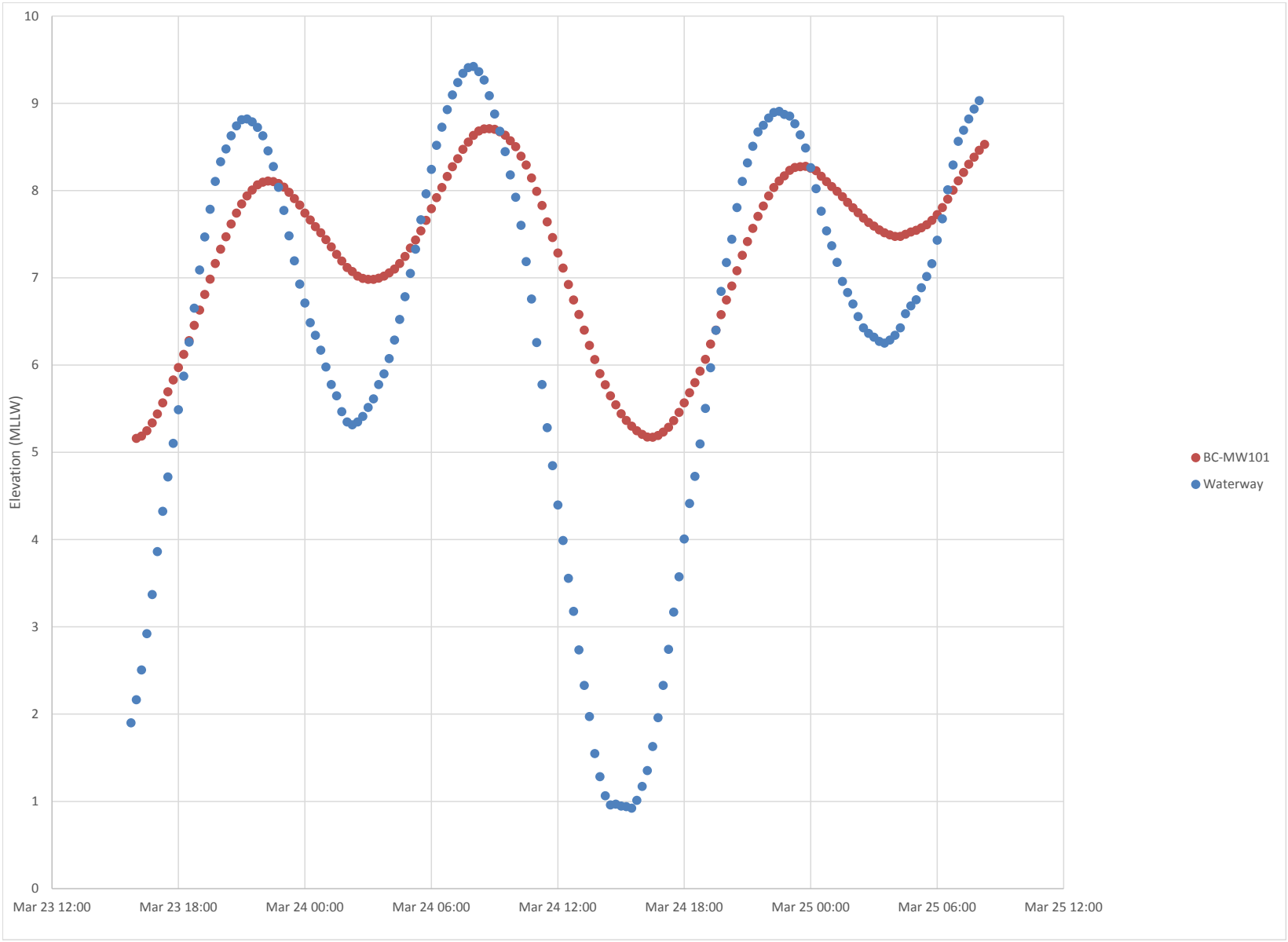
Data analysis by method of Bouwer and Rice (1976; 1989) or Van der Kamp (1976)

Bold values are entered from field data and other values are calculated.

All depths are below ground surface

[a] A, B, and C coefficients are calculated using regression equations of Van Rooy (1988).

[b] R_e/r_w is the effective radial distance over which y is dissipated, divided by the radial distance of well development.



Aspect Consulting
5/14/2015
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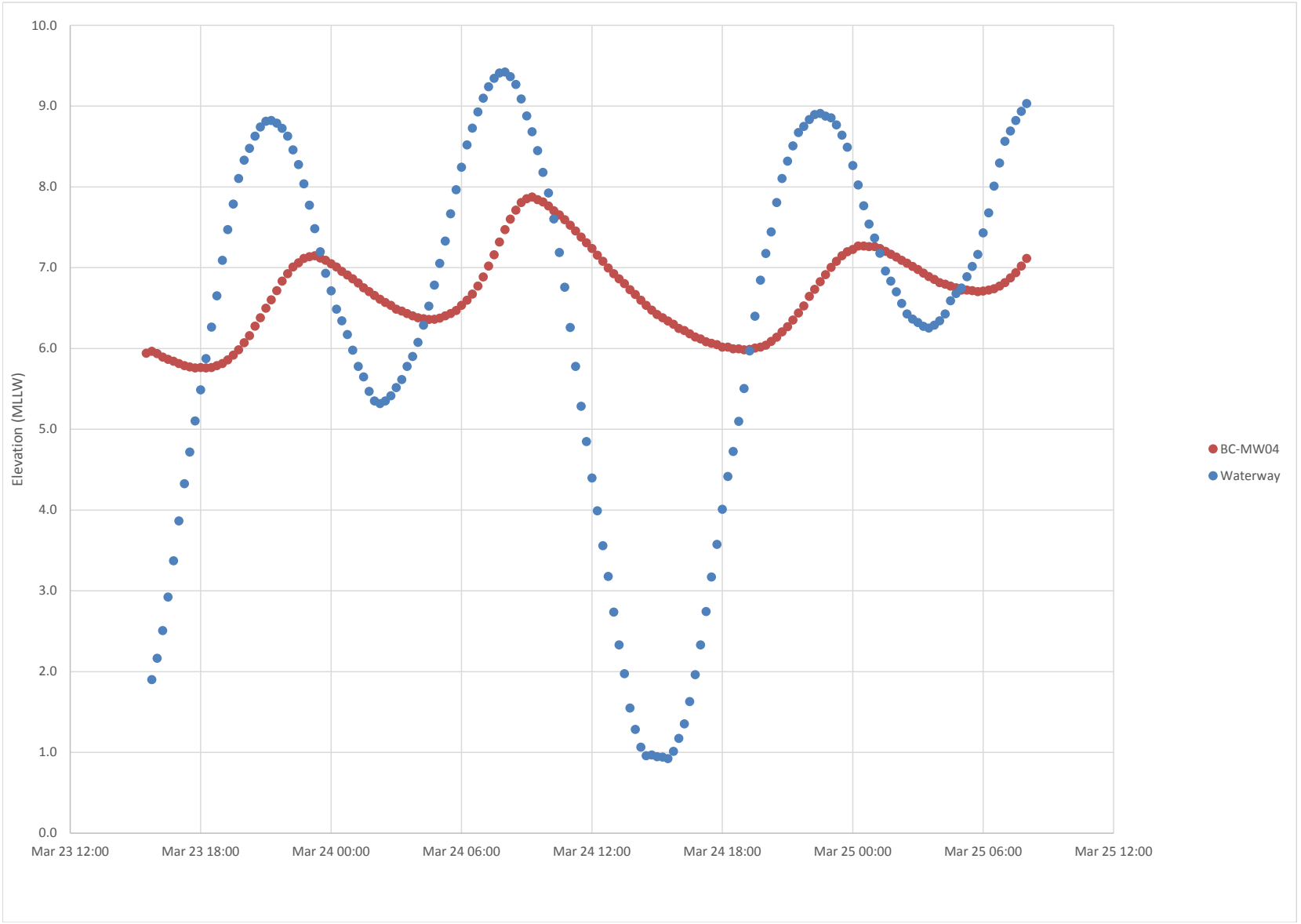
Figure B-1 - MW-101 Tidally Influenced Water Levels
Engineering Design Report - Pulp/Tissue Mill RAU
Bellingham, WA



Aspect Consulting
5/14/2015
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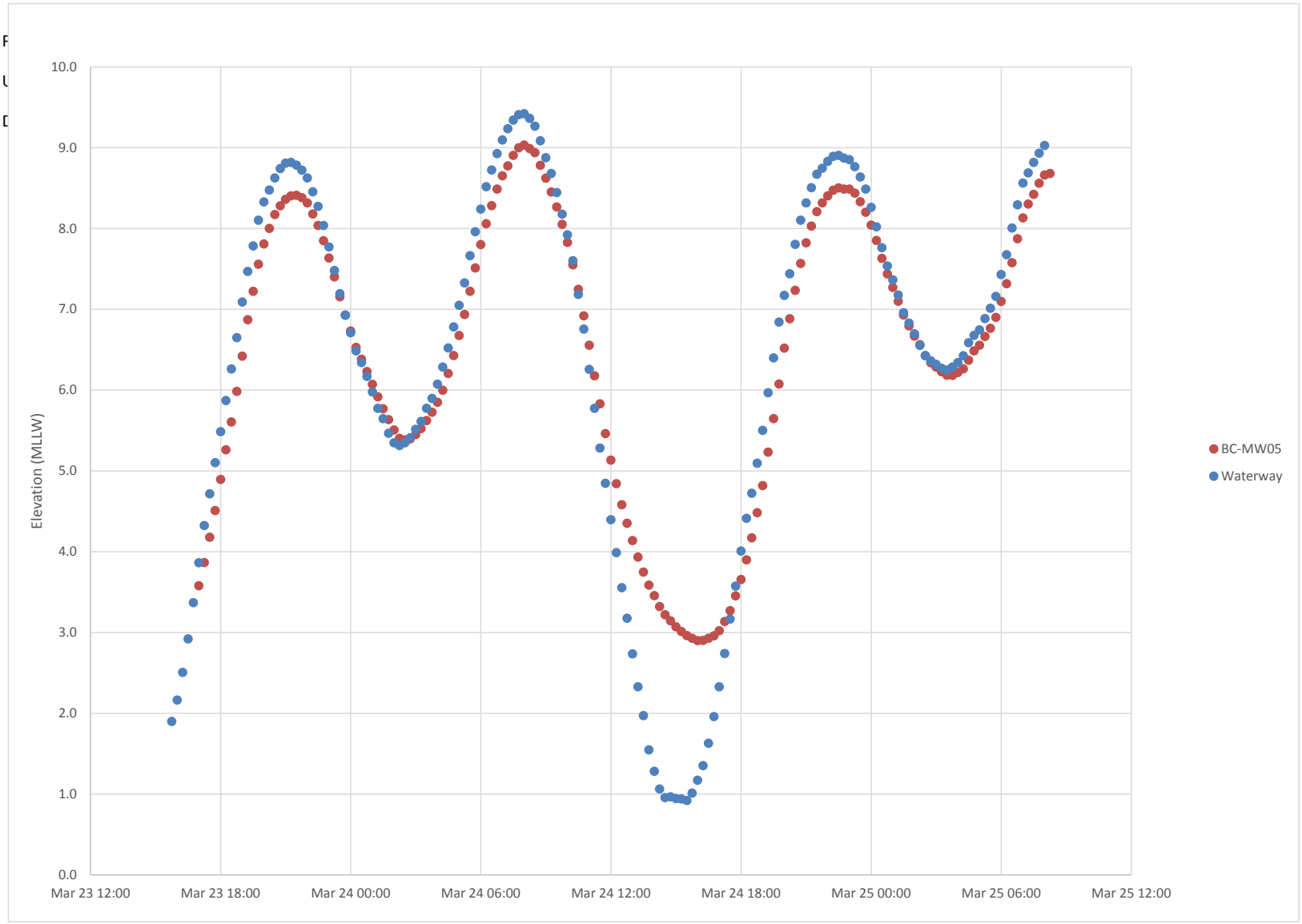
Figure B-2 - MW-04 Tidally Influenced Water Levels
Engineering Design Report - Pulp/Tissue Mill RAU
Bellingham, WA



Aspect Consulting
5/14/2015
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Figure B-3 - MW-05 Tidally Influenced Water Levels
Engineering Design Report - Pulp/Tissue Mill RAU
Bellingham, WA

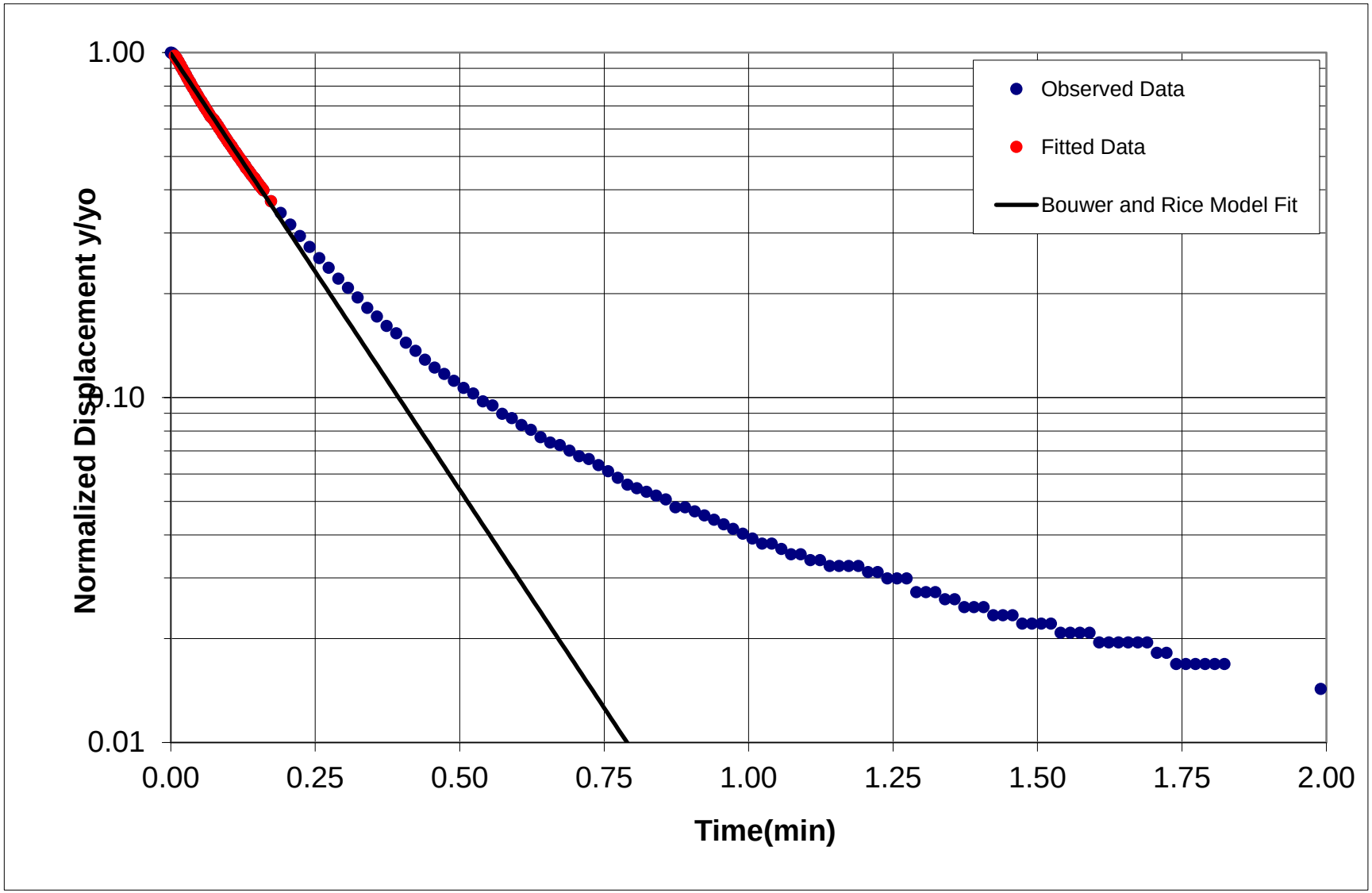

Figure B-4
BC-MW101 Slug-out Response
Pulp and Tissue Mill RAU , Engineering Design Report
G-P West Site, Bellingham, Washington

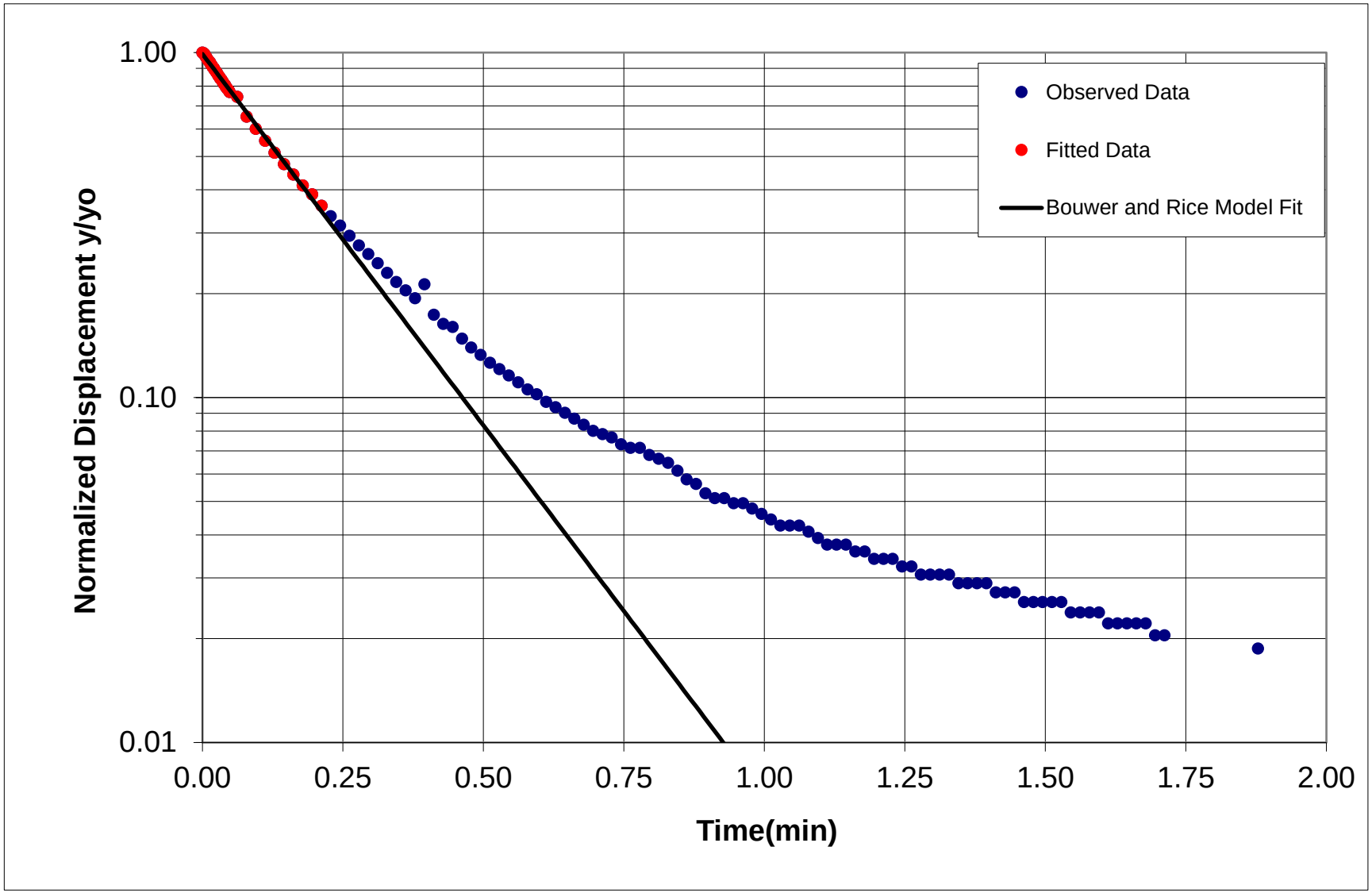

Figure B-5
BC-MW101 Slug-in Response
Pulp and Tissue Mill RAU, Enginering Design Report
G-P West Site, Bellingham, Washington

Aspect Consulting
5/14/2015
V:\140298 POB GP West Pulp & Tissue RAU Cleanup\Deliverables\EDR_Vol 1 Bunker C Dig\Final\Appendix B\Table B-1 - BC-MW101 Slug Test Analyses.xls

APPENDIX C

Data Validation Report and Laboratory Certificates of Analysis from Pre-Design Probe Investigation

DATA VALIDATION REPORT

Port of Bellingham GP West Site
Pre-Design Characterization Soil Sampling for
Cleanup of Pulp/Tissue Mill Remedial Action Unit
February 2015
SDGs 1502-245, 1502-263

Prepared by:
Aspect Consulting, LLC
401 Second Ave South, Suite 201
Seattle, WA 98104

Project No. 140298 • March 10, 2015

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1 Introduction

This report summarizes the findings of the United States Environmental Protection Agency (USEPA) Stage 2A data validation performed on analytical data for soil samples collected during February 23 through 26, 2015 for the Pulp/Tissue Mill Remedial Action Unit (RAU) Pre-Design Characterization – specifically characterizing soil quality in the Bunker C subarea to refine cleanup design. This data quality review is divided into sections by sample delivery group (SDG). A complete list of samples and analyses for each SDG is provided in the Sample Index at the beginning of each section.

Samples were analyzed by On-Site Environmental (OSE) in Seattle, Washington, an Ecology-accredited laboratory. The analytical methods for the soil samples are summarized below:

Analysis	Method	Laboratory
TPH- Diesel and Motor Oil Ranges with Silica Gel	NWTPH-Dx	OSE
RCRA 8 Metals	EPA 6010C	OSE
Total Mercury	EPA 7471B	OSE
Polycyclic Aromatic Hydrocarbons (PAHs)	SW8270D-SIM	OSE
Polychlorinated Biphenyls (PCBs)	EPA 8082A	OSE

The validation followed the procedures documented in the analytical methods, the work plan (Aspect, 2015), *National Functional Guidelines for Organic Data Review* (USEPA, 1999), and *National Functional Guidelines for Inorganic Data Review* (USEPA, 2004).

Data assigned a J qualifier (estimated) may be used for site evaluation purposes but the reasons for qualification should be taken into account when interpreting sample concentrations. Data marked as do-not-report (DNR) should not be used under any circumstances. Values without qualification meet all data measurement quality objectives and are suitable for use.

Data qualifier definitions and a summary table of the qualified data are included in the Qualified Data Summary at the end of this report. Data qualifiers have been incorporated into the project chemistry database to reflect the validation in this report.

2 Data Validation Findings for SDG 1502-245

Groundwater samples in this SDG, and the chemical analyses performed on them, are tabulated below. The sections below describe the results of the data quality review for this SDG by analyte group (analysis).

Sample Index

Sample ID	Sample Date	Sample Matrix	Analyte			
			TPH-Dx/Oil w/sg	PAHs	PCBs	RCRA Metals
BC-SB111-6.5	2/23/2015	Soil	x			
BC-SB111-13.5	2/23/2015	Soil	x			
BC-SB111-20	2/23/2015	Soil	x			
BC-SB108-7.5	2/23/2015	Soil	x	x	x	x
BC-SB108-6	2/23/2015	Soil	x			
BC-SB108-11.5	2/23/2015	Soil	x			
BC-SB108-16	2/23/2015	Soil	x			
BC-SB117-6	2/23/2015	Soil	x			
BC-SB117-10.5	2/23/2015	Soil	x			
BC-SB117-20	2/23/2015	Soil	x			
BC-SB115-7	2/23/2015	Soil	x			
BC-SB115-18	2/23/2015	Soil	x			
BC-SB115-25	2/23/2015	Soil	x			
BC-SB114-6	2/24/2015	Soil	x			
BC-SB114-13.5	2/24/2015	Soil	x			
BC-SB114-21	2/24/2015	Soil	x			
BC-SB112-6	2/24/2015	Soil	x			
BC-SB112-9.5	2/24/2015	Soil	x			
BC-SB112-11	2/24/2015	Soil	x			
BC-SB112-22	2/24/2015	Soil	x			
BC-SB113-6.5	2/24/2015	Soil	x			
BC-SB113-17	2/24/2015	Soil	x			
BC-SB113-25	2/24/2015	Soil	x			
BC-SB105-6	2/24/2015	Soil	x			
BC-SB105-7	2/24/2015	Soil	x	x	x	x
BC-SB105-11	2/24/2015	Soil	x			
BC-SB105-21	2/24/2015	Soil	x			
BC-SB102-6.5	2/24/2015	Soil	x			
BC-SB102-16	2/24/2015	Soil	x			
BC-SB102-22	2/24/2015	Soil	x			
BC-SB109-6	2/24/2015	Soil	x			
BC-SB109-9	2/24/2015	Soil	x			
BC-SB106-6	2/24/2015	Soil	x			
BC-SB106-8	2/24/2015	Soil	x	x	x	x
BC-SB106-12	2/24/2015	Soil	x			
BC-SB106-22	2/24/2015	Soil	x			
BC-SB107-6.5	2/24/2015	Soil	x			
BC-SB107-13	2/24/2015	Soil	x			
BC-SB107-22	2/24/2015	Soil	x			
BC-SB124-6.5	2/25/2015	Soil	x			
BC-MW101-6	2/25/2015	Soil	x			
BC-MW101-7.5	2/25/2015	Soil	x	x	x	x
BC-MW101-19	2/25/2015	Soil	x			

Sample ID	Sample Date	Sample Matrix	Analyte			
			TPH-Dx/Oil w/sg	PAHs	PCBs	RCRA 8 Metals
BC-MW101-22	2/25/2015	Soil	x			
BC-MW101-35	2/25/2015	Soil	x			
BC-SB103-7.5	2/25/2015	Soil	x			
BC-SB103-12.5	2/25/2015	Soil	x			
BC-SB103-14	2/25/2015	Soil	x			
BC-SB103-17.5	2/25/2015	Soil	x			
BC-SB103-25	2/25/2015	Soil	x			
BC-SB121-6	2/25/2015	Soil	x			
BC-SB121-15	2/25/2015	Soil	x			
BC-SB121-18	2/25/2015	Soil	x			
BC-SB121-20	2/25/2015	Soil	x			
BC-SB104-6	2/26/2015	Soil	x			
BC-SB104-11	2/26/2015	Soil	x			
BC-SB104-12.5	2/26/2015	Soil	x			
BC-SB104-22	2/26/2015	Soil	x			
BC-SB119-6	2/25/2015	Soil	x			
BC-SB119-14	2/25/2015	Soil	x			
BC-SB119-22	2/25/2015	Soil	x			
BC-SB110-6	2/25/2015	Soil	x			
BC-SB110-8.5	2/25/2015	Soil	x			
BC-SB110-12	2/25/2015	Soil	x			
BC-SB110-20	2/25/2015	Soil	x			
BC-SB108-21	2/23/2015	Soil	x			

2.1 PAHs (EPA 8270D-SIM)

2.1.1 Sample Receipt, Preservation, and Holding Times

Soil samples should be extracted within 14 days of collection. Extracted samples should be analyzed within 40 days of extraction.

Sample receipt, preservation (2-6 degrees Celsius [C]), and holding times were acceptable.

2.1.2 Method Blanks

Target analytes were not detected at or above the reporting levels in the method blanks.

2.1.3 Surrogates

All surrogate spike recoveries were within control limits or were not applicable due to sample dilution.

2.1.4 Matrix Spike/Matrix Spike Duplicates (MS/MSD)

Matrix spike (MS) and matrix spike duplicate (MSD) recoveries (%R) and relative percent differences (RPD) between duplicates were within the project control limits.

2.1.5 Reported Results and Reporting Limits (RL)

The reporting limits (RL) were met or were elevated accordingly due to high detected concentrations of target analytes. RLs were acceptable for their intended use.

2.1.6 Overall Assessment

Accuracy was acceptable based on the surrogate and MS recoveries and precision was acceptable based on the MS/MSD RPD values. The data are of known quality and are acceptable for use as qualified.

2.2 Diesel- and Oil-Range TPH with Silica Gel (NWTPH-Dx)

2.2.1 Sample Receipt, Preservation, and Holding Times

Water samples should be analyzed within 14 days of collection.

Sample receipt, preservation (2-6 degrees C), and holding times were acceptable.

2.2.2 Method Blanks

Target analytes were not detected at or above the reporting levels in the method blanks.

2.2.3 Surrogates

All %R were within control limits.

2.2.4 Laboratory Duplicates

For laboratory duplicate results that are greater than the reporting limit, the RPD control limit is 20%. For laboratory duplicate results less than five times the reporting limit, the difference between the sample and duplicate must be less than the reporting limit.

All RPD were within the control limits specified above.

2.2.5 Reported Results and Reporting Limits (RL)

The target RLs met the project requirements.

2.2.6 Overall Assessment

Accuracy was acceptable based on the surrogate recoveries, and precision was acceptable based on the laboratory duplicate RPD values. The data are of known quality and are acceptable for use as qualified.

2.3 PCB Aroclors (EPA 8082A)

2.3.1 Sample Receipt, Preservation, and Holding Times

Soil samples should be extracted within 14 days of sample receipt and analyzed within 40 days of extraction. Sample receipt, preservation, and holding times were acceptable.

2.3.2 Method Blanks

Target analytes were not detected at or above the reporting levels in the method blanks.

2.3.3 Surrogates

All surrogate spike %R were within control limits.

2.3.4 Matrix Spikes (MS/MSD)

MS and MSD %R and RPD were within the project control limits.

2.3.5 Reported Results and Reporting Limits (RL)

The target RLs met the project requirements.

2.3.6 Overall Assessment

Accuracy was acceptable based on the surrogate spike and MS recoveries, and precision was acceptable based on the MS/MSD RPD values. The data are of known quality and are acceptable for use as qualified.

2.4 RCRA 8 Metals (EPA 6010C)

2.4.1 Sample Receipt, Preservation, and Holding Times

Soil samples should be maintained at 2-6 degrees C until preparation and analysis. Soil samples should be analyzed within 180 days of collection. Sample receipt, preservation, and holding times were acceptable.

2.4.2 Method Blanks

Target analytes were not detected at or above the reporting levels in the method blanks.

2.4.3 Matrix Spikes (MS/MSD)

MS and MSD %R and RPD were within the project control limits.

2.4.4 Laboratory Duplicates

All RPD were within the control limits with one exception. The relative percent difference for cadmium was outside the control limits, most likely to inhomogeneity in the sample. The parent sample, BC-SB106-8, was qualified as estimated (J).

2.4.5 Reported Results and Reporting Limits (RL)

The target RLs met the project requirements.

2.4.6 Overall Assessment

Accuracy was acceptable based on the MS recoveries, and precision was acceptable based on the MS/MSD and laboratory duplicate RPD values. The data are of known quality and are acceptable for use as qualified.

2.5 Total Mercury (EPA 7471B)

2.5.1 Sample Receipt, Preservation, and Holding Times

Soil samples should be maintained at 2-6 degrees Celsius (C) until preparation and analysis. Samples should be analyzed within 28 days.

Sample receipt, preservation, and holding times were acceptable.

2.5.2 Method Blanks

Target analytes were not detected at or above the reporting levels in the method blanks.

2.5.3 Laboratory Control Samples (LCS)

Laboratory control sample (LCS) percent recoveries (%R) were within the project control limits.

2.5.4 Matrix Spikes (MS/MSD)

MS and MSD %R and RPD were within the project control limits.

2.5.5 Laboratory Duplicates

For laboratory duplicate results that are greater than the reporting limit, the RPD control limit is 20%. For laboratory duplicate results less than five times the reporting limit, the difference between the sample and duplicate must be less than the reporting limit.

All RPD were either within the control limits or the control limits were not applicable.

2.5.6 Reported Results and Reporting Limits (RL)

The target RLs met the project requirements.

2.5.7 Overall Assessment

Accuracy was acceptable based on the MS recoveries, and precision was acceptable based on the MS/MSD and laboratory duplicate RPD values. The data are of known quality and are acceptable for use as qualified.

3 Data Validation Findings for SDG 1502-263

Groundwater samples in this SDG, and the chemical analyses performed on them, are tabulated below. The sections below describe the results of the data quality review for this SDG by analyte group (analysis).

Sample Index

Sample ID	Sample Date	Sample Matrix	Analyte
			TPH-Dx/Oil w/sg
BC-SB125-7	2/26/2015	Soil	x
BC-SB125-8.5	2/26/2015	Soil	x
BC-SB125-19	2/26/2015	Soil	x
BC-SB125-22	2/26/2015	Soil	x
BC-SB118-6	2/26/2015	Soil	x
BC-SB118-14.5	2/26/2015	Soil	x
BC-SB118-21.5	2/26/2015	Soil	x
BC-SB116-6	2/26/2015	Soil	x
BC-SB116-16	2/26/2015	Soil	x
BC-SB116-22	2/26/2015	Soil	x
BC-SB122-5.5	2/26/2015	Soil	x
BC-SB122-15	2/26/2015	Soil	x
BC-SB122-22	2/26/2015	Soil	x
BC-SB123-6.5	2/26/2015	Soil	x
BC-SB123-17	2/26/2015	Soil	x
BC-SB123-22.5	2/26/2015	Soil	x
BC-SB120-5	2/26/2015	Soil	x
BC-SB120-16	2/26/2015	Soil	x
BC-SB120-22	2/26/2015	Soil	x

3.1 Diesel- and Oil-Range TPH with Silica Gel (NWTPH-Dx)

3.1.1 Sample Receipt, Preservation, and Holding Times

Water samples should be analyzed within 14 days of collection.

Sample receipt, preservation (2-6 degrees C), and holding times were acceptable.

3.1.2 Method Blanks

Target analytes were not detected at or above the reporting levels in the method blanks.

3.1.3 Surrogates

All %R were within control limits.

3.1.4 Laboratory Duplicates

All RPD were within the control limits specified above.

3.1.5 Reported Results and Reporting Limits (RL)

The target RLs met the project requirements.

3.1.6 Overall Assessment

Accuracy was acceptable based on the surrogate recoveries, and precision was acceptable based on the laboratory duplicate RPD values. The data are of known quality and are acceptable for use as qualified.

4 Qualified Data Summary

Qualified Data Summary Table

Sample ID	Laboratory ID	Analyte	Qualifier	Qualified Reason
BC-SB106-8	1502-245-34	Cadmium	J	MS/MSD %RPD above control limits.

Data Qualifier Definitions

Data Qualifier	Definition
DNR	Do not report; the result should be reported from an alternative analysis.
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
R	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
U	The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ	The analyte was analyzed for, and the associated quantitation limit was an estimated value.
X	The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

5 References

Aspect, 2015, Pre-Design Characterization Plan, Remedial Action Unit, GP West Site, Bellingham, Washington, February 6, 2015.

U.S. Environmental Protection Agency (USEPA), 1994, Method 200.8 Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma – Mass Spectrometry, Revision 5.4, Environmental Monitoring Systems Laboratory Office of Research and Development.

U.S. Environmental Protection Agency (USEPA), 1997, Method 1640 Determination of Trace Elements in Waters by Preconcentration and Inductively Coupled Plasma – Mass Spectrometry, Office of Water & Office of Science and Technology Engineering and Analysis Division (4303), April.

U.S. Environmental Protection Agency (USEPA), 1999, Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Office of Emergency and Remedial Response, USEPA Publication No. 540/R-99/008, October.

U.S. Environmental Protection Agency (USEPA), 2004, Contract Laboratory Program National Functional Guidelines for Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation (OSRTI), USEPA Publication No. 540-R-04-004, October.