

Draft
Southwest Harbor Terminal 5
Groundwater Quality Monitoring
Evaluation Report
Seattle, Washington

Prepared for Port of Seattle

September 23, 2010 17627-00





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Prepared by **Hart Crowser, Inc.**

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LIST OF ACRONYMS

BEHP Bis(2-ethylhexyl) phthalate **bgs** below ground surface

BNSF Burlington Northern Santa Fe Railway
CEE's chlorinated ethanes and ethenes

DCE dichloroethene

Ecology Washington State Department of Ecology

EPA Environmental Protection Agency

GQMER Groundwater Quality Monitoring Evaluation Report **GWCMP** Groundwater Confirmation Monitoring Program

IDW Investigation-derived waste

PCE Tetrachloroethene
Port Port of Seattle
RA Remediation Area

SWHP Southwest Harbor ProjectSSI Seattle Steel Incorporated

TCE trichloroethene

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SOUTHWEST HARBOR TERMINAL 5 GROUNDWATER QUALITY MONITORING EVALUATION REPORT SEATTLE, WASHINGTON

1.0 INTRODUCTION

This Groundwater Quality Monitoring Evaluation Report (GQMER) presents the results from four semiannual (twice yearly) groundwater monitoring events for the Phase II Southwest Harbor Project (SWHP) Groundwater Confirmation Monitoring Program (GWCMP) located at the Southwest Harbor Terminal 5 (Site) in Seattle, Washington (Figure 1). The purpose of the GWCMP is to confirm that soil remedial actions conducted under the individual SWHP Cleanup Action Plans are protective of surface water quality for the Site as a whole.

Phase I of the GWCMP focused on characterizing the post-remediation groundwater flow system at the Site in 2006. The resulting Hydrologic Characterization Report (Aspect 2007a) presented a detailed characterization of the post-remediation groundwater flow system, and concluded that Fill Aquifer flow conditions at the Site had equilibrated sufficiently to proceed with Phase II of the GWCMP.

This report summarizes the sampling activities and laboratory results for the four sampling events, completed by Aspect Consulting in October 2008, March/April 2009, and September 2009 and by Hart Crowser in June 2010. Sampling was performed in accordance with the Ecology-approved Water Quality Monitoring Plan (Aspect 2007 b).

Our work was completed in general accordance with our executed contract dated April 29, 2010, authorized by Mr. Brian Knight with the Port of Seattle.

2.0 BACKGROUND

The SWHP is located along the base of the West Seattle highlands at the confluence of the West Waterway of the Duwamish River (West Waterway) and Elliott Bay. The Site location is shown on Figure 1. The SWHP comprises approximately 185 areas of land generally bordered by Harbor Avenue and non-Port industrial and commercial properties on the west, SW Spokane Street and non-Port commercial properties on the south, Elliott Bay and Florida Street on the north, and the original Terminal 5 on the east. Most of the SWHP overlies

former tideflats that have been filled and used for various industrial purposes, including but not limited to railroad yards, wood treatment facilities, steel scrap storage, and a municipal and wood waste landfill.

The SWHP was divided into five Remediation Areas (RAs). Figure 2 shows the SWHP area and the boundaries of each RA. To facilitate Port plans for redevelopment, the individual RAs were remediated in the mid- to late-1990s. RA-1, RA-2, RA-3 and RA-5 were redeveloped under oversight by Ecology, while RA-4 was addressed under agreement with EPA. The locations and histories of the individual RAs and specific remedial actions completed at each RA are summarized below.

2.1 Remediation Area (RA) Descriptions

2.1.1 Spokane Street Properties (RA-1)

RA-1 consists of two disconnected land parcels (Figure 2). The narrow northern strip of land in RA-1 is the site of the former Buckley Yard, a rail car staging area that dates from the 1920s. The portion of RA-1 south of the former Buckley Yard is referred to as the Spokane Street Properties, which was historically occupied by an aluminum foundry, a chemical distribution warehouse, automotive repair areas, a fuel oil distribution facility and retail food stores. Soil contamination associated with the Spokane Street Properties was remediated between 1994 and 1998. Low-level soil contamination associated with the Buckley Yard was left in place. Asphalt and concrete covers were placed over the Buckley Yard, except in the northern portion of the area east of RA-3, where 24 inches of ballast cover was placed under the railroad tracks. Presently, RA-1 is occupied by Burlington Northern Santa Fe (BNSF) rail spurs, the main access road into the intermodal yard facility, and office buildings.

2.1.2 Former Salmon Bay Steel Property (RA-2)

RA-2 is the former Salmon Bay Steel property, located north of Spokane Street (Figure 2), and was used to store slag and scrap for the steel mill south of Spokane Street from the early 1900s until the 1970s. The area also included two large warehouses, a scale, and railroad spurs. Beginning in the late 1800s, the tideflats on the property were gradually filled with dredge sediment, slag, and steel mill debris. This fill material is predominantly slag, and reaches depths of 25 feet in places. Between 1996 and 1998, a cleanup measure was implemented that involved covering a quarter of the RA with a gravel ballast cap and the remainder of the RA with an impermeable asphalt pavement cap. Prior to this effort, the contaminated soil from areas where the gravel ballast cover was to be placed was moved to areas where asphalt cover would be placed.

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Presently, the western portion of RA-2 is occupied by the BNSF Rail Yard, and the eastern portion is occupied by the main entrance and south end of the intermodal yard.

2.1.3 Former West Seattle Landfill and Purdy Scrap/Former Seattle Steel Inc. Property (RA-3)

RA-3 was the location of both the West Seattle Landfill and the former Seattle Steel Incorporated (SSI) property (Figure 2), a scrap metal processing company. The West Seattle Landfill occupied 30 acres (approximately three-quarters of this RA) and was in operation from 1939 to 1966. The former landfill was almost entirely covered with slag, construction debris, steel mill debris, and an unengineered soil cover. In the spring of 1995, near-surface refuse from the eastern portion of the landfill was relocated to a consolidation landfill area on the western portion of the RA. An interim cover consisting of processed solid landfill material was placed over the property. Since this time, an engineered cover consisting of clean fill and a low-permeability geomembrane has been placed over the former landfill, and an asphalt cover has been placed over the former SSI property south of the landfill. The Port operates a landfill gas collection and treatment system in the former landfill area. Presently, the asphalt-paved area on the consolidated landfill portion of RA-3 is used for tenantlease activities including truck and vehicle parking, container chassis storage, and temporary construction laydown and component assembly for Sound Transit's light rail project.

2.1.4 Pacific Sound Resources Superfund Site (RA-4)

RA-4, a former wood treating facility referred to as the Pacific Sound Resources Superfund site, is being addressed separately under the Superfund process by EPA (Figure 2). Monitoring of groundwater downgradient of RA-4, for the purpose of verifying RA-4 cleanup action protection, is not included in the scope of the GWCMP. However, the portion of RA-4 south of Florida Street is being considered under this GWCMP in order to evaluate groundwater flow from RA-4 into the adjacent remediation areas.

Until 1994, when remediation activity began, the north portion of RA-4 (north of the Florida Street alignment) was occupied by wood treating operations, and the south portion was the location of a kiln building, laboratory area, sawmill, office building and storage areas for treated and untreated stock (Retec 1994). Remediation involved limited removal of contaminated soils and the placement of a specially-designed, low-permeability asphalt concrete cap over the entire RA. Woodwaste from an area at the west side of the RA was recycled off site and the resulting excavation pit was backfilled with fill. A geotextile identifier

layer was installed throughout the RA between clean import fill and underlying contaminated soils. In addition, a groundwater containment slurry wall was built in the northern portion of the property to reduce tidal influence on groundwater in the RA interior and limit migration of contaminants into Puget Sound. RA-4 is presently occupied by the northern end of the Terminal 5 intermodal yard, the BNSF Storage Track Yard, and the Jack Block Public Shoreline Access and Park area.

2.1.5 Former Lockheed Shipyard 2 (RA-5)

RA-5 was originally a tideflat zone that has since been filled with dredge sediment, slag, and construction debris. The western portion of the remediation area (Figure 2), filled prior to 1936, was the site of Nettleton Lumber until the late 1960s. The eastern portion of the RA was filled in the late 1950s, becoming the location of Lockheed Shipyard 2, which operated from 1956 to 1987 as a ship maintenance and refitting yard. In 1994, the area used for shipbuilding operations underwent excavation and treatment of contaminated soils. Pursuant to this cleanup effort, the shipyard-era storm drain system was removed or abandoned, and the associated contaminated storm drain sediments were disposed of. In addition, an asphalt concrete cap was placed over the entire site and a new stormwater drainage system was installed. Presently, RA-5 is used by the intermodal yard tenant for parking and interim container storage.

2.2 Monitoring Locations

The study area addressed in the GWCMP encompasses most of the SWHP Site, including the former Buckley Yard and Spokane Street Properties (RA-1), former Salmon Bay Steel Property (RA-2), former West Seattle Landfill and SSI property (RA-3), and the former Lockheed Shipyard 2 (RA-5). Phase II of the GWCMP involves sampling of Fill and Estuarine Aquifer monitoring wells within and/or downgradient of these RAs.

Figure 2 presents the locations of 11 Fill Aquifer and 3 Estuarine Aquifer monitoring wells that are currently sampled as part of the Phase II monitoring network. These wells are used to monitor groundwater quality within and/or downgradient of the target RAs, as follows:

- Wells CMP-17 and MW-125 monitor Fill Aquifer groundwater quality downgradient of the former Spokane Street Properties (RA-1).
- Well CMP-3 monitors Fill Aquifer groundwater quality downgradient of RA-2 and the extreme southern portion of the former Buckley Yard (RA-1).

- Well CMP-4, located within the former Buckley Yard (RA-1), monitors Fill Aquifer groundwater quality within this RA, and immediately downgradient of the central portion of RA-3.
- Well MW-308N monitors Fill Aquifer groundwater quality downgradient of the northern portions of the former Buckley Yard (RA-1) and RA-3.
- Well MW-308S monitors Estuarine Aquifer groundwater quality downgradient of the northern portions of the former Buckley Yard (RA-1) and RA-3.
- Well CMP-15 monitors Fill Aquifer groundwater quality on flow paths that transect the central and/or northern portions of the former Buckley Yard (RA-1) and RA-3, the southern portion of RA-4, and the western portion of RA-5.
- Well MW-36 monitors Estuarine Aquifer groundwater quality on flow paths that transect the central and/or northern portions of the former Buckley Yard (RA-1) and RA-3, the southern portion of RA-4, and the western portion of RA-5.
- Well MW-26R monitors Fill Aquifer groundwater quality on flow paths that transect the central portions of the former Buckley Yard (RA-1) and RA-3, the southern portion of RA-4, and the eastern portion of RA-5.
- Well MW-44 monitors Estuarine Aquifer groundwater quality on flow paths that transect the central portions of the former Buckley Yard (RA-1) and RA-3, the southern portion of RA-4, and the eastern portion of RA-5.

Four Phase II GWCMP wells were sampled to monitor background water quality upgradient of the target RAs, as follows:

- Background wells FM-105 and CMP-1 are located on the southern borders of RA-1 and RA-2, respectively. These wells monitor the quality of groundwater that flows beneath the Nucor Steel facility and SW Spokane Street, and enters the SWHP from the south.
- Background well CMP-2 monitors groundwater quality entering the SWHP from commercial/industrial areas located immediately southwest of RA-2.
- Background well CMP-5, located immediately upgradient of RA-3, monitors groundwater quality along the flow path of recharge from the adjacent West Seattle highlands.

The Phase II GWCMP monitoring network comprises monitoring wells sited for the Phase I groundwater flow characterization. It is possible that one or more of the monitoring wells may not prove to be optimal for Phase II water quality monitoring. The first four rounds of groundwater monitoring during the Phase II GCWMP have been completed and are summarized within this groundwater quality monitoring evaluation report. A summary of the recommendations for the replacement or addition of wells to better meet the goals of the Phase II program are detailed in Section 6.0.

2.3 Monitoring Schedule

In accordance with the Groundwater Conceptual Letter, Phase II groundwater sampling was performed semiannually (twice yearly) (Port of Seattle 1999). Aspect Consulting completed two low-level groundwater sampling events in October 2008 and September 2009 and one high-level groundwater sampling event in March/April 2009. Hart Crowser completed the second high-level groundwater sampling event in June 2010.

Figure 2 shows the spatial distribution of monitoring wells that are currently sampled as part of the Phase II monitoring network.

3.0 SCOPE OF WORK

The purpose of the Phase II Southwest Harbor Project (SWHP) Groundwater Confirmation Monitoring Program (GWCMP) is to confirm that soil remedial actions conducted under the individual SWHP Cleanup Action Plans are protective of surface water quality for the Site as a whole.

The groundwater monitoring tasks included in Phase II are described below.

- Measure depth to water in sampled monitoring wells to determine groundwater elevation contours during the high-level groundwater sampling event (Table 1).
- Sample 14 monitoring wells in the existing monitoring well network using low-flow sampling methods.
- Monitor field parameters (dissolved oxygen, pH, temperature, specific conductivity, and turbidity) using a flow-through cell during purging and sampling.

■ Collect and submit one grab groundwater sample for chemical analysis, using low-flow sampling, from each monitoring well location.

4.0 GROUNDWATER ELEVATIONS

4.1 Site Hydrogeology

The Site is underlain by two aquifers, a shallow Fill Aquifer and a deeper Estuarine Aquifer. Eleven wells are completed in the Fill Aquifer and three wells are completed in the Estuarine Aquifer. The Fill Aquifer consists of groundwater in various fill materials between 20 to 40 feet below ground surface (bgs). Sandy Silt to silty fine Sand tideflat deposits, typically 1 to 10 feet in thickness, occur between the Fill and Estuarine Aquifer zones over most of the Site with the exception of the easternmost portion near the West Waterway, and in isolated areas near the former axis of Longfellow Creek along the eastern edge of RA-3. Where present, this low-permeability unit results in locally confined conditions in the Estuarine Aquifer zone. The Estuarine Aquifer is underlain by a lower permeability unit that occurs at depths ranging from 30 to 50 feet bgs. The Fill Aquifer/Estuarine Aquifer system is bounded to the north by Elliott Bay and to the east by the West Waterway. The aquifers thin to the south and west and terminate to the west against the West Seattle bluff, encountering deposits of the low-permeability Lawton Clay unit.

4.2 Groundwater Elevations

The depth to water was measured in all the monitoring wells during the June 2 through June 4, 2010, groundwater sampling event. Monitoring well groundwater elevation data for all four groundwater sampling events (low and high levels) are summarized and presented in Table 1. Since groundwater at the Site is tidally influenced and water levels were measured over a 3-day period, meaningful groundwater contours could not be plotted. Post-redevelopment and tidally corrected groundwater elevation contours based on a 72-hour mean during dry and wet season in the Fill and Estuarine Aquifers are provided in Figures 3 through 6 (Aspect 2007a).

4.2.1 Fill Aquifer

The groundwater elevations during the June 2010 measurements for shallow monitoring wells in the Fill Aquifer ranged from 8.67 to 15.09 feet bgs. Groundwater elevations in all monitoring wells increased by 0.29 to 1.85 feet relative to the September 2009 monitoring event. Based on the Aspect Consulting Hydrologic Characterization Report (2007a), groundwater flows in

the Fill Aquifer monitoring wells were generally toward the east-northeast of the West Seattle uplands, beneath RA-3, and then diverged toward the nearest water body, West Waterway or Elliott Bay, within the main Terminal 5 area. The most recent groundwater elevation contours based on a 72-hour mean during dry and wet seasons in the Fill Aquifer are provided in Figure 3 and 4, respectively. In general, Fill Aquifer groundwater flows measured during the June 2010 sampling event showed a similar trend to what was observed during the long-term study conducted by Aspect Consulting.

4.2.2 Estuarine Aquifer

The groundwater elevations in the deep monitoring wells completed in the Estuarine Aguifer ranged from 8.29 to 9.44 feet bgs. Groundwater elevations in monitoring wells MW-308A(S) and MW-36 were 0.27 to 0.38 feet lower than nearby shallow monitoring wells screened in the Fill Aquifer, indicating that a downward gradient exists between the Fill Aquifer and the Estuarine Aquifer. A downward gradient was not observed at the shallow and deep monitoring well cluster, MW-26R and MW-44. This is likely due the absence of a lowpermeability confining unit on the easternmost portion of the Site near the West Waterway. However, based on the Aspect Consulting Hydrologic Characterization Report (2007a), groundwater flows in the Estuarine Aquifer monitoring wells were generally from the southwest toward the northeast, with discharge to Elliott Bay and the West Waterway. The most recent groundwater elevation contours based on a 72-hour mean during dry and wet season in the Estuarine Aquifer are provided in Figure 5 and 6, respectively. During the June 2010 sampling event, only three deep monitoring wells (MW-308S, MW-36, and MW-44) were measured, providing inadequate data for field verification of groundwater flows observed during the long-term study conducted by Aspect Consulting.

5.0 GROUNDWATER SAMPLING AND ANALYTICAL RESULTS

5.1 Surface Water Quality Screening Criteria

As noted in the Groundwater Conceptual Letter (Port of Seattle 1999), the remediation activities completed at each of the RAs are believed to be protective of groundwater quality whose highest beneficial use is discharge to surface water. Since surface water is the assumed final receptor of groundwater, surface water quality screening criteria were included in this report for preliminary comparison purposes only.

Potential surface water quality screening criteria for each analyte are summarized in Table 2. Note that the most stringent surface water criterion for arsenic is 0.14 ug/L. However, since Ecology has established the natural background concentration of arsenic in groundwater at 5 ug/L (MTCA Method A), arsenic concentrations were screened against the established background concentration of 5 ug/L. It should also be noted that surface water quality criteria are based on dissolved metals concentrations. Since the work plan for the SWHP GWCMP specified analysis of total metals, depending upon turbidity and suspended solids concentrations, reported groundwater metal concentrations may have an artificially high bias relative to the dissolved metals criteria they are being screened against.

5.2 Groundwater Concentrations Protective of Surface Water

As part of this Groundwater Quality Monitoring Evaluation Report, a memorandum was developed to identify the appropriate groundwater chemical concentrations that are protective of surface water, against which the GWCMP data should be compared (Appendix A).

The protectiveness of current groundwater chemical concentrations was assessed by modeling natural attenuation of chemical constituents within the groundwater aquifer to determine if chemicals detected in groundwater are naturally attenuated to concentrations below surface water quality criteria prior to discharge to Puget Sound marine water.

Fate and transport modeling using BIOSCREEN was conducted to predict contaminant concentrations at the shoreline. The natural attenuation processes simulated in the modeling include dispersion and sorption. Biodegradation and tidal mixing processes were not included in the model.

The model results show that even under the conservative conditions, predicted concentrations of most constituents of potential concern (COPCs), including bis(2-ethylhexyl)phthalate, PAHs and PCBs detected in groundwater will not exceed the screening level concentrations at the shoreline within 100 years. For organic compounds, groundwater concentrations as high as the solubility limit would not result in an exceedance of surface water quality criteria at the shoreline.

Tidal dilution factors ranging from 4 to 10,000 have been reported from groundwater modeling at the Terminal 5 and adjacent sites (Aspect 2007; Retec 1998). Use of the lowest tidal dilution estimate of four would further reduce the calculated chemical concentrations at the shoreline after 100 years by an additional factor of four. Incorporation of chemical degradation rates would

result in even lower chemical concentrations at the groundwater to surface water interface.

5.3 Monitoring Well Groundwater Sampling and Analysis

Groundwater samples were collected from the 11 shallow Fill Aquifer monitoring wells (CMP-1, CMP-2, CMP-3, CMP-4, CMP-5, CMP-15, CMP-17, MW-26R, MW-125, MW-308N, and FM-105) and the deep Estuarine Aquifer monitoring wells (MW-36, MW-44, and MW-308S) to evaluate water quality in the Fill and Estuarine Aquifers.

All groundwater samples were submitted for chemical analysis of:

- cPAHs by EPA Method 8270C-SIM;
- PCBs by EPA Method 8082;
- TPH-Dx by NWTPH-Dx with silica gel cleanup; and
- Bis(2-ethylhexyl) phthalate (BEHP) by EPA Method 8270C.

Additionally, selected groundwater samples were submitted for chemical analysis of:

- VOCs, chlorinated ethanes and ethenes (CEE's) by EPA Method 8260B for monitoring wells FM-105, MW-125, and CMP-17;
- Total metals by EPA Method 6010B/6020 for antimony, arsenic, chromium, copper, lead, and nickel for monitoring wells CMP-15, MW-26R, MW-36, and MW-44; and
- Total metals by EPA Method 6010B/6020 for arsenic and lead for monitoring wells CMP-1, CMP-2, CMP-3, CMP-4, CMP-5, CMP-17, MW-125, MW-308N, MW-308S, and FM-105.

Details of the low-flow sampling procedures are presented in Appendix A. The monitoring well boring logs for the Phase II GWCMP monitoring network are presented in Appendix B. Field water quality parameters including pH, temperature, conductivity, dissolved oxygen, and turbidity were monitored during groundwater sampling of the Fill and Estuarine Aquifer monitoring wells. Field water quality monitoring results are provided on the groundwater sampling forms presented in Appendix C. The review of chemical data quality and laboratory certificates is included in Appendix D.

Tables 3 through 6 present the tabulated field monitoring and analytical results for the RA-1 and RA-3, RA-2, and RA-5, respectively, for the four groundwater monitoring events (October 2008, March/April 2009, September 2009, and

June 2010). Groundwater quality data are organized by RA, background/confirmation monitoring location, aquifer designation, and sampling date.

5.3.1 Spokane Street Properties (RA-1)

Groundwater samples were collected from within the Fill Aquifer from one upgradient background monitoring well (FM-105) and two confirmation monitoring wells (MW-125 and CMP-17) to evaluate water quality within RA-1. Groundwater monitoring and analytical results for the Phase II GWCMP are summarized in Table 3. Additional information or clarification for selected analytes and monitoring wells is provided below.

Total arsenic was detected in all background and confirmation monitoring wells. Concentrations were comparable in the background monitoring well, FM-105, and the confirmation monitoring well, MW-125. Concentrations in confirmation monitoring well, CMP-17, were somewhat higher and may be indicative of the more reducing conditions (lower dissolved oxygen) in CMP-17.

Bis(2-ethylhexyl) phthalate (BEHP) was detected in the duplicate groundwater sample but not the primary groundwater sample collected from background monitoring well, FM-105, in March 2009. BEHP was not detected in groundwater samples from the two downgradient confirmation monitoring wells, MW-125 and CMP-17.

Tetrachloroethene (PCE) and its degradation products, trichloroethene (TCE) and dichloroethene (DCE) were detected in the upgradient background monitoring well FM-105 and confirmation monitoring wells, MW-125 and CMP-17 indicating that contamination is from an off-site source not associated with the RA-1 area. Concentrations of the more mobile degradation compounds TCE and DCE are slightly higher in downgradient confirmation monitoring well CMP-17 than in background well MW-125.

5.3.2 Former Salmon Bay Steel Property (RA-2)

Groundwater samples were collected from within the Fill Aquifer from two upgradient background monitoring wells (CMP-1 and CMP-2) and one confirmation monitoring well (CMP-3) to evaluate water quality within RA-2. Groundwater monitoring and analytical results for the Phase II GWCMP are summarized in Table 4. Additional information or clarification for selected analytes and monitoring wells is provided below.

Total arsenic concentrations ranged from 2.6 to 3.1 ug/L in background monitoring well CMP-1, from 20.8 to 23.2 ug/L in background monitoring well

CMP-2, and from 6.6 to 11.6 ug/L in confirmation monitoring well CMP-3 indicating that contamination is from an off-site source not associated with the RA-2 area.

Total lead concentrations ranged from 1 to 15 ug/L in background monitoring well CMP-2 and from non-detected to 4 ug/L in confirmation monitoring well CMP-3 indicating that contamination is from an off-site source not associated with the RA-2 area.

5.3.3 Former West Seattle Landfill and Purdy Scrap/Former Seattle Steel Inc. Property (RA-3), Former Buckley Yard (RA-1)

Groundwater samples were collected from within the Fill Aquifer from one upgradient background monitoring well (CMP-5) and two confirmation monitoring wells (CMP-4 and MW-308N) within RA-3 and RA-1, and one monitoring well (MW-308S) within the Estuarine Aquifer to evaluate water quality within RA-3 and RA-1. Groundwater monitoring and analytical results for the Phase II GWCMP are summarized in Table 5. Additional information or clarification for selected analytes and monitoring wells is provided below.

BEHP was detected in background well CMP-5 and confirmation monitoring well CMP-4. Background concentrations were higher than the confirmation well concentrations suggesting that contamination is from an off-site source.

5.3.4 Former Lockheed Shipyard 2 (RA-5)

Groundwater samples were collected from within the Fill Aquifer from one upgradient background monitoring well (CMP-5) and two confirmation monitoring wells (CMP-15 and MW-26R) and two monitoring wells (MW-36 and MW-44) within the Estuarine Aquifer to evaluate water quality within RA-5. Groundwater monitoring and analytical results for the Phase II GWCMP are summarized in Table 6. Additional information or clarification for selected analytes and monitoring wells is provided below.

Diesel- and motor oil-range petroleum hydrocarbons were not detected with the exception of Estuarine Aquifer well MW-44, which had a concentration of 530 ug/L. This single result may be questionable. Monitoring well MW-44 is located in a container storage area with heavy truck traffic and, therefore, is susceptible to small oil drips on the pavement. In addition, the flush-mount well monument was full of water, presumably runoff from the pavement, which had to be removed before the well could be sampled.

Concentrations of BEHP detected in background well CMP-5 were higher than the confirmation and Estuarine Aquifer well concentrations suggesting that contamination is from an off-site source not associated with RA-5.

6.0 FUTURE ESTUARINE WELL GROUNDWATER MONITORING PROGRAM

As noted in the Ecology-approved Water Quality Monitoring Plan (Aspect 2008), the remediation activities completed at each of the RAs are believed to be protective of groundwater quality whose highest beneficial use is discharge to surface water. As such, the Phase II GWCMP is not expected to continue indefinitely. Groundwater monitoring will continue for one additional year (one high water and one low water event) after the submittal of this Groundwater Quality Monitoring Evaluation Report. Groundwater monitoring may be continued after that time in select monitoring wells for select analytes, if Ecology and the Port are in mutual agreement that additional groundwater monitoring is warranted to meet the GWCMP program's objectives. Once the goal of demonstrating that surface water protection is met, groundwater monitoring will be discontinued.

In addition, as specified in the Ecology-approved work plan and in accordance with the Groundwater Conceptual Letter (Port of Seattle 1999):

"Assessment of whether modifications to the monitoring network are warranted will occur on an ongoing basis as the program progresses. The Port will evaluate the initial findings after completion of the first year of groundwater monitoring, and may propose modifications to the monitoring network at that time. Water quality in the monitored Estuarine Aquifer wells will be evaluated after 1 year of monitoring. If no inorganic or organic constituents are detected in the Estuarine Aquifer wells above background levels during the first year, these wells will be dropped from the program and the assessment of the Estuarine Aquifer will be considered complete."

The Port has continued monitoring estuarine wells for an additional year beyond the time required by the work plan. The following changes to groundwater monitoring for Estuarine Aquifer wells will be implemented based on the fact that the analytes have not been detected in estuarine wells during four rounds of semiannual groundwater monitoring conducted over a 2-year period, between October 2008 and June 2010 or chemical concentrations in estuarine wells are less than background levels.

Estuarine Well MW-308S

- TPH monitoring in Estuarine Aquifer well MW-308S will be discontinued since TPH has not been detected in this monitoring well.
- Lead monitoring in Estuarine Aquifer well MW-308S will be discontinued since lead has not been detected in this monitoring well.
- cPAH monitoring in Estuarine Aquifer well MW-308S will be discontinued since cPAHs have not been detected in this monitoring well.
- PCB monitoring in Estuarine Aquifer well MW-308S will be discontinued since PCBs have not been detected in this monitoring well.

Estuarine Well MW-36

- TPH monitoring in Estuarine Aquifer well MW-36 will be discontinued since TPH has not been detected in this monitoring well.
- Antimony, chromium, copper, and lead monitoring in Estuarine Aquifer well MW-36 will be discontinued since these analytes have not been detected in this monitoring well.
- cPAH monitoring in Estuarine Aquifer well MW-36 will be discontinued since cPAHs have not been detected in this monitoring well.
- PCB monitoring in Estuarine Aquifer well MW-36 will be discontinued since PCBs have not been detected in this monitoring well.

Estuarine Well MW-44

- PCB monitoring in Estuarine Aquifer well MW-44 will be discontinued since PCBs have not been detected in this monitoring well.
- Estuarine Aquifer well, MW44, which had a questionable detection of TPH will be redeveloped prior to the next round of groundwater sampling to determine if TPH is actually present in the groundwater or if it was an artifact resulting from surface water leaking into the monitoring well casing. If TPH is not detected during the next monitoring event (October 2010), TPH monitoring will be discontinued.

7.0 CONCLUSIONS

Groundwater concentrations at Terminal 5 are protective of surface water for all chemicals included in the long-term groundwater monitoring program. For semivolatile organic compounds, natural attenuation modeling demonstrates that groundwater concentrations at the shoreline would be non-detect even after 100 years. Incorporation of chemical degradation rates and tidal mixing factors would further decrease groundwater chemical concentrations and would also result in non-detect concentrations for volatile organic compounds and metals near the shore.

In accordance with the Ecology-approved work plan and the Groundwater Conceptual Letter groundwater monitoring will be discontinued in estuarine wells for chemicals that have not been detected during the past two years.

8.0 LIMITATIONS

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

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Table 1 - Summary of Monitoring Well Groundwater Elevation Data

Well Name	TOC Elevation in Feet (1)	Date	DTW in Feet	Groundwater Elevation in Feet
Fill Aquifer				
CMP-1	22.71	10/13/2008 3/31/2009 9/4/2009 6/4/2010	12.92 12.21 13.10 11.83	9.79 10.50 9.61 10.88
CMP-2	22.67	10/13/2008 3/31/2009 9/2/2009 6/4/2010	12.92 12.92 13.60 11.75	9.75 9.75 9.07 10.92
CMP-3	17.40	10/14/2008 4/1/2009 9/3/2009 6/2/2010	8.40 7.90 8.45 7.60	9.00 9.50 8.95 9.80
CMP-4	19.92	10/14/2008 4/2/2009 9/3/2009 6/2/2010	11.04 10.34 11.01 10.17	8.88 9.58 8.91 9.75
CMP-5	23.80	10/13/2008 4/1/2009 9/2/2009 6/3/2010	10.09 8.48 10.12 8.71	13.71 15.32 13.68 15.09
CMP-15	18.42	10/14/2008 4/2/2009 9/3/2009 6/3/2010	10.38 9.91 10.14 9.75	8.04 8.51 8.28 8.67
CMP-17	18.43	10/13/2008 3/31/2009 9/2/2009 6/4/2010	9.47 9.05 9.50 8.81	8.96 9.38 8.93 9.62
MW-26R	18.27	10/14/2008 4/1/2009 9/3/2009 6/4/2010	9.91 9.66 9.69 9.40	8.36 8.61 8.58 8.87
MW-125	15.90	10/13/2008 3/31/2009 9/2/2009 6/3/2010	6.88 6.40 7.01 6.25	9.02 9.50 8.89 9.65
MW-308A(N)	14.86	10/13/2008 4/2/2009 9/4/2009 6/3/2010	6.53 5.86 6.50 5.73	8.33 9.00 8.36 9.13
FM-105	20.80	10/13/2008 3/31/2009 9/2/2009 6/3/2010	11.20 10.76 11.36 10.70	9.60 10.04 9.44 10.10

Table 1 - Summary of Monitoring Well Groundwater Elevation Data

Well Name	TOC Elevation in Feet (1)	Date	DTW in Feet	Groundwater Elevation in Feet			
Estuarine Aquifer							
		10/14/2008	10.00	7.60			
		4/2/2009	9.06	8.54			
MW-36	17.60	9/3/2009	9.72	7.88			
		6/2/2010	9.31	8.29			
		10/14/2008	10.90	7.48			
		4/1/2009	8.94	9.44			
MW-44	18.38	9/3/2009	11.46	6.92			
		6/2/2010	8.94	9.44			
		10/13/2008	6.30	8.12			
						4/1/2009	5.74
MW-308B(S)	14.42	9/4/2009	6.17	8.25			
		6/3/2010	5.56	8.86			

Notes:

TOC - Top of Casing.

DTW - Depth to Water.

Vertical datum is in Feet MLLW.

(1) Based on a professional survey completed by Aspect Consulting, LLC (December 21, 2009).

Table 2 - Surface Water Quality Screening Criteria. Screening Levels for Groundwater Based on Marine Surface Water Criteria

Port of Seattle Terminal 5 Southwest Harbor

For or Seattle Terminal 3 Southwest Harbor		1	ı	ı		Surface Water		1		ı	
	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	ARAR - Aquatic	Surface Water	Surface Water	Surface Water,	Surface Water,	
									,	,	
	ARAR - Aquatic	ARAR - Aquatic Life	ARAR - Aquatic	ARAR - Aquatic	ARAR - Aquatic Life		ARAR - Human	ARAR - Human	Method B,	Method B, Non-	
	Life - Marine/Acute		Life - Marine/Acute		- Marine/Chronic -	Marine/Chronic -			Carcinogen,	Carcinogen,	l <u>.</u> .
	-	Clean Water Act	- National Toxics	Marine/Chronic -	Clean Water Act	National Toxics	 Clean Water 	- National Toxics	Standard	Standard	Screening
	Ch. 173-201A WAC	•		Ch. 173-201A WAC		Rule, 40 CFR 131		Rule, 40 CFR 131	Formula Value	Formula Value	Level 2,3
Analyte	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Metals (4)					•		•				
Antimony							640	4300		1000	640
,											0.14
Arsenic, inorganic	69	69	69	36	36	36	0.14	0.14	0.098	18	(5 - MTCA A GW)
Chromium (VI)	1100	50	1100	50	1100	50				490	50
Copper	4.8	4.8	2.4	3.1	3.1	2.4				2,700	2.4
Lead	210	210	210	8.1	8.1	8.1					8.1
Nickel soluble salts	74	74	74	8.2	8.2	8.2	4,600	4,600		1,100	8.2
Polychlorinated Biphenyls (PCBs)	<u> </u>	l .	l .	l .	•	<u> </u>		l l			
Aroclor 1016						0.03				0.0058	0.0058
Aroclor 1221											
Aroclor 1221 Aroclor 1232											
Aroclor 1232 Aroclor 1242											
Aroclor 1242 Aroclor 1248	 										
Aroclor 1254						0.03				0.0017	0.0017
Aroclor 1260		İ				0.03					0.03
Aroclor 1260 Aroclor 1262	 										
Aroclor 1268	 										
Polychlorinated biphenyls	10			0.03	0.03	0.03	0.000064	0.00017	0.00011		0.00064
Total Petroleum Hydrocarbons	10			0.00	0.00	0.00	0.000004	0.00011	0.00011		0.000004
-		T	T	1	1	T	1	T		ī	5
TPH, diesel range											500 ⁵
TPH, heavy oils											500 ⁵
Chlorinated Volatile Organic Compounds (VOCs)											
1,1,1,2-Tetrachloroethane											
1,1,1-Trichloroethane										930,000	420,000
1,1,2,2-Tetrachloroethane							4	11	6.5		4
1,1,2-Trichloroethane							16	42	25	2,300	16
1,1-Dichloroethane											
1,1-Dichloroethene							7100	3.2		23,000	3.2
1,2-Dichloroethane							37	99	59	43,000	37
Chloroethane											
cis-1,2-Dichloroethene											
Tetrachloroethene							3.3	8.9	0.39	840	0.39
trans-1,2-Dichloroethene							10,000			33,000	10,000
Trichloroetlene							30	81	6.7	71	6.7
Vinyl chloride	==	==			==		2.4	530	3.7	6,600	2.4
Semivolatile Organic Compounds (SVOCs)											
bis(2-Ethylhexyl) phthalate							2.2	5.9	3.6	400	2.2
Carcinogenic Polycyclic Aromatic Hydrocarbons (cP	AHs)	1		1	1		1	<u>ı</u>		1	'
Benzo[a]anthracene							0.018	0.031			0.018
Benzo[a]pyrene							0.018	0.031	0.03		0.018
Benzo[b]fluoranthene							0.018	0.031			0.018
Benzo[k]fluoranthene	 						0.018	0.031			0.018
								0.031			
Chrysene							0.018				0.018
Dibenzo[a,h]anthracene							0.018	0.031			0.018
Indeno[1,2,3-cd]pyrene							0.018	0.031			0.018

- 1. -- = Not established.

- Screening levels may be adjusted depending on lab PQLs.
 Screening levels may be adjusted based on background data results
 Surface water quality criteria screening levels are based on dissolved metal concentrations.
 Screening levels based on MTCA Method A Cleanup levels for groundwater.

Abbreviations

μg/L = micrograms per liter.

ARAR = applicable or relevant and appropriate requirements

CFR = code of federal regulations

WAC = Washington Administrative Code

Table 3 - RA-1 Groundwater Monitoring and Analytical Results

POS Terminal 5 Southwest Harbor

POS Terminal 5 Southwest Harbor	Remediation Area 1 (former Spokane Street Properties)														
Phase II GWCMP SWHP						Remediation	n Area 1 (fo	ormer Spok	ane Street I	Properties)					
			Е	Background						(Confirmation	Monitoring			
				•			Fill Aqu	uifer							•
Sample Name	FM105- 081013	FM105- 081013D	FM105- 090331	FM105- 090331D	FM105- 090902	FM105- 090902D	FM105	MW125- 081013	MW125- 090331	MW125- 090902	MW125	CMP17- 081013	CMP17- 090331	CMP17- 090902	CMP17
Sampling Date	10/13/08	10/13/08	3/31/09	3/31/09	9/2/09	9/2/09	6/3/10	10/13/08	3/31/09	9/2/09	6/3/10	10/13/08	3/31/09	9/2/09	6/4/10
Groundwater Level Measurements	<u> </u>	-	<u> </u>	-		-	L.		<u> </u>		<u> </u>	-		<u> </u>	
Reference Elevation in feet MLLW	20.8	30	20.8	30	20	.80	20.80	15.90	15.90	15.90	15.90	18.43	18.43	18.43	18.43
Depth To Water in feet	11.2	20	10.7	6	11.	.36	10.70	6.88	6.40	7.01	6.25	9.47	9.05	9.50	8.81
Water Level Elevation in feet MLLW	9.6	0	10.0)4	9.	44	10.10	9.02	9.50	8.89	9.65	8.96	9.38	8.93	9.62
Water Quality Field Parameters															
Temperature in degrees Celsius	14.		11.			1.5	12.1	18.6	11.4	19.3	15.1	17.6	12.3	17.5	13.8
рН	7.0		6.2			95	6.45	6.61	6.18	5.94	6.42	6.61	6.05	5.83	6.19
Conductivity in µS/cm	440		476		5′		399	412	589	475	387	569	678	597	483
Dissolved Oxygen in mg/L	0.3	•	0.9		0.		0.97	0.52	1.74	0.83	2.47	0.1	0.39	0.32	0.02
Turbidity in NTUs	2.1 0.53		3.	64	0	0.9	0.74	2.34	0	1.74	2	4.87	135		
Total Petroleum Hydrocarbons by Method															
Diesel Range in μg/L	250 U	250 U	250 U	250 U	250 U		100 U	250 U	250 U		100 U	250 U	250 U		100 U
Motor Oil Range in μg/L	500 U	500 U	500 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U
Total Metals by EPA Method 200.8															
Total arsenic, inorganic in µg/L	0.4	0.4	0.5	0.5	0.5	0.5	2 U	0.4	0.4	0.6	2 U	2.6	2.6	2.9	8.1
Total lead in µg/L	1 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U
Carcinogenic Polycyclic Aromatic Hydroc				0.040 11	0.040 11	0.040 11	0.040 11	0.040 11	0.040 11	0.007	0.040 11	0.040 11	0.040 11	0.040 11	0.040 1
Benz(a)anthracene in µg/L	0.010 U	0.010 U	0.010 U 0.010 U	0.010 U	0.010 U		0.010 U	0.010 U			0.010 U	0.010 U	0.010 U		0.010 U
Benzo(a)pyrene in μg/L Benzo(b)fluoranthene in μg/L	0.010 U 0.010 U	0.010 U 0.010 U	0.010 U	0.010 U 0.010 U	0.010 U 0.010 U		0.010 U 0.010 U	0.010 U 0.010 U	0.010 U 0.010 U		0.010 U 0.011	0.010 U 0.010 U	0.010 U 0.010 U		0.010 U 0.010 U
Benzo(k)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U		0.011	0.010 U	0.010 U		0.010 U
Chrysene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U		0.011	0.010 U	0.010 U	0.010 U	0.010 U
Dibenzo(a,h)anthracene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U		0.011 0.010 U	0.010 U	0.010 U		0.010 U
Indeno(1,2,3-cd)pyrene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U		0.010 U
Semi-Volatile Organics by EPA Method 82		0.010 0	0.010	0.010 0	0.010	0.010 0	0.010 0	0.010 0	0.010 0	0.031	0.010 0	0.010 0	0.010	0.010 0	0.010 0
bis(2-ethylhexyl) phthalate in μg/L	1.0 U	1.0 U	1.0 UJ	5.8 J	1.0 U	1.0 U	1.4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Polychlorinated Biphenyls (PCBs) by EPA														110	
Aroclor 1016 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1221 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U		0.010 U
Aroclor 1232 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U			0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1242 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1248 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	-	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U
Aroclor 1254 in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U	ī	0.010 U
Aroclor 1260 in μg/L	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Total PCBs in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Volatile Organic Compounds by EPA Met															
tetrachloroethane;1,1,1,2- in μg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U			0.2 U	0.2 U	0.2 U		0.2 U
tetrachloroethane;1,1,2,2- in μg/L	0.2 U	0.2 U	0.2 U	0.2 U			0.2 U	0.2 U			0.2 U	0.2 U	0.2 U		
trichloroethane;1,1,1- in μg/L	0.2 U	0.2 U	0.2 U	0.2 U			0.2 U	0.2	0.2 U		0.2	0.2 U			
trichloroethane;1,1,2- in μg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U			0.2 U	0.2 U	0.2 U		0.2 U
dichloroethane;1,1- in μg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.4	0.2	0.3	0.3	0.2 U	0.2 U		0.2 U
dichloroethane;1,2- in μg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U			0.2 U	0.2 U	0.2 U		
ethyl chloride in µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U			0.2 U	0.2 U	0.2 U		
tetrachloroethene in µg/L	6.1	6.2	3.4	3.7	5.2	5	5.7	6.7	4.1	5.1	5.4	0.3	0.2	0.3	0.2 U
trichloroethene in µg/L	0.9	0.9	0.6	0.6	0.6	0.5	0.8	2.8	1.0	1.8	1.4	0.2 U	0.2 U		
dichloroethene;1,1- in µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U			0.2 U	0.2 U	0.2 U		0.2 U
dichloroethene;1,2-,cis in µg/L	0.7	0.7	0.4	0.5	0.2	0.2	2.5	2.1	0.4	1	1.5	0.2 U	0.2 U		0.2 U
dichloroethene;1,2-,trans in μg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U		0.2 U
vinyl chloride in μg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

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

J - The analyte was detected above the reported quantitation limit, and the reported concentrations was an estimated value.

UJ - The analyte was analyzed for, and the associated quantitation limit was an estimated value. Detected concentrations are bolded.

Table 4 - RA-2 Groundwater Monitoring and Analytical Results

POS Terminal 5 Southwest Harbor Phase II GWCMP SWHP

1	Remediation Area 2 (former Salmon Bay Steel Property)													
				Backg	round	•		ĺ	(Confirmation	Monitoring			
						Fill Aq	uifer							
Sample Name	CMP1-	CMP1-	CMP1-	CMP1	CMP2-	CMP2-	CMP2-	CMP2	CMP3-	CMP3-	CMP3-	CMP3		
	081013	090331	090904		081013	090331	090902		081014	090401	090903			
Sampling Date	10/13/08	3/31/09	9/4/09	6/4/10	10/13/08	3/31/09	9/2/09	6/4/10	10/14/08	4/1/09	9/3/09	6/2/10		
Groundwater Level Measurements														
Reference Elevation in feet MLLW	22.71	22.71	22.71	22.71	22.67	22.67	22.67	22.67	17.40	17.40	17.40	17.40		
Depth To Water in feet	12.92	12.21	13.10	11.83	12.92	12.92	13.60	11.75	8.40	7.90	8.45	7.60		
Water Level Elevation in feet MLLW	9.79	10.50	9.61	10.88	9.75	9.75	9.07	10.92	9.00	9.50	8.95	9.80		
Water Quality Field Parameters	_	-		•	-	-			-					
Temperature in degrees Celsius	14.4	12.7	13.1	13.1	16.9	14.96	16.2	14.1	19.5	12.9	19.8	15.5		
pH	6.9	6.23	6.36	6.61	9.38	9.08	8.42	9.01	10.96	8.68	10.01	9.55		
Conductivity in µS/cm	563	506	511	482	1272	1402	1669	920	613	726	703	403		
Dissolved Oxygen in mg/L	0.3	0.19	0.55	0.2	0.09	0.26	0.24	0.12	0.19	0.26	0.4	0.08		
Turbidity in NTUs	1.76	1.17	0.78	38	0.86	1.58	1.31	4	1.09	1.8	5.3	4		
Total Petroleum Hydrocarbons	-			<u>.</u>	-									
Diesel Range in μg/L	250 U	250 U	250 U	100 U	250 U	250 U	250 U	100 U	250 U	250 U	250 U	100 U		
Motor Oil Range in μg/L	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U		
Total Metals by EPA Method 200.8					_				-					
Total arsenic, inorganic in μg/L	2.8	2.7	3.1	2.6	22.7	23.2	20.8	23	11.6	6.6	8.3	7.4		
Total lead in μg/L	1 U			1 U	15	1	1 U	2	1 U	4	1 U	1 U		
Carcinogenic Polycyclic Aromatic Hydroc														
Benz(a)anthracene in μg/L	0.010 U				0.010 U	0.010 U	0.010 U		0.010	0.010 U	0.010 U			
Benzo(a)pyrene in µg/L	0.010 U				0.010 U	0.010 U	0.010 U		0.010 U	0.011	0.010 U			
Benzo(b)fluoranthene in µg/L	0.010 U				0.010 U	0.010 U	0.010 U		0.010 U	0.019	0.010 U			
Benzo(k)fluoranthene in μg/L	0.010 U				0.010 U	0.010 U	0.010 U		0.010 U	0.011	0.010 U			
Chrysene in µg/L	0.010 U				0.010 U	0.010 U	0.010 U		0.013	0.015	0.010	0.010 U		
Dibenzo(a,h)anthracene in μg/L	0.010 U				0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U			
Indeno(1,2,3-cd)pyrene in µg/L Semi-Volatile Organics by EPA Method 82	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		
bis(2-ethylhexyl) phthalate in µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		
Polychlorinated Biphenyls (PCBs) by EPA			1.0 0	1.0 0	1.0 0	1.0 0	1.0 0	1.0 0	1.0 0	1.0 0	1.0 0	1.0 0		
Aroclor 1016 in µg/L	0.010 U		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.100 U	0.100 U		
Aroclor 1221 in µg/L	0.010 U				0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.100 U			
Aroclor 1232 in µg/L	0.010 U				0.010 U	0.015 Y	0.010 U		0.010 U	0.010 U	0.100 U			
Aroclor 1242 in µg/L	0.010 U				0.012 Y	0.010 U	0.010 U		0.200 Y	0.400 Y	0.100 U			
Aroclor 1248 in µg/L	0.010 U				0.010 U	0.010 U	0.015	0.020	0.010 U	0.010 U	1.2 PJ			
Aroclor 1254 in µg/L	0.010 U				0.010 U	0.010 U	0.016	0.010 U	0.150 Y	0.400 Y	1.000 Y	1.5		
Aroclor 1260 in μg/L	0.010 U	0.010 U			0.010 U	0.010 U	0.010 U	0.010 U	0.015 Y	0.010 U	0.100 U			
Total PCBs in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.012 Y	0.015 Y	0.031	0.02	0.200 Y	0.400 Y	1.2 PJ	4		
	_	•							•			•		

Notes

- U Analyte was not detected at or above the reported result.
- Y The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.
- P The analyte was detected on both chromatographic columns but the quantified values differ by >=40% RPD with no obvious chromatographic interference.
- J The analyte was detected above the reported quantitation limit, and the reported concentrations was an estimated value.

Detected concentrations are bolded.

Table 5 - RA-3 and RA-1 Groundwater Monitoring and Analytical Results

POS Terminal 5 Southwest Harbor Phase II GWCMP SWHP

		Remediation Area 3 (former West Seattle Landfill and SSI Property), Remediation Area 1 (Former Buckley Yard)														
		Backgr	ound							Confirmation	n Monitoring					
İ				•		Fill Ac	uifer							Estuarine	Aquifer	
Sample Name	CMP5-	CMP5-	CMP5-	CMP5	CMP4-	CMP4-	CMP4-	CMP4	MW308N-	MW308N-	MW308N-	MW308N	MW308S-	MW308S-	MW308S-	MW308S
	081013	090401	090902		081014	090402	090903		081013	090402	090904		081013	090401	090904	
Sampling Date	10/13/08	4/1/09	9/2/09	6/3/10	10/14/08	4/2/09	9/3/09	6/2/10	10/13/08	4/2/09	9/4/09	6/3/10	10/13/08	4/1/09	9/4/09	6/3/10
Groundwater Level Measurements																
Reference Elevation in feet MLLW	23.80	23.80	23.80	23.80	19.92	19.92	19.92	19.92	14.86	14.86	14.86	14.86	14.42	14.42	14.42	14.42
Depth To Water in feet	10.09	8.48	10.12	8.71	11.04	10.34	11.01	10.17	6.53	5.86	6.50	5.73	6.30	5.74	6.17	5.56
Water Level Elevation in feet MLLW	13.71	15.32	13.68	15.09	8.88	9.58	8.91	9.75	8.33	9.00	8.36	9.13	8.12	8.68	8.25	8.86
Water Quality Field Parameters																
Temperature in degrees Celsius	16	11.2	16.8	13.4	17.1	12.6	17	14.2	16.8	12.3	16.3	13.8	15	12.9	14.5	13.7
рН	6.73	6.05	6.05	6.4	7.7	6.14	8.13	6.47	7.59	6.45	6.55	7.08	8.11	7.13	7.08	7.79
Conductivity in µS/cm	358	480	509	228	440	619	771	472	1586	1712	2509	959	15230	1565	1541	13000
Dissolved Oxygen in mg/L	0.07	0.32	0.44	0.15	0.25	0.74	0.19	0.73	0.02	0.05	0.23	0.03	0.03	0.08	0.11	0.03
Turbidity in NTUs	0.81	4.11	6.98	0	0.98	0.83	2.75	23	12.7	8.62	11.2	0	2.13	1.1	1.51	0
Total Petroleum Hydrocarbons																
Diesel Range in μg/L	250 U	250 U	250 U	100 U	250 U	250 U	250 U	100 U	250 U		250 U	100 U	250 U	250 U	250 U	100 U
Motor Oil Range in μg/L	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U
Total Metals by EPA Method 200.8				-								•	=			
Total arsenic, inorganic in μg/L	14.2	1.9	12.9	3.6	2.8	1.1	3.8	1.4	25.4	16.8	15.3	16.2	8	3	3	2 U
Total lead in µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	5 U	5 U	5 U	5 U
Carcinogenic Polycyclic Aromatic Hydroc	arbons (cPAH	ls) by Method 8	3270D-SIM													
Benz(a)anthracene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(a)pyrene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U		0.010 U	0.010 U
Benzo(b)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(k)fluoranthene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Chrysene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Dibenzo(a,h)anthracene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Indeno(1,2,3-cd)pyrene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Semi-Volatile Organics by EPA Method 82	270D															
bis(2-ethylhexyl) phthalate in μg/L	1.0 U	23	1 U	1.0 U	1.0 U	1.0 U	1 U	2.4	1.0 U	1.1	1.0 U	1.0 U	1.5	5	1.0 U	1.0 U
Polychlorinated Biphenyls (PCBs) by EPA	Method 8082															
Aroclor 1016 in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1221 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1232 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.015 Y	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1242 in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.013	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1248 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.017	0.025	0.014	0.010 U	0.010 U	0.020	0.010 U		0.010 U	0.010 U
Aroclor 1254 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.02	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1260 in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Total PCBs in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.013	0.010 U	0.017	0.045	0.014	0.015 Y	0.01	0.02	0.010 U	0.010 U	0.010 U	0.010 U

Notes

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

Y - The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit. Detected concentrations are bolded.

Table 6 - RA-5 Groundwater Monitoring and Analytical Results

POS Terminal 5 Southwest Harbor

Phase II GWCMP SWHP	Г	Remediation Area 5 (former Lockheed Shipyard 2)															
	-		Backg	round		Confirmation Monitoring											
	-			,					Fill Ad				<u> </u>				·
	Sample Name	CMP5- 081013	CMP5- 090401	CMP5- 090902	CMP5	CMP15- 081014	CMP15- 090402	CMP15- 090903	CMP15	MW26R- 081014	MW26R- 081014D	MW26R- 090401	MW26R- 090401D	MW26R- 090903	MW26R- 090903D	MW26R	MW26RD
	Sampling Date	10/13/08	4/1/09	9/2/09	6/3/10	10/14/08	4/2/09	9/3/09	6/3/10	10/14/08	10/14/08	4/1/09	4/1/09	9/3/09	9/3/09	6/4/10	6/4/10
Groundwater Level Measureme	ents	•	<u> </u>	<u> </u>		-	<u> </u>	<u>. </u>					<u> </u>				-
Reference Elevation in feet ML	LW	23.80	23.80	23.80	23.80	18.42	18.42	18.42	18.42	18	.27	18	3.27	18	.27	18	8.27
Depth To Water in feet		10.09	8.48	10.12	8.71	10.38	9.91	10.14	9.75	9.		9	.66	9.	69	9	9.40
Water Level Elevation in feet N	ILLW	13.71	15.32	13.68	15.09	8.04	8.51	8.28	8.67	8.		8	.61		58		3.87
Water Quality Field Parameters	s	<u>-</u>	•	•		-	_	•	•		-		-		_		
Temperature in degrees Celsiu		16	11.2	16.8	13.4	17.7	13.2	15.9	14.2	16	6.9	1	2.3	15	5.4	1	14.2
pH		6.73	6.05	6.05	6.4	6.88	6.69	6.39	6.64	7.	29	6	.43	7.	14	6	6.86
Conductivity in µS/cm		358	480	509	228	2336	7059	3547	6920	10 ⁻	190	1	198	10	43	9	600
Dissolved Oxygen in mg/L		0.07	0.32	0.44	0.15	0.008	0.1	0.36	0.05	0.	11	0	.22	0.	15	0).05
Turbidity in NTUs		0.81	4.11	6.98	0	1.12	0.73	1.78	0	0.	94	0	.93	1.	91		11
Total Petroleum Hydrocarbons	,																
Diesel Range in μg/L		250 U	250 U	250 U	250 U	250 U	250 U	250 U	100 U	250 U	250 U	250 U	250 U	250 U	250 U	100 L	J 100 U
Motor Oil Range in μg/L		500 U	500 U	500 U	500 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	500 U	500 U	500 U	200 L	J 200 U
Total Metals by EPA Method 20	00.8																
Total antimony in μg/L		14.2	1.9	12.9	3.6	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U		1 U	1 U	1 U			-
Total arsenic, inorganic in µg/L	-					1	1	0.9	0.5 U	2 U	3	2 U	2 U	2 U	2 U	2 L	J 2 U
Total chromium (total) in µg/L						1 U	1 U	2 U	0.5 U	2 U	3	3	3	3	3	3	4
Total copper in µg/L						0.8	1 U	0.5 U	0.7	2 U			2 U	3	3	2 L	-
Total lead in μg/L		1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U		5 U	•	5 U	5 U	5 L	-i
Total nickel soluble salts in µg/	'L					1	4	2	5.6	6	7	6	7	7	6	6	6
Carcinogenic Polycyclic Arom	atic																
Hydrocarbons (cPAHs) by Met																	
Benz(a)anthracene in µg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.025	0.024	0.010 U	0.010 U	0.010 U	0.010 U	0.010 L	J 0.010 U
Benzo(a)pyrene in µg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U				0.010 U			-
Benzo(b)fluoranthene in µg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.018	0.010 U			-
Benzo(k)fluoranthene in µg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.016	0.010 U	0.010 U	0.010 L	J 0.010 U
Chrysene in µg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.027	0.026	0.011	0.022	0.013	0.013	0.014	0.014
Dibenzo(a,h)anthracene in μg/	L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 L	J 0.010 U
Indeno(1,2,3-cd)pyrene in µg/L	_	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 L	J 0.010 U
Semi-Volatile Organics by EPA	Method 8270D																
bis(2-ethylhexyl) phthalate in µ	ıg/L	1.0 U	23	1.0 U	1.0 U	1.0 U	1 U	1.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 L	J 1.0 U
Polychlorinated Biphenyls (PC Method 8082	Bs) by EPA																
Aroclor 1016 in µg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 L	J 0.010 U
Aroclor 1221 in μg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 L	J 0.010 U
Aroclor 1232 in μg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 L	J 0.010 U
Aroclor 1242 in μg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 L	J 0.010 U
Aroclor 1248 in μg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 L	J 0.010 U
Aroclor 1254 in μg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.018 Y	0.010 U	0.010 U	0.010 U	0.010 U				0.010 U			
Aroclor 1260 in µg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U				0.010 U			
Total PCBs in μg/L		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U

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

Detected concentrations are bolded.

Y - The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit. NA = Not available.

Table 6 - RA-5 Groundwater Monitoring and Analytical Results

POS Terminal 5 Southwest Harbor

Phase II GWCMP SWHP		Dan	aadiatian A	F /f	an Laaldaa	al Claires and	2)	
Thase if GWGWii GWFII		Ren			ner Lockhee	a Snipyara	<u> </u>	
					n Monitoring			
Sample Name	MW36-	MW36-	MW36-	Estuarine MW36	MW44-	MW44-	MW44-	MW44
	081014	090402	090903	WWV30	081014	090401	090903	1010044
Sampling Date	10/14/08	4/2/09	9/3/09	6/2/10	10/14/08	4/1/09	9/3/09	6/2/10
Groundwater Level Measurements								
Reference Elevation in feet MLLW	17.60	17.60	17.60	17.60	18.38	18.38	18.38	18.38
Depth To Water in feet	10.00	9.06	9.72	9.31	10.90	8.94	11.46	8.94
Water Level Elevation in feet MLLW	7.60	8.54	7.88	8.29	7.48	9.44	6.92	9.44
Water Quality Field Parameters								
Temperature in degrees Celsius	14.6	12.4	13.9	14.7	15.3	11.5	14	14.9
pH	7.47	6.48	8.78	7.43	7.23	6.42	5.84	5.94
Conductivity in µS/cm	36200	3734	3812	40000	41	46	37	11
Dissolved Oxygen in mg/L	0.06	0.11	0.13	0.08	1.59	7.25	3.84	6.88
Turbidity in NTUs	1.02	0.84	1.83	5	3.21	7.33	3.26	NA
Total Petroleum Hydrocarbons								
Diesel Range in μg/L	250 U	250 U	250 U	100 U	250 U	250 U	250 U	100 U
Motor Oil Range in μg/L	500 U	500 U	500 U	200 U	500 U	500 U	500 U	530
Total Metals by EPA Method 200.8								
Total antimony in µg/L	5 U	2 U	2 U	2 U	0.2 U	0.6	0.3	0.4
Total arsenic, inorganic in µg/L	6	7	6	5 U	0.5	0.8	0.3	0.8
Total chromium (total) in µg/L	10 U	5 U	5 U	5 U	1 U	11	3.4	7.8
Total copper in µg/L	10 U	5 U	5 U	5 U	7	18	6.4	15.5
Total lead in µg/L	20 U	10 U	10 U	10 U	4	33	4	21
Total nickel soluble salts in µg/L	10 U	9	12	12	2	4.3	1.4	3.8
	_							
Carcinogenic Polycyclic Aromatic								
Hydrocarbons (cPAHs) by Method 8270D-SIM								
Benz(a)anthracene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.059	0.010 U	0.033
Benzo(a)pyrene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.11	0.010 U	0.054
Benzo(b)fluoranthene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.27	0.010	0.079
Benzo(k)fluoranthene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.14	0.010 U	0.079
Chrysene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.19	0.010 U	0.13
Dibenzo(a,h)anthracene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.035	0.010 U	0.023
Indeno(1,2,3-cd)pyrene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.11	0.010 U	0.063
Semi-Volatile Organics by EPA Method 8270D		-		1	-			
bis(2-ethylhexyl) phthalate in μg/L	1.0 U	1.0 U	1.0 U	1.5	1.0	2.2	1.0 U	2.4
Polychlorinated Biphenyls (PCBs) by EPA Method 8082								
Aroclor 1016 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1221 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1232 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.015 Y	0.010 U	0.010 U
Aroclor 1242 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1248 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1254 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1260 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U
Total PCBs in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U

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

Detected concentrations are bolded.

Y - The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit. NA = Not available.

Table 5 - RA-3 and RA-1 Groundwater Monitoring and Analytical Results

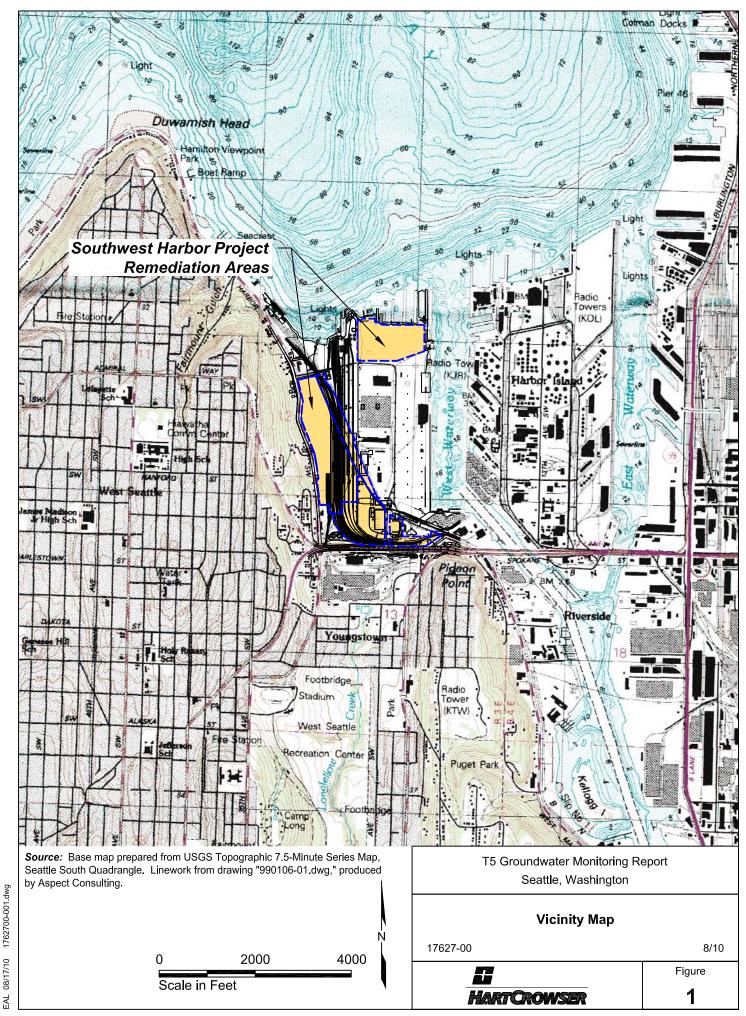
POS Terminal 5 Southwest Harbor Phase II GWCMP SWHP

		Remediation Area 3 (former West Seattle Landfill and SSI Property), Remediation Area 1 (Former Buckley Yard)														
		Backgr	ound							Confirmation	n Monitoring					
İ				•		Fill Ac	uifer							Estuarine	Aquifer	
Sample Name	CMP5-	CMP5-	CMP5-	CMP5	CMP4-	CMP4-	CMP4-	CMP4	MW308N-	MW308N-	MW308N-	MW308N	MW308S-	MW308S-	MW308S-	MW308S
	081013	090401	090902		081014	090402	090903		081013	090402	090904		081013	090401	090904	
Sampling Date	10/13/08	4/1/09	9/2/09	6/3/10	10/14/08	4/2/09	9/3/09	6/2/10	10/13/08	4/2/09	9/4/09	6/3/10	10/13/08	4/1/09	9/4/09	6/3/10
Groundwater Level Measurements																
Reference Elevation in feet MLLW	23.80	23.80	23.80	23.80	19.92	19.92	19.92	19.92	14.86	14.86	14.86	14.86	14.42	14.42	14.42	14.42
Depth To Water in feet	10.09	8.48	10.12	8.71	11.04	10.34	11.01	10.17	6.53	5.86	6.50	5.73	6.30	5.74	6.17	5.56
Water Level Elevation in feet MLLW	13.71	15.32	13.68	15.09	8.88	9.58	8.91	9.75	8.33	9.00	8.36	9.13	8.12	8.68	8.25	8.86
Water Quality Field Parameters																
Temperature in degrees Celsius	16	11.2	16.8	13.4	17.1	12.6	17	14.2	16.8	12.3	16.3	13.8	15	12.9	14.5	13.7
рН	6.73	6.05	6.05	6.4	7.7	6.14	8.13	6.47	7.59	6.45	6.55	7.08	8.11	7.13	7.08	7.79
Conductivity in µS/cm	358	480	509	228	440	619	771	472	1586	1712	2509	959	15230	1565	1541	13000
Dissolved Oxygen in mg/L	0.07	0.32	0.44	0.15	0.25	0.74	0.19	0.73	0.02	0.05	0.23	0.03	0.03	0.08	0.11	0.03
Turbidity in NTUs	0.81	4.11	6.98	0	0.98	0.83	2.75	23	12.7	8.62	11.2	0	2.13	1.1	1.51	0
Total Petroleum Hydrocarbons																
Diesel Range in μg/L	250 U	250 U	250 U	100 U	250 U	250 U	250 U	100 U	250 U		250 U	100 U	250 U	250 U	250 U	100 U
Motor Oil Range in μg/L	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U
Total Metals by EPA Method 200.8				-								•	=			
Total arsenic, inorganic in μg/L	14.2	1.9	12.9	3.6	2.8	1.1	3.8	1.4	25.4	16.8	15.3	16.2	8	3	3	2 U
Total lead in µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	5 U	5 U	5 U	5 U
Carcinogenic Polycyclic Aromatic Hydroc	arbons (cPAH	ls) by Method 8	3270D-SIM													
Benz(a)anthracene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(a)pyrene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U	0.010 U	0.010 U		0.010 U	0.010 U
Benzo(b)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(k)fluoranthene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Chrysene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Dibenzo(a,h)anthracene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Indeno(1,2,3-cd)pyrene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Semi-Volatile Organics by EPA Method 82	270D															
bis(2-ethylhexyl) phthalate in μg/L	1.0 U	23	1 U	1.0 U	1.0 U	1.0 U	1 U	2.4	1.0 U	1.1	1.0 U	1.0 U	1.5	5	1.0 U	1.0 U
Polychlorinated Biphenyls (PCBs) by EPA	Method 8082															
Aroclor 1016 in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1221 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1232 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.015 Y	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1242 in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.013	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1248 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.017	0.025	0.014	0.010 U	0.010 U	0.020	0.010 U		0.010 U	0.010 U
Aroclor 1254 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.02	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1260 in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Total PCBs in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.013	0.010 U	0.017	0.045	0.014	0.015 Y	0.01	0.02	0.010 U	0.010 U	0.010 U	0.010 U

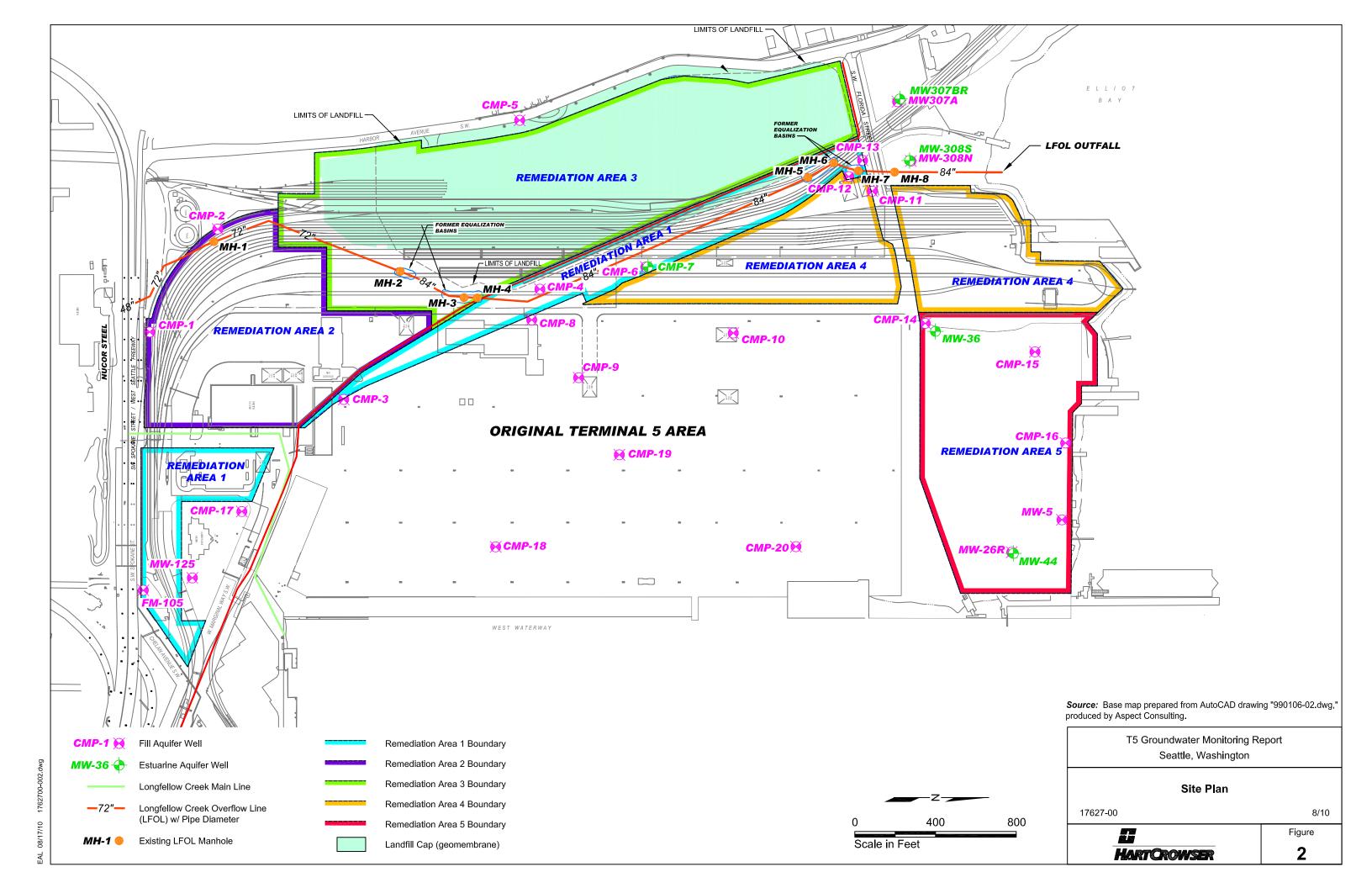
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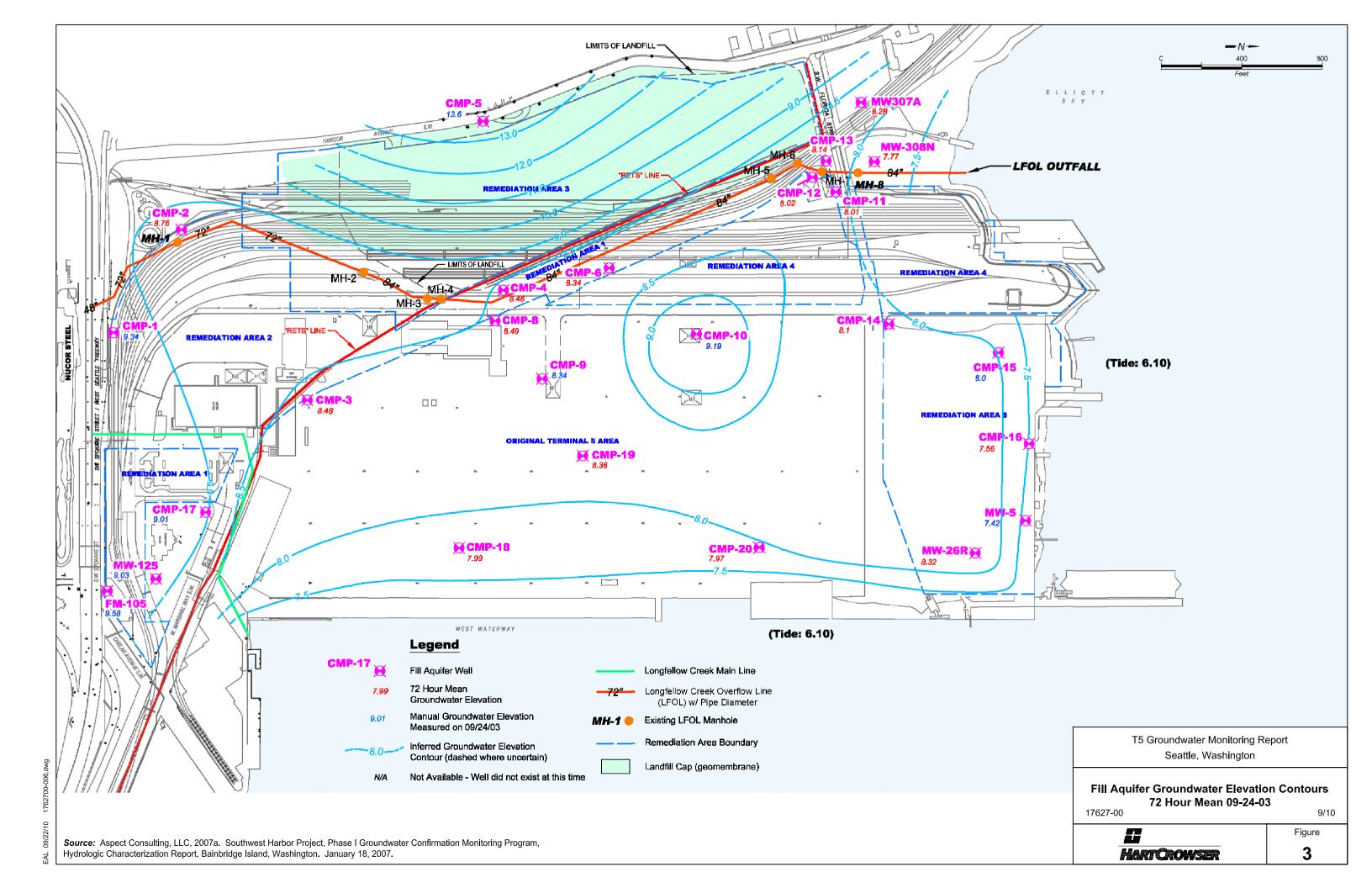
U - Analyte was not detected at or above the reported result.

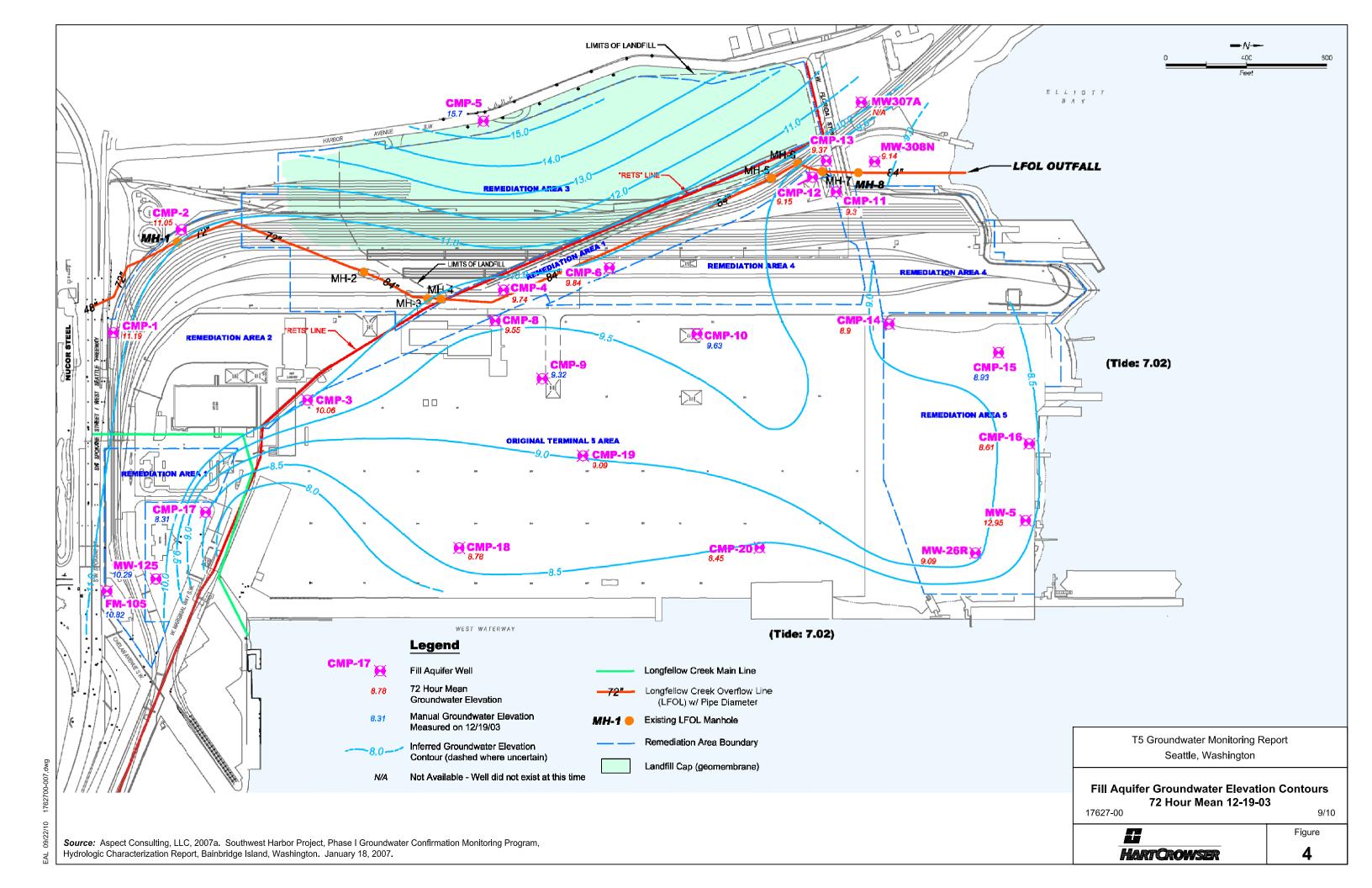
Y - The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit. Detected concentrations are bolded.

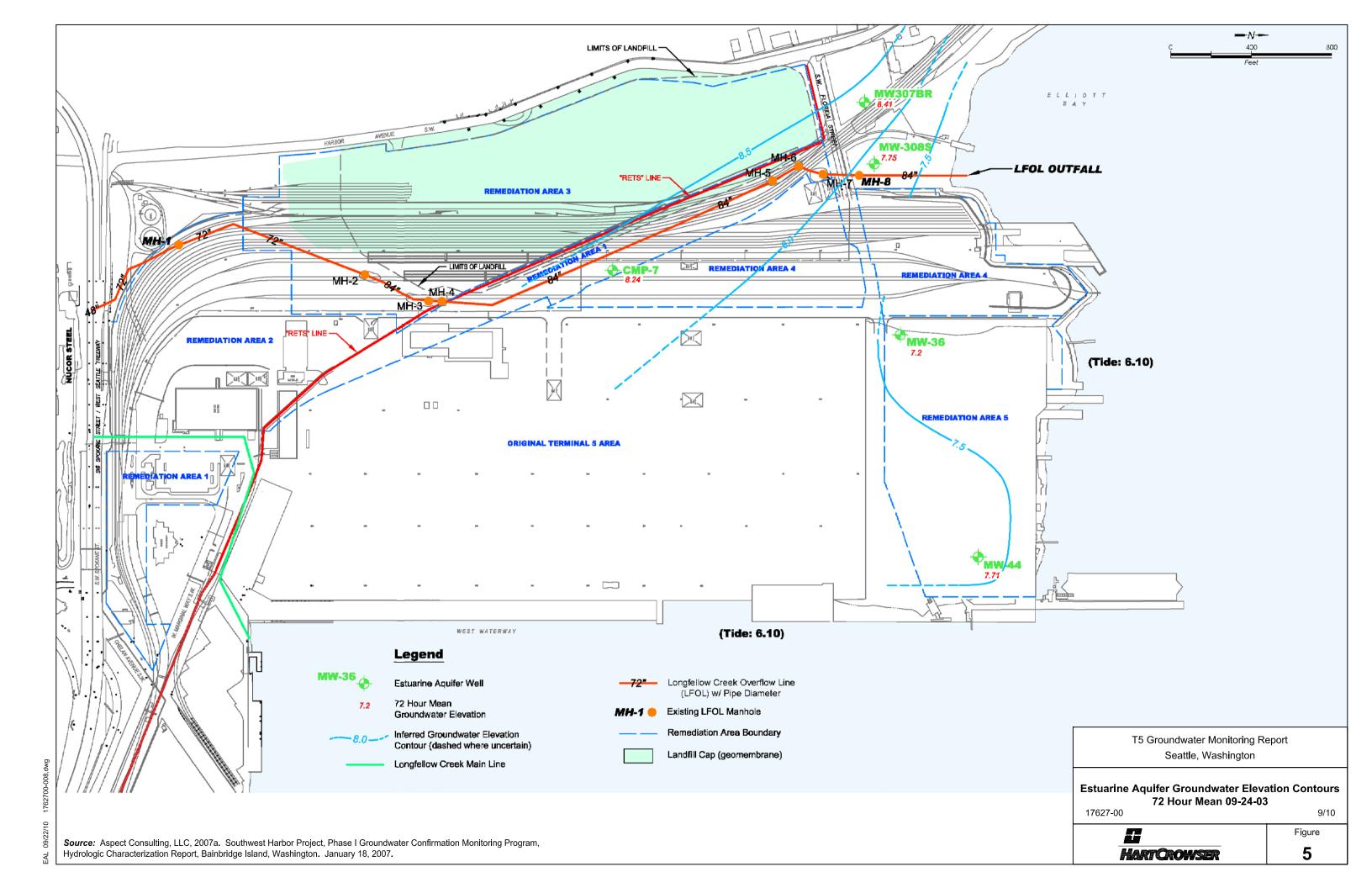


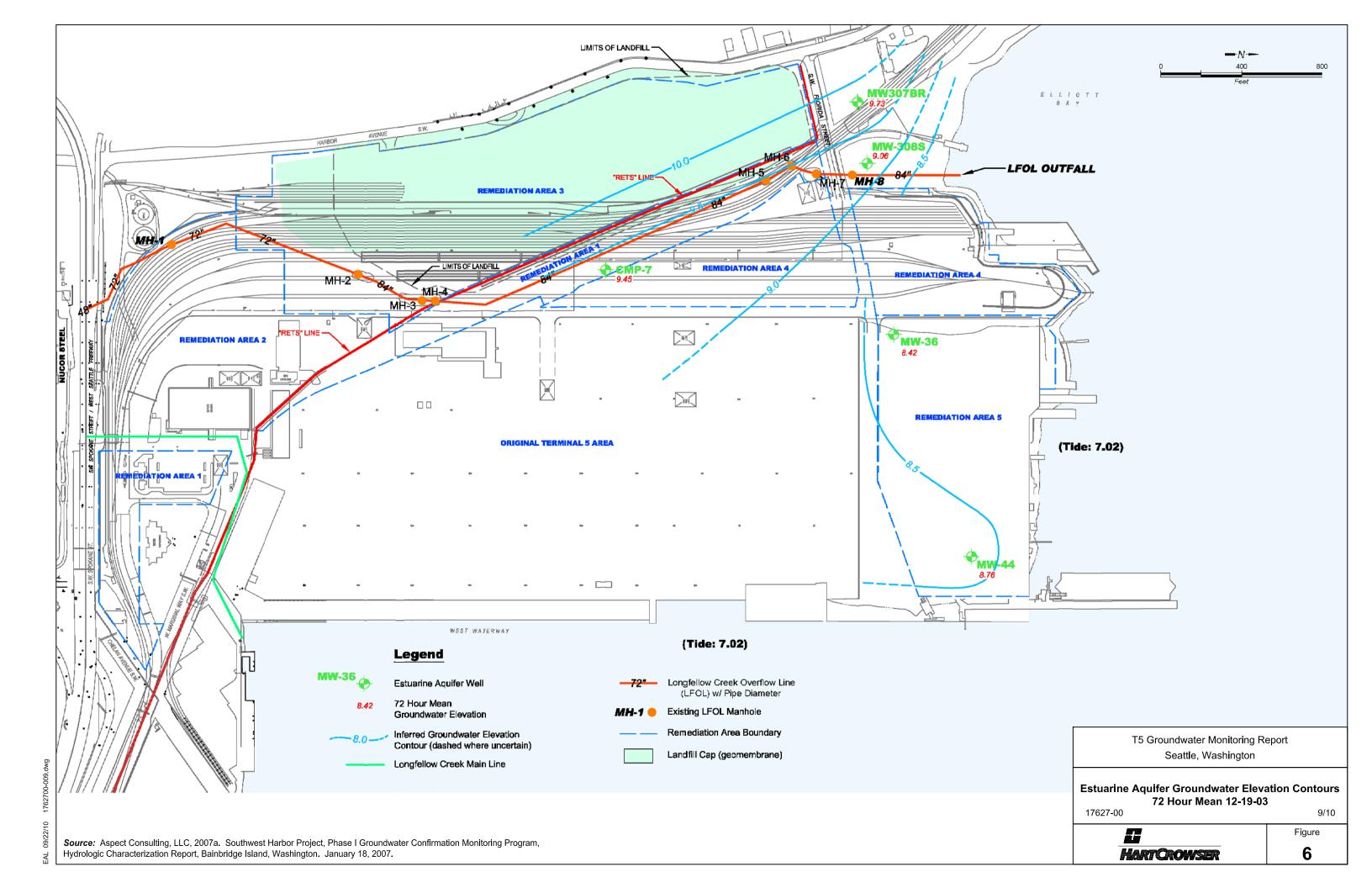
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APPENDIX A EVALUATION OF GROUNDWATER CHEMICAL CONCENTRATIONS PROTECTIVE OF SURFACE WATER

APPENDIX A EVALUATION OF GROUNDWATER CHEMICAL CONCENTRATIONS PROTECTIVE OF SURFACE WATER

This Appendix presents our evaluation to determine groundwater chemical concentrations that would be protective of surface water for the Phase II Southwest Harbor Project (SWHP) located at the Southwest Harbor Terminal 5 (Terminal 5) in Seattle, Washington. The protectiveness of current groundwater chemical concentrations was assessed by modeling natural attenuation of chemical constituents. The purpose of modeling natural attenuation is to supplement the Groundwater Confirmation Monitoring Program and to determine if chemicals detected in groundwater are naturally attenuated to concentrations below surface water quality criteria prior to discharge to Puget Sound marine water.

GROUNDWATER CHEMICAL CONDITIONS

Groundwater quality data was obtained from four rounds of groundwater data collected from 14 wells between 2008 and 2010 as part of the confirmational groundwater monitoring program. Monitoring well locations for the program are presented on Figure 1 and are summarized below:

- Four background monitoring wells are screened in the Fill Aquifer (FM-105, CMP-1, CMP-2, and CMP-5);
- Seven downgradient monitoring wells are screened in the Fill Aquifer (CMP-3, CMP-4, CMP-15, CM-17, MW-26R and MW-125, and MW-308N); and
- Three downgradient monitoring wells are screened in the Estuarine Aquifer (MW-36, MW-44, and MW-308S).

Identification of Constituents of Potential Concern

A compilation of Terminal 5 groundwater quality data was reviewed to identify constituents of potential concern (COPCs). COPCs for groundwater were identified using a three-step procedure summarized below:

- Step 1 Screening levels were developed for chemicals analyzed as part of the Terminal 5 Long-Term Monitoring Program. Screening levels for individual chemicals were defined as the most conservative of the marine surface water quality criteria taken from Washington State Department of Ecology's Cleanup Levels and Risk Calculation (CLARC) database. Groundwater quality criteria were not evaluated since the highest beneficial use for groundwater at the site is discharge to surface water. The screening levels were intended to identify COPCs and should not be considered cleanup levels or standards. The screening levels for Terminal 5 are presented in Table 1.
- Step 2 Terminal 5 groundwater quality data collected as part of the groundwater confirmation monitoring program were reviewed to identify the chemicals detected in groundwater samples. Table 2 presents a general statistical summary of groundwater analytes and results from the Terminal 5 groundwater confirmation monitoring program compared to potentially applicable surface water quality criteria.
- Step 3 Groundwater quality data was compared to the screening levels. A well-by-well comparison of groundwater concentrations with the screening criteria is presented in Table 3.

Groundwater Screening Process

Validated groundwater sample analytical results were compared to the most conservative surface water quality criteria to identify COPCs in groundwater at Terminal 5. Migration of upland groundwater has been identified as a potential pathway for dissolved chemicals to reach surface water. Surface water quality criteria used to screen the Terminal 5 groundwater chemical concentrations include:

- Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC);
- Clean Water Act 304 for Human Health and Chronic Aquatic Life;
- National Toxics Rule (40 CFR Part 131) for Human Health and Chronic Aquatic Life; and

■ MTCA Method B carcinogen and non-carcinogen cleanup levels for surface water (WAC 173-340-730).

The published marine surface water criteria used to establish the surface water screening levels are presented in Table 1. The most conservative of these criteria for each constituent were established as the preliminary screening levels for groundwater modeling.

Groundwater Screening Results

Tables 2 and 3 present a summary of the results of groundwater comparing concentrations against the screening levels for COPCs at Terminal 5. Relatively few of the detected constituents exceed the screening levels. The analytes with one or more detections in monitoring wells, which exceed the screening levels include:

- Heavy oil-range petroleum hydrocarbons;
- Polychlorinated biphenyls (PCBs);
- Metals (arsenic, copper, lead, and nickel);
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs);
- Bis(2-ethylhexyl) phthalate; and
- Tetrachlorethene (PCE).

Natural Attenuation of Dissolved Groundwater Chemicals

Natural attenuation refers to the reliance on natural processes to achieve site-specific cleanup goals (EPA, 1997). Natural attenuation occurs using the physical, chemical, and biological processes inherent within the aquifer that act to reduce the mass, toxicity, mobility, volume or concentration of contaminants in soil or groundwater. These processes can include biodegradation, dispersion, dilution, sorption, transformation, stabilization, and volatilization of the unwanted contaminants.

Biodegradation is degradation of chemicals by microbes within the soil matrix. The rate of and extent of microbial degradation of chemicals are complex and regulated by the chemical properties of the contaminant, soil and groundwater chemistry, and the microbial population present. Degradation rates are typically measured in terms of half-life. The half-life is the amount of time needed for one-half of the original contaminant mass to be degraded. The half life of the COPCs are presented in Table 4.

Dispersion refers to the process whereby a plume will spread out in a longitudinal direction (along the direction of groundwater flow), transversely (perpendicular to groundwater flow), and vertically downwards due to mechanical mixing in the aquifer and chemical diffusion. Dispersion is usually estimated rather than measured, given the impracticability of measuring dispersion in the field. Dispersion is usually estimated based on the length of the plume or distance to the measurement point. Researchers indicate that dispersion values can range over two to three orders of magnitude for a given value of plume length or distance to a measurement point (Gelhar et al., 1992).

Tidal dilution is mixing of chemicals in groundwater that occurs as the result of changes in gradient during tidal changes. Groundwater will mix with tidal inflows during rising tides. The outflow during a falling tide consists of a mixture of tidal inflow and groundwater. The amount of tidal dilution is a function of the relative range in tidal stage and the aquifer properties. Tidal dilution factors ranging from 4 to 10,000 have been reported from groundwater modeling at Terminal 5 and adjacent sites (Aspect 2007; S. S. Papadopulos & Associates 1997).

Most organic chemicals are removed from solution by sorption onto soil particles. Sorption of dissolved contamination onto the aquifer matrix results in slowing or retardation of the contaminant relative to advective groundwater flow velocity and a reduction in dissolved contaminant concentrations. Sorption is generally represented in fate and transport models using a retardation factor. The retardation factor is the rate at which dissolved contaminants moving through an aquifer are reduced by sorption of contaminants to the solid aquifer matrix. The degree of retardation depends on both aquifer and constituent properties. The retardation factor is the ratio of the groundwater seepage velocity to the rate that organic chemicals migrate in the groundwater. A retardation value of two indicates that if the groundwater seepage velocity is 100 feet/year, then the organic chemicals migrate at approximately 50 feet/yr.

FATE AND TRANSPORT MODELING

A fate and transport model was implemented to evaluate the potential for existing upland groundwater to exceed the screening criteria at the point of compliance (surface water). The selected fate and transport model, BIOSCREEN (EPA 1996), is based on the Domenico analytical solution (Domenico 1987), and was used to estimate the natural attenuation of COPCs between downgradient

monitoring wells and the surface water/sediment interface. BIOSCREEN uses the following assumptions:

- Uniform and constant aquifer properties;
- One-dimensional groundwater flow;
- First-order decay, degradation, or transformation of contaminants; and
- Constant source area and concentrations.

The model predicts maximum groundwater concentrations in the centerline of the groundwater chemical plume to the receptor (Elliott Bay and Duwamish Waterway). The model was evaluated using the following conditions:

- Steady-state conditions without biodegradation;
- Assumed dispersion in the longitudinal, transverse, and vertical directions,
- Equilibrium partitioning and adsorption of COPCs to the aquifer soil matrix;
 and
- The minimum distance from the monitoring well to the surface water was used for the distance to the receptor.

Model Input Parameters

Model input parameters are summarized in Table 4.

Arsenic attenuation was not modeled since it is ubiquitous throughout the region. Background monitoring wells have arsenic concentrations ranging from 0.4 to 23.2 micrograms per liter (ug/L) and the downgradient wells have arsenic concentrations ranging from 0.3 to 25.4 ug/L.

The model represents the contaminant source as a vertical plane, perpendicular to groundwater flow, releasing dissolved constituents into groundwater passing through this plane. The source is assumed to have existed for a period of 100 years, with source zone concentrations set to equal measured chemical concentrations in the groundwater wells. Concentrations used for modeling were conservatively set to equal the maximum measured concentration at each well location.

The groundwater flow and velocity are defined by the hydraulic conductivity, hydraulic gradient, and porosity. Hydrogeologic and aquifer characteristics were obtained from the fate and transport analysis in the Upland Remedial Investigation and Feasibility Study report (RETEC 1997) and Marine Sediments

Remedial Investigation and Marine Sediments Feasibility Study (Weston 1998a and 1998b, respectively).

Biodegradation was not used in modeling. For references purposes, biodegradation half life values presented in Table 4 were taken from Howard, 1991.

The soil bulk density, in kg/L, of the aquifer matrix is related to porosity and pure solids density. Although this value can be measured in the lab, in most cases estimated values are used. A default value of 1.7 kg/L was used.

Fraction organic carbon (foc) is the fraction of the aquifer soil matrix comprised of natural organic carbon. More natural organic carbon typically means higher adsorption of organic constituents on the aquifer matrix. Typical values of foc are 0.002 to 0.02. A value of 0.01 was used for this study as this is a representative value for site soil based on RETEC (1997) and WESTON (1998a and 1998b). Other chemical properties (e.g., organic carbon partition coefficient) were obtained through Ecology's CLARC database.

The model was used to predict the chemical concentration at the receptor which was considered to be at the groundwater/surface water interface. The distance to the receptor was measured on the site map from the well to the closest shoreline following the groundwater flow path based on the groundwater contour maps provided in Aspect (2007). A simulation time of 100 years was considered a sufficient amount of time for the COPCs to potentially reach the surface water.

Two modeling runs were performed using: (1) a maximum concentration of the COPCs for each well from groundwater quality database (Hart Crowser 2010) as a baseline case; and (2) solubility concentrations for the COPCs for each well (solubility case). The solubility case is considered to be the worst-case scenario assuming that NAPL phase was present. There is no evidence that NAPL phase is present at Terminal 5.

Modeling Results

The model results are summarized in Table 5. The model results predict that for the baseline case using the maximum chemical concentrations detected in each well, the COPC concentrations will not reach marine surface water after 100

years except for tetrachloroethene (PCE) from MW-125 and copper from MW-26R and MW-44.

The model predicts the PCE from MW-125 will reach the shoreline at a concentration in the Fill Aquifer of 1.9 ug/L (0.0019 mg/L), which is slightly above the screening criteria of 0.39 ug/L (0.00039 mg/L). If PCE degradation is incorporated into the model, concentrations at the shoreline after 100 years would be non-detect.

The model also predicts that copper from MW-26R and MW-44 will reach the shoreline at concentrations less than 0.1 ug/L (0.0001 mg/L), which is below the screening criteria of 2.4 ug/L (0.0024 mg/L).

For organic compounds, using the solubility limit as a worst-case scenario, the model results predict the COPC concentrations will be non-detect at the surface water after 100 years, except for PCE. Given that the aqueous solubility of PCE is relatively high (200 mg/L), the predicted concentration using the solubility limit model is well above surface water criteria. This scenario assumes that PCE in the form of dense non-aqueous phase liquid (DNAPL) is present. However, the relatively low dissolved PCE concentrations observed in both upgradient and site wells do not indicate the presence of DNAPL at Terminal 5 making the solubility scenario unrealistic. If PCE degradation is incorporated into the model, concentrations at the shoreline after 100 years would be non-detect.

Solubility values for metals were not provided in the CLARC database; therefore, the metals were not modeled for the solubility case.

Tidal Mixing

Tidal mixing, while not incorporated into the model, would further reduce chemical concentrations in groundwater prior to discharge to surface water. As discussed earlier, groundwater will mix with tidal inflows during rising tides. The outflow during a falling tide consists of a mixture of tidal inflow and groundwater. The amount of tidal mixing is a function of the relative range in tidal stage and the aquifer properties. Tidal dilution factors ranging from 4 to 10,000 have been reported from groundwater modeling at the Terminal 5 and adjacent sites (Aspect 2007; S. S. Papadopulos & Associates 1997). Use of the lowest tidal dilution estimate of four would further reduce the calculated chemical concentrations at the shoreline after 100 years by an additional factor of four times less than concentrations presented in Table 5.

SUMMARY AND CONCLUSIONS

- An evaluation was completed to determine if chemicals detected in groundwater at Terminal 5 are naturally attenuated to concentrations below marine surface water quality criteria prior to discharge to Puget Sound.
- Screening criteria based on marine surface water criteria were developed to compare against the groundwater quality data collected from Terminal 5. The screening criteria are presented in Table 1. The statistical summary of groundwater quality database and a comparison with the screening criteria are presented in Tables 2 and 3.
- Fate and transport modeling using BIOSCREEN was conducted to predict contaminant concentrations at the shoreline. The natural attenuation processes simulated in the modeling include dispersion and sorption. Processes not modeled included biodegradation and tidal mixing.
- The model results show that even under conservative conditions, predicted concentrations of most COPCs, including bis(2-ethylhexyl)phthalate, PAHs and PCBs detected in groundwater will not exceed the screening level concentrations at the shoreline within 100 years. For organic compounds, concentrations as high as the solubility limit would not result in an exceedance of surface water quality criteria at the shoreline.
- The model results show that even under the conservative conditions, predicted concentrations of copper and lead detected in groundwater will not exceed the screening level concentrations at the shoreline within 100 years. If tidal mixing is incorporated into the model, copper and lead concentrations four times higher than the maximum detected concentrations will not exceed the screening level concentrations at the shoreline within 100 years.
- PCE in monitoring well MW-125 is calculated to exceed surface water quality criteria within 100 years based on retardation modeling. If degradation half-life and tidal mixing are incorporated into the model, PCE concentrations will be non-detect at the shoreline after 100 years. Furthermore, the source of PCE is from off-site of Terminal 5. PCE is present in off-site, upgradient monitoring well FM-105 at concentrations comparable to those found in MW-125.

Although not simulated during modeling, tidal mixing and biodegradation are important natural attenuation processes that would further reduce groundwater chemical concentrations at Terminal 5.

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Analyte	Surface Water ARAR - Aquatic Life - Marine/Acute - Ch. 173-201A WAC (µg/L)	Surface Water ARAR - Aquatic Life Marine/Acute - Clean Water Act §304 (µg/L)	Life - Marine/Acute - National Toxics	Surface Water ARAR - Aquatic Life - Marine/Chronic - Ch. 173-201A WAC (µg/L)	Surface Water ARAR - Aquatic Life - Marine/Chronic - Clean Water Act §304 (µg/L)	Surface Water ARAR - Aquatic Life - Marine/Chronic - National Toxics Rule, 40 CFR 131 (µg/L)	Surface Water ARAR - Human Health – Marine – Clean Water Act §304 (µg/L)	Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131 (µg/L)	Surface Water, Method B, Carcinogen, Standard Formula Value (µg/L)	Surface Water, Method B, Non- Carcinogen, Standard Formula Value (µg/L)	Screening Level ^{2, 3} (µg/L)
Metals											
Antimony							640	4300		1,000	640
Arsenic, inorganic	69	69	69	36	36	36	0.14	0.14	0.098	18	0.14 (5 - MTCA A GW)
Chromium (VI)	1100	50	1100	50	1100	50				490	50
Copper	4.8	4.8	2.4	3.1	3.1	2.4				2,700	2.4
Lead	210	210	210	8.1	8.1	8.1					8.1
Nickel soluble salts	74	74	74	8.2	8.2	8.2	4,600	4,600		1,100	8.2
Polychlorinated Biphenyls (PCBs)											
Aroclor 1016						0.03				0.0058	0.0058
Aroclor 1221											
Aroclor 1232									-		
Aroclor 1242									-		
Aroclor 1248											
Aroclor 1254						0.03				0.0017	0.0017
Aroclor 1260						0.03					0.03
Aroclor 1262											
Aroclor 1268						-				-	
Polychlorinated biphenyls	10			0.03	0.03	0.03	0.000064	0.00017	0.00011		0.000064
Total Petroleum Hydrocarbons											
TPH, diesel range organics											500 ⁵
TPH, heavy oils											500 ⁵
Volatile Organic Compounds (VOCs)	•	•	•	•			•				
1,1,1,2-Tetrachloroethane											
1,1,1-Trichloroethane										930,000	420,000
1,1,2,2-Tetrachloroethane							4	11	6.5		4
1,1,2-Trichloroethane							16	42	25	2,300	16
1,1-Dichloroethane											
1,1-Dichloroethene							7100	3.2		23,000	3.2
1,2-Dichloroethane							37	99	59	43,000	37
Chloroethane											
cis-1,2-Dichloroethene									-		
Tetrachloroethene							3.3	8.9	0.39	840	0.39
trans-1,2-Dichloroethene							10,000			33,000	10,000
Trichloroetlene							30	81	6.7	71	6.7
Vinyl chloride							2.4	530	3.7	6,600	2.4

	Surface Water ARAR - Aquatic Life - Marine/Acute - Ch. 173-201A WAC	Surface Water ARAR - Aquatic Life Marine/Acute - Clean Water Act §304		Surface Water ARAR - Aquatic Life - Marine/Chronic - Ch. 173-201A WAC	Clean Water Act		- Clean Water		Surface Water, Method B, Carcinogen, Standard Formula Value	Surface Water, Method B, Non- Carcinogen, Standard Formula Value	Screening Level ^{2, 3}
Analyte	(μg/L)	(μg/L)	(μg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Semivolatile Organic Compounds (SVOCs)											
bis(2-Ethylhexyl) phthalate							2.2	5.9	3.6	400	2.2
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPA	NHs)										
Benzo[a]anthracene							0.018	0.031			0.018
Benzo[a]pyrene							0.018	0.031	0.03		0.018
Benzo[b]fluoranthene							0.018	0.031			0.018
Benzo[k]fluoranthene							0.018	0.031			0.018
Chrysene							0.018	0.031			0.018
Dibenzo[a,h]anthracene							0.018	0.031			0.018
Indeno[1,2,3-cd]pyrene							0.018	0.031			0.018

Notes

- 1. -- = Not established.
- 2. Screening levels may be adjusted depending on lab PQLs.
- 3. Screening levels may be adjusted based on background data results.
- 4. Surface water quality criteria are based on dissolved metal concentrations.

<u>Abbreviations</u>

 μ g/L = micrograms per liter.

ARAR = applicable or relevant and appropriate requirements

CFR = code of federal regulations

WAC = Washington Administrative Code

Table A-2 - Statistical Summary of Groundwater Quality Data Port of Seattle Terminal 5

	Dotontial		Number o	Number of Samples		Of th	Of the Samples Detected	cted
Chemical	Screening Level	Analyzed	Non- Detect	Detected	Exceeding Screening Levels	Minimum Concentration	Maximum Concentration	Average Concentration
TPH Diesel range in µg/L Motor oil range in µg/L	500 500	56 56	56 55	0	0 1	0 230	0	
Total Metals Total antimony in µg/L Total arsenic, inorganic in µg/L Total chromium in µg/L	640 0.14/5 (1) 50 2.4	16 56 16	13 9 0	3 47 6	0 19 0	0.3 0.3 3	0.6 25.4 11	0.4 6.5 5.2 7.3
Total lead in µg/L Total nickel soluble salts in µg/L	8.2 . 1.3	56 16	54 -	9 15		;	33	9.4 5.5
cPAHs Benzo(a)anthracene in µg/L Benzo(a)pyrene in µg/L Benzo(b)fluoranthene in µg/L Benzo(k)fluoranthene in µg/L Chrysene in µg/L Dibenzo(a,h)anthracene in µg/L Indeno(1,2,3-cd)pyrene in µg/L	0.018 0.018 0.018 0.018 0.018	56 56 56 56 56	51 52 50 51 45 53	v 4 o v 1 c c	4 1 4 4 4 4 1 1 1	0.01 0.011 0.01 0.011 0.023 0.023	0.097 0.14 0.27 0.14 0.035 0.035	0.045 0.079 0.082 0.072 0.047 0.029
bis(2-ethylhexyl) phthalate in µg/L	2.2	56	45	11	4	1	23	3.9
PCBs Aroclor 1016 in μg/L Aroclor 1221 in μg/L Aroclor 1232 in μg/L Aroclor 1242 in μg/L Aroclor 1248 in μg/L Aroclor 1254 in μg/L Aroclor 1260 in μg/L Arotlor 1260 in μg/L	0.0058 0.0017 0.03	56 56 56 56 56 56	56 56 54 48 53 56	0 0 2 8 8 0 10	0 	0 0 0.01 0.014 0.016 0	0 0 0 0.013 2.5 1.5 0	 0.012 0.476 0.512

Table A-2 - Statistical Summary of Groundwater Quality Data Port of Seattle Terminal 5

	Dotential		Number o	Number of Samples		Of th	Of the Samples Detected	cted
Chemical	Screening Level	Analyzed	Non- Detect	Detected	Exceeding Screening Levels	Minimum Concentration	Maximum Concentration	Average Concentration
VOCs								
Tetrachloroethane;1,1,1,2- in µg/L	ŀ	13	13	0	ŀ	0	0	:
Tetrachloroethane;1,1,2,2- in µg/L	4	13	13	0	0	0	0	:
Trichloroethane;1,1,1- in µg/L	420,000	13	1	2	0	0.2	0.2	0.2
Trichloroethane;1,1,2- in µg/L	16	13	13	0	0	0	0	1
Dichloroethane;1,1- in µg/L	ŀ	13	6	4	1	0.2	0.4	0.3
Dichloroethane;1,2- in µg/L	37	13	13	0	0	0	0	1
Ethyl chloride in µg/L	ŀ	13	13	0	1	0	0	1
Tetrachloroethene in µg/L	0.39	12	_	17	80	0.2	6.7	3.9
Trichloroethene in µg/L	6.7	12	4	ω	0	9.0	2.8	1.2
Dichloroethene;1,1- in µg/L	3.2	12	12	0	0	0	0	1
Dichloroethene;1,2-,cis in µg/L	ŀ	12	4	ω	1	0.2	2.5	1.1
Dichloroethene;1,2-,trans in µg/L	10,000	12	12	0	0	0	0	1
Vinyl chloride in µg/L	2.4	12	12	0	0	0	0	1

Notes:

TPH = Total Petroleum Hydrocarbons

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons

sVOCs = Semivolatile Organic Compounds

PCBs = Polychlorinated Biphenyls

VOCs = Volatile Organic Compounds

(1) 0.14 is based on Surface Water screening criteria and 5 is based on MTCA Method A groundwater cleanup level.

Table A-3 - Well-by-Well Statistical Summary of Groundwater Quality Data Port of Seattle Terminal 5

Samp	ole Name	T	CMF	P-15			MW	26R			MW	-36			MV	V44			CM	1P-5	
		#		# Above	Max	#		# Above		#		# Above		#		# Above		#		# Above	
	oling Date Screen Level	Samples #	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.
Total Petroleum Hydrocarbons									1												
Diesel Range in µg/L	500 500	4	0	0		4	0	0		4	0	0)	4	4	0	530	0	0	0	
Motor Oil Range in μg/L Total Metals	500	4	U	U		4	U	U		4	U	0)	4	1	1	530	0	U	0	
Total metals Total antimony in µg/L	640	1 4	0	0	<u> </u>	1	0	0		1	٥	0	J	1 4	3	0	0.6	I	l	[_	<u></u>
Total aritimony in pg/L Total arsenic, inorganic in µg/L	0.14/5 (1)	4	3	3	1	4	0	0		4	2	2	7	4	1	0	0.8			3	14.2
Total chromium (total) in µg/L	50	4	0	0	-	4	3	0	2	4	0	0) /	4	2	0	11		4		14.2
	2.4	4	2	0	0.8	4	1	1	3	4	0		,	4	3	4	18				
Total copper in µg/L	8.1	4	0	0	0.6	4	0	0	3	4	0		,	4	4	2	33				
Total lead in µg/L	8.2	4	0	0		4	0	0	7	4	0	0		4	4	0			U	0	
Total nickel soluble salts in µg/L Carcinogenic Polycyclic Aromatic	0.2	4	4	0	5.6	4	4	0	/	4	3	3	12	4	4	0	4.3	l		<u></u>	
Hydrocarbons (cPAHs)																					
Benzo(a)anthracene in µg/L	0.018	4	0	0		4	1	1	0.025	4	0	0)	4	2	2	0.060	4	0	0	
Benzo(a)pyrene in µg/L	0.018	4	0	0		4	0	0		4	0	0)	4	2	2	0.110	4	0	0	
Benzo(b)fluoranthene in μg/L	0.018	4	0	0		4	0	0		4	0	0)	4	3	2	0.270	4	0	0	
Benzo(k)fluoranthene in µg/L	0.018	4	0	0		4	0	0		4	0	0)	4	2	2	0.140	4	0	0	
Chrysene in µg/L	0.018	4	0	0		4	4	1	0.027	4	0	0)	4	2	2	0.190	4	0	0	
Dibenzo(a,h)anthracene in µg/L	0.018	4	0	0		4	0	0		4	0	0)	4	2	2	0.040	4	0	0	
Indeno(1,2,3-cd)pyrene in µg/L	0.018	4	0	0		4	0	0		4	0	0)	4	2	2	0.110	4	0	0	
Semivolatile Organic	•	•												u.	u.		l.				
bis(2-ethylhexyl) phthalate in μg/L	2.2	4	1	0	1.6	4	0	0	NA	4.0	1.0	0.0	1.5	4	3	1	2.4	4	1	1	23
Polychlorinated Biphenyls (PCBs)			-																		
Aroclor 1016 in μg/L	0.0058	4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1221 in μg/L		4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1232 in μg/L		4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1242 in μg/L		4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1248 in μg/L		4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1254 in μg/L	0.0017	4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1260 in μg/L	0.03	4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Total PCBs in µg/L	0.000064	4	0	0		4	0	0		4	0	0)	4	0	0		4	0	0	
Volatile Organic Compounds		<u> </u>	ı		ī ·		T		<u> </u>		, r			1	1	1	1	1	Ī		
Tetrachloroethane;1,1,1,2- in μg/L																					
Tetrachloroethane;1,1,2,2- in μg/L	4												 								
Trichloroethane;1,1,1- in μg/L	420,000																				<u> </u>
Trichloroethane;1,1,2- in μg/L	16												 								
Dichloroethane;1,1- in μg/L													 								
Dichloroethane;1,2- in μg/L	37												 								
Ethyl Chloride in µg/L													 								
Tetrachloroethene in µg/L	0.39												<u> </u>							<u> </u>	<u></u>
Trichloroethene in μg/L+A22	6.7																			<u> </u>	<u> </u>
Dichloroethene;1,1- in μg/L	3.2																				<u> </u>
Dichloroethene;1,2-,cis in μg/L													<u> </u>								<u> </u>
Dichloroethene;1,2-,trans in μg/L	10,000																			<u></u>	<u></u>
Vinyl Chloride in μg/L	2.4																				<u> </u>

Table A-3 - Well-by-Well Statistical Summary of Groundwater Quality Data Port of Seattle Terminal 5

Sample Name			CMF	P-4			MW-	308N			MW30)8S			MW	308S			CI	MP2	
			T T		1										1						
Occupies Date	0	#		# Above	Max	#	# D - 1 1 -	# Above	Max	#		# Above	Max	#	# D - 1 1 -	# Above	Max	#	# D - 1 1 -	# Above	
Sampling Date Total Petroleum Hydrocarbons	Screen Level	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.
Diesel Range in μg/L	500	0	0 0	0		4	0	0		4	0	0		4	0	0		4	() ()
Motor Oil Range in µg/L	500	0	<u> </u>	0		4	0	0		4	0	0		4	0	0		4)
Total Metals				_								-				_					-
Total antimony in µg/L	640																				
Total arsenic, inorganic in µg/L	0.14/5 (1)	4	4	0	3.8	4	4	4	25.4	4	3	1	8	4	4	0	3.1	4	4		4 23.2
Total chromium (total) in µg/L	50	C)			0				0											
Total copper in µg/L	2.4	C)			0				0											
Total lead in µg/L	8.1	4	1 1	0	1	4	0	0		4	0	0		4	0	0		4	3	, 1	1 15
Total nickel soluble salts in µg/L	8.2																				
Carcinogenic Polycyclic Aromatic			<u> </u>		-		<u> </u>			-			<u> </u>		-	<u>-</u>		<u>. </u>		-	-
Hydrocarbons (cPAHs)		, 				.															
Benzo(a)anthracene in μg/L	0.018	4	1 0	0		4	0	0		4	0	0		4	0	0		4	(, C)
Benzo(a)pyrene in µg/L	0.018	4	1 0	0		4	0	0		4	0	0		4	0	0		4	C	<u>, c</u>)
Benzo(b)fluoranthene in μg/L	0.018	4	1 0	0		4	0	0		4	0	0		4	0	0		4	(, C)
Benzo(k)fluoranthene in μg/L	0.018	4	1 0	0		4	0	0		4	0	0		4	0	0		4	(1 0)
Chrysene in µg/L	0.018	4	1 0	0		4	0	0		4	0	0		4	0	0	-	4	() ()
Dibenzo(a,h)anthracene in μg/L	0.018	4	1 0	0		4	0	0		4	0	0		4	0	0		4	C) ()
Indeno(1,2,3-cd)pyrene in µg/L	0.018	4	1 0	0		4	0	0		4	0	0		4	0	0	-	4	C	, ()
Semivolatile Organic																					
bis(2-ethylhexyl) phthalate in μg/L	2.2	4.0	1.0	1.0	2.4	4	0	0		4.0	2.0	1.0	5.0	4	0	0		4	C	()
Polychlorinated Biphenyls (PCBs)				,		T															
Aroclor 1016 in μg/L	0.0058	4	1 0	0		4	0	0		4	0	0		4	0	0		4	(, C)
Aroclor 1221 in μg/L		4	1 0	0		4	0	0		4	0	0		4	0	0		4	(, C)
Aroclor 1232 in μg/L		4	1 0	0		4	0	0		4	0	0		4	0	0		4	(, ,)
Aroclor 1242 in μg/L		4	1	0	0.013	4	1	0		4	0	0		4	0	0		4	C	, ,)
Aroclor 1248 in μg/L		4	1 2	0	0.025	4	2	0		4	0	0		4	0	0		4	2	: (0.020
Aroclor 1254 in μg/L	0.0017	4	1	1	0.020	4	0	0		4	0	0		4	0	0		4	1	1	0.016
Aroclor 1260 in μg/L	0.03	4	1 0	0	NA		0	0		4	0	0		4	0	0		4		_)
Total PCBs in µg/L	0.000064	4	1 3	3	0.045	4	3	3	0.020	4	0	0		4	0	0		4	2	. 2	2 0.031
Volatile Organic Compounds			1			Ī						1									_
Tetrachloroethane;1,1,1,2- in µg/L																				 	
Tetrachloroethane;1,1,2,2- in µg/L	420,000																			 	
Trichloroethane;1,1,1- in µg/L	420,000 16																			 	
Trichloroethane;1,1,2- in µg/L																				 	
Dichloroethane;1,1- in µg/L	37																			 	
Dichloroethane;1,2- in μg/L						<u></u>															
Ethyl Chloride in µg/L																				 	
Tetrachloroethene in µg/L	0.39																				
Trichloroethene in µg/L+A22	6.7																				
Dichloroethene;1,1- in μg/L	3.2		 																		+
Dichloroethene;1,2-,cis in μg/L																					
Dichloroethene;1,2-,trans in μg/L	10,000																				<u></u>
Vinyl Chloride in μg/L	2.4																		-	<u> </u>	<u> </u>

Table A-3 - Well-by-Well Statistical Summary of Groundwater Quality Data Port of Seattle Terminal 5

Sample Name			CM	P-3			FM-	-105			MW	-125			CM	P-17	
		ļ	-	1			1				1	-			ı	1	1
		#	_	# Above	Max	#	_	# Above	Max	#	_	# Above	Max	#		# Above	Max
Sampling Date	Screen Level	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.
Total Petroleum Hydrocarbons	500						_			1 4							T
Diesel Range in µg/L	500 500	4	0	0		4	0	0		4	0	0		4	0	0	
Motor Oil Range in μg/L Total Metals	500	4	U	U		4	U	U		4	U	U		4	U	U	
Total Metals Total antimony in µg/L	640																I
Total arsenic, inorganic in µg/L	0.14/5 (1)	1	4	1	11.6	1	2	0	0.5	4	2	0	0.6	4	1	0	8.1
1	50	4	4	4	11.0	4	3	U	0.5	0	3	U	0.0	0	4	U	0.1
Total chromium (total) in μg/L	2.4									0							
Total copper in µg/L												0		0			
Total lead in μg/L	8.1	4	1	0	4	4	0	0		4	0	0		4	_	0	
Total nickel soluble salts in µg/L	8.2													0			
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)																	
Benzo(a)anthracene in μg/L	0.018	4	1	0	-	4	0	0		4	1	1	0.097	4	0	0	
Benzo(a)pyrene in µg/L	0.018	4	1	0	0.011	4	0	0		4	1	1	0.140	4	0	0	
Benzo(b)fluoranthene in μg/L	0.018	4	1	1	0.019	4	0	0		4	2	1	0.100	4	0	0	
Benzo(k)fluoranthene in μg/L	0.018	4	1	0	0.011	4	0	0		4	2	1	0.120	4	0	0	
Chrysene in µg/L	0.018	4	3	0	0.015	4	0	0		4	2	1	0.084	4	0	0	
Dibenzo(a,h)anthracene in µg/L	0.018	4	0	0	-	4	0	0		4	1	1	0.028	4	0	0	
Indeno(1,2,3-cd)pyrene in µg/L	0.018	4	0	0	-	4	0	0		4	1	1	0.051	4	0	0	
Semivolatile Organic		ll l	l l									l l					u.
bis(2-ethylhexyl) phthalate in μg/L	2.2	4	0	0		4.0	1.0	0.0	1.4	4	0	0		4	0	0	
Polychlorinated Biphenyls (PCBs)																	
Aroclor 1016 in μg/L	0.0058	4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1221 in μg/L		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1232 in μg/L		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1242 in μg/L		4	0	0	-	4	0	0		4	0	0		4	0	0	
Aroclor 1248 in μg/L		4	2	0	2.5	4	0	0		4	0	0		4	0	0	
Aroclor 1254 in μg/L	0.0017	4	1	1	1.5	4	0	0		4	0	0		4	0	0	
Aroclor 1260 in µg/L	0.03	4	0	0	-	4	0	0		4	0	0		4	0	0	
Total PCBs in μg/L	0.000064	4	2	2	4.0	4	0	0		4	0	0		4	0	0	
Volatile Organic Compounds																	
Tetrachloroethane;1,1,1,2- in μg/L						4	0	0		4	0	0		4	0	0	
Tetrachloroethane;1,1,2,2- in μg/L	4					4	0			4	0	0		4	0	0	
Trichloroethane;1,1,1- in μg/L	420,000					4	0	0		4	2	0	0.2	4	0	0	
Trichloroethane;1,1,2- in μg/L	16					4	0	0		4	0	0		4	0	0	
Dichloroethane;1,1- in μg/L						4	0	0		4	4	0	0.4	4	0	0	
Dichloroethane;1,2- in μg/L	37					4	0	0		4	0	0		4	0	0	
Ethyl Chloride in µg/L						4	0	0		4	0	0		4	0	0	
Tetrachloroethene in µg/L	0.39					4	4	4	6.1	4	4	4	6.7	4	3	0	0.3
Trichloroethene in µg/L+A22	6.7					4	4	0	0.8	4	4	0	2.8	4	0	0	
Dichloroethene;1,1- in μg/L	3.2					4	0	0		4	0	0		4	0	0	
Dichloroethene;1,2-,cis in µg/L						4	4	0	2.5	4	4	0	2.1	4	0	0	
Dichloroethene;1,2-,trans in μg/L	10,000					4	0	0		4	0	0		4	0	0	
Vinyl Chloride in µg/L	2.4					1	0	0		4	0	0		4	0		

Table A-4 - Summary of Input Parameters Used for Groundwater Transport Model Port of Seattle Terminal 5

					Source Values			H	ydrogeology			Dispersion			Adsc	rption		
Class	Chemical	Potential Screening Level in mg/L	Well ID	Distance to Receptor in Feet	Source Concentration in mg/L	Source Width in Feet	Source Thickness in Feet	Hydraulic Conductivity in cm/sec	Hydraulic Gradient in Feet/Feet	Porosity	Longitudinal in Feet	Transverse in Feet	Vertical in Feet	Soil Bulk Density in kg/L	Koc in L/kg	Kd in L/kg	Fraction of Organic Carbon	Bio- degradation half-life range in Years
	Lead	0.0081	CMP-2	940	1.5E-02	100	10	0.024	0.0007	0.45	5.5	2	1	1.7		1.00E+04	0.01	
	Polychlorinated biphenyls	0.000000064	CMP-2	940	3.1E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.10E+05	3.10E+03	0.01	
Background	Tetrachloroethene	0.00039	FM-105	355	6.2E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	2.70E+02	2.70E+00	0.01	1 - 2
	bis(2-Ethylhexyl) phthalate	0.0022	FM-105	355	5.8E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.10E+05	1.10E+03	0.01	0.027 - 1
	bis(2-Ethylhexyl) phthalate	0.0022	CMP-5	1160	2.3E-02	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.10E+05	1.10E+03	0.01	0.027 - 1
	Copper	0.0024	MW-26R	105	3.0E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7		2.20E+01	0.01	
	Polychlorinated biphenyls	0.000000064	CMP-3	490	1.2E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.10E+05	3.10E+03	0.01	
	Polychlorinated biphenyls	0.000000064	CMP-4	760	1.7E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.10E+05		0.01	
	Polychlorinated biphenyls	0.000000064	MW-308N	185	1.4E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.10E+05		0.01	
	Tetrachloroethene	0.00039	MW-125	250	6.7E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	2.70E+02		0.01	1 - 2
	bis(2-Ethylhexyl) phthalate	0.0022	CMP-4	760	2.4E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.10E+05		0.01	0.027 - 1
	Benzo[a]anthracene	0.000018	MW-125	250	9.7E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.60E+05		0.01	0.56 - 2.73
Fill Aquifer	Benzo[a]anthracene	0.000018	MW-26R	105	2.5E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.60E+05		0.01	0.56 - 2.73
· •	Benzo[a]pyrene	0.000018	MW-125	250	1.4E-04	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	9.70E+05		0.01	0.31 - 2.9
	Benzo[b]fluoranthene	0.000018	MW-125	250	1.0E-04	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.20E+06		0.01	1.97 - 3.34
	Benzo[b]fluoranthene	0.000018	CMP-3	490	1.9E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.20E+06		0.01	1.97 - 3.34
	Benzo[k]fluoranthene	0.000018	MW-125	250	1.2E-04	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.20E+06		0.01	4.99 - 11.7
	Chrysene	0.000018	MW-125	250	8.4E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	4.00E+05		0.01	2.04 - 5.48
	Chrysene	0.000018	MW-26R	105	2.7E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	4.00E+05		0.01	2.04 - 5.48
	Dibenzo[a,h]anthracene	0.000018	MW-125	250	2.8E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.80E+06		0.01	1.98 - 5.15
	Indeno[1,2,3-cd]pyrene	0.000018	MW-125	250	5.1E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.50E+06	3.50E+04	0.01	3.89 - 4
	Copper	0.0024	MW-44	100	1.8E-02	100	10	0.014	0.0008	0.45	5.5	2	1	1.7		2.20E+01	0.01	
	Lead	0.0081	MW-44	100	3.3E-02	100	10	0.014	0.0008	0.45	5.5	2	1	1.7		1.00E+04	0.01	
	Nickel soluble salts	0.0082	MW-36	360	1.2E-02	100	10	0.014	0.0008	0.45	5.5	2	1	1.7		6.50E+01	0.01	
	TPH, heavy oils	0.5	MW-44	100	5.3E-01	100	10	0.014	0.0008	0.45	5.5	2	1	1.7			0.01	
	bis(2-Ethylhexyl) phthalate	0.0022	MW-308S	190	5.0E-03	100	10	0.014	0.0008	0.45	5.5	2	1	1.7		1.10E+03	0.01	0.027 - 1
Estuarine	bis(2-Ethylhexyl) phthalate	0.0022	MW-44	100	2.4E-03	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	1.10E+05		0.01	0.027 - 1
Aquifor	Benzo[a]anthracene	0.000018	MW-44	100	5.9E-05	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	3.60E+05		0.01	0.56 - 2.73
	Benzo[a]pyrene	0.000018	MW-44	100	1.1E-04	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	9.70E+05		0.01	0.31 - 2.9
	Benzo[b]fluoranthene	0.000018	MW-44	100	2.7E-04	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	1.20E+06		0.01	1.97 - 3.34
	Benzo[k]fluoranthene	0.000018	MW-44	100	1.4E-04	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	1.20E+06		0.01	4.99 - 11.7
	Chrysene	0.000018	MW-44	100	1.9E-04	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	4.00E+05		0.01	2.04 - 5.48
	Dibenzo[a,h]anthracene	0.000018	MW-44	100	3.5E-05	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	1.80E+06		0.01	1.98 - 5.15
	Indeno[1,2,3-cd]pyrene	0.000018	MW-44	100	1.1E-04	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	3.50E+06	3.50E+04	0.01	3.89 - 4

Notes:

Potential screening levels are obtained from GQMER (Hart Crowser 2010).

Source concentrations values are maximum concentrations for individual wells.

Source width, source thickness, hydraulic conductivity, longitudinal dispersion, transverse dispersion, vertical dispersion, and fraction of organic carbon values are referenced from the RI - PSR Marine Sediments Unit (Weston 1998b).

Hydraulic gradients are calculated from the 72-hour mean groundwater elevations provided in the Hydrologic Characterization Report (Aspect 2007).

Koc = soil adsorption coefficient.

Kd = soil distribution coefficient.

Kd = Koc x fraction of organic carbon.

-- = not applicable.

ND = not detected.

Biodegradation half-life provided for reference; not used in modeling

Table A-5 - Summary of Groundwater Transport Modeling Results Port of Seattle Terminal 5

				Baselin	ie Case	Solubili	ty Case
Class	Chemical	Well ID	Potential Screening Level in mg/L (1)	Source Concentration in mg/L (2)	Concentration After 100 Years at Receptor in mg/L	Solubility Concentration (3) in mg/L	Concentration After 100 Years at Receptor in mg/L
	Lead	CMP-2	8.1E-03	1.5E-02			
	Polychlorinated biphenyls	CMP-2	6.4E-08	3.1E-05		7.0E-01	
Background	Tetrachloroethene	FM-105	3.9E-04	6.2E-03		2.0E+02	
	bis(2-Ethylhexyl) phthalate	FM-105	2.2E-03	5.8E-03		3.4E-01	
	bis(2-Ethylhexyl) phthalate	CMP-5	2.2E-03	2.3E-02		3.4E-01	
	Copper	MW-26R	2.4E-03	3.0E-03	6.5E-06		
	Polychlorinated biphenyls	CMP-3	6.4E-08	1.2E-03	ND	7.0E-01	ND
	Polychlorinated biphenyls	CMP-4	6.4E-08	1.7E-05	ND	7.0E-01	ND
	Polychlorinated biphenyls	MW-308N	6.4E-08	1.4E-05	ND	7.0E-01	ND
	Tetrachloroethene	MW-125	3.9E-04	6.7E-03	0.0019 ^a	2.0E+02	57 ^a
	bis(2-Ethylhexyl) phthalate	CMP-4	2.2E-03	2.4E-03	ND	3.4E-01	ND
	Benzo[a]anthracene	MW-125	1.8E-05	9.7E-05	ND	9.4E-03	ND
Fill Aquifer	Benzo[a]anthracene	MW-26R	1.8E-05	2.5E-05	ND	9.4E-03	ND
Fili Aquilei	Benzo[a]pyrene	MW-125	1.8E-05	1.4E-04	ND	1.6E-03	ND
	Benzo[b]fluoranthene	MW-125	1.8E-05	1.0E-04	ND	1.5E-03	ND
	Benzo[b]fluoranthene	CMP-3	1.8E-05	1.9E-05	ND	1.5E-03	ND
	Benzo[k]fluoranthene	MW-125	1.8E-05	1.2E-04	ND	8.0E-04	ND
	Chrysene	MW-125	1.8E-05	8.4E-05	ND	1.6E-03	ND
	Chrysene	MW-26R	1.8E-05	2.7E-05	ND	1.6E-03	ND
	Dibenzo[a,h]anthracene	MW-125	1.8E-05	2.8E-05	ND	2.5E-03	ND
	Indeno[1,2,3-cd]pyrene	MW-125	1.8E-05	5.1E-05	ND	2.2E-05	ND
	Copper	MW-44	2.4E-03	1.8E-02	7.2E-07		
	Lead	MW-44	8.1E-03	3.3E-02	ND		
	Nickel soluble salts	MW-36	8.2E-03	1.2E-02	ND		
	TPH, heavy oils	MW-44	5.0E-01	5.3E-01			
	bis(2-Ethylhexyl) phthalate	MW-308S	2.2E-03	5.0E-03	ND	3.4E-01	ND
Estuarine	bis(2-Ethylhexyl) phthalate	MW-44	2.2E-03	2.4E-03	ND	3.4E-01	ND
Aguifer	Benzo[a]anthracene	MW-44	1.8E-05	5.9E-05	ND	9.4E-03	ND
Aquilei	Benzo[a]pyrene	MW-44	1.8E-05	1.1E-04	ND	1.6E-03	ND
	Benzo[b]fluoranthene	MW-44	1.8E-05	2.7E-04	ND	1.5E-03	ND
	Benzo[k]fluoranthene	MW-44	1.8E-05	1.4E-04	ND	8.0E-04	ND
	Chrysene	MW-44	1.8E-05	1.9E-04	ND	1.6E-03	ND
	Dibenzo[a,h]anthracene	MW-44	1.8E-05	3.5E-05	ND	2.5E-03	ND
	Indeno[1,2,3-cd]pyrene	MW-44	1.8E-05	1.1E-04	ND	2.2E-05	ND

Notes:

Background groundwater data was not modeled.

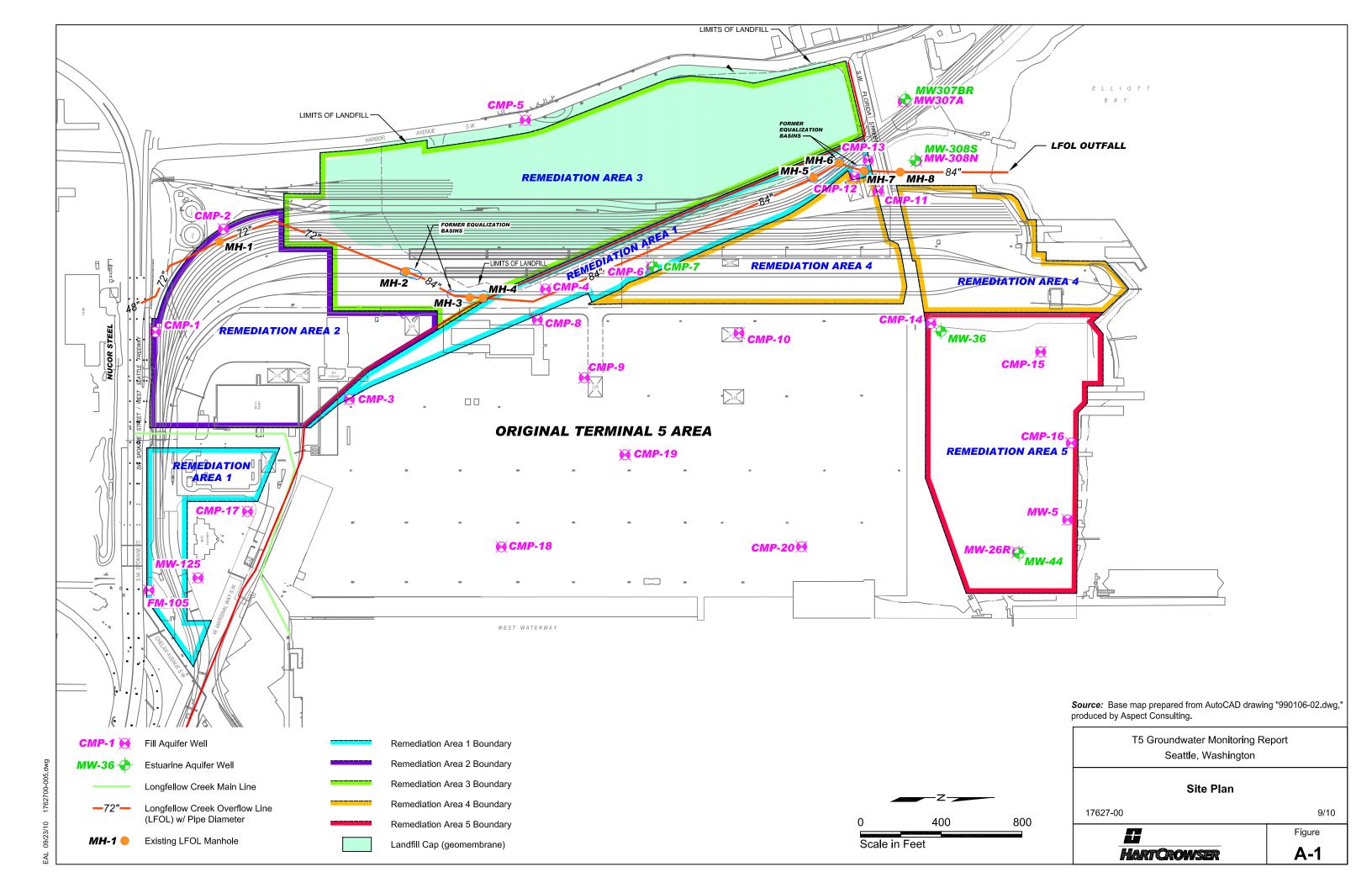
Receptor is the surface water (Elliott Bay and/or Duwamish Waterway).

^{1.} Potential screening levels are obtained from GQMER (Hart Crowser 2010).

 $^{2. \} Source \ concentrations \ values \ are \ maximum \ concentrations \ for \ individual \ wells.$

^{3.} Solubility concentration values are obtained from CLARC database.

^a Predicted concentrations of PCE with biodegradation (1 to 2 half life) were less than 0.0001 mg/L



APPENDIX B GROUNDWATER SAMPLING PROCEDURES AND SAMPLE HANDLING METHODS

APPENDIX B GROUNDWATER SAMPLING PROCEDURES AND SAMPLE HANDLING METHODS

This appendix summarizes the groundwater sampling and handling procedures used by Hart Crowser to conduct its fieldwork.

Groundwater Level Measurements

Groundwater level measurements were made during the groundwater sampling event from June 2 through June 4, 2010. Groundwater elevation data are summarized in Table 1. Depths to water measurements were made using a water level indicator. The probe was cleaned with deionized water between measurements to prevent cross-contamination of monitoring wells.

Groundwater Sampling

Groundwater samples were collected from monitoring wells CMP-1, CMP-2, CMP-3, CMP-4, CMP-5, CMP-15, CMP-17, MW-26R, MW-36, MW-44, MW-125, MW-308A(N), MW-308B(S), and FM-105 from June 2 through June 4, 2010 for chemical analysis. One duplicate sample was collected for each analyte during the sampling event. Equipment used for groundwater sample collection of groundwater samples included:

- Multiparameter water quality meter;
- Water level indicator;
- Peristaltic pump with disposable polyethylene tubing;
- Laboratory-supplied, pre-cleaned and preserved, 500 mL and 1 L HPDE and amber bottles;
- Coolers with ice; and
- Hart Crowser Sample Custody Record and Groundwater Sampling Data forms.

Upon arrival at the wellhead, field personnel recorded well conditions, depth to water, and depth to sediment in the well using a water level indicator. Purging and sampling was conducted at a depth representing the middle of the screened interval of each well. Groundwater samples were collected using low-flow sampling techniques. The wells were purged and sampled with a peristaltic pump. Clean sample tubing was used for each well and disposed of after use.

The field parameters pH, temperature, specific conductivity, dissolved oxygen, turbidity, and oxygen redox potential were measured and recorded periodically during well purging. Once the field parameters remained stable between

measurements, the groundwater sample was collected. The final stabilized readings measured just before sampling were recorded on the Groundwater Sampling Data form. Copies of the Groundwater Sampling Data forms are presented in Appendix C.

Sample Handling and Laboratory Analysis

Groundwater samples collected during the monitoring event were submitted to Analytical Resources Inc. of Tukwila, Washington. Samples were delivered by courier to the laboratory under chain of custody protocols.

One field duplicate and two trip blank samples were collected for the groundwater samples and submitted to the laboratory to assess combined field and laboratory variability. The one field duplicate sample was assigned the same exploration label with the letter "D" at the end of the number. The two trip blank samples were assigned the label "Trip Blank."

All groundwater samples were submitted for chemical analysis of cPAHs by EPA Method 8270C-SIM, PCBs by EPA Method 8082, TPH-Dx by NWTPH-Dx with silica gel cleanup, and bis(2-ethylhexyl)phthalate (BEHP) by EPA Method 8270C. Selected groundwater samples (FM-105, MW-125, and CMP-17) were submitted for chemical analysis of VOCs chlorinated ethanes and ethenes (CEEs) by EPA Method 8260B. Selected groundwater samples (CMP-15, MW-26R, MW-36, and MW-44) were submitted for chemical analysis of total metals by EPA Method 6010B/6020 for As, Pb, Sb, Cr, Cu, and Ni. Selected groundwater samples (CMP-1, CMP-2, CMP-3, CMP-4, CMP-5, CMP-17, MW-125, MW-308N, MW-308S, and FM-105) were submitted for chemical analysis of total metals by EPA Method 6010B/6020 for As and Pb.

Investigation-Derived Waste Storage and Disposal

Investigation-derived waste (IDW) generated from purging groundwater for sampling by Hart Crowser will be transported and transferred to a 1,100-gallon poly tank stored on site within a locked fence area at Pier 2-East (adjacent to SW Florida Street). Wastewater will periodically be picked up via tanker truck and transported to the Phillip Services facility in Kent, Washington for treatment. Wastewater disposal will be managed under an existing Phillip Services waste profile developed for wastewater during the Phase I Groundwater Confirmation Monitoring Program (GWCMP).

Dedicated disposable sampling equipment such as gloves, tubing, and Tyvek will be disposed of as solid waste.

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APPENDIX C MONITORING WELL BORING LOGS

List of Well Completion Reports

CMP-1
CMP-2
CMP-3
CMP-4
CMP-5
CMP-15
CMP-17
MW-26R
MW-36

MW-44 MW-125

MW-308A(N)

MW-308B(S)

FM-105

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.



Exploration Log Key

ţ	Aspect cons	ulting				Project	Numb	er & IVI	lonitoring Well C Well Number	onstruction Log Sheet
	IN-DEPTH PERS	SPECTIVE					0106		CMP-1	1 of 1
roject Name	Southwest Ha	arbor P	roiect						Monument Ele	
cation	Seattle, Washing								 Water Elev. (ft	
illing Method			D/4" ID ;	Hol	t Drilling	j ·			Start Date	September 19, 2001
=	hod 2" Diameter, Spl								Finish Date	September 19, 2001
pth	Well Construction	PID (ppm)	H2S (ppm)	S	Blows/ 6"	Sample ID	Mtl. Graphic		Descr	iption
N K	8" Steel Monument		,,,,	\parallel	·		0000		CRUSHED GRA	VEL SURFACE
	Type L-868 Concrete seal				•		00000	1-1/4" m	ninus crushed gravel	
	Bentonite chips	0	- 0		12 15 17	S-1		Dense,	FII damp, dark brown SAND;	
				6				,		,
	Filter Pack, 10 X 20 & 20 X 40 Colorado Silica Sand		Wyyn banna a banna a banna a banna a banna a banna a banna a banna a banna a banna a banna a banna a banna a b							
	Well Screen 2" ID SCH 40 PVC, 0.01" slot size	0	0		13 8 6	S-2		-grades	to medium dense	
y	11.5' ATD							Medium grains	dense, wet, black SAND;	sand fine to medium, trace
		0.	0		3 6 10	S-3				
								Medium	dense, wet, gray-brown S	AND; sand fine to medium
	PVC Threaded End Cap Filter Pack, 10 X 20 & 20 X 40 Colorado Silica Sand	0	0		4 6 10	S-4				
				٥				Bottom	of exploration boring at 19	feet.
0		•								
	pler Type (ST): 3.25" OD D & M Split-	Spoon Ri	ing Samı	oler	G - 0	Tests: Brain Siz ermeabi			Logged by Approved I	

		Aspect cons	sulting SPECTIVE				Project	olog t Numb 0106	
Prolec	t Name	Southwest H	arbor P	roiect			221	0100	Monument Elev. (ft mllw) 23.04
Location		Seattle, Washin							Water Elev. (ft mllw) 10.5
	Method	Hollow Stem Au		D/4" ID :	Ho	t Drilling			Start Date September 18, 2001
_	ing Metho								Finish Date September 18, 2001
Depth feet		ell Construction	PID (ppm)	H2S (ppm)	S	Blows/	Sample	Mtl. Graphic	Description
		Steel Monument		(PPIII)	+			0,00	
-		ype L-868 oncrete seal	,					000000000000000000000000000000000000000	oroad ballast, 1-1/4" minus gravel with sand; trace silt
-	₩ N	entonite chips	0	0		12 50/6"	S-1		Very dense, damp to moist, brown SAND; sand fine to medium Very dense, damp, brown GRAVELLY SAND with SILT
-5					NOI				
-	×	lter Pack, 10 X 20 & 20 40 Colorado Silica Sand	0	0		18	S-2	-00000000000000000000000000000000000000	Dense, damp, dark brown SANDY GRAVEL
-		/ell Screen 2" ID SCH 40 VC, 0.01" slot size				16 12			SLAG AND KILN BRICK
					0	12		\otimes	Slag and kiln brick like material at 8.5'
- 10									
	12	2.5' ATD	0	0	0	23 15 9	S-3		Yellow kiln brick like material in shoe at 12'
-15				,					-drills like gravels
-	Fi	VC Threaded End Cap Ilter Pack, 10 X 20 & 20 40 Colorado Silica Sand	0	0		9 16 8	S-4		Medium dense, wet, brown GRAVELLY SAND; some slag and brick
.	··············^	40 Colorado Silica Sariu			H				Bottom of exploration boring at 19 feet.
20	4								
					With the state of				
and the state of t									
.	Sampler	Type (ST):			Ш	Lab T		<u>1 </u>	Logged by: RRH
	3.2	5" OD D & M Split-S	Spoon Rii	ng Samp	ler		rain Size		Approved by: WVG
	O No	Recovery					ermeabil loisture (ot '
		OD Split-Spoon San	nnler	₩ ,	Mat				tatic Water Level Figure No.

<u>.</u>	Agree ¹					Ge	oloa	ic & Monitoring Well Construction Log
	Aspect cons	sulting SPECTIVE				Project	Numb	er Well Number Sheet
	Cauthurant II	arbar D	wa!a.t			990	0106	CMP-3 1 of 1
Project Name	Southwest H Seattle, Washin		roject					Monument Elev. (ft mllw) 17.75 Water Elev. (ft mllw) 8.2
Location Drilling Method	Hollow Stem Au		י כון ייאר	Halt I	Drilling			Start Date September 19, 2001
Sampling Method					אווווווק	!		Finish Date September 19, 2001
Depth Depth	Z Diamotor, op	PID	H2S	7.3	Blows/	Sample	Mtl.	
feet Well	Construction	(ppm)	(bbw)	Т	6"	ID	Graphic	
	Steel Monument pe L-868					,	0,00	ASPHALT SURFACE FILL
	ncrete seal						0.00	-road ballast, 1-1/4" minus crushed gravel; trace sand and silt;
	norcte scar							cobbles in cutting Dense, damp, brown GRAVELLY SAND; trace silt, sand fine to
								coarse
	ntonite chips	0	0		6	S-1		
					9 26			
-				H				;
								·
1 1 1 1	ter Pack, 10 X 20 & 20 40 Colorado Silica Sand		į					
							1000	Very dense, moist, brown SANDY GRAVEL; sand fine to coarse
							1000	-very gravelly to 11 feet
							0000	very gravery to 11 loca
		0.	0		13	S-2	1000	
				H	31 42		0000	
				М	-		0000	
9.5	5' ATD						0000	
- 10							0000	
	ell Screen 2" ID SCH 40							Loose, wet, dark brown GRAVELLY SAND with SILT; sand fine to
	C, 0.01" slot size							coarse
- :								
		0	0		3	S-3		
				H	<u>3</u> 5 3			
					3			
-15								Medium dense, wet, brown SANDY GRAVEL with SILT
								Modulii dense, wet, blown orayb i Gravele war ole i
PV PV	C Threaded End Cap	0	0		4	S-4	900	·
L Filt	er Pack, 10 X 20 & 20				9 11			TIDAL MARSH DEPOSITS Very stiff, moist, light brown SANDY SILT; sand fine
	0 Colorado Silica Sand			9			ШЩ	Bottom of exploration boring at 17.5 feet.
								bottom of exploration boning at 17.5 leet.
								•
-20								
15								
Sampler								
Sampler	Type (ST):	_			Lab T		-	Logged by: RRH
3.2	5" OD D & M Split-9	Spoon Rii	ng Samp			rain Size ermeabil		Approved by: WVG
	Recovery					oisture		t
2" (DD Split-Spoon Sar	npler	▼ ∨	Nater	r Leve	I (ATD)	∑ Sta	atic Water Level Figure No.

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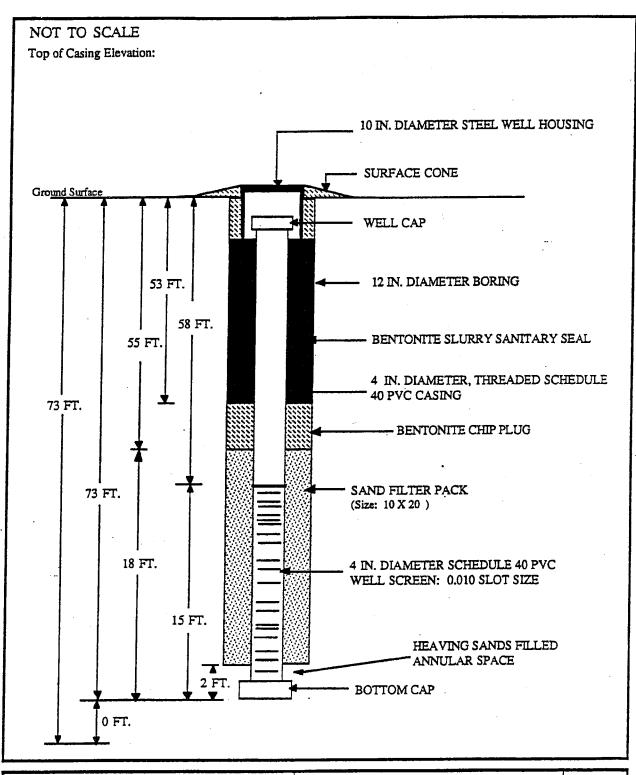
		Aspectcon	sultina				Ge	olog	ic & M	lonitorir	ng Well C	Constru	uction Log
		IN-DEPTH PER	RSPECTIVE				Project 99	t Numb 0106	er	l .	Number CMP-4		Sheet 1 of 1
Proje	ct Nam	e Southwest F	larbor F	roject						L	Monument Ele	ev. (ft mllw	
Locat	ion	Seattle, Washir	gton								Water Elev. (ft mllw)	7.93
Drillin	g Meth					t Drilling	g				Start Date		ber 18, 2001
Samp	oling Me	ethod 2" Diameter, Sp	olit Spoon	Sample	r				T		Finish Date	Septem	ber 18, 2001
Depth feet		Well Construction	PID (ppm)	H2S (ppm)	S T	Blows/ 6"	Sample ID	Mtl. Graphic				cription	
	M	8" Steel Monument Type L-868						0000			ASPHALT	SURFAC	E
F		Concrete seal						000	-railroad	d bedding, 1	-1/4" crushed		ace sand
_		Bentonite chips	0	0		10 20	S-1		Dense, o structure		n SAND; sand	d fine to m	edium; no visible
_ _5		Banoine dipa				28							
_		Filter Pack, 10 X 20 & 20 X 40 Colorado Silica Sand				•							
_		Well Screen 2" ID SCH 40 PVC, 0.01" slot size	0	0		10 19 22	S-2						
-10 -												·	
- - -		12.32' ATD	0	0		2 3 4	S-3		-grades -become	to loose es wet			
15 			0	0		0	S-4		Loose, v	wet, gray SA	ND; few silt,	trace grav	els, sand fine to medium
						0 2 3					•		
		PVC Threaded End Cap Filter Pack, 10 X 20 & 20			8	Ū			Pottom (of ovaloratio	on boring at 1	7 E foot	
-20		X 40 Colorado Silica Sand				:			BOROTT	or exploration	on boing at 1	7.5 leet.	
F				ļ.									
<u> </u>													
_													
			,										
	Sam	npler Type (ST):	1	1		Lab 7	Tests:				Logged by	r: RI	RH
	П	3.25" OD D & M Split-	Spoon Ri	ng Samp	oler	G - G	rain Size			a	Approved		/VG
	Ō	No Recovery		·			ermeabii Ioisture		t	7			
		2" OD Split-Spoon Sa	mpler	Y '	Wat				atic Wate	er Level	Figure No.		

SouthWest Harbor Project SouthWest Harbor Project South Water Elev. (ft milw) 24.07 South Water El	· ·	Aspect con	sulting				Project	t Numb	er	onitoring Well C		Sheet
Location Seattle, Washington Hollow Stem Auger 8" ODJA" ID; Holt Drilling Start Date October 29, 2001 Sampling Method 2" Diameter, Split Spoon Sampler, 140 lb hammer PiD Pept (gim) P23 8 Blows Sampler, 140 lb hammer PiD Pept (gim) P23 8 Blows Sampler, 140 lb hammer PiD Pept (gim) P23 8 Blows Sampler, 140 lb hammer PiD Pept (gim) P23 8 Blows Sampler, 140 lb hammer PiD Pept (gim) P23 8 Blows Sampler, 140 lb hammer PiD Pept (gim) P23 8 Blows Sampler, 140 lb hammer PiD Pept (gim) P23 8 Blows Sampler, 140 lb hammer PiD Pept (gim) P23 8 Blows Sampler, 140 lb hammer PiD Pept (gim) P23 8 Blows Sampler, 140 lb hammer PiD Pept (gim) P23 8 Blows Sampler, 140 lb hammer PiD Pept (gim) P23 8 Blows Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer PiD Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Sampler, 140 lb hammer Pept (gim) P23 8 Samp		0					990	0106		CMP-5		1 of 1
Drilling Method Method Mode Mo	-			roject							, ,	
Sampling Method 2" Diameter, Split Spoon Sampler, 140 lb hammer Finish Date October 29, 2001				2/40/15							-	
Depth well Construction PiD H23 5 Slower Sample Math. Snaph. CONCRETE ROAD BED	=											
Well Construction Copm C		lod 2" Diameter, Sp		1	77		T	T	1	Finish Date	October 2	29, 2001
Modris Flush Mount Concrete seal Sentonite chips O O O I 16 12 15 Filler Pack, 10 x 20 & 20 X 40 Colorado Sitica Sand V.Wrap Well Screen 2' to SCH 40 FVC, 0.01* dot size O O O O O O O O O O O O O O O O O O O		Vell Construction		1						Desc	cription	
Concrete seal Medium dense, damp, brown SAND; sand fine to medium NATIVE DEPOSITS Medium dense, moist, brown SAND with gray SILTY SAND interbeds to 2° Interbeds to 2° Loose, wet, gray SLIGHTLY SILTY to SILTY SAND; sand fine to medium Concrete seal Concre	1/ // 1/ //				П			9 6 d		CONCRETE	E ROAD BE	D
Concrete seal Bentonite chips 0 0 1 16 12 15 Filter Pack, 10 X 20 & 20 X 40 Colorado Silka Sand 10 0 0 5 5 5-2 The rest of Sand Sand Sand Sand Sand Sand Sand Sand		Worns Flush Wount				•		1000		F	ILL	
Bentonite chips 0 0 1 16 12 15 Filter Pack, 10 X 20 & 20 X 40 Colorado Silica Sand X 40 Colorado Silica Sand 2 10 Sch 40 PVC, 0.01* slot size 0 0 0 5 5 S-2 Medium dense, damp, brown SAND; sand fine to medium NATIVE DEPOSITS Medium dense, moist, brown SAND with gray SILTY SAND interbeds to 2* 10 11.0* ATD 11.0* ATD 15 PVC Threaded End Cap 0 0 0 4 7 S-4 - grades to medium dense with trace gravel		Concrete seal						000	Dense, da	amp, brown SANDY GR ad fine to medium	AVEL; trace	e silt, trace wood, tr
Filter Pack, 10 X 20 & 20 X 40 Colorado Silica Sand V-Wrap Well Screen 2**D Sch 40 PVC, 0.01** slot size 0 0 0 5 6 5 S-2 11.0* ATD 11.0* ATD 0 0 2 3 3 6 PVC Threaded End Cap 0 0 0 4 4 7 Filter Pack, 10 X 20 & 20 X 40 PVC, 15 Sill TY SAND; sand filter packs to medium dense, moist, brown SAND with gray SILTY SAND; sand filter packs to medium dense with trace gravel		Bentonite chips						2.2.	Medium d	ense, damp, brown SA	ND; sand fir	ne to medium
Filter Pack, 10 X 20 & 20 X 40 Colorado Silica Sand V.Wrap Well Screen 2º 10 SCH 40 PVC, 0.01° slot size 0 0 5 5 S-2 Medium dense, moist, brown SAND with gray SILTY SAND interbeds to 2" Loose, wet, gray SLIGHTLY SILTY to SILTY SAND; sand fin medium 11.0° ATD 0 0 2 3 S-3 6 S-4 S-4 grades to medium dense with trace gravel			0	0			S-1					
Filter Pack, 10 X 20 & 20 X 40 Colorado Silica Sand V-Wrap Well Screen 2* ID SCH 40 PVC, 0.01* slot size 0 0 5 5 S-2 Medium dense, moist, brown SAND with gray SILTY SAND interbeds to 2" Loose, wet, gray SLIGHTLY SILTY to SILTY SAND; sand filt medium 11.0* ATD 0 0 2 S-3 6 5 PVC Threaded End Cap 0 0 4 S-4 7 -grades to medium dense with trace gravel					14	12 15			-			
NATIVE DEPOSITS V-Wrap Well Screen 2* ID SCH 40 PVC, 0.01* slot size 0 0 5 5 6 5 S-2 Loose, wet, gray SLIGHTLY SILTY SAND; sand fir medium 11.0' ATD 15 PVC Threaded End Cap 0 0 4 7 S-4 PVC Threaded End Cap 0 0 4 4 7 PVC Threaded End Cap 0 0 4 4 7 PVC Threaded End Cap 0 0 4 4 7 PVC Threaded End Cap 0 0 4 4 7			,		0	13						
NATIVE DEPOSITS V-Wrap Well Screen 2* ID SCH 40 PVC, 0.01* slot size 0 0 5 5 5 S-2 Medium dense, moist, brown SAND with gray SILTY SAND interbeds to 2** Loose, wet, gray SLIGHTLY SILTY to SILTY SAND; sand find medium 11.0* ATD 0 0 2 3 6 6 5 S-3 -grades to medium dense with trace gravel	1. 1.				Н							
V-Wrap Well Screen 2*ID SCH 40 PVC, 0.01* slot size 0 0 5 5 6 5 S-2 Dosch 40 PVC, 0.01* slot size Dosch 40 PVC, 0.01* s		X 40 Colorado Silica Sand										
10 0 0 5 S-2 DSCH 40 PVC, 0.01" slot size	; []											
Medium dense, moist, brown SAND with gray SILTY SAND interbeds to 2" 10 11.0' ATD 0 0 2 5 5 5-2 Loose, wet, gray SLIGHTLY SILTY to SILTY SAND; sand find medium 15 PVC Threaded End Cap 0 0 4 4 7 S-4grades to medium dense with trace gravel										NATIVE	DEDOCITO	
Medium dense, moist, brown SAND with gray SILTY SAND interbeds to 2" 11.0' ATD 15. S-2 Loose, wet, gray SLIGHTLY SILTY to SILTY SAND; sand firmedium 0 0 2 3 6 6 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	1 1 1 1						•					
10 11.0' ATD 0 0 5 6 5 S-2 Loose, wet, gray SLIGHTLY SILTY to SILTY SAND; sand find medium 0 0 2 3 6 S-3 PVC Threaded End Cap 0 0 4 S-4 7 S-4 -grades to medium dense with trace gravel				}					Medium de interbeds	ense, moist, brown SAI to 2"	ND with gray	y SILTY SAND
11.0' ATD 11.0' ATD 0 0 2 3 6 6 PVC Threaded End Cap 0 0 4 7 S-4grades to medium dense with trace gravel									TROIDCUS	10 2		
11.0' ATD 11.0' ATD 0 0 2 3 6 6 7 PVC Threaded End Cap 0 0 4 7 S-4 -grades to medium dense with trace gravel	十十十											
11.0' ATD 11.0' ATD 0 0 2 3 6 S-3 PVC Threaded End Cap 0 0 4 S-4 grayes to medium dense with trace gravel			0	0		5 6	S-2					
11.0' ATD 11.0' ATD 0 0 2 3 6 S-3 PVC Threaded End Cap 0 0 4 S-4 -grades to medium dense with trace gravel		4				5						
11.0' ATD 11.0' ATD 0 0 2 3 6 S-3 PVC Threaded End Cap 0 0 4 S-4 -grades to medium dense with trace gravel												
11.0' ATD 11.0' ATD 0 0 2 3 6 S-3 PVC Threaded End Cap 0 0 4 S-4 -grades to medium dense with trace gravel					Ĭ							
11.0' ATD 11.0' ATD 0 0 2 3 6 S-3 PVC Threaded End Cap 0 0 4 S-4 -grades to medium dense with trace gravel												
Threaded End Cap 0 0 4 S-4 grades to medium dense with trace gravel												
Threaded End Cap 0 0 4 S-4 grades to medium dense with trace gravel								ШП	Loose, we	t, gray SLIGHTLY SILT	Y to SILTY	SAND: sand fine to
5 PVC Threaded End Cap 0 0 4 S-4 -grades to medium dense with trace gravel	₹. .	11.0' ATD							medium	, ,		•
5 PVC Threaded End Cap 0 0 4 S-4 -grades to medium dense with trace gravel			,									
5 PVC Threaded End Cap 0 0 4 S-4 grades to medium dense with trace gravel												
5 PVC Threaded End Cap 0 0 4 S-4 -grades to medium dense with trace gravel				0		2	6.2					
5 PVC Threaded End Cap 0 0 4 S-4 grades to medium dense with trace gravel			0	U		3	O-0					
- Grades to medium dense with trace gravel						6						
- Grades to medium dense with trace gravel					М							
-grades to medium dense with trace gravel					ŀ							
- Grades to medium dense with trace gravel	5				Ш							
8 8		PVC Threaded End Cap	0	0			S-4		-grades to	medium dense with tra	ce gravel	
						8						
		:										
					M							
					Ш							
0 0 1 S-5			0	0			S-5					
1 LAWTON CLAY										LAWTO	N CLAY	
Soft, wet, gray CLAYEY SILT						١			Soft, wet, g	gray CLAYEY SILT		
Bottom of exploration boring at 19 feet.					A			1111	Bottom of e	exploration boring at 19	feet.	
2 State of exploration borning at 10 lock						Ì						
Complet Tara (OT)		T (OT)							· · · · · · · · · · · · · · · · · · ·			
Sampler Type (ST): Lab Tests: Logged by: RRH 3 25" OD D & M Split-Spoon Ring Sampler G - Grain Size Approved by: WVG			O	0	1.			<u>.</u>				
P - Permeability	=		spoon Rir	ng Samp	ler					Approved I	by: VVV	'G
○ No Recovery M - Moisture Content 2" OD Split-Spoon Sampler Water Level (ATD) Static Water Level Figure No.									t			

	Aspectcons	sultina							Monitoring Well Construction Log			
	À	IN-DEPTH PER	SPECTIVE				Project	: Numb)106	er	Well Number CMP-15	Sheet 1 of 1	
Project Na	me	Southwest H	arbor P	roject				7100		Monument Elev		
Location		Seattle, Washing		TOJCCE						Water Elev. (ft		
Drilling Me	thod	Hollow Stem Au		7/4" !D •	. Llai	lt Drillin	~			Start Date	November 5, 2001	
_		2" Diameter, Sp								Finish Date	November 5, 2001	
Depth Depth	Metriou	Z Diameter, Spi			1, 1			I	1	FIIISH Date _	November 5, 2001	
feet		Construction	PID (ppm)	H2S (ppm)	T	Blows/ 6"	Sample ID	Mtl. Graphic		Descri		
		teel Monument a C-868						000		ASPH FIL	ALT	
-		crete seal tonite chips	· 0	0		29 35	S-1			se, damp, brown SANDY		
-5	1.	r Pack, 10 X 20 & 20 0 Colorado Silica Sand				20		000 20000000000000000000000000000000000	trace woo	noist, dark brown to black od and slag-like material dense, moist, black SAND	SANDY GRAVEL with SILT;	
-10]∷ 2" 10	rap Well Screen D SCH 40 PVC, " slot size	0	0	A	3 8 11	S-2					
. ¥	12.0	'ATD	0	0		4 7 9	S-3		-wet at 12	2.5'		
-15	PV.C	Threaded End Cap	0	0		4 6 16	S-4		Medium d shell fragi	TIDAL MARSH lense, wet, brown SAND; nents; sand fine to mediu	I DEPOSITS trace silt, trace organics, trac m; slight creosote-like odor -	
,								H	Bottom of	exploration boring at 17.4	feet.	
			-				:					
Sa I	3.25' No R					P - Pe M - M	rain Size ermeabili loisture C	ty Content	t atic Water	Logged by: Approved by Level Figure No.	RRH r WVG	

		À	pectcons	SPECTIVE				Project	Numb)106	er Well Number Sheet CMP-17 1 of 1
Projec	4 Nlam		outhwest H	orbor E	Project			990	100	Monument Elev. (ft mllw) 18.61
-					TUJECE					
Locati			eattle, Washin							Water Elev. (ft mllw) 7.3
Drilling			ollow Stem Au							Start Date November 6, 2001
Samp	ing Me	ethod 2"	Diameter, Sp	it Spoon	Sample	r, 14	10 lb ha	mmer	·	Finish Date November 6, 2001
Depth feet		Well Cons		PID (ppm)	H2S (ppm)	S	Blows/ 6"	Sample ID	Mtl. Graphic	
		8" Steel N Type C-8	fonument 68						000	1
		Concrete	seal		44.4				300000000000000000000000000000000000000	Very dense, moist, dark brown GRAVELLY SAND; trace s
- -5			chips ck, 10 X 20 & 20 orado Silica Sand	0	O		15 26 28	S-1		
		V-Wran \	Vell Screen	0	0		10 15	S-2		Dense, moist, dark brown SAND; sand fine to medium; regrains visible
_ -10			H 40 PVC,				19			- 1" silt lense at 8.5'
- - -		11.3' ATE)							Medium dense, wet, dark gray SAND with silt interbeds; s to medium
_				0	0	OKILLINIA	5 6 8	S-3		
- 15 -		PVC Three	eaded End Cap	0	0	H. C. C. C. C. C. C. C. C. C. C. C. C. C.	5 6 6	S-4		Bottom of exploration boring at 16.5 feet.
_										
	Sam	l pler Type			<u> </u>			Tests:		Logged by: RRH
		3.25" O	D & M Split-9	Spoon Ri	ng Samp	oler		irain Size ermeabil		Approved by: WVG

	•	Aspectcons	sulting				Ge	olog	ic & Mo	onitoring Well (Constru	ıction Log
		IN-DEPTH PER	SPECTIVE					t Numb 0106	er	Well Number MW-26(R)		Sheet 1 of 1
Project	Name	Southwest H	arbor F	roiect				0100		Monument El	ev. (ft mllw	
Locatio		Seattle, Washin							•	Water Elev.	•	7.59
Drilling	Method	Hollow Stem Au		D/4" ID ;	Но	lt Drillin	g			Start Date		per 6, 2001
Sampli	ng Metho									Finish Date		per 6, 2001
Depth feet	We	ell Construction	PID (ppm)	H2S (ppm)	s	Blows/	Sample	Mtl. Graphic		Des	cription	
		" Steel Monument		(ррил)	+	<u> </u>		e de la la la la la la la la la la la la la		ASPHAL	T SURFAC	E
		Type C-868						0,00			ILL	
		Concrete seal							Medium o	dense, damp, brown SA gravel medium to coars	NDY GRA	VEL; sand fine to
								2.00	Medium o	lense, damp, brown SA	ND; sand	ine to medium
	▋₿₿	Bentonite chips	0	0		5	S-1					
						10 6						
-5		Filter Pack, 10 X 20 & 20										
		40 Colorado Silica Sand										
- :							İ		-trace she	ell fragments in cuttings		
:										g.		
- <u> </u>												
<u> </u>			0	0		2	S-2		grades to	wet at 0'		
<u> </u>	· E I v	/-Wrap Well Screen		"		3 6	3-2		-grades it	o wet at 9		
:	1 1 1	"ID SCH 40 PVC, 0.01" slot size				5						
_ :	:目:I°	5.01 SIOL SIZE	<u> </u>		O							•
ŀ												
-10												
- 10												
₩:												
- 首.	:目:11	1.0' ATD										
-	:目:1							THE		TIDAL MAR	SH DEPOS	ITS
	:目:		0	0		4	S-3		Medium d	ense, wet, dark gray to	brown SII	TY SAND with SILT
- [目丨	,				7 17			interbeds;	trace organics, trace s	hells	TT OF WILL OLD
						17						
- :					Н							
			-									
-15	目:		0	0		5	S-4					
:			U	0		5 6 5	3-4					
_ :					19	5			, ,			
:									-grades to	loose at 16'		
_	. 🕮 : . P'	VC Threaded End Cap										
									Bottom of	exploration boring at 1	7 feet.	
_										•		
	.											
_												
	Sample	r Type (ST):				Lab 7	L Γests:			Logged by	/: RF	RH
	3.25" OD D & M Split-Spoon Ring Sampler					G - G	Grain Size			Approved		VG
	No Recovery					P - Permeability M - Moisture Content						
	_	OD Split-Spoon San	nnler	_	\^/~ '					ovol Figure N		
	V2 -	OD OPIR OPOUR GAR	inhie!	<u></u>	vvat	ei reve	H(AID)	<u>*</u> 20	atic Water I	Level Figure No		



a mara	Well MW36 Completion Diagram	Figure
enviro	Date Well Completed: 7/8/90 Geologist/ Engineer: M. S. SUROWIEC	C-39A
Job 3. 900625 Apprones Date: 118.90		

			Log	of Boring	ring MW44				
Analytical Results	Blow Count	Sample Recovery (%)	(ft)	Soil USCS Profile Symbo	ol Soil Description	PID/ Remarks			
MW44-0.5 ft	4,6,	90	0.		ASPHALT, 6 inches. Loose to medium dense, brown, fine SAND:	4.2 ppm			
WTPH-418.1	12	90	-	SP	laminated in places; trace silt; dry; no sign of	no odors			
	2,4,6	90		H	contamination. (Hydraulic Fill) - occasional shell fragments and charcoal.				
MW44-5 ft.			5 -		- 2 inch bed of shell fragments and stony debris	3.4 ppm			
WTPH-418.1	5,6,6	90			(slag?); moist.				
	5.4.4	90	_		- dark gray, wet, slightly brackish odor.	slight odd			
	3,3,3	90	10						
MW44-10 ft.	2.4.5	90	10	SP/ ML	Loose, dark gray, silty, fine SAND and SILT: laminated and bedded; minor shell fragments;	1.8 ppm			
WTPH-418.1	7.6.7	90	-		plant fibers along laminae, 6" reedy bed at 10.5	slight sulfur od			
	2.2.3	90			wet. (Tidal Marsh soil)				
MW44-15 ft.	1,1,1	15	15	SP	Very loose, dark gray, fine SAND. (Fluvial Deltaic soil)	no odor			
WTPH-418.1	2,4,4	90	4	. ML	Soft, dark gray SILT: laminated; occasional	no odor			
	2,2,2	90		CL	reeds; wet. Soft to medium stiff, dark gray, Clayey SILT:	2.7 ppm			
•	225	90	20 -		laminated; wet; peaty debris on laminae; occa- sional shell fragments; sandy beds toward base.	slight sulfur ode			
	2,3,3	60		SP	Very loose to medium dense, dark gray, fine				
	3,4,5	90	1		SAND: laminated with occasional thin clayey silt interbeds; shell fragments and/or plant	2.4 mm Backgrour			
	3,5	90	25		debris in places. (Fluvial Deltaic soils)	0.0 ppm			
MW44-25 fl. WTPH-418.1	4,4,4	90			- 4" clayey silt interbed at 24 feet.	below 25'.			
	2.3,2	80	[- 4" clayey silt interbed.	0.0 ppm			
	1,1,1	90	· [slight sulfur odd			
	2,1,1	60	30 -	CL	Soft, green gray, Clayey SILT: laminated,	0.0 ppm			
	3,6,1	90	ſ		with soft sediment deformation.	slight			
	3,8,11	90	1	SP	Loose to medium dense, dark gray, fine SAND:	sulfur odo			
	11,17,	90	35 -		laminated; occasional silt laminae, shells, plant debris; wet; no sign of contamination. (Fluvial				
	13,15,	90	33		Deltaic beds)				
	16 8,11,				- silt laminae with soft sediment deformation.				
	14 8,11,9	90	ŀ		- peaty layer - shell fragments	no odor			
		90	40 +		- अल्प एवर्डाालाल	0.0 ppm			
	1 1				(continues on page 2)				
		İ	1						
en	viro	5		Ge	ate Drilled: 6-23-92 cologist/Engineer: S.H. Evans				
······································	·				puipment: 6" i.d. Hollowstern Auger ound Water Level When Drilling: 9.5 feet	A-			
b No.900819 Task 15.3	Appr.:	Da	te:		oject Name: Southwest Harbor Project	page 1 of 2			

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		I	og of	Вогіг	ng MW44 (cont.) 15 / Scletch 58' - 73'					
Analytical Results	Blow Count	Sample Recovery (%)	(π)	Soil Profile	USCS Symbo		PID/ Remarks			
	4,4,4	90	40			(continued from page 1)	0.0 ppm no odor			
•	2,3,5	70			СL	Soft, green gray to dark gray, Clayey SILT: laminated; occasional sand beds, shell fragments,	transitional			
•	3,3,3	90	٠,			soft sediment deformation; no evidence of	sequence			
MW44-45 ft.	2.2.2	100	45-			contamination. (Fluvial Deltaic soil) - very dark gray bands, Interval sampled.	0.0 ppm			
WTPH-418.1	1,2,3	90				- increasing sand interbeds.				
	3,2.5	90			SP/	Loose and soft, interbedded, dark gray and dark green gray, fine SAND and Clayey SILT: shell	slight sulfur odor			
	5,6	90	50 -	H	CL	fragments, peary debris; wet; no sign of	no odor			
MW44-50 ft	3,2,5	90	307			contamination. (Fluvial Deltaic soil)	0.0 pp m			
WTPH-418.1	1,2,4	90					slight sulfur odor			
.*	4,7,7	90				- clam shells and peaty laminae.				
· ·	3,4,6	90	55-	П						
<u>.</u> .	3,5,9	80			SP	Loose to medium dense, dan's gray, fine SAND: occasional clayey silt laminae; peaty plant	no odor			
	5,9,9	90			51	debris; no sign of contamination. (Fluvial				
	3,5,5	90	60-			Deltaic soil) - 2" peaty silt bed at 59.5".				
	3,4,4	70				Loose, dark gray, Silty fine SAND and SILT:	1			
•	3,4,4	.90	===		SM	wood debris at top; clayey laminae; occasional	no odor			
	3,3,3	90	E			peaty material; no sign of contamination. (Fluvial Deltaic soil)	slight sulfur odor			
MW44-65 ft. M	4,5,8	90	<u>65</u> -		SP	Medium dense to loose, dark gray, fine SAND:]			
Acid/Base/Nutral	7,6,8	90				clean; laminated; wet; no sign of contamination. (Fluvial Deltaic beds)	no odor			
185						- thin silt beds.				
· I	3,3,3	0	70-	Ħ						
76	1,2,3	0		Ħ		•				
of the	2,2,3	5		H						
25	4,4	60		H		- occasional shell fragments	no odor			
MW44-75 ft.	3,2,4	5	75-	_		- Occasional Sien Haginenis				
WTPH-418.1										
]			
			80-			Total Depth: 78.5 feet	Background 0.0 ppm			
						Note: sample interval at approximately 68 feet overdrilled. Sand pack on well squeezed by	oro bbin			
		·	-			native soil after removal of auger, pushing sand up to 58 feet.				
		·		لسبيل		Lup to Jo tect.				
en	viro	S				Date Drilled: 6-23-92 Geologist/Engineer: S.H. Evans				
					E	quipment: 6" i.d. Hollowstem Auger	A-			
					-1 0	Ground Water Level When Drilling: 9.5 feet	page 2 of 2			
ob No.900819 Task 15.3 Ap	opr.:	D	ate:		1	Toject Name: Southwest Harbor Project	hake v or v			

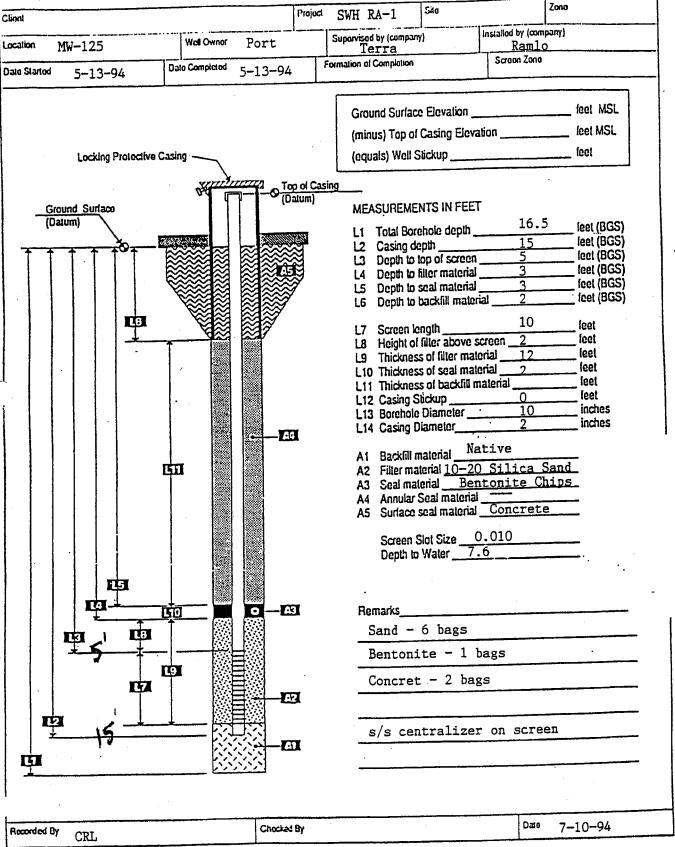
Well Installation

(Above Grade)

Well No. MW-125

Page 1 of 1

URS Consultants, Inc.

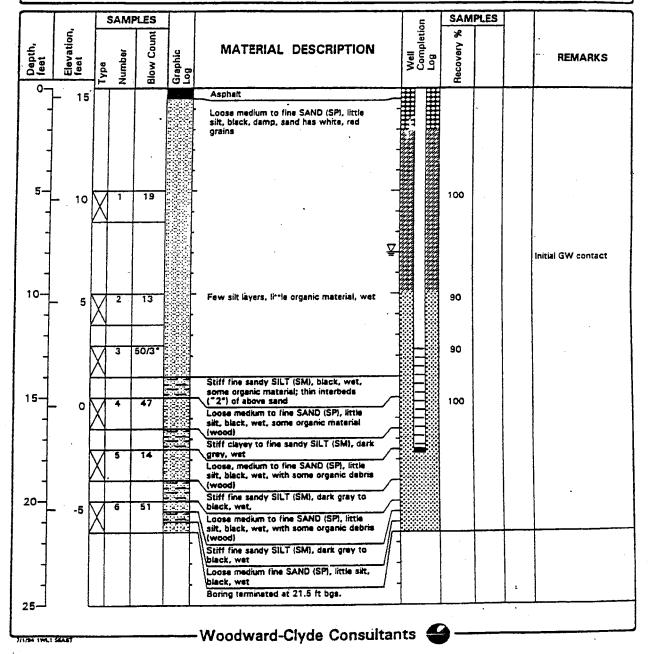


Project: PORT OF SEATTLE Project Location: SEATTLE, WA Project Number: 9360423

Log of Boring MW308A(N)

Sheet 1 of 1 FILL AQ.

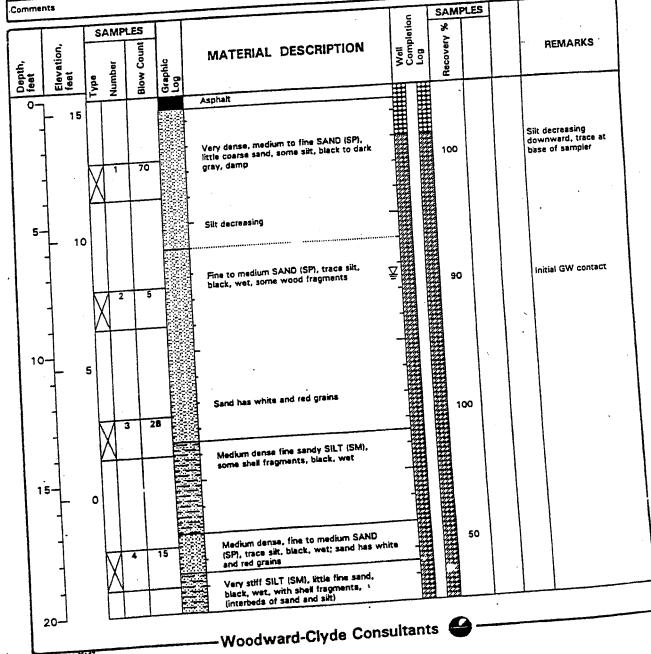
Date(s) Orilled	4/5/94	Logged K. GOFFMAN	Checked By	G. DAVIS
Drilling Method	8"OD 4"ID HOLLOW STEM AUGER	Top of PVC 14.7 Elevation (feet)	Total Depth Orilled (feet)	21.5
Drift Rig Type	MOBILE 8-61	Drilled TACOMA PUMP AND DRILLING	Hammer Weight/ Drop (lbs/in.)	140#/30"
Groundwater Lavel (ft bgs)	8	Sampler SPLIT SPOON	Approx. Surface Elevation (feet)	15.4
Diameter of Hole (inches)	8 Dismeter of 2 Well (inches)	Type of Well Casing SCH 40 PVC	Screen Perforation	.02" (12.5'-17.5')
Type of Send Pack	10/20 SILICA SAND	Type/Thickness CONCRETE / 0-2' BENTONITE of Seal(s)	/ 2-10"	
Comments				



Project: PORT OF SEATTLE Project Location: - SEATTLE, WA Project Number: 93CO423 Log of Boring MW308B(S)

Sheet 1 of 2 EST. AQ.

		Logged K. GOFFMAN	Ву	
	4/4/94	By	Total Depth Drilled (feat)	40.0
rilling	8"OD 4"ID HOLLOW STEM AUGER	Slevetion (feet)	Hammer Weight/ Drop (lbs/in.)	140#/30"
Method		Drilled TACOMA PUMP AND DRILLE	Accept. Surface	15.5
Drill Rig Type	MOBILE 8-61	Sampler SPLIT SPOON	Elevation (IEEL)	
Groundwater Level (ft bgs)	7.5	Type of SCH 40 PVC	Screen Perforation	.02" (35'-40')
Dismeter of	8 : Oismeter of 2 Well (inches)		/2-31	
Hole (inches)	10/20 SILICA SAND	Type/Thickness CONCRETE / 0-2' BENTONITE of Sealts)		
Type of Sand Pack	10/20 SILICA 3A42			



Project: PORT OF SEATTLE Project Location: SEATTLE, WA Project Number: 93CO423

Log of Boring MW308B(S)

Sheet 2 of 2

			SAM	PLES	7		- F	SAM	PLES		
Depth, feet	Elevation, feet	Type	- ·	Blow Count	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	Recovery %			REMARKS
20	5										
-		X	5	50/4*		Dense to very dense flire to medium SAND (SP), trace silt, black, wet, sand has white and red grains	-	100			
25-	10					Dense sitty fine SAND (SM), dark grey to black, wet, some shell fragments, trace organic material					Thin layer wood debris (1") at top of unit
4		M	6	35		Dense fine to medium SAND (SPI, trace silt, black, wet, sand has white and red grains.	-	100			•
30-		Δ				Dense fine sandy SILT (SM), some organic material, dark, gray, wet, some shell fragments; lenses of fine sand, clayey silt					
30-	- •15	X	7	47		Dense silty fine SAND (SM), dark gray, wet, with occasional shells, sandy silt lenses	_	100			·
		X	8	68				100			
35-	20	X	9	94		•		100			,
-		M	10	108				100			
40-		4				· · · · · · · · · · · · · · · · · · ·				·	
	25					Boring terminated at 40 ft bgs.					
45-	-30				:						
7/1/94 TWC1						-Woodward-Clyde Consult	ants (<u> </u>	<u></u>		

		Converse NW		ect Nu	<u>ngi</u>	<u>L 02 17</u>	Monitoring Well Construction Log					
\mathfrak{Z}	7	COMACISE MAN		-351		:	FM-105 Sheet 1 of 1					
rojec		LKLCSÓ					Location SW Spokane St					
ievat	r) noi:	op of Well Casing)		100			Surface Elevation 115					
	Leyel g Mat	Hollow Stem	A	106			Start Date September 28, 1992 Finish Date September 29, 1992					
		ving Weight SPT 140	1b./R 3001	b			Jedienive 27 1992					
epth					0 W = /	Moisture						
225		Well Construction	Tes		12"	Density	Description					
Ì	1.	flush mount steel					FILL					
		monumen:				,	SAND; mostled gray-brown, fine to medium, little gravel, clayer silt lumps with few gravel clasts; medium dense, slightly moist					
- 1												
		concrete surface sea	4		22							
Ì	1				24							
.		bentonite chip seal		1			;					
		patronica curb sard	.				•					
	7.5	2° ID schedule 40 P	vc	H	9		GRAVEL; olive-brown, with fine sand matrix, scattered clay					
.		riser					lumps; loose, slightly moist					
5							***					
			i	#1			· •					
ł				П	9		SILT; olive-gray, few fine sand, few gravel, wood fragments; so					
							slightly moist					
- 1		10/20 silica sand										
	[]			Ш			SAND; dark brown, fine to medium, few course; very loose, we					
					3							
	♀∷											
	_	12/23/92										
)				Ш		21 / 95	wood fragments, gray mottled cizy lumps					
			G		2	21 / 93						
ŀ							gray, few fine to coarse gravel clasts					
j	<u>;</u> :		j	ı								
1		2" ID 0.010" slot, so	hedule	H								
		40 PYC		h	2		•					
							dark gray to black, little silt, few wood fragments					
			1.									
		∃ 31	Ì	Π		İ						
5							•					
1					ŀ		•					
					Ì		***************************************					
		∃ ∷ '					SILT; dark gray to black, little fine sand, wood fragments; yer loose, wet					
İ		크			[throwit was					
	رروع	PVC bottom cap	FM-10		2							
			5 N2-71	13-4	1		drive shoe has pitch black silt with medium strong petroleum/					
		native backfill	ł		}		eder (Oppm) with charcoal lump					
- 1	. 722	The first Annual Title		-			Bottom of boring at depth 19 feet. Piesometer installed to de					
							17 (eet.					
)					- 1		Composite soil sample (FM-105-C) collected from 0-10 feet. Less than I ppm total organic vapors detected by OVM field					
	-				ļ		screening of each soil sample.					
					į							
	-				1		:					
		•			l							
	1		Ì		ļ	. 1						
			ř		ļ							
-		•					_					
		•					•					
- 1												
		Sampler Type:		-	ተ . ኤ ጥ	Cests:	Logged by: CJP					
	ST -	. Sambles Tabe:				Chemical (. •					

APPENDIX D GROUNDWATER SAMPLING FORMS

GROUNDWATER SAMPLING FORMS HART CROWSER, INC.

	Gro	roundwater Sampling Data - Well I.D								CMP-1						
	Project			Port of	Seattle - T	erminal 5		Date/Time Sampled 6/4//0 1040								
	Job No			17627-				Tidally Influenced Yes No								
	Project	Manage	r .	Roger	McGinnis			-			h in Feet	-	17	1	1,0	
	Field R	eps.		CFRIK	MR/AJG				Screened Interval in Feet 7-17						_	
	1) Pu	rging D	ata/Fie	eld Me	asureme	ents: All N	/leasure	ments Relative to Top of Casing (TOC)								
		epth in Fe			J	17'								79		
		of Sedime) in Fee	t /	6.71		-			olume in Gall	and the last of th	-	0,79	652 gal/ft)	
		of Water (2007	5.0		11.83		8	[1" diameter = x .041 gal/ft, 2" d. = x .163 gal/ft, 4" d. = x .653 gal/ft] Purge Volume in Gallons							
	(DTS -	DTW)				4.88		-	Actual Purge in Gallons / ^5L							
		No. of					Po	08	P.							_
	Time	Gallons Purged	pH	Temp in °C	Conduct in mS/cm	Turbidity NTU	Commen	m	V D	acovor	v Color Odor	Shoon Ass	ımı ılatad C	:14/0		
	In1-1	11_	10:102	13.3	0.485	83	0,26	ments Quality, Recovery Color, Odor, Shee 26 18 Tuybid Orange							T 0 -	_
	10.30	21	6.62	13.3	0.484		0,24			IUV	ou j ()ra	nge Color	<u>, 1000</u>	<u>1 1007</u>	Shaen	_
		3/	1	1		68		1	6			11 1- 1		-	21	- 5
	1033		6.62	_	0.482	11.	0.19	+	4		The The	llow fint				
	1036	4L	6.62	1000000	0,482	15	0.20	1	3			\downarrow				
님	- 1039 5L 6.61			13.1	0.482	38	0.20	1	2	1		Clear		V		
SMPL	1040		_								3			3		4
	Comm	ents			99			4776								
)															
		Met	hod		ng Rate in /min	Depth of Equ	Show and a second	Î	Bails	s dry?		Ye	es		No	
F	ourge	Penis	faltic.	0,3	3 4min	M2		5	At no	n of C	asing Volum	100		~ 1		
		,]	/		4	1,	/			J. J. J	ading volum	.00		1		
S	ample	1	/		V	<u> </u>					ter Disposal I				ISITE	_
	-1 -								(Stor	red in	1,000 gallon	temporary of	onsite sto	rage ta	nk.)	
_	2) Sar	npling	Data													
Bot	tle Type	No of Co	ntainers		Analyse	s	Perserv.	Filter			Total Nur	nber of Bot	ttles		9	
	DE	1 - 500n			etals - As, Pl	b	HNO3	N					8			_
_	iber iber	2 - 500n 2 - 1L	nL	cPAHs PCBs			None None	N N			Duplicate	Sample I.I	D			_
Am	ber	2 - 500n		TPH-Dx	w/ silica gel		None	Ν			Field Blar	nk I.D.		_		_
Am	ber	2 - 500n	nL	Bis(2-eth	nylhexyl)phti	halate	None	N	1		Rinseate	Sample I.E).			
													¥.			_
	3) Fie	ld Equi	pment				I		ı Typ	e/Br	and/Seria	l No./Mate	erial/Un	its		
	Pump -	Type/Tul	oina Tvr	ne	Peristaltic	Pump dec	dicated to	ıhina	1/4	"PE	Temn/n⊔	/E.C./D.O	Horiba	11 22-	.10	
	Bailer 7	ACC00	-··· છ • ૪١		N/A	or amp dec	aloutou tt	-birig	water Level Probe Waterline/Solinst/Heron					-		
	Filter T				None				Other ORP Pen				-			
	4) We	II Cond	itions		ок [X	Not OK		Ex	plain	4 BOLTS	HC Standard	Aspec	1 Loc	K	_
												no Standard	s/rield For	ms/GW-	-weii iD	

Gro	undwater S	Sampling D	ata - We	ell I.D.		С	MP-2			
Project Job No Project Field R	o. t Manager	Port of Seattle - 17627-00 Roger McGinnis CFR/KMR/AJG	Terminal 5		- _ Tida _ Wel	e/Time Sam ally Influenc I Depth in F eened Interv	ed eet		7 7-17	945 No
1) Pu	rging Data/Fi		ents: All N	/leasure	ments Relative to Top of Casing (TOC)					
Well De	epth in Feet of Sediment (DTS of Water (DTW) in	s) in Feet	17' 16.7' 11.75' 4.95		Cas [1" d Purç	ing Volume iameter = x .0 ge Volume i	in Gallons 041 gal/ft, 2" o		0.81	
Time 1932 1935 1938 1941 1944 1945 Comm	2 IL 8,92 14.0 0.934 12 0.16 5 2L 8.94 14.0 0.930 11 0.1 3 3L 8.97 14.0 0.928 7 0.1 4L 8.99 14.0 0.928 5 0.0 5 5L 9.01 14.1 0.920 4 0.1				2 -2 -11 -16	1 01	or, Odor, Shee		ated Silt/San	
Purge Sample	Method Penistaltic	Purging Rate in L/min	Depth of Equ Fee \(\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	•	At no		g Volumes sposal Metho gallon temp			No No No No No No No No No No No No No N
2) Sar	mpling Data	,								
ottle Type PDE mber mber mber mber	No of Containers 1 - 500mL 2 - 500mL 2 - 1L 2 - 500mL 2 - 500mL	Analyse Total Metals - As, P cPAHs PCBs TPH-Dx w/ silica ge Bis(2-ethylhexyl)phl	b cleanup	HNO3 None None None	Filter N N N N N N N	Du _l Fie	tal Number plicate Sam eld Blank I.D nseate Sam	ple I.D.		9
Pump	<i>Id Equipment</i> Type/Tubing Ty		c Pump dec	dicated tu		,,	/Serial No. mp/pH/E.C.,		<i>I/Units</i> oriba U-24	2-10
Bailer 7		N/A				Water Level Probe Waterline/Solinst/Heron				
Filter T	ype II Conditions	None OK	X	Not OK	Ex	Oth	Bolts.	Remove A andards/Fie	ASPEA Id Forms/GV	Lak W-Well ID

Gro	undwater	Samplii	ng Da	ita - We	ell I.D.			CMF	P-3			
Project	t	Port of Se	eattle - Te	erminal 5		D	ate/Time	Sampled		12/10	130	55
Job No).	17627-00)			 -	idally Infl	1 1		Yes	1	No
Project	t Manager	Roger Mo	Ginnis			w	/ell Deptl	h in Feet		16	-	
Field R	Reps.	CFR/KMF	R/AJG			s	creened	Interval in	Feet	6-16		
1) Pu	rging Data/F	ield Meas	sureme	nts: All N	Measure	ements i	Relative	to Top	of Casing	g (TOC)		
Well D	epth in Feet)(1 ~		С	asing Vo	lume in G	allons		,32	
Depth	of Sediment (DT	S) in Feet_	-	7.60	15.71	_				x .163 gal/ft,		.653 gal/ft]
Depth	of Water (DTW)	in Feet		7.60			Purge Volume in Gallons					
(DTS -	DTW)		{	3.11		_ A	ctual Pur	ge in Gall	ons	1	51	
Time	No. of Gallons Purged pH		onduct in mS/cm	Turbidity NTU	DO mala Commen	DRP MV Is Quality	Recover	v Color. Od	lor, Sheen, A	ccumulated S	Silt/Sand	
1248	11 0 10 17 1 A log .					-98				Sheen u		High
1252					-107	Oue	v, 100	out, no	overn, u	2 110VV	IIALL	
1256	201 2. 0.50 4 5 6 14 0						-	1		+		
12 36	AT 1200 11. 10 TA 17 TO 18					105	-		\		-	
1361	西岛 4上 9.57 15.5 0.463 5 0.00					108		1	<u></u>		1	
1	1304 5L 9.55 15.5 0.403 4 0.				0.09	1-1B	1		₹	V	NO CO	Val
1305						1						
Comm	ents $\underline{\lambda}'$	Inch wel	11. 100	Ked Cal	0							
)				1								
	Method	Purging F L/mi	Same and recognising the	Depth of Equ			ails dry?			Yes		No
Purge	Peństaltic	0,25 4	-/min	1/1	1.5	At	no. of C	asing Volu	umes		^	
Sample	1	\downarrow		J			Purge Water Disposal Method/Volume ONSITE					
VIII1 100000						(S	tored in	1,000 gall	on tempora	ry onsite sto	rage tar	nk.)
2) Sai	mpling Data											
ottle Type	No of Containers		Analyses	5	Perserv.	Filter		Total N	umber of E	Rottles		9
IPDE	1 - 500mL	Total Metals			HNO3	N						
mber mber	2 - 500mL 2 - 1L	cPAHs PCBs			None None	N N		Duplica	ite Sample	I.D.		
mber	2 - 500mL	TPH-Dx w/	silica gel	cleanup	None	N		Field Bl	lank I.D.			
mber	2 - 500mL	Bis(2-ethylh	nexyl)phth	alate	None	N						
								Rinsea	te Sample	I.D.		
3) Fie	ld Equipmen	t				<i>T</i> 3	ype/Bra	and/Ser	ial No./M	aterial/Ur	nits	
Pump -	Type/Tubing Ty	/pe Pe	eristaltic	Pump ded	dicated to	ubina /	14 PE	Temp/n	H/E.C./D.) Horiba	-ووسلاء	U-10
Bailer		N/.		•		/	Water Level Probe Waterline/Solinst/Heron					
Filter T		-	one					Other	_OR			
4) We	II Conditions		ок Г	+	Not OK		Explain .	3 boHs		perl Ask	port 1	lock -

Gro	undwate	er S	amp	ling Da	ata - We	ell I.D.		CMP-4					
Project	t		Port of	Seattle - T	erminal 5		[Date/Time Sampled 6/2/10 1510					
Job No).		17627-	00	9		100	Tidally Influenced Yes No					
, , , ,	t Manager		~	McGinnis			_	Well Depth in Feet 17					
Field R	Reps.	(CFR/K	MR/ÁJG			- S	Screened Interval in Feet 7-17					
1) Pu	rging Data	a/Fie	ld Me	asureme	ents: All N	/leasure	ments	Relative to Top of Casing (TOC)					
Well D	epth in Feet	_		1	7.0		C	Casing Volume in Gallons /.68					
Depth	of Sediment	(DTS)	in Feet		.30		- _ [1	[1" diameter = x .041 gal/ft(2" d. = x .163 gal/ft) 4" d. = x .653 gal/ft]					
	of Water (DT	W) in	Feet		17			Purge Volume in Gallons					
(DTS -				6.	63		- A	Actual Purge in Gallons ~4L					
Time	ime Purged pH in °C mS/cm NTU Comments:					DD mg/L Commen	my ts: Quality, Recovery Color, Odor, Sheen, Accumulated Silt/Sand						
1500	1116	50	14.3	0.500	136	13.50	177	Turkid. H. brown color, no odar / Sheen					
503	2L 6	.49	14.3	0.479	24	0.65	170	Clear.					
1506	3L 11.	40)	14.3	0,413	22	0,70	167	Inp color					
1509	441	,41	14.2	0.472	23	0,73	103						
WS 1510			500	3									
Comm	nents					80.94	100000000000000000000000000000000000000						
	_			,									
	Γ						1						
	Method			ng Rate in /min	Depth of Equ	The 6000000		Bails dry? Yes No					
	DIL And	12	0,3L/		16	/		No.					
Purge	Peristul	TIL	/שעוי	1	16		A	At no. of Casing Volumes					
Sample	V	70	1	V	V		P	Purge Water Disposal Method/Volume					
			44 A					Stored in 1,000 gallon temporary onsite storage tank.)					
2) Sai	mpling Da	ıta											
Bottle Type	No of Contai	inere		Analyse		Perserv.	Cilia.	Total Number of Balling					
HPDE	1 - 500mL		Total Me	Analyse etals - As, P		HNO3	Filter N	Total Number of Bottles 9					
Amber Amber	2 - 500mL 2 - 1L		cPAHs PCBs			None	N N	Duplicate Sample I.D.					
Amber	2 - 500mL			w/ silica gel	cleanup	None None	N	Field Blank I.D.					
Amber	2 - 500mL	E	Bis(2-eth	nylhexyl)pht	halate	None	N	Pinacete Cample I D					
								Rinseate Sample I.D.					
	l,												
3) Fie	ld Equipm	nent					7	Type/Brand/Serial No./Material/Units					
Pump	Type/Tubin	д Тур	е	Peristaltion	c Pump ded	dicated to	ubing)	1/4" PE Temp/pH/E.C./D.O Horiba U-22- U-10					
Bailer	20 20	net affilia.		N/A				Water Level Probe Waterline/Solinst/Heron					
Filter T	Гуре			None				Other ORP Pen					
4) We	ell Conditio	ons		ок	Y	Not OK		Explain 3 holds / shared off					

Gro	undwa	ater S	Samp	oling D	ata - We	ell I.D.			*	CMP-5	5				,
Projec	t		Port of	f Seattle - T	erminal 5			Date	e/Time	Sampled	61	3/10	1360	`	
Job No			17627				_			uenced	<u> </u>	Yes >	/ 500	No	1
Project	t Manager			McGinnis	1000		-			h in Feet		15		140	ı
Field F	-			MR/AJG)			-			Interval in Fe	eet	5-1			
1) Pu	rging D	ata/Fie	eld Me	asureme	ents: All N	/leasure	- emen			e to Top of	9 				
Well D	epth in Fe	et		15	- /		_	Casi	ing Vo	lume in Gallo	ons		lal		
Depth	of Sedime	ent (DTS) in Fee	t	14.91			[1" di	amete	r = x .041 gal/fi	t, 2" d. = x	.163 ga	I/ft, 4" d. = x	.653 gal/ft]	
	of Water (DTW) in	Feet	0.00	8.71		_	Purg	je Voli	ume in Gallor	าร				
(DTS -					6.19		_	Actu	al Pur	ge in Gallons	3		~5L		
Time	No. of Gallons Purged	pН	Temp in °C	Conduct in mS/cm	Turbidity NTU	DO	0	RP/		y Color, Odor,	Ch		10000		
1247	11	6.41	13.3	0.135	10	ħ.l.	is. Qu	40							
	71	(111		0100	10	0.46	1			ghtly turn	notion c	orbet,	red-oran	g tunt, 1	10 00
1250	21	leith	133	0.233	0	0.20) -	21	C	lear				·	\perp
1253	31	6.42	13.3	0.227	0	0.18	1-	1		/			1		
1256	4L	6.40	13.4	6.227	0	10,2	1	2					Cleur		
1259	5L	6:40	13.4	0.228	Ö	0.15	-	7	Ι,		-2		J		1
WS 1300		1	-9.1			0.11							4-	····	V
Comm	ents	<u></u>	L	. L					1						-
Oomin	CITIS				*										
2			r				7		*********		1 10 10 10 10 10 10 10 10 10 10 10 10 10				
	Meti	hod		ng Rate in _/min	Depth of Equ Fee			Bails	dry?			Yes		No	
Purge	Perist	altic	20	13 Ymin	~ 14	ri .		At no	o. of C	asing Volume	es		1		
0	1				V								-	``	
Sample	4		,	V	V		_			er Disposal N 1,000 gallon t			0ns	ite	
2) Sai	mpling	Data						(3101	eu III	1,000 gallori	temporar	y onsite	storage ta	пк.)	
Bottle Type	No of Co	ntainers		Analyse	s	Perserv.	Filter			Total Num	ber of B	ottles		9	
HPDE	1 - 500n		Total Me	etals - As, Pi	b	HNO3	N	1					-	<u> </u>	
Amber Amber	2 - 500m 2 - 1L		cPAHs PCBs			None	N	4		Duplicate	Sample	I.D.	2		
Amber	2 - 500m			w/ silica gel	cleanup	None None	N	┥		Field Blan	k I.D.				
Amber	2 - 500m	nL		hylhexyl)phtl		None	N						-	7.00	
								-		Rinseate S	Sample I	l.D.			- 2
3) Fie	ld Equi	oment						Тур	e/Bra	and/Serial	No./Ma	aterial/	/Units		
Pump	Type/Tub	oing Typ	е	Peristaltion	Pump dec	dicated t	ubing	1/4	"PE	_Temp/pH/l	E.C./D.C) <u>Ho</u>	riba U₌22	10	
Bailer ⁻	Туре			N/A				zeui		Water Lev	el Probe	Wa	terline/So	linst/Hero	on
Filter T	уре			None						Other	0	RP Pe	20		
4) We	II Cond	itions		ок [Not OK	X	Ex	plain	Strippes	holf				
					ď			- 32		17	IC Standa	rds/Field	Forms/GW-	-Well ID	

Gro	undwa	ater S	Samp	ling D	ata - V	Vell I.I	D.		CMP-	15			
Projec	t		Port of	Seattle	Terminal 5	5		Date/Time S	ampled	6131	10	nayo)
Job No			17627-					Tidally Influe	38		s×	No	
Projec	t Manager	ń.		McGinnis				Well Depth in			17	140[
Field F	\ \		a	MR/AJG				Screened Int		 eet	7-17		
1) Pi	ıraina D.	(ata/Fi	old Me:	asurem	ents. A	II Maasi	- romo	nts Relative					
1) 1 4	nging D	utu/i it	iu wice	asur erri	ins. A	ii ivicasi	ii enie	nis Relative	ειο τορ	or Casing	(100)	to an	
Well D	epth in Fe	et			. /		- 120° / 1	Casing Volur	me in Gall	ons		1.19	
	of Sedime	1A 1	1		17.10		_	[1" diameter =	x .041 gal/	ft, 2" d. = x .1	63 gal/ft,	4 " d. = x .653	gal/ft]
	of Water (DTW) in	Feet		9.75		-	Purge Volum					
(DIS-	DTW)				7,35		-	Actual Purge	in Gallon	S		151	
	No. of Gallons		Temp	Conduct in	Turbidity	00.	ORP						
Time	Purged	pН	in °C	mS/cm	NTU		nts: Qua	lity, Recovery C	color, Odor,	Sheen, Accu	umulated S	Silt/Sand	
1926	IL	6.64	14.2	1.93	3	0.16	-39	1 1	1	nn tint		odor kne	n
0920	21	1,1,4	142	10,93	1	0.14	-37	1 1	100	TOTT JIVOT) 110	1	
100 22	21	6,64	141	1.62	7		-36			1			
00,20	111	1	1110	(17)		0.10		 	V)			·
000	44	6.64	1412	6,92	0	0.07	-36		10 0	olor			
. 0938	PL	6.64	14.2	6.92	0	0.05	-37	V	1)			
1940)												
Comm	nents										A. 208-0436 O		
\													
)	-									· · · · · · · · · · · · · · · · · · ·			
			Purgin	g Rate in	Depth of	Equipment						Ţ	/
	Meth	nod		/min	in I	Feet	-	Bails dry?		Ye	s	Nø	
Purge	Perist	alic	~0,	34min	~)	6	_	At no. of Casi	ing Volum	es		\wedge	
Sample	1	/	,		•	4		Purge Water	Disposal I	Method/Volu	ume	onsite	(DW
							_	(Stored in 1,0	000 gallon	temporary of	onsite sto	orage tank.)	
2) Sa	mpling L	Data											
	I					T							0
ottle Type	No of Cor	ntainers		Analyses		Perserv.	Filter		Fotal Nun	nber of Bot	tles	_10	7
PDE	1 - 500m	ıL	Total Me Cu, Ni	tals-As, Pb	, Sb, Cr,	HNO3	N						
mber	2 - 500m		cPAHs			None	N	Γ	Duplicate	Sample I.I	Э.		
mber	2 - 1L		PCBs			None	N	_			· •		
mber mber	2 - 500m 2 - 500m		10000 0000 000	w/ silica ge		None None	N N	ŀ	Field Blar	nk I.D.	_		
	2 30011		DIO(E CIT	ушскупри	Halate	110110	i v	F	Rinseate	Sample I.E).	-	_
)-) .		
	1					<u> </u>	<u> </u>						
3) Fie	ld Equip	oment						Type/Bran	d/Seria	No./Mat	erial/Uı	nits	
								1942000					
Pump	Type/Tub	ing Typ	oe -	Peristalti	c Pump o	dedicated	d tubin	g /4"PE 7	Γemp/pH	E.C./D.O	Horiba	U-22 10	
Bailer	Туре			N/A			-				And designation of the last of	ine/Solinst/l	Heron
Filter 7	уре		1	None			<u>-</u>	(Other	0	2P Per	^	
4) We	ell Condi	itions		ОК	X	Not OK		Explain	4 BOLT	5, Good	(OND)	TION	-

Grou	ındwater	Sampling D	ata - We	ell I.D.		CMP-	17		
Project		Port of Seattle -	Terminal 5		ĺ	Date/Time Sampled	6/4/10	1945	and the same of th
Job No.		17627-00				Tidally Influenced	Yes	No	
Project	Manager	Roger McGinnis			_	Well Depth in Feet	16	·····[
Field Re	eps.	CFR/KMR/AJG)			Screened Interval in F	-		
1) Pur	ging Data/F	ield Measurem	ents: All N	/leasure	ements	Relative to Top o	f Casing (TOC)		- 11 - 11 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -
	pth in Feet		16'				976 S	1 29	
	f Sediment (DT	S) in Feet	15.5'		5. 9	Casing Volume in Gal 1" diameter = x .041 gal		109	
	f Water (DTW)		8,31		_	Purge Volume in Gallo		.,,4 d x .000 g	jai/itj
(DTS - [6.10		-	Actual Purge in Gallor		- loL	
	No. of			DO.	OFFI	1			
Time	Gallons Purged pH	Temp Conduct in oC mS/cm		mall	MV				
Time 1835	1. 4		NTU 211		ts: Qualit	y, Recovery Color, Odor	1 1-	Silt/Sand	1.4
0033	11 10.17	3 13.7 0.504	627	0.35	111	Tyrbid, ora	ngc-bomm fin	t, no odo	r/Sha
0831	LL loil	0 13, 7 0,499	258	0.17	125	1.	,	1	
0839	3L 6.18	3 13.8 0,493	163	0.00	127				
0841	41 10.18	3 13.8 0.488	118	0.06	126		J		#
1943	5L 10.16	1 13.80.485	153	0.03	126	1	& yellow hint		
NSWPL V84X	10L 6.16	0.10	135	0.02	125		T WENDWAINT	- 5	*
100101	-	11150 01 100	100	0.00	1103	1 V	- V		/
Comme	ents			- 01			-		
			4						
-	*	Purging Rate in	Depth of Equ	uinment in	1			٦ . [7
-	Method	L/min	Fee	- 5		Bails dry?	Yes	No	
Purge	Dedicated	5. 0.5 \$4min	14		١,	At no. of Cooling Volum		11	
, uigo	LYCAN DI	1			'	At no. of Casing Volun	nes		
Sample	$-\psi$	V	1		F	urge Water Disposal	Method/Volume	. Onsite	
					(Stored in 1,000 gallor	n temporary onsite s	toragé tank.)	
2) San	npling Data								
Rottle Type	No of Container	ànata		D	<u></u>	TatalNi			
Bottle Type HPDE	No of Containers 1 - 500mL	Total Metals - As, P		Perserv. HNO3	Filter	i otal Nu	mber of Bottles	12	
	2 - 500mL	cPAHs		None	N	Duplicate	e Sample I.D.		and the same of th
	2 - 1L 2 - 500mL	PCBs	l alamana	None	N	E:-IJ DI-			Hesp.
	2 - 500mL	TPH-Dx w/ silica ge Bis(2-ethylhexyl)ph		None None	N	Field Bla	nk I.D.		
VOA Vial	3 - 40mL	Chlorinated Ethane		HCL	N	Rinseate	Sample I.D.	Accessorated installed installed	-
		-							
<u> </u>						. 5			
3) Fiel	d Equipmer	nt			7	Type/Brand/Seria	ıl No./Material/U	Inits	
Pump T	ype/Tubing T	vne Dedicate	ed QED Blad	dder Pur	mn T	emp/pH/E.C./D.O	Horiba U-22-/	2	
Bailer T		N/A	alb bid	adoi i di		Vater Level Probe	Waterline/Solin	st/Heron	
Filter Ty		None	-			Other		Pen	-
AL 187-1		A 7 4		l			0 1	- 1 1	
4) vvei	I Conditions	s OK	X	Not OK		Explain 4 Bolts	HC Standards/Field F	fect Locifi orms/GW-Well II	D

(Gro	undw	ater S	Samp	ling D	ata - V	Vell I.L	D.		MW-26	R	JUP	120	10
Р	roject	t		Port of	Seattle -	Terminal 5	5		Date/1	Time Sampled	614110) 17	17)	
	ob No			17627-				_		/ Influenced	Yes	XI	No	7
P	roject	t Manage	r	Roger I	McGinnis				·	Depth in Feet	1	6.5		_
F	ield R	Reps.		CFRIKI	MR/AJG)		_	Scree	ned Interval in Fee		.5-16.5	- 10 10	
1) Pu	rging E	Data/Fie	eld Mea	asurem	ents: Al	ll Measu	remei	nts Re	elative to Top o	f Casing (TC	DC)		
V	/ell D	epth in Fe	eet		16	0.5			Casino	g Volume in Gallor	ns	1.12	2	
D	epth (of Sedime	ent (DTS) in Feet		6.25		-		neter = x .041 gal/ft _s		al/ft, 4" d. =	x .653 gal	— I/ft]
D	epth o	of Water	(DTW) in	Feet		9,40		_	Purge	Volume in Gallons	3	-		•
(E	OTS -	DTW)				6.85		_	Actual	Purge in Gallons		15	L	
		No. of Gallons		Temp	Conduct i	and the second s		ORE						
11	Time GI	Purged	pH	in °C	mS/cm	NTU / -	Commen			overy Color, Odor, S				
111	24	11_	6.89	19,4	10.6	60	0.29	13	1 -	Slightly turbic	d, brownt	nit, no	odor	Sheen
Ш	5]	2	6.88	14.2	10,2	38	0.12	3						
11	100	3L	6.88	14.2	9.6	19	0,08	1-2						
1	703	4L	6,87	14.2	9.2	15	0.67	-4		Clear				
1	706	5L	(0.86)	14.2	9.6	111	0.05	1						
SMPL 12	ID	00	W100	1112	110		0,00		+					
	-10	L	1.	,	0			1 20	1					
C	omm	ents	Well	LOCATIC	on! K	OW 61	01, DA	4 5	1,57	ACK D				
)														
				Purgin	g Rate in	Depth of	Equipment				Г		\]
		Me	thod	L	/min	in I	-eet	-	Bails d	ry?	Yes		No X	
Pui	rge	Pens	staltic	018	5 4min	~11	.5		At no.	of Casing Volume	S	1	(
Sam	nnle				11		/		Durge	Water Disposal M	othod/\/aluma	7	2010 -	
Odii	ipio				Ψ		ν	-		d in 1,000 gallon to			ン <i>ルシ</i> ィフ ank.)	E
2) Sai	mpling	Data						3.50			3		
							T	г 1						
3ottle	Туре	No of Co	ontainers		Analyse	s	Perserv.	Filter		Total Numb	er of Bottles		18	
HPDI	F	1 - 500r	ml	Total Me Cu, Ni	tals-As, Pl	o, Sb, Cr,	HNO3	N						
\mbe		2 - 500r		cPAHs			None	N		Duplicate S	Sample I.D.	MW-	26RD (D	Ouplicate)
Ambe		2 - 1L		PCBs			None	N			gar agar • Project Samme of Pagarage Professional		LOND (D	upilicate)
Ambe		2 - 500r 2 - 500r			w/ silica ge		None	N N		Field Blank	I.D.			
WIIDO	51	2 - 0001	IIE.	48EH	ıylhexyl)ph)	maiate	None	IN		Rinseate S	ample I.D.	9		
		L	· · · · · · · · · · · · · · · · · · ·				<u> </u>							
3)) Fie	ld Equi	ipment						Туре	/Brand/Serial	No./Materia	I/Units		,
Pı	ump '	Type/Tu	bing Tyr	ре	Peristalt	ic Pump c	dedicated	tubina	1/4"	₽E Temp/pH/E	C./DO H	oriba U-21	7/0	
	ailer ⁻		5 71		N/A	T -			,,,,	Water Leve		aterline/S		eron
	lter T				None			-		Other		Pen	J 1001 10	J. 011
				ş -						5	Removed Asp		4	
4)) We	II Cona	litions		OK	X	Not OK		Expl	ain	HC Standards/F	ield Forms/	GW-Well I	D

	Gro	undwa	ter S	Samp	ling D	ata - V	Vell I.L).		M	W-36)				
	Project			Port of	Seattle - 7	Terminal 5			Date/T	ime Sam	pled	6/21	10	162	2/10	
	Job No			17627-	00					Influence	3		Yes 📈		No	
1	Project	Manager		Roger	McGinnis			_	150	epth in Fe			73			
	Field R	eps.		CFR/KI	MR/AJG)			_		ed Interv		et	58-73	3		
	1) Pui	rging Da	ta/Fie	eld Me	asurem	ents: Al	l Measu	- remer	nts Rei	lative to	Торо	f Casin	g (TOC)			
		epth in Fee				75'?				Volume				0,71		
		of Sedimen		in Foot		75'	10 1010	Tree)						4" d. = x .6		
		of Water (D		9		9.31		-		Volume ir			. 103 gai/II.	4 u. = x .6	53 gai/πj	
	(DTS -		, , , , , , , , , , , , , , , , , , ,	1 000		65.60		-02	9/5/							
	(5.0					65.0		-	Actual	Purge in	Gallons			5L		
		No. of Gallons		Temp	Conduct in	Turbidity	Do.	OR								
	Time	Purged	pН	in °C	mS/cm	NTU	Commen	ts: Qual	ity, Reco	very Colo	r, Odor, S	Sheen, Aco	cumulated	Silt/Sand		
	1007	IL	1.43	15.0	139.3	5	1.47	-1-	111	Year.		5 44	- no c		reen	4
	1610	71	7,43	149	39.95	5	115	-4'	3	T,	July) 110 0	1301 30	(LEV)	
	1613	31 -	7.42	140	39,9	5	n.19	-40		1-						
	1. 1.	41 -	7/12	14.7			10111	-5	-				-			
15	1616		7.40	1.1.1	40.0	0	0.10	1 -1	1	-	1/	1				
	100	5L	7 <i>4</i> 3	14.7	40.0	5	0.08	-6	1	V	Hu	llow tru	+	\mathcal{L}		
5	1620					L			\perp		1					
	Comm	ents														
		_					300000						-	7.00		
1		_									*					-
		A		Purgin	g Rate in	Depth of I	Equipment]						7	V	
		Metho	bc		/min	100	eet		Bails dr	у?		•	res		No No	
F	Purge	Perista	Otic.	0,2	5 L/min	~ 7.	4		At no. o	of Casing	Volume	ıs.		41		
-000		1.	× 110		1	.1	,									
5	ample	V			¥			-		Water Dis					SITE	
	N SOLDEN SCHOOL	1000							(Stored	in 1,000	gallon t	emporary	onsite st	orage tank	ί.)	
	2) Sar	npling D)ata													
	tla Tuna	No of Cont	talu aua												*	
JU	tle Type	No of Conf	tainers	Talal Ma	Analyses		Perserv.	Filter		lota	al Num	ber of Bo	ottles		9	
P	DE	1 - 500ml	L	Cu, Ni	tals-As, Pb	, SD, Cr,	HNO3	N								
_		2 - 500ml		cPAHs			None	N		Dup	olicate S	Sample I	.D.	_	_	
		2 - 1L		PCBs	72 1000		None	N				0 02 02000		_		
		2 - 500ml 2 - 500ml			w/ silica ge ylhexyl)pht		None None	N N		Fiel	ld Blank	c I.D.				
-	001	2 0001111	-	DI3(2-6ti	iyiriexyi)prit	Halate	ivone	IN		Rin	seate S	Sample I.	D	-	-	
												ampio i				
		1242														
	3) Fiel	ld Equip	ment						Type/	Brand/	Serial	No./Ma	terial/U	nits		
	Pump 7	Type/Tubi	ng Tvn	e	Peristalti	c Pump d	ledicated	tuhing	V4ª D	Ten	nn/nH/F	E.C./D.O	Horib	a U-22/1		
	Bailer 7	170.5	5 7	•	N/A		3 2.001.00		, , , , , ,			el Probe			nst/Heron	
	Filter T	уре		•	None			9		Oth			DRP Pe			
	4) Wei	II Condit	tions		ок	X	Not OK	Ϋ́ I	Expla	in R	olans	d I-P		*****		
	0.5		-		100000000000000000000000000000000000000		1		hid		THE LEVEL OF THE	F/8	I STEP !			

	Gro	undwa	ater S	Samp	ling Da	ata - l	Vell I.	D.		MW-44				
	Project	ŧ,	•	Port of	Seattle - T	erminal :	5		Date	/Time Sampled	6/21	10	1150	
	Job No).		17627-	00				Tida	lly Influenced	Ye	T.	No	7
	Project	Managei	r	Roger	McGinnis			_		Depth in Feet		78,	-	_
	Field R	leps.		CFR/K	MR(AJG)			_		ened Interval in Feet		NA		
	1) Pu	rging D	ata/Fie	eld Me	asureme	ents: A	ll Meas	uremen	ts R	elative to Top of	Casing (TOC)		
	Well De	epth in Fe	eet		78.	5			Casi	ng Volume in Gallons	3		10.77	
	Depth o	of Sedime	ent (DTS) in Feet	75	10		_		ameter = x .041 gal/ft,@				-
	Depth o	of Water ((DTW) ir	Feet	3	,94		_		e Volume in Gallons		<u> </u>		
	(DTS -	DTW)							Actu	al Purge in Gallons	L		-9L	
		No. of Gallons		Temp	Conduct in	Turbidity	ORP	(mg/						
	Time	Purged	pН	in °C	mS/cm	NTU	Commen			overy Color, Odor, Shee				
	1/20	12	5.32	15.2		^75		6.3	2	TURBIDE 4	/ U151	ABLE	Sedment no	odor, n.
	1/38	41	5.87	15,2	6.012	175	87		-					
	1140	61	5.80	14.9	0.011	175	91	7.0	1					
	1148	8L	5.94	14.9	0.011	175	84	6.	35			V		
SIMIP	1150	91	5,94	14.9	0,011	175	84	6:	88		/ (//	
	Comm	ents	To	RBIDIT	4 15	5u5	PECT	FOR	MA	1-44				
1			1	10N -	_		3AY 39						 	
J	3					7		7	-					
		N4-11	ال م ما		g Rate in		Equipment		.				X	-
		Met	12		min = 1/mm		eet		Bails	dry?	Ye	s] No]
-	urge	Kerista.	ItiC	Un	1	17	9		At no	. of Casing Volumes				
Sa	ample	V			V		/			e Water Disposal Me				SW
		1 242							(Stor	ed in 1,000 gallon ter	nporary o	nsite sto	rage tank.)	
	2) Sar	mpling	Data											
ott	lle Type	No of Co	ntainers		Analyses		Perserv.	Filter		Total Numbe	er of Rott	les	9	
_	DE	1 - 1L		Total Me	tals - As, Pl)		N		rotal ramb	or or bott	103		
DI	DE	1 - 1L		55 St. 100 CO. O. O. O. O. O. O. O. O. O. O. O. O. O	tals-As, Pb,	Sb, Cr,	LINO	N.		D 1: 1 0	–	*20		
_	ber	2 - 500n	nL.	Cu, Ni cPAHs			HNO3 None	N N		Duplicate Sa	ample I.L).		
_		2 - 1L		PCBs	especial and		None	N		Field Blank	I.D.			
_		2 - 500n			w/ silica gel		None	N						
		2 - 500n 3 - 40ml		Bis(2-eth Ethenes	ylhexyl)phtl	nalate	None HCL	N N		Rinseate Sa	mple I.D			
	V VIGI	0 101111		Linenes			TIOL	IN						
	3) Fie	ld Equi _l	pment						Тур	e/Brand/Serial N	lo./Mate	rial/Ur	nits	
	Pump 7	Type/Tut	bing Typ	oe	Peristaltion	: Pump	dedicate	d tubina	1/4"	₽ Temp/pH/E.	C./D.O	Horiba	a U-22 /O	
	Bailer 7		5 77.		N/A				,	Water Level			line/Solinst/Her	 on
	Filter T				None					Other _	ORP	Pen		<u> </u>
	4) Wei	II Cond	itions		ок	X	Not OK		Ext	olain –				a

	Gro	undwa	ter S	Samp	ling Da	ata - We	ell I.D.			N	1W-12	25			
	Project Job No Project Field R	o. Manager	(17627- Roger I	Seattle - T 00 McGinnis MR/AJG	erminal 5		- -	Tidall Well I	Time San y Influenc Depth in F ened Inter	ed eet	6/3//0 Yes	Ti	600	No
	1) Pu	rging Da	ta/Fie	eld Mea	asureme	ents: All N	/leasure	- emen				Casing (To			
	Well De	epth in Fee of Sedimer of Water (D	et nt (DTS)	in Feet	1	5' 13.15' 0.25'		-	Casin [1" dia Purge	g Volume	in Gallo 041 gal/ft in Gallor	ons ., 2" d. = x .163 ns		\2 'd. = x	.653 gal/ft]
	Time 550	No. of Gallons Purged	рН 136 35	Temp in °C	Conduct in mS/cm	Turbidity NTU	00 commen 5.11 5.59	Ts: Qua	RP No No No No No No No No No No No No No	overy Colo		Sheen, Accum			un
_ 	1554 1556 1558		6.43	15.2 15.1	0.385	0	3.47 2.79 2.59		53		V	10 color			
5	1600	66	6.42	15.1	0.387	0	2,47	15	9	V		V		V	
)	Comm	Metho	od		g Rate in	Depth of Equ	. 10,50	1	Deile	Jn. 0					
	ourge ample	Didicate QED.		~0.	54min	~13	et		Purge	of Casing	sposal M	lethod/Volum		<u>~ 1</u> Ønsi	No[]
	2) Sar	mpling D	ata					ı	(Store	d in 1,000) gallon t	emporary on	site stora	ige tan	ık.)
P	tle Type DE	No of Cont			Analyse: tals - As, Pt		Perserv. HNO3	Filter N		То	tal Num	ber of Bottle	es _	8	10 1 <u>Z</u>
m	ber ber ber	2 - 500ml 2 - 1L 2 - 500ml		PCBs	w/ silica gel	alaanus	None None	N N	-		2000 martin (1815)	Sample I.D.	_		**************************************
n	ber	2 - 500ml 2 - 500ml 3 - 40mL		Bis(2-eth	ylhexyl)phth ed Ethanes	nalate	None None HCL	N N N			eld Blank nseate S	Sample I.D.			
											-	p.o		* * * * * * * * * * * * * * * * * * * *	
		ld Equip							Туре	/Brand/	Serial	No./Mater	ial/Uni	ts	
		Гуре/Tubi	ng Typ	-		d QED Blac	der Pun	np		/pH/E.C.		Horiba U-2			
	Bailer T Filter T	* *		-	N/A None				Water Other	Level P	robe	Waterline/S	0		
	4) We	II Condit	ions		ок [X	Not OK		Expl	ain	Н	IC Standards/F			Well ID
											4.0		I OIIII	J 1 4-1	

Gro	undwater S	Sampling Da	ata - We	ell I.D.			MW-308	4(N)		
Project Job No Project Field R	o. Manager	Port of Seattle - T 17627-00 Roger McGinnis CFR/KMR(AJG)	erminal 5		_ Ti _ W	ate/Time S dally Influe ell Depth in	enced	<i>6/3/10</i> Yes	1/1/1/	No
1) Pu	rging Data/Fie	eld Measureme	ents: All N	/leasure	-			sina (TC		250
Well De Depth of Depth of	epth in Feet of Sediment (DTS of Water (DTW) in) in Feet/	75' 7.5' 5.73'		_ Ci _ [1' _ Pi	asing Volui " diameter = urge Volum	me in Gallons x .041 gal/ft, 2" ne in Gallons		/, 9/{ gal/ft, 4" d. =	
(DTS -		· · · · · · · · · · · · · · · · · · ·	/1.7 /		_ Ad	ctual Purge	in Gallons	ì	~ 6 L	
Time 1051 1054 1057 1106 Comm	5L 7.08	Temp in °C mS/cm 13.6 1.68 13.6 1.67 13.9 1.46 13.8 0.962 13.7 0.960 13.8 0.959 Purging Rate in L/min 13.3 4 min	Turbidity NTU 5 0 0 0 Depth of Equ	0.19 0.39 0.10 0.04 0.03	-35 -51 -52 -53 -54	Changed or	Color, Odor, She Color Onset (low Batt) ut pensalts.	Clear	light many	, ilo robor JShu
Sample	L	1	1		Pı	ırge Water	Disposal Meth			te IDW
2) Sar	mpling Data				(5	torea in 1,0	000 gallon tem	porary ons	site storage ta	ank.)
mber mber	No of Containers 1 - 500mL 2 - 500mL 2 - 1L 2 - 500mL 2 - 500mL	Analyse Total Metals - As, Pt cPAHs PCBs TPH-Dx w/ silica gel Bis(2-ethylhexyl)phtf	cleanup		Filter N N N N N	I I	Total Number Duplicate Sar Field Blank I.I Rinseate San	mple I.D.	es	9
)	Id Equipment Type/Tubing Typ		: Pump dec	dicated to		" -	nd/Serial No Temp/pH/E.C		<i>ial/Units</i> Horiba U <u>-2-</u> 2	-10
Bailer 7		N/A	- amp det	anodicu ii	abing / 7		Vater Level F		Waterline/So	
Filter T	уре	None					Other	OR	P Pen	
4) We	II Conditions	ок [X	Not OK		Explain _	3 BOLTS O	CUT Location	ield Forms/GW	CONDITION /-Well ID

	Gro	undw	ater S	Samp	ling D	ata - We	ell I.D.			MW-30	08B(S)			
	Project Job No Project		r	17627-	Seattle - T 00 McGinnis	erminal 5		_ Tid	ally Infl	Sampled uenced n in Feet		// (es	120	05 No.
	Field R	leps.		CFRIKI	MR(AJG)			_ Scr	eened	Interval in Fe	et	35-40		
	1) Pu	rging D	ata/Fie	eld Mea	asureme	ents: All N	<i>Aeasure</i>	ements R	elative	to Top of	Casing (TOC)		
	Depth o	epth in Fe of Sedime of Water (DTW)	ent (DTS			10 91.35 5.56 32 19		_ [1" c _ Pur	diameter ge Volu	lume in Gallo r = x .041 gal/ft ume in Gallor	i, 2" d. = x . ⁻		51 "d.=x.	.653 gal/ft]
	(= : =	No. of	1				0.0	-	uai Fui	ge in Gallons		<u> </u>	ال_	
	Time	Gallons Purged	рН	Temp in °C	Conduct in mS/cm	Turbidity NTU	Commen	ts: Quality, F		y Color, Odor,		ımulated Sil	t/Sand	
	1153	IL	1.78	13.7	12,6	0.	0,29	-63	Cle	ar bran	ptivit,	10 00	lorle	Sheen
8	1156	21	7.79	13.7	12.8	0	0.11	-66			1		1	-
	1159	3L	7.79	13.7	12.8	0	6.09	1-71			1			
44	1202	4L	7.79	13.7	13.0	0	0.04	-77		yell	ow tint			
PE	1205	5L	1.79	13.7	13.0	O	0.03	-80		J 0	1		L	
SMP														
	Comm	ents	·		· · · · · · · · · · · · · · · · · · ·									
)	ī	ğ				2 1			To respect to					
		Meti	hod		g Rate in min	Depth of Equ			s dry?		Υe	es		No
F	urge	Penista	thù	20.3	3 L/min	~ 38		At n	o of Ca	asing Volume	ne.		/ \	
Sa	ample	1	/	7		L				er Disposal M		ume <i>1</i>	Onsit	e IDW
	2) San	npling	Data					(Sto	red in 1	1,000 gallon t	emporary o	onsite stora	age tan	k.)
	1													
	le Type DE	No of Co 1 - 500m		Total Met	Analyse tals - As, Pt		Perserv. HNO3	Filter N		Total Num	ber of Bot	tles _		9
_		2 - 500m 2 - 1L	nL	cPAHs			None	N		Duplicate \$	Sample I.I	D	_	
m	ber	2 - 500m	nL	PCBs TPH-Dx \	w/ silica gel	cleanup	None None	N N		Field Blank	k I.D.		-	and a few distributions of
m	ber	2 - 500m	nL	Bis(2-eth	ylhexyl)phth	nalate	None	N		Dinacete C	'ample I F	_	Security	-
										Rinseate S	sample I.L).		
							te ·							
	3) Fiel	ld Equi _l	oment					Тур	e/Bra	and/Serial	No./Mate	erial/Uni	ts	
ار	Pump 7	Type/Tub	oing Typ	e <u>l</u>	Peristaltic	Pump ded	licated tu	ubing 1/4"	PE	_Temp/pH/E	E.C./D.O	Horiba	U-22	10
	Bailer T			1	N/A			(Water Leve	el Probe	Waterlin	ne/Soli	nst/Heron
	Filter Ty	ype		1	None					Other	06	2P Pan	2040	
	4) Wel	I Condi	itions		ок [<u> </u>	Not OK	E	plain	3 SINFA	ed lolk	s/Field Form	ns/GW-V	Vell ID
														101110

Groun	dwater S	Sampling D	ata - W	ell I.D.				FM	-105	5					
Project		Port of Seattle -	Terminal 5			Date	/Time S	Sample	ed	6	13/10)	15	00	
Job No.		17627-00					ly Influ				Yes	T	10	No	7
Project Ma		Roger McGinnis			_	Well	Depth	in Feet	į			18		<u> </u>	_
Field Reps		CFR/KMR/AJG			_	Scree	ened In	iterval	in Fe	et		7-17			
1) Purgii	ng Data/Fie	eld Measurem	ents: All l	Measure	ements	s Rel	lative	to To	o of	Casir	ng (TO	C)			
Well Depth	in Feet					Casir	ng Volu	ıme in	Gallo	ns		١.	15		
Depth of Se	ediment (DTS)		1.78		_	[1" dia	ameter =	x .041	gal/ft,	, 2" d. :	- 163. x =	gal/ft, 4'	'd. = x	.653 gal/ft	-]
	/ater (DTW) in	Feet	0.70		_	1000	e Volun				-				
(DTS - DTV			7.08		-	Actua	al Purge	e in Ga	llons		-	1	71		
1 1	o. of allons	Temp Conduct in	Turbidity	00	ORP										
	ırged pH	in °C mS/cm	NTU	Commen	ts: Quali	ty, Re	covery (Color, C	Odor, S	Sheen,	Accumul	ated Silt	/Sand		
1448 3	- 4	12,3 0,397	0	1,29	40		MI	1						Sheen	L
14514	L 6.51	12.2 0.397	\bigcirc	1.07	140	0		,	J	Name of Street) .			
1454 5	L 6.48	12.2 0,398	0	0,98	49	3					,				
1457 6	L 6.44	12,1 17,399	0	0.94	1	-				D (a	املا				
7 1500 7	L 6.45		0	0.97	41)		1	//				
SMPL	2 410	12.11		10.11	17	4					18			V	
Comments				<u> </u>											
Comments				· · · · · · · · · · · · · · · · · · ·								·			
)			-												
		Purging Rate in	Depth of Eq	uipment in											
	Method	L/min	Fee			Bails	dry?				Yes	, in		NoX	
Purge	dicated GED B.P.	10.3 1/min	15	5	,	At no.	of Cas	sing Vo	lume	s			11		
1		1	1	,								_			
Sample		V	V								/Volume ary onsi)ns+	e	
2) Sampl	ling Data				(Olore	, u III I,	ooo ga	IIOII LE	empor	ary onsi	te stora	ige tar	ık.)	
2) Sallipi	ing Data			γ											
	of Containers	Analyse	s	Perserv.	Filter			Total I	Numb	ber of	Bottles	.		12	
		Total Metals - As, P	b		N						2 4	-			**********
Amber 2 - 2 -		cPAHs PCBs		None None	N N			Duplic	ate S	sampl	e I.D.	_		SCHOOL STREET	
	500mL	TPH-Dx w/ silica gel		None	N			Field E	3lank	l.D.			-	- Contract	
		Bis(2-ethylhexyl)pht Chlorinated Ethanes		None HCL	N N			Dinco	oto C	·	- 1.0	- A	_		
		Ornomiated Ethanes	& Linenes	HOL				Rinsea	ale S	ampie	e I.D.	-			
3) Field E	Equipment					Туре	e/Bran	nd/Se	rial l	No.//	/lateria	al/Unit	ts	8	
Pump Type	e/Tubing Typ	e Dedicate	d QED Blad	dder Pun	ד מו	Temn	/pH/E.	.C./D.(2	Horih	a U-22	10			
Bailer Type		N/A					r Level			- Contraction	rline/So		leron		
Filter Type		None				Other			(The same of the sa	ORP	Pen	.5.011		
4) Well C	onditions	ок [\vee	Not OK		Exp	lain		•	- 22 - 11	V 1 1	1.,	,,,		

Sample Custody Record
Samples Shipped to: ART

Seattle, Washington 98102-3699 1910 Fairview Avenue East Hart Crowser, Inc. Phone: 206-324-9530 FAX: 206-328-5581

HARTCROWSER

TOTAL NUMBER OF CONTAINERS COMPOSITING INSTRUCTIONS OBSERVATIONS/COMMENTS/ 10-50ml, 3-100ml X STANDARD □,1 WEEK SAMPLE RECEIPT INFORMATION SHIPMENT METHOD: CHAND OTHER いろろ TURNAROUND TIME: 3) Ay Py Sb, Cc, Co, W. Total Metals Gelos/Gest Good condition CUSTODY SEALS: TEMPERATURE □ 24 HOURS ☐ 48 HOURS ☐ 72 HOURS NO. OF CONTAINERS a STORAGE LOCATION: 1) AS 86: TOTAL MAPILS 60103/6030 3) TPH-DX WITH SILICA GEL CLEWOP SPECIAL SHIPMENT HANDLING OR for Other Contract Requirements STORAGE REQUIREMENTS: See Lab Work Order No. COOLER NO.: GANC 1620 WATER 1510 WATER WATER 6/2/16 MATRIX 6/21/10 1305 WATER 521 DATE TIME. DATE TIME 13 13 IIME 0/18/0 0/12/9 RECEIVED BY RECEIVED BY DATE PRINT NAME SIGNATURE COMPANY 17627-CC LAB NUMBER PROJECT NAME TERANIVAL S
HART CROWSER CONTACT C. RUST DESCRIPTION を取り SAMPLED BY: CFFY ASG 1830 DATE DATE TIME SAMPLE ID 1112-3C CMP-3 CMP-4 M10-44 RELINQUISHED BY

S

SIGNATURE RELINOUISHED BY. PRINT NAME COMPANY COMPANY LAB NO. 10B

Gold to Sample Custodiar

Lab to Return White Copy to Hart Crowser

Pink to Project Manager

White and Yellow Copies to Lab

Sample Custody Record
Samples Shipped to:

(11/2

Hart Crowser, Inc.

1910 Fairview Avenue East Seattle, Washington 98102-3699 Phone: 206-324-9530 FAX: 206-328-5581 9120

HARTCROWSER

177-60					7 6	REQUESTED ANALYSIS	;	
108 / 100/ J		LAB NUMBER			(E)	(P)	ЕВС	シング
PROJECT NAME	ERMINAL	2			B) .	P) C. (2) (1) (2) (2) (2) (2) (2) (2) (2) (2) (2) (2	NIV.	OBSERVATIONS/COMMENTS/
HART CROWSER CONTACT	\int	27			s H Py Lavy	E.) (E) (E)	LNO	
					0/6 171	5,= J+i V-) 10 	
SAMPLED BY: CFR	AT	9			101 ATD[0	937 139 HJL		
LAB NO. SAMPLE ID	DESCRIPTION	N DATE	TIME	MATRIX				
CMP-15	LATER	- 613/10	940	MER	XXX	×××	6	
MN-308/N			1105	_	×	×	6	
MW-323(S)			1205/		×××	×	6	
CMP-5		-	13c		×	×	6	
FM-105			1500		X	XXX	<i>t</i> /	
125	>	>	023/	\Rightarrow	×	× × ×	&/ 	
TRIP BLANK	\rightarrow	\rightarrow		\rightarrow		×	B	
					-	•		
:								
RALINQUISHED BY	DATE	RECEIVED BY		DATE	SPECIAL SHIPM	SPECIAL SHIPMENT HANDLING OR	3	TOTAL NUMBER OF CONTAINERS
And Sall	0/3/10	Oan Pele	رمعها	ielalio	STORAGE REQUIREMENTS:	JIREMENTS:		SAMPLE RECEIPT INFORMATION CUSTORY SFALS
SGNAWRE CROSSES	TIME	MGNAI URE		TIME	10000	23 12 12 12 12 12 12 12 12 12 12 12 12 12		□YES □NO □N/A
PRINTINAME	1730	COMPANY)	250	32	(4) (4) (4) (5) (4) (4) (5) (4) (4) (5) (6) (6) (6) (6) (6) (6) (6) (6) (6) (6	3) TPH-DX WITH SILVER CERL CLANDER		GOOD CONDITION TYPE TEMPERATURE
RELINQUISHED BY	DATE	RECEIVED BY		DATE				SHIPMENT METHOD: —HAND —COURIER —OVERNIGHT
					COOLER NO.:	STORAGE LOCATION:		ND TIME:
SIGNATURE	TIME	SIGNATURE		TIME				□ 24 HOURS □ 1 WEEK
PRINT NAME		PRINT NAME			See Lab Work Order No.	Order No.		, `
COMPANY	1	COMPANY			for Other Contr	for Other Contract Requirements		□ 72 HOURS OTHER
White and Yellow Copies to Lab	Pink to Project Manager		ab to Return W	Lab to Return White Copy to Hart Crowser		Gold to Sample Custodian	-	

Sample Custody Record Samples Shipped to: __

ZOFI

1910 Fairview Avenue East Seattle, Washington 98102-3699 Hart Crowser, Inc. Phone: 206-324-9530 FAX: 206-328-5581

HARTCROWSER

TOTAL NUMBER OF CONTAINERS OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS □N/A STANDARD □ 1 WEEK SAMPLE RECEIPT INFORMATION SHIPMENT METHOD:

HAND OTHER TURNAROUND TIME: GOOD CONDITION

YES

NC (h20) CUSTODY SEALS: TEMPERATURE □ 24 HOURS ☐ 48 HOURS ☐ 72 HOURS <u>d</u> NO. OF CONTAINERS \$ 90 1) 60108/6020 For As Po 2) 60108/6020 For As, Po, Sb, Cr, Co, N; 3) TPH-OX WITH SIMEN GER CHEALUP STORAGE LOCATION: REQUESTED ANALYSIS SPECIAL SHIPMENT HANDLING OR for Other Contract Requirements Gold to Sample Custodiar X X X X X X X X X X STORAGE REQUIREMENTS: See Lab Work Order No. COOLER NO.: Lab to Return White Copy to Hart Crowser WATER X MATRIX 1550 DATE DATE TIME CH1110 845 040/ 1940 0/8/ TIME **BECEIVED BY** RECEIVED BY DATE PRINT NAME SIGNATURE COMPANY Pink to Project Manager LAB NUMBER PROJECT NAME TERMINAL S

HART CROWSER CONTACT C. RUT DESCRIPTION MP-17 NATER SAMPLED BY: CFR/ASC 1650 DATE DATE TIME TRP BUNK JOB 17627-00 MW-JGRD SAMPLE ID MW-36R White and Yellow Copies to Lab Sup-a JAP-1 RELINQUISHED BY RELINQUISHED BY SIGNATURE PRINT NAME COMPANY LAB NO. COMPANY

GROUNDWATER SAMPLING FORMS ASPECT CONSULTING, LLC



CMP-1081013

GROUNI	DWATER S	SAMPLING	RECOF	RD			WELL NUME	BER: CMP	-1			Page: 1 of 1
	me: SOUTHV	VEST HARB	OR PROJ	ECT -	Phase II G0	CWMP	Project Numb					1
Date: Lo	13/08						Starting Wate			.92	<u>-</u>	
	by: DFR/AT	TO 0					Casing Stick					
	Point of Well						Total Depth (Casing Diam					
	nterval (ft. To Interval (ft. T						Casing Diam	eter (inches				
	,				1 0 124	~ ^ /	2 11/6					
	ume <u> </u>					(a) = (3.6) - 1.47 cmf	. 5 (L)(gai)			Sample Inte	aka Danti	n (ft TOC): ~12 ft
Casing void		7.16 gpf 7.62 Lpf				= 1.47 gpt = 5.56 Lpf				Campic into	and Dopti	1 (100). 12 10
PURGIN	G MEASU			то Ерг		0.00 Lp1						
Time	Cumul. Vol.			ater	Temp.	Specific	Dissolved	рН	Eh	Turbidity	Γ	Comments
	(gal o	(gpm or k p		el (ft)	(C or F)	Conductance	1		ORP	(NTU)		
						(µS/cm)	(mg/L)		(mv)		-	
830	/	0.4					/				clear	discharge
835	2		12.	94	14.3	597	0.76	6.77	316.7	13.0	turbo	after YSI
840	4		12.	92	14.3	576	0.50	6.85	209.3			
845	6				14.4	567	0.41	6.86	188.5	/		
850	8		12.		14.4	564	0.36	6.87	188.3			
								ì	1	1		/
855	10				14.4	565	0.31	6.88	178.6			· / Ye .
900	12	<u> </u>	12.	96	14.4	563	0.30	6.90	181.7	1.76	turbo	d w/o YS1
	l.						ļ-					
								l		<u> </u>	l	
Total Galic	ons Purged:	3,	l				Total Casing	Volumes F	Removed:	4.9		
			- ar									
Ending Wa	ater Level (ft	TOC):	16.10				Ending Total	Depth (ft i	OC): 16.85	****		
SAMPLE	E INVENTO	PRY			T	1			···	1		
Time	Volume	Bottle Ty	ре		Quantity	Filtration	Preservation		arance		I	Remarks
								Color	Turbidity & Sediment			
900	1,1	LIDDE				none	UNIOS	clear	n = Ne	Total Make	ilo - Ao D	h
	1L	HPDE			ĺ	none	HNO3	1	1	Total Meta	115 - A5, P	D .
900	500mL	Amber glas	s			none	none		+ +	cPAHs		
9,00	1L	Amber glas	s		2	none	none	 		PCBs		
900	500mL	Amber glas	s		2	none	none	<u> </u>	$\perp \perp$	TPH- DX		
900	500mL	Amber glas	s		2	none	none	↓	1	Bis(2-ethy	l hexyl) pi	nthalate
l												
метно	DS	1				1		1				
1		nd IDs:	Porie	taltic F	⊃ump and ∨	SI 556# ! 4	7					
						C. 000 # • •		inmont:	Alconor	Victillad VV/at	or	
" "	quipment:	•			ated tubing				Alconox, D	nsuneu vvat	. c ı	
Disposal o	of Discharged	Water:	Store	ed in 1	,000 gallon	temporary onsi	te storage tan	K				
Observation	ons/Commen	its:										



CMP-2-081013

Project Number: 680084 Project Number: 680	of 1
Developed by: DERAT TOC	
Measuring Point of Well	
Screened Interval (ft. TOC) 7.0-17.0 5.0-19.0 5	
Filter Pack Interval (ft. TOC)	
Casing Volume	
Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf Sample Intake Depth (ft TOC): ~12 2" = 0.85 Lpf 6" = 5.56 Lpf FURGING MEASUREMENTS Time Cumul Vol. Purge Rate Level (ft) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Cor F) Conductance (usl of C) Conductance (us	
Purga Rate Water Temp. Specific Conductance Co	~12 ft
Time	
Gyal o Gyam or Gyam Cyam or Gyam Cyam	ents
12.5	
12.94 16.7 11.97 0.16 7.98 140.5 2.37 turbud after YS 12.97 12.93 16.6 12.69 0.11 2.85 131.0	ham
12 - 93 12 - 94 12 - 94 12 - 94 13 - 18 13 - 94 13 - 94 14 15 - 94	
1	101
12.95 6.9 12.73 0.10 13.6 13.76 1.20	
12.45 16.9 12.73 0.09 9.36 135.3 0.92 17.95 16.9 12.72 0.09 9.38 137.3 0.86 1	
1000 12	
17.95 16.9 17.95 16.9 17.95 16.9 17.95	
Total Gallons Purged: 3.1 Total Gallons Purged: 3.1 Ending Water Level (ft TOC): 12.45 Ending Total Depth (ft TOC): 17.3 SAMPLE INVENTORY Time Volume Bottle Type Quantity Fitration Preservation Color Turbitily & Sediment Sediment Sediment Sediment Color Turbitily & Sediment Sediment Color Turbitily & Sediment Co	151
Ending Water Level (ft TOC): 12.45 Ending Total Depth (ft TOC): 17.3	
Ending Water Level (ft TOC): 12.45 SAMPLE INVENTORY Time Volume Bottle Type Quantity Filtration Preservation Appearance Color Turbidity & Sediment (000 1L HPDE 1 none HNO3 clear how Total Metals - As, Pb 1000 1L Amber glass 2 none none CPAHs 1000 500mL Amber glass 2 none none PCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 3 2 none none DCBs 1000 500mL Amber glass 4 147	- 1
Ending Water Level (ft TOC): 12.45 Ending Total Depth (ft TOC): 17.3	
Ending Water Level (ft TOC): 12.45 SAMPLE INVENTORY Time Volume Bottle Type Quantity Filtration Preservation Appearance Color Turbidity & Sediment (000 1L HPDE 1 none HNO3 clear how Total Metals - As, Pb 1000 1L Amber glass 2 none none CPAHs 1000 500mL Amber glass 2 none none PCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 2 none none DCBs 1000 500mL Amber glass 3 2 none none DCBs 1000 500mL Amber glass 4 147	
Ending Water Level (ft TOC): 12.45 Ending Total Depth (ft TOC): 17.3	
Ending Water Level (ft TOC): 12.45 SAMPLE INVENTORY Time Volume Bottle Type Quantity Filtration Preservation Appearance Color Turbidity & Sediment [000 1L HPDE 1 none HNO3 clear Nove Total Metals - As, Pb 1000 1L Amber glass 2 none none CPAHs 1000 500mL Amber glass 2 none none PCBs 1000 500mL Amber glass 2 none none TPH- DX 1000 500mL Amber glass 2 none none None None DCBs 1000 500mL Amber glass 2 none none None None None None None None	
Ending Water Level (ft TOC): 12.45 Ending Total Depth (ft TOC): 17.3	
Ending Water Level (ft TOC): 12.45 Ending Total Depth (ft TOC): 17.3	
Ending Water Level (ft TOC): 12.45 Ending Total Depth (ft TOC): 17.3	
Ending Water Level (ft TOC): 12.45 Ending Total Depth (ft TOC): 17.3	
SAMPLE INVENTORY Time Volume Bottle Type Quantity Filtration Preservation Color Turbidity & Remarks Quantity Filtration Preservation Appearance Remarks	
Time Volume Bottle Type Quantity Filtration Preservation Color Turbidity & Sediment Ocion IL HPDE I none HNO3 CLEAT NOME Total Metals - As, Pb Total Metals - As, Pb Total Metals - As, Pb CPAHs PCBs The DX Total Metals - As, Pb CPAHs PCBs Total Metals - As, Pb Total Metals - As, Pb Total Metals - As, Pb Total Metals - As	
Color Turbidity & Sediment [OCO 1L HPDE	
Total Metals - As, Pb Tota	
Total Metals - As, Pb Total Metals - As, Pb Total Metals - As, Pb	
Coo SoomL Amber glass Coo IL Amber glass Coo IL Amber glass Coo IL Amber glass Coo IL Amber glass Coo IL Amber glass Coo IL Amber glass Coo IL ICO I	······
Amber glass 2 none none PCBs OUO 500mL Amber glass 2 none none TPH-DX OUO 500mL Amber glass 2 none none METHODS Sampling Equipment and IDs: Peristaltic Pump and YSI 556 # [47]	
Some Some The DX	
METHODS Sampling Equipment and IDs: Note Substitute Peristaltic Pump and YSI 556 # 147	
METHODS Sampling Equipment and IDs: Peristaltic Pump and YSI 556 # 147	
METHODS Sampling Equipment and IDs: Peristaltic Pump and YSI 556 # 147	
Sampling Equipment and IDs: Peristaltic Pump and YSI 556 # 147	
Sampling Equipment and IDs: Peristaltic Pump and YSI 556 # 【47	
Duraina Caulinment: Deciateltia Dump w/ dedicated tubina Decon Equipment: Alconov Distilled Water	
Purging Equipment: Peristaltic Pump w/ dedicated tubing Decon Equipment: Alconox, Distilled Water	
Disposal of Discharged Water: Stored in 1,000 gallon temporary onsite storage tank	
Observations/Comments:	
·	



CMP3-081014

Casing Volume 7.44 (ft Water) x 0.16 (Lpfv)(gpf) = 1.19 (L)(gal) Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf Sample Intake Depth (ft TOC 2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf PURGING MEASUREMENTS Time Cumul. Vol. Purge Rate (gpm or Lomb) Level (ft) (C or F) Conductance (µS/cm) (mg/L) (mv) 815 / 0.4 8.40 / / / / Clear discessed 3.42 [9.6 588 0.30 [0.73 137.5 [.63 8.42 [9.7 593 0.24 10.83 133.6 1.30]	
Developed by: DFR/AT	
Measuring Point of Well TOC Screened Interval (ff. TOC) 6.0-16.0 Casing Diameter (inches 2 2 2 2 2 3 3 4 2 4 4 4 4 4 4 4 4	
Screened Interval (ft. TOC)	
Filter Pack Interval (ft. TOC) 4.0-17.5 Casing Volume 7.44 (ft Water) x 6.16 (Lpfv)(gpf) = 1.19 (L)(gal) Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf Sample Intake Depth (ft TOC 2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf PURGING MEASUREMENTS Time Cumul. Vol. Purge Rate (gpm or Lom) Level (ft) (C or F) (C onductance (µS/cm) (mg/L) (mv) 815	
Casing Volume 7.44 (ft Water) x 0.16 (Lpfv)(gpf) = 1.19 (L)(gal) Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf Sample Intake Depth (ft TOC 2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf PURGING MEASUREMENTS Time Cumul Vol. Purge Rate (gpm or Lomb) Level (ft) (C or F) Conductance (µS/cm) (mg/L) (mv) 815	
Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf 2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf PURGING MEASUREMENTS Time Cumul. Vol. (gal or L) (gpm or Lem) Level (ft) (C or F) Conductance (μS/cm) (mg/L) (mv) 815	
2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf PURGING MEASUREMENTS Time Cumul. Vol. (gal or L) (gpm or Lem) Level (ft) (C or F) Conductance (μS/cm) (mg/L) (mv) 815 / ο. 4 8.40 / / / / / / / / clear disc 820 Z 8.45 19.2 57.2 0.47 10.39 143.5 5.82 turbid effective for the first section of the first secti	v ~11 ft
PURGING MEASUREMENTS Time Cumul. Vol. (gal or L) Purge Rate (gpm or Lem) Water Level (ft) Temp. (C or F) Specific Conductance (μS/cm) Dissolved Oxygen (mg/L) pH Eh ORP (NTU) Turbidity (NTU) Com (mg/L) 815 / 0.4 8.40 / / / / / / / / / / / / / / / / / / /	,. · 1 1 10
Time Cumul. Vol. (gal or L) (gpm or Lom) Level (ft) (C or F) Conductance (μS/cm) (mg/L) PH Eh ORP (NTU) (NTU) (NTU) Clear discovered (μS/cm) (μS/cm) (μS/cm) (mg/L) (νννννν στο στο στο στο στο στο στο στο στο στο	
(gal orL) (gpm or Lam) Level (ft) (C or F) Conductance (µS/cm) (mg/L) ORP (mv) (NTU)	ments
815 / 0.4 8.40 / / / / clear disc 820 2 8.45 19.2 572 0.47 10.39 143.5 5.82 turbed at 825 4 9.42 19.6 588 0.30 10.73 137.5 1.63 830 6 8.42 19.7 593 0.24 10.83 133.6 1.30	
820 Z 8.45 19.2 57.2 0.47 10.39 143.5 5.82 turbed of 825 4 8.42 19.6 588 0.30 10.73 137.5 1.63 830 6 8.42 19.7 593 0.24 10.83 133.6 1.30	
825 4 8.42 9.6 588 0.30 10.73 137.5 1.63 830 6 8.42 19.7 593 0.24 10.83 133.6 1.30	harye
825 4 8.42 9.6 588 0.30 10.73 137.5 1.63 830 6 8.42 19.7 593 0.24 10.83 133.6 1.30	kr KSI
835 8 8.42 19.7 600 0.21 10.82 134.7 1.09	
840 10 8.42 19.6 608 0.19 10.98 143.8 1.08	
845 12 V 8.42 19.5 613 0.19 10.96 142,7 1.07 tobal /	VCI
13 17 12 4 1.5 17 011 1016 12, 7 1.01 table 0/2	. (>1
Total Gallons Purged: 3.15 Total Casing Volumes Removed: 2.65	
Ending Water Level (ft TOC): 9.47 Ending Total Depth (ft TOC): 15.84	
SAMPLE INVENTORY	
Time Volume Bottle Type Quantity Filtration Preservation Appearance Remarks	
Color Turbidity & Sediment	
Color Sediment	
845 1L HPDE 1 none HNO3 Claw none Total Metals - As, Pb	
8 15 500mL Amber glass 2 none none cPAHs	
845 1L Amber glass 2 none none PCBs	
845 500mL Amber glass 2 none none TPH- DX (w/silica gel cleanu	2)
auc V V	-,
847 500mL Amber glass 2 none none Bis(2-ethyl hexyl) phthalate	
METHODS	
METHODS (4.2)	
Sampling Equipment and IDs: Peristaltic Pump and YSI 556 # 147	
Purging Equipment: Peristaltic Pump w/ dedicated tubing Decon Equipment: Alconox, Distilled Water	·
Disposal of Discharged Water: Stored in 1,000 gallon temporary onsite storage tank	
Observations/Comments:	
OSSITUATION CONTINUING.	



CMP4-081014

GROUNE	JWATER 8	SAMPLING RI			WELL NUMI	Page: 1 of 1								
		WEST HARBOR		- Phase II G(OWMP	Project Num								
		8	. ,			Starting Wat								
	by: DFR/AT					Casing Stick	up (ft):	<u> </u>						
		TOC DC)	70170			Total Depth (ft TOC): 17 Casing Diameter (inches 2								
			5.0-17.5			Casing Diameter (Inches2								
		16 (ft Water)	•			۱۲ (۱)(nal)								
	umes: 2"=0		4" = 0.65 gpf		эрі) = = 1.47 gpf	<u>▶ ₩</u> (∟/(yaı/				Sample Into	ake Depth (ft TOC); ~12 ft			
		- ·	4" = 2.46 Lpf		= 5.56 Lpf									
PURGING	G MEASUR													
Time	Cumul. Vol.		Water	Temp.	Specific	Dissolved	pН	\Box	Eh	Turbidity	Comments			
,	(gal o(L))	(gpm or Lpm)	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)			ORP (mv)	(NTU)				
915		0,4	11.04	/	(μδ/cm)		 	, 🕇	(IIIV)					
	t	1		16.8	613	0.40	9.10		72.4	4.62	clear discharge turbil after \$51			
920	2	 	11.08				1				torbid after \$51			
925	4		11.08	16.9	497	0.33	8,77		12.0	2.79				
0930	6		11.08	16.9	449	0.26								
0935	8		11.08	17.0	439	0.23	4			1.67				
0940	10		11.08	17.0	438	0.24				1.55				
0945	12	V	11.08	17.1	440	0.25	7.7	01	89.6	0.98	turbed before YSI			
*****								\neg						
								\top						
				+		+								
							-	+						
						1 ,								
				<u> </u>			 	_						
	<u> </u>		<u> </u>	<u> </u>		<u> </u>	<u> </u>							
		<u> </u>	<u> </u>	<u> </u>				<u></u>						
Total Gallo	ons Purged:	3,15			_	Total Casing	y Volumes	s Rem	noved:	3.32	·			
Ending Wa	ater Level (ft 1	TOC):	18			Ending Tota	-! Donth (f	"	*\- 47 N					
						Ending Tota	i Deptii (i	1100	7). 17.0					
	E INVENTO	,		Quantity	Filtration	Preservation Appearance					Domarka			
Time	Volume	Bottle Type	pe Quantity		Filtration	Preservation		· T	ruce Turbidity &	Remarks				
					ļ	<u> </u>	Color		Sediment					
0945	1L	HPDE		1	none	ниоз	clear		none	Total Meta	ls - As, Pb			
	500mL	Amber glass		2	none	none				cPAHs				
	1L.	Amber glass		2	none	none	\Box			PCBs				
	500mL	Amber glass			none	none				TPH- DX (w/silica gel cleanup)			
	500mL	Amber glass		į	none	none	V		1	1	hexyl) phthalate			
	SOUTH	Altiber glass		-	Hone	lione	 	+		Dia(2-Guiy)	nexy) philialate			
	 		+	+		+	 	-		ļ				
METHO						<u> </u>				1				
1			- ' - IAI- I			~								
		nd IDs:												
Purging Ed		Peristaltic Pu						AI	conox, D	istilled Wate	er			
Disposal o	f Discharged	l Water:	Stored in 1	<u>,000 gailon t</u>	emporary onsit	te storage tan	.k							
Observation	ons/Comment	its:												



LMP5-08101毫3

GROUN	DWATER S	SAMPLING R	ECORD			WELL NUM	BER: CMF	P-5	<u> </u>	Page: 1 of 1	
		VEST HARBOR	PROJECT -	Phase II G	CWMP	Project Num					
Date: 10			_			Starting Wat	er Level (ft	TOC): +2	92 10	.09	
	by: DFR/AT					Casing Stick		-0.27			
	Point of Well					Total Depth		15.1			
	Interval (ft. T0 Interval (ft. T		5.5-15.5 3.0-19.0			Casing Diam	neter (inche	2			
	•										
		(ft Water			-	(L)(@)					
Casing voi	umes: 2" = (4" = 0.65 gpt 4" = 2.46 Lp		= 1.47 gpf = 5.56 Lpf				Sample Inf	take Depth (ft TOC): ~10.5 ft	
PURGIN		REMENTS	4 - 2.46 LP	0	- 5.56 Lpt			•			
Time	Cumul. Vol.	Purge Rate	Water	Temp.	Specific	Dissolved	pН	Eh	Turbidity	Comments	
	(gal or(L)	(gpm or (pm))	Level (ft)	(C or F)	Conductance			ORP	(NTU)		
		- 44			(µS/cm)	(mg/L)		(mv)		1	DFR
430		0.4								clear dischard	wrong
1450		0.4				1	100			clear discharge	
1455	2	<u> </u>	10.25	16.4	359	0.08	6.73	183.4	4.32		
1500	4	0.3	10.50	16.2	343	0.08	6.46	180.3	2.08	discharge reduced, to	so which DC
1505	5.5	-(10.48	16.0	346	0.07	6.68	154.8	1.22	•	
1510	1.0	\	10.46	16.0	352	0.08	6.56	137.4	1.35		
1515	8.5	1	10.46	16.0	358	0.07	6.73	111.3	0.78		
1520	10.0	0,3	16.46	16.0	358	0.07	6.73	112.6	0.81	turbed w/o YSI	·····
1300	1010	0,5	10176	10.0	320	7	0.73	11216	0.00	101610 4/0 171	
										·	
-	1								 		
T : 10 "		2.63		1					2 2 6	•	
l otal Gallo	ons Purged:	2.65				Total Casing	y Volumes I	Removed:	3.28	<u> </u>	
Ending Wa	ater Level (ft	гос):	6			Ending Tota	I Depth (ft ⁻	TOC): 15.1			
	E INVENTO			-	···						
		T	1		F:144:	D			1	Remarks	
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	eservation Appea		1		
							Color	Turbidity & Sediment		*******	
1520	1L	HPDE		1	none	HNO3	clear	none	Total Meta	als - As, Pb	
1	500mL	Amber glass			none	none	,	,	cPAHs		
	1L	Amber glass			none				PCBs		
			1			none	++-	 		A. J. W. a. a. a. I. J. S.	
	500mL	Amber glass	+	 	none	none	 	+		(w/silica gel cleanup)	
<u> </u>	500mL	Amber glass	<u> </u>	2	none	none		+	Bis(2-ethy	vl hexyl) phthalate	
			1				ļ <u> </u>		ļ	W. C. C. C. C. C. C. C. C. C. C. C. C. C.	
										, may 11, pr operation	
METHO	DS										
Sampling	Equipment ar	nd IDs:	Peristaltic I	oump and Y	SI 556# 147	<u> </u>					_
Purging E					· /- /- /-		ipment.	Alconox, D	Distilled Wat	ter	
		Water:				- '		,, L			-
Dishosal (n Discriaiged	vvale:	Stored III I	ooo ganon	cinporary onsi	ie siorage ian	N.				
Observation	ons/Commen	ts:									
_											
I											_



CMP15-081014

GROUNL	WATER 5	AWPLING RI	ECORD			MAETE MOINE	SER: CIVIP	-15			rage: 1 of 1			
-		EST HARBOR	PROJECT -	Phase II GC	WMP	Project Number: 080064								
	10/14/08					Starting Water Level (ft TOC): [0.38								
	by: DFR/AT					Casing Stickup (ft): -0.29								
	Point of Well					Total Depth (ft TOC): 17.05 Casing Diameter (inches2								
)C)				Casing Diam	eter (inches	2						
		OC)												
		ft Water)				(L)(gal)								
Casing volu		.16 gpf 4			= 1.47 gpf				Sample Into	ake Depth (ft TOC): ~12 ft			
).62 Lpf 4	1" = 2.46 Lpf	6"	= 5.56 Lpf									
PURGING	G MEASUF	REMENTS												
Time	Cumul. Vol.		Water Level (ft)	Temp.	Specific	Dissolved	pН	Eh ORP	Turbidity (NTU)		Comments			
	(gal or L)	(gpm or Lpm)	Level (II)	(C)or F)	Conductance (µS/cm)	Oxygen (mg/L)		(mv)	(1410)					
1155	/	0.4	10,38			/			_	ela «	dualacea			
1200	0			17-7	1861	0.31	6.73	204.9	2.26	turb id	discharge			
	2	1	10.50		2014	0.22	6.82	 	1.14	TOOD IA	atter (31			
1205	4			17.8		 								
1210	6		10.49	17.8	2190	0.12	6.87	92.1	1.26					
1215	0		10.49	17.7	2258	0.08	6.08	48.7	1.26					
1220	10		10.49	17.7	2334	0.08	6.89	44.4	1.26		· .			
1225	12	V	10,49	17,7	2336	0.008	6.88	48.1	1.12	turbed	extrulo YSI			
1000	L.S.	_	10111	1.0	<u> </u>	V.000	00	10.11		1	74 1 1 1 1 1 1			
						1								
						<u> </u>								
	<u>L</u> .					<u> </u>		<u> </u>	<u> </u>					
Total Gallo	ns Purged:		3,15			Total Casing	Volumes F	Removed:	2.97					
		l o												
Ending Wa	ater Level (ft 7	roc):	.44			Ending Tota	Depth (ft T	OC): 17.05						
SAMPLE	INVENTO	RY												
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appe	arance	Remarks					
							Color	Turbidity &						
								Sediment			1 (E) (E)			
1225	11500 mL	HPDE		21	none	HNO3	clear	noul	Total Meta	is - As, Pb,	Sb, Cr, Cu, Ni			
igsquare	500mL	Amber glass		2	none	none			cPAHs					
	1L	Amber glass		2	none	none			PCBs					
	500mL	Amber glass			none	none		1	TPH- DX (w/silica gel	cleanup)			
	500mL	Amber glass			none	none	V	\ \V		hexyl) phth				
—	JOUNIL	Miner Arass		 	LIGHE	TIONE		-	1013(Z-CHIYI	HONYI) PITU	MINIO			
	1							1						
LAFT. I.C.			L	<u> </u>	<u></u>				ı					
METHO														
Sampling	Equipment ar	nd IDs:	Peristaltic I	oump and Y	SI 556 # 4	ት								
Purging Ed	quipment:	Peristaltic Pu	mp w/ dedic	ated tubing		_ Decon Equ	ıipment:	Alconox, E	Distilled Wat	er				
Disposal o	of Discharged	Water:	Stored in 1	.000 gallon t	emporary onsi	te storage tan	k							
<u> </u>	Ū		_											
Observation	ons/Commen	ts:	total	bott	<u>25</u>									
						, in the second								



CMP17-081013

GROUNDWATER SAMPLING RECORD							WELL NUMBER: CMP-17 Page: 1 of 1								
	me: SOUTHV	VEST H	IARBOR	PROJECT -	Phase II GO	CWMP	Project Num								
	13/08					!	Starting Water								
	by: <u>DFR/AT</u>						Casing Stick								
Measuring	Point of Well		TOC	0.0.40.0			Total Depth								
Filter Pack	nterval (ft. TC Interval (ft. T	(OC)		6.0-16.0 4.0-16.5			Casing Diameter (inches2								
					(1 = £ .\/.		(1.)(67)								
	ume <u>6.1</u> umes: 2"=0			(i) =	(L)(gai))					Sample Inte	aka Danth	(ft TOC): 14 ft			
Casing voic				4" = 0.65 gpi 4" = 2.46 Lpf		= 5.56 Lpf						Jampie inte	ake Deptii	(11 100). 14 11	
PURGIN	G MEASU														
Time	Cumul, Vol.			Water	Temp.	Specific	Dissolved	r	Н	E		Turbidity		Comments	
	(gal o(L)	o(<u>L</u>) (gpm or (<u>p</u> p))		Level (ft)	(C or F)	Conductance				OF		(NTU)			
176.		-		4 417	/	(μS/cm)	(mg/L)		$\overline{}$	(m			-/ 10.0	1 , ,	
1350		0.2	210	9,47		/ UE 4							Clear	discharge after YSI	
1355	~ 1	 '		9.50	17.8	454	1.86		63	261			+U161d	after YSI	
1400	~2	<u> </u>	<u> </u>	9.50	17.6	55 5	0.48	1	53	194		2.67	 		
1405	~ 3	<u> </u>	<u> </u>	9.50	17.6	564	0.27	6.0	65	191	.8	2.00	<u> </u>		
1410	~ 4		· '	9,50	17.6	572	81.0	6.	62	189	.4	2.02			
1415	~5			9.50	17.6	573	0.15			188		3.64			
1420	~6	\ \ \ \	V	9.50	17.6	569	0.10		61	185		-	4.00 hod	l w/o Y51	
17 20			<u></u>	1100	1110	,		 _		<u> </u>	-	V 1 7	*******	(w/ 0 , - ,	
	+	 					+	\vdash		 		 	1	P-1	
				 								 	1		
		<u> </u>		ļ			_	ـــــــ				<u> </u>	<u> </u>		
			!							<u> </u>			<u> </u>	Surgery .	
		·	- 1		 										
					1								1		
					 		+	+							
- / / 0-11-						<u> </u>	T / / Oi-			<u> </u>		. 41	1	A (2-1)	
Total Gallo	ons Purged:		1.	57		_	Total Casing	j Volu	mes ĸ	emove	∋d:	<u> 1,4</u>			
Ending Wa	ater Level (ft ⁻	TOC):	9	1.50			Ending Tota	ıl Depf	th (ft T	OC): 1	16.21				
	E INVENTO														
Time	Volume		le Type		Quantity	Filtration	Preservation	1	Appearance			Remarks			
		Double Type		'		1.000.101.01	Color		Turbi	idity &	1				
		-			-					Sedi	iment	1			
1420	1L	HPDE		<u> </u>	1	none	HNO3	cle	41	No.	ne	Total Meta	ls - As, Pb)	
1420	500mL	Amber	r glass	<u> </u>	. 2	none	none		<u> </u>	Ш		cPAHs			
1420	1L	Ambe	r glass		2	none	none				!	PCBs			
1420	500mL	Amber	r glass -	1	2	none	none]!	「 <u> </u>	_}		TPH- DX (w/silica ge	l cleanup)	
1420	500mL	1	rglass			2 none	none					Bis(2-ethyl	l hexyl) ph	thalate	
1420	40mL	VOA v		†		3 none	HCI	1		1				and Ethenes (CEEs	e)
1-100	401111	70/11	lai	+	 	lione	1101	+		-		Onion nace.	u zululies	and Edition (
METHO	DS			<u> </u>		1	1					<u> </u>			
		nd IDo:		Dodinated	OED Wall V	Vizard Bladdar	Dump and VS	21 556	# 14	· ¬,					
	Equipment ar					Vizard Bladder I			•	•		· · · · · · · · · · · · · · · · · · ·			
Purging Ed					ard Bladder		_	-	nt:	Alcor	10X, L	Distilled Water	er		—
Disposal o	of Discharged	Water:		Stored in 1	,000 gallon t	temporary onsit	te storage tan	ık							
Observation	ons/Commen	ıts:													
	•														



FM105-081013

	OWATER S						WELL NUM	BER: FM	l-105				Page: 1 of 1
Project Nar	ne; SOUTHV	VEST HAF	RBOR	PROJECT -	Phase II GO	WMP	Project Num			f ı	20	1	
	0 13 0 9 by: DFR/AT	D			•		Starting Wate		ft TOC)	-0.2	20		
•	Point of Well	Т(DC				Casing Stick Total Depth			18			
_	nterval (ft. TC			7.0-17.0			Casing Diam	` —					
	Interval (ft. T			6.0-17.5	•								
	umes: 2" = 0		4	x <u>0, l</u> " = 0.65 gpf I" = 2.46 Lpf	6"	(pf) = = 1.47 gpf = 5.56 Lpf	(L)(gal)				Sample Inta	ake Depth (f	t TOC): 15 ft
PURGIN	G MEASU			I									
Time	Cumul. Vol. (gal or ()	Purge f		Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	(Eh DRP mv)	Turbidity (NTU)		Comments
1045	0,210	0.21	10	11.20							/	clear	dischange
1050	~ 1	١		11.20	14.8	715	1.31	8.65	25	PB. Z	38.5	turbed	after VSI
1055	~ 2			11,20	14.8	600	1.17	8.35		7.3	32,4		
	~ 3			•	14.7	479	0.77	7.77	1	,5	14.4		
1105	 			11.20	14.7	448	0.53	7.41	_	7.5	6.54		
	~4	-		****		*							
1110	5.5			11.20	14.8	442	0.44	7.21		4.3	11.8		***
1115	~6.5			11.20	14.8	441	0.34	7.09		3,7	1.99		
420	~7.5	1		11.20	14.8	440	0,37	7.06	18	1.6	1.25		
1125	8.8	V		11.20	14.8	440	6,37	7.03	lβ	1.9	2.1	torbid	w/c YS1
						,							
Total Gallons Purged: 2.2 Total Casing Volumes Removed: 2 Ending Water Level (ft TOC): 11.20 Ending Total Depth (ft TOC): 18													
SAMPLE	E INVENTO	DRY											
Time	Volume	Bottle ²	Туре		Quantity	Filtration	Preservation	Ар	pearan	се	-d	Rei	marks
								Color		bidity &			
1125	1L ·	HPDE			2	none	ниоз	Cleur		, Ne	Total Meta	Is - As Ph	- 1400 -
1	500mL	Amber gl	lace			none	none	Liens	T.	1	cPAHs	,	
 					1			-		1			
- - - - - - - - - - 	11L	Amber gl				none	none			1	PCBs		
 	500mL	Amber g	lass		4	none	none		-	+	TPH- DX (w/silica gel o	cleanup)
	500mL	Amber g	lass _.	ļ.,	4	none	none			1,	Bis(2-ethyl	hexyl) phtha	alate
<u> </u>	40mL	VOA vial	<u> </u>		6	none	HCI			<u>V</u>	Chlorinate	d Ethanes a	nd Ethenes (CEEs)
MACTUO	DC:	<u> </u>						.,,,,					
METHO													
Sampling	Equipment ar	nd IDs:		Dedicated	QED Well W	/izard Bladder	Pump and YS	1 556 #	177				
Purging E	quipment:	<u>Dedica</u>	ted QE	ED Well Wiz	ard Bladder	Pump	_ Decon Equ	uipment:	Alc	onox, [Distilled Wat	er	
Disposal c	of Discharged	l Water: _		Stored in 1	,000 gallon t	emporary onsi	te storage tan	ık					
Observation	ons/Commen	ts:	lled	Samo	ie ba	itles u	ntil 1	230					
	Cocond cot	of hottles	aallaaf	•					D ri	Her	10	1130	on CoC
	Second Set	OI DOLLIES	CUITECT	ea ioi aupiia	ate sample	1 /1102	, 001	U. J.	, .,		- CV.	, , , ,	



MWZGR-081014 / MWZGR-081014D

GROUNI	OWATER S	SAMPLING	RECORD			WELL NUM	BER: MV	V-26R		Page: 1 of 1			
Project Nar	ne: SOUTHV	VEST HARB	OR PROJECT -	Phase II GO	CWMP	Project Num							
Date:	10/14	108						ft TOC): 9.	· · · · · · · · · · · · · · · · · · ·				
Developed	by: DFR/AT	T00				Casing Stick							
	Point of Well nterval (ft. TC					Casing Diam		17.05 nes 2					
	Interval (ft. T					Casing Dian	leter (IIIci	163		· · · · · · · · · · · · · · · · · · ·			
			ater) x 0.16	(l. pf.)/c	unf) - 1 11	U (L)(aal)							
	umes: 2" = 0		4" = 0.65 gpf		pi) = i. = 1.47 gpf	(L)(gai)			Sample Int	ake Depth (ft TOC): ~ 11.5 ft			
Odding von			4" = 2.46 Lpf		= 5.56 Lpf				oumple inc	and Bopin (in 100).			
PURGIN	G MEASUI												
Time	Cumul. Vol.			Temp.	Specific	Dissolved	рН	Eh	Turbidity	Comments			
	(gal or	(gpm or L	ঠী) Level (ft)	(C or F)	Conductance	Oxygen		ORP .	(NTU)				
			<i>G</i> a .		(µS/cm)	(mg/L)	_	(mv)					
1015		0.4	9.91		- 20-	/		<u>/</u>	5 115	clear discharge			
1020	2		9.91	16.2	12290	0.35	7.03			tuibid after YSI			
1025	4		9.93	16.5	11600	0.23	7.15	195.3	1.39				
1030	6		9.95	16.6	9,930	0.15	7.30	187.9	1.16				
1035	શ		9.95	16.9	9.735	0.13	7.30		0.70				
1040	lo		9.95	i .	10,130	0.11	7.30	l .					
		1		16.9		1	1			1.4 / 26.1			
1045	12		9,95	16.9	10,190	6.11	7.29	194.5	0.17	torbid w/o YSI			
										·			
-				-									
****									1				
Total Gallons Purged: 3.15 Total Casing Volumes Removed: 2.76													
Total Gallo	Fotal Gallons Purged: 3.15 Total Casing Volumes Removed: 2.76												
Ending Ma	ater Level (ft 7	TOC):	9.95			Ending Tota	I Donth /f	t TOC): 17.05					
		,,,				Enuling Fota	i Debui (i	1100). 17,00					
	INVENTO	1		0	F:144:	In			T	Remarks			
Time	Volume	Bottle Typ	De	Quantity	Filtration	Preservation	Api	pearance Turbidity &	-	Remarks			
							Color	Sediment					
1045	1L	HPDE		2	none	ниоз	clear	rnone	Total Meta	ıls - As, Pb, Sb, Cr, Cu, Ni			
1	500mL	Amber glas	s		none	none	1	1	cPAHs				
	1L	Amber glas			none	none			PCBs				
										iv/cilion gol alcony			
	500mL	Amber glas		ĺ .	none	none	1	+ 1		w/silica gel cleanup)			
 	500mL	Amber glas	S	4	none	none	-		Bis(2-ethy	l hexyl) phthalate			
$\vdash \downarrow -$		<u> </u>								- WA			
	1				<u></u>			<u> </u>					
METHO	DS												
Sampling	Equipment ar	nd IDs:	Peristaltic F	oump and Y	SI 556# 143	-							
Purging E			Pump w/ dedic				upment:	Alconox, [<u>Distilled W</u> at	er			
Disposal o	of Discharged	Water:	Stored in 1	.000 gallon t	emporary onsit	e storage tan	k						
-	-		2.2,04 1	, generi									
Observation	ons/Commen	•							INFR				
	Second set	of bottles co	llected for duplic	ate sample	- MW ZE	P-081	014 D	af	1050				
I													



MW36-081014

GROUN	IDWATER S	AMPLING R	ECORD			WELL NUM	BER: MW-3	36		Page: 1 of 1		
		VEST HARBOR	PROJECT -	Phase II Go	CWMP	Project Num						
	0/14/68		-			Starting Wat			0.0 @			
	d by: <u>DFR/AT</u>					Casing Stick						
	g Point of Well				<u>-</u>	Total Depth						
)C)	58.0-73.0			Casing Diam	eter (inches	2		 .		
Filter Pac	k Interval (ft. T	OC)	55.0-71.0									
Casing V	olume <u>63</u>	(ft Water)x 0.16	(Lpfv)(g	gpf) = <u>lo.o</u>	8(L)(43))						
Casing v	olumes: 2" = 0).16 gpf	4" = 0.65 gpf	6"	= 1.47 gpf				Sample Into	ake Depth (ft TOC): ~ 65.5 ft		
	2" = (0.62 Lpf	4" = 2.46 Lpt	6"	= 5.56 Lpf							
PURGI	NG MEASUI	REMENTS										
Time	Cumul. Vol.		Water	Temp.	Specific	Dissolved	pН	Eh	Turbidity	Comments		
	(gal or ₄()	(gpm or Lpn)	Level (ft)	(C or F)	Conductance	, , ,		ORP	(NTU)			
					(µS/cm)	(mg/L)		(mv)	1			
1250		0.4	10.00			/	/			Clear discharge		
1255	2		10.04	14,7	36,900	0.11	7.15	-30.8	1.55	turbidity after YSI		
1300	4	1 1 .	10.04	14.6	36,766	0.07	7.27	-50,0	1.03			
1305	6		10.04	14.7	36,480	0.07	7,34	-65.7	1.40			
	3		10.04	14.6	1		7.39	-70.5	1.23			
1310					36,380	0.06			1	1		
1315	10		10.04	14.6-	36,220	0.05	7.44	-78.9	1.17			
1320	12		10.04	14.6	36,190	0.05	7.46	-79.6				
1325	- 14		10.04	14.6	36,200	0.06	1.47	-74.3	1.02	toobed w/o YSI		
										,,		
							1					
					1	ļ	-					
									ļ			
							ì					
			<u> </u>									
-		2 1 6	<u> </u>	<u> </u>		1				,		
Total Gallons Purged: 3.68 Total Casing Volumes Removed: 0.36												
Ending \	Notor Lovel (ft	TOC):	n 4			Ending Tota	al Denth (ft T	OC): 73				
						Littling Foto	ii Deptii (it i	00). 10				
SAMPI	E INVENTO		F	- 			Т		1			
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	n Appe	arance		Remarks		
							Color	Turbidity & Sediment				
1328	16500mL	LIDDE	1	7	none	HNO3	clear	none	Total Mate	als - As, Pb, Sb, Cr, Cu, Ni		
1320							Clear	ribud		ais - As, 1 b, Ob, O1, Ou, 141		
$\vdash \vdash$	500mL	Amber glass	1	 	2 none	none	+		cPAHs			
	1L	Amber glass		1	2 none	none	1 1		PCBs	- Anna -		
	500mL	Amber glass	<u></u>	<u> </u>	2 none	none			TPH- DX	(w/silica gel cleanup)		
V	500mL	Amber glass			2 none	none	V	1	Bis(2-ethv	l hexyl) phthalate		
├	- COOME	, who glass	1					<u> </u>				
								 	+			
	000			1				<u> </u>				
METH						_						
Samplin	g Equipment a	nd IDs:	Peristaltic	Pump and Y	'SI 556# '4	}						
Purging	Equipment:	Peristaltic P	ump w/ dedic	ated tubing		_ Decon Eq	uipment:	Alconox, i	Distilled Wa	ter		
1 "		l Water:				_ `						
· ·	•					otorago tal						
Observa	ations/Commen	nts: <u> [6</u>	to tal	Dottle	\$							
1												



MW44-091014

GROU	NDWATER S	SAMPLING R	ECORD			WELL NUM	BER: MW-	44		P	age: 1 of 1		
		VEST HARBOR	PROJECT -	Phase II GO	WMP	Project Num							
	10/14/09		_			Starting Wat			90				
	ed by: <u>DFR/AT</u>					Casing Stick							
	ng Point of Well d Interval (ft. T0		n/a			Total Depth Casing Diam							
	ck Interval (it. T		n/a			Oading Dian							
Cooling	/olumo f 7	(ft Water	0.16	(1 nfv)(c	inf) = 14 A	(Len)(1) &							
	olumes: 2" = 0		4" = 0.65 gpf		= 1.47 gpf	(L)(gai)			Sample Inta	ake Depth (ft	TOC): ~ 68 ft		
			4" = 2.46 Lpt	6"	= 5.56 Lpf								
	ING MEASU		1	T ====================================		l n:		T ==1.	Total Californ	1	Cammanta		
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pΗ	Eh ORP (mv)	Turbidity (NTU)		Comments		
1045	. /	0,4	10.90		(рогонт)	(Higi-1)	/	//		dear	dish		
1050	1	,	11.00	15.8	2,020	2.31	8.01	161.2	6.35		after	YsI	
1055			11.00	15.5	193	2.68	8.23	170.9					
1100	6		11.00	15.5	090	2.36	7.82	181.2	5.79				
1105	1		11.00	15.4	061	1.96	7.41	188.6	5.36				
1110	10		11.00	15.4	052	1.90	7.38	197.8	5,21				
1115	12		11.00	15.4	046	1.64	7.21	196.7	6.32				
1120	14		[1,00	15.4	043	1.60	7.20	198.1	4.32				
1125		V	11.00	15.3	041	1.59	7,23	199,7	3.21	turbid	w/0 451		
											,		
Total G	Total Gallons Purged: 4.21 Total Casing Volumes Removed: 5.41												
Ending	Water Level (ft	тос):	00			Ending Tota	al Depth (ft]	ГОС): 73.9					
SAMF	LE INVENTO	DRY											
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	n Appe	earance		Ren	narks		
							Color	Turbidity & Sediment					
1129	5 /L 500 ml	HPDE		21	none	HNO3	clear	none	Total Meta	ls - As, Pb, S	Sb, Cr, Cu, Ni		
	500mL	Amber glass			none	none	1		cPAHs				
	1L	Amber glass		2	none	none			PCBs		····		
	500mL	Amber glass		2	none	none			TPH- DX (w/silica gel c	eleanup)		
1	500mL	Amber glass		2	none	none	1	V	Bis(2-ethy	l hexyl) phtha	alate		
										····			
METH						•							
Sampli	ng Equipment a	nd IDs:			SI 556# \4								
	g Equipment:	<u>, </u>	ump w/ dedic				uipment: _	Alconox, [Distilled Wat	er			
Dispos	al of Discharged	d Water:	Stored in 1		temporary onsi	te storage tar	nk						
Observ	ations/Commer	nts: 10	bottles	total									
1													



MW125-08/013

GROUND	WATER S	SAMPL	ING R	ECORD		ļ	WELL NUME	3ER: MW-	125		F	Page: 1 of 1
Project Nan	ne: SOUTHV	V <u>E</u> ST H	ARBOR	PROJECT -	Phase II GC	WMP .	Project Numb			-		
Date:	011310	8					Starting Wate				<u> </u>	
	by: DFR/AT						Casing Stick					
	Point of Well		TOC	5.0-15.0	·		Total Depth (Casing Diam			2		
Screened ir Filter Pack	nterval (ft. TC Interval (ft. T	.UC)	-	3.0-15.0			Casing Diam					
					(I E A)		(1.)/1)					
		-) × <u> </u>		gpf) = l.0 = 1.47 gpf	(L)(gal)			Sample In	taka Denth (f	t TOC): 13 ft
Jasing void	umes: 2" = 0 2" = 0	o. 16 gpi 0.62 Lpf		+ = 0.65 gpr 4" = 2.46 Lpf		= 5.56 Lpf				oampie im	.anc Dopin (i	1 100). <u>10 k</u>
PURGINO	G MEASU			<u> </u>		0.00 Lps						
	Cumul. Vol.		e Rate	Water	Temp.	Specific	Dissolved	рН	Eh	Turbidity		Comments
	(gal or L)		or ŁOM)	Level (ft)	(C or F)	Conductance			ORP	(NTU)		
OCE						(µS/cm)	(mg/L)		(mv)	 	 	
1255	/	. 2	10	6.88	/	/						discharge
1300	~1	<u> </u>		6.88	18.1	429	1.37	6.72			turbid	after YSI
1365	~2		<u> </u>	6.98	18,5	428	0.90	6.66	197.	1.25		
1310	~ 3		1	6.98	18.5	423	0.73	6.63	1 .			
1315	~ 4			7,00	18.6	420	0.66	6.67				
	~5		\vdash	7.01	18.6	415	0.56			1000	,	
1320			 	7.01	18.6	412	0.52	6.61	196.		NASIO	YSI
1325	~ 6	├─ `	<u>V</u>	<u> </u>		- 11 6	0.72	V.W.	1 10		1010	177
1808	M	<u> </u>		THE .			-				-	
		<u> </u>				<u> </u>						
			ļ									
											T	
		+-						 				
	 	-			· · ·		+	-	1	+	+	
			- 10			<u></u>		<u> </u>				
Total Galio	ons Purged:		1.65				Total Casing	ا Volumes و	Removed	1.69	>	
Ending Wa	ater Level (ft ⁻	TOC):	7	ı. ol			Ending Tota	al Depth (ft	TOC): 13.	35		
								1				
	E INVENTO		le Type	T .	Quantity	Filtration	Preservation	Δηη	earance	7	Re	marks
Time	Volume	Dom	е≀уµ о		Quantity	FIII(auon	FIESEIVALIO			, <u>R</u>	1101	Haire
		<u> </u>				ļ		Color	Sedime			
1325	1L	HPDE			1	none	HNO3	Clear	non	Total Met	als - As, Pb	
	500mL	Amber	r glass		2	none	none	<u> </u>	<u></u> _	cPAHs		
	1L	Amber				none	none		\top	PCBs		
		Amber	_			2 none	none		1		(w/silica gel	cleanun)
	500mL							+	1 1			
$\vdash \downarrow$	500mL	Amber	•			none	none	1	1 1		yl hexyl) phth	
	40mL	VOA v	ial		3	3 none	HCI	 	+	Chlorinate	ed Ethanes a	and Ethenes (CEEs)
1	<u></u>			<u> </u>		<u> </u>						
METHO									- 4 🖱			
Sampling I	Equipment ar	nd IDs:		Dedicated /	QED Well W	Vizard Bladder	Pump and YS	31 556 # L	4+			•
Purging Ed	quipment:	Ded	icated Qf	ED Well Wiza	ard Bladder	Pump	_ Decon Equ	uipment: _	Alcono	<u>ς Distilled Wa</u>	iter	
Disposal o	of Discharged	d Water:		Stored in 1	,000 gallon	temporary onsi	ite storage tar	ık				
Ot - 2m - 44	- 10		-	_								
Observanc	ons/Commen	its:										-,
.												
1											and the second second	



MW308N-081013

GROUND	WATER S	AMPLING	RECORD			WELL NUMB	BER: MW-3	308N			Page: 1 of 1	
Project Nan	ne: SOUTHV	VEST HARBO	R PROJECT -	Phase II GC	CWMP	Project Numb						
Date:	10/13/09	<u> </u>				Starting Wate	r Level (ft	TOC): <u>6</u> .	53			
Developed	by: DFR/AT					Casing Sticku	ıp (ft):	-0.29				
Measuring I	Point of Well	TOC				Total Depth (ft TOC):	17.95				
		DC)	12.5-17.5			Casing Diame	eter (inches	2				
Filter Pack	Interval (ft. T	OC)	10.0-21.5									
Cooing \/oli	11.	07. (#1\Mat	only Mile	1. 16 (Lpfu)/a	ipf) = [.76	(L)(nal)						
						(L)(gai)			Sample into	aka Danth (1	ft TOC): ~15 ft	
asing voil		16 gpf			= 1.47 gpf				Sample into	ake Deptii (i	(100). <u>101(</u>	
			4" = 2.46 Lpf	r 6"	= 5.56 Lpf							
PURGING	G MEASU	REMENTS										
Time	Cumul. Vol.			Temp.	Specific	Dissolved	pН	Eh	Turbidity		Comments	
	(gal or L)	(gpm or Lpm	n) Level (ft)	(C or F)	Conductance			ORP	(NTU)			
					(µS/cm)	(mg/L)		(mv)				
1645	/	0.4	6.53	/	/				/	clear	discharge	
1650	2	ı	6.70	16.7	1.850	0.03	8.10	-83.7	29.3	tuched	discharge after YS	,
		 	-						23.8	1 - 1 - 1		
1655	4	<u> </u>	6.71	16.7	1,595	0.02	7.82	-36.4				
1700	6		6.71	16.7	1,585	0.02	7.68	- 86.5	22.2			
1705	93		6.72	16.7	1.586	0.03	7.61	-85.2	17.9	Lurbid	w/o YSI	
			· · · · ·			i I					•	
1710	10	ļ	6.73	16. 7	1,586	0.02	7.60	-87.3			~/o Y51	
1715	12	🗸	6.75	16.8	1,586	0.02	7.59	-80.9	12.7	tulbed	w/0 YS1	
											•	
						1					14,400,00	
		:										
					-							
	L											
		 						 		-		
					-							
Total Calla	ns Purged:	3.15	1			Total Casing	Volumes F	Removed:	-3-15	- 1.79	ን	
Total Gallo	nis Fuigeu.					Total Gasing	VOIGITIOS I			<u> </u>	*	
Ending Ws	ater Level (ft :	TOC):	6.75			Ending Total	Depth (ft 1	TOC): 17.95				
Eliding vva	Tel Level (II	100)				Littling Total	- Deptil (it i	100). 17.00				
SAMPLE	EINVENTO	DRY										
Time	Volume	Bottle Type	е	Quantity	Filtration	Preservation	Appe	earance		Re	marks	
	1	1					Color	Turbidity &	1			
							Color	Sediment				
1715	1L	HPDE		1	none	ниоз	Slighty	nove	Total Meta	ıls - As, Pb		
171)					1		yellow	/ 1		7.0,1.2		
	500mL	Amber glass		2	none	none	- - - - - - - - - - 	 	cPAHs			
1	1L	Amber glass		2	none	none			PCBs ·			
		1							TOU DV	w/silica gel	oloopup)	
	500mL	Amber glass			none	none	V					
$\overline{}$	500mL	Amber glass		2	none	none	V	V	Bis(2-ethy	I hexyl) phth	nalate	
<u>-</u>												
					1		T			10-1		
		1			1		<u> </u>					
METHO	DS											
Sampling	Equipment a	nd IDs:	Peristaltic	Pump and Y	SI 556 # 14	7						
					•		inmont:	Alconov	Distilled Mar	tor		
	quipment:								Jiaunieu vva	101		
Disposal c	of Discharged	Water:	Stored in 1	1,000 gailon	temporary ons	ite storage tan	k					
l												
Observation	ons/Commer	nts:										
-												



MW3085-081013

GROUND	OWATER S	AMPLING R	ECORD			WELL NUM	BER:	MW-30	088		Page: 1 of 1
Project Nar	me: SOUTHV	VEST HARBOR	PROJECT -	Phase II G0	CWMP	Project Num	ber: 0	80064			
Date:		·				Starting Wat	er Lev	el (ft T	OC): 6.	30	
	by: DFR/AT					Casing Stick			-0.61		
		TOC	05.0.40.0			Total Depth			40.5		
	`		35.0-40.0 31.0-40.0			Casing Diam	ieter (i	ncnes	2		
						7					
		(ft Water)				<u>-</u> (L)(gal)				0	-lia Danti (# TOO) 27 5 #
Casing volu	umes: 2" = 0 2" = 0		1" = 0.65 gpf 4" = 2.46 Lpf		= 1.47 gpf = 5.56 Lpf					Sample Into	ake Depth (ft TOC): ~ 37.5 ft
PURGIN	G MEASUI	REMENTS									
Time	Cumul. Vol. (gal or ()	Purge Rate (gpm or Lpfn)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	р	Н	Eh ORP (mv)	Turbidity (NTU)	Comments
1600		0.4	6.30	/			<u> </u>	/	/		clear discharge
	2	→		1.1 61	16 200	0.04	7.		3.0	3.7	1 d l'a tole Care
1605			7,00		15,290						disch reduced too much
1610	4	0.3	6.80	14.9	15,260	0.03	7,9		- 20.6	0.81	disch reduced too much
1615	65.5	<u> </u>	6.97	15.0	15,250	0.03	8.0		-43.0	1.81	
1620	47	0.25	6.95	15.0	15,250	0.03	8.0	8	-57.9	1.79	disch reduced, too much !
1625	8		6.10	15.0	15,230	0.03	8.1	0	-55.9	1.46	•
1630	9	V	6.60	15.0	15,230	0.03	8.	11	- 56.8	2.13	turbed w/o YSI
	,							İ			,
	ļ										
							ł				
							<u> </u>				
Total Gallo	ons Purged:	2.36				Total Casing	ı Volu	mes R	emoved:	0.4	3
			7.		_		-				
	ater Level (ft					Ending Tota	i Dept	n (π ι	UC): 40.5		
	E INVENTO	T		Quantity	Filtration	Preservation	J	Apper	ranco	1	Remarks
Time	Volume	Bottle Type		Quantity	Filliation	Freservation	-	Appea	Turbidity &		Kellarks
							C	olor	Sediment		
1636	1L	HPDE		1	none	HNO3	>(1)	ellow	none	Total Meta	ıls - As, Pb
1	500mL	Amber glass		2	none	none	1 1	!	1	cPAHs	•
	1L	Amber glass			none	none				PCBs	
						1					(w/silica gel cleanup)
 	500mL	Amber glass			none	none	+ -				
V	500mL	Amber glass		2	none	none	 	-		Bis(2-ethy	l hexyl) phthalate
						<u> </u>	-				
METUC	<u> </u>						1			1	
METHO						^					
Sampling	Equipment ar	nd IDs:	Peristaltic I	Pump and Y	SI 556 # 14	†					
Purging E	quipment:	Peristaltic Pu	mp w/ dedic	ated tubing		_ Decon Equ	uipme	nt:	Alconox, E	Distilled Wat	.er
Disposal c	of Discharged	Water:	Stored in 1	,000 gallon i	temporary onsit	te storage tan	ık				
Obnesie	oon/Co	to:									
Onservatio	ons/Commen	ιο.		****							

ARI Assigned Number:	Turn-around Requested:	Requested:			Page:	jo	اللوي			6	Analytica	Analytical Resources, Incorporated
	0 - <					ANNA .	estable is				Analytica	Analytical Chemists and Consultants
уошо	S.	Phone:		(Date:	0 2	lce Present?				4611 Sour	4611 South 134th Place, Suite 100
ころとのことのことのことのことのことのことのことのことのことのことのことのことのこと	Se Survey	- 1	7	36	NO.	1000			,		JUNNIIA, V	77 201 00
Client Contact:					No. of Coolers:	くこ Coc Ten	Cooler /5, -</td <td>-10,</td> <td>^</td> <td></td> <td>206-695-6</td> <td>206-695-6200 206-695-6201 (tax)</td>	-10,	^		206-695-6	206-695-6200 206-695-6201 (tax)
Name:		ı				, v.	Analysis	Analysis Requested				Notes/Comments
Southwest Hurbor Project	ŧ	アスタメ	4 えいろの	<u></u>	S1 02 51		W	atso				
Client Project #: C おらっ ら イ	Samplers: DA UÉ	DW6H/	AMA	716	(9./ (9./	5 1 7'48 709/		グ フゥ	つく			
Sample ID	Date	Time	Matrix	No. Containers	M +ot 8 0103 9 ,28) M +ot	'9a'sy '80109	2H A9 2F S 8	9 TWU 152510 51114 W	14 년 8 14 년 8	808 87d		
CMP-1-081013	10/13/08	200	7203	Q.,,	X		X	×	×	X		
S10180-74W3	g engarite	000	Silvenia.	Green	×		×	X	, ×	X		
00 5 7		S 2 = 2	Some side was beside	C.	×	<u>×</u>	×	×	×	×		
TM105-081013D	, vergooneroonio	200		7	×	<u>×</u>	X	×	×	×		
MW125-081013	Paradonales condice	5721		12	×	×	\times	X	X	X		
CMP17-081012	quintininaranenga	<u> </u>		and the same	×	×	×	\times	×	X		
S10180-54W7	William St. Wallet	1520	gingstiller vir exclus	2	. ×		×	×	X	X		
, 4	and the second second	201	dintroviduos, q	15-	×		X	X	×	X		
NW 308N - 081013	1	514	sered.	li	\times		×	\times	×	X		
		1	<									
l to	Relinquished by: (Signature)		S	Received by: (Signature)			Relinquished by: (Signature)	d by:			Received by: (Signature)	
Supplemental Color	Printed Name:	3	まられる	Printed Name:	Mean	7.	Printed Name:	::			Printed Name:	
V-18695	Company			Company:			Company:				Сотрапу:	
	Date & Time:		8	Date & Time: / / / / / / / / / / / / / / / / / / /	2	(2021)	Date & Time:				Date & Time:	
										.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		

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-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 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.

18/9/11

			•						ſ				
ARI Assigned Number:	Turn-around	Turn-around Requested:			Page:	ಚ	of					Analytical Resources, Incorporated	þ
	STD					smodulu.	No.					Analytical Chemists and Consultants	nts
ARI Client Company:	777	Phone:	-081-902	9330	Date:		Ice Present?					4611 South 134th Place, Suite 100 Tukwila, WA 98168	0
1		i i		1	No. of Coolers:		Cooler Temps:					206-695-6200 206-695-6201 (fax)	~ l
t Na						.W	An	Analysis Requested	lested			Notes/Comments	П
laybor	Project -	Phase 2	2 GWC/	CMP		07			30 r				
	Šamplers: りA∨≀り	2 COEH	7 10 1	11cE	190	1779	શ	15/5		20.	78		
Sample ID	Date		Matrix	No. Containers	N +6T (80108 1,2A)	s'4d'sV) 80109	547 8260 (EE	0F18 19TWN	1438 m/silica 125210	F 18	'08		1
7-0180-8AW2	10/m/1/18	5.73	water	Luca,	X			×	×	X	X		
J	ro enclosed	3	de September 1989	1	×					×	X		
10000 - 80 CMS		Y Z		5		X		> <	×	·×	X		
\$ 10.80 - 49 CRE	p retricted topic	2 2		. 0		X		<u>\</u>	×	X	X	,	
			i in the season discovering the	0		×		×	×	X	X		
		KO		<u> </u>		· ×		×	X	X	X	ž.	
	<u> </u>	225	<u> </u>	2		.Х		· ` `	. X	X	7		I
						,			•				
			<										
Comments/Special Instructions	Relinquished by.	- K		Received by:			Re	Relinquished by:			<u> </u>	Received by:	Ī
((Signature)	K	くくご	(Signature)	1	and the same of th	(S)	(Signature)			<u>ټ</u>	(Signature)	T
Joppiemental Cook	Printed Name:	ľ	がなった。	Printed Name:			5	Printed Name:			<u></u>	Printed Name:	
S_LB_695	Company:	4400 44000		Company:) ×	in the second second	8	Company:				Сотрапу:	
	Date & Time:		5	Date & Time:	<i>š</i> 5	430	Da	Date & Time:				Date & Time:	
	2 0 0 0	۱											1

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 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-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 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.



CMP1-090331

GROUN	DWATER :	SAMPLING R	ECORD			WELL NUN	IBER: CM	P #		Page: 1 of 1		
		WEST HARBOR	RPROJECT	- Phase II (GCWMP	Project Nun						
	3/3//2		-			Starting Wa			1.21			
	by: <u>DFR/AT</u>					Casing Stick						
	Point of Wel		7.0-17.0			Total Depth Casing Diar			-	·		
		гос)	5.0-19.0			Casing Diar	meter (more	B:2	<u> </u>			
	-	69(ft Water		/Lofv	(apf) = Δ, Δ,	(L)(ga	n					
	umes: 2" =	0.16 gpf	4" = 0.65 gp	f 6	" = 1.47 gpf	(L)(ya	1)		Sample Int	ake Depth (ft TOC): ~12 ft		
BUBCIN		0.62 Lpf REMENTS	4" = 2.46 Lp	f 6	" = 5.56 Lpf							
Time	Cumul. Vol.		Water	Temp.	Specific	Diagolard	-11	T (**).	T			
i iiile	(gal or L)	(gpm or Long)	Level (ft)	(C or F)	Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pН	Eh ORP (mv)	Turbidity (NTU)	Comments		
915	/	0.4	/	/	/	7	/	/	/	cleur discharge		
920	2	1	12.26	12.7	566	0.48	6.63	1495	4.65	tuibed after YSI		
925	4	12,27	12041	12.7	537	0.37	6.53	239.5	4.80			
930	6		12,27		521	6.32	6.26	278.4	1.70			
435	8	1	12.27		513	0.27	1	266,5				
940	10		12.25		511	0.22	1	244.6	1 1			
945	12	\downarrow	17,25	12. 7	506	0.19	1	233,6		turbul before YSI		
1 1 4				-1. L' 1	300	<u> </u>		<i>W</i> 1131.0		THE PARCY E 1 ST		
								 -				
-					-			ļ <u>.</u>				
						<u> </u>	_	-	<u> </u>			
							<u> </u>		_			
								 				
						:						
	·	<u> </u>	محمي					L				
Total Gallons Purged: 3.88												
Ending Wa	ter Level (ft	roc): 12,	25			Ending Total	Depth (ft T	TOC): 45%	16,85			
SAMPLE	INVENTO	RY	_									
Time	Volume	Bottle Type		Quantity	Filtration	Preservation		arance		Remarks		
							Color	Turbidity & Sediment				
445	1L	HPDE		1	none	HNO3	clens	1	Total Metals	e _ Δe . Ph		
i		Amber glass				none	1	1	cPAHs	· 1011 D		
	1L	Amber glass			none	none			PCBs			
1	500mL	Amber glass		<u>-</u> -		none	1	 	TPH- DX			
	500mL	Amber glass			_					bood white afair-		
	JOOITIL	Arribei glass	-		none	none		_	Bis(z-etnyt i	hexyl) phthalate		
METHO		,					.		· · · -			
Sampling E	Equipment an	d lDs:	Peristaltic P	ump and YS	61 556 # 14 7	}-						
Purging Eq	uipment:	Peristaltic Pun	np w/ dedica	ted tubing		Decon Equi	pment:	Alconox, Di	istilled Wate	r		
Disposal of	Discharged	Water:	Stored in 1,0	000 gallon te	emporary onsite	e storage tanl	k					
Observatio	ns/Comment	s:										
2230,7400	commone											
												



GROUNI	DWATER :	SAMPLING I	RECORD	•	,54164	WELL NUM	BER: CMF	*2		Pa	ge: 1 of 1
Project Na	me: SOUTH	WEST HARBO	R PROJECT	- Phase II C	CWMP	Project Num	ber: 08006	i4			
	<u> 3/3//</u>		-			Starting Wa	ter Level (ft	TOC):	12.92		
	by: DFR/AT					Casing Stick		-0.29	~ 1		
_	Point of Wel	•				Total Depth		19 85	-	3	
	Interval (ft. T		7.0-17.0			Casing Dian	neter (inche	:2			
	interval (ft. 1		5.0-19.0			1 A					
		(ft Wate				L)(gal	l)				
Casing vol	umes: 2" = -		4" = 0.65 gp		' = 1.47 gpf				Sample Inta	ake Depth (ft 1	TOC): ~12 ft
		0.62 Lpf	4" = 2.46 Lp	f 6	" = 5.56 Lpf						
		REMENTS	<u> </u>								
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pΗ	Eh ORP (mv)	Turbidity (NTU)	C	Comments
815	/	0.4		/	/	/	/		/	clear	dischara
820	2	i.	12,95	14.3	1650	0.52	9.20	148.5	4.09	turbid	discharge after Ysi
325	4		12.96	14,4	1550	0,40	4.29	132.7	1.96		
830	6		12,96	14.5	1482	0.36	9.31	156.2	1.90		
835	3		12,96	1 5 4	1447	0.32		138.7	1.82		
0840	10		12.96		1415	0.29	1	134.4	1,22		
845	12	3.7	12.96		1402		9.08	139.4			10 %
8-13	12-	V	16.76	17(16	1706	0.26	1,00	157.9	1.58	7016, U	befor 151
		···									
			<u> </u>				,				
	• *										
		٠									
Total Gallons Purged: 3-15 Total Casing Volumes Removed: 4,5											
\	411 (64 -	roov 17	91.			Fadina Tatak	D4- (6) T	'CO'. 40-08	کی ا ب	2	
		гос): <u>12 с</u>	119			Ending Total	Depth (tt 1	OC): 1685	1/2 =	<u> </u>	
SAMPLE	INVENTO		1				•				
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Remai	rks
				:			Color	Turbidity & Sediment			
845	1L	HPDE	,	1	none	HNO3	clear	howe	Total Metals	s - As, Pb	
-	500mL.	Amber glass		2	none	none	ļ		cPAHs		
	1L	Amber glass	ļ	2	none	none			PCBs		
1	500mL	Amber glass		2	none	none			TPH- DX		_
-\-	500mL	Amber glass		2	none	none	<u> </u>	- ✓	Bis(2-ethyl	hexyl) phthala	te
METHOD	<u> </u>										
METHOD		1.10	n		N 550 # 147	1					
		d IDs:					-	A1 . =:			<u></u>
Purging Eq	•	Peristaltic Pu				Decon Equi		Alconox, Di	stilled Wate	<u> </u>	
Disposal of	Discharged	Water:	Stored in 1,	000 gallon to	emporary onsite	e storage tan	k				
Observatio	ns/Comment	s:									



CMP3-090401

GROUN	DWATER :	SAMPLING F	RECORD			WELL NUM	IBER: CM	- -3		Page: 1 of 1		
		WEST HARBOR	RPROJECT	- Phase II (GCWMP	Project Num						
	4/3/4		-			Starting Wa						
	by: <u>DFR/AT</u>	TOC				Casing Sticl Total Depth						
		OC)	6.0-16.0			Casing Diar						
		roc)	4.0-17.5			Occurig Dian	110111					
Casing Vo	lume 7, 9	<u>イ</u> (ft Wate	r) x 0 . i (6 (Lpfv)	$\log f = 1.2$	7_ (L)(ga	1)					
	lumes: 2" =	0.16 gpf		of 6	" = 1.47 gpf " = 5.56 Lpf		,		Sample Int	ake Depth (ft TOC): ~11 ft		
PURGIN	IG MEASU	REMENTS							-			
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lom)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рH	Eh ORP (mv)	Turbidity (NTU)	Comments		
840	/	0,5	/						/	char discharge		
845	2.5	1	7.90	13.3	718	0,38	10.13	181,5	6.80	turbed after YSI		
850	5,0		7,90	13.1		0.32	9,75	185.8	4,79	1		
885	7,5			13.1	715	0.28	9.33					
900	16.0		790	13.1	719	0.25		194.7				
905	12.5		7.90		723	0.24		211.0	1.78			
910	15,0	1	7,90	12.9	126	0,26		2013		tooled w/o YSI		
	1 1	· · · · · · · · · · · · · · · · · · ·		,,,,	1.00	0120	Dion	F 011 2	11-50	10 1810 W/0 431		
												
		,										
		-			. <u>.</u>					<u> </u>		
				,		_						
		···· <u> </u>								<u> </u>		
T (0	<u> </u>	2 411							'3			
Total Gallons Purged: 3.44 Total Casing Volumes Removed: 3.10												
Ending Water Level (ft TOC): 12.9 Ending Total Depth (ft TOC): 15.84												
	INVENTO											
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	rance		Remarks		
						'	Color	Turbidity & Sediment	·			
910	1L	HPDE				LINO2			~			
1					none	HNO3	elear	1	Total Metals	S - AS, PD		
1		Amber glass			none	none			cPAHs			
<u> </u>	1L	Amber glass	- - -		none	none		_	PCBs	<u> </u>		
-√		Amber glass			none	none		-		/silica gel cleanup)		
	500mL	Amber glass		2	none	none	_	*	Bis(2-ethyl l	nexyl) phthalate		
						<u>. </u>						
METHOL												
		d IDa	Doriet-W- D		21 550 #							
	•	d IDs:	····									
Purging Eq	•	<u>Peristaltic Pur</u>				Decon Equi		Alconox, Di	stilled Wate	<u>r </u>		
Disposal of	Discharged	Water:	Stored in 1,0	UUU gallon te	emporary onsite	e storage tank	<u> </u>		 -			
Observatio	ns/Comment	s:										
	· _											
												



CMP4-090402

GROUN	DWATER :	SAMPL	ING R	ECORD			WELL NUM	BER:	CMP	-4		P	age: 1 of 1
Project Na	me: SOUTH	WEST H	ARBOR	RPROJECT	- Phase II G	SCWMP	Project Num	ber: 0	80064	4			
	64/62/						Starting Wai	ter Lev	el (ft	TOC): /	0.34		
Developed	l by: <u>DFR/AT</u>						Casing Stick	cup (ft)	:	-0.32			
	Point of Wel		roc				Total Depth	(ft TO	C <u>):</u>	17			
	Interval (ft. T	_		7.0-17.0			Casing Dian	neter (i	nche:	2			·
Filter Pack	Interval (ft. 1	гос)		5.0-17.5									
Casing Vol	lume <u>6.6</u>	6 (f	t Water)x_0.16	(Lpfv)	(gpf) = 1,06	> (L)(gal	}					İ
	umes: 2" =	0.16 gpf		4" = 0.65 gp	f 6'	' = 1.47 gpf					Sample Into	ake Depth (ft	TOC): ~12 ft
PURGIN	G MEASU	0.62 Lpf REMEN		4" = 2.46 Lp	1 0	<u>= 5.56 Lpf</u>					a		-
Time	Cumul. Vol.	Purge	Rate	Water	Temp.	Specific	Dissolved	pl	1 1	Eh	Turbidity	!	Comments
	(gal or L)	(gpm or	Lpm)	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)	'		ORP (mv)	(NTU)		
825	/	U	5		/	/			- 1		/	cleur	dischurge
830	215			10.41	12,6	617	0.45	6.8	33	117,2	1.52	luvbid	active YSI
835	5,0			10.42	12.7	618	0,93	6.6		151.7	1.18	1	2010 21
840	7.5			10,43	12.7	618	1.07	6.4		136.2	0,86		
845	1010			10.43	12,6		0.83	6.2		121-1	6.77		
250	12.5			(6:43	12.6	617	0.75	6,2		137.2	0,86	V	
855	15,0	V		10.43	12.6	619	0,74	601		192.3	0,83	torbid .	J. YS)
	,			1-3-2		-12/	<u> </u>	0 1		<u> </u>		101010	
									7				
									1				
									_				
				<u> </u>					\dashv				
		 ;	<u> </u>						!		ر د م	<u> </u>	
Total Gallo	ns Purged:		3.9	4		_	Total Casing	Volum	nes R	emoved:	3.71		
Ending Wa	iter Level (ft 1	гос):	10.	43			Ending Total	Depth	(ft TC	OC): 17.0			
SAMPLE	INVENTO	RY											
Time	Volume	Bottle	Туре		Quantity	Filtration	Preservation	A	ppea	rance		Rema	arks
				-				Col	or	Turbidity &			
৪ 55	1L	HPDE					HNO3	cle		Sediment	T-4-1 M-4-1	- A- Dh	
1	500mL					none		<u></u>	ay.	1	Total Metals	5 - AS, FD	· -
		Amber gl				none	none		\dashv		cPAHs		
<u> </u>	1L	Amber gl				none	none	-+			PCBs		
	500mL	Amber gl				none	none	$-\downarrow$	_			v/silica gel cle	· / ·
$-\Psi$	500mL	Amber gl	ass		2	none	none			4	Bis(2-ethyl I	hexyl) phthala	ate.
									_				
METHOE													<u>-</u>
METHOE		JUD.		D. 24 10 5		N 550 #							
	quipment an												
Purging Eq						11	•	-	:	Atconox, Di	stilled Wate	<u> </u>	
uisposal of	Discharged	vvater:	-	Stored in 1,0	υυυ gallon te	emporary onsite	e storage tan	K			. <u></u>	-	
Observation	ns/Comment	s:										<u></u>	



GROUNI	DWATER S	SAMPLING R	ECORD			WELL NUM	BER: CMI	P-5		P	age: 1 of 1	
		WEST HARBOR	PROJECT	- Phase II G	SCWMP	Project Num						
	4/1/2					Starting Wa	ter Level (ft		148			
	by: <u>DFR/AT</u>					Casing Stick		-0.27				
	Point of Wel		5.5-15.5			Total Depth Casing Dian		15.1 2 2				
	Interval (ft. 1		3.0-19.0			Casing Dian	neter (morte					
		2 (ft Water		12.16 nfw	$(anf) = \vec{l} \cdot \vec{l}$	< (LVan)	1)					
	umes: 2"=1		4" = 0.65 gp		(9p1) =(' = 1.47 gpf	(L/(gai	1,7		Sample Inta	ake Denth (ft	TOC): ~10.5	ft
			4" = 2.46 Lp		' = 5.56 Lpf				Cumpic in.	ano Bopai (it	100). 10.0	'`
PURGIN	G MEASU	REMENTS										
Time	Cumul. Vol.		Water	Temp.	Specific	Dissolved	ρН	Eh	Turbidity	· -	Comments	
	(gal or £)	(gpm or Lpm)	Level (ft)	(C or F)	Conductance (μS/cm)	(mg/L)		ORP (mv)	(NTU)			
1245		015	8,48							ilear	dischar	rye
1250	7.5	\downarrow	8.73	11,00	467	0.41	6.22	230.1	12.3	torted	ufter Ys	1
1255	5.0	0.4	4.76	11.2	480	0,31	6.22	231,8	11.4		, ,	
1300	7, 0	014	8.75	11, 1	482	0.42	6,22	254.3	8.91			
1305	9.0		8,75	11.2	482	0.47	5,96	272,9	8,85			
1310	1110_		8,75	11.2	180	0,33	6.12	258,3	4,77	1/		
1315	-13,0			1112	480	0.32	6105	257.6	4,11	torby	w/o YS1	
, 1, 1	110	Ť	875	[[] [_	יסטו	0174	6102	1221.0	/11/	TUVVIA	W/0 121	
							<u> </u>					
								<u> </u>				
						:						
_												
Total Gallo	ns Purged:	3,4	2		_	Total Casing	Volumes F	Removed:	3,25			
Ending Wa	ter Level (ft 1	roc): 8.7	·5		_	Ending Total						
	INVENTO			•			орил (п. т			_		
Time	Volume	Bottle Type	1	Quantity	Filtration	Preservation	Appe	arance		Rema	arke	
111110	VOIGITIC	Doute Type		Quantity	·	i iosolvatori	7,ррсі	Turbidity &		Nome	aino	
_							Color	Sediment	_			
1315	1L.	HPDE		1	none	HNO3	clear	none	Total Metals	s - As, Pb		
	500mL	Amber glass		2	none	попе			cPAHs			
	1L	Amber glass		2	none	none			PCBs			
	500mL	Amber glass		2	none	none			TPH- DX (v	v/silica gel cle	eanup)	1
1	500mL	Amber glass		2	лопе	none	1	1	Bis(2-ethvl)	hexyl) phthala	ate	
			<u></u>	_					, , , , , ,			
				-								
METHOE	os											
Sampling E	quipment an	d IDs:	Peristaltic P	ump and YS	81 556 #							
Purging Eq	uipment:	Peristaltic Pur	np w/ dedica	ted tubing		Decon Equi	ipment:	Alconox, D	stilled Wate	r		
Disposal of	Discharged	Water:	Stored in 1,0	000 gallon te	emporary onsite	e storage tan	k					
Ohsanzation	ns/Comment	e.										
ODSGI VALIUI		·			•							
									-			



CMP 15 - 090402

GROUNI	DWATER :	SAMPLING	RECORD			WELL NUM	IBER: CM	P-15		Page: 1 of 1
Project Na	me: SOUTH	WEST HARE	OR PROJECT	- Phase II (GCWMP	Project Nun				
	リ <u> 2 2</u> by: <u>DFR/AT</u>					Starting Wa Casing Stick		TOC <u>): 4</u> 0.29-		
	Point of Wel					Total Depth		17.05		
	•	OC <u>)</u>				Casing Diar				
	•	ГОС)				l <u></u>				
					(gpf) =	<u>니</u> (L)(ga	1)			
Casing vol	umes: 2" = -		4" = 0.65 gp		" = 1.47 gpf				Sample Int	ake Depth (ft TOC): ~12 ft
PURGIN		0.62 Lpf REMENTS	4" = 2.46 L _I	<u>or 0</u>	" = 5.56 Lpf		<u>-</u>			
Time	Cumul. Vol.	Purge Rat	e Water	Temp.	Specific	Dissolved	рH	Eh	Turbidity	Comments
	(gal or L)	(gpm or Lp)	m) Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)		ORP (mv)	(NTU)	
1645		015					/	/		clear discharge
1050	21.5	1_	10.02	13.3	7340	0.14	682	2079	0.97	tuibed after Y 81
1055	5:0		10.03	13.5	7044	0.15	6.56	210.0	1.19	<u> </u>
1100	7.5		10.03	13.4	7295	0.15	6,31	206.6	0.46	
1105	LO, D		10.09	13.4	7196	0,12	6,20	207.7	0.99	
1116	145		10.04	13,3	7070	0.11	6.12	203.5	1,04	
1115	15,0	W	10.04	13, 2	7059	0.10	6.69	198.2	0.73	turbed ets YSI
						V-1-1-1-1-1			,	7
					·			·		
-					_					
							-			
			<u> </u>				<u> </u>			-
			 							
										
Total Gallo	ns Puraed:	3,6	 [4]			Total Casing	Volumes F	Removed:	3,45	
	ter Level (ft 1		04		_				<u> </u>	
	<u> </u>	. 00/.	<u></u> -			Ending Total	Depth (it i	00): 17.05		
Time	INVENTO Volume		. T	Ougatitu	Filtration	Description	Anna		_	
11016	volune	Bottle Type	;	Quantity	Filtration	Preservation	-	Turbidity &		Remarks
							Color	Sediment		
1115	1L	HPDE		1	none	HNO3	cleur	none	Total Metals	s - As, Pb, Sb, Cr, Cu, Ni
	500mL	Amber glass		2	none	none			cPAHs _	
	1L	Amber glass		2	попе	none			PCBs	
	500mL	Amber glass		2	попе	none			TPH- DX (w	v/silica gel cleanup)
√	500mL	Amber glass		2	лопе_	none)	→	Bis(2-ethyl l	hexyl) phthalate
									<u>-</u>	
METHOD	S				······································					
Sampling E	quipment an	d IDs:	Peristaltic P	ump and Y	31 556 #				·-··	
Purging Eq	uipment:	Peristaltic I	oump w/ dedica	ited tubing		Decon Equi	ipment:	Alconox, Di	stilled Wate	·
Disposal of	Discharged	Water:	Stored in 1,	000 gallon t	emporary onsite					
										
CD3CI ValiUI	no comment	J				···			-	
			· · · · · · · · · · · · · · · · · · ·			· <u> </u>				<u></u>



CMP17-090331

GROUN	DWATER S	SAMPLING F	RECORD			WELL NUMI	BER: CMP	P-17		Page: 1 of 1
Project Na	me: SOUTH	WEST HARBO	ROJECT	- Phase II C	3CWMP	Project Numl			71	
	3]31[09		-			Starting Wate	-		9,05	
	by: <u>DFR/AT</u> Point of Wel				 .	Casing Stick Total Depth (
		OC)	6.0-16.0		······································	Casing Diam				·
		roc)	4.0-16.5				``			
Casing Vo	lume	し(ft Wate	r) x <u>. 1.6</u>	(Lpfv)	نارا = (gpf) =	(L)(gal))			
	umes: 2"=	0.16 gpf	4" = 0.65 gp 4" = 2.46 Lp	f 6	" = 1.47 gpf " = 5.56 Lpf				Sample Into	ake Depth (ft TOC): 14 ft
PURGIN		REMENTS								
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lom)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pН	Eh ORP (mv)	Turbidity (NTU)	Comments
1415	/	0,35		/		1	/		/	clear dischumi
1426	1.75	1	9,08	12.4	663	0,80	6.03	287.6	33	clear dischung
1425	-		9.08	12.4	680	0,60	6.04	284.1	16	turbed after YSI
1430	5.25		9.08	12,3	679	0.47	6,03	281.6		i
	7.00		4.08	12.3	681	0,44	6,05	Z80.8	3.11	
1435			9,08	12,3	678			279,5	6:08	
14.46	8.75		1.08		1 '	0,39	6,04			
1445	1015			12.3	679	0.41	6.04	279,1	6,04	
1450	12.25	**	9.08	12.3	678	0139	605	278,3	2,00	forbid w/o YSI
										·
		•								
Total Gallo	ns Purged:	3.2	-2		_	Total Casing	Volumes F	Removed:	2.8	2
	_		3 m D		_					
		ГОС):	1.00			Ending Total	Depth (ft T	OC): 16.21		
	INVENTO				I					
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Remarks
							Color	Turbidity & Sediment		.
1450	1L	HPDE		1	none	HNO3			Total Metal	s - As, Pb
[500mL	Amber glass		2	none	none			cPAHs	
	1L	Amber glass			none	none			PCBs	
	500mL	Amber glass			none	none				v/silica gel cleanup)
,	500mL	Amber glass			none	none				hexyl) phthalate
$\vdash \forall \vdash$	40mL	VOA vial			none	HCI				Ethanes and Ethenes (CEEs)
	TOULE	YOR VIGI	,	3	TIONG	.10			ornormated	Lateries and Eulenes (GELs)
METHO	DS	<u> </u>	1		l			I	_	
		d IDs:	Dedicated 0	QED Well W	/izard Bladder I	oump and YS	I 556 #			
Purging Eq					Pump	Decon Equi	•	Alconox D	istilled Wate	
0.0		Water:				•		. accitor, D	Sunga Prate	
Piohosai 0	- PiscialGed	vva.ci	owieu III I,	ooo gail0t1 l	στηροιατ <u>ή υπο</u> ιι	o stor <u>age talli</u>	`			· · · · · · · · · · · · · · · · · · ·
Observatio	ns/Comment	s:			 					
							**			



ROUNI	DWATER :	SAMPLING F			31 and	WELL NUM						Page: 1 of 1
	me: SOUTH	WEST HARBO	RPROJECT	- Phase II C	SCWMP	Project Num						
ate:	h DED/AT		_			Starting Wat						
	by: DFR/AT	TOC				Casing Stick Total Depth			-0.2 18			
		OC)	7.0-17.0			Casing Dian						
lter Pack	Interval (ft.	ГОС)	6.0-17.5									
asing Vol	ume <u>7.</u>	고니 (ft Wate	r) x 0 , i	16(Lpfv)	(gpf) = <u>[</u>	(L)(gal)					
asing vol		Ģ.	4" = 0.65 gpt		" = 1.47 gpf					Sample Int	ake Depth (1	ft TOC): 15 ft
			4" = 2.46 Lp	f 6	" = 5.56 Lpf				 			<u>-</u>
		REMENTS	T						1		1	
Time	Cumul. Vol. (gal or L)		Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pł	Ħ	Eh ORP (mv)	Turbidity (NTU)		Comments
105		0.35	/								clear	discharge
110	1.75		16,80	11,7	519	1.90	6.	31	73.8	2.69	tulbed	efter YSI
115	3,50		10.80	11.7	513	1.34	6:	32	65.0	1.34	1	.,,
120	5,25		10,00		901	1.20	6.		44.1	1.02		
125	7 00			11.6	441	1,08	6.		31.7	0.74		
130	8.75		10.80	. ,	486	1,03	6.2		43.2			
35	10:55		10.81		480	0,99	6,7		75,4	0,60	1	
140	12,25		10.81	11,5	476	0.96	6.2		74.3	0,53	1 1	before YS
170	1-101	- V	to.ot	1(12	110	0,10	.O.Z	رعار	1717	V13 /	TOTALL	WELLANE 12
							asing Volumes Removed: 2,80 Total Depth (ft TOC): 18					
otal Gallo	ns Purged:	3.27	2	•	_	Total Casing	y Volun	nes R	Removed:	2,80		
odina Ma	ter Level (ft '	гос): <u>10.</u>	0.1			Ending Total Depth (ft TOC): 18						
			<u></u>			Litting rota	Depu	1 (11. 1			-	
	INVENTO			O	Filtration	ion Preservation Appearance Res						
Time	Volume	Bottle Type		Quantity	· · · · · · · · · · · · · · · · · · ·	iiaiks						
	-	FM105-	040331				Col	lor				
145	1L Get 6	APOE		2	none	HNO3	cleu	√	Nove	Total Metal	s - As, Pb	
	500mL	Amber glass		4	none	none	1			cPAHs		
	1L	Amber glass		4	none	none				PCBs		
	500mL	Amber glass		4	none	none				TPH- DX (\	w/silica gel c	eleanup)
	500mL	Amber glass		4	none	none]		Bis(2-ethyl	hexyl) phtha	alate
⋖	40mL	VOA vial		6	none	HCI	$ \Psi $		4	Chlorinated	l Ethanes ar	nd Ethenes (CEEs)
ETHO	os		<u> </u>		•		•					
ampling E	quipment ar	ıd IDs:	Dedicated G	ED Well W	/izard Bladder	Pump and YS	SI <u>55</u> 6 ;	#				
	uipment:				Pump				Alconox, D	istilled Wate	er	
	•	Water:			_	•	•					
										_		·



MW26R-090401 and WELL NUMBER: MW-26R GROUNDWATER SAMPLING RECORD Page: 1 of 1 Project Name: SOUTHWEST HARBOR PROJECT - Phase II GCWMP Project Number: 080064 Date: 4/1/2009 Starting Water Level (ft TOC): Developed by: DFR/AT Casing Stickup (ft): -0.32 TOC Measuring Point of Wel Total Depth (ft TOC): 17.05 Screened Interval (ft. TOC) 6.5-16.5 Casing Diameter (inche-Filter Pack Interval (ft. TOC) 4.0-17.0 Casing Volume 7,39 (ft Water) x 0,16 $(Lpfv)(gpf) = 1 \cdot 12 \quad (L)(gal)$ Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf6" = 1.47 apfSample Intake Depth (ft TOC): ~ 11.5 ft 4" = 2.46 Lpf 6" = 5.56 Lpf2" = 0.62 Lpf**PURGING MEASUREMENTS** Cumul, Voi. Purge Rate Water Temp. Specific Dissolved ьHа Eh Turbidity Comments (gal or L) (gpm or Lpm) Level (ft) (C or F) Conductance Oxygen ORP (NTU) (µS/cm) (mg/L) (mv) 0,5 clear dischary. 950 6,59 242.3 2,5 9.66 1556 0.42 2,70 tookid 5,0 1394 6.56 233,2 1600 715 12.4 1304 0.26 6.47 235,8 6,92 9.66 1005 1258 6.42 2296 1,24 14, 4 0.25 1010 10.0 12,4 1212 6.41 227.3 9,66 0,22 1015 12.5 12,3 1198 torbid 1.66 0,22 15.0 1020 3,34 3,44 Total Gallons Purged: Total Casing Volumes Removed: 9.66 Ending Water Level (ft TOC): Ending Total Depth (ft TOC): 17.05 SAMPLE INVENTORY Bottle Type Quantity Filtration Preservation Appearance Remarks Volume Time Turbidity & Color Sediment 1620 HPDE 2 none HNO3 Moul Total Metals - As, Pb, Sb, Cr, Cu, Ni 4 none cPAHs 500mL none Amber glass PCBs Amber glass 4 none none TPH- DX (w/silica gel cleanup) 500mL Amber glass 4 none none Bis(2-ethyl hexyl) phthalate 500mL Amber glass 4 none none duplicate 1025 MW76R- 0904010 METHODS Sampling Equipment and IDs: Peristaltic Pump and YSI 556 # Decon Equipment: Alconox, Distilled Water Peristaltic Pump w/ dedicated tubing Purging Equipment: Disposal of Discharged Water: Stored in 1,000 gallon temporary onsite storage tank Observations/Comments: Second set of bottles collected for duplicate sample 1025



MW36-09040Z

GROUN	DWATER S	SAMPLING R	ECORD			WELL NUM	BER:	MW-	36,			Page: 1 of 1
		WEST HARBOR	RPROJECT	- Phase II C	GCWMP	Project Num						
	4/2/2 by: DFR/AT		•			Starting Wa		•		1,06		
	Point of Wel					Casing Stick Total Depth			-0.23 73	···		
	Interval (ft. Te		58.0-73.0			Casing Dian	-			· · · · · · · · · · · · · · · · · · ·		
	Interval (ft. 1		55.0-71.0									
Casing Vol	lume 63.	94(ft Water	a ode	(Lpfv)	$(apf) = lO_1 \hat{Z}$	23 (L)(gal	n					
	umes: 2" =	0.16 gpf	4" = 0.65 gp 4" = 2.46 Lp	f 6'	" = 1.47 gpf " = 5.56 Lpf		,			Sample Inte	ake Depth (f	ft TOC): ~ 65.5 ft
PURGIN		REMENTS	1 2.13 28	<u> </u>	0.00 _p.				 			
Time	Cumul. Vol.		Water	Temp.	Specific	Dissolved	ρŀ	1	Eh	Turbidity		Comments
	(gal of t)	(gpm or zpm)	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)			ORP (mv)	(NTU)	_	
945		015	/	/							cleur	discharge
950	215		9.11	1215	3657	0.24	6,		211,6	0,98	forbid	after YSIO
955	5,0			12.6	3689	0,18	6.5		212.3	1.63)	
1000	715		9.13	12:5	3727	0.12	65	۵	220,2	0.92		
1605	16.6		9,13	12,5	3733	6,12	6,48	B	204,3	0195		
1016	12,5		9,13	12.4	3737	0.12	6.4	8	210,3	0.97		V
1017	W\$.()	4	9,13	12.4	3734	0.11	6,4	8	219,9	0.84	turbid	w/o YSI
										-		
		· -										
							İ					
•••												
Total Gallo	ns Purged:	3.46	 1			Total Casing	. Volum	ses R	emoved:	013	<u>_</u>	
					_					0,,0	<u></u>	
Ending Wa	ter Level (ft 7	гос): <u>9 · 1 3</u>				Ending Total	l Depth	(ft T	OC): 73			
SAMPLE	INVENTO	RY										
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	A	ppea	arance		Rem	narks
							Cal	or	Turbidity & Sediment			
1015	1L	HPDE		1	none	HNO3	clea	<u>, </u>		Total Metal:	s - As, Pb. S	Sb, Cr, Cu, Ni
	500mL	Amber glass			none	none	P			cPAHs	-,, -	
	1L	Amber glass			none	none				PCBs		
	500mL	Amber glass			none	none					//silica gel cl	leanup)
110	500mL	Amber glass			поле	none	- √		W		hexyl) phtha	<u> </u>
							_				prioriu	
METHOD	s				·	_			l	•		
Sampling E	quipment an	d IDs:	Peristaltic P	ump and Y	SI 556#							
Purging Eq	uipment:	Peristaltic Pur	np w/ dedica	ted tubing		Decon Equ	ipment		Alconox, Di	stilled Wate	r	
Disposal of	Discharged	Water:	Stored in 1.0	000 gallon te	emporary onsite	•						·-
					***				<u>-</u> -			
oservatioi	ns/Comment	s:				·						
						··· · · · · · · · · · · · · · · · · ·						



MW125-090331

GROUNI	DWATER :	SAMP	LING R	ECORD			WELL NUM	IBER: MW	-125		Page: 1 of 1
Project Na	me: SOUTH	WEST	HARBOF	RPROJECT	- Phase II C	CWMP	Project Num				
	3/3//2			-			Starting Wa				
	by: <u>DFR/AT</u> Point of Wel		TOC				Casing Stick Total Depth				
	Interval (ft. T			5.0-15.0			Casing Dian				
	Interval (ft. 7			3.0-15.0							
Casing Vol	lume <u>6 1</u>	14	(ft Water	r) x Ocl6	(Lpfv)	(gpf) = <u>[] [</u> [(L)(gal	I)			
Casing vol	umes: 2" =	0.16 gp 0.62 Lp	of	4" = 0.65 gp 4" = 2.46 Lp	f 6'	" = 1.47 gpf " = 5.56 Lpf				Sample Into	ake Depth (ft TOC): 13 ft
PURGIN	G MEASU										
Time	Cumul. Vol. (gal or L)		ge Rate or Logn)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pН	Eh ORP (mv)	Turbidity (NTU)	Comments
1310		0,	35	/	/		/	/		/	clear discharge
1315	1.75			6,56	11.4	608	2.65	6.26	131.5	1,75	turbed after YSI
1320	3,50			6,56	11.4	609	2,44		118.7	1.27	Î
1325	5,25			6,56	11.4	604	2.27		155.8	1.02	
1330	7,00			6.56	11.4	593	2.05		1643	1.01	
1335	8,75			6 156	11.3	586	1.84	6.25	162.9	0.68	
1340	10:5			6,58	11,4	586	1,77	6.19	224.3	0.79	•
1345	12,25		1	6.28	11.4	589	1174	6.18	150,1	0.74	torked w/o YSI
					٠						/
											· - · · · · ·
	*										
Total Gallo	ns Purged:		3,22	2			Total Casing	Volumes F	Removed:	2,91	<u> </u>
	iter Level (ft 1	 _:_гос					Ending Total				
	INVENTO							•	,		••
Time	Volume		е Туре		Quantity	Filtration	Preservation	Appea	arance		Remarks
			• •		-			Color	Turbidity &		
,7 <i>11</i>	41	LIDDE			A.		LINION	_	Sediment	T . ()	4 51
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1L	HPDE				none	HNO3	dew	none	Total Metal:	s - As, Pb
	500mL	Amber				none	none			cPAHs	
1		Amber	Ť			none	none		 	PCBs	
1		Amber				none	none	 			v/silica gel cleanup)
\		Amber	Ť.			none	none				hexyl) phthalate
	40mL	VOA vi	ial I		3	попе	HCI			Chlorinated	Ethanes and Ethenes (CEEs)
METHOD	 DS		ļ								
	guipment an	d IDe:		Dedicated C	IED Well W	izard Bladder F	Dump and VC	1556# LL	I)		
Purging Eq		-				Pump			-	istillad Mlata	· · · · · · · · · · · · · · · · · · ·
	•					emporary onsite			AICOHOX, D	omen wate	
							- amage rall	-		 	· · · · · · · · · · · · · · · · · · ·
Observation	ns/Comment	s:									
							 			<u> </u>	·



MW44 - 090401

GROUN	DWATER S	SAMPLING R	ECORD			WELL NUM	IBER: MV	V-44		Page: 1 of 1
		WEST HARBOR	RPROJECT	- Phase II (3CWMP	Project Num				
	<u>4/01/</u>	2009	•			Starting Wa			8.94	
	by: <u>DFR/AT</u>	700				Casing Stick		-0.18		,
	Point of Wel Interval (ft. To		n/a			Total Depth Casing Dian				
	interval (ft. 1		n/a			Casing Dian	neter (inch	e	2	
		.96_(ft Water		f (1 mfr)	(ant) = 16 3	5 /1 Vaal	13			
	umes: 2" = 1		4" = 0.65 gp	<u>Б</u> (LDIV)	(gpi) = <u>/b i 3</u> " = 1.47 gpf	L)(gai	')		Samala Int	ake Depth (ft TOC): ~ 68 ft
Casing voi			4" = 2.46 Lp		" = 5.56 Lpf				Sample int	ake Depti (it 100). 00 it
PURGIN		REMENTS								·
Time	Cumul. Vol.		Water	Temp.	Specific	Dissolved	рН	Eh	Turbidity	Comments
	(gal or L)	(gpm or Lipph)	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)		ORP (mv)	(NTU)	
(070		015								clear duch
1035	2.5	t	8.45	12.)	106	7.07	7.25	13873	10.32	turbed of YSI
1040	5.0		8.96	11.9	67	6,94	7.13	120.6	9157	1
1045	7.5		8.97	12.3	48	6.97	6.89	164,4	9.47	
					-				1	
1050	10.0	 	8.98	12.4	43	7.18	6.74	1620	9.31	
102 z	12.5			12,4	49	7.06	6.60	179,9	9,39	V
11 00	15.0	- A	9.101	11.5	46	+ 25	642	194.8	7,33	turbed w/o YSI
										. •
	•									
								<u> </u>		
Total Gallo	ns Purged:	3.94			_	Total Casing	y Volumes	Removed:	0.3	<u>8</u>
Ending Wa	iter Level (ft	гос): <i>'j .</i>	01			Ending Total	l Depth (ft	TOC): 73.9		
SAMPLE	INVENTO	RY								
Time	Volume	Bottle Type	,	Quantity	Filtration	Preservation	Арре	earance		Remarks
		•					Color	Turbidity &	1	
1180/0								Sediment		
1(00	1L	HPDE		1	none	HNO3	Clear	None	Total Metal	s - As, Pb, Sb, Cr, Cu, Ni
1 -	500mL	Amber glass		2	none	none		1	cPAHs	
	1L	Amber glass		2	none	none			PCBs	
	500mL	Amber glass		2	none	none			TPH- DX (v	v/silica gel cleanup)
	500mL	Amber glass		2	none	none	1		Bis(2-ethyl	hexyl) phthalate
		* .								
METHO	os '				1			-1	•	
Sampling E	quipment an	d IDs:	Peristaltic P	ump and Y	SI 556 #					
Purging Eq	, ,	Peristaltic Pur				Decon Fau	ipment:	Alconox. I	Distilled Water	er
		Water:				•	_			
Pishosai Oi	- Pioorial ged	· · ator ·	·	ooo gailtii l	omporary 011810	c siciada (all	IX.			
Observatio	ns/Comment	s:			,					·



MW308N-09040Z

GROUN	DWATER:	SAMPLING R	ECORD			WELL NUM	BER: MW	-308N			Page: 1	of 1
		WEST HARBOR	RPROJECT	- Phase II (CWMP	Project Num						
	1/2/20		•			Starting Wa						
	by: <u>DFR/AT</u>	TOC				Casing Stick Total Depth		-0.29 17.95				
			12.5-17.5			Casing Dian						
			10.0-21.5				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
		<u>04</u> (ft Water				<u>3(L)(gal</u>)			4		
Casing vol	umes: 2" = 2" =		4" = 0.65 gp 4" = 2.46 Lp		" = 1.47 gpf " = 5.56 Lpf				Sample Int	ake Depth	(ft TOC): <u>~</u>	15 ft
PURGIN	G MEASU	REMENTS										
Time	Cumul, Vol. (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рH	Eh ORP (mv)	Turbidity (NTU)		Commer	nts
1240		0,5	/			/		/			·	
1245_	2.5	0.3	7.06	12.0	2400	0.35	6.74	180,1	24.0	alanu	nactul.	s present
1250	\$10	0.25	1,20	12.3	1801	0.07	10.6D			-10 la	JA 1	atter YSI
1255	5.5	υ. 2	8,00	12.2	1766	0.06	6.50	181.5		121216	TOADIO	MIKENTO
1700	7.0	U: L	8,00	12.2	17-48		6.45	176,2				
						0.06						
2011	8,5		8.30	12,2	1734	0.06	6.43	182,4				
1310	10,0		8,32	12.3	1714	0.06	6.43	190.9	8.92		<u>V</u>	
1315	12.5	\forall	8,34	12.3	1712	0.05	6.45	188,3	8.62	tuibid	₩/0 Y	SL
											<u> </u>	
]		
	-				:							
									-			
					_				- · · · -			
Total Galla	ne Durand:	3.28	· · · · · · · · · · · · · · · · · · ·			Total Casina	Volumon E	l	1. 3	-04		
	ns Purged:		,		_	Total Casing	volumes F	Removed:		<u>07</u>		
Ending Wa	iter Level (ft	TOC):	34			Ending Total	Depth (ft T	OC): 17.95				
	INVENTO						-	· · ·				
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Rei	marks	
					•		Color	Turbidity & Sediment				1
1710					. <u>-</u>			Sediment				
1315	1L	HPDE				HNO3			Total Metal	s - As, Pb		
	500mL	Amber glass			none	none	<u></u>		cPAHs			
	1L	Amber glass		2	none	none			PCBs			
	500mL	Amber glass		2	none	none			TPH- DX (v	v/silica gel	cleanup)	
	500mL	Amber glass	,	. 2	none	none			Bis(2-ethyl	hexyl) phth	alate	
4						<u> </u>					· —	
,					· · · · · · · · · · · · · · · · · ·							
METHO	os				<u> </u>		,	·				
Sampling E	Equipment an	d IDs:	Peristaltic P	ump and YS	SI 556 #							
Purging Eq		Peristaltic Pun				Decon Equi	pment:	Alconox, D	istilled Wate	er —		
	•	Water:										
•	_	*						"				
Observation	ns/Comment	s:				•		· ·				
	· .										•	



ROU	IDWATER	SAMPLING R	FCORD			WELL NUM	BER: MW	-3085			age: 1 of 1
				Db U.	DOWNED	<u> </u>					aye: For I
roject iv	ame: SOUTH - 기기	WEST HARBOF	RPROJECT	- Phase II (3CWMP	Project Num Starting Wa			5,74		
	ed by: DFR/AT		-			Casing Stick					
-	g Point of We					Total Depth					
	Interval (ft. T		35.0-40.0			Casing Dian	-				
		TOC)	31.0-40.0				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				
	,	i 子ら (ft Wate		/ /1=6.0	(ant) = C . <	T. (1.Van)	11				
	olumes: 2" =		4" = 0.65 gp		(gpi) = <u>д</u> " = 1.47 gpf	(L)(gai	יי		Comple 1-t	alea Dawth /fil	TOC), 37 F.A
asing v			4" = 0.05 gp 4" = 2.46 Lp		- 1.47 gpi " = 5.56 Lpf				Sample Inc	аке верш (п	t TOC): <u>~ 37.5 ft</u>
LID CII			4 - 2.40 Lp	1 0	- 3.30 Lpt						
		REMENTS	141.7		T 5 15	1 m			T =		
Time	Cumul. Vol.	-	Water Level (ft)	Temp. (C or F)	Specific Conductance	Dissolved	pН	Eh	Turbidity		Comments
	(gal or L)	(gpm or Lpm)	Lever (III)	(Cur)	(µS/cm)	Oxygen (mg/L)		ORP (mv)	(NTU)		
400	1	0.5	5:74	/ '	(20,011)	/		(,	/	<i>.</i> 1.	1 .
	1 2 50	0.3		12	1			7202	1.50	Clear	w/ YS/
405		_	6.48	13.1	1558	0.12		238.2	1.29	tobul	<u>ω/ Υ5/ </u>
<u> 110</u>	4,0	0.3	6.37	13.0	1567	0.09	7.26	239.0	1.01	L 1	•
115	9.5	01/2	6.25	12.9	1567	0,08	7.16	232.6	0.96	1	<u></u>
420)	6,25	12.4	1567	_	7.15	205.5	1013		
		 				0.00	1			\/,	
425	9.5	ļ	6,25	12.9	1565	0,09	7,13	R12.3	1,43	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
430	(0,0	*	B. 23	12.9	1565	0,08	7.13	208,9	101	turbid	<u> </u>
•						0,	7-17				· -/
	1	· · · · - ·				 	 -				-
					<u> </u>	 	-				
											-
tal Gal	ons Purged:	2,63	;			Total Casino	Volumes F	umes Removed:o_c	0,47	}_	
	_				_		,				
ding W	ater Level (ft	TOC): <u> </u>	- 3			Ending Total	Depth (ft T				
MPI	E INVENTO)RY									
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Annor	arance		Dam	nelso.
Time	Volunie	Dottie Type		Quantity	FIREARON	rieservation				Rema	arks
					·		Color	Turbidity & Sediment			
430	1L	HPDE		1	none	HNO3	Clar	nove	Total Metals	e_Ar Dh	· · · · · · · · · · · · · · · · · · ·
170					i		1/200	nove		5 - A3, FD	
1	500mL	Amber glass	, 1885 ·		none	none			cPAHs		
1	1L	Amber glass			none	none		<u> </u>	PCBs		
1	500mL	Amber glass		2	none	попе			TPH- DX (w	: i/silica gel cle	eanup) ,
V	500mL	Amber glass	• -		попе	попе	1	J	:	hexyl) phthal	
<u> </u>	JOOHIL	raniosi giass			HORO	1110112	1	-	Dro(∠-Eulyl I	navai) huugu	a1 0
.					• .	 					
									_		
ETHO	DS									•	
									1		
	Equipment ar	ıd IDs:	Peristaltic P	ump and YS	SI 556 #						
mpling	Equipment ar	nd IDs: Peristaltic Pur			SI 556 #	Decon Equi	inment.	Alconov D	stilled Wate	.r	

Observations/Comments:

Date & Time:		16:	Date & Time:	1550		31/09	Date & Time:	1250		Date & Time: 1	
Company:			Company:			かだ	Company:	7	4 4	Company:	
Printed Name:		me:	Printed Name:	<u></u>	blaardsen	_	Printed Name:	アルサ	-	Printed Name:	
(Signature)			(Signature)				(Signature)	15	と言	(Signature)	
Received by:		ed by:	Relinquished by:	ļ		رو	Received by:		チナ	Relinquished by	Comments/Special Instructions
	×	×	×	×	×	×	-2	«	2	F	FM 105 - 090231 D
	×	×	×	×	×	×	-2	~	1450	konce	CMP17-090331
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	× ¹	×	×	×,	×	×	2	d. Brandrian da	140	Millertsseite	FM105-690331
	×	×	×	×		×	~~ <i>Q</i>	Horizona.	245	i egyppiddile**	CMPT 040331
	×	×	×	×		×	<i>و</i>	٤	845	3/3/109	CMP2-090331
	PC B 808	BEH 827	NWTP+ Presci Wsilice	(PAH 8770	CE 6 824		No. Containers	Matrix	Time	Date	Sample ID
	s 2	P	1- PX	5	'5 .0b	letal	TILE	1 }//	Ru6#	Samplers:	demonstrate of the second
Notes/Comments		्रRequested ज	Analy	M	,	S	GWCMP	2 60	Phase	- - -	Southwest Harbor Dr.
206-695-6200 206-695-6201 (fax)		2000	がた Sis ショ	Cooler Temps:	S.E.	No. of Coolers:					Chip Goodhive
4611 South 134th Place, Suite 100 Tukwila, WA 98168	4	'	resent?	PG	31/2009	Date: 3/3/	70	780 9370	Phone: 206 7	LLC	ARI Client Company: Aspect Consulting LI
Analytical Resources, Incorporated Analytical Chemists and Consultants		ogeny .		₫,	76 Talena	Page:			Requested:	Turn-around Requested:	ARI Assigned Number:

signed agreement between ARI and the Client. 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 comeets 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 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

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.

Time:	Date & Time:	*****	**	Date & Time:	>	1000	R	Date & Time:	0	1540	Late & lime?		
ny:	Company:			Company:		<u></u>	ļ · \	Company:	5	-	HSQL +		~~
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ed dy: ure)	(Signature)	i	l oy.	(Signature)		S. S.	\$ \$		2	7	(Signature)	Comments obecast instructions	<u></u>
	7							Docks h		-	Beling rished by:	ommonts/Conocial Instructions	3
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/		X	X	X	×		\times	Carren	Ź	1430		MW3085-09040)	3
Metals-Astb and		+	X	X.	X	S S S S S S S S S S S S S S S S S S S	×	2	×	1315		CMP 5-090401	5
		X	X	X	×	×		_2	٤	1100		10401-11WM	3
		\times	×	×	×	×			Ź	1025	4	MW26R-090401D	3
		\times	X	X	×	×		_4	٤	1020		MW26R-096401	≥.
	÷	\times	X	X	×		×	-9	Š	910	4/1/2009	CMP3-090101	
		會 PC BO	BE H1 827	NWTPI Diesel	62700	Tot N 6010B Ms.Pb.	Tot A 6010B	No. Containers	Matrix	Time	Date	Sample ID	
		B5 82	> o c	MD + Oct + Elegr	45	letuli /602 Sb,Cr	Netal /602 . Pb)	TICE	1/AMY	D RUGH	Samplers:		<u></u>
Notes/Comments			Analysis Requested	Analysis		٥	5	P	GWC MP		Project - Phress 2	Southwest Harbar Place	<u>(ΛΩ</u>
206-695-6200 206-695-6201 (fax)	206		5.2,7.4	Cooler Temps: 6.6,5.2,7.4		(3 N;)	No. of Coolers:				3	Chip Goodhue	Ω
4611 South 134th Place, Suite 100 Tukwila, WA 98168	461 Tuk	4	<i>S</i>	Ice Present? \-2\		12.009	Date: 4/ 1	2759	780	Phone: 206	ררכ	ARI Client Company:	
Analytical Resources, Incorporated Analytical Chemists and Consultants	Ana			~	<u>라</u>	_	Page:			Requested:	Turn-around Requested:	ARI Assigned Number:	≥

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ARI Assigned Number:	Turn-around	Requested:		\	Рапе:	Ī	<u>ဍ</u> ,			\	,	
	STD	_				braria	•				Anal	Analytical Kesources, Incorporated Analytical Chemists and Consultants
ARI Client Company: Aspect Consulting LLC	てて	Phone:	780 9370	76	Date: 니고)	12602	lce Present?	ţ?		4	4611 Tuky	4611 South 134th Place, Suite 100 Tukwila. WA 98168
Client Contact: 5 ood hue					No. of Coolers:	N:)	Cooler Temps:				206-	206-695-6200 206-695-6201 (fax)
			WORD	J		U	1	Analysis Requested	equested	-		Notes/Comments
est Harbor	· I	7598	N D W	1	= 15 Z O	~ { { 0 r _i (] 2411				
Client Project #: の8006 イ	Samplers:	RUGH/	AMY T	TICE	Met. 1602 Pb)	Met. 1602. Sb,C) C	s 2 —		
Sample ID	Date	Time	Matrix	No. Containers	Total 6010B, (As,	Total COLOB, (AS, Pb,	CPAH 8Z70	NWTPH Diesel Vsilic	BEHP 8270	PCB 808		
CMPY- ON O10402	4/2/09	528	Wati	70	X		\times	\times	\times	\times		
MW36-090402	est menter	1015	rangement 1, gain	_7		X	×	×	×	×		
CMP15-090402	Pil-thogherprepin	7	e ggap a s e colore tra	۵_		×	\times	×	X	X		
MW30AN-090402	<	135	<	A	×		X	X	X	X		
				:						,		
				k.					_			
							<u> </u>					
					•							
Comments/Special Instructions	Relinquished by (Signature)	DE DI)	• • •	Library			Relinquished by: (Signature)	y:		Received by: (Signature)	d by: re)
	DAV 10	D Rug!	-	Printed Name:	Wa Mulumbo	olub		Printed Name:			Printed Name:	Name:
	PSQ+	7-1-	C	×	グー			Company:			Company:	W:
	Date & Time: 4/2/2001		1400 1400	Date & Time:	11/21/2004 14(NO	JOH 1		Date & Time:			Date & Time:	Time:

1.1.1449

signed agreement between ARI and the Client. 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 comeets 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 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

4/2/2001

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 afternate retention schedules have been established by work-order or contract.



CMP1. Ogcary

GROUN	DWATER	SAMPLING F	RECORD			WELL NUN	BER	t: CM	P-1		Page: 1 of 1
Project Na	ame: SOUTH	WEST HARBO	R PROJECT	- Phase II	GCWMP	Project Nun					
	<u>9 /4/09</u>		_			Starting Wa					
	d by: DFR/A					Casing Stic			-0.29		
	p Point of We Interval (ft. 1		7.0-17.0			Total Depth			16.85		
Filter Paci	k Interval (ft. 1	TOC)	5.0-19.0			Casing Diar	neter	(inche	= 2		
Casinalia	2	75_ (ft Wate		9 // mari	·/~~~ ? .:	22	-15				
	lumes: 2" =		4" = 0.65 gr		(gpr) = <u></u> " = 1.47 gpf	<u>55 (L)(g</u> a	11)			Cample Int	ake Depth (ft TOC): ~12 ft
Casing VO		0.62 Lpf	4" = 2.46 Lg		= 1.47 gpt = 5.56 Lpf					Sample int	ake Deptil (II 100). ~12 II
PURGIN		JREMENTS	. 2.10 2	<u> </u>	0.00 Epi						
Time	Cumul. Vol.		Water Level (ft)	Temp. (C or F)	Specific Conductance	, , ,		pН	Eh ORP	Turbidity (NTU)	Comments
0619	0	350	13.10	-	(μS/cm)	(mg/L)			(mv)	25.0	Arrigation that
-7		330		111			 	e) -1			NID thro Ast
0827	1(51)			13.01	53(p	1.06		<u>32</u>	37.4	16.1	exist tast
0825	7100		13.1	12.08	52.11	0.49	(0:	<u>21</u>	10.2	2.54	reading
0276	3100		13.11	13.05		0.22	_	35	9. W	1,42	
୦୯୫୮	4200	<u> </u>	13.11	13.00	51	0.55	10	55 L	2.0	SEO	•
					-						•
						· · · · ·	 				
						<u> </u>					
						.,		• • • • • • • • • • • • • • • • • • • •			
		ļ									
-											
			-								
Total Gallo	ns Purged:	2-11.0	5 UTIC	y <,		Total Casing	ı Volu	ımes F	Semoved.	1.96	0
Ending Water Level (ft TOC): Ending Total Depth (ft TOC): 16.85											
	INVENTO					Litaria rota	ьср	ui (it i	00). 10.00	<u> </u>	
			• • • • • • • • • • • • • • • • • • • •	Overtite	Filippiina	Danasastia		A			Damada
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	<u> </u>	Appea	Turbidity &		Remarks
								olor	Sediment		
0835	1L	HPDE		1	none	HNO3	do	ar	evene.	Total Metals	s - As, Pb
	500mL	Amber glass		2	none	none	1			cPAHs	
· [1L	Amber glass				none			-	PCBs	
	500mL	Amber glass				none			-	TPH- DX	
1/	•							,	V		la a a a la la la la la la la la la la l
V	500mL	Amber glass			none	none	<u> </u>		. 4	Dis(∠-etnyl l	hexyl) phthalate
			· ·								
METLIAS	<u>. </u>										
METHO					11/	`					
Sampling E	Equipment ar	nd IDs:			SI 556# 16	 					
Purging Eq	uipment:	Peristaltic Pun	np w/ dedica	ted tubing		Decon Equi	ipmer	nt:	Alconox, D	istilled Wate	<u>er</u>
Disposal of	Discharged	Water:	Stored in 1,0	000 gallon te	emporary onsite	e storage tanl	k				
Ohservatio	ns/Common	ts:									
Judia VallO		<u>.</u>									



CMP2-090902

GROUN	IDWATER	SAMPLING F	RECORD			WELL NUM	IBER: CM	P-2		Page: 1 of 1
Project Na	ame: SOUTH	IWEST HARBOI	R PROJECT	- Phase II	GCWMP	Project Num				
Date: _	12109					Starting Wa				
Develope	d by: DFR/AT	<u> </u>				Casing Stick		-0.29		
	g Point of We Interval (ft. 1		7.0-17.0			Total Depth Casing Dian		17.3 e 2		
	k Interval (ft. 1		5.0-17.0			Casing Dian	neter (incite		<u>. </u>	
Casina V	Jumo 7.	7 (ft Wate	0 × D (0	7 (1 nfc)	Vant = 2.2	<u></u> (L)(ga	JN.			
Casing vo	lumes: 2" =	0 16 opf	4" = 0.65 gr	of G	(gpi) – <u>** ; *</u> " = 1.47 gpf	<u> </u>	ll)		Sample Inf	ake Depth (ft TOC): ~12 ft
Cuomy 10			4" = 2.46 L		"= 5.56 Lpf				oumple in	and Depth (It 100)12 It
PURGIN		IREMENTS								
Time	Cumul, Vol.		Water	Temp.	Specific	Dissolved	pН	Eh	Turbidity	Comments
	(galor(C)	(gpm or Lpm)	Level (ft)	(Or F)	Conductance			ORP	(NTU)	
०४८३	0	1180	13.60		(µS/cm)	(mg/L)		(mv)		
	 			11 D.C	11.00	J	0 Us		ļ. —	NTU Thru ysi
0856	1.44	480		16.28	1685	,35	8.40		0.87	evood lad reading
0890	2.28	480		16.23	1662	,27	843	159.8		J
0902	4.32	480	13.59	16.19	1669	.24	8.42	1489	1.31	
			•			_				
				,						
	- -									
•			- .							
-										
						ļ				
		5·m-						-		
Total Gallo	ons Purged:	лЦ,	5 13	Crs		Total Casing	Volumon F	l	1.97	
TOTAL CLIK	nia i diged.			* * .a.t	_	Total Casing	VOIDITIES I	veillovea.	1, 1"	
Ending Wa	ater Level (ft	тос): <i>13</i>	.69			Ending Total	Depth (ft T	OC): 17.3		
SAMPLE	INVENTO	ORY								
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Remarks
							Color	Turbidity &		
0905								Sediment		
ケルン		HPDE				HNO3	Clear	nonc	Total Metals	s - As, Pb
	500mL	Amber glass		2	none	none	1		cPAHs	
	1L	Amber glass		2	none	none		ļ	PCBs	
	500mL	Amber glass		2	none	none			TPH- DX	
4	500mL	Amber glass		2	none	none	Ŀ	4	Bis(2-ethyl l	hexyl) phthalate
		ľ								
										
METHO	os				I					
Sampling E	Equipment ar	nd IDs:	Peristaltic P	ump and YS	1556# 12	r)				
Purging Ed	•	Peristaltic Purr					pment:	Alconox D	istilled Wate	er
	•	Water:								···
						- storage tall				
Observatio	ns/Comment	s:					-			·



CMP3-090903

GROUN	DWATER	SAMPLING F	RECORD			WELL NUM	BER: CM	P-3		Page: 1 of 1
Project Na	me: SOUTH	IWEST HARBO	R PROJECT	- Phase II (GCWMP -	Project Nun				····
	1/3/09 d by: <u>DFR/A</u> 1		-			Starting Wa Casing Stick			8.45	
	Point of We					Total Depth		-0.37 15.84		
		OC)	6.0-16.0			Casing Diar	•			
	k Interval (ft.		4.0-17.5							
Casing Vo	lume <u>7 ,</u>	39(ff Wate	r) x <u> </u>	<u>2</u> (Lpfv)	(gpf) =	<u>58</u> (L)(ga	l)			
Casing vo	lumes: 2" =		4" = 0.65 gp 4" = 2.46 Lp		" = 1.47 gpf " = 5.56 Lpf				Sample Into	ake Depth (ft TOC): ~11 ft
PURGIN		REMENTS	4 - 2.40 LL	л О	- 5.50 Epi		<u> </u>			
Time	Cumul. Vol.		Water	Temp.	Specific	Dissolved	рH	Eh	Turbidity	Comments
	(gal or L) ≫₁ ((gpm or Lpm)	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)		ORP (mv)	(NTU)	
૦૮૫૬	Ô	400mi	8.45		_	,	,			MTU Thin 451
27.13	1500	400mL	8.415	18.76	685	0.62	9.97	169	19.8	evient last
0851	24,60	400	\$1.00 to	19.58	597	0.63	10.03	199.9	11.0	
0801	3600	400	જ.4૪	19.77	703	0.40	10.01	1211-8	5.3	
		-			·					
	<u></u>									
						-				
										~
	-1-2-						-			

-,-										
										· · · · · · · · · · · · · · · · · · ·
							· · ·			
Total Gallo	ns Purged:	L]	<u> </u>			Total Casing	Volumes F	Semoney.	0.87	
		тос): <u>8</u>		•	-	Ending Total			•	
	INVENTO		-			Ending Total	Deptil (it i			
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	rance		Remarks
						, , , , , , , , , , , , , , , , , , , ,	Color	Turbidity &		. tomano
0900								Sediment		
		HPDE				HNO3	P1011	c Coox	Total Metals	s - As, Pb
i		Amber glass			none	none	-		cPAHs	
 1		Amber glass				none	i	1	PCBs	
W	500mL	Amber glass		2	none	none	 ;	1	TPH- DX (w	//silica gel cleanup)
	500mL	Amber glass		2	none	none	V		Bis(2-ethyl l	nexyl) phthalate
						- 				
METHOD)S								<u></u>	
		id IDo:	Dorlatallia D	imp and VC	SI 556#) 원(`				
	• •	-			SI 556 # した					_
Purging Eq	•	Peristaltic Pun				•		Alconox, D	istilled Wate	<u>т</u>
Disposal of	Discharged	Water:	Stored in 1,0	iuu gallon te	mporary onsite	storage tanl	(
Observatio	ns/Comment	s:								
								_		



CMNIT Ododod

GRO	UN	DWATER	SAMPLING I	RECORD			WELL NUN	MBER: CM	P-4		Page: 1 of 1
Projec	t Na	me: SOUTI	IWEST HARBO	R PROJECT	Γ - Phase II	GCWMP	Project Nur				
		1/3/09		-			Starting Wa				
		by: <u>DFR/A</u> Point of W					Casing Stic		-0.32		
		Interval (ft.		7.0-17.0			Casing Dia			2]
			TOC)	5.0-17.5			Cuoming Dian	THOSE (INC.)	<u> </u>	<u> </u>	
] 9 (ft Wate	er) x () · (2 (Lpfv	$r)$ (apf) = $\frac{3}{3}$	<u>ا ا</u> (۱)(ga	a()			
		lumes: 2" =		4" = 0.65 g		7.55.7 <u></u> 3" = 1.47 gpf	(-/(8-	,		Sample Int	ake Depth (ft TOC): ~12 ft
<u> </u>		2"=	0.62 Lpf	4" = 2.46 L	pf (6" = 5.56 Lpf				···	
PUR	GIN	G MEASU	JREMENTS								
Tim	е	Cumul. Vol (gal or L)	. Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рĤ	Eh ORP (mv)	Turbidity (NTU)	Comments
093	4	Ø	400	11.01	***	American .	P	100	10.7	Ferrisa .	NO through
093		1200	400	11.06	16.81	789	0.25	8.73	38.8	6.96	
094	-	3,400	400	11.05	1697		0.21		30.2.	2.63	
094		7(00)	400	11.05	17,05	777	0.19	8.13	22.1	2.35	
	<u> </u>	2100	1 1/2 42	3.93	1460 -	771	0.11	0.2	1000	4.7.	
									-	 	
	_							 	 		
											
				 				ļ			**************************************
		-								ļ	
								-			-
		• •	-								
		· · ·	-								
Total C	مالد	ns Purged:	~	4 (110)	\ <	<u> </u>	Tatal Casina			1.09	7
Total	allo	iis i uigeu.			·)	_	Total Casing	y volumes r	temoveu:		<u> </u>
Ending	Wa	ter Level (ft	TOC):	11.05			Ending Total	l Depth (ft T	OC): 17.0		
SAME	'LE	INVENT	DRY								
Time		Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Remarks
			,,					Color	Turbidity &	1	, , , , , , , , , , , , , , , , , , , ,
2) A 1	90							!	Sediment		
094	·		HPDE		1	поле	HNO3	NOW!	C1600	Total Metals	s - As, Pb
1		500mL	Amber glass		2	none	none	1		cPAHs	
	_	<u>1L</u>	Amber glass		2	none	none			PCBs	,
		500mL	Amber glass		2	none	none		•	TPH- DX (w	//silica gel cleanup)
1		500mL	Amber glass		2	none	none	. 1,	·V	Bis(2-ethyl l	hexyl) phthalate
	_ [-		
							7			-	3
METH	OD	S									
Samplii	ng E	quipment ar	nd IDs:	Peristaltic P	ump and Y	SI 556# \2 C)				
		uipment:	Peristaltic Pun					ipment:	Alconox D	istilled Wate	er
	•	•	Water:			emporant oneiti	•	· —		vvale	<u>. </u>
						· · ·	- overage tall	IX.			
Observ	atior	is/Commen	ts:				<u> </u>				
_			=-		_						



CMP5-090902

GROU	NDWATER	SAMPLING F	RECORD			WELL NUM	BER: CM	P-5		Page: 1 of 1
Project N	lame: SOUTH	IWEST HARBOI	R PROJECT	- Phase II	GCWMP	Project Nun				
	4/2/00		-			Starting Wa	•			
	ed by: <u>DFR/A1</u>	TOC				Casing Stice Total Depth		-0.27		
		OC)	5.5-15.5			Casing Diar		15.1 2		
		TOC)	3.0-19.0			Casing Dia	neter (mone	<u> </u>	·	
		<u>्रि</u> (ft Wate		2 (Infi	V(ant) = 3	09 11/05	al).			
	olumes: 2" =		4" = 0.65 gp		7,997 <u> 5</u> 5" = 1.47 gpf	<u>∵ 1</u> _ (⊏)(9¢	"',		Sample Int	ake Depth (ft TOC): ~10.5 ft
ì			4" = 2.46 Lp		5" = 5.56 Lpf					(11.00)
PURGI	NG MEASL	REMENTS								
Time	Cumul. Vol.		Water	Temp.	Specific	Dissolved	pН	Eh	Turbidity	Comments
	(galorL) ゕし	(gpm or Lpm) <u>エルカル</u> へ	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)		ORP (mv)	(NTU)	
1229	0	450	10.12			*-	<i>-</i>		portine.	NTU IMM YSI
1737	1200	400	10.39	1774	509	0.78	6.05	-65.9	20.0	·
1235	2400	375		1737		0.53	6.09	-831	6.7	
1238	<u>_</u>	375	1070	16.84	509	0.44	6.05	-94.2	6.98	
	•		·			-				
			·							
										, ,
										1
	<u> </u>									
		~							1 20	
Total Gall	ons Purged:		Cl.c.		-	Total Casing	Volumes F	Removed:	1.29	
Ending W	ater Level (ft	TOC):	10.70			Ending Total	Depth (ft T	OC): 15.1		
	E INVENTO									
Time	Volume	Bottle Type	Ī	Quantity	Filtration	Preservation	Appea	rance		Remarks
111110	Volumo	Bottle Type		Quantity	i intenditi	i reservation		Turbidity &	1	Nemarks
10(11)							Color	Sediment		
1240		HPDE		1	none	HNO3	(7601	HOM	Total Metals	s - As, Pb
	500mL	Amber glass				none	<u>.</u>	•	cPAHs	-
	1L	Amber glass		2	none	none			PCBs	
1	500mL	Amber glass		2	попе	none			TPH- DX (w	//silica gel cleanup)
<u></u>	500mL	Amber glass		2	none	none	X.17	\\ \\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Bis(2-ethyl l	hexyl) phthalate
										,
RACT!										
METHÓ				_	100					
		nd IDs:								
-	quipment:	Peristaltic Pun				Decon Equi		Alconox, D	istilled Wate	er
Disposal o	of Discharged	Water:	Stored in 1,0	100 gallon te	emporary onsite	storage tan	k			
Observati	ons/Comment	s:								
				-						



CMD15-090903

		SAMPLING F				WELL NUN	IBER: CMI	P-15		Page: 1 of 1
Project Na	ame: SOUTH	IWĒST HARBOI Ì	R PROJECT	- Phase II	GCWMP	Project Num				
			-			Starting Wa		- 1 -		
	d by: DFR/AT					Casing Stick		-0.29		
		TOC)	7.0-17.0			Total Depth Casing Diar				
		TOC)	4.0-17.4			Casing Diai	neter (inche	·		
	olume <u> </u>	91 /410/242	<u>۱۸۱ () برد</u>	/)(gpf) =	19 11Van	.1\			
	olume <u> </u>		4" = 0.65 gr)(gpt) = <u> </u>	<u>c v (L)(ga</u>	11)		Cample Int	ake Depth (ft TOC): ~12 ft
Casing vo			4'' = 2.46 Lp		5" = 5.56 Lpf				oample in	ake Deptil (it 100). ~12 it
PURGIN		JREMENTS	. 2.10 2		<u> </u>					
Time	Cumul. Vol. (gal or L)	. Purge Rate	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	Turbidity (NTU)	Comments
W13	D	350	10.14	-	, ,	4111		_	ζ	NTO Anni MEI
1116	1050	350	10.22	15.95	3911	0.32	7:10	- 114.7	1.92	NTU mwys!
1110	2100							-114.7		ocading
		350	10.24	15.96	3706	0.34			1.50	Fraction 5
1122	3100	350	1074	15.97	3543	0.36	6.20	3.5	1.78	
										•
				·]					_
					1					
					<u> </u>					
						<u> </u>				•
otal Gallo	ons Purged:	0, 41	(((c)	S		Total Casing	Volumes F	Removed:	0.93	3
	_	,								
Inding Wa	ater Level (ft	TOC);	0.24			Ending Total	Depth (ft T	OC): 17.05	5	
SAMPLE	INVENTO	DRY	,						·	
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Remarks
							Color	Turbidity &		
1176		LIDDE						Sediment		
1125		HPDE			none	HNO3	cleo y	1.623	Total Metal:	s - As, Pb, Sb, Cr, Cu, Ni
1.	500mL	Amber glass		2	none	none		1	cPAHs	
	1L	Amber glass		2	none	none		1	PCBs	
	500mL	Amber glass		2	none	none			TPH- DX (w	//silica gel cleanup)
V	500mL	Amber glass		2	none	none	4	1/	Bis(2-ethyl l	hexyl) phthalate
						_				
	····				-					
/ETHO	DS								<u> </u>	
		nd IDs:	Peristaltin D	umn and V	SI 556# 123	0				
					J J J J J			Alac:	Institute - 1.57 - 1	
urging Eq		Peristaltic Pun				Decon Equi		Alconox, D	istilled Wate	<u> </u>
isposal of	f Discharged	Water:	Stored in 1,0	000 gallon t	emporary onsite	<u>e storage tanl</u>	k			
)bservatio	ns/Comment	ts:								
						<u> </u>				

CMP17.090907.

GROUN	IDWATER	SAMPLING F	RECORD			WELL NUM	IBER: CM	P-17			Page: 1 of 1	
Project Na	ame: SOUTH	IWEST HARBO	R PROJECT	- Phase II (GCWMP	Project Num						
	9/2/09		-			Starting Wa				i		
	d by: <u>DFR/AT</u> g Point of We					Casing Stick Total Depth		-0.1 16.2				
	g Follit of vve Interval (ft. T		6.0-16.0			Casing Dian			2			
Filter Pack	k Interval (ft.	TOC)	4.0-16.5					·				
		(ft Wate		2 (Lpfv)	$\log t = l$	(L)(ge	al)					
	olumes: 2" =		4" = 0.65 gp		6" = 1.47 gpf	<u>· · · · · · · · · · · · · · · · · · · </u>	"7		Sample Int	ake Depth	(ft TOC): 14 ft	
<u> </u>			4" = 2.46 Lp		6" = 5.56 Lpf							
PURGIN	IG MEASU	IREMENTS										
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm) h Lp m	, ,	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pН	Eh ORP (mv)	Turbidity (NTU)		Comments	
1025	○	500	9.50			y e e	4			NIU	Abino US	
102%	1500	500	9.58	17.53	599	0.57	5.85	124.3	86.3	1 260 1	through the	die
1031	3000	500	9.60	1748		0.25	5.73	120.1	15.2	-\3C-2 1	2.7.3.	¥
1034	(SOO)	500	9.58	17.46		0.32	5.83	115.24				
1 - 0 - 1	1 40 50 50				 	<u> </u>	-		1			
	 			<u> </u>			 	 	1	, 		
	 			<u> </u>	 	 	 	 	1			
			ļ	-			 	ļ	 			
					 		<u> </u>	<u> </u>	 			
	 			ļ	ļ		ļ		ļ			
		İ	ļ			<u> </u>						
	<u> </u>											
		,										
	·								<u> </u>			
Total Gallo	ons Purged:	// Co	5 ml	<u> </u>	<u></u>	Total Casino	· Volumes F	Jamonay.	1.0%	ζ		
Total Gallons Purged: Total Casing Volumes Removed: Total Casing Vol												
	E INVENTO					-nen g	, soper, (•			
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Anne:	arance	T	Poi	marks	
Thine	Volume	Bottle Type		Quantity	Tillialion	r ieservauoii	'	Turbidity &	-	Ne	ilidi K5	
							Color	Sediment				
1040	1L	HPDE		1	none	HNO3	Ule v	none	Total Metal	s - As, Pb		
1	500mL	Amber glass		2	none	none	1		cPAHs		· =. =. · · · · · · · · · · · · · · · ·	
	1L	Amber glass		2	none	none			PCBs			
	500mL	Amber glass		2	none	none			TPH- DX (v	v/silica gel	cleanup)	
1	500mL	Amber glass		2	none	none			Bis(2-ethyl	hexyl) phth	alate	
. /	40mL	VOA vial			попе	HCI	1		Chlorinated	Ethanes a	ind Ethenes (CEEs	s)
											3	.,
METHO	วร	L						l	1			
Sampling F	Equipment an	nd IDs:	Dedicated C	JED Well W	/izard Bladder F	Pump and YS	31556# 12	0				
Purging Eq	• •	Dedicated QE							Distilled Water			_
	• •					•		AIGOROX, L	DISTINCU VVAL	<u> </u>		_
nishozai 01	Discharged	Water:	Stored In 1,0	JOO GARION TE	sinporary onsite	storage tan	K		-			-
Observatio	ns/Comment	is:						<u> </u>				
												- 1



TM105-090902 + 1 10009-09000722

GRO	JNDWATER	SAMPLING F	RECORD			WELL NUM	IBER: FM-	105		Page: 1 of 1				
Projec	Name: SOUTH	IWEST HARBOI	R PROJECT	- Phase II	GCWMP	Project Num								
Date:	9/2/0	19	_			Starting Wa								
	ped by: <u>ĎFŘÍA</u>					Casing Stick		-0.2						
	ring Point of We ed Interval (ft. 1		7.0-17.0			Total Depth Casing Dian		18						
	ack Interval (ft.		6.0-17.5			Casing Dian	neter (inche							
		.(ft Wate		7- (Lpfv	Vant) = L	12 (L)(ga	JN							
	volumes: 2" =		4" = 0.65 gr)(9Pi) = <u>i </u>	(L)(ga	",		Sample Into	ake Depth (ft TOC): 15 ft				
Cubing		0.62 Lpf	4" = 2.46 Lp		6" = 5.56 Lpf				Campio inc	and Dopan (in 100). To in				
PURC	ING MEASL													
Time	Cumul. Vol (gal or L)		Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pН	Eh ORP (mv)	Turbidity (NTU)	Comments				
1107	0	500	11.360		<i></i>					PUTU TUNUUSI				
1:20	1500	500	11.42	1447	520	0.81	6,0%	108.3,	6.89					
1108	7,000	500	11.40	17.11	512	0.69		109.8						
1111	11500	500	11.89	•	518	0.58	5.25	10.7	3.64					
			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		2.10	12.70	7		7					
1														
										·				
	-				· · · · · · · · · · · · · · · · · · ·				~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					
Total G	allons Purged:	_ 75	Ulfers	:	_	Total Casing	Volumes F	Removed:	± 1.21					
Ending	Water Level (ft	TOC):	1.39			Ending Total	Depth (ft T	OC): 18		i				
	LE INVENTO					<u></u>								
Time		Bottle Type		Quantity	Filtration	Preservation	Appea	rance		Remarks				
1 11112	Volunie	Dottie Type		Quantity	1 III audi	1 16361 Valion		Turbidity &		Remarks				
111							Color	Sediment						
1115	1L	HPDE		2	none	HNO3	dan.	2222	Total Metal	s - As, Pb				
1	500mL	Amber glass		4	none	none	1	ì	cPAHs					
	1L	Amber glass		4	none	none			PCBs					
	500mL	Amber glass		4	none_	none			TPH- DX (v	v/silica gel cleanup)				
	500mL	Amber glass		4	none	none			Bis(2-ethyl	hexyl) phthalate				
·ŀ	40mL	VOA vial		6	none	HCI		.17	Chlorinated	Ethanes and Ethenes (CEEs)				
1120	o € dupti	me								· · ·				
METH		·	L					l						
Samplir	g Equipment ar	nd IDs:	Dedicated C	QED Well W	/izard Bladder F	ump and YS	1556# 17	LO						
Purgina	Equipment:				Pump	Decon Equi			istilled Wate					
		Water:												
				- 6										
Observa	ations/Commen	ts:												
	Second set	of bottles collecte	ed for duplica	ate sample										



MW262-090903 1 WW262-090903 D

GROUN	DWATER	SAMPLING F	RECORD			WELL NUM	IBER:	MW	-26R				Page: 1 of 1
Project Na	ame: SOUTH	WEST HARBOR	RPROJECT	- Phase II (GCWMP	Project Nun					·		
Date:	9/3/0	<u> </u>	-			Starting Wa			_				
	by: <u>DFR/A1</u> Point of We					Casing Stick Total Depth).32 7.05			
	interval (ft. T		6.5-16.5			Casing Diar	•			2			
	k Interval (ft.		4.0-17.0			Cubing Dian	110101	(IFIOITO					
		36_(ft Wate		2_ (Lpfv)	(ant) = 4.	56 (L)(02	ıΝ						
	lumes: 2" =		4" = 0.65 gr		" = 1.47 gpf	<u> </u>					Sample Int	ake Depth	(ft TOC): ~ 11.5 ft
			4" = 2.46 Lp		" = 5.56 Lpf							•	, , , , , , , , , , , , , , , , , , , ,
PURGIN	G MEASU	REMENTS						,					
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm) mlpm	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	р	H	Eh ORI (mv	>	Turbidity (NTU)		Comments
1335	0	400	9.69	d				-		,		No	100 001
1338	1200	4100	9.18	15.14	11 (05	0.2.0	9.3	(4)	- 20	7	5.47	1 1/0 m	Thm USI
1241	3 (100)	400		15.29	1117	0.17	7.0		710	_	2.10	K X()	
		400		15.42	1043	0.15	7		-30		1.91		
1590	2 1000	~(C :-2	9.78	1000	1042	()-145 	νί,	• • • •	- 52	()	11.5(1		N
 -													
												•	,
			· · · · · · · · · · · · · · · · · · ·							-			
							<u> </u>						
					·	, , , , , , , , , , , , , , , , , , , ,	<u> </u>						
		<u> </u>					L						
Total Gallo	ns Purged:	~~	Lile	<u> </u>	_	Total Casing	y Volui	mes F	Remove	d:	0.88	<u> </u>	
Ending Wa	iter Level (ft	тос):9,	18			Ending Tota	l Depti	h (ft T	OC): 1	7.05	5		
SAMPLE	INVENTO	RY											
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	/	Арреа	тапсе			Re	emarks
							Co	lor	Turbidit				
1390	41						-		Sedime				
•		HPDE			none	HNO3	ctec	ŧ,	non	۲_		s - As, Pb,	Sb, Cr, Cu, Ni
i		Amber glass			none	none			+	_	cPAHs		
	1L	Amber glass		4	none	none	<u> </u>		<u> </u>		PCBs		
1 1	500mL	Amber glass		4	лопе	none	'				TPH- DX (v	//silica gel	сІеалир)
1	500mL	Amber glass		4	none	none	\		\		Bis(2-ethyl	hexyl) phtl	nalate
1399	dupti	ne											
METHOL							L						
Sampling E	Equipment an	id IDs:	Peristaltic P	ump and YS	SI 556# 7,7	•							
Purging Eq		Peristaltic Pun			100		ipmen	t:	Alcono	 к. D	istilled Wate	er	
	•	Water:		•	emporary oneifi					., D	.Janou vvalt		
				,	porary orioit	o otorago tari							
		s:											
	Second set of	of bottles collecte	ed for duplica	ate sample									



mw36.090903

GROUN	DWATER	SAMPLING F	RECORD			WELL NUM	BER: MV	V-36		Page: 1 of 1
Project Na	me SOUTH	WEST HARBO	R PROJECT	- Phase II (GCWMP	Project Num				
	9/30		•			Starting Wa				<u>. </u>
	d by: <u>DFR/AT</u>					Casing Stick		-0.23		
_	Point of We					Total Depth				
		·OC <u>)</u> TOC)	58.0-73.0 55.0-71.0			Casing Dian	neter (inch	e2		
				2	a	12				
		3 ,28 (ft Wate				<u> とう</u> (L)(ga	ıl)			
Casing vo	lumes: 2" = 2" =		4" = 0.65 gp 4" = 2.46 Lp		" = 1.47 gpf " = 5.56 Lpf				Sample Int	ake Depth (ft TOC): ~ 65.5 ft
PURGIN	G MEASU	IREMENTS								
Time	Cumul. Vol. (gal or L)		Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pН	Eh ORP (mv)	Turbidity (NTU)	Comments
1035	D	3 50	9.42		(12.5.1.5)	, , , , , <u>s, -</u>	£	(,,,,,	6	NTO Inscuah 1501
1037	1050	350	9.74	14.11	3810	0.19	8.89	.93.9	1.84	except (asit
lo'ti	2 h0	350	9,72	13.96		0.15	9.01	-105.7		readina
10 121	3:50	360	9.74	13.87	3812	0.12	2.78			reading
10 12	-11 W	300	1.79	12.54	2016	10	6.70	-119.6	1.83	
								<u> </u>	-	·-·
							ļ <u></u>	ļ		
						l	<u> </u>			
										
			(, , , ,							
Total Gallo	I Gallons Purged: ~3.5 Cracis Total Casing Volumes Removed: 0.09									
Ending Wa	ater Level (ft	TOC):	1.74			Ending Total	Depth (ft	TOC): 73		
SAMPLE	INVENTO	ORY				•				
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appe	arance		Remarks
							Color	Turbidity & Sediment		
1050	1L	HPDE	•	1	none	HNO3	clear	nore	Total Metal	s - As, Pb, Sb, Cr, Cu, Ni
17	500mL	Amber glass		2	none	none			cPAHs	
		Amber glass			none	none			PCBs	
ì		Amber glass			none	none				v/silica gel cleanup)
1 1		Amber glass			none	none	1,	1		hexyl) phthalate
1/	JOOHIE.	Author glass			none	none			DIS(Z-EIII)II	nexy) primalate
***			-							
METHO)S	: I					1	1—————————————————————————————————————		
Sampling E	Equipment ar	nd IDs:	Peristaltic P	ump and YS	61 556 # 20					
Purging Eq		Peristaltic Pun				Decon Equi	ipment:	Alconox D	istilled Wate	
	•	Water:			emporary onsite	•	•			
							. 5			
Observatio	ns/Comment	s:					<u> </u>	.		
										,



mw41-090903

GROUN	IDWATER	SAMPLING F	RECORD			WELL NUM	IBER: MW	I-44		Page: 1 of 1
		IWEST HARBOR	R PROJECT	- Phase II	GCWMP	Project Num				
	1.3.09					Starting Wa			11.46	
	d by: <u>DFR/A1</u> g Point of We					Casing Stick		-0.18 73.9		
		OC)	n/a			Total Depth Casing Dian				
		TOC)	n/a			Ousing Dian	neter (men			
		.니니 (ft Wate	nx 0.6	2 antic	Vant = 38	71 a Van	ın.			
	dumes: 2" =		4" = 0.65 gr		/(9РГ) = <u></u>	· (L)(9a	ш		Sample Int	ake Depth (ft TOC): ~ 68 ft
			4" = 2.46 Lp		5" = 5.56 Lpf					
PURGIN	IG MEASU	REMENTS								
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm) mUp m	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pН	Eh ORP (mv)	Turbidity (NTU)	Comments
1411	0	400	11.46	•				-	,	PTU TO TO YS!
1414	1200	400	1151	14.40	207	4.18	698	7.7	14.3	eyeci+ Loss
14/3	26100	400	11.50	14.22		4.10	6.73	13.8	9,29	reading
1420	3600	400	1150	14.12	38	396	6.31	210	5.50	0
1423	4800	400	1.50	14.06		3.85	5.86	15.4	4.63	* Sp. covic your inble
11/20	6000	1100	11.50	1407	27	3.84	584	80.1	3.26	between 55 and
() ()	10000		4(-)()	1-16-7	5 1	2.0"1)·6~3	6.7	3.6.0	-3
								<u> </u>		ن ت
								!		
										·
·		·								
Total Gallo	ons Purged:	~ (0	Liles	5	A	Total Casing	ı Volumes	Removed [,]	0.15	
TOTAL SUIT	ano i aigou.				_	Total Octome	, 10/4/100	· como rou.		
Ending Wa	ater Level (ft	TOC):	1.60			Ending Total	Depth (ft	TOC): 73.9		
SAMPLE	E INVENTO	DRY								
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appe	arance		Remarks
						i	Color	Turbidity &	1	
1430	41	HPDE		-1	nano	HNO3	clocia	Sediment	Total Matal	s - As, Pb, Sb, Cr, Cu, Ni
1 120	500mL				none		1	1 16 POM	i	s-ms, r v, ov, or, ou, IVI
		Amber glass			none	none	+	 	cPAHs	
		Amber glass	1		none	none		1 1	PCBs	
		Amber glass			none	none				v/silica gel cleanup)
7	500mL	Amber glass		2	none	none	1	₩	Bis(2-ethyl	hexyl) phthalate
	<u> </u>	<u></u>								
METHO	D\$				_					
Sampling I	Equipment ar	nd IDs:	Peristaltic P	ump and Y	SI 556 #\7 O					
Purging Ed	quipment:	Peristaltic Pun	np w/ dedica	ted tubing		Decon Equi	ipment:	Alconox, D	istilled Wate	er
Disposal o	f Discharged	Water:	Stored in 1,0	000 gallon t	emporary onsite	e storage tan	k			
Obsesses	ne/Common	ls:								_
Obset Vallu	marcommen									



MW125-090902

GROUN	DWATER	SAMPLING F	RECORD			WELL NUN	IBER: MW	-125		Page: 1 of 1
		IWEST HARBO	RPROJECT	- Phase II	GCWMP	Project Nun				
	7/2/09					Starting Wa				
	d by: <u>DFR/A1</u> Point of We					Casing Stick Total Depth		-1.11 13.35		
	Interval (ft. 1		5.0-15.0			Casing Diar				
Filter Paci	k Interval (ft.	TOC)	3.0-15.0							
Casing Vo	olume <u>(</u>	34 (ft Wate	r) x <u>0 · 6</u> 4" = 0.65 gp	<u>Z</u> (l 6 1))(gpf) = <u>3 · 1</u> " = 1.47 gpf	1 <u>3</u> (L)(ga	ti)		Sample Int	take Depth (ft TOC): 13 ft
Cuonig 10			4" = 2.46 Lp		" = 5.56 Lpf					
PURGIN	IG MEASL	IREMENTS								3
Time	Cumul. Vol. (gal or L)		Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pН	Eh ORP (mv)	Turbidity (NTU)	Comments
0951	0	500	7.01	a.com	\$err-	*** ***		v ··		NW Thro yst
0954	1500	500	7.23	1924	542	1.04	5.94	129.11	7.42	except last
0952	3000	500	7.21	19.33	496	0.94	5.94	129.4	1.65	reading
1000	4500	500	7.19	19.33	486	0.85	5.23	130.3	1.64	0
1002,	6000	500	7.20	1931	U75	0.83	500	130.3	234	
ر ۱۰۰۰			(- (2)	(1.)	: 1 -/	0 0	,,,	1 3 2 1 2	-	
	1									
							 			
	<u>.</u>			· · · · · · · · · · · · · · · · · · ·						
		· .						,		
		•								
		7.44								
Total Gallo	ons Purged:	3	o Lile	r 5		Total Casing	Volumes F	Removed:	1.53	3
	ater Level (ft	<u> </u>			_	Ending Total				
	INVENTO									
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	rance		Remarks
				,			Color	Turbidity &		
1								Sediment		
1005	1L	HPDE				HNO3	POW.P	t	Total Metal	s - As, Pb
	500mL	Amber glass		2	none	none		All de la constant de	cPAHs	
	1L	Amber glass		2	none	none		-	PCBs	
	500mL	Amber glass		2	none	поле		المرداد	TPH- DX (v	v/silica gel cleanup)
	500mL	Amber glass		2	none	none			Bis(2-ethyl	hexyl) phthalate
1	40mL	VOA vial		3	none	HCI	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	4	Chlorinated	Ethanes and Ethenes (CEEs)
METHO	os									
Sampling E	Equipment ar	nd IDs:	Dedicated C	ED Well W	izard Bladder F	oump and YS	1556#	Z6		<u></u>
Purging Eq	uipment:	Dedicated QE	D Well Wiza	rd Bladder	Pump	Decon Equi	ipment:	Alconox, D	istilled Wate	er_
Disposal of	f Discharged	Water:	Stored in 1,0	000 gallon te	emporary onsite	e storage tan	k			
•										
observatio	ns/Comment	s:								
, ,										



MW308N-090904

1			SAMPLING F				WELL NUM	IBER: MV	/-308N		Page: 1 of 1
		ame: SOUTH	WEST HARBO	R PROJECT	- Phase II	GCWMP	Project Nun			0.0	
Date	_	9/4/0°		-			Starting Wa				
1	-	d by: <u>DFR/A</u> * g Point of We					Casing Stick Total Depth		-0.29 17.95		
•		Interval (ft. 1		12.5-17.5			Casing Diar				
		k Interval (ft.		10.0-21.5			Owning 2 in		<u> </u>		
Casi	na Vo	olume 17	<u>れら</u> (ft Wate	enx D.de	2 (Lpfv	Napr) = 14	0 (L)(ga	al)			
		lumes: 2" =		4" = 0.65 gp	of (5" = 1,47 gpf				Sample Int	take Depth (ft TOC):_~15 ft
<u> </u>		2" =	0.62 Lpf	4" = 2.46 Lp	of (3" = 5.56 Lpf					
PU	RGIN	IG MEASU	JREMENTS								
Ti	me	Cumul. Vol (gal or L)	Purge Rate (gpm or Lpm) Mしかい	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	Turbidity (NTU)	Comments
09	09	0	400	6.50		,	e-	-	,		NTO INVA YS!
00		1200	150	8.00	15.49	2723	0.73	10.110	1116	6.79	97/18:11 (00)+
<u>09</u>		SU					100000000000000000000000000000000000000	A STATE OF THE STA	3 3 3 3 4	1 . , ,	reaction
	F	7,	TE CI					 	The second second second second	•	suged and purged
2/3	- A	71100	100	<i>t</i> 3 (n			-			7	
09	20	1	150	8,60	110 415				15112	15.0	ic afficulation
		2850	 	850			0.51	1	-1244		riean seveen
	200			8.62	16.31	2007	0.34	6.41	-124.5	10.7	
· · · ·	201	3250	<i>\\</i>	8.70	16.38		2.23	6.52	-127.1	9.24	bucieria appurh
09	<u>32</u>	4700	1	8.77	16.34	2509	0.73	6.55	-12:1.9	11.2:	inside coling
											•===
Total	Gallo	ons Purged:	~ 4/20	90 mc			Total Casing	ı Volumes	Removed:	0.50	1
			0			_		,			'
Endir	ig Wa	ater Level (ft	тос): <u>У</u>	.72		·	Ending Tota	Depth (ft	TOC): 17.95	i	•
SAN	PLE	INVENT	DRY								
Tìr	ne	Volume	Bottle Type		Quantity	Filtration	Preservation	Арре	arance		Remarks
								Color	Turbidity & Sediment		
09	35	1L	HPDE		1	none	НИОЗ	dear		Total Metal	ls - As. Pb
<u> </u>	J	500mL	Amber glass			none	none	1	1	cPAHs	.,
		1L	Amber glass		•	none	none	<u> </u>		PCBs	
I		500mL					~				v/cilies gol clospur)
-	,	~	Amber glass			none	none	1	J		w/silica gel cleanup)
		500mL	Amber glass		2	none	none	<u> </u>		Bis(2-ethyl	hexyl) phthalate
											And the state of t
MET	HOI))S					L	l			
			! ID	Desira W. E		CL 550 # 17 /	`				
-	-					SI 556 # \ 7 (*	· · · · · · · · · · · · · · · · · · ·
-	-	quipment:	Peristaltic Pur	····			Decon Equ		Alconox, D	istilled Wate	er
Dispo	sal o	f Discharged	Water:	Stored in 1,0	000 gallon t	emporary onsit	e storage tan	k			
Obse	rvatic	ns/Commen	ts:								<u> </u>
_											



mw3085-090904

Project Name: SOUTH-IWEST HARBOR PROJECT - Phase II GCWMP Date: 9 4 0 0	
Developed by: DFR/AT Casing Stickup (ft): -0.61 Total Depth (ft TOC): 40.5 Screened Interval (ft. TOC) 35.0-40.0 Casing Diameter (inche 2	
Measuring Point of We	
Screened Interval (ft. TOC) 35.0-40.0 Casing Diameter (inche 2 2 2 3 2	
Filter Pack Interval (ft. TOC)	
Casing Volume 3 4 33 (ft Water) x 0.02 (Lpfv)(gpf) = 21.29 (L)(gal) Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf 2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf PURGING MEASUREMENTS Time Cumul. Vol. Purge Rate (gpm or Lpm) (G or F) Conductance (μS/cm) (mg/L) (mv) 1027 0 250 (6.14	
Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf 2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf PURGING MEASUREMENTS Time Cumul. Vol. Purge Rate (gpm or Lpm) (C or F) (C or F) (C or Goductance (ps/cm)) (mg/L) (mv) 1027 0 250 (6.17	
2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf PURGING MEASUREMENTS Time Cumul. Vol. Purge Rate (gpm or Lpm) Level (ft) (C or F) Conductance (µS/cm) (mg/L) (mv) 1027 0 250 (6.17	
Time Cumul. Vol. Purge Rate (gal or L) (gal or L) (gam or Lpm) (C or F) (C or F) (C or F) (C or F) (Dissolved Oxygen (mg/L) (MTU) (
(gal or L) (gpm or Lpm) Level (ft) (C or F) Conductance Oxygen (mg/L) (mv) (NTU) (1027 O 250 G. 17	
1027 0 250 6.17	
1025 750 1 6.60 1491 1520 200 7.63 1201 3.50 except to 1	
1028 1500 6.67 14.69 1639 0.13 7.09 199.2 2.19	
	\rightarrow
·	
Total Gallons Purged: ~ 2.5 Litcrs Total Casing Volumes Removed: 0.12	
Ending Water Level (ft TOC): Ending Total Depth (ft TOC): 40.5	
Entering Visitor Depth (it 100): 40.0	
SAMPLE INVENTORY	
Time Volume Bottle Type Quantity Filtration Preservation Appearance Remarks	
Color Turbidity & Sediment	
1035 1L HPDE 1 none HNO3 doc 1 MOV Total Metals - As, Pb	
500mL Amber glass 2 none none cPAHs	
1L Amber glass 2 none none PCBs	\neg
	-
500mL Amber glass 2 none none TPH- DX (w/silica gel cleanup)	-
500mL Amber glass 2 πone none W Bis(2-ethyl hexyl) phthalate	
METHODS	Ì
Sampling Equipment and IDs: Peristaltic Pump and YSI 556 # 17 O	_
Purging Equipment: Peristaltic Pump w/ dedicated tubing Decon Equipment: Alconox, Distilled Water	
Disposal of Discharged Water: Stored in 1,000 gallon temporary onsite storage tank	_ l
	_
Observations/Comments:	I

Chain of Stody Record & Laboratory Analysis Request

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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-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 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 alemate retention schedules have been established by work-order or contract.

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APPENDIX E DATA VALIDATION REPORT AND CERTIFICATES OF ANALYSIS

DATA VALIDATION REPORT PYRON ENVIRONMENTAL, INC. HART CROWSER, INC.

Data Validation Report

Port of Seattle, Southwest Harbor Phase II Groundwater Quality Confirmation Monitoring June 2010 Sampling

Laboratory SDG Numbers:

QY97, QZ16, & QZ41

Prepared for:

Hart Crowser, Inc.

1700 Westlake Avenue North, Suite 200 Seattle, Washington 98109-6212

Prepared by:

Pyron Environmental, Inc.

3530 32nd Way NW Olympia, WA 98502

ACRONYMS

%D percent difference

 D_f percent drift

%R percent recovery

%RSD percent relative standard deviation

AMU atomic mass unit

ARI Analytical Resources, Inc. **BFB** Bromofluorobenzene

CCB continuing calibration blank

CCV continuing calibration verification

CF calibration factor

CLP U.S. EPA Contract Laboratory Program

COC chain-of-custody

cPAHs carcinogenic polycyclic aromatic hydrocarbons

DFTPP Decafluorotriphenylphosphine

ECD electron capture detector

EPA U.S. Environmental Protection Agency

FID flame ionization detector

GC/MS gas chromatograph/mass spectrometer

ICAL initial calibration

ICB initial calibration blank

ICP/MS inductively coupled plasma/ mass spectrometer

ICS ICP interference check sample **ICV** initial calibration verification LCS laboratory control sample

LCSD laboratory control sample duplicate

μg/L microgram per liter **MDL** method detection limit

MS matrix spike

MSD matrix spike duplicate

NFGs CLP National Functional Guidelines for Data Review (EPA 1999 - Organics; EPA 2004 -

Inorganics)

PAHs polycyclic aromatic hydrocarbons

polychlorinated biphenyls **PCBs**

QAPP quality assurance project plan

QA/QC quality assurance/quality control

RF response factor
RL reporting limit

RPD relative percent difference

SDG sample delivery groupSIM selective ion monitoring

SVOCs semi-volatile organic compounds

TPH total petroleum hydrocarbon

VOCs volatile organic compounds

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during June 2010 for the referenced project. The laboratory reports validated herein were submitted by Analytical Resources, Inc. (ARI), assigned sample delivery group (SDG) numbers QY97, QZ16, and QZ47.

A level III data validation was performed on the laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2004 and EPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with those specified in the quality assurance project plan ([QAPP], Aspect 2008) and the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. Field duplicate results and evaluation is presented in **Appendix A**.

Samples and the associated analyses validated herein are summarized as follows:

						P	Analysis			
Field Sample ID	Laboratory Sample ID	Sampling Date	Sample Type	VOCs	SVOCs	cPAHs	PCBs	As Pb	Metals	ТРН
MW44	QY97A	06/02/10	GW		Х	Х	Х		Х	Х
CMP3	QY97B	06/02/10	GW		Х	Х	Х	Х		Х
CMP4	QY97C	06/02/10	GW		Х	Х	Х	Х		Х
MW36	QY97D	06/02/10	GW		Х	Х	Х		х	Х
CMP15	QZ16A	06/03/10	GW		Х	Х	Х		х	Х
MW308(N)	QZ16B	06/03/10	GW		Х	Х	Х	Х		Х
MW308(S)	QZ16C	06/03/10	GW		Х	Х	Х	Х		Х
CMP5	QZ16D	06/03/10	GW		Х	Х	Х	Х		Х
FM105	QZ16E	06/03/10	GW	Х	Х	Х	Х	Х		Х
MW125	QZ16F	06/03/10	GW	Х	Х	Х	Х	Х		Х
Trip Blank	QZ16G	06/03/10	ТВ	Х						
CMP17	QZ47A	06/04/09	GW	Х	Х	Х	Х	Х		Х
CMP2	QZ47B	06/04/09	GW		Х	Х	Х	Х		Х
CMP1	QZ47C	06/04/09	GW		Х	Х	Х	Х		Х
MW26R	QZ47D	06/04/09	GW		Х	Х	Х		Х	Х
MW26RD	QZ47E	06/04/09	FD		Х	Х	Х		х	Х
Trip Blank	QZ47F	06/04/10	ТВ	Х						

Notes:

X - The analysis was requested and performed on the sample

VOCs - Volatile organic compounds, chlorinated ethanes and ethenes only

SVOCs – Semi-volatile organic compound, bis(2-ethylhexyl)phthalate only

PAHs - Polycyclic aromatic hydrocarbons, carcinogenics only

PCBs – Polychlorinated biphenyl Aroclors

As – Arsenic

Pb - Lead

Metals – Antimony, arsenic, chromium, copper, lead, and nickel

TPH – Diesel and motor oil range total petroleum hydrocarbon

GW - Groundwater sample

FD – Field duplicate

TB - Trip blank

Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

Parameter	Analytical Method	Laboratory
VOCs	SW846 Method 8260B	
SVOCs	SW846 Method 8270D-Full Scan	
cPAHs	SW846 Method 8270D-SIM	Analytical Resources, Inc. (ARI)
PCB Aroclors	SW846 Method 8082	Tukwila, WA
Metals (Sb, As, Cr, Cu, Pb, & Ni)	EPA Method 200.8	
TPH-Diesel and Motor Oil	NWTPH-Dx	

Notes:

- 1. SW846 Methods *USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996.
- 2. EPA Method 200.8 USEPA Methods for Chemical Analysis of Water and Wastes, EPA –600/4-79-020, March 1983
- 3. NWTPH Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997.
- 4. SIM Selective ion monitoring

DATA VALIDATION FINDINGS

1. VOCs by GC/MS (EPA Method SW8260B)

1.1 Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation. The temperature for coolers was outside the upper limit of $4\pm2^{\circ}\text{C}$ upon the receipt at the laboratory. All samples were hand-delivered to the laboratory the same day of collection. The higher cooler temperature had no significant effects on data quality. No other anomalies were identified in relation to sample preservation, handling, and transport.

Water samples should be analyzed within 14 days of collection. All samples were analyzed within the required holding time.

1.2 GC/MS Instrument Performance Check

Bromofluorobenzene (BFB) tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

1.3 Initial Calibration

The National Functional Guidelines (NFGs) require that the percent relative standard deviation (%RSD) be <30% and the average response factor (RF) be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if sixpoint non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. Initial calibration met the criteria for all target compounds.

1.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the percent difference (%D) be within $\pm 20\%$, and (3) the RF be >0.01 for poor response compounds and >0.05 for all other compounds. Calibration verification analyses met the method requirements.

1.5 Method Blank

A method blank was prepared and analyzed as required. Target compounds were not detected at or above the method detection limits (MDLs) in the method blank.

1.6 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD were prepared and analyzed as required by the method. All percent recovery (%R) and relative percent difference (RPD) values met the laboratory control criteria.

1.7 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

1.8 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

1.9 Internal Standard

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

1.10 Reporting Limits (RLs)

The sample-specific RLs met the QAPP requirements and were supported with adequate initial calibration concentrations.

1.11 Overall Assessment of VOCs Data Usability

VOCs data are of known quality and acceptable for use.

2. bis(2-Ethylhexyl)phthalate by GC/MS (EPA Method SW8270C)

2.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

2.2 GC/MS Instrument Performance Check

Decafluorotriphenylphosphine (DFTPP) tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

2.3 Initial Calibration

The NFGs criteria require that the percent %RSD be <30% and the average RF be >0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be <15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. The initial calibration met the criteria.

2.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within $\pm 20\%$, and (3) the RF be >0.01 for poor response compounds and >0.05 for all other compounds. Calibration verifications met the criteria.

2.5 Method Blank

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the MDL in the method blanks.

2.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

2.7 Matrix Spike (MS) and MS Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

2.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

2.9 Internal Standards

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

2.10 Field Duplicates

One pair of field duplicates (samples MW26R and MW26RD) were submitted for *bis*(2-ethylhexyl)phthalate analyses. *bis*(2-Ethylhexyl)phthalate was not detected at or above the RL in these samples. The field precision met the project criterion.

2.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

2.12 Overall Assessment of bis(2-Ethylhexyl)phthalate Data Usability

bis(2-Ethylhexyl)phthalate data are of known quality and acceptable for use.

3. cPAHs by GC/MS - SIM (EPA Method SW8270C)

3.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

3.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

3.3 Initial Calibration

The NFGs criteria require that the %RSD be <30% and the average RRF be >0.05 for all target compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be <15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. The initial calibration met the criteria, except for the following:

Initial Calibration ID	Analyte	Exceedance	Affected Sample	Data Qualification
Instrument: NT11 Calibration Date: 06/12/2010	Benzo(a)pyrene	%RSD = 19.2% (>15%)	MW-44	J

3.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within ±20%, and (3) the RF be >0.01 for poor response compounds and >0.05 for all other compounds. Calibration verification analyses met the criteria.

3.5 Method Blanks

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the MDLs in the method blanks.

3.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were within the laboratory control limits.

3.7 Matrix Spike (MS) and MS Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

3.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

3.9 Internal Standards

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

3.10 Field Duplicates

One pair of field duplicates (samples MW26R and MW26RD), were submitted for cPAHs analyses. The duplicate RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

3.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

3.12 Overall Assessment of cPAHs Data Usability

cPAHs data are of known quality and acceptable for use.

4. PCB Aroclors by GC/ECD (EPA Method SW8082)

4.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

4.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using the mixture of Aroclor 1016 and 1260, (2) a single-point calibration be performed for the other five Aroclors to establish calibration factors (CFs) and for Aroclor pattern recognition, (3) at least 3 peaks (preferably 5 peaks) must be chosen for each Aroclor for characterization, (4) the relative standard deviation (%RSD) values of Aroclor 1016 and 1260 CFs must be ≤20%, and (5) if dual column analysis is chosen, both columns should meet the requirements.

The laboratory chose the internal-standard linear calibration for the Aroclor quantitation. The average RF %RSD values met the linearity criterion (20%). All RFs were >0.01, as recommended by SW846 Method 8000. The initial calibrations met the method requirements and were acceptable.

4.3 Calibration Verification

The method requires that (1) the initial calibration be verified prior to any analysis for each 12-hour analysis sequence, and (2) the percent drift $(\%D_f)$ be within ±15% to demonstrate the linearity of the initial calibration. Calibration verifications were performed at the required frequency. All $\%D_f$ values either met the method criterion or at levels that had no effects on sample results (e.g., biased-high $\%D_f$ values where target analytes were not detected in associated samples).

4.4 Method Blanks

Method blanks were prepared and analyzed as required. PCB Aroclors were not detected at or above the MDLs in the method blanks.

4.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

4.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

4.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

4.8 Internal Standards

The laboratory chose the internal-standard calibration approach for analyte quantitation. The SW-846, Method 8000 requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

4.9 Field Duplicates

One pair of field duplicates (samples MW26R and MW26RD) were submitted for PCB Aroclors analyses. PCB Aroclors were not detected at or above the RLs in these samples. The field precision met the project criterion.

4.10 Reporting Limits and Target Compound Quantitation

Sample-specific RLs met the QAPP requirements. RLs in selected samples were raised due to non-target chemical interference or response peaks that did not meet the laboratory Aroclor identification criteria (e.g., peak ratios, chromatographic patterns).

The dual column RPD values were within 40% for Aroclor detections greater than the RLs.

4.11 Overall Assessment of PCB Aroclors Data Usability

PCB Aroclor data are of known quality and acceptable for use as qualified.

5. Total Metals by ICP/MS (EPA Method 200.8)

5.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be analyzed within 180 days. Samples were analyzed within the required holding time.

5.2 ICP/MS Tuning

Instrument tuning was performed at the required frequency. The stability check (%RSD <5%), mass calibration (mass difference <0.1 AMU), and resolution check (peak width <1.0 AMU at 5% peak height) met the NFG and method criteria.

5.3 Initial Calibration

The ICP methods requires that (1) a blank and one calibration standard be used in establishing the analytical curve, and (2) the average of replicate exposures be reported for all standards, QC, and sample analyses.

A check standard containing target analytes at the reporting limit levels was analyzed at the beginning of each analytical run. The results were within the NFGs criteria of 70-130%.

5.4 Calibration Verification (ICV and CCV)

Initial calibration verifications (ICVs) and continuing calibration verifications (CCVs) were analyzed at the required frequency. The %R values met the control criteria (90 – 110%).

5.5 Blanks

Calibration Blanks: Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed at required frequency. Target analytes were not detected at or above the MDLs in ICBs/CCBs.

Method Blanks: Method blanks were prepared and analyzed as required. Target analytes were not detected at or above the MDLs in the method blanks.

5.6 ICP Interference Check Sample (ICS)

The method requires that (1) an inter-element interference check sample be analyzed at the beginning of each analytical run, and (2) the results should be within \pm 20% of the true value. ICP interference check sample analyses met the requirements.

5.7 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values met the control limits (80 – 120%).

5.8 Duplicate Sample Analysis

Duplicate sample analyses were performed on sample CMP-15. The RPD or concentration difference values met the laboratory control limits for all target analytes.

5.9 Matrix Spike (MS)

Matrix spike analyses were performed on sample CMP-15. The %R values were within the control limits for all target analytes.

5.10 Internal Standards

At least three internal standards were added to all field and QC samples for ICP/MS analyses. All percent relative intensity values were within the method criteria (30 - 120% of those for the associated calibration blank).

5.11 ICP Serial Dilution

Serial dilution analyses were performed on samples CMP-15 and MW-44. The %D values were within ±10% for analyses with concentrations greater than 50xMDLs.

5.12 Field Duplicates

One pair of field duplicates (samples MW26R and MW26RD) were submitted for metals analyses. The duplicate RPD or concentration difference values for detected analytes and data qualification are presented in Appendix A of this report.

5.13 Analyte Quantitation and Reporting Limits

RLs for selected analytes in a number of samples were raised due to the required dilution to overcome matrix interference associated with the samples. The QAPP requirements for quantitation limits were achieved.

5.14 Overall Assessment of Metals Data Usability

Metals data are of known quality and acceptable for use.

6. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

6.1 Holding Time

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. The extraction and analysis of samples met the requirements.

6.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using individual petroleum product reference standards to ensure the proper identification and quantitation of petroleum hydrocarbons in samples, (2) the calibration curve includes a sufficiently low standard to provide the necessary reporting limits, and (3) the linear working range of the instrument be defined.

The ICAL met the method requirements. The linearity of the ICAL curve was verified with %RSD of RFs (%RSD \leq 20%, according to EPA SW 846 Method 8000), and was acceptable for both diesel and motor oil range total petroleum hydrocarbon (TPH).

6.3 Calibration Verification

The method requires that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the percent drift value be within $\pm 15\%$ of the true value. The calibration verification analyses met the requirements.

6.4 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Diesel and TPH-Motor Oil were not detected at or above the MDLs in the method blanks.

6.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

6.6 Duplicate Analysis

Duplicate analyses were not performed on project samples in these SDGs, and therefore were not reported. Analytical precision was evaluated based on the LCS/LCSD analyses.

6.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

6.8 Field Duplicates

One pair of field duplicates (samples MW26R and MW26RD) were submitted for TPH-Diesel & Motor Oil analyses. The target compounds were not detected at or above the RLs in these samples. The field precision met the project criterion.

6.9 Reporting Limits

The reported RLs were supported with adequate ICAL concentrations. Sample-specific RLs met the QAPP requirements.

6.10 Overall Assessment of TPH-Diesel and Motor Oil Data Usability

TPH-Diesel and Motor Oil data are of known quality and acceptable for use.

SUMMARY

I. Data qualification are summarized as follows:

Sample ID	Analyte	Data Qualifier	Reason	Report Section
MW-44	Benzo(a)pyrene	J	The initial calibration %RSD value exceeded 15%.	3.2

II. Data affected by associated blanks are qualified and results adjusted as follows:

Sample ID	Analyte	Original Result	Adjusted Result	Unit	Report Section
	No data were qualified in relation	on to detections in blar	nks in these SDG	Ss.	

III. Data Qualifiers are defined as follows:

Data Qualifier	Definition
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
NJ	The analyte was not definitively identified and the reported concentration was an estimated value.
R	The result was rejected and could not be used.
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.

Approved By:		Date:	
·	Mingta Lin		

REFERENCES

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- USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- State of Washington, Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997
- Port of Seattle, Southwest Harbor Project, Phase II Groundwater Confirmation Monitoring Program, Water Quality Monitoring Plan, Aspect Consulting, Inc., October 2008.

APPENDIX A

The precision criterion (\leq 50%) was applied to evaluating the relative percent difference (RPD) values of field duplicate results greater than five times the RL (5xRL). For results less than 5xRL, an advisory criterion of 2xRL was applied to evaluating the concentration differences.

The RPD and concentration difference values for detected analytes and data qualification are presented as follows:

Barrand	B.	Sample ID & Concentration (μg/L)		222	Conc.	
Detected Target Analyte	RL (μg/L)	MW26R	MW26RD	RPD (%)	Difference (µg/L)	Data Qualification
Chrysene	0.01	0.014	0.014	-	0	No action
Chromium	2	3	4	-	1	No action
Copper	2	ND	3	-	1	No action
Nickel	2	6	6	-	0	No action

Notes:

RL – Reporting limit

ND – Not detected at or above the RL

RPD – Relative percent difference

Conc. Difference – Concentration difference between the parent sample and the field duplicate sample

DATA VALIDATION REPORT PYRON ENVIRONMENTAL, INC. ASPECT CONSULTING, LLC

Data Validation Report

Port of Seattle, Southwest Harbor Phase II Groundwater Quality Confirmation Monitoring October 2008 Sampling

Laboratory SDG Numbers:

NU12 & NU25

Prepared for:

Aspect Consulting, Inc.

179 Madrone Lane N Bainbridge Island, WA 98110

Prepared by:

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3530 32nd Way NW Olympia, WA 98502

December 22, 2008

ACRONYMS

%D percent difference

 $\mathbf{\mathcal{D}}_{f}$ percent drift

%R percent recovery

%RSD percent relative standard deviation

AMU atomic mass unit

ARI Analytical Resources, Inc.

BFB bromofluorobenzene

CCB continuing calibration blank

CCV continuing calibration verification

CF calibration factor

CLP U.S. EPA Contract Laboratory Program

COC chain-of-custody

DFTPP decafluorotriphenylphosphine

ECD electron capture detector

EPA U.S. Environmental Protection Agency

FID flame ionization detector

GC/MS gas chromatograph/mass spectrometer

ICAL initial calibration

ICB initial calibration blank

ICP/MS inductively coupled plasma/ mass spectrometer

ICS ICP interference check sample
ICV initial calibration verification
LCS laboratory control sample

LCSD laboratory control sample duplicate

μg/L microgram per literMDL method detection limit

MS matrix spike

MSD matrix spike duplicate

NFGs CLP National Functional Guidelines for Data Review (EPA 2008 – Organics, EPA

2004 - Inorganics)

PCB polychlorinated biphenyl

QAPP quality assurance project planQA/QC quality assurance/quality control

RF response factor

RPD relative percent difference

SDG sample delivery groupSIM selective ion monitoring

SVOCs semi-volatile organic compounds

TPH total petroleum hydrocarbonVOCs volatile organic compounds

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during October 2008 for the referenced project. The laboratory reports validated herein were submitted by Analytical Resources, Inc. (ARI), assigned sample delivery group (SDG) numbers NU12 and NU25.

A level III data validation was performed on the laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2004 and 2008) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with those specified in the quality assurance project plan ([QAPP], Aspect 2008) and the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. Field duplicate results and evaluation is presented in **Appendix A**.

Samples and the associated analyses validated herein are summarized as follows:

				Analysis						
Field Sample ID	Laboratory Sample ID	Sampling Date	Sample Type	VOCs	SVOCs	PAH	PCBs	As Pb	Metals	ТРН
CMP1-081013	NU12A	10/13/08	GW		Х	Х	Х	Х		Х
CMP2-081013	NU12B	10/13/08	GW		Х	Х	Х	Х		Х
FM105-081013	NU12C	10/13/08	GW	Х	Х	Х	Х	Х		Х
FM105-081013D	NU12D	10/13/08	FD	Х	Х	Х	Х	Х		Х
MW 125-081013	NU12E	10/13/08	GW	Х	Х	Х	Х	Х		Х
CMP17-081013	NU12F	10/13/08	GW	Х	Х	Х	Х	Х		Х
CMP5-081013	NU12G	10/13/08	GW		Х	Х	Х	Х		Х
MW308S-081013	NU12H	10/13/08	GW		Х	Х	Х	Х		Х
MW308N-081013	NU12I	10/13/08	GW		Х	Х	Х	Х		Х
Trip Blank	NU12J	10/13/08	ТВ	Х						
CMP3-081014	NU25A	10/14/08	GW		Х	Х	Х	Х		Х
CMP4-081014	NU25B	10/14/08	GW		Х	Х	Х	Х		Х
MW26R-081014	NU25C	10/14/08	GW		Х	Х	Х		Х	Х
MW26R-081014D	NU25D	10/14/08	FD		Х	Х	Х		Х	Х
MW 44-081014	NU25E	10/14/08	GW		Х	Х	Х		Х	Х
CMP15-081014	NU25F	10/14/08	GW		Х	Х	Х		Х	Х
MW36-081014	NU25G	10/14/08	GW		Х	Х	Х		Х	Х

Notes:

X - The analysis was requested and performed on the sample VOCs – Volatile organic compounds, chlorinated ethanes and ethenes only SVOCs – Semi-volatile organic compound, bis(2-ethylhexyl)phthalate only PAHs – Polycyclic aromatic hydrocarbons, carcinogenics only PCBs – Polychlorinated biphenyl Aroclors As – Arsenic Pb - Lead Metals – Antimony, arsenic, chromium, copper, lead, and nickel TPH – Diesel and motor oil range total petroleum hydrocarbon GW – Groundwater sample FD – Field duplicate TB – Trip blank

Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

Parameter	Analytical Method	Laboratory
VOCs	SW846 Method 8260B	
SVOCs	SW846 Method 8270C – Full Scan	
PAHs	SW846 Method 8270C-SIM	Analytical Resources, Inc. (ARI)
PCB Aroclors	SW846 Method 8082	Tukwila, WA
Metals (Sb, As, Cr, Cu, Pb, & Ni)	EPA Method 200.8	
TPH-Diesel and Motor Oil	NWTPH-Dx	

Notes:

- SW 846 Methods USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- EPA Method 200.8 USEPA Methods for Chemical Analysis of Water and Wastes, EPA –600/4-79-020, March 1983 Revision.
- 3. NWTPH Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June
- 4. SIM Selective ion monitoring

DATA VALIDATION FINDINGS

1. VOCs by GC/MS (EPA Method SW8260B)

1.1 Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation. The cooler temperature was measured at 10.5°C and 15°C upon the receipt at the laboratory. All samples were hand-delivered to the laboratory the same of day of collection. The higher cooler temperature had no significant effects on data quality. No other anomalies were identified in relation to sample preservation, handling, and transport.

Water samples should be analyzed within 14 days of collection. All samples were analyzed within the required holding time.

1.2 GC/MS Instrument Performance Check

Bromofluorobenzene (BFB) tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

1.3 Initial Calibration

The National Functional Guidelines (NFGs) require that the percent relative standard deviation (%RSD) be <30% and the average response factor (RF) be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. Initial calibration met the criteria for all target compounds.

1.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the percent difference (%D) be within $\pm 20\%$, and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

Calibration verification analyses met the method requirements.

1.5 Blanks

Method Blank: Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the method detection limits (MDLs) in method blanks.

Trip Blank: One trip blank was submitted with samples for VOCs analyses. No target compounds were detected at or above the RLs in the trip blank.

1.6 Laboratory Control Sample (LCS)

LCS and LCS duplicate (LCSD) were prepared and analyzed as required by the method. All percent recovery (%R) and relative percent difference (RPD) values met the laboratory control criteria.

1.7 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

1.8 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

1.9 Internal Standard

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

1.10 Field Duplicates

Samples FM105-081013 and FM105-081013D were field duplicates. The duplicate sample RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

1.11 Reporting Limits

The sample-specific RLs met the QAPP requirements and were supported with adequate initial calibration concentrations.

1.12 Overall Assessment of VOCs Data Usability

VOCs data are of known quality and acceptable for use.

2. bis(2-Ethylhexyl)phthalate by GC/MS (EPA Method SW8270C)

2.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

2.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

2.3 Initial Calibration

The NFGs criteria require that the percent %RSD be <30% and the average RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. The initial calibration met the criteria.

2.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within ±20%, and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verifications met the criteria.

2.5 Method Blank

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the RLs in the method blanks.

2.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. %R values for one of the four surrogate spikes, nitrobenzene-d4, were below the lower control limits in selected samples. %R values for all other surrogates were within the laboratory control limits. No data were qualified on this basis.

2.7 Matrix Spike (MS) and MS Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

2.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

2.9 Internal Standards

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

2.10 Field Duplicates

Two pairs of field duplicates - samples FM105-081013 and FM105-081013D; and samples MW26R-081014 and MW26R-081014D, were submitted for *bis*(2-ethylhexyl)phthalate analyses. *bis*(2-Ethylhexyl)phthalate was not detected at or above the RL in these samples. The field precision met the project criterion.

2.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

2.12 Overall Assessment of bis(2-Ethylhexyl)phthalate Data Usability

bis(2-Ethylhexyl)phthalate data are of known quality and acceptable for use.

3. PAHs by GC/MS - SIM (EPA Method SW8270C)

3.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

3.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

3.3 Initial Calibration

The NFGs criteria require that the %RSD be <30% and the average RRF be >0.05 for all target compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995,

and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. The initial calibration met the criteria.

3.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within $\pm 20\%$, and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verification analyses met the criteria.

3.5 Method Blanks

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the RLs in the method blanks.

3.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were within the laboratory control limits.

3.7 Matrix Spike (MS) and MS Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

3.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

3.9 Internal Standards

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

3.10 Field Duplicates

Two pairs of field duplicates - samples FM105-081013 and FM105-081013D; and samples MW26R-081014 and MW26R-081014D, were submitted for PAHs analyses. The duplicate RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

3.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

3.12 Overall Assessment of PAHs Data Usability

PAHs data are of known quality and acceptable for use.

4. PCB Aroclors by GC/ECD (EPA Method SW8082)

4.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

4.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using the mixture of Aroclor 1016 and 1260, (2) a single-point calibration be performed for the other five Aroclors to establish calibration factors (CFs) and for Aroclor pattern recognition, (3) at least 3 peaks (preferably 5 peaks) must be chosen for each Aroclor for characterization, (4) the relative standard deviation (%RSD) values of Aroclor 1016 and 1260 CFs must be \leq 20%, and (5) if dual column analysis is chosen, both columns should meet the requirements.

The laboratory chose the internal-standard linear calibration for the Aroclor quantitation. The average RF %RSD values met the linearity criterion (20%). All RFs were >0.01, as recommended by SW846 Method 8000. The initial calibrations met the method requirements and were acceptable.

4.3 Calibration Verification

The method requires that (1) the initial calibration be verified prior to any analysis for each 12-hour analysis sequence, and (2) the percent drift ($\%D_f$) be within ±15% to demonstrate the linearity of the initial calibration. Calibration verifications were performed at the required frequency. All $\%D_f$ values either met the method criterion or at levels that had no effects on sample results (*e.g.*, biased high recovery where target analytes were not detected in associated samples).

4.4 Method Blanks

Method blanks were prepared and analyzed as required. PCB Aroclors were not detected at or above the RLs in the method blanks.

4.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

4.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

4.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

4.8 Internal Standards

The laboratory chose the internal-standard calibration approach for analyte quantitation. The SW-846, Method 8000 requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within $\pm 50\%$ to $\pm 100\%$ of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

4.9 Field Duplicates

Two pairs of field duplicates - samples FM105-081013 and FM105-081013D; and samples MW26R-081014 and MW26R-081014D, were submitted for PCB Aroclors analyses. PCB Aroclors were not detected at or above the RL in these samples. The field precision met the project criterion.

4.10 Reporting Limits and Target Compound Quantitation

Sample-specific RLs met the QAPP requirements. RLs in selected samples were raised due to non-target chemical interference or response peaks that did not meet the Aroclor identification criteria (e.g., peak ratios, chromatographic patterns).

4.11 Overall Assessment of PCB Aroclors Data Usability

PCB Aroclor data are of known quality and acceptable for use.

5. Total Metals by ICP/MS (EPA Method 200.8)

5.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be analyzed within 180 days. Samples were analyzed within the required holding time.

5.2 ICP/MS Tuning

Instrument tuning was performed at the required frequency. The stability check (%RSD <5%), mass calibration (mass difference <0.1 AMU), and resolution check (peak width <1.0 AMU at 5% peak height) met the NFG and method criteria.

5.3 Initial Calibration

The ICP methods requires that (1) a blank and one calibration standard be used in establishing the analytical curve, and (2) the average of replicate exposures be reported for all standards, QC, and sample analyses.

A check standard containing target analytes at the reporting limit levels was analyzed at the beginning of each analytical run. The results were within the NFGs criteria of 70-130%.

5.4 Calibration Verification (ICV and CCV)

Initial calibration verifications (ICVs) and continuing calibration verifications (CCVs) were analyzed at the required frequency. The %R values met the control criteria (90 – 110%).

5.5 Blanks

Calibration Blanks: Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed at required frequency. Target analytes were not detected in ICBs/CCBs at or above the method detection limits (MDLs).

Method Blanks: Method blanks were prepared and analyzed as required. Target analytes were not detected at or above the RLs.

5.6 ICP Interference Check Sample (ICS)

The method requires that (1) an inter-element interference check sample be analyzed at the beginning of each analytical run, and (2) the results should be within \pm 20% of the true value. ICP interference check sample analyses met the requirements.

5.7 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values met the control limits (80 – 120%).

5.8 Duplicate Sample Analysis

Duplicate sample analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical precision was evaluated based on the field duplicate results.

5.9 Matrix Spike (MS)

Matrix spike analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical accuracy was evaluated based on the LCS results.

5.10 Internal Standards

At least three internal standards were added to all field and QC samples for ICP/MS analyses. All percent relative intensity values were within the method criteria (30 - 120% of those for the associated calibration blank).

5.11 ICP Serial Dilution

Serial dilution analysis were not performed on project samples in these SDGs, and therefore not reported.

5.12 Field Duplicates

Two pairs of field duplicates - samples FM105-081013 and FM105-081013D; and samples MW26R-081014 and MW26R-081014D, were submitted for metals analyses. The duplicate RPD or concentration difference values for detected analytes and data qualification are presented in Appendix A of this report.

5.13 Analyte Quantitation and Reporting Limits

RLs for selected analytes in a number of samples were raised due to the required dilution to overcome matrix interference associated with the samples. The QAPP requirements for quantitation limits were achieved.

5.14 Overall Assessment of Metals Data Usability

Metals data are of known quality and acceptable for use.

6. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

6.1 Holding Time

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. The extraction and analysis of samples met the requirements.

6.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using individual petroleum product reference standards to ensure the proper identification and quantitation of petroleum hydrocarbons in samples, (2) the calibration curve includes a sufficiently low standard to provide the necessary reporting limits, and (3) the linear working range of the instrument be defined.

The ICAL met the method requirements. The linearity of the ICAL curve was verified with %RSD of RFs (%RSD ≤ 20%, according to EPA SW 846 Method 8000), and was acceptable for both diesel and motor oil range total petroleum hydrocarbon (TPH).

6.3 Calibration Verification

The method requires that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the percent drift value be within ±15% of the true value. The calibration verification analyses met the requirements.

6.4 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Diesel and TPH-Motor Oil were not detected at or above the RLs in the method blanks.

6.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

6.6 Duplicate Analysis

Duplicate analyses were not performed on project samples in these SDGs, and therefore were not reported. Analytical precision was evaluated based on the LCS/LCSD analyses.

6.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

6.8 Field Duplicates

Two pairs of field duplicates - samples FM105-081013 and FM105-081013D; and samples MW26R-081014 and MW26R-081014D, were submitted. TPH-Diesel & Motor Oil were not detected at or above the RL in these samples. The field precision met the project criterion.

6.9 Reporting Limits

The reported RLs were supported with adequate ICAL concentrations. Sample-specific RLs met the QAPP requirements.

6.10 Overall Assessment of TPH-Diesel and Motor Oil Data Usability

TPH-Diesel and Motor Oil data are of known quality and acceptable for use.

SUMMARY

 Data qualification are summarized as follow

Sample ID Anal	alyte	Data Qualifier	Reason	Report Section
	No data	a were qualit	fied in these SDGs.	

II. Data affected by associated blanks are qualified and results adjusted as follows:

Sample ID	Analyte	Original Result	Adjusted Result	Unit	Report Section
	No data were qualified in relatio	n to detections in blan	ks in these SD0	es.	

III. Data Qualifiers are defined as follows:

Data Qualifier	Definition
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
NJ	The analyte was not definitively identified and the reported concentration was an estimated value.
R	The result was rejected and could not be used.
U	The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
υJ	The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Approved By:		Date	:
	Mingta Lin		

REFERENCES

- USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, June 2007, EPA-540-R-08-01.
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, October 2004, EPA 540/R-04/004.
- USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- State of Washington, Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997
- Port of Seattle, Southwest Harbor Project, Phase II Groundwater Confirmation Monitoring Program, Water Quality Monitoring Plan, Aspect Consulting, Inc., October 2008.

APPENDIX A

The precision criterion (\leq 50%) was applied to evaluating the relative percent difference (RPD) values of field duplicate results greater than five times the MRL (5xRL). For results less than 5xRL, an advisory criterion of 2xRL was applied to evaluating the concentration differences.

The RPD and concentration difference values for detected analytes and data qualification are presented as follows:

		San Concen	RPD	Conc.	Data	
Detected Target Analyte	RL (µg/L)	FM105-081013	FM105-081013D	(%)	Difference (µg/L)	Data Qualification
Arsenic	0.2	0.40	0.40	-	0	No action
cis-1,2-Dichloroethene	0.2	0.70	0.70	-	0	No action
Tetrachloroethene (PCE)	0.2	6.10	6.20	1.6%	-	No action
Trichloroethene (TCE)	0.2	0.90	0.90	-	0	No action
	RL	Sample ID & Concentration (µg/L)		RPD	Conc.	Data
Detected Target Analyte	(µg/L)	MW26R-081014	MW26R-081014D	(%)	(µg/L)	Qualification
Benz(a)anthracene	0.01	0.025	0.024	-	0.001	No action
Chrysene	0.01	0.027	0.026	-	0.001	No action
Arsenic	2	ND	3	-	3	No action
Chromium III	2	ND	3	-	3	No action
Nickel	2	6	7	-	1	No action

Note:

RL - Reporting limit

ND - Not detected at or above the RL

RPD - Relative percent difference

Conc. Difference - Concentration difference between the parent sample and the field duplicate sample

Data Validation Report

Port of Seattle, Southwest Harbor Phase II Groundwater Quality Confirmation Monitoring April 2009 Sampling

Laboratory SDG Numbers:

OT19, OT38, & OT68

Prepared for:

Aspect Consulting, Inc.

179 Madrone Lane N Bainbridge Island, WA 98110

Prepared by:

Pyron Environmental, Inc.

3530 32nd Way NW Olympia, WA 98502

ACRONYMS

%D percent difference

%D_f percent drift

%R percent recovery

%RSD percent relative standard deviation

AMU atomic mass unit

ARI Analytical Resources, Inc.

BFB Bromofluorobenzene

CCB continuing calibration blank

CCV continuing calibration verification

CF calibration factor

CLP U.S. EPA Contract Laboratory Program

COC chain-of-custody

DFTPP Decafluorotriphenylphosphine

ECD electron capture detector

EPA U.S. Environmental Protection Agency

FID flame ionization detector

GC/MS gas chromatograph/mass spectrometer

ICAL initial calibration

ICB initial calibration blank

ICP/MS inductively coupled plasma/ mass spectrometer

ICS ICP interference check sampleICV initial calibration verificationLCS laboratory control sample

LCSD laboratory control sample duplicate

μg/L microgram per literMDL method detection limit

MS matrix spike

MSD matrix spike duplicate

NFGs CLP National Functional Guidelines for Data Review (EPA 2008 – Organics, EPA

2004 - Inorganics)

PAHs polycyclic aromatic hydrocarbons

PCB polychlorinated biphenyl

QAPP quality assurance project plan

QA/QC quality assurance/quality control

RF response factor
RL reporting limit

RPD relative percent differenceSDG sample delivery group

SIM selective ion monitoring

SVOCs semi-volatile organic compounds

TPH total petroleum hydrocarbonVOCs volatile organic compounds

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during April 2009 for the referenced project. The laboratory reports validated herein were submitted by Analytical Resources, Inc. (ARI), assigned sample delivery group (SDG) numbers OT19, OT38, and OT68.

A level III data validation was performed on the laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2004 and 2008) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with those specified in the quality assurance project plan ([QAPP], Aspect 2008) and the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. Field duplicate results and evaluation is presented in **Appendix A**.

Samples and the associated analyses validated herein are summarized as follows:

				Analysis						
Field Sample ID	Laboratory Sample ID	Sampling Date	Sample Type	VOCs	SVOCs	PAHs	PCBs	As Pb	Metals	TPH
CMP2-090331	OT19A	03/31/.09	GW		X	Х	Х	Х		Х
CMP1-090331	OT19B	03/31/.09	GW		Х	Х	Х	Х		Х
FM105-090331	OT19C	03/31/.09	GW	Х	Х	Х	Х	Х		Х
MW125-090331	OT19D	03/31/.09	GW	Х	Х	Х	Х	Х		Х
CMP17-090331	OT19E	03/31/.09	GW	Х	Х	Х	Х	Х		Х
FM105-090331D	OT19F	03/31/.09	FD	Х	Х	Х	Х	Х		Х
Trip Blank	OT19F	03/31/.09	ТВ	Х						
CMP3-090401	OT38A	04/01/09	GW		Х	Х	Х	Х		Х
MW26R-090401	OT38B	04/01/09	GW		Х	Х	Х		Х	Х
MW26R-090401D	OT38C	04/01/09	FD		Х	Х	Х		Х	Х
MW44-090401	OT38D	04/01/09	GW		Х	Х	Х		Х	Х
CMP5-090401	OT38E	04/01/09	GW		Х	Х	Х	Х		Х
MW308S-090401	OT38F	04/01/09	GW		Х	Х	Х	Х		Х
CMP4-090402	OT68A	04/02/09	GW		Х	Х	Х	Х		Х
MW36-090402	OT68B	04/02/09	GW		Х	Х	Х		Х	Х
CMP15-090402	OT68C	04/02/09	GW		Х	Х	Х		Х	Х
MW308N-090402	OT68D	04/02/09	GW		Х	Х	Х	Х		Х

Notes:

X - The analysis was requested and performed on the sample

VOCs - Volatile organic compounds, chlorinated ethanes and ethenes only

SVOCs - Semi-volatile organic compound, bis(2-ethylhexyl)phthalate only

PAHs - Polycyclic aromatic hydrocarbons, carcinogenics only

PCBs - Polychlorinated biphenyl Aroclors

As – Arsenic

Pb - Lead

Metals - Antimony, arsenic, chromium, copper, lead, and nickel

TPH - Diesel and motor oil range total petroleum hydrocarbon

GW - Groundwater sample

FD - Field duplicate

TB - Trip blank

Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

Parameter	Analytical Method	Laboratory
VOCs	SW846 Method 8260B	
SVOCs	SW846 Method 8270C - Full Scan	
PAHs	SW846 Method 8270C-SIM	Analytical Resources, Inc. (ARI)
PCB Aroclors	SW846 Method 8082	Tukwila, WA
Metals (Sb, As, Cr, Cu, Pb, & Ni)	EPA Method 200.8	
TPH-Diesel and Motor Oil	NWTPH-Dx	

Notes:

SW846 Methods - USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.

EPA Method 200.8 - USEPA Methods for Chemical Analysis of Water and Wastes, EPA –600/4-79-020, March 1983 Revision. NWTPH - Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997. SIM – Selective ion monitoring

DATA VALIDATION FINDINGS

1. VOCs by GC/MS (EPA Method SW8260B)

1.1 Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation. The temperature for three of the coolers (7.2 $^{\circ}$ C, 6.6 $^{\circ}$ C, and 7.4 $^{\circ}$ C) was outside the upper limit of 4±2 $^{\circ}$ C upon the receipt at the laboratory. All samples were hand-delivered to the laboratory the same day of collection. The higher cooler temperature had no significant effects on data quality. No other anomalies were identified in relation to sample preservation, handling, and transport.

Water samples should be analyzed within 14 days of collection. All samples were analyzed within the required holding time.

1.2 GC/MS Instrument Performance Check

Bromofluorobenzene (BFB) tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

1.3 Initial Calibration

The National Functional Guidelines (NFGs) require that the percent relative standard deviation (%RSD) be <30% and the average response factor (RF) be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. Initial calibration met the criteria for all target compounds.

1.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the percent difference (%D) be within $\pm 20\%$, and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

Calibration verification analyses met the method requirements.

1.5 Blanks

Method Blank: Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the method detection limits (MDLs) in method blanks.

Trip Blank: One trip blank was submitted with samples for VOCs analyses. No target compounds were detected at or above the RLs in the trip blank.

1.6 Laboratory Control Sample (LCS)

LCS and LCS duplicate (LCSD) were prepared and analyzed as required by the method. All percent recovery (%R) and relative percent difference (RPD) values met the laboratory control criteria.

1.7 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

1.8 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

1.9 Internal Standard

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

1.10 Field Duplicates

Samples FM105-090331 and FM105-090331D were field duplicates. The duplicate sample RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

1.11 Reporting Limits

The sample-specific RLs met the QAPP requirements and were supported with adequate initial calibration concentrations.

1.12 Overall Assessment of VOCs Data Usability

VOCs data are of known quality and acceptable for use.

2. bis(2-Ethylhexyl)phthalate by GC/MS (EPA Method SW8270C)

2.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

2.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

2.3 Initial Calibration

The NFGs criteria require that the percent %RSD be <30% and the average RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. The initial calibration met the criteria.

2.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within ±20%, and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verifications met the criteria.

2.5 Method Blank

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the RLs in the method blanks.

2.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

2.7 Matrix Spike (MS) and MS Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

2.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

2.9 Internal Standards

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

2.10 Field Duplicates

Two pairs of field duplicates - samples FM105-090331 and FM105-090331D; and samples MW26R-090401 and MW26R-090401D, were submitted for *bis*(2-ethylhexyl)phthalate analyses. *bis*(2-Ethylhexyl)phthalate was not detected at or above the RL in these samples. The field precision met the project criterion.

2.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

2.12 Overall Assessment of bis(2-Ethylhexyl)phthalate Data Usability

bis(2-Ethylhexyl)phthalate data are of known quality and acceptable for use.

3. PAHs by GC/MS - SIM (EPA Method SW8270C)

3.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

3.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

3.3 Initial Calibration

The NFGs criteria require that the %RSD be <30% and the average RRF be >0.05 for all target compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995,

and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. The initial calibration met the criteria.

3.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within $\pm 20\%$, and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verification analyses met the criteria or the %D values were at levels that had no effects on sample results (*e.g.*, biased-high %D values and the target analytes were not detected in associated samples).

3.5 Method Blanks

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the RLs in the method blanks.

3.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were within the laboratory control limits.

3.7 Matrix Spike (MS) and MS Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

3.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

3.9 Internal Standards

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

3.10 Field Duplicates

Two pairs of field duplicates - samples FM105-090331 and FM105-090331D; and samples MW26R-090401 and MW26R-090401D, were submitted for PAHs analyses. The duplicate RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

3.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

3.12 Overall Assessment of PAHs Data Usability

PAHs data are of known quality and acceptable for use.

4. PCB Aroclors by GC/ECD (EPA Method SW8082)

4.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

4.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using the mixture of Aroclor 1016 and 1260, (2) a single-point calibration be performed for the other five Aroclors to establish calibration factors (CFs) and for Aroclor pattern recognition, (3) at least 3 peaks (preferably 5 peaks) must be chosen for each Aroclor for characterization, (4) the relative standard deviation (%RSD) values of Aroclor 1016 and 1260 CFs must be \leq 20%, and (5) if dual column analysis is chosen, both columns should meet the requirements.

The laboratory chose the internal-standard linear calibration for the Aroclor quantitation. The average RF %RSD values met the linearity criterion (20%). All RFs were >0.01, as recommended by SW846 Method 8000. The initial calibrations met the method requirements and were acceptable.

4.3 Calibration Verification

The method requires that (1) the initial calibration be verified prior to any analysis for each 12-hour analysis sequence, and (2) the percent drift $(\%D_f)$ be within $\pm 15\%$ to demonstrate the linearity of the initial calibration. Calibration verifications were performed at the required frequency. All $\%D_f$ values either met the method criterion or at levels that had no effects on sample results (*e.g.*, biased-high $\%D_f$ values where target analytes were not detected in associated samples).

4.4 Method Blanks

Method blanks were prepared and analyzed as required. PCB Aroclors were not detected at or above the RLs in the method blanks.

4.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

4.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

4.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

4.8 Internal Standards

The laboratory chose the internal-standard calibration approach for analyte quantitation. The SW-846, Method 8000 requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to $\pm 100\%$ of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

4.9 Field Duplicates

Two pairs of field duplicates - samples FM105-090331 and FM105-090331D; and samples MW26R-090401 and MW26R-090401D, were submitted for PCB Aroclors analyses. PCB Aroclors were not detected at or above the RL in these samples. The field precision met the project criterion.

4.10 Reporting Limits and Target Compound Quantitation

Sample-specific RLs met the QAPP requirements. RLs in selected samples were raised due to non-target chemical interference or response peaks that did not meet the Aroclor identification criteria (*e.g.*, peak ratios, chromatographic patterns).

4.11 Overall Assessment of PCB Aroclors Data Usability

PCB Aroclor data are of known quality and acceptable for use.

5. Total Metals by ICP/MS (EPA Method 200.8)

5.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be analyzed within 180 days. Samples were analyzed within the required holding time.

5.2 ICP/MS Tuning

Instrument tuning was performed at the required frequency. The stability check (%RSD <5%), mass calibration (mass difference <0.1 AMU), and resolution check (peak width <1.0 AMU at 5% peak height) met the NFG and method criteria.

5.3 Initial Calibration

The ICP methods requires that (1) a blank and one calibration standard be used in establishing the analytical curve, and (2) the average of replicate exposures be reported for all standards, QC, and sample analyses.

A check standard containing target analytes at the reporting limit levels was analyzed at the beginning of each analytical run. The results were within the NFGs criteria of 70-130%.

5.4 Calibration Verification (ICV and CCV)

Initial calibration verifications (ICVs) and continuing calibration verifications (CCVs) were analyzed at the required frequency. The %R values met the control criteria (90 – 110%).

5.5 Blanks

Calibration Blanks: Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed at required frequency. Target analytes were not detected in ICBs/CCBs at or above the method detection limits (MDLs).

Method Blanks: Method blanks were prepared and analyzed as required. Target analytes were not detected at or above the RLs.

5.6 ICP Interference Check Sample (ICS)

The method requires that (1) an inter-element interference check sample be analyzed at the beginning of each analytical run, and (2) the results should be within \pm 20% of the true value. ICP interference check sample analyses met the requirements.

5.7 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values met the control limits (80 – 120%).

5.8 Duplicate Sample Analysis

Duplicate sample analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical precision was evaluated based on the field duplicate results.

5.9 Matrix Spike (MS)

Matrix spike analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical accuracy was evaluated based on the LCS results.

5.10 Internal Standards

At least three internal standards were added to all field and QC samples for ICP/MS analyses. All percent relative intensity values were within the method criteria (30 - 120% of those for the associated calibration blank).

5.11 ICP Serial Dilution

Serial dilution analysis were not performed on project samples in these SDGs, and therefore not reported.

5.12 Field Duplicates

Two pairs of field duplicates - samples FM105-090331 and FM105-090331D; and samples MW26R-090401 and MW26R-090401D, were submitted for metals analyses. The duplicate RPD or concentration difference values for detected analytes and data qualification are presented in Appendix A of this report.

5.13 Analyte Quantitation and Reporting Limits

RLs for selected analytes in a number of samples were raised due to the required dilution to overcome matrix interference associated with the samples. The QAPP requirements for quantitation limits were achieved.

5.14 Overall Assessment of Metals Data Usability

Metals data are of known quality and acceptable for use.

6. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

6.1 Holding Time

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. The extraction and analysis of samples met the requirements.

6.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using individual petroleum product reference standards to ensure the proper identification and quantitation of petroleum hydrocarbons in samples, (2) the calibration curve includes a sufficiently low standard to provide the necessary reporting limits, and (3) the linear working range of the instrument be defined.

The ICAL met the method requirements. The linearity of the ICAL curve was verified with %RSD of RFs (%RSD ≤ 20%, according to EPA SW 846 Method 8000), and was acceptable for both diesel and motor oil range total petroleum hydrocarbon (TPH).

6.3 Calibration Verification

The method requires that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the percent drift value be within $\pm 15\%$ of the true value. The calibration verification analyses met the requirements.

6.4 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Diesel and TPH-Motor Oil were not detected at or above the RLs in the method blanks.

6.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

6.6 Duplicate Analysis

Duplicate analyses were not performed on project samples in these SDGs, and therefore were not reported. Analytical precision was evaluated based on the LCS/LCSD analyses.

6.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

6.8 Field Duplicates

Two pairs of field duplicates - samples FM105-090331 and FM105-090331D; and samples MW26R-090401 and MW26R-090401D, were submitted for TPH-Diesel & Motor Oil analyses. The target compounds were not detected at or above the RL in these samples. The field precision met the project criterion.

6.9 Reporting Limits

The reported RLs were supported with adequate ICAL concentrations. Sample-specific RLs met the QAPP requirements.

6.10 Overall Assessment of TPH-Diesel and Motor Oil Data Usability

TPH-Diesel and Motor Oil data are of known quality and acceptable for use.

SUMMARY

I. Data qualification are summarized as follows:

Sample ID	Analyte	Data Qualifier	Reason	Report Section
FM105-090331 FM105-090331D	bis(2-Ethylhexyl)phthalate	Ŋ IJ	The field duplicate result did not meet the project control limits.	Appendix A

II. Data affected by associated blanks are qualified and results adjusted as follows:

Sample ID	Analyte	Original Result	Adjusted Result	Unit	Report Section
	No data were qualified in relation	n to detections in blan	ks in these SDC	às.	

III. Data Qualifiers are defined as follows:

Data Qualifier	Definition
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
NJ	The analyte was not definitively identified and the reported concentration was an estimated value.
R	The result was rejected and could not be used.
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.

Approved By:		Date:	
	Mingta Lin		

REFERENCES

- USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, June 2007, EPA-540-R-08-01.
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, October 2004, EPA 540/R-04/004.
- USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- State of Washington, Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997
- Port of Seattle, Southwest Harbor Project, Phase II Groundwater Confirmation Monitoring Program, Water Quality Monitoring Plan, Aspect Consulting, Inc., October 2008.

APPENDIX A

The precision criterion (\leq 50%) was applied to evaluating the relative percent difference (RPD) values of field duplicate results greater than five times the MRL (5xRL). For results less than 5xRL, an advisory criterion of 2xRL was applied to evaluating the concentration differences.

The RPD and concentration difference values for detected analytes and data qualification are presented as follows:

		Sam Concentr		Conc.		
Detected Target Analyte	RL (µg/L)	FM105-090331	FM105-090331D	RPD (%)	Difference (µg/L)	Data Qualification
Arsenic	0.2	0.50	0.50	-	0	No action
cis-1,2-Dichloroethene	0.2	0.40	0.50	-	0.01	No action
Tetrachloroethene (PCE)	0.2	3.4	3.7	8.5%	-	No action
Trichloroethene (TCE)	0.2	0.60	0.60	-	0	No action
bis(2-Ethylhexyl)phthalate	1.0	ND	5.8	-	5.8	UJ/J
		Sample ID & Concentration (µg/L)			Conc.	
Detected Target Analyte	RL (µg/L)	MW26R-090401	MW26R-090401D	RPD (%)	Difference (µg/L)	Data Qualification
Benz(a)anthracene	0.01	ND	0.011	-	0.011	No action
Benzo(b)fluoranthene	0.01	ND	0.018	-	0.018	No action
Benzo(k)fluoranthene	0.01	ND	0.016	-	0.016	No action
Chrysene	0.01	0.011	0.022	-	0.011	No action
Chromium	2	3	3	-	0	No action
Nickel	2	6	7	-	1	No action

Notes:

RL - Reporting limit

ND - Not detected at or above the RL

RPD – Relative percent difference

Conc. Difference – Concentration difference between the parent sample and the field duplicate sample

Data Validation Report

Port of Seattle, Southwest Harbor Phase II Groundwater Quality Confirmation Monitoring September 2009 Sampling

Laboratory SDG Numbers:

PM70, PN04, & PN16

Prepared for:

Aspect Consulting, Inc.

179 Madrone Lane North Bainbridge Island, WA 98110

Prepared by:

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3530 32nd Way NW Olympia, WA 98502

October 20, 2009

ACRONYMS

%D percent difference

%D_f percent drift

%R percent recovery

%RSD percent relative standard deviation

AMU atomic mass unit

ARI Analytical Resources, Inc.

BFB Bromofluorobenzene

CCB continuing calibration blank

CCV continuing calibration verification

CF calibration factor

CLP U.S. EPA Contract Laboratory Program

COC chain-of-custody

DFTPP Decafluorotriphenylphosphine

ECD electron capture detector

EPA U.S. Environmental Protection Agency

FID flame ionization detector

GC/MS gas chromatograph/mass spectrometer

ICAL initial calibration

ICB initial calibration blank

ICP/MS inductively coupled plasma/ mass spectrometer

ICS ICP interference check sampleICV initial calibration verificationLCS laboratory control sample

LCSD laboratory control sample duplicate

μg/L microgram per literMDL method detection limit

MS matrix spike

MSD matrix spike duplicate

NFGs CLP National Functional Guidelines for Data Review (EPA 2007 – Organics, EPA

2004 - Inorganics)

PAHs polycyclic aromatic hydrocarbons

PCBs polychlorinated biphenyls

QAPP quality assurance project plan

QA/QC quality assurance/quality control

RF response factor
RL reporting limit

RPD relative percent difference
SDG sample delivery group

SIM selective ion monitoring

SVOCs semi-volatile organic compounds

TPH total petroleum hydrocarbonVOCs volatile organic compounds

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during September 2009 for the referenced project. The laboratory reports validated herein were submitted by Analytical Resources, Inc. (ARI), assigned sample delivery group (SDG) numbers PM70, PN04, and PN16.

A level III data validation was performed on the laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2004 and 2007) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with those specified in the quality assurance project plan ([QAPP], Aspect 2008) and the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. Field duplicate results and evaluation is presented in **Appendix A**.

Samples and the associated analyses validated herein are summarized as follows:

				Analysis						
Field Sample ID	Laboratory Sample ID	Sampling Date	Sample Type	VOCs	SVOCs	PAHs	PCBs	As Pb	Metals	ТРН
CMP2-090902	PM70A	09/02/09	GW		Х	Х	Х	Х		Χ
MW125-090902	PM70B	09/02/09	GW	Х	Х	Х	Χ	Х		Х
CMP17-090902	PM70C	09/02/09	GW	Х	Х	Х	Χ	Х		Х
FM105-090902	PM70D	09/02/09	GW	Х	Х	Х	Х	Х		Х
FM105-090902D	PM70E	09/02/09	FD	Х	Х	Х	Х	Х		Х
CMP5-090902	PM70F	09/02/09	GW		Х	Х	Х	Х		Х
CMP3-090903	PN04A	09/03/09	GW		Х	Х	Х	Х		Х
CMP4-090903	PN04B	09/03/09	GW		Х	Х	Х	Х		Х
CMP15-090903	PN04C	09/03/09	GW		Х	Х	Х		Х	Х
MW26R-090903	PN04D	09/03/09	GW		Х	Х	Х		Х	Х
MW26R-090903D	PN04E	09/03/09	FD		Х	Х	Х		Х	Х
MW44-090903	PN04F	09/03/09	GW		Х	Х	Х		Х	Х
MW36-090903	PN04G	09/03/09	GW		Х	Х	Х		Х	Χ

Notes:

X - The analysis was requested and performed on the sample

VOCs - Volatile organic compounds, chlorinated ethanes and ethenes only

SVOCs - Semi-volatile organic compound, bis(2-ethylhexyl)phthalate only

PAHs - Polycyclic aromatic hydrocarbons, carcinogenics only

PCBs - Polychlorinated biphenyl Aroclors

As – Arsenic

Pb - Lead

Metals – Antimony, arsenic, chromium, copper, lead, and nickel TPH – Diesel and motor oil range total petroleum hydrocarbon GW – Groundwater sample FD – Field duplicate

Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

Parameter	Analytical Method	Laboratory		
VOCs	SW846 Method 8260B			
SVOCs	SW846 Method 8270C-Full Scan			
PAHs	SW846 Method 8270C-SIM	Analytical Resources, Inc. (ARI)		
PCB Aroclors	SW846 Method 8082	Tukwila, WA		
Metals (Sb, As, Cr, Cu, Pb, & Ni)	EPA Method 200.8			
TPH-Diesel and Motor Oil	NWTPH-Dx			

Notes:

- SW846 Methods USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- 2. EPA Method 200.8 USEPA Methods for Chemical Analysis of Water and Wastes, EPA -600/4-79-020, March 1983 Revision
- 3. NWTPH Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997.
- 4. SIM Selective ion monitoring

DATA VALIDATION FINDINGS

1. VOCs by GC/MS (EPA Method SW8260B)

1.1 Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation. The temperature for coolers was outside the upper limit of 4±2°C upon the receipt at the laboratory. All samples were hand-delivered to the laboratory the same day of collection. The higher cooler temperature had no significant effects on data quality. No other anomalies were identified in relation to sample preservation, handling, and transport.

Water samples should be analyzed within 14 days of collection. All samples were analyzed within the required holding time.

1.2 GC/MS Instrument Performance Check

Bromofluorobenzene (BFB) tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

1.3 Initial Calibration

The National Functional Guidelines (NFGs) require that the percent relative standard deviation (%RSD) be <30% and the average response factor (RF) be >0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. Initial calibration met the criteria for all target compounds.

1.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the percent difference (%D) be within $\pm 20\%$, and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

Calibration verification analyses met the method requirements.

1.5 Method Blank

A method blank was prepared and analyzed as required. Target compounds were not detected at or above the method detection limits (MDLs) in the method blank.

1.6 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD were prepared and analyzed as required by the method. All percent recovery (%R) and relative percent difference (RPD) values met the laboratory control criteria.

1.7 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

1.8 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

1.9 Internal Standard

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

1.10 Field Duplicates

Samples FM105-090902 and FM105-090902D were field duplicates. The duplicate sample RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

1.11 Reporting Limits (RLs)

The sample-specific RLs met the QAPP requirements and were supported with adequate initial calibration concentrations.

1.12 Overall Assessment of VOCs Data Usability

VOCs data are of known quality and acceptable for use.

2. bis(2-Ethylhexyl)phthalate by GC/MS (EPA Method SW8270C)

2.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

2.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

2.3 Initial Calibration

The NFGs criteria require that the percent %RSD be <30% and the average RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. The initial calibration met the criteria.

2.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within $\pm 20\%$, and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verifications met the criteria.

2.5 Method Blank

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the MDL in the method blanks.

2.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits, except that the %R value for one of the surrogates, *p*-terphenyl-d₁₄, exceeded the upper control limit in sample CMP1-090904. *bis*(2-Ethylhexyl)phthalate was not detected at or above the RL in this samples. The higher surrogate recovery had no effect on data quality; no data were qualified on this basis.

2.7 Matrix Spike (MS) and MS Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

2.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

2.9 Internal Standards

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

2.10 Field Duplicates

Two pairs of field duplicates - samples FM105-090902 and FM105-090902D; and samples MW26R-090903 and MW26R-090903D, were submitted for *bis*(2-ethylhexyl)phthalate analyses. *bis*(2-Ethylhexyl)phthalate was not detected at or above the RL in these samples. The field precision met the project criterion.

2.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

2.12 Overall Assessment of bis(2-Ethylhexyl)phthalate Data Usability

bis(2-Ethylhexyl)phthalate data are of known quality and acceptable for use.

3. PAHs by GC/MS - SIM (EPA Method SW8270C)

3.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

3.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

3.3 Initial Calibration

The NFGs criteria require that the %RSD be <30% and the average RRF be >0.05 for all target compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995,

and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be >0.99. The initial calibration met the criteria.

3.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within $\pm 20\%$, and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verification analyses met the criteria or the %D values were at levels that had no effects on sample results (*e.g.*, biased-high %D values and the target analytes were not detected in associated samples).

3.5 Method Blanks

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the MDLs in the method blanks.

3.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were within the laboratory control limits, except that the %R value (30.9%) for one of the surrogates, 2-methylnaphthalene-d₁₀, was less than the lower control limit in sample CMP2-090902. The sample was diluted and re-analyzed. The %R values for both surrogates were within the control limits in the re-analysis, indicating that the lower surrogate recovery in the initial analysis was a result of matrix interference rather than extraction deficiency. Data were not qualified on this basis.

3.7 Matrix Spike (MS) and MS Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

3.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

3.9 Internal Standards

The method requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

3.10 Field Duplicates

Two pairs of field duplicates - samples FM105-090902 and FM105-090902D; and samples MW26R-090903 and MW26R-090903D, were submitted for PAHs analyses.

The duplicate RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

3.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

3.12 Overall Assessment of PAHs Data Usability

PAHs data are of known quality and acceptable for use.

4. PCB Aroclors by GC/ECD (EPA Method SW8082)

4.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

4.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using the mixture of Aroclor 1016 and 1260, (2) a single-point calibration be performed for the other five Aroclors to establish calibration factors (CFs) and for Aroclor pattern recognition, (3) at least 3 peaks (preferably 5 peaks) must be chosen for each Aroclor for characterization, (4) the relative standard deviation (%RSD) values of Aroclor 1016 and 1260 CFs must be \leq 20%, and (5) if dual column analysis is chosen, both columns should meet the requirements.

The laboratory chose the internal-standard linear calibration for the Aroclor quantitation. The average RF %RSD values met the linearity criterion (20%). All RFs were >0.01, as recommended by SW846 Method 8000. The initial calibrations met the method requirements and were acceptable.

4.3 Calibration Verification

The method requires that (1) the initial calibration be verified prior to any analysis for each 12-hour analysis sequence, and (2) the percent drift ($\%D_f$) be within $\pm 15\%$ to demonstrate the linearity of the initial calibration. Calibration verifications were performed at the required frequency. All $\%D_f$ values either met the method criterion or at levels that had no effects on sample results (*e.g.*, biased-high $\%D_f$ values where target analytes were not detected in associated samples).

4.4 Method Blanks

Method blanks were prepared and analyzed as required. PCB Aroclors were not detected at or above the MDLs in the method blanks.

4.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

4.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

4.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

4.8 Internal Standards

The laboratory chose the internal-standard calibration approach for analyte quantitation. The SW-846, Method 8000 requires that (1) internal standard retention time be within ± 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within $\pm 50\%$ to $\pm 100\%$ of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

4.9 Field Duplicates

Two pairs of field duplicates - samples FM105-090902 and FM105-090902D; and samples MW26R-090903 and MW26R-090903D, were submitted for PCB Aroclors analyses. PCB Aroclors were not detected at or above the RLs in these samples. The field precision met the project criterion.

4.10 Reporting Limits and Target Compound Quantitation

Sample-specific RLs met the QAPP requirements. RLs in selected samples were raised due to non-target chemical interference or response peaks that did not meet the Aroclor identification criteria (*e.g.*, peak ratios, chromatographic patterns).

The dual column RPD value for Aroclor 1248 in sample CMP3-090903 was greater than 40%. The Aroclor 1248 result in this sample was qualified (J) as estimated.

4.11 Overall Assessment of PCB Aroclors Data Usability

PCB Aroclor data are of known quality and acceptable for use as qualified.

5. Total Metals by ICP/MS (EPA Method 200.8)

5.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be analyzed within 180 days. Samples were analyzed within the required holding time.

5.2 ICP/MS Tuning

Instrument tuning was performed at the required frequency. The stability check (%RSD <5%), mass calibration (mass difference <0.1 AMU), and resolution check (peak width <1.0 AMU at 5% peak height) met the NFG and method criteria.

5.3 Initial Calibration

The ICP methods requires that (1) a blank and one calibration standard be used in establishing the analytical curve, and (2) the average of replicate exposures be reported for all standards, QC, and sample analyses.

A check standard containing target analytes at the reporting limit levels was analyzed at the beginning of each analytical run. The results were within the NFGs criteria of 70-130%.

5.4 Calibration Verification (ICV and CCV)

Initial calibration verifications (ICVs) and continuing calibration verifications (CCVs) were analyzed at the required frequency. The %R values met the control criteria (90 – 110%).

5.5 Blanks

Calibration Blanks: Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed at required frequency. Target analytes were not detected at or above the MDLs in ICBs/CCBs.

Method Blanks: Method blanks were prepared and analyzed as required. Target analytes were not detected at or above the MDLs in the method blanks.

5.6 ICP Interference Check Sample (ICS)

The method requires that (1) an inter-element interference check sample be analyzed at the beginning of each analytical run, and (2) the results should be within \pm 20% of the true value. ICP interference check sample analyses met the requirements.

5.7 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values met the control limits (80 – 120%).

5.8 Duplicate Sample Analysis

Duplicate sample analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical precision was evaluated based on the field duplicate results.

5.9 Matrix Spike (MS)

Matrix spike analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical accuracy was evaluated based on the LCS results.

5.10 Internal Standards

At least three internal standards were added to all field and QC samples for ICP/MS analyses. All percent relative intensity values were within the method criteria (30 - 120% of those for the associated calibration blank).

5.11 ICP Serial Dilution

Serial dilution analysis were not performed on project samples in these SDGs, and therefore not reported.

5.12 Field Duplicates

Two pairs of field duplicates - samples FM105-090902 and FM105-090902D; and samples MW26R-090903 and MW26R-090903D, were submitted for metals analyses. The duplicate RPD or concentration difference values for detected analytes and data qualification are presented in Appendix A of this report.

5.13 Analyte Quantitation and Reporting Limits

RLs for selected analytes in a number of samples were raised due to the required dilution to overcome matrix interference associated with the samples. The QAPP requirements for quantitation limits were achieved.

5.14 Overall Assessment of Metals Data Usability

Metals data are of known quality and acceptable for use.

6. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

6.1 Holding Time

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. The extraction and analysis of samples met the requirements.

6.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using individual petroleum product reference standards to ensure the proper identification and quantitation of petroleum hydrocarbons in samples, (2) the calibration curve includes a sufficiently low standard to provide the necessary reporting limits, and (3) the linear working range of the instrument be defined.

The ICAL met the method requirements. The linearity of the ICAL curve was verified with %RSD of RFs (%RSD ≤ 20%, according to EPA SW 846 Method 8000), and was acceptable for both diesel and motor oil range total petroleum hydrocarbon (TPH).

6.3 Calibration Verification

The method requires that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the percent drift value be within ±15% of the true value. The calibration verification analyses met the requirements.

6.4 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Diesel and TPH-Motor Oil were not detected at or above the MDLs in the method blanks.

6.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

6.6 Duplicate Analysis

Duplicate analyses were not performed on project samples in these SDGs, and therefore were not reported. Analytical precision was evaluated based on the LCS/LCSD analyses.

6.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

6.8 Field Duplicates

Two pairs of field duplicates - samples FM105-090902 and FM105-090902D; and samples MW26R-090903 and MW26R-090903D, were submitted for TPH-Diesel & Motor Oil analyses. The target compounds were not detected at or above the RLs in these samples. The field precision met the project criterion.

6.9 Reporting Limits

The reported RLs were supported with adequate ICAL concentrations. Sample-specific RLs met the QAPP requirements.

6.10 Overall Assessment of TPH-Diesel and Motor Oil Data Usability

TPH-Diesel and Motor Oil data are of known quality and acceptable for use.

SUMMARY

I. Data qualification are summarized as follows:

Sample ID	Analyte	Data Qualifier	Reason	Report Section
CMP3-090903	Aroclor 1248	J	The dual column RPD value was greater than 40%.	4.10

II. Data affected by associated blanks are qualified and results adjusted as follows:

Sample ID	Analyte	Original Result	Adjusted Result	Unit	Report Section		
No data were qualified in relation to detections in blanks in these SDGs.							

III. Data Qualifiers are defined as follows:

Data Qualifier	Definition
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
NJ	The analyte was not definitively identified and the reported concentration was an estimated value.
R	The result was rejected and could not be used.
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.

Approved By:		Date:	
	Mingta Lin		

REFERENCES

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- USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- State of Washington, Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997
- Port of Seattle, Southwest Harbor Project, Phase II Groundwater Confirmation Monitoring Program, Water Quality Monitoring Plan, Aspect Consulting, Inc., October 2008.

APPENDIX A

The precision criterion (\leq 50%) was applied to evaluating the relative percent difference (RPD) values of field duplicate results greater than five times the MRL (5xRL). For results less than 5xRL, an advisory criterion of 2xRL was applied to evaluating the concentration differences.

The RPD and concentration difference values for detected analytes and data qualification are presented as follows:

		Sample ID & Concentration (µg/L)			Conc.	
Detected Target Analyte	RL (µg/L)	FM105-090902	FM105-090902D	RPD (%)	Difference (µg/L)	Data Qualification
Arsenic	0.2	0.50	0.50	-	0	No action
cis-1,2-Dichloroethene	0.2	0.20	0.20	-	0	No action
Tetrachloroethene (PCE)	0.2	5.2	5.0	4%	-	No action
Trichloroethene (TCE)	0.2	0.60	0.50	-	0.10	No action
		Sample ID & Concentration (µg/L)			Conc.	
Detected Target Analyte	RL (µg/L)	MW26R-090903	MW26R-090903D	RPD (%)	Difference (µg/L)	Data Qualification
Chrysene	0.01	0.013	0.013	-	0	No action
Chromium	2	3	3	-	0	No action
Copper	2	3	3	-	0	No action
Nickel	2	7	6	-	1	No action

Notes:

RL - Reporting limit

ND - Not detected at or above the RL

RPD - Relative percent difference

Conc. Difference - Concentration difference between the parent sample and the field duplicate sample

CERTIFICATES OF ANALYSIS ANALYTICAL RESOURCES, INC. HART CROWSER, INC.

CERTIFICATES OF ANALYSIS ANALYTICAL RESOURCES, INC. ASPECT CONSULTING LLC