Appendix J
Summary of Columbia River Fisheries

Appendix J. Summary of Columbia River Fisheries

This appendix provides a summary of the fisheries in the Columbia River near the site, including Endangered or Threatened Species status and includes the following:

- Appendix J-1. Summary of Columbia River Fisheries

Appendix J-1
Summary of Columbia River Fisheries

Appendix J-1. Summary of Columbia River Fisheries

The mainstem Columbia River provides habitat for a vast array of fish species. This includes anadromous species; many of which have Threatened and Endangered (T&E) status under the Endangered Species Act (ESA), other native resident and anadromous fish, as well as introduced or non-native species.
Recent surveys in the Priest Rapids and Wanapum reservoirs documented 34 species of fish, 20 of which were native species (Pfeifer et al. 2001). The primary game species are rainbow trout (Oncorhynchus mykiss), mountain whitefish (Prosopium williamsoni), walleye (Stizostedion vitreum), largemouth bass (Micropterus salmoides), and smallmouth bass (Micropterus dolomieui). The walleye and bass species are non-native, and are of management concern because of their predation on juvenile salmonids, including those listed under the Endangered Species Act (ESA).

ESA-listed anadromous fish species that may be found throughout the mainstem of the Columbia River at various times of the year and in various life stages, and their ESA status are noted in Table J-1.

Table J-1 ESA Status of Salmon and Steelhead Stocks in the Columbia River Basin

Area of Origin	Species/Stock	ESA Status
Upper Columbia	Chinook Salmon *(Oncorhynchus tshawytscha)* – Spring Run	Endangered
	Chinook Salmon – Summer/Fall Run	Not Warranted
	Steelhead Trout *(Oncorhynchus mykiss)*	Threatened
	Sockeye Salmon *(Oncorhynchus nerka)*	Not Warranted
Snake River	Sockeye Salmon	Endangered
	Chinook Salmon – Spring/Summer Run	Threatened
	Chinook Salmon – Fall Run	Threatened
	Steelhead Trout	Threatened
Middle Columbia	Chinook Salmon – Spring Run	Not Warranted
	Steelhead Trout	Threatened
Lower Columbia	Chinook Salmon	Threatened
	Coho Salmon *(Oncorhynchus kisutch)*	Threatened
	Steelhead Trout	Threatened
	Chum Salmon *(Oncorhynchus keta)*	Threatened

Source – National Marine Fisheries Service - http://www.nwr.noaa.gov/ESA-Salmon-Listings/upload/snapshot-7-09.pdf

Steelhead Trout (Oncorhynchus mykiss)

Steelhead/rainbow trout exhibits a diverse and complex life history throughout its range (Busby, et al. 1996). This species includes the anadromous form, steelhead trout, and the resident form, commonly referred to as rainbow or redband trout. Two genetic groups of steelhead are recognized in North America - the inland group and the coastal group. In the Columbia River Basin, steelhead using tributaries east of the Cascade crest are considered part of the inland group.

Chinook Salmon (Oncohynchus tshawytscha)

Chinook salmon exhibit the most variability and variety in their life history characteristics compared to other anadromous salmonids in the Columbia Basin. There are different seasonal “runs” or modes in adult migration from the ocean to freshwater. These are categorized as spring, summer, and fall Chinook. Typically, spring/summer Chinook spawn higher in the watersheds where they can gain access during the high snowmelt period. Fall Chinook generally spawn lowest in the watersheds.

Sockeye salmon (Oncorhynchus nerka)

Nearly all sockeye salmon in the Columbia River Basin originate in the upper Columbia from either Lake Wenatchee or Lake Osoyoos in the Okanogan system. A much smaller number of sockeye originate in the Stanley Basin in Idaho.

Coho salmon (Oncorhynchus kisutch)

Columbia Basin coho salmon are primarily confined to tributaries of the lower river downstream of Bonneville Dam and some tributaries in the mid-Columbia. There was an endemic stock from the upper Columbia, but it is considered extinct (Nehlsen et al 1991). However, coho salmon reintroduction efforts through hatchery planting have been attempted in the upper Columbia using lower river and coastal stocks. Reintroduction efforts were substantial in the 1960s and 1970s, were all but eliminated in the 1980s and 1990s, and have begun again in recent years.

Chum salmon (Oncorhynchus keta)

Chum salmon are found in the Columbia River downstream of Bonneville Dam and in nearby tributary streams. The population in the lower Columbia River is very small and is an ESA-listed endangered species.

Other species native to the Columbia River basin and of particular importance include:

Pacific Lamprey (Lampetra tridentata)

Pacific lamprey is an anadromous fish species distributed in areas of the Columbia River Basin with upstream passage. Lamprey migrate upriver in late summer and overwinter in areas where they will spawn. Available data suggest that the numbers of Pacific lamprey have declined substantially over the last several decades throughout its range, including the Columbia Basin (Close et al. 1995).

White Sturgeon (Acipenser transmontanus)

White sturgeon inhabit most of the Columbia River and its larger tributaries, most notably the Snake River. White sturgeon can have an anadromous life history, but most populations now found in the Columbia River upstream of Bonneville Dam have adapted to a freshwater life history, due in large part to their restricted ability to use conventional fishways designed for salmonids.

Bull Trout (Salvelinus confluentus)

Bull trout is a char species of the Salmonidae family. The Columbia River population segment of bull trout was listed under the ESA as a threatened species in 1998. Most bull trout populations are found in higher elevation tributaries of the Columbia River and its major tributaries, owing primarily to their requirement for cold water for spawning and juvenile rearing. Although a few have been observed in the mainstem Columbia River, bull trout were probably never abundant there (Mongillo 1993).

References

Busby, J. Busby, etal., 1996. Status Review of West Coast Steelhead from WA, ID, OR, CA. National Technical Information Service, U.S. Department of Commerce. 275 pgs

Close, David A., Martin Fitzpatrick, Hiramli, Oregon Cooperative Fishery Reserach Unit, Department of Fisheries & Wildlife, Oregon State University, Blaine Parker, Douglas Hatch, Columbia River Inter-Tribal Fish Commission, Gary James, Department of Natural Resources, Fisheries Program, Confederated Tribes of the Umatilla Indian Reservation, U.S. Department of Energy, Bonneville Power Administration, Division of Fish & Wildlife, Project Number Contract Number 95B139067, 40 pgs (BPA Report DOE/BP-39067-1), 1995.

Mongillo, P.E. 1993. *The distribution and status of bull trout/Dolly Varden in Washington State*, June 1992. Washington Department of Fish and Wildlife, Fisheries Management Division, Olympia, Washington.

Nehlsen, W., J.E. Williams, and J.A. Lichatowich. 1991. *Pacific salmon at the crossroads: Stocks at risk from California, Oregon, Idaho, and Washington*. Fisheries 16(2):4-21.

Pfeifer, B., J.E. Hagen, D. Weitkamp, and D.H. Bennett. 2001. *An Evaluation of Fish Species Present in the Priest Rapids Project Area*. Prepared for Public Utility District No. 2 of Grant County, Ephrata, WA

Appendix K
Ecological Screening Results

Appendix K. Ecological Screening Results

This appendix section presents the results of an ecological risk screening evaluation for the BNSF Wishram Railyard (BNSF Track Switching Facility) in Wishram, Washington. The screening was conducted in accordance with the State of Washington Department of Ecology's *Sediment Cleanup User's Manual* (SCUM) guidance (Ecology 2021), specifically with respect to identifying cleanup sites based on benthic criteria and bioaccumulative criteria using the Sediment Management Standards (SMS) rule put forth by this guidance. This appendix includes the following:

- Appendix K-1 – Ecological Screening Results
- Table K-1 – Analytical and Screening Results from Step 1 - Benthic Community Criteria
- Table K-2 – Analytical and Screening Results from Step 1 - Bioaccumulation
- Attachment K-1 – Total PAH Calculations
- Attachment K-2 – ProUCL Output

Appendix K-1
Ecological Screening Results

1. Ecological Screening Results

1.1 Available Analytical Data

The data used for screening in this appendix are associated with the sediment grab samples collected from the biologically active zone (BAZ) as discussed in Sections 2.2.1 and 3.1.2 of the Remedial Investigation (RI) Report to which this section is appended. The analytical results from sediment collected from 13 site locations were used for screening. However, prior to screening, total PAHs were calculated by summing the concentrations for individual PAH compounds (for undetected PAH compounds, one-half the reported value was used as a surrogate concentration). The Total PAH calculations are included in **Attachment K-1**. Additionally, background samples were collected at 8 locations. Preliminary natural background values were identified from this 8-sample dataset for use in site screening. The preliminary natural background values are presented in RI Section 3.1.3 and **Appendix F**.

1.2 Identifying Cleanup Sites Based on Benthic Criteria

The SMS rule for identifying cleanup sites based on benthic criteria has a two-tiered decision-making framework (chemical and biological criteria at the numerical Sediment Cleanup Objectives [SCOs] and the Cleanup Screening Levels [CSLs]) to protect the functions and integrity of the benthic community and is used for the initial evaluation of station clusters and site identification. The SCO is the long-term sediment quality goal. The CSL reflects slightly higher tolerance for potential effects or risks. The currently available SCOs and CSLs for freshwater are provided in Table 8-1 of Ecology (2021). The SCO includes chemical and biological criteria. Sediment values at or below the SCO are predicted to have no adverse effects on the benthic community. Sediment values above the SCO but at or below the CSL are expected to have minor adverse effects on the benthic community.

Step 1 (chemical data) of the possible 5-step process for identifying cleanup sites based on benthic criteria is to screen the available analytical sediment sample results against CSLs. **Table K-1** presents the analytical and the screening results. For each chemical, Step 1 calls for screening the mean of the results for the three stations with the highest concentration. However, this step was not needed for any of the chemicals, except sulfide. Regardless, **Table K-1** presents all 13 site-related sample results as well as summary statistics for this samples data set, including the mean[1]. None of the concentrations of chemicals, except sulfide, exceeded either the CSL or the more conservative SCO. Subsequently, the mean of the results for the three stations with the highest concentrations would also not exceed. Therefore, for all chemicals except sulfide, the remaining steps of the process for identifying cleanup sites based on benthic criteria are not needed because these chemicals pose no risks to the benthic community.

Sulfide is the only detected constituent that exceeded the SCO (39 mg/kg) or the CSL (69 mg/kg). Sulfide was detected at four of 13 locations (D160, E320, E460 and I120) at concentrations ranging from 51.7 J mg/kg to 318 J mg/kg. The average concentrations in all site samples (79.2 mg/kg) and the three highest results (213 mg/kg) exceeded both the CSL and the SCO. However, sulfide is not considered a site-related constituent since there is no known site source. It is believed to be a naturally occurring constituent of sediments in this system, because it was also detected in background sediment samples. According to SCUM guidance, mean site concentrations are acceptable for comparing to preliminary natural background levels for this evaluation. The preliminary natural background values for this site are presented in **Appendix F**. The average concentrations of sulfide in all site samples (79.2 mg/kg) is below the preliminary natural background value of 179 mg/kg. Subsequently, sulfide is unlikely to pose site-related risk to the benthic community. Therefore, Step 2 (bioassay override) and Step 3 (biological data) are not necessary, and the site exhibits low or no potential for benthic toxicity (Step 4).

[1] Mean concentrations from the site dataset were calculated by ProUCL (Version 5.2) using the Kaplan-Meier (KM) method. **Attachment K-2** provides ProUCL output for the means presented in **Table K-1**.

1.3 Identifying Cleanup Sites Based on Bioaccumulative Criteria

Similar to the benthic assessment, the SMS rule for identifying cleanup sites based on bioaccumulative criteria has a two-tiered decision-making framework (the SCO and CSL) to protect humans and upper trophic levels from bioaccumulative effects.

Step 1 of the possible 2-step process for identifying cleanup sites based on bioaccumulative criteria is to screen the available chemical results against CSLs. A cleanup site of potential concern is identified when at least three stations exceed the CSL for the same chemical. However, because CSLs have not been established based on bioaccumulative chemicals, the SMS rule allows for the use of background data for this screening. According to SCUM guidance, the mean site concentrations are acceptable for comparing to preliminary natural background values for this evaluation. The same mean concentrations used for the benthic screening (**Table K-1**) were used for the bioaccumulative screening. **Table K-2** presents a comparison of the mean site concentrations to the preliminary natural background values. Of the chemicals detected in site sediment samples, only the mean concentrations of total PAHs and diesel fuel exceeded the preliminary natural background values.

Given the site history and understanding of the site conceptual model, the presence of PAHs and diesel fuel in site sediment is potentially site related. However, both were detected infrequently at concentrations above background. The detected PAH concentration in only three of the 13 samples (E320, E460 and SG03) yielded total PAH concentrations in exceedance of the preliminary natural background value (sample specific concentrations presented in **Table K-1**). The detected concentration of diesel fuel in only two of the 13 samples (E320 and L320) exceeded the preliminary natural background value. Therefore, the presence of PAHs and diesel fuel is highly localized. Neither diesel fuel nor total PAHs exceeded conservative benthic screening criteria. Diesel fuel is known to be subject to weathering and biodegradation in the aquatic environment and its components are not considered bioaccumulative. Evaluating risks from PAHs to higher trophic receptors (i.e., food web exposures) is uncertain because PAHs are not expected to significantly bioaccumulate in the tissues in fish or crustacean tissue. Therefore, further ecological risk evaluation of diesel fuel or total PAHs is not warranted.

References

Washington State Department of Ecology (Ecology). 2021. Sediment Cleanup User's Manual (SCUM), Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC. Publication No. 12-09-057, Third Revision, December.

Table K-1
Analytical and Screening Results from Step 1

Table K-1. Analytical and Screening Results from Step 1 - Benthic Community Criteria

BNSF Wishram Sediment Remedial Investigation Report

Analyte	Sediment Cleanup Objective (SCO)[1]	Cleanup Screening Level (CSL)[1]	Summary Statistics for Site Samples								Site Sample Results					
			Frequency of Detection	Non-Detects		Detects				Mean[3]	D160	E320	E380	E460	H360	I120
				Minimum	Maximum	Minimum		Maximum			BNSF-D160-042822-0-5 4/28/2022	BNSF-E320-042822-0-4 4/28/2022	BNSF-E380-042822-0-4 4/28/2022	BNSF-E460-042922-0-4 4/29/2022	BNSF-H360-042922-0-8 4/29/2022	BNSF-I120-042922-0-6 4/29/2022
Metals (mg/kg)																
Arsenic	14	120	13 / 13	--	--	2.0	SG01	4.7	H360	2.8	**2.7**	**2.1**	**2.2**	**2.6**	**4.7**	**2.9**
Cadmium	2.1	5.4	13 / 13	--	--	0.089	SG13	0.64	D160	0.34	**0.64**	**0.47**	**0.36**	**0.35**	**0.35**	**0.27**
Chromium	72	88	13 / 13	--	--	8.2	SG13	17.3	SG02	14.1	**15.7**	**14.7**	**15.1**	**16.1**	**17.2**	**15.6**
Copper	400	1200	13 / 13	--	--	7.7	SG13	19.5	SG02	13.4	**15.8**	**12 J**	**10.9**	**14.5**	**18.3**	**12.3**
Lead	360	1300	13 / 13	--	--	3.6	SG13	14.3	H360	8.3	**8.9**	**8.6**	**6.9**	**8.6**	**14.3**	**8.3**
Nickel	26	110	13 / 13	--	--	9.3	SG13	16.8	SG02	14.0	**13.9**	**14.6**	**13.4**	**14.8**	**16.2**	**15.3**
Selenium	11	20	12 / 13	0.11	0.11	0.12	SG23	0.47	SG02	0.25	**0.34 J**	**0.29**	**0.22 J**	**0.31**	**0.27 J**	**0.24 J**
Silver	0.57	1.7	5 / 13	0.18	0.3	0.22	SG23	0.4	L320	0.23	0.19 U	0.18 U	0.19 U	0.21 U	0.21 U	0.22 U
Zinc	3200	4200	13 / 13	--	--	32.3	SG13	120.0	SG02	85.4	**102**	**95.9**	**85.9**	**99.2**	**107**	**90.6**
Mercury	0.66	0.8	11 / 13	0.011	0.011	0.013	SG11	0.035	SG02	0.020	**0.027**	**0.024 J**	**0.016 J**	**0.021 J**	**0.017 J**	**0.016 J**
Semivolatile Organic Compounds (mg/kg)																
3 & 4-Methylphenol (m,p-Cresols)	0.26	2	1 / 13	0.0131	0.147	0.0195	SG23	0.0195	SG23	0.014	0.147 UJ	0.144 UJ	0.0138 UJ	0.146 UJ	0.0134 UJ	0.0139 UJ
Benzoic Acid	2.9	3.8	2 / 13	0.149	1.67	0.158	H360	0.238	SG11	0.163	1.67 UJ	1.63 UJ	0.157 UJ	1.66 UJ	**0.158 J**	0.158 UJ
Bis (2-ethylhexyl) phthalate	0.5	22	0 / 13	0.0531	0.597	--		--		--	0.597 UJ	0.585 UJ	0.056 UJ	0.593 UJ	0.0543 UJ	0.0565 UJ
Carbazole	0.9	1.1	1 / 13	0.013	0.146	0.08	SG03	0.08	SG03	0.020	0.146 UJ	0.143 UJ	0.0137 UJ	0.145 UJ	0.0133 UJ	0.0138 UJ
Dibenzofuran	0.2	0.68	1 / 13	0.0137	0.154	0.0365	SG03	0.0365	SG03	0.016	0.154 UJ	0.151 UJ	0.0145 UJ	0.153 UJ	0.014 UJ	0.0146 UJ
Di-N-Butylphthalate	0.38	1	0 / 13	0.0144	0.161	--		--		--	0.161 UJ	0.158 UJ	0.0151 UJ	0.16 UJ	0.0147 UJ	0.0153 UJ
Di-n-octyl phthalate	0.039	1.1	0 / 13	0.0283	0.318	--		--		--	0.318 UJ	0.312 UJ	0.0298 UJ	0.316 UJ	0.029 UJ	0.0301 UJ
Pentachlorophenol	1.2	1.2	0 / 13	0.0113	0.127	--		--		--	0.127 UJ	0.124 UJ	0.0119 UJ	0.126 UJ	0.0115 UJ	0.012 UJ
Phenol	0.12	0.21	0 / 13	0.0169	0.19	--		--		--	0.19 UJ	0.186 UJ	0.0178 UJ	0.188 UJ	0.0173 UJ	0.0179 UJ
Total PAHs[2]	17	30	7 / 13	0.0711	0.7993	0.0798	I120	4.0224	SG03	0.568	0.7993	**0.7981**	**0.0810**	**0.7490**	0.0728	**0.0798**
Other Parameters (mg/kg)																
Ammonia as Nitrogen (N)	230	300	13 / 13	--	--	10.0	L320	40	SG02	20.2	**20 B**	**17 J**	**20 B**	**30 B**	**20 B**	**20 B**
Diesel Fuel	340	510	11 / 13	9.5	9.7	9.9	SG11	223	E320	63.8	**52.1 J**	**223 J**	9.7 UJ	**38.8 J**	**31 J**	**32.2 J**
Total Petroleum Hydrocarbons (TPHs) as Motor Oil	3600	4400	13 / 13	--	--	25.1	E380	630	E320	176.8	**215 J**	**630 J**	**25.1 J**	**112 J**	**107 J**	**70 J**
Sulfide	39	61	4 / 13	37.4	59.5	51.7	I120	318	E320	79.2	**220 J**	**318 J**	39.8 UJ	**101 J**	38.6 UJ	**51.7 J**

Notes:

All concentrations are reported on a dry weight basis

Bolded site sample concentrations are detects

Grey shaded site sample concentrations exceed the SCO

Red site sample concentrations are greater than the CSL

PAHs - polycyclic aromatic hydrocarbons

1 - SCOs and CSLs from Table 8-1 of Ecology (2021)

2 - Total PAHs calculated by summing concentrations of individual PAH compounds (when undetected, 1/2 the reported value was used as a surrogate concentrations); Backup calculations included as **Attachment K-1**

3 - Calculated by ProUCL (Version 5.2) using Kaplan-Meier (KM) method; **Attachment K-2** provides ProUCL output

Table K-1. Analytical and Screening Results from Step 1 - Benthic Community Cr

BNSF Wishram Sediment Remedial Investigation Report

Analyte	Sediment Cleanup Objective (SCO)[1]	Cleanup Screening Level (CSL)[1]	Site Sample Results							
			L320	SG01		SG02	SG03	SG11	SG13	SG23
			BNSF-L320-042922-0-2	BNSF-SG01-041922-0-10	FD01-041922-0-10	BNSF-SG02-041922-0-10	BNSF-SG03-042722-0-5.5	BNSF-SG11-042822-0-5	BNSF-SG13-042522-0-1.5	BNSF-SG23-042122-0-6
			4/29/2022	4/19/2022	Field Duplicate	4/19/2022	4/27/2022	4/28/2022	4/25/2022	4/21/2022
Metals (mg/kg)										
Arsenic	14	120	**2.6**	**2.1**	**2.0**	**3.8**	**3.4**	**2.6**	**2.1**	**2.4**
Cadmium	2.1	5.4	**0.18**	**0.43**	**0.43**	**0.53**	**0.28**	**0.28**	**0.089 J**	**0.17**
Chromium	72	88	**12**	**13.8**	**14**	**17.3**	**12.9**	**14.6**	**8.2**	**9.9**
Copper	400	1200	**11.9**	**9.9**	**10.7**	**19.5**	**18.9**	**12.2**	**7.7**	**9**
Lead	360	1300	**8.2**	**7**	**7.4**	**12.3**	**8.8**	**7.4**	**3.6 J**	**5.2**
Nickel	26	110	**13.5**	**12.5**	**13**	**16.8**	**15.3**	**14.8**	**9.3**	**11.1**
Selenium	11	20	**0.22 J**	**0.18 J**	**0.14 J**	**0.47 J**	**0.21 J**	**0.25 J**	0.11 U	**0.12 J**
Silver	0.57	1.7	**0.4 J**	**0.27 J**	0.2 U	0.3 U	0.2 U	**0.41 J**	**0.26 J**	**0.22 J**
Zinc	3200	4200	**69**	**94.9**	**100**	**120**	**60.2**	**83.2**	**32.3**	**65.3**
Mercury	0.66	0.8	**0.016 J**	**0.021 J**	**0.022 J**	**0.035 J**	**0.028**	**0.013 J**	0.011 U	0.011 U
Semivolatile Organic Compounds (mg/kg)										
3 & 4-Methylphenol (m,p-Cresols)	0.26	2	0.0259 UJ	0.0281 U	0.0141 U	0.0413 U	0.0138 U	0.0135 UJ	0.0131 U	**0.0195 J**
Benzoic Acid	2.9	3.8	0.294 UJ	0.319 U	0.16 U	0.468 U	0.156 U	**0.238 J**	0.149 U	0.149 U
Bis (2-ethylhexyl) phthalate	0.5	22	0.105 UJ	0.114 U	0.0571 U	0.167 U	0.0559 U	0.0548 UJ	0.0531 U	0.0533 U
Carbazole	0.9	1.1	0.0257 UJ	0.0279 U	0.0139 U	0.0409 U	**0.08 J**	0.0134 UJ	0.013 U	0.013 U
Dibenzofuran	0.2	0.68	0.0272 UJ	0.0295 U	0.0148 U	0.0433 U	**0.0365 J**	0.0142 UJ	0.0137 U	0.0138 U
Di-N-Butylphthalate	0.38	1	0.0284 UJ	0.0308 U	0.0154 U	0.0452 U	0.0151 U	0.0148 UJ	0.0144 U	0.0144 U
Di-n-octyl phthalate	0.039	1.1	0.0561 UJ	0.0609 U	0.0305 U	0.0893 U	0.0298 U	0.0292 UJ	0.0283 U	0.0284 U
Pentachlorophenol	1.2	1.2	0.0223 UJ	0.0242 U	0.0121 U	0.0355 U	0.0119 U	0.0116 UJ	0.0113 U	0.0113 U
Phenol	0.12	0.21	0.0334 UJ	0.0363 U	0.0181 U	0.0532 U	0.0177 U	0.0174 UJ	0.0169 U	0.0169 U
Total PAHs[2]	17	30	0.1410	**0.1734**	0.0765	0.2241	**4.0224**	**0.0851**	0.0711	0.0715
Other Parameters (mg/kg)										
Ammonia as Nitrogen (N)	230	300	**10 B**	33 U	**15 J**	**40 J**	**14 J**	**20 B**	**12 J**	**24 J**
Diesel Fuel	340	510	**136 J**	**25.4 J**	**56.9 J**	**53.1**	**21.4**	**9.9 J**	9.5 U	**12.9 J**
Total Petroleum Hydrocarbons (TPHs) as Motor Oil	3600	4400	**503 J**	**106 J**	**167 J**	**291**	**77.6**	**35.4 J**	**28.5**	**37.4 B**
Sulfide	39	61	37.4 UJ	40.6 UJ	40.6 UJ	59.5 UJ	39.7 U	39 UJ	37.8 U	37.9 U

Notes:

All concentrations are reported on a dry weight basis

Bolded site sample concentrations are detects

Grey shaded site sample concentrations exceed the SCO

Red site sample concentrations are greater than the CSL

PAHs - polycyclic aromatic hydrocarbons

1 - SCOs and CSLs from Table 8-1 of Ecology (2021)

2 - Total PAHs calculated by summing concentrations of individual PAH compounds (when undetected, 1/2 the reported value was used as a surrogate concentrations); Backup calculations included as **Attachment K-1**

3 - Calculated by ProUCL (Version 5.2) using Kaplan-Meier (KM) method; **Attachment K-2** provides ProUCL output

Table K-2
Analytical and Screening Results from Step 1- Bioaccumulation

Table K-2. Analytical and Screening Results from Step 1 - Bioaccumulation
BNSF Wishram Sediment Remedial Investigation Report

Analyte	Mean[2]	Preliminary Natural Background Value[3]	
Metals (mg/kg)			
Arsenic	2.8	3.3	Maximum Detect
Cadmium	0.34	0.52	Maximum Detect
Chromium	14.1	15.7	Maximum Detect
Copper	13.4	16.2	Maximum Detect
Lead	8.3	8.6	Maximum Detect
Nickel	14.0	15.3	Maximum Detect
Selenium	0.25	0.45	Maximum Detect
Silver	0.23	0.41	Maximum Detect
Zinc	85.4	106	Maximum Detect
Mercury	0.020	0.058	Maximum Detect
Semivolatile Organic Compounds (mg/kg)			
3 & 4-Methylphenol (m,p-Cresols)	0.014	0.257	Maximum Detect
Benzoic Acid	0.163	0.327	Maximum Detect
Bis (2-ethylhexyl) phthalate	Undetected	2.17	Maximum PQL
Carbazole	0.020	2.17	Maximum PQL
Dibenzofuran	0.016	2.17	Maximum PQL
Di-N-Butylphthalate	Undetected	2.17	Maximum PQL
Di-n-octyl phthalate	Undetected	2.17	Maximum PQL
Pentachlorophenol	Undetected	2.17	Maximum PQL
Phenol	Undetected	0.053	Maximum Detect
Total PAHs[1]	0.568	0.22	Maximum PQL[4]
Other Parameters (mg/kg)			
Ammonia as Nitrogen (N)	20.2	69.5	Maximum Detect
Diesel Fuel	63.8	58.2	Maximum Detect
Total Petroleum Hydrocarbons (TPHs) as Motor Oil	176.8	318	Maximum Detect
Sulfide	79.2	179	Maximum Detect

Notes:

All concentrations are reported on a dry weight basis

Pink-shaded concentrations exceed preliminary natural background value

PAHs - polycyclic aromatic hydrocarbons

PQL - Practical Quantitation Limit

1 - Total PAHs calculated by summing concentrations of individual PAH compounds (when undetected, 1/2 the reported value was used as a surrogate concentrations);

Backup calculations included as **Attachment K-1**

PAHs - polycyclic aromatic hydrocarbons

2 - Same mean concentrations as Table K-1; Calculated by ProUCL (Version 5.2) using Kaplan-Meier (KM) method; **Attachment K-2** provides ProUCL output

3 - **Appendix F**

4 - PQL for benzo(a)pyrene

Attachment K-1
Total PAH Calculations

Attachment K-1. Total PAH Calculations

BNSF Wishram Sediment Remedial Investigation Report

		Site Samples													
		D160	E320	E380	E460	H360	I120	L320	SG01	SG01	SG02	SG03	SG11	SG13	SG23
		BNSF-D160-042822-0-5	BNSF-E320-042822-0-4	BNSF-E380-042822-0-4	BNSF-E460-042922-0-4	BNSF-H360-042922-0-8	BNSF-I120-042922-0-6	BNSF-L320-042922-0-2	BNSF-SG01-041922-0-10	FD01-041922-0-10	BNSF-SG02-041922-0-10	BNSF-SG03-042722-0-5.5	BNSF-SG11-042822-0-5	BNSF-SG13-042522-0-1.5	BNSF-SG23-042122-0-6
		N	N	N	N	N	N	N	N	FD	N	N	N	N	N
Analyte	Units	4/28/2022	4/28/2022	4/28/2022	4/29/2022	4/29/2022	4/29/2022	4/29/2022	4/19/2022	4/19/2022	4/19/2022	4/27/2022	4/28/2022	4/25/2022	4/21/2022
RAW															
1-Methylnaphthalene	mg/kg	0.0603 UJ	0.059 UJ	0.00565 UJ	0.0599 UJ	0.00549 UJ	0.0057 UJ	0.0106 UJ	0.0115 U	0.00577 U	0.0169 U	**0.0064 J**	**0.00623 J**	0.00536 U	0.00538 U
2-Methylnaphthalene	mg/kg	0.0611 UJ	0.0599 UJ	**0.00894 J**	0.0607 UJ	0.00556 UJ	**0.00706 J**	0.0108 UJ	0.0117 U	0.00585 U	0.0171 U	**0.00871 J**	**0.00945 J**	0.00544 U	0.00546 U
Acenaphthene	mg/kg	0.0762 UJ	0.0747 UJ	0.00715 UJ	0.0758 UJ	0.00694 UJ	0.00721 UJ	0.0135 UJ	0.0146 U	0.0073 U	0.0214 U	**0.0604**	0.007 UJ	0.00679 U	0.00681 U
Acenaphthylene	mg/kg	0.0663 UJ	0.065 UJ	0.00622 UJ	0.0659 UJ	0.00604 UJ	0.00627 UJ	0.0117 UJ	0.0127 U	0.00635 U	0.0186 U	0.00621 U	0.00609 UJ	0.0059 U	0.00593 U
Anthracene	mg/kg	0.0839 UJ	0.0822 UJ	0.00786 UJ	0.0834 UJ	0.00764 UJ	0.00793 UJ	0.0148 UJ	0.0161 U	0.00803 U	0.0236 U	**0.126**	0.0077 UJ	0.00746 U	0.00749 U
Benzo(a)anthracene	mg/kg	0.083 UJ	0.0813 UJ	0.00779 UJ	0.0825 UJ	0.00756 UJ	0.00785 UJ	0.0146 UJ	0.0158 U	0.00795 U	0.0232 U	**0.384**	0.00762 UJ	0.00739 U	0.00742 U
Benzo(a)pyrene	mg/kg	0.0876 UJ	**0.103 J**	0.00821 UJ	0.087 UJ	0.00797 UJ	0.00828 UJ	0.0155 UJ	**0.0185 J**	0.00838 U	0.0246 U	**0.434**	0.00804 UJ	0.00779 U	0.00782 U
Benzo(b)fluoranthene	mg/kg	0.0878 UJ	0.086 UJ	0.00824 UJ	0.0873 UJ	0.008 UJ	0.00831 UJ	0.0155 UJ	0.0168 U	0.00841 U	0.0246 U	**0.463**	0.00806 UJ	0.00782 U	0.00785 U
Benzo(g,h,i)perylene	mg/kg	0.0861 UJ	0.0844 UJ	0.00808 UJ	0.0856 UJ	0.00784 UJ	0.00815 UJ	0.0152 UJ	**0.0187 J**	0.00825 U	0.0242 U	**0.236**	0.00791 UJ	0.00767 U	0.0077 U
Benzo(k)fluoranthene	mg/kg	0.0837 UJ	0.082 UJ	0.00785 UJ	0.0832 UJ	0.00762 UJ	0.00792 UJ	0.0147 UJ	0.016 U	0.00802 U	0.0234 U	**0.168**	0.00769 UJ	0.00745 U	0.00748 U
Chrysene	mg/kg	0.0936 UJ	0.0917 UJ	0.00878 UJ	0.0931 UJ	0.00853 UJ	0.00886 UJ	0.0165 UJ	0.0179 U	0.00896 U	0.0262 U	**0.4**	**0.0101 J**	0.00833 U	0.00837 U
Dibenzo(a,h)anthracene	mg/kg	0.131 UJ	0.128 UJ	0.0122 UJ	0.13 UJ	0.0119 UJ	0.0123 UJ	0.0231 UJ	0.025 U	0.0125 U	0.0367 U	**0.0588**	0.012 UJ	0.0116 U	0.0117 U
Fluoranthene	mg/kg	0.085 UJ	0.0833 UJ	0.00797 UJ	0.0845 UJ	0.00774 UJ	0.00804 UJ	0.015 UJ	0.0162 U	0.00814 U	0.0238 U	**0.844**	0.0078 UJ	0.00757 U	0.0076 U
Fluorene	mg/kg	0.0767 UJ	0.0751 UJ	0.00719 UJ	0.0762 UJ	0.00698 UJ	0.00725 UJ	0.0135 UJ	0.0146 U	0.00734 U	0.0214 U	**0.0528**	0.00704 UJ	0.00682 U	0.00685 U
Indeno(1,2,3-cd)pyrene	mg/kg	0.133 UJ	0.13 UJ	0.0125 UJ	0.132 UJ	0.0121 UJ	0.0126 UJ	0.0234 UJ	0.0254 U	0.0127 U	0.0373 U	**0.246**	0.0122 UJ	0.0118 U	0.0119 U
Naphthalene	mg/kg	0.118 UJ	0.116 UJ	0.0111 UJ	0.118 UJ	0.0108 UJ	0.0112 UJ	0.0208 UJ	0.0226 U	0.0113 U	0.0331 U	**0.0211 J**	0.0109 UJ	0.0105 U	0.0106 U
Phenanthrene	mg/kg	0.0935 UJ	0.0916 UJ	0.00877 UJ	0.0929 UJ	0.00851 UJ	0.00884 UJ	0.0165 UJ	0.0179 U	0.00895 U	0.0262 U	**0.507**	0.00858 UJ	0.00832 U	0.00835 U
Pyrene	mg/kg	0.0917 UJ	**0.184 J**	0.00859 UJ	**0.0973 J**	0.00835 UJ	0.00867 UJ	0.0162 UJ	0.0176 U	0.00877 U	0.0258 U	**0.624**	**0.0142 J**	0.00816 U	0.00819 U
DETECTS															
1-Methylnaphthalene	mg/kg											**0.0064 J**	**0.00623 J**		
2-Methylnaphthalene	mg/kg			**0.00894 J**			**0.00706 J**					**0.00871 J**	**0.00945 J**		
Acenaphthene	mg/kg											**0.0604**			
Acenaphthylene	mg/kg														
Anthracene	mg/kg											**0.126**			
Benzo(a)anthracene	mg/kg											**0.384**			
Benzo(a)pyrene	mg/kg		**0.103 J**						**0.0185 J**			**0.434**			
Benzo(b)fluoranthene	mg/kg											**0.463**			
Benzo(g,h,i)perylene	mg/kg								**0.0187 J**			**0.236**			
Benzo(k)fluoranthene	mg/kg											**0.168**			
Chrysene	mg/kg											**0.4**	**0.0101 J**		
Dibenzo(a,h)anthracene	mg/kg											**0.0588**			
Fluoranthene	mg/kg											**0.844**			
Fluorene	mg/kg											**0.0528**			
Indeno(1,2,3-cd)pyrene	mg/kg											**0.246**			
Naphthalene	mg/kg											**0.0211 J**			
Phenanthrene	mg/kg											**0.507**			
Pyrene	mg/kg		**0.184 J**		**0.0973 J**							**0.624**	**0.0142 J**		
1/2 NON-DETECTS															
1-Methylnaphthalene	mg/kg	0.03015 UJ	0.0295 UJ	0.002825 UJ	0.02995 UJ	0.002745 UJ	0.00285 UJ	0.0053 UJ	0.00575 U	0.002885 U	0.00845 U			0.00268 U	0.00269 U
2-Methylnaphthalene	mg/kg	0.03055 UJ	0.02995 UJ		0.03035 UJ	0.00278 UJ		0.0054 UJ	0.00585 U	0.002925 U	0.00855 U			0.00272 U	0.00273 U
Acenaphthene	mg/kg	0.0381 UJ	0.03735 UJ	0.003575 UJ	0.0379 UJ	0.00347 UJ	0.003605 UJ	0.00675 UJ	0.0073 U	0.00365 U	0.0107 U		0.0035 UJ	0.003395 U	0.003405 U
Acenaphthylene	mg/kg	0.03315 UJ	0.0325 UJ	0.00311 UJ	0.03295 UJ	0.00302 UJ	0.003135 UJ	0.00585 UJ	0.00635 U	0.003175 U	0.0093 U	0.00621 U	0.003045 UJ	0.00295 U	0.002965 U
Anthracene	mg/kg	0.04195 UJ	0.0411 UJ	0.00393 UJ	0.0417 UJ	0.00382 UJ	0.003965 UJ	0.0074 UJ	0.00805 U	0.004015 U	0.0118 U		0.00385 UJ	0.00373 U	0.003745 U
Benzo(a)anthracene	mg/kg	0.0415 UJ	0.04065 UJ	0.003895 UJ	0.04125 UJ	0.00378 UJ	0.003925 UJ	0.0073 UJ	0.0079 U	0.003975 U	0.0116 U		0.00381 UJ	0.003695 U	0.00371 U
Benzo(a)pyrene	mg/kg	0.0438 UJ		0.004105 UJ	0.0435 UJ	0.003985 UJ	0.00414 UJ	0.00775 UJ		0.00419 U	0.0123 U		0.00402 UJ	0.003895 U	0.00391 U
Benzo(b)fluoranthene	mg/kg	0.0439 UJ	0.043 UJ	0.00412 UJ	0.04365 UJ	0.004 UJ	0.004155 UJ	0.00775 UJ	0.0084 U	0.004205 U	0.0123 U		0.00403 UJ	0.00391 U	0.003925 U
Benzo(g,h,i)perylene	mg/kg	0.04305 UJ	0.0422 UJ	0.00404 UJ	0.0428 UJ	0.00392 UJ	0.004075 UJ	0.0076 UJ		0.004125 U	0.0121 U		0.003955 UJ	0.003835 U	0.00385 U

		Site Samples													
		D160		E320		E380		E460		H360		I120		L320	
		BNSF-D160-042822-0-5		BNSF-E320-042822-0-4		BNSF-E380-042822-0-4		BNSF-E460-042922-0-4		BNSF-H360-042922-0-8		BNSF-I120-042922-0-6		BNSF-L320-042922-0-2	
		N		N		N		N		N		N		N	
Analyte	Units	4/28/2022		4/28/2022		4/28/2022		4/29/2022		4/29/2022		4/29/2022		4/29/2022	
Benzo(k)fluoranthene	mg/kg	0.04185	UJ	0.041	UJ	0.003925	UJ	0.0416	UJ	0.00381	UJ	0.00396	UJ	0.00735	UJ
Chrysene	mg/kg	0.0468	UJ	0.04585	UJ	0.00439	UJ	0.04655	UJ	0.004265	UJ	0.00443	UJ	0.00825	UJ
Dibenzo(a,h)anthracene	mg/kg	0.0655	UJ	0.064	UJ	0.0061	UJ	0.065	UJ	0.00595	UJ	0.00615	UJ	0.01155	UJ
Fluoranthene	mg/kg	0.0425	UJ	0.04165	UJ	0.003985	UJ	0.04225	UJ	0.00387	UJ	0.00402	UJ	0.0075	UJ
Fluorene	mg/kg	0.03835	UJ	0.03755	UJ	0.003595	UJ	0.0381	UJ	0.00349	UJ	0.003625	UJ	0.00675	UJ
Indeno(1,2,3-cd)pyrene	mg/kg	0.0665	UJ	0.065	UJ	0.00625	UJ	0.066	UJ	0.00605	UJ	0.0063	UJ	0.0117	UJ
Naphthalene	mg/kg	0.059	UJ	0.058	UJ	0.00555	UJ	0.059	UJ	0.0054	UJ	0.0056	UJ	0.0104	UJ
Phenanthrene	mg/kg	0.04675	UJ	0.0458	UJ	0.004385	UJ	0.04645	UJ	0.004255	UJ	0.00442	UJ	0.00825	UJ
Pyrene	mg/kg	0.04585	UJ			0.004295	UJ			0.004175	UJ	0.004335	UJ	0.0081	UJ
Total Detects		0		0.287		0.00894		0.0973		0		0.00706		0	
Total Non-Detects		0.79925		0.6951		0.072075		0.749		0.072785		0.07269		0.14095	
Total PAHs (mg/kg)		0.79925		**0.9821**		**0.081015**		**0.8463**		0.072785		**0.07975**		0.14095	
Total PAHs (ug/kg)		799.3		**982.1**		**81.0**		**846.3**		72.8		**79.8**		141.0	

		Site Samples													
		SG01		SG01		SG02		SG03		SG11		SG13		SG23	
		BNSF-SG01-041922-0-10		FD01-041922-0-10		BNSF-SG02-041922-0-10		BNSF-SG03-042722-0-5.5		BNSF-SG11-042822-0-5		BNSF-SG13-042522-0-1.5		BNSF-SG23-042122-0-6	
		N		FD		N		N		N		N		N	
Analyte	Units	4/19/2022		4/19/2022		4/19/2022		4/27/2022		4/28/2022		4/25/2022		4/21/2022	
Benzo(k)fluoranthene	mg/kg	0.008	U	0.00401	U	0.0117	U			0.003845	UJ	0.003725	U	0.00374	U
Chrysene	mg/kg	0.00895	U	0.00448	U	0.0131	U					0.004165	U	0.004185	U
Dibenzo(a,h)anthracene	mg/kg	0.0125	U	0.00625	U	0.01835	U			0.006	UJ	0.0058	U	0.00585	U
Fluoranthene	mg/kg	0.0081	U	0.00407	U	0.0119	U			0.0039	UJ	0.003785	U	0.0038	U
Fluorene	mg/kg	0.0073	U	0.00367	U	0.0107	U			0.00352	UJ	0.00341	U	0.003425	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.0127	U	0.00635	U	0.01865	U			0.0061	UJ	0.0059	U	0.00595	U
Naphthalene	mg/kg	0.0113	U	0.00565	U	0.01655	U			0.00545	UJ	0.00525	U	0.0053	U
Phenanthrene	mg/kg	0.00895	U	0.004475	U	0.0131	U			0.00429	UJ	0.00416	U	0.004175	U
Pyrene	mg/kg	0.0088	U	0.004385	U	0.0129	U					0.00408	U	0.004095	U
Total Detects		0.0372		0		0		4.64021		0.03998		0		0	
Total Non-Detects		0.1362		0.076485		0.22405		0.00621		0.059315		0.071085		0.07145	
Total PAHs (mg/kg)		**0.1734**		0.076485		0.22405		**4.64642**		**0.099295**		0.071085		0.07145	
Total PAHs (ug/kg)		**173.4**		76.5		224.1		**4646.4**		**99.3**		71.1		71.5	

Notes:
mg/kg = milligram per kilogram
U= non detected value
J = estimated value

Total PAHs represents the sum of 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(ghi)perylene, chrysene, dibenz(ah)anthracene, fluoranthene, fluorene, indeno(123-cd)pyrene, naphthalene, phenanthrene, pyrene, total benzofluoranthenes (b+k+j). (WAC 173-204-563(2)(h))

Attachment K-2
ProUCL Output

	General Statistics on Uncensored Data
Date/Time of Computation	ProUCL 5.2 3/14/2023 5:34:10 PM
User Selected Options	
From File	BNSF-Wishram-SD-Eco_ProUCL_Input_031423.xls
Full Precision	OFF

From File: BNSF-Wishram-SD-Eco_ProUCL_Input_031423.xls

General Statistics for Censored Data Set (with NDs) using Kaplan Meier Method

Variable	NumObs	# Missing	Num Ds	NumNDs	% NDs	Min ND	Max ND	KM Mean	KM Var	KM SD	KM CV
Ammonia as Nitrogen (N)	13	1	13	0	0.00%	N/A	N/A	20.15	62.47	7.904	0.392
Diesel Fuel	13	1	11	2	15.38%	9.5	9.7	52.79	3475	58.95	1.117
TPH as Motor Oil	13	1	13	0	0.00%	N/A	N/A	176.8	36762	191.7	1.084
Arsenic	13	1	13	0	0.00%	N/A	N/A	2.785	0.591	0.769	0.276
Cadmium	13	1	13	0	0.00%	N/A	N/A	0.338	0.0234	0.153	0.452
Chromium	13	1	13	0	0.00%	N/A	N/A	14.1	7.382	2.717	0.193
Copper	13	1	13	0	0.00%	N/A	N/A	13.36	14.22	3.771	0.282
Lead	13	1	13	0	0.00%	N/A	N/A	8.346	7.338	2.709	0.325
Nickel	13	1	13	0	0.00%	N/A	N/A	14	4.152	2.038	0.146
Selenium	13	1	12	1	7.69%	0.11	0.11	0.248	0.00823	0.0907	0.365
Silver	13	1	5	8	61.54%	0.18	0.3	0.232	0.00641	0.0801	0.345
Zinc	13	1	13	0	0.00%	N/A	N/A	85.43	551.1	23.47	0.275
Mercury	13	1	11	2	15.38%	0.011	0.011	0.0198	4.82E-05	0.00694	0.351
3 & 4-Methylphenol (m,p-Cresols)	13	1	1	12	92.31%	0.0131	0.147	0.014	5.02E-06	0.00224	0.16
Benzoic Acid	13	1	2	11	84.62%	0.149	1.67	0.163	9.47E-04	0.0308	0.189
Bis (2-ethylhexyl) phthalate	13	1	0	13	100.00%	0.0531	0.597	N/A	N/A	N/A	N/A
Carbazole	13	1	1	12	92.31%	0.013	0.146	0.0197	4.04E-04	0.0201	1.02
Dibenzofuran	13	1	1	12	92.31%	0.0137	0.154	0.0162	5.13E-05	0.00717	0.441
Di-N-Butylphthalate	13	1	0	13	100.00%	0.0144	0.161	N/A	N/A	N/A	N/A
Di-n-octyl phthalate	13	1	0	13	100.00%	0.0283	0.318	N/A	N/A	N/A	N/A
Pentachlorophenol	13	1	0	13	100.00%	0.0113	0.127	N/A	N/A	N/A	N/A
Phenol	13	1	0	13	100.00%	0.0169	0.19	N/A	N/A	N/A	N/A
Sulfide	13	1	4	9	69.23%	37.4	59.5	79.15	7207	84.9	1.073
Total PAHs (calcuated)	13	1	7	6	46.15%	0.0711	0.799	0.568	1.475	1.214	2.139
Total Organic Carbon	13	1	13	0	0.00%	N/A	N/A	11167	76383056	8740	0.783

General Statistics for Raw Data Sets using Detected Data Only

Variable	NumObs	# Missing	Minimum	Maximum	Mean	Median	Var	SD	MAD/0.675	Skewness	CV
Ammonia as N	13	1	10	40	20.15	20	62.47	7.904	5.93	1.364	0.392
Diesel Fuel	11	1	9.9	223	60.66	38.8	4074	63.83	25.8	2.042	1.052
TPH as Motor Oil	13	1	25.1	630	176.8	107	36762	191.7	106.2	1.595	1.084
Arsenic	13	1	2.1	4.7	2.785	2.6	0.591	0.769	0.593	1.531	0.276
Cadmium	13	1	0.089	0.64	0.338	0.35	0.0234	0.153	0.119	0.345	0.452
Chromium	13	1	8.2	17.3	14.1	14.7	7.382	2.717	2.076	-1.037	0.193
Copper	13	1	7.7	19.5	13.36	12.2	14.22	3.771	3.41	0.424	0.282
Lead	13	1	3.6	14.3	8.346	8.3	7.338	2.709	1.334	0.646	0.325
Nickel	13	1	9.3	16.8	14	14.6	4.152	2.038	1.631	-1.063	0.146
Selenium	12	1	0.12	0.47	0.26	0.245	0.00784	0.0885	0.0593	1.008	0.34
Silver	5	1	0.22	0.41	0.312	0.27	0.00757	0.087	0.0741	0.398	0.279
Zinc	13	1	32.3	120	85.43	90.6	551.1	23.47	16.9	-0.881	0.275
Mercury	11	1	0.013	0.035	0.0214	0.021	4.45E-05	0.00667	0.00741	0.781	0.312
3 & 4-Methylphenol (m,p-Cresols)	1	1	0.0195	0.0195	0.0195	0.0195	N/A	N/A	0	N/A	N/A
Benzoic Acid	2	1	0.158	0.238	0.198	0.198	0.0032	0.0566	0.0593	N/A	0.286
Bis (2-ethylhexyl) phthalate	0	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Carbazole	1	1	0.08	0.08	0.08	0.08	N/A	N/A	0	N/A	N/A
Dibenzofuran	1	1	0.0365	0.0365	0.0365	0.0365	N/A	N/A	0	N/A	N/A
Di-N-Butylphthalate	0	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Di-n-octyl phthalate	0	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pentachlorophenol	0	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Phenol	0	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sulfide	4	1	51.7	318	172.7	160.5	14377	119.9	124.8	0.401	0.694
Total PAHs (calcuated)	7	1	0.0798	4.646	0.987	0.173	2.751	1.659	0.139	2.367	1.681
Total Organic Carbon	13	1	670	30000	11167	8000	76383056	8740	7413	0.959	0.783

Percentiles using all Detects (Ds) and Non-Detects (NDs)											
Variable	NumObs	# Missing	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
Ammonia as N	13	1	12.4	14.4	15	20	20	22.4	28.8	34	38.8
Diesel Fuel	13	1	9.74	11.1	12.9	32.2	53.1	55.38	120.2	170.8	212.6
TPH as Motor Oil	13	1	29.88	36.2	37.4	107	215	260.6	460.6	553.8	614.8
Arsenic	13	1	2.1	2.14	2.2	2.6	2.9	3.2	3.72	4.16	4.592
Cadmium	13	1	0.172	0.216	0.27	0.35	0.43	0.454	0.518	0.574	0.627
Chromium	13	1	10.32	12.36	12.9	14.7	15.7	15.94	16.98	17.24	17.29
Copper	13	1	9.34	10.78	10.9	12.2	15.8	17.3	18.78	19.14	19.43
Lead	13	1	5.54	7.1	7.4	8.3	8.8	8.86	11.62	13.1	14.06
Nickel	13	1	11.48	13.16	13.4	14.6	15.3	15.3	16.02	16.44	16.73
Selenium	13	1	0.132	0.192	0.21	0.24	0.29	0.302	0.334	0.392	0.454
Silver	13	1	0.19	0.194	0.2	0.22	0.27	0.288	0.38	0.404	0.409
Zinc	13	1	61.22	66.78	69	90.6	100	101.2	106	112.2	118.4
Mercury	13	1	0.0114	0.0142	0.016	0.017	0.024	0.0258	0.0278	0.0308	0.0342
3 & 4-Methylphenol (m,p-Cresols)	13	1	0.0134	0.0136	0.0138	0.0195	0.0413	0.103	0.146	0.146	0.147
Benzoic Acid	13	1	0.15	0.156	0.157	0.238	0.468	1.165	1.654	1.664	1.669
Bis (2-ethylhexyl) phthalate	13	1	0.0535	0.0545	0.0548	0.0565	0.167	0.418	0.591	0.595	0.597
Carbazole	13	1	0.0131	0.0133	0.0134	0.0257	0.08	0.118	0.145	0.145	0.146
Dibenzofuran	13	1	0.0138	0.0141	0.0142	0.0272	0.0433	0.108	0.153	0.153	0.154
Di-N-Butylphthalate	13	1	0.0145	0.0147	0.0148	0.0153	0.0452	0.113	0.16	0.16	0.161
Di-n-octyl phthalate	13	1	0.0285	0.0291	0.0292	0.0301	0.0893	0.223	0.315	0.317	0.318
Pentachlorophenol	13	1	0.0113	0.0115	0.0116	0.012	0.0355	0.0886	0.126	0.126	0.127
Phenol	13	1	0.017	0.0173	0.0174	0.0179	0.0532	0.133	0.188	0.189	0.19
Sulfide	13	1	37.82	38.18	38.6	39.8	59.5	84.4	196.2	259.2	306.2
Total PAHs (calcuated)	13	1	0.0717	0.0756	0.0798	0.141	0.799	0.827	0.955	2.448	4.207
Total Organic Carbon	13	1	3200	4400	5000	8000	15000	18000	22400	25800	29160

Appendix L
Human Health Risk Evaluation

Appendix L. Human Health Risk-Based Concentrations and Comparisons

This appendix provides the results from calculating the human health risk-based concentrations (RBCs) and comparisons with site data for Phases 1 and 2 Wishram RI work.

1. Introduction

Risk-based concentrations were calculated consistent with Washington State Department of Ecology (Ecology) Sediment Management Standards (SMS; Chapter 173-204 WAC), as described in the *Sediment Cleanup User's Manual* (SCUM) (Ecology 2021) and for comparison with data collected at the BNSF Wishram Railyard (BNSF Track Switching Facility) in Wishram, Washington (site).

Calculating RBCs and comparing with site data generally consists of the following four elements (EPA 1989):

- Data Evaluation: Consists of reviewing and evaluating available data, and identifying the target chemicals in sediment at the site
- Exposure Assessment: Includes evaluating potential exposure pathways and the potential human populations that could be exposed to them, either now or in the future. Default exposure parameters are identified as inputs to calculate RBCs
- Toxicity Assessment: Toxicity values that characterize potential adverse health effects from exposure to chemicals are identified as inputs for calculating RBCs
- Risk Characterization: Site data (i.e., Exposure point concentrations [EPCs]) are compared with RBCs to evaluate potential risks to human health

These steps are further described in the following sections.

2. Data Evaluation

Prior to identifying the target chemicals that need RBCs, the analytical results from sampling were validated in a data quality evaluation report (Appendix G). The analytical results were further evaluated using the following data reduction steps:

- Estimated values (flagged with "J" qualifiers) were treated as detected concentrations.
- Native and duplicate (i.e., field duplicate) sample pairs were reduced as follows (and note that toxicity equivalents [TEQs] were first calculated for both normal and duplicate samples as discussed in Section J.4 and were then reduced):
    1. If there were two detections, the higher of the two concentrations was used.
    2. If there was one detection and one nondetection, the detected value was used.
    3. If there were two nondetections, the result having the lowest detection limit was used.

Sediment samples with beginning depths from 0 to 1.5 feet below ground surface (bgs) were used to calculate the EPC. Samples with beginning depths of 3 feet bgs and greater were excluded, because the human exposure pathways are incomplete.

Background samples were excluded from the EPC calculation.

Sediment samples used to calculate the EPC are provided in **Table L-1**; summary statistics are provided in **Attachment L-1**.

3. Exposure Assessment

An exposure area describes a location or area where humans might encounter one or more contaminated environmental media on a regular basis. The site was evaluated as one exposure area for sediment.

3.1 Human Exposure Scenarios and Pathways

People, currently and in the future, potentially exposed to chemicals measured in sediment are recreational users (child and adult) and subsistence harvesters (adult).

The following exposure scenarios and exposure pathways are recommended for evaluating direct contact with chemicals in sediment, in accordance with Section 9.2 of SCUM guidance:

- **Fish/Shellfish Consumption**. Child and adult exposure to bio-accumulative contaminants in sediment through consumption of fish or shellfish, or both

- **Beach Play.** Child and adult exposure to contaminants in sediment through the dermal contact and incidental ingestion exposure pathways during shoreline beach play activities (i.e., digging, walking, wading, or recreational games): only the more conservative child exposure was considered when calculating RBCs

- **Clam Digging.** Adult exposure to contaminants in sediment through the dermal contact and incidental ingestion exposure pathways during shoreline clam digging activities

- **Net Fishing.** Adult exposure to contaminants in sediment through the dermal contact and incidental ingestion exposure pathways during shoreline net fishing activities

Because sediment impacts at the site are in areas with fairly deep water and there are no beaches adjacent to the site, the beach play and clam digging exposure scenarios are considered incomplete for current uses. Since this area is a tribal usual and accustomed fishing area, the shellfish/fish consumption exposure scenario is considered complete. In addition, the SMS rule WAC 173-204-561(2)(b)(i) requires the reasonable maximum exposure scenario to include historic, current, and potential future tribal use of fish and shellfish from the general vicinity of the site. Therefore, the shellfish/fish consumption, beach play, clam digging, and net fishing exposure scenarios were considered potentially complete for future uses.

3.2 Exposure Point Concentrations

EPCs were evaluated for each constituent detected in sediment. Based on SCUM guidance, the mean of all sample concentrations within the exposure area was used as the EPC for each analyte. The latest version of EPA's ProUCL software, version 5.2 (EPA 2022a), was used to calculate the mean, where treatment of nondetections was addressed by ProUCL and the mean concentration was selected in accordance with Table 6.4 of SCUM guidance. Kaplan-Meier methods were used to evaluate the mean when non-detected results represent less than 50 percent of the samples. Consistent with Table 6.4 of SCUM: 1) regression on order statistics mean concentrations were used when non-detected results represent 50 to 80 percent of the samples; and 2) where more than 80 percent of sample results are non-detects, the maximum detected concentration was used as the EPC.

ProUCL input and output are provided in **Attachment L-2**.

3.3 Exposure Parameters

The exposure parameters used to calculate RBCs are considered reasonable maximum exposure (RME) parameters, in accordance with Chapter 9.2 of SCUM guidance. SCUM-recommended RME parameters or EPA's (EPA 2014) default parameters were used. **Exposure parameters,** sources, and assumptions are provided in **Table L-2**.

4. Toxicity Assessment

The toxicological data used to develop the RBCs were obtained from the most recent U.S. Environmental Protection Agency (EPA) Regional Screening Levels tables (2023a) in accordance with the hierarchy provided in Appendix E of SCUM guidance.

5. Carcinogenic Polycyclic Aromatic Hydrocarbons

Carcinogenic risk for polycyclic aromatic hydrocarbons (PAHs) was evaluated using EPA-recommended relative potency factors (RPFs) (EPA 2023b). The approach accounts for the relative cancer risk of the various PAHs by applying the following TEFs that are relative to the potency of benzo[a]pyrene:

- Benzo[a]anthracene = 0.1
- Benzo[a]pyrene = 1.0
- Benzo[b]fluoranthene = 0.1
- Benzo[k]fluoranthene = 0.1
- Chrysene = 0.01
- Dibenz[a,h]anthracene = 0.1
- Indeno[1,2,3-cd]pyrene = 0.1

Because the majority of carcinogenic PAH (cPAH) results are non-detects, in accordance with Appendix F of SCUM guidance, Kaplan-Meier statistical methods for evaluating nondetected results were not used. Therefore, one half the limit of detection (LOD) was used as the concentration for nondetected sample results. The RFP-adjusted results for each sample, including duplicate samples, were summed to produce a benzo[a]pyrene toxicity equivalence concentration for carcinogenic PAHs (cPAH TEQ) as presented in **Attachment L-3**.

The SCUM guidance, Table 6-1, provides carcinogenic PAH (cPAHs) toxicity equivalency factors (TEFs) based on 2005 California EPA guidance; however, the TEFs have been updated by both EPA and California EPA based on updated toxicity information for benzo[k]fluoranthene, chrysene, and dibenz[a,h]anthracene (EPA 2023b; DTSC 2015). T cPAH TEQ concentrations were also calculated using EPA RPFs for comparison (**Attachment L-3)**.

Based on SCUM guidance, to address early-in-life susceptibility to cPAHs, a potency adjustment was applied as follows:

- Ten-fold adjustment for 0 to less than 2 years

- Three-fold adjustment for 2 to less than 16 years

6. Dioxins and Dioxin-like Compounds

Dioxins and dioxin-like compounds were evaluated using the TEFs recommended by the World Health Organization to characterize the toxicity of these mixtures (Van den Berg 2006), in accordance with SCUM guidance.

The TEFs that were applied to sample concentrations of dioxins and dioxin-like compounds are shown in Table 6-2 of the SCUM guidance and **Attachment L-4**. Because the majority of dioxin and dioxin-like compound results are non-detects, in accordance with Appendix F of SCUM guidance, Kaplan-Meier statistical methods for evaluating nondetected results were not used. Therefore, one half the LOD was used as the concentration for nondetected sample results. The TEF-adjusted results for each sample, including duplicate samples, were summed to produce 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) toxicity equivalence (2,3,7,8-TCDD TEQ) EPCs, as presented in **Attachment L-4**.

7. Risk Characterization

RBCs were developed for the human potentially complete exposure scenarios and pathways and are presented in Attachment L-5.

Based on Option 1 in Section 9.2 of SCUM guidance and because tissue data were not collected to calculate site-specific biota-sediment accumulation factors, background concentrations are used as SCOs for the consumption of fish/shellfish exposure scenario because they are conservative and consistent with the SMS. Background concentrations are the calculated preliminary natural background values where available (Appendix F). For constituents detected in sediment that do not have calculated preliminary natural background values, the maximum reporting quantification limits were used in accordance with Section 9.2 of SCUM guidance.

RBCs were calculated for the child beach play, adult clam digging, and adult net fishing exposure direct contact scenarios using the EPA RSL calculator (EPA 2022b, 2023c) with the exposure parameters listed in **Table L-2** and the toxicity values discussed above. The RBCs are based on a target hazard quotient of 1 and a cancer risk of 10^{-6}, in accordance with SMS Sediment Cleanup Objectives (SCO). The equations used to derive the RBCs are those presented in Section 9.2 of SCUM guidance. The RSL calculator inputs and outputs are provided in **Attachment L-5**, and the RBCs for each exposure scenario are shown in **Table L-3.** While the RSL calculator considers the ingestion, dermal contact, and inhalation exposure pathways, only the output for the ingestion and dermal contact exposure pathways are considered, as discussed in Section L.3, in accordance with Section 9.2 of SCUM guidance.

A comparison of EPCs to RBCs is provided in **Table L-3**, and the results are summarized as follows:

Fish/Shellfish Consumption. With the exception of 2,3,7,8-TCDD TEQ, diesel fuel, and benzo(g,h,i)perylene, the EPCs of constituents detected in sediment are less than the preliminary natural background values used to evaluate the fish/shellfish consumption exposure scenario. The EPC of 2,3,7,8-TCDD TEQ (0.78 nanogram per kilogram [ng/kg]) exceeds the preliminary natural background value (0.53 ng/kg). However, only 3 of the 13 samples analyzed for dioxin-like substances had TEQ concentrations slightly exceeding preliminary natural background (0.633 ng/kg at BNSF-D160-042822-0-5; 4.251 ng/kg at BNSF-E320-042822-0-4; and 0.811 at BNSF-SG11-042822-0-5). As shown in **Attachment L-4**, the majority of dioxin-like compounds were not detected in sediment samples. Because the nondetected compounds were included in the 2,3,7,8-TCDD TEQ calculations, the EPC may be biased high. In summary, exceedances of the 2,3,7,8-TCDD TEQ preliminary natural background value are slight and limited. The

EPC of benzo(g,h,i)perylene (0.24 mg/kg) only slightly exceeds the preliminary natural background value (0.22 mg/kg). Because there were only two detected concentrations of 21 samples, the EPC is the maximum detected concentration which is biased high. Only one sample result (5 percent of total samples) exceeds the preliminary natural background value. The mean of the two detected concentrations (0.13 mg/kg) is less than the preliminary natural background value and the 19 nondetected values range from 0.0076 mg/kg to 0.086 mg/kg. In summary, benzo(g,h,i)perylene concentrations are below or similar to the preliminary natural background value. The EPC of diesel fuel (59 mg/kg) only slightly exceeds the preliminary natural background value (58 mg/kg). However, risk from exposure to diesel fuel is evaluated using RBCs for petroleum indicator compounds (i.e. PAHs).

Beach Play. With the exception of arsenic, EPCs of constituents detected in sediment are less than the RBCs for the child beach play exposure scenario. Although the EPC of arsenic (2.8 milligrams per kilogram [mg/kg]) slightly exceeds the RBC (2.5 mg/kg), it is less than the preliminary natural background value of 3.3 mg/kg, indicating that arsenic does not exceed SMS criteria. Therefore, risks from exposure to sediment through the beach play exposure scenario meet the SMS and SCUM guidance human health criteria.

Clam Digging. With the exception of arsenic, EPCs of constituents detected in sediment are less than the RBCs for the adult clam digging exposure scenario. Although the EPC of arsenic (2.8 mg/kg) exceeds the RBC (1.2 mg/kg), it is less than the preliminary natural background value of 3.3 mg/kg, indicating that arsenic does not exceed SMS criteria. Therefore, SMS and SCUM guidance human health criteria have been met.

Net Fishing. EPCs of constituents detected in sediment are less than the RBCs for the adult net fishing exposure scenario. Therefore, risks from exposure to sediment through the net fishing exposure scenario meet the SMS and SCUM guidance human health criteria.

8. References

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Table L-1
Sediment Samples Included in the Human Health Risk Evaluation

Table L-1. Sediment Samples Included in the Human Health Risk Evaluation

BNSF Wishram Railyard Human Health Risk Evaluation

Location ID	Sample Name	Sample Date	Sample Type	Start Depth (feet bgs)	End Depth (feet bgs)	Depth Units
G000	BNSF-G000-SC-1.5-2.5-110322	03 Nov 2022	N	1.5	2.5	ft
G020	BNSF-G020-SC-0.0-1.0-110422	04 Nov 2022	N	0	1	ft
K200	BNSF-K200-SC-0.0-0.4-110922	09 Nov 2022	N	0	0.4	ft
EF240	BNSF-EF240-SC-1.0-2.0-111022	10 Nov 2022	N	1	2	ft
EF240	BNSF-EF240-SC-1.0-2.0-111022-1	10 Nov 2022	FD	1	2	ft
HN300	BNSF-HN300-SC-1.0-2.0-111322	13 Nov 2022	N	1	2	ft
I500	BNSF-I500-SC-0.0-0.8-111322	13 Nov 2022	N	0	0.8	ft
O280	BNSF-O280-SC-0.0-0.7-111322	13 Nov 2022	N	0	0.7	ft
J060	BNSF-J060-SC-0.5-1.5-111422	14 Nov 2022	N	0.5	1.5	ft
SG01	BNSF-SG01-041922-0-10	19 Apr 2022	N	0	10	cm
SG01	FD01-041922-0-10	19 Apr 2022	FD	0	10	cm
SG02	BNSF-SG02-041922-0-10	19 Apr 2022	N	0	10	cm
SG23	BNSF-SG23-042122-0-6	21 Apr 2022	N	0	6	cm
SG13	BNSF-SG13-042522-0-1.5	25 Apr 2022	N	0	1.5	cm
SG03	BNSF-SG03-042722-0-5.5	27 Apr 2022	N	0	5	cm
D160	BNSF-D160-042822-0-5	28 Apr 2022	N	0	5	cm
E320	BNSF-E320-042822-0-4	28 Apr 2022	N	0	4	cm
E380	BNSF-E380-042822-0-4	28 Apr 2022	N	0	4	cm
SG11	BNSF-SG11-042822-0-5	28 Apr 2022	N	0	5	cm
E460	BNSF-E460-042922-0-4	29 Apr 2022	N	0	4	cm
H360	BNSF-H360-042922-0-8	29 Apr 2022	N	0	8	cm
I120	BNSF-I120-042922-0-6	29 Apr 2022	N	0	6	cm
L320	BNSF-L320-042922-0-2	29 Apr 2022	N	0	2	cm

Notes:

FD = field dupllicate sample

N = native sample

Table L-2
Exposure Assumptions for Evaluation of Risk-Based Concentrations

Table L-2. Exposure Assumptions for Evaluation of Risk-Based Concentrations

Exposure Parameter	Symbol	Units	Beach Play (Child)	Source	Subsistence Clam Digging (Adult)	Source	Subsistence Net Fishing (Adult)	Source
Target Cancer Risk	TCR	Unitless	1E-06	a	1E-06	a	1E-06	a
Target Hazard Quotient	THQ	Unitless	1	a	1	a	1	a
Adult Body Weight	BW_a	kg	--	--	80	b	80	b
Child Body Weight	BW_c	kg	15 (10 and17 for cPAHs)	a	--	--	--	--
Exposure Frequency (soil)	EF_s	days/yr	41	a	120	a	119	a
Adult Exposure Duration	ED_a	Years	--	--	64	c	64	c
Child Exposure Duration	ED_c	Years	6	a	--	--	--	--
Exposure Time	ET	hrs/day	8	c	8	c	8	c
Carcinogenic Averaging Time	AT_c	Days	25,550	a	25,550	a, b	25,550	a, b
Adult Noncarcinogenic Averaging Time	AT_n	Days	--	--	23,360	c	23,360	c
Child Noncarcinogenic Averaging Time	AT_n	Days	2,190	a,b	--	--	--	--
Adult Incidental Soil Ingestion Rate	IRS_a	mg/day (dry)	--	--	100	a	50	a
Child Incidental Soil Ingestion Rate	IRS_c	mg/day (dry)	200	a,b	--	--	--	--
Adult Skin Surface Area (soil)	SA_a	cm^2	--	--	11,813	a	5,590	a
Child Skin Surface Area (soil)	SA_c	cm^2	3,835 (2980 and 4258 for cPAHs)	a	--	--	--	--

Table L-2. Exposure Assumptions for Evaluation of Risk-Based Concentrations

Exposure Parameter	Symbol	Units	Beach Play (Child)	Source	Subsistence Clam Digging (Adult)	Source	Subsistence Net Fishing (Adult)	Source
Dermal Absorption Fraction	ABS	Unitless	Chemical-specific	d	Chemical-specific	d	Chemical-specific	d
Adult Soil-to-Skin Adherence Factor	AF_a	mg/cm^2	--	--	0.24	a	0.19	a
Child Soil-to-Skin Adherence Factor	AF_c	mg/cm^2	2.6	a	--	--	--	--

[a] Sediment Cleanup User's Manual (SCUM), Table 9-1 and Table 9-2 (Ecology 2021).

[b] EPA 2014. *Human Health Evaluation Manual, Supplemental Guidance, Update of Standard Default Exposure Factors*. Office of Solid Waste and Emergency Response. OSWER Directive: 9200.1-120.

[c] Site-specific. Assumed 8 hours per day for exposure time. Subsistence harvester exposure duration assumes an adult lifetime of 64 years (SCUM default is 70 years).

[d] EPA 2022b. Regional Screening Levels - User's Guide. November. https://www.epa.gov/risk/regional-screening-levels-rsls-users-guide.

[e] EPA 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*. Solid Waste and Emergency Response, Washington, D.C. OSWER 9355.4-24. December.

Notes:
cm/hr = centimeter(s) per hour
cm^2 = square centimeter(s)
days/yr = day(s) per year
kg = kilogram(s)
mg/cm^2 = milligram(s) per square centimeter
mg/day (dry) = milligram(s) per day dry weight

Table L-3
Sediment Concentrations Compared With Risk-Based Concentrations

Table L-3. Sediment Concentrations Compared With Risk-Based Concentrations

BNSF Wishram Railyard Human Health Risk Evaluation

CHEMICAL NAME	CAS	Units	MDC	KM Mean	ROS Mean	EPC	EPC Basis	Sediment Preliminary Natural Background Value (Fish/Shellfish Consumption RBC)[a]	EPC Exceeds Preliminary Natural Background Value?	Beach Play (Child) RBC	EPC Exceeds Beach Play RBC?	Subsistence Clam Digging (Adult) RBC	EPC Exceeds Subsistence Clam Digging RBC?	Subsistence Net Fishing (Adult) RBC	EPC Exceeds Subsistence Net Fishing RBC?	Notes
2,3,7,8-TCDD TEQ	2,3,7,8-TCDD TEQ	ng/kg	4.3E+00	NA	NA	7.8E-01	Mean[b]	5.3E-01	**Yes**	2.4E+01	No	1.1E+01	No	2.5E+01	No	2,3,7,8-TCDD Toxicity
cPAH TEQ	cPAH	mg/kg	6.0E-01	NA	NA	4.8E-02	Mean[b]	2.2E-01	No	1.8E-01	No	4.3E-01	No	1.1E+00	No	Benzo(a)pyrene Toxicity
Ammonia as N	NH3N	mg/kg	4.0E+01	2.0E+01	NA	2.0E+01	KM Mean	7.0E+01	No	--	--	--	--	--	--	
Diesel Fuel	68334-30-5	mg/kg	2.2E+02	5.9E+01	NA	5.9E+01	KM Mean	5.8E+01	**Yes**	--	--	--	--	--	--	
TPH as Motor Oil	TPHMO	mg/kg	9.1E+02	1.9E+02	NA	1.9E+02	KM Mean	3.2E+02	No	--	--	--	--	--	--	
Arsenic	7440-38-2	mg/kg	4.7E+00	2.8E+00	NA	2.8E+00	KM Mean	3.3E+00	No	2.5E+00	**Yes**	1.2E+00	**Yes**	2.9E+00	No	Arsenic concentrations do not exceed background.
Cadmium	7440-43-9	mg/kg	6.4E-01	3.4E-01	NA	3.4E-01	KM Mean	5.2E-01	No	2.2E+01	No	1.1E+02	No	2.7E+02	No	
Chromium	7440-47-3	mg/kg	1.7E+01	1.4E+01	NA	1.4E+01	KM Mean	1.6E+01	No	1.0E+06	No	3.7E+06	No	7.4E+06	No	Chromium III Toxicity
Copper	7440-50-8	mg/kg	2.0E+01	1.3E+01	NA	1.3E+01	KM Mean	1.6E+01	No	2.7E+04	No	9.7E+04	No	2.0E+05	No	
Lead	7439-92-1	mg/kg	1.4E+01	8.3E+00	NA	8.3E+00	KM Mean	8.6E+00	No	4.0E+02	No	4.0E+02	No	4.0E+02	No	Residential Soil Lead RSL used as RBC
Nickel	7440-02-0	mg/kg	1.7E+01	1.4E+01	NA	1.4E+01	KM Mean	1.5E+01	No	1.3E+04	No	4.9E+04	No	9.8E+04	No	
Selenium	7782-49-2	mg/kg	4.7E-01	2.5E-01	NA	2.5E-01	KM Mean	4.5E-01	No	3.3E+03	No	1.2E+04	No	2.5E+04	No	
Silver	7440-22-4	mg/kg	4.1E-01	NA	2.1E-01	2.1E-01	ROS Mean	4.1E-01	No	3.3E+03	No	1.2E+04	No	2.5E+04	No	
Zinc	7440-66-6	mg/kg	1.2E+02	8.5E+01	NA	8.5E+01	KM Mean	1.1E+02	No	2.0E+05	No	7.3E+05	No	1.5E+06	No	
Mercury	7439-97-6	mg/kg	3.5E-02	2.0E-02	NA	2.0E-02	KM Mean	5.8E-02	No	2.0E+02	No	7.3E+02	No	1.5E+03	No	Based on toxicity values for mercuric chloride.
1-Methylnaphthalene	90-12-0	mg/kg	6.4E-03	NA	NA	6.4E-03	MDC	2.2E-01	No	3.6E+01	No	2.0E+01	No	4.9E+01	No	
2-Methylnaphthalene	91-57-6	mg/kg	9.5E-03	NA	NA	9.5E-03	MDC	2.2E-01	No	3.6E+02	No	2.1E+03	No	5.2E+03	No	
3 & 4-Methylphenol (m,p-Cresols)	65794-96-9	mg/kg	2.0E-02	NA	NA	2.0E-02	MDC	2.6E-01	No	--	--	--	--	--	--	
Acenaphthene	83-32-9	mg/kg	6.0E-02	NA	NA	6.0E-02	MDC	2.2E-01	No	5.4E+03	No	3.1E+04	No	7.8E+04	No	
Anthracene	120-12-7	mg/kg	1.3E-01	NA	NA	1.3E-01	MDC	2.2E-01	No	2.7E+04	No	1.6E+05	No	3.9E+05	No	
Benzo(a)anthracene	56-55-3	mg/kg	3.8E-01	NA	NA	See cPAH TEQ	See cPAH TEQ	NE	NE	NE	NE	NE	NE	NE	NE	See cPAH TEQ
Benzo(a)pyrene	50-32-8	mg/kg	4.3E-01	NA	2.8E-02	2.8E-02	ROS Mean	2.2E-01	No	2.7E+01	No	1.6E+02	No	3.9E+02	No	Non-carcinogenic Toxicity. See cPAH TEQ.
Benzo(b)fluoranthene	205-99-2	mg/kg	4.6E-01	NA	NA	See cPAH TEQ	See cPAH TEQ	NE	NE	NE	NE	NE	NE	NE	NE	See cPAH TEQ
Benzo(g,h,i)perylene	191-24-2	mg/kg	2.4E-01	NA	NA	0.24	MDC	2.2E-01	**Yes**	2.7E+03	No	1.6E+04	No	3.9E+04	No	Based on toxicity values for pyrene.
Benzo(k)fluoranthene	207-08-9	mg/kg	1.7E-01	NA	NA	See cPAH TEQ	See cPAH TEQ	NE	NE	NE	NE	NE	NE	NE	NE	See cPAH TEQ
Benzoic Acid	65-85-0	mg/kg	2.4E-01	NA	NA	2.4E-01	MDC	3.3E-01	No	4.5E+05	No	2.5E+06	No	6.3E+06	No	
Carbazole	86-74-8	mg/kg	8.0E-02	NA	NA	8.0E-02	MDC	2.2E+00	No	--	--	--	--	--	--	
Chrysene	218-01-9	mg/kg	4.0E-01	NA	NA	See cPAH TEQ	See cPAH TEQ	NE	NE	NE	NE	NE	NE	NE	NE	See cPAH TEQ
Dibenzo(a,h)anthracene	53-70-3	mg/kg	5.9E-02	NA	NA	See cPAH TEQ	See cPAH TEQ	NE	NE	NE	NE	NE	NE	NE	NE	See cPAH TEQ
Dibenzofuran	132-64-9	mg/kg	3.7E-02	NA	NA	3.7E-02	MDC	2.2E+00	No	6.7E+02	No	2.4E+03	No	4.9E+03	No	
Fluoranthene	206-44-0	mg/kg	8.4E-01	NA	NA	8.4E-01	MDC	2.2E-01	Yes	3.6E+03	No	2.1E+04	No	5.2E+04	No	
Fluorene	86-73-7	mg/kg	5.3E-02	NA	NA	5.3E-02	MDC	2.2E-01	No	3.6E+03	No	2.1E+04	No	5.2E+04	No	
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	2.5E-01	NA	NA	See cPAH TEQ	See cPAH TEQ	NE	NE	NE	NE	NE	NE	NE	NE	See cPAH TEQ
Naphthalene	91-20-3	mg/kg	2.1E-02	NA	NA	2.1E-02	MDC	2.2E-01	No	8.7E+00	No	4.7E+00	No	1.2E+01	No	
Phenanthrene	85-01-8	mg/kg	5.1E-01	NA	NA	5.1E-01	MDC	2.2E-01	Yes	--	--	--	--	--	--	
Pyrene	129-00-0	mg/kg	6.2E-01	NA	4.8E-02	4.8E-02	ROS Mean	2.2E-01	No	2.7E+03	No	1.6E+04	No	3.9E+04	No	
Sulfide	18496-25-8	mg/kg	3.2E+02	NA	5.9E+01	5.9E+01	ROS Mean	1.8E+02	No	--	--	--	--	--	--	

[a] Preliminary natural background values, see Appendix F.

[b] As presented in Sections L.5 and L.6, KM methods were not used to evaluate TEQs because the majority of sample results were non-detects. The mean of the calculated TEQs is used as the EPC.

Notes:

-- = no toxicity values for constituent
CAS = Chemical Abstracts Service
cPAH = carcinogenic PAHs
EPC = exposure point concentration
KM = Kaplan Meier Method
MDC = maximum detected concentration
NA = not applicable.
NE = not evaluated. See cPAH TEQ.
PAH = polycyclic aromatic hydrocarbons
RBC = risk-based concentration
ROS = regression on order statistics
TCDD = tetrachlorodibenzo-p-dioxin
TEQ = toxicity equivalence
UCL = upper confidence limit

Attachment L-1
Summary Statistics for Sediment

Attachment L-1 Summary Statistics for Sediment

BNSF Wishram Railyard

Human Health Risk

Analyte	CAS	Units	Number of Samples	Number of Detects	Detection Frequency	Minimum Nondetect Concentration	Maximum Nondetect Concentration	Minimum Detected Concentration	Maximum Detected Concentration	KM Mean Concentration	ROS Mean Concentration	Median Detected Concentration	Preliminary Natural Background Value	Maximum Detected Concentration Exceeds Preliminary Natural Background?
1-Methylnaphthalene	90-12-0	mg/kg	21	2	10%	5.3E-03	6.0E-02	6.2E-03	6.4E-03	5.4E-03	NE	6.3E-03	2.2E-01	No
2,3,7,8-TCDD TEQ	2,3,7,8-TCDD TEQ	ng/kg	13	13	100%	N/A	N/A	4.2E-01	4.3E+00	7.8E-01	NE	4.4E-01	5.3E-01	Yes
2-Methylnaphthalene	91-57-6	mg/kg	21	4	19%	5.4E-03	6.1E-02	7.1E-03	9.5E-03	6.2E-03	NE	8.8E-03	2.2E-01	No
3 & 4-Methylphenol (m,p-Cresols)	65794-96-9	mg/kg	21	1	5%	1.3E-02	1.5E-01	2.0E-02	2.0E-02	1.3E-02	NE	2.0E-02	2.6E-01	No
Acenaphthene	83-32-9	mg/kg	21	1	5%	6.7E-03	7.6E-02	6.0E-02	6.0E-02	9.7E-03	NE	6.0E-02	2.2E-01	No
Ammonia, as N	NH3N	mg/kg	13	13	100%	N/A	N/A	1.0E+01	4.0E+01	2.0E+01	NE	2.0E+01	7.0E+01	No
Anthracene	120-12-7	mg/kg	21	1	5%	7.4E-03	8.4E-02	1.3E-01	1.3E-01	1.3E-02	NE	1.3E-01	2.2E-01	No
Arsenic	7440-38-2	mg/kg	13	13	100%	N/A	N/A	2.1E+00	4.7E+00	2.8E+00	NE	2.6E+00	3.3E+00	Yes
Benzo[a]anthracene	56-55-3	mg/kg	21	4	19%	7.3E-03	8.3E-02	7.8E-03	3.8E-01	NE	NE	1.1E-02	2.2E-01	Yes
Benzo[a]pyrene	50-32-8	mg/kg	21	5	24%	7.7E-03	8.8E-02	9.8E-03	4.3E-01	NE	2.8E-02	1.9E-02	2.2E-01	Yes
Benzo[b]fluoranthene	205-99-2	mg/kg	21	4	19%	7.7E-03	8.8E-02	8.5E-03	4.6E-01	NE	NE	1.1E-02	2.2E-01	Yes
Benzo[g,h,i]perylene	191-24-2	mg/kg	21	2	10%	7.6E-03	8.6E-02	1.9E-02	2.4E-01	NE	NE	1.3E-01	2.2E-01	Yes
Benzo[k]fluoranthene	207-08-9	mg/kg	21	1	5%	7.4E-03	8.4E-02	1.7E-01	1.7E-01	NE	NE	1.7E-01	2.2E-01	No
Benzoic Acid	65-85-0	mg/kg	21	2	10%	1.5E-01	1.7E+00	1.6E-01	2.4E-01	NE	NE	2.0E-01	3.3E-01	No
Cadmium	7440-43-9	mg/kg	13	13	100%	N/A	N/A	8.9E-02	6.4E-01	3.4E-01	NE	3.5E-01	5.2E-01	Yes
Carbazole	86-74-8	mg/kg	21	1	5%	1.3E-02	1.5E-01	8.0E-02	8.0E-02	NE	NE	8.0E-02	2.2E+00	No
Chromium	7440-47-3	mg/kg	13	13	100%	N/A	N/A	8.2E+00	1.7E+01	1.4E+01	NE	1.5E+01	1.6E+01	Yes
Chrysene	218-01-9	mg/kg	21	4	19%	8.2E-03	9.4E-02	9.2E-03	4.0E-01	NE	NE	1.2E-02	2.2E-01	Yes
Copper	7440-50-8	mg/kg	13	13	100%	N/A	N/A	7.7E+00	2.0E+01	1.3E+01	NE	1.2E+01	1.6E+01	Yes
cPAH SCUM TEFs	cPAH	mg/kg	21	21	100%	N/A	N/A	1.1E-02	6.0E-01	4.8E-02	NE	7.0E-03	2.2E-01	Yes
cPAH EPA RPFs	cPAH	mg/kg	21	21	100%	N/A	N/A	1.1E-02	6.0E-01	6.2E-02	NE	1.3E-02	2.2E-01	Yes
Dibenzo[a,h]anthracene	53-70-3	mg/kg	21	1	5%	1.2E-02	1.3E-01	5.9E-02	5.9E-02	NE	NE	5.9E-02	2.2E-01	No
Dibenzofuran	132-64-9	mg/kg	21	1	5%	1.4E-02	1.5E-01	3.7E-02	3.7E-02	NE	NE	3.7E-02	2.2E+00	No
Diesel Fuel	68334-30-5	mg/kg	21	15	71%	9.0E+00	9.9E+00	9.9E+00	2.2E+02	5.9E+01	NE	5.2E+01	5.8E+01	Yes
Fluoranthene	206-44-0	mg/kg	21	4	19%	7.5E-03	8.5E-02	1.1E-02	8.4E-01	NE	NE	1.7E-02	2.2E-01	Yes
Fluorene	86-73-7	mg/kg	21	1	5%	6.7E-03	7.7E-02	5.3E-02	5.3E-02	NE	NE	5.3E-02	2.2E-01	No
Indeno[1,2,3-cd]pyrene	193-39-5	mg/kg	21	1	5%	1.2E-02	1.3E-01	2.5E-01	2.5E-01	NE	NE	2.5E-01	2.2E-01	Yes
Lead	7439-92-1	mg/kg	13	13	100%	N/A	N/A	3.6E+00	1.4E+01	8.3E+00	NE	8.3E+00	8.6E+00	Yes
Mercury	7439-97-6	mg/kg	13	11	85%	1.1E-02	1.1E-02	1.3E-02	3.5E-02	2.0E-02	NE	2.1E-02	5.8E-02	No
Naphthalene	91-20-3	mg/kg	21	1	5%	1.0E-02	1.2E-01	2.1E-02	2.1E-02	NE	NE	2.1E-02	2.2E-01	No
Nickel	7440-02-0	mg/kg	13	13	100%	N/A	N/A	9.3E+00	1.7E+01	1.4E+01	NE	1.5E+01	1.5E+01	Yes
Phenanthrene	85-01-8	mg/kg	21	3	14%	8.2E-03	9.4E-02	1.7E-02	5.1E-01	NE	NE	1.7E-02	2.2E-01	Yes
Pyrene	129-00-0	mg/kg	21	8	38%	8.1E-03	9.2E-02	1.1E-02	6.2E-01	NE	4.8E-02	2.3E-02	2.2E-01	Yes
Selenium	7782-49-2	mg/kg	13	12	92%	1.1E-01	1.1E-01	1.2E-01	4.7E-01	2.5E-01	NE	2.5E-01	4.5E-01	Yes
Silver	7440-22-4	mg/kg	13	5	38%	1.8E-01	3.0E-01	2.2E-01	4.1E-01	NE	2.1E-01	2.7E-01	4.1E-01	No
Sulfide	18496-25-8	mg/kg	13	4	31%	3.7E+01	6.0E+01	5.2E+01	3.2E+02	NE	5.9E+01	1.6E+02	1.8E+02	Yes
TPH as Motor Oil	TPHMO	mg/kg	21	21	100%	N/A	N/A	1.2E+01	9.1E+02	1.9E+02	NE	7.8E+01	3.2E+02	Yes
Zinc	7440-66-6	mg/kg	13	13	100%	N/A	N/A	3.2E+01	1.2E+02	8.5E+01	NE	9.1E+01	1.1E+02	Yes

Notes:

CAS = Chemical Abstracts Service

cPAH = carcinogenic polycyclic aromatic hydrocarbon

EPC = exposure point concentration

KM = Kaplan Meier Method

mg/kg = milligram(s) per kilogram

N/A = not available or not applicable

NE = not evaluated

ng/mg = nanogram(s) per kilogram

ROS = regression on order statistics

RPF = relative potency factor

TEF = toxicity equivalency factor

TEQ = toxicity equivalence

TPH = total petroleum hydrocarbons

Attachment L-1 Summary Statistics for Sediment
BNSF Wishram Railyard
Human Health Risk

Analyte	EPC	EPC Basis
1-Methylnaphthalene	6.4E-03	Maximum Detected Concentration
2,3,7,8-TCDD TEQ	7.8E-01	Mean (Kaplan Meier Method)
2-Methylnaphthalene	9.5E-03	Maximum Detected Concentration
3 & 4-Methylphenol (m,p-Cresols)	2.0E-02	Maximum Detected Concentration
Acenaphthene	6.0E-02	Maximum Detected Concentration
Ammonia, as N	2.0E+01	Mean (Kaplan Meier Method)
Anthracene	1.3E-01	Maximum Detected Concentration
Arsenic	2.8E+00	Mean (Kaplan Meier Method)
Benzo[a]anthracene	See cPAH TEQ	See cPAH TEQ
Benzo[a]pyrene	2.8E-02	Lognormal ROS Mean
Benzo[b]fluoranthene	See cPAH TEQ	See cPAH TEQ
Benzo[g,h,i]perylene	2.4E-01	Maximum Detected Concentration
Benzo[k]fluoranthene	See cPAH TEQ	See cPAH TEQ
Benzoic Acid	2.4E-01	Maximum Detected Concentration
Cadmium	3.4E-01	Mean (Kaplan Meier Method)
Carbazole	8.0E-02	Maximum Detected Concentration
Chromium	1.4E+01	Mean (Kaplan Meier Method)
Chrysene	See cPAH TEQ	See cPAH TEQ
Copper	1.3E+01	Mean (Kaplan Meier Method)
cPAH SCUM TEFs	4.8E-02	Mean (Kaplan Meier Method)
cPAH EPA RPFs	6.2E-02	Mean (Kaplan Meier Method)
Dibenzo[a,h]anthracene	See cPAH TEQ	See cPAH TEQ
Dibenzofuran	3.7E-02	Maximum Detected Concentration
Diesel Fuel	5.9E+01	Mean (Kaplan Meier Method)
Fluoranthene	8.4E-01	Maximum Detected Concentration
Fluorene	5.3E-02	Maximum Detected Concentration
Indeno[1,2,3-cd]pyrene	See cPAH TEQ	See cPAH TEQ
Lead	8.3E+00	Mean (Kaplan Meier Method)
Mercury	2.0E-02	Mean (Kaplan Meier Method)
Naphthalene	2.1E-02	Maximum Detected Concentration
Nickel	1.4E+01	Mean (Kaplan Meier Method)
Phenanthrene	5.1E-01	Maximum Detected Concentration
Pyrene	4.8E-02	Lognormal ROS Mean
Selenium	2.5E-01	Mean (Kaplan Meier Method)
Silver	2.1E-01	Lognormal ROS Mean
Sulfide	5.9E+01	Lognormal ROS Mean
TPH as Motor Oil	1.9E+02	Mean (Kaplan Meier Method)
Zinc	8.5E+01	Mean (Kaplan Meier Method)

Notes:
CAS = Chemical Abstracts Service
cPAH = carcinogenic polycyclic aromati
EPC = exposure point concentration
KM = Kaplan Meier Method
mg/kg = milligram(s) per kilogram
N/A = not available or not applicable
NE = not evaluated
ng/mg = nanogram(s) per kilogram
ROS = regression on order statistics
RPF = relative potency factor
TEF = toxicity equivalency factor
TEQ = toxicity equivalence
TPH = total petroleum hydrocarbons

Attachment L-2
ProUCL Input and Output

ProUCL Input Stats

SYS_LOC_CODE	Sample Name	Sample Date	Units	1-Methylnaphthalene	d_1-Methylnaphthalene	2,3,7,8-TCDD TEQ	d_2,3,7,8-TCDD TEQ	2-Methylnaphthalene	d_2-Methylnaphthalene	3 & 4-Methylphenol (m,p-Cresols)
D160	BNSF-D160-042822-0-5	28 Apr 2022	mg/kg	0.0603	0	0.632742	1	0.0611	0	0.147
E320	BNSF-E320-042822-0-4	28 Apr 2022	mg/kg	0.059	0	4.250768	1	0.0599	0	0.144
E380	BNSF-E380-042822-0-4	28 Apr 2022	mg/kg	0.00565	0	0.441673	1	0.00894	1	0.0138
E460	BNSF-E460-042922-0-4	29 Apr 2022	mg/kg	0.0599	0	0.495846	1	0.0607	0	0.146
EF240	BNSF-EF240-SC-1.0-2.0-111022	10 Nov 2022	mg/kg	0.00591	0			0.00599	0	0.0144
EF240	BNSF-EF240-SC-1.0-2.0-111022-1	10 Nov 2022	mg/kg							
G000	BNSF-G000-SC-1.5-2.5-110322	03 Nov 2022	mg/kg	0.00581	0			0.00589	0	0.0142
G020	BNSF-G020-SC-0.0-1.0-110422	04 Nov 2022	mg/kg	0.00623	0			0.00632	0	0.0152
H360	BNSF-H360-042922-0-8	29 Apr 2022	mg/kg	0.00549	0	0.42533	1	0.00556	0	0.0134
HN300	BNSF-HN300-SC-1.0-2.0-111322	13 Nov 2022	mg/kg	0.00563	0			0.00571	0	0.0137
I120	BNSF-I120-042922-0-6	29 Apr 2022	mg/kg	0.0057	0	0.443176	1	0.00706	1	0.0139
I500	BNSF-I500-SC-0.0-0.8-111322	13 Nov 2022	mg/kg	0.00529	0			0.00536	0	0.0129
J060	BNSF-J060-SC-0.5-1.5-111422	14 Nov 2022	mg/kg	0.00586	0			0.00595	0	0.0143
K200	BNSF-K200-SC-0.0-0.4-110922	09 Nov 2022	mg/kg	0.00538	0			0.00546	0	0.0131
L320	BNSF-L320-042922-0-2	29 Apr 2022	mg/kg	0.0106	0	0.437051	1	0.0108	0	0.0259
O280	BNSF-O280-SC-0.0-0.7-111322	13 Nov 2022	mg/kg	0.00559	0			0.00567	0	0.0137
SG01	BNSF-SG01-041922-0-10	19 Apr 2022	mg/kg							
SG01	FD01-041922-0-10	19 Apr 2022	mg/kg	0.00577	0	0.476118	1	0.00585	0	0.0141
SG02	BNSF-SG02-041922-0-10	19 Apr 2022	mg/kg	0.0169	0	0.81129	1	0.0171	0	0.0413
SG03	BNSF-SG03-042722-0-5.5	27 Apr 2022	mg/kg	0.0064	1	0.427399	1	0.00871	1	0.0138
SG11	BNSF-SG11-042822-0-5	28 Apr 2022	mg/kg	0.00623	1	0.442967	1	0.00945	1	0.0135
SG13	BNSF-SG13-042522-0-1.5	25 Apr 2022	mg/kg	0.00536	0	0.429355	1	0.00544	0	0.0131
SG23	BNSF-SG23-042122-0-6	21 Apr 2022	mg/kg	0.00538	0	0.421371	1	0.00546	0	0.0195

SYS_LOC_CODE	Sample Name	Sample Date	d_3 & 4-Methylphenol (m,p-Cresols)	Acenaphthene	d_Acenaphthene	Ammonia, as N	d_Ammonia, as N	Anthracene	d_Anthracene	Arsenic	d_Arsenic
D160	BNSF-D160-042822-0-5	28 Apr 2022	0	0.0762	0	20	1	0.0839	0	2.7	1
E320	BNSF-E320-042822-0-4	28 Apr 2022	0	0.0747	0	17	1	0.0822	0	2.1	1
E380	BNSF-E380-042822-0-4	28 Apr 2022	0	0.00715	0	20	1	0.00786	0	2.2	1
E460	BNSF-E460-042922-0-4	29 Apr 2022	0	0.0758	0	30	1	0.0834	0	2.6	1
EF240	BNSF-EF240-SC-1.0-2.0-111022	10 Nov 2022	0	0.00748	0			0.00823	0		
EF240	BNSF-EF240-SC-1.0-2.0-111022-1	10 Nov 2022									
G000	BNSF-G000-SC-1.5-2.5-110322	03 Nov 2022	0	0.00735	0			0.00809	0		
G020	BNSF-G020-SC-0.0-1.0-110422	04 Nov 2022	0	0.00789	0			0.00868	0		
H360	BNSF-H360-042922-0-8	29 Apr 2022	0	0.00694	0	20	1	0.00764	0	4.7	1
HN300	BNSF-HN300-SC-1.0-2.0-111322	13 Nov 2022	0	0.00712	0			0.00783	0		
I120	BNSF-I120-042922-0-6	29 Apr 2022	0	0.00721	0	20	1	0.00793	0	2.9	1
I500	BNSF-I500-SC-0.0-0.8-111322	13 Nov 2022	0	0.00669	0			0.00736	0		
J060	BNSF-J060-SC-0.5-1.5-111422	14 Nov 2022	0	0.00742	0			0.00816	0		
K200	BNSF-K200-SC-0.0-0.4-110922	09 Nov 2022	0	0.00681	0			0.00749	0		
L320	BNSF-L320-042922-0-2	29 Apr 2022	0	0.0135	0	10	1	0.0148	0	2.6	1
O280	BNSF-O280-SC-0.0-0.7-111322	13 Nov 2022	0	0.00708	0			0.00779	0		
SG01	BNSF-SG01-041922-0-10	19 Apr 2022								2.1	1
SG01	FD01-041922-0-10	19 Apr 2022	0	0.0073	0	15	1	0.00803	0		
SG02	BNSF-SG02-041922-0-10	19 Apr 2022	0	0.0214	0	40	1	0.0236	0	3.8	1
SG03	BNSF-SG03-042722-0-5.5	27 Apr 2022	0	0.0604	1	14	1	0.126	1	3.4	1
SG11	BNSF-SG11-042822-0-5	28 Apr 2022	0	0.007	0	20	1	0.0077	0	2.6	1
SG13	BNSF-SG13-042522-0-1.5	25 Apr 2022	0	0.00679	0	12	1	0.00746	0	2.1	1
SG23	BNSF-SG23-042122-0-6	21 Apr 2022	1	0.00681	0	24	1	0.00749	0	2.4	1

SYS_LOC_CODE	Sample Name	Sample Date	Benzo[a] anthracene	d_Benzo[a] anthracene	Benzo[a] pyrene	d_Benzo[a] pyrene	Benzo[b] fluoranthene	d_Benzo[b] fluoranthene	Benzo[g,h,i] perylene	d_Benzo[g,h,i] perylene	Benzo[k] fluoranthene	d_Benzo[k] fluoranthene
D160	BNSF-D160-042822-0-5	28 Apr 2022	0.083	0	0.0876	0	0.0878	0	0.0861	0	0.0837	0
E320	BNSF-E320-042822-0-4	28 Apr 2022	0.0813	0	0.103	1	0.086	0	0.0844	0	0.082	0
E380	BNSF-E380-042822-0-4	28 Apr 2022	0.00779	0	0.00821	0	0.00824	0	0.00808	0	0.00785	0
E460	BNSF-E460-042922-0-4	29 Apr 2022	0.0825	0	0.087	0	0.0873	0	0.0856	0	0.0832	0
EF240	BNSF-EF240-SC-1.0-2.0-111022	10 Nov 2022	0.00814	0	0.00859	0	0.00862	0	0.00845	0	0.00821	0
EF240	BNSF-EF240-SC-1.0-2.0-111022-1	10 Nov 2022										
G000	BNSF-G000-SC-1.5-2.5-110322	03 Nov 2022	0.008	0	0.00844	0	0.00847	0	0.0083	0	0.00807	0
G020	BNSF-G020-SC-0.0-1.0-110422	04 Nov 2022	0.0116	1	0.0119	1	0.0106	1	0.00891	0	0.00866	0
H360	BNSF-H360-042922-0-8	29 Apr 2022	0.00756	0	0.00797	0	0.008	0	0.00784	0	0.00762	0
HN300	BNSF-HN300-SC-1.0-2.0-111322	13 Nov 2022	0.00778	1	0.00818	0	0.00847	1	0.00804	0	0.00782	0
I120	BNSF-I120-042922-0-6	29 Apr 2022	0.00785	0	0.00828	0	0.00831	0	0.00815	0	0.00792	0
I500	BNSF-I500-SC-0.0-0.8-111322	13 Nov 2022	0.00729	0	0.00769	0	0.00771	0	0.00756	0	0.00735	0
J060	BNSF-J060-SC-0.5-1.5-111422	14 Nov 2022	0.00973	1	0.00979	1	0.0112	1	0.00838	0	0.00815	0
K200	BNSF-K200-SC-0.0-0.4-110922	09 Nov 2022	0.00741	0	0.00782	0	0.00784	0	0.00769	0	0.00748	0
L320	BNSF-L320-042922-0-2	29 Apr 2022	0.0146	0	0.0155	0	0.0155	0	0.0152	0	0.0147	0
O280	BNSF-O280-SC-0.0-0.7-111322	13 Nov 2022	0.00771	0	0.00813	0	0.00816	0	0.008	0	0.00778	0
SG01	BNSF-SG01-041922-0-10	19 Apr 2022			0.0185	1			0.0187	1		
SG01	FD01-041922-0-10	19 Apr 2022	0.00795	0			0.00841	0			0.00802	0
SG02	BNSF-SG02-041922-0-10	19 Apr 2022	0.0232	0	0.0246	0	0.0246	0	0.0242	0	0.0234	0
SG03	BNSF-SG03-042722-0-5.5	27 Apr 2022	0.384	1	0.434	1	0.463	1	0.236	1	0.168	1
SG11	BNSF-SG11-042822-0-5	28 Apr 2022	0.00762	0	0.00804	0	0.00806	0	0.00791	0	0.00769	0
SG13	BNSF-SG13-042522-0-1.5	25 Apr 2022	0.00739	0	0.00779	0	0.00782	0	0.00767	0	0.00745	0
SG23	BNSF-SG23-042122-0-6	21 Apr 2022	0.00742	0	0.00782	0	0.00785	0	0.0077	0	0.00748	0

ProUCL Input Stats

SYS_LOC_CODE	Sample Name	Sample Date	Benzoic Acid	d_Benzoic Acid	Cadmium	d_Cadmium	Carbazole	d_Carbazole	Chromium	d_Chromium	Chrysene	d_Chrysene	Copper
D160	BNSF-D160-042822-0-5	28 Apr 2022	1.67	0	0.64	1	0.146	0	15.7	1	0.0936	0	15.8
E320	BNSF-E320-042822-0-4	28 Apr 2022	1.63	0	0.47	1	0.143	0	14.7	1	0.0917	0	12
E380	BNSF-E380-042822-0-4	28 Apr 2022	0.157	0	0.36	1	0.0137	0	15.1	1	0.00878	0	10.9
E460	BNSF-E460-042922-0-4	29 Apr 2022	1.66	0	0.35	1	0.145	0	16.1	1	0.0931	0	14.5
EF240	BNSF-EF240-SC-1.0-2.0-111022	10 Nov 2022	0.164	0			0.0143	0			0.00918	0	
EF240	BNSF-EF240-SC-1.0-2.0-111022-1	10 Nov 2022											
G000	BNSF-G000-SC-1.5-2.5-110322	03 Nov 2022	0.161	0			0.014	0			0.00903	0	
G020	BNSF-G020-SC-0.0-1.0-110422	04 Nov 2022	0.173	0			0.0151	0			0.0137	1	
H360	BNSF-H360-042922-0-8	29 Apr 2022	0.158	1	0.35	1	0.0133	0	17.2	1	0.00853	0	18.3
HN300	BNSF-HN300-SC-1.0-2.0-111322	13 Nov 2022	0.156	0			0.0136	0			0.00874	0	
I120	BNSF-I120-042922-0-6	29 Apr 2022	0.158	0	0.27	1	0.0138	0	15.6	1	0.00886	0	12.3
I500	BNSF-I500-SC-0.0-0.8-111322	13 Nov 2022	0.147	0			0.0128	0			0.00822	0	
J060	BNSF-J060-SC-0.5-1.5-111422	14 Nov 2022	0.162	0			0.0142	0			0.00922	1	
K200	BNSF-K200-SC-0.0-0.4-110922	09 Nov 2022	0.149	0			0.013	0			0.00836	0	
L320	BNSF-L320-042922-0-2	29 Apr 2022	0.294	0	0.18	1	0.0257	0	12	1	0.0165	0	11.9
O280	BNSF-O280-SC-0.0-0.7-111322	13 Nov 2022	0.155	0			0.0135	0			0.00869	0	
SG01	BNSF-SG01-041922-0-10	19 Apr 2022			0.43	1							
SG01	FD01-041922-0-10	19 Apr 2022	0.16	0			0.0139	0	14	1	0.00896	0	10.7
SG02	BNSF-SG02-041922-0-10	19 Apr 2022	0.468	0	0.53	1	0.0409	0	17.3	1	0.0262	0	19.5
SG03	BNSF-SG03-042722-0-5.5	27 Apr 2022	0.156	0	0.28	1	0.08	1	12.9	1	0.4	1	18.9
SG11	BNSF-SG11-042822-0-5	28 Apr 2022	0.238	1	0.28	1	0.0134	0	14.6	1	0.0101	1	12.2
SG13	BNSF-SG13-042522-0-1.5	25 Apr 2022	0.149	0	0.089	1	0.013	0	8.2	1	0.00833	0	7.7
SG23	BNSF-SG23-042122-0-6	21 Apr 2022	0.149	0	0.17	1	0.013	0	9.9	1	0.00837	0	9

ProUCL Input Stats

SYS_LOC_CODE	Sample Name	Sample Date	d_Copper	cPAH EPA RPF	d_cPAH EPA RPF	cPAH_SCUM TEF	d_cPAH_SCUM TEF	Dibenzo[a,h] anthracene	d_Dibenzo[a,h] anthracene	Dibenzofuran	d_Dibenzofuran	Diesel Fuel	d_Diesel Fuel
D160	BNSF-D160-042822-0-5	28 Apr 2022	1	0.1249553	1	0.070193	1	0.131	0	0.154	0	52.1	1
E320	BNSF-E320-042822-0-4	28 Apr 2022	1	0.18232085	1	0.1288235	1	0.128	0	0.151	0	223	1
E380	BNSF-E380-042822-0-4	28 Apr 2022	1	0.01167514	1	0.0065779	1	0.0122	0	0.0145	0	9.7	0
E460	BNSF-E460-042922-0-4	29 Apr 2022	1	0.12405255	1	0.0697155	1	0.13	0	0.153	0	38.8	1
EF240	BNSF-EF240-SC-1.0-2.0-111022	10 Nov 2022						0.0128	0	0.0151	0		
EF240	BNSF-EF240-SC-1.0-2.0-111022-1	10 Nov 2022		0.0125192	1	0.0070445	1					151	1
G000	BNSF-G000-SC-1.5-2.5-110322	03 Nov 2022		0.01202837	1	0.00676215	1	0.0126	0	0.0149	0	9.6	0
G020	BNSF-G020-SC-0.0-1.0-110422	04 Nov 2022		0.021617	1	0.016055	1	0.0135	0	0.0159	0	154	1
H360	BNSF-H360-042922-0-8	29 Apr 2022	1	0.01136037	1	0.00638665	1	0.0119	0	0.014	0	31	1
HN300	BNSF-HN300-SC-1.0-2.0-111322	13 Nov 2022		0.01247847	1	0.0073797	1	0.0122	0	0.0144	0	9	0
I120	BNSF-I120-042922-0-6	29 Apr 2022	1	0.01177203	1	0.0066333	1	0.0123	0	0.0146	0	32.2	1
I500	BNSF-I500-SC-0.0-0.8-111322	13 Nov 2022		0.01097086	1	0.0061636	1	0.0115	0	0.0135	0	199	1
J060	BNSF-J060-SC-0.5-1.5-111422	14 Nov 2022		0.01893297	1	0.0136677	1	0.0127	0	0.015	0	9.9	0
K200	BNSF-K200-SC-0.0-0.4-110922	09 Nov 2022		0.01115908	1	0.0062683	1	0.0117	0	0.0138	0	14.7	1
L320	BNSF-L320-042922-0-2	29 Apr 2022	1	0.02205675	1	0.0123975	1	0.0231	0	0.0272	0	136	1
O280	BNSF-O280-SC-0.0-0.7-111322	13 Nov 2022		0.01157175	1	0.00651595	1	0.0121	0	0.0143	0	9.1	0
SG01	BNSF-SG01-041922-0-10	19 Apr 2022		0.03398895	1	0.0235395	1						
SG01	FD01-041922-0-10	19 Apr 2022	1					0.0125	0	0.0148	0	56.9	1
SG02	BNSF-SG02-041922-0-10	19 Apr 2022	1	0.0350351	1	0.019691	1	0.0367	0	0.0433	0	53.1	1
SG03	BNSF-SG03-042722-0-5.5	27 Apr 2022	1	0.60418	1	0.56998	1	0.0588	1	0.0365	1	21.4	1
SG11	BNSF-SG11-042822-0-5	28 Apr 2022	1	0.01146255	1	0.0064995	1	0.012	0	0.0142	0	9.9	1
SG13	BNSF-SG13-042522-0-1.5	25 Apr 2022	1	0.01108692	1	0.00623965	1	0.0116	0	0.0137	0	9.5	0
SG23	BNSF-SG23-042122-0-6	21 Apr 2022	1	0.01116009	1	0.00626935	1	0.0117	0	0.0138	0	12.9	1

ProUCL Input Stats

SYS_LOC_CODE	Sample Name	Sample Date	Fluoranthene	d_Fluoranthene	Fluorene	d_Fluorene	Indeno[1,2,3-cd] pyrene	d_Indeno[1,2,3-cd] pyrene	Lead	d_Lead	Mercury	d_Mercury
D160	BNSF-D160-042822-0-5	28 Apr 2022	0.085	0	0.0767	0	0.133	0	8.9	1	0.027	1
E320	BNSF-E320-042822-0-4	28 Apr 2022	0.0833	0	0.0751	0	0.13	0	8.6	1	0.024	1
E380	BNSF-E380-042822-0-4	28 Apr 2022	0.00797	0	0.00719	0	0.0125	0	6.9	1	0.016	1
E460	BNSF-E460-042922-0-4	29 Apr 2022	0.0845	0	0.0762	0	0.132	0	8.6	1	0.021	1
EF240	BNSF-EF240-SC-1.0-2.0-111022	10 Nov 2022	0.00834	0	0.00752	0	0.0131	0				
EF240	BNSF-EF240-SC-1.0-2.0-111022-1	10 Nov 2022										
G000	BNSF-G000-SC-1.5-2.5-110322	03 Nov 2022	0.0082	0	0.00739	0	0.0128	0				
G020	BNSF-G020-SC-0.0-1.0-110422	04 Nov 2022	0.0131	1	0.00793	0	0.0138	0				
H360	BNSF-H360-042922-0-8	29 Apr 2022	0.00774	0	0.00698	0	0.0121	0	14.3	1	0.017	1
HN300	BNSF-HN300-SC-1.0-2.0-111322	13 Nov 2022	0.0108	1	0.00716	0	0.0124	0				
I120	BNSF-I120-042922-0-6	29 Apr 2022	0.00804	0	0.00725	0	0.0126	0	8.3	1	0.016	1
I500	BNSF-I500-SC-0.0-0.8-111322	13 Nov 2022	0.00746	0	0.00673	0	0.0117	0				
J060	BNSF-J060-SC-0.5-1.5-111422	14 Nov 2022	0.0206	1	0.00746	0	0.013	0				
K200	BNSF-K200-SC-0.0-0.4-110922	09 Nov 2022	0.00759	0	0.00685	0	0.0119	0				
L320	BNSF-L320-042922-0-2	29 Apr 2022	0.015	0	0.0135	0	0.0234	0	8.2	1	0.016	1
O280	BNSF-O280-SC-0.0-0.7-111322	13 Nov 2022	0.00789	0	0.00712	0	0.0124	0				
SG01	BNSF-SG01-041922-0-10	19 Apr 2022										
SG01	FD01-041922-0-10	19 Apr 2022	0.00814	0	0.00734	0	0.0127	0	7.4	1	0.022	1
SG02	BNSF-SG02-041922-0-10	19 Apr 2022	0.0238	0	0.0214	0	0.0373	0	12.3	1	0.035	1
SG03	BNSF-SG03-042722-0-5.5	27 Apr 2022	0.844	1	0.0528	1	0.246	1	8.8	1	0.028	1
SG11	BNSF-SG11-042822-0-5	28 Apr 2022	0.0078	0	0.00704	0	0.0122	0	7.4	1	0.013	1
SG13	BNSF-SG13-042522-0-1.5	25 Apr 2022	0.00757	0	0.00682	0	0.0118	0	3.6	1	0.011	0
SG23	BNSF-SG23-042122-0-6	21 Apr 2022	0.0076	0	0.00685	0	0.0119	0	5.2	1	0.011	0

SYS_LOC_CODE	Sample Name	Sample Date	Naphthalene	d_Naphthalene	Nickel	d_Nickel	Phenanthrene	d_Phenanthrene	Pyrene	d_Pyrene	Selenium	d_Selenium	Silver
D160	BNSF-D160-042822-0-5	28 Apr 2022	0.118	0	13.9	1	0.0935	0	0.0917	0	0.34	1	0.19
E320	BNSF-E320-042822-0-4	28 Apr 2022	0.116	0	14.6	1	0.0916	0	0.184	1	0.29	1	0.18
E380	BNSF-E380-042822-0-4	28 Apr 2022	0.0111	0	13.4	1	0.00877	0	0.00859	0	0.22	1	0.19
E460	BNSF-E460-042922-0-4	29 Apr 2022	0.118	0	14.8	1	0.0929	0	0.0973	1	0.31	1	0.21
EF240	BNSF-EF240-SC-1.0-2.0-111022	10 Nov 2022	0.0116	0			0.0165	1	0.0153	1			
EF240	BNSF-EF240-SC-1.0-2.0-111022-1	10 Nov 2022											
G000	BNSF-G000-SC-1.5-2.5-110322	03 Nov 2022	0.0114	0			0.00901	0	0.00884	0			
G020	BNSF-G020-SC-0.0-1.0-110422	04 Nov 2022	0.0122	0			0.00967	0	0.0272	1			
H360	BNSF-H360-042922-0-8	29 Apr 2022	0.0108	0	16.2	1	0.00851	0	0.00835	0	0.27	1	0.21
HN300	BNSF-HN300-SC-1.0-2.0-111322	13 Nov 2022	0.011	0			0.00873	0	0.0112	1			
I120	BNSF-I120-042922-0-6	29 Apr 2022	0.0112	0	15.3	1	0.00884	0	0.00867	0	0.24	1	0.22
I500	BNSF-I500-SC-0.0-0.8-111322	13 Nov 2022	0.0104	0			0.00821	0	0.00805	0			
J060	BNSF-J060-SC-0.5-1.5-111422	14 Nov 2022	0.0115	0			0.0172	1	0.0195	1			
K200	BNSF-K200-SC-0.0-0.4-110922	09 Nov 2022	0.0106	0			0.00835	0	0.00818	0			
L320	BNSF-L320-042922-0-2	29 Apr 2022	0.0208	0	13.5	1	0.0165	0	0.0162	0	0.22	1	0.4
O280	BNSF-O280-SC-0.0-0.7-111322	13 Nov 2022	0.011	0			0.00868	0	0.00851	0			
SG01	BNSF-SG01-041922-0-10	19 Apr 2022									0.18	1	0.27
SG01	FD01-041922-0-10	19 Apr 2022	0.0113	0	13	1	0.00895	0	0.00877	0			
SG02	BNSF-SG02-041922-0-10	19 Apr 2022	0.0331	0	16.8	1	0.0262	0	0.0258	0	0.47	1	0.3
SG03	BNSF-SG03-042722-0-5.5	27 Apr 2022	0.0211	1	15.3	1	0.507	1	0.624	1	0.21	1	0.2
SG11	BNSF-SG11-042822-0-5	28 Apr 2022	0.0109	0	14.8	1	0.00858	0	0.0142	1	0.25	1	0.41
SG13	BNSF-SG13-042522-0-1.5	25 Apr 2022	0.0105	0	9.3	1	0.00832	0	0.00816	0	0.11	0	0.26
SG23	BNSF-SG23-042122-0-6	21 Apr 2022	0.0106	0	11.1	1	0.00835	0	0.00819	0	0.12	1	0.22

SYS_LOC_CODE	Sample Name	Sample Date	d_Silver	Sulfide	d_Sulfide	TPH as Motor Oil	d_TPH as Motor Oil	Zinc	d_Zinc
D160	BNSF-D160-042822-0-5	28 Apr 2022	0	220	1	215	1	102	1
E320	BNSF-E320-042822-0-4	28 Apr 2022	0	318	1	630	1	95.9	1
E380	BNSF-E380-042822-0-4	28 Apr 2022	0	39.8	0	25.1	1	85.9	1
E460	BNSF-E460-042922-0-4	29 Apr 2022	0	101	1	112	1	99.2	1
EF240	BNSF-EF240-SC-1.0-2.0-111022	10 Nov 2022							
EF240	BNSF-EF240-SC-1.0-2.0-111022-1	10 Nov 2022				241	1		
G000	BNSF-G000-SC-1.5-2.5-110322	03 Nov 2022				24.4	1		
G020	BNSF-G020-SC-0.0-1.0-110422	04 Nov 2022				392	1		
H360	BNSF-H360-042922-0-8	29 Apr 2022	0	38.6	0	107	1	107	1
HN300	BNSF-HN300-SC-1.0-2.0-111322	13 Nov 2022				46	1		
I120	BNSF-I120-042922-0-6	29 Apr 2022	0	51.7	1	70	1	90.6	1
I500	BNSF-I500-SC-0.0-0.8-111322	13 Nov 2022				905	1		
J060	BNSF-J060-SC-0.5-1.5-111422	14 Nov 2022				29.9	1		
K200	BNSF-K200-SC-0.0-0.4-110922	09 Nov 2022				58.8	1		
L320	BNSF-L320-042922-0-2	29 Apr 2022	1	37.4	0	503	1	69	1
O280	BNSF-O280-SC-0.0-0.7-111322	13 Nov 2022				12.1	1		
SG01	BNSF-SG01-041922-0-10	19 Apr 2022	1	40.6	0				
SG01	FD01-041922-0-10	19 Apr 2022				167	1	100	1
SG02	BNSF-SG02-041922-0-10	19 Apr 2022	0	59.5	0	291	1	120	1
SG03	BNSF-SG03-042722-0-5.5	27 Apr 2022	0	39.7	0	77.6	1	60.2	1
SG11	BNSF-SG11-042822-0-5	28 Apr 2022	1	39	0	35.4	1	83.2	1
SG13	BNSF-SG13-042522-0-1.5	25 Apr 2022	1	37.8	0	28.5	1	32.3	1
SG23	BNSF-SG23-042122-0-6	21 Apr 2022	1	37.9	0	37.4	1	65.3	1

	General Statistics on Uncensored Data
Date/Time of Computation	ProUCL 5.2 7/26/2023 12:03:02 PM
User Selected Options	
From File	ProUCL_Input_GenStats_Sediment.xls
Full Precision	OFF

From File: ProUCL_Input_GenStats_Sediment.xls

General Statistics for Censored Data Set (with NDs) using Kaplan Meier Method

Variable	NumObs	# Missing	Num Ds	NumNDs	% NDs	Min ND	Max ND	KM Mean	KM Var	KM SD	KM CV
1-Methylnaphthalene	21	2	2	19	90.48%	0.00529	0.0603	0.00542	1.1582E-7	3.4032E-4	0.0628
2,3,7,8-TCDD TEQ	13	10	13	0	0.00%	N/A	N/A	0.78	1.1	1.049	1.345
2-Methylnaphthalene	21	2	4	17	80.95%	0.00536	0.0611	0.00616	2.0965E-6	0.00145	0.235
ylphenol (m,p-Cresols)	21	2	1	20	95.24%	0.0129	0.147	0.0133	2.5523E-6	0.0016	0.12
Acenaphthene	21	2	1	20	95.24%	0.00669	0.0762	0.00967	1.5136E-4	0.0123	1.272
Ammonia, as N	13	10	13	0	0.00%	N/A	N/A	20.15	62.47	7.904	0.392
Anthracene	21	2	1	20	95.24%	0.00736	0.0839	0.013	6.3834E-4	0.0253	1.942
Arsenic	13	10	13	0	0.00%	N/A	N/A	2.785	0.591	0.769	0.276
Benzo[a]anthracene	21	2	4	17	80.95%	0.00729	0.083	0.0257	0.00642	0.0801	3.117
Benzo[a]pyrene	21	2	5	16	76.19%	0.00769	0.0876	0.0335	0.00843	0.0918	2.738
Benzo[b]fluoranthene	21	2	4	17	80.95%	0.00771	0.0878	0.0298	0.00938	0.0969	3.245
Benzo[g,h,i]perylene	21	2	2	19	90.48%	0.00756	0.0861	0.0191	0.00236	0.0486	2.543
Benzo[k]fluoranthene	21	2	1	20	95.24%	0.00735	0.0837	0.015	0.00117	0.0342	2.281
Benzoic Acid	21	2	2	19	90.48%	0.147	1.67	0.154	4.8376E-4	0.022	0.143
Cadmium	13	10	13	0	0.00%	N/A	N/A	0.338	0.0234	0.153	0.452
Carbazole	21	2	1	20	95.24%	0.0128	0.146	0.0165	2.3694E-4	0.0154	0.931
Chromium	13	10	13	0	0.00%	N/A	N/A	14.1	7.382	2.717	0.193
Chrysene	21	2	4	17	80.95%	0.00822	0.0936	0.0274	0.00694	0.0833	3.04
Copper	13	10	13	0	0.00%	N/A	N/A	13.36	14.22	3.771	0.282
cPAH EPA RPF	21	2	21	0	0.00%	N/A	N/A	0.0622	0.0177	0.133	2.137
cPAH_SCUM TEF	21	2	21	0	0.00%	N/A	N/A	0.0478	0.0153	0.124	2.588
Dibenzo[a,h]anthracene	21	2	1	20	95.24%	0.0115	0.131	0.0141	1.1739E-4	0.0108	0.767
Dibenzofuran	21	2	1	20	95.24%	0.0135	0.154	0.0149	2.9287E-5	0.00541	0.364
Diesel Fuel	21	2	15	6	28.57%	9	9.9	59.05	4515	67.2	1.138
Fluoranthene	21	2	4	17	80.95%	0.00746	0.085	0.0487	0.0316	0.178	3.656
Fluorene	21	2	1	20	95.24%	0.00673	0.0767	0.00929	1.1136E-4	0.0106	1.136
Indeno[1,2,3-cd]pyrene	21	2	1	20	95.24%	0.0117	0.133	0.0229	0.00249	0.0499	2.183
Lead	13	10	13	0	0.00%	N/A	N/A	8.346	7.338	2.709	0.325
Mercury	13	10	11	2	15.38%	0.011	0.011	0.0198	4.8178E-5	0.00694	0.351
Naphthalene	21	2	1	20	95.24%	0.0104	0.118	0.011	6.3385E-6	0.00252	0.228
Nickel	13	10	13	0	0.00%	N/A	N/A	14	4.152	2.038	0.146
Phenanthrene	21	2	3	18	85.71%	0.00821	0.0935	0.033	0.0112	0.106	3.214
Pyrene	21	2	8	13	61.90%	0.00805	0.0917	0.0525	0.018	0.134	2.551
Selenium	13	10	12	1	7.69%	0.11	0.11	0.248	0.00823	0.0907	0.365
Silver	13	10	5	8	61.54%	0.18	0.3	0.232	0.00641	0.0801	0.345
Sulfide	13	10	4	9	69.23%	37.4	59.5	79.15	7207	84.9	1.073
TPH as Motor Oil	21	2	21	0	0.00%	N/A	N/A	190.9	56033	236.7	1.24
Zinc	13	10	13	0	0.00%	N/A	N/A	85.43	551.1	23.47	0.275

General Statistics for Raw Data Sets using Detected Data Only

Variable	NumObs	# Missing	Minimum	Maximum	Mean	Median	Var	SD	MAD/0.675	Skewness	CV

1-Methylnaphthalene	2	2	0.00623	0.0064	0.00632	0.00632	1.4450E-8	1.2021E-4	1.2602E-4	N/A	0.019
2,3,7,8-TCDD TEQ	13	10	0.421	4.251	0.78	0.443	1.1	1.049	0.0261	3.536	1.345
2-Methylnaphthalene	4	2	0.00706	0.00945	0.00854	0.00883	1.0691E-6	0.00103	5.4855E-4	-1.459	0.121
hylphenol (m,p-Cresols)	1	2	0.0195	0.0195	0.0195	0.0195	N/A	N/A	0	N/A	N/A
Acenaphthene	1	2	0.0604	0.0604	0.0604	0.0604	N/A	N/A	0	N/A	N/A
Ammonia, as N	13	10	10	40	20.15	20	62.47	7.904	5.93	1.364	0.392
Anthracene	1	2	0.126	0.126	0.126	0.126	N/A	N/A	0	N/A	N/A
Arsenic	13	10	2.1	4.7	2.785	2.6	0.591	0.769	0.593	1.531	0.276
Benzo[a]anthracene	4	2	0.00778	0.384	0.103	0.0107	0.035	0.187	0.00283	2	1.812
Benzo[a]pyrene	5	2	0.00979	0.434	0.115	0.0185	0.0332	0.182	0.0129	2.004	1.579
Benzo[b]fluoranthene	4	2	0.00847	0.463	0.123	0.0109	0.0513	0.226	0.00202	2	1.836
Benzo[g,h,i]perylene	2	2	0.0187	0.236	0.127	0.127	0.0236	0.154	0.161	N/A	1.207
Benzo[k]fluoranthene	1	2	0.168	0.168	0.168	0.168	N/A	N/A	0	N/A	N/A
Benzoic Acid	2	2	0.158	0.238	0.198	0.198	0.0032	0.0566	0.0593	N/A	0.286
Cadmium	13	10	0.089	0.64	0.338	0.35	0.0234	0.153	0.119	0.345	0.452
Carbazole	1	2	0.08	0.08	0.08	0.08	N/A	N/A	0	N/A	N/A
Chromium	13	10	8.2	17.3	14.1	14.7	7.382	2.717	2.076	-1.037	0.193
Chrysene	4	2	0.00922	0.4	0.108	0.0119	0.0378	0.195	0.00332	1.999	1.797
Copper	13	10	7.7	19.5	13.36	12.2	14.22	3.771	3.41	0.424	0.282
cPAH EPA RPF	21	2	0.011	0.604	0.0622	0.0125	0.0177	0.133	0.00206	3.756	2.137
cPAH_SCUM TEF	21	2	0.00616	0.57	0.0478	0.00704	0.0153	0.124	0.00119	4.158	2.588
Dibenzo[a,h]anthracene	1	2	0.0588	0.0588	0.0588	0.0588	N/A	N/A	0	N/A	N/A
Dibenzofuran	1	2	0.0365	0.0365	0.0365	0.0365	N/A	N/A	0	N/A	N/A
Diesel Fuel	15	2	9.9	223	79.07	52.1	5270	72.6	55.45	0.922	0.918
Fluoranthene	4	2	0.0108	0.844	0.222	0.0169	0.172	0.415	0.00726	1.999	1.867
Fluorene	1	2	0.0528	0.0528	0.0528	0.0528	N/A	N/A	0	N/A	N/A
Indeno[1,2,3-cd]pyrene	1	2	0.246	0.246	0.246	0.246	N/A	N/A	0	N/A	N/A
Lead	13	10	3.6	14.3	8.346	8.3	7.338	2.709	1.334	0.646	0.325
Mercury	11	10	0.013	0.035	0.0214	0.021	4.4455E-5	0.00667	0.00741	0.781	0.312
Naphthalene	1	2	0.0211	0.0211	0.0211	0.0211	N/A	N/A	0	N/A	N/A
Nickel	13	10	9.3	16.8	14	14.6	4.152	2.038	1.631	-1.063	0.146
Phenanthrene	3	2	0.0165	0.507	0.18	0.0172	0.0801	0.283	0.00104	1.732	1.57
Pyrene	8	2	0.0112	0.624	0.124	0.0234	0.0445	0.211	0.0158	2.419	1.699
Selenium	12	10	0.12	0.47	0.26	0.245	0.00784	0.0885	0.0593	1.008	0.34
Silver	5	10	0.22	0.41	0.312	0.27	0.00757	0.087	0.0741	0.398	0.279
Sulfide	4	10	51.7	318	172.7	160.5	14377	119.9	124.8	0.401	0.694
TPH as Motor Oil	21	2	12.1	905	190.9	77.6	56033	236.7	77.84	1.867	1.24
Zinc	13	10	32.3	120	85.43	90.6	551.1	23.47	16.9	-0.881	0.275

Percentiles using all Detects (Ds) and Non-Detects (NDs)

Variable	NumObs	# Missing	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
1-Methylnaphthalene	21	2	0.00538	0.00549	0.00559	0.00581	0.0064	0.0106	0.059	0.0599	0.0602
2,3,7,8-TCDD TEQ	13	10	0.426	0.428	0.429	0.443	0.496	0.578	0.776	2.187	3.838
2-Methylnaphthalene	21	2	0.00546	0.00556	0.00567	0.00599	0.00945	0.0108	0.0599	0.0607	0.061
hylphenol (m,p-Cresols)	21	2	0.0131	0.0135	0.0137	0.0141	0.0195	0.0259	0.144	0.146	0.147
Acenaphthene	21	2	0.00681	0.00694	0.007	0.0073	0.0135	0.0214	0.0747	0.0758	0.0761
Ammonia, as N	13	10	12.4	14.4	15	20	20	22.4	28.8	34	38.8
Anthracene	21	2	0.00749	0.00764	0.0077	0.00803	0.0148	0.0236	0.0834	0.0839	0.118
Arsenic	13	10	2.1	2.14	2.2	2.6	2.9	3.2	3.72	4.16	4.592
Benzo[a]anthracene	21	2	0.00741	0.00756	0.00762	0.00795	0.0146	0.0232	0.0825	0.083	0.324
Benzo[a]pyrene	21	2	0.00782	0.00797	0.00804	0.00844	0.0185	0.0246	0.0876	0.103	0.368
Benzo[b]fluoranthene	21	2	0.00784	0.008	0.00806	0.00847	0.0155	0.0246	0.0873	0.0878	0.388

Benzo[g,h,i]perylene	21	2	0.00769	0.00784	0.00791	0.0083	0.0187	0.0242	0.0856	0.0861	0.206
Benzo[k]fluoranthene	21	2	0.00748	0.00762	0.00769	0.00802	0.0147	0.0234	0.0832	0.0837	0.151
Benzoic Acid	21	2	0.149	0.155	0.156	0.16	0.238	0.294	1.63	1.66	1.668
Cadmium	13	10	0.172	0.216	0.27	0.35	0.43	0.454	0.518	0.574	0.627
Carbazole	21	2	0.013	0.0133	0.0134	0.0139	0.0257	0.0409	0.143	0.145	0.146
Chromium	13	10	10.32	12.36	12.9	14.7	15.7	15.94	16.98	17.24	17.29
Chrysene	21	2	0.00836	0.00853	0.00869	0.00903	0.0165	0.0262	0.0931	0.0936	0.339
Copper	13	10	9.34	10.78	10.9	12.2	15.8	17.3	18.78	19.14	19.43
cPAH EPA RPF	21	2	0.0112	0.0114	0.0115	0.0125	0.034	0.035	0.125	0.182	0.52
cPAH_SCUM TEF	21	2	0.00627	0.00639	0.0065	0.00704	0.0197	0.0235	0.0702	0.129	0.482
Dibenzo[a,h]anthracene	21	2	0.0117	0.0119	0.012	0.0125	0.0231	0.0367	0.128	0.13	0.131
Dibenzofuran	21	2	0.0138	0.014	0.0142	0.0148	0.0272	0.0365	0.151	0.153	0.154
Diesel Fuel	21	2	9.5	9.7	9.9	31	56.9	136	154	199	218.2
Fluoranthene	21	2	0.00759	0.00774	0.0078	0.0082	0.0206	0.0238	0.0845	0.085	0.692
Fluorene	21	2	0.00685	0.00698	0.00704	0.00734	0.0135	0.0214	0.0751	0.0762	0.0766
Indeno[1,2,3-cd]pyrene	21	2	0.0119	0.0121	0.0122	0.0127	0.0234	0.0373	0.132	0.133	0.223
Lead	13	10	5.54	7.1	7.4	8.3	8.8	8.86	11.62	13.1	14.06
Mercury	13	10	0.0114	0.0142	0.016	0.017	0.024	0.0258	0.0278	0.0308	0.0342
Naphthalene	21	2	0.0106	0.0108	0.0109	0.0113	0.0208	0.0211	0.116	0.118	0.118
Nickel	13	10	11.48	13.16	13.4	14.6	15.3	15.3	16.02	16.44	16.73
Phenanthrene	21	2	0.00835	0.00851	0.00858	0.00895	0.0172	0.0262	0.0929	0.0935	0.424
Pyrene	21	2	0.00818	0.00835	0.00851	0.0112	0.0258	0.0272	0.0973	0.184	0.536
Selenium	13	10	0.132	0.192	0.21	0.24	0.29	0.302	0.334	0.392	0.454
Silver	13	10	0.19	0.194	0.2	0.22	0.27	0.288	0.38	0.404	0.409
Sulfide	13	10	37.82	38.18	38.6	39.8	59.5	84.4	196.2	259.2	306.2
TPH as Motor Oil	21	2	25.1	29.9	35.4	77.6	241	291	503	630	850
Zinc	13	10	61.22	66.78	69	90.6	100	101.2	106	112.2	118.4

Attachment L-3
Carcinogenic PAH Toxicity Equivalence Calculations Using EPA RPFs

Attachment L-3.1 Carcinogenic PAH Toxicity Equivalence Calculations using SCUM Guidance TEFs

BNSF Wishram Railyard Human Health Risk Evaluation

		Sample Name		**BNSF-D160- 042822-0-5**		**BNSF-E320- 042822-0-4**		**BNSF-E380- 042822-0-4**		**BNSF-E460- 042922-0-4**		**BNSF-EF240-SC- 1.0-2.0-111022**		**BNSF-EF240-SC- 1.0-2.0-111022-**		**BNSF-G000-SC- 1.5-2.5-110322**		**BNSF-G020-SC- 0.0-1.0-110422**		**BNSF-H360- 042922-0-8**		**BNSF-HN300-SC- 1.0-2.0-111322**		**BNSF-I120- 042922-0-6**	
		Sample Type		**N**		**N**		**N**		**N**		**N**		**FD**		**N**		**N**		**N**		**N**		**N**	
		Sample Location		**D160**		**E320**		**E380**		**E460**		**EF240**		**EF240**		**G000**		**G020**		**H360**		**HN300**		**I120**	
		Sample Date		**4/28/2022**		**4/28/2022**		**4/28/2022**		**4/29/2022**		**11/10/2022**		**11/10/2022**		**11/3/2022**		**11/4/2022**		**4/29/2022**		**11/13/2022**		**4/29/2022**	
Chemical	CAS	Unit	TEF[a]																						
Benzo[a]anthracene	56-55-3	mg/kg	0.1	0.083	UJ	0.0813	UJ	0.00779	UJ	0.0825	UJ	0.00814	U	0.00833	U	0.008	UJ	**0.0116**	**J**	0.00756	UJ	**0.00778**	**J**	0.00785	UJ
Benzo[a]pyrene	50-32-8	mg/kg	1	0.0876	UJ	**0.103**	**J**	0.00821	UJ	0.087	UJ	0.00859	U	0.00879	U	0.00844	UJ	**0.0119**	**J**	0.00797	UJ	0.00818	U	0.00828	UJ
Benzo[b]fluoranthene	205-99-2	mg/kg	0.1	0.0878	UJ	0.086	UJ	0.00824	UJ	0.0873	UJ	0.00862	U	0.00882	U	0.00847	UJ	**0.0106**	**J**	0.008	UJ	**0.00847**	**J**	0.00831	UJ
Benzo[k]fluoranthene	207-08-9	mg/kg	0.1	0.0837	UJ	0.082	UJ	0.00785	UJ	0.0832	UJ	0.00821	U	0.0084	U	0.00807	UJ	0.00866	U	0.00762	UJ	0.00782	U	0.00792	UJ
Chrysene	218-01-9	mg/kg	0.01	0.0936	UJ	0.0917	UJ	0.00878	UJ	0.0931	UJ	0.00918	U	0.0094	U	0.00903	UJ	**0.0137**	**J**	0.00853	UJ	0.00874	U	0.00886	UJ
Dibenzo[a,h]anthracene	53-70-3	mg/kg	0.1	0.131	UJ	0.128	UJ	0.0122	UJ	0.13	UJ	0.0128	U	0.0131	U	0.0126	UJ	0.0135	U	0.0119	UJ	0.0122	U	0.0123	UJ
Indeno[1,2,3-cd]pyrene	193-39-5	mg/kg	0.1	0.133	UJ	0.13	UJ	0.0125	UJ	0.132	UJ	0.0131	U	0.0134	U	0.0128	UJ	0.0138	U	0.0121	UJ	0.0124	UJ	0.0126	UJ

Chemical	**CAS**	**Unit**	**TEF[a]**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**
Benzo[a]anthracene	56-55-3	mg/kg	0.1	0.00415	0.004065	0.0003895	0.004125	0.000407	0.0004165	0.0004	0.00116	0.000378	0.000778	0.0003925
Benzo[a]pyrene	50-32-8	mg/kg	1	0.0438	0.103	0.004105	0.0435	0.004295	0.004395	0.00422	0.0119	0.003985	0.00409	0.00414
Benzo[b]fluoranthene	205-99-2	mg/kg	0.1	0.00439	0.0043	0.000412	0.004365	0.000431	0.000441	0.0004235	0.00106	0.0004	0.000847	0.0004155
Benzo[k]fluoranthene	207-08-9	mg/kg	0.1	0.004185	0.0041	0.0003925	0.00416	0.0004105	0.00042	0.0004035	0.000433	0.000381	0.000391	0.000396
Chrysene	218-01-9	mg/kg	0.01	0.000468	0.0004585	0.0000439	0.0004655	0.0000459	0.000047	0.00004515	0.000137	0.00004265	0.0000437	0.0000443
Dibenzo[a,h]anthracene	53-70-3	mg/kg	0.1	0.00655	0.0064	0.00061	0.0065	0.00064	0.000655	0.00063	0.000675	0.000595	0.00061	0.000615
Indeno[1,2,3-cd]pyrene	193-39-5	mg/kg	0.1	0.00665	0.0065	0.000625	0.0066	0.000655	0.00067	0.00064	0.00069	0.000605	0.00062	0.00063
Calculated Carcinogenic PAH TEQ (mg/kg):				**0.070193**	**0.1288235**	**0.0065779**	**0.0697155**	**0.0068844**	**0.0070445**	**0.00676215**	**0.016055**	**0.00638665**	**0.0073797**	**0.0066333**

Notes:

TEF based on SCUM Table 6-1 (Ecology 2021).

CAS = Chemical Abstracts Service

J = result is an estimate

mg/kg = milligram(s) per kilogram

N = normal sample

PAH = polycyclic aromatic hydrocarbon

RPF = relative potency factor

TEF = toxicity equivalency factor

TEQ = toxicity equivalence

U = not detected

UJ = not detected/estimate

Attachment L-3.1 Carcinogenic PAH Toxicity Equivalenc

BNSF Wishram Railyard Human Health Risk Evaluation

			Sample Name		BNSF-I500-SC-0.0-0.8-111322		BNSF-J060-SC-0.5-1.5-111422		BNSF-K200-SC-0.0-0.4-110922		BNSF-L320-042922-0-2		BNSF-O280-SC-0.0-0.7-111322		BNSF-SG01-041922-0-10		FD01-041922-0-10		BNSF-SG02-041922-0-10		BNSF-SG03-042722-0-5.5		BNSF-SG11-042822-0-5		BNSF-SG13-042522-0-1.5		BNSF-SG23-042122-0-6	
			Sample Type		N		N		N		N		N		N		FD		N		N		N		N		N	
			Sample Location		I500		J060		K200		L320		O280		SG01		SG01		SG02		SG03		SG11		SG13		SG23	
			Sample Date		11/13/2022		11/14/2022		11/9/2022		4/29/2022		11/13/2022		4/19/2022		4/19/2022		4/19/2022		4/27/2022		4/28/2022		4/25/2022		4/21/2022	
Chemical	CAS	Unit	TEF[a]																									
Benzo[a]anthracene	56-55-3	mg/kg	0.1		0.00729	U	**0.00973**	**J**	0.00741	U	0.0146	UJ	0.00771	U	0.0158	U	0.00795	U	0.0232	U	**0.384**		0.00762	UJ	0.00739	U	0.00742	U
Benzo[a]pyrene	50-32-8	mg/kg	1		0.00769	U	**0.00979**	**J**	0.00782	U	0.0155	UJ	0.00813	U	**0.0185**	**J**	0.00838	U	0.0246	U	**0.434**		0.00804	UJ	0.00779	U	0.00782	U
Benzo[b]fluoranthene	205-99-2	mg/kg	0.1		0.00771	U	**0.0112**	**J**	0.00784	U	0.0155	UJ	0.00816	U	0.0168	U	0.00841	U	0.0246	U	**0.463**		0.00806	UJ	0.00782	U	0.00785	U
Benzo[k]fluoranthene	207-08-9	mg/kg	0.1		0.00735	U	0.00815	U	0.00748	U	0.0147	UJ	0.00778	U	0.016	U	0.00802	U	0.0234	U	**0.168**		0.00769	UJ	0.00745	U	0.00748	U
Chrysene	218-01-9	mg/kg	0.01		0.00822	U	**0.00922**	**J**	0.00836	U	0.0165	UJ	0.00869	U	0.0179	U	0.00896	U	0.0262	U	**0.4**		**0.0101**	**J**	0.00833	U	0.00837	U
Dibenzo[a,h]anthracene	53-70-3	mg/kg	0.1		0.0115	U	0.0127	U	0.0117	U	0.0231	UJ	0.0121	U	0.025	U	0.0125	U	0.0367	U	**0.0588**		0.012	UJ	0.0116	U	0.0117	U
Indeno[1,2,3-cd]pyrene	193-39-5	mg/kg	0.1		0.0117	UJ	0.013	UJ	0.0119	U	0.0234	UJ	0.0124	UJ	0.0254	U	0.0127	U	0.0373	U	**0.246**		0.0122	UJ	0.0118	U	0.0119	U

Chemical	**CAS**	**Unit**	TEF[a]	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**	**TEQ values**
Benzo[a]anthracene	56-55-3	mg/kg	0.1	0.0003645	0.000973	0.0003705	0.00073	0.0003855	0.00079	0.0003975	0.00116	0.0384	0.000381	0.0003695	0.000371
Benzo[a]pyrene	50-32-8	mg/kg	1	0.003845	0.00979	0.00391	0.00775	0.004065	0.0185	0.00419	0.0123	0.434	0.00402	0.003895	0.00391
Benzo[b]fluoranthene	205-99-2	mg/kg	0.1	0.0003855	0.00112	0.000392	0.000775	0.000408	0.00084	0.0004205	0.00123	0.0463	0.000403	0.000391	0.0003925
Benzo[k]fluoranthene	207-08-9	mg/kg	0.1	0.0003675	0.0004075	0.000374	0.000735	0.000389	0.0008	0.000401	0.00117	0.0168	0.0003845	0.0003725	0.000374
Chrysene	218-01-9	mg/kg	0.01	0.0000411	0.0000922	0.0000418	0.0000825	0.00004345	0.0000895	0.0000448	0.000131	0.004	0.000101	0.00004165	0.00004185
Dibenzo[a,h]anthracene	53-70-3	mg/kg	0.1	0.000575	0.000635	0.000585	0.001155	0.000605	0.00125	0.000625	0.001835	0.00588	0.0006	0.00058	0.000585
Indeno[1,2,3-cd]pyrene	193-39-5	mg/kg	0.1	0.000585	0.00065	0.000595	0.00117	0.00062	0.00127	0.000635	0.001865	0.0246	0.00061	0.00059	0.000595
Calculated Carcinogenic PAH TEQ (mg/kg):				**0.0061636**	**0.0136677**	**0.0062683**	**0.0123975**	**0.00651595**	**0.0235395**	**0.0067138**	**0.019691**	**0.56998**	**0.0064995**	**0.00623965**	**0.00626935**

Notes:

TEF based on SCUM Table 6-1 (Ecology 2021).

CAS = Chemical Abstracts Service

J = result is an estimate

mg/kg = milligram(s) per kilogram

N = normal sample

PAH = polycyclic aromatic hydrocarbon

RPF = relative potency factor

TEF = toxicity equivalency factor

TEQ = toxicity equivalence

U = not detected

UJ = not detected/estimate

Attachment L-3.2 Carcinogenic PAH Toxicity Equivalence Calculations Using EPA RPFs

BNSF Wishram Railyard Human Health Risk Evaluation

			Sample Name	BNSF-D160-042822-0-5		BNSF-E320-042822-0-4		BNSF-E380-042822-0-4		BNSF-E460-042922-0-4		BNSF-EF240-SC-1.0-2.0-111022		BNSF-EF240-SC-1.0-2.0-111022-		BNSF-G000-SC-1.5-2.5-110322		BNSF-G020-SC-0.0-1.0-110422		BNSF-H360-042922-0-8		BNSF-HN300-SC-1.0-2.0-111322		BNSF-I120-042922-0-6	
			Sample Type	N		N		N		N		N		FD		N		N		N		N		N	
			Sample Location	D160		E320		E380		E460		EF240		EF240		G000		G020		H360		HN300		I120	
			Sample Date	4/28/2022		4/28/2022		4/28/2022		4/29/2022		11/10/2022		11/10/2022		11/3/2022		11/4/2022		4/29/2022		11/13/2022		4/29/2022	
Chemical	CAS	Unit	RPF[a]																						
Benzo[a]anthracene	56-55-3	mg/kg	0.1	0.083	UJ	0.0813	UJ	0.00779	UJ	0.0825	UJ	0.00814	U	0.00833	U	0.008	UJ	**0.0116**	**J**	0.00756	UJ	**0.00778**	**J**	0.00785	UJ
Benzo[a]pyrene	50-32-8	mg/kg	1	0.0876	UJ	**0.103**	**J**	0.00821	UJ	0.087	UJ	0.00859	U	0.00879	U	0.00844	UJ	**0.0119**	**J**	0.00797	UJ	0.00818	U	0.00828	UJ
Benzo[b]fluoranthene	205-99-2	mg/kg	0.1	0.0878	UJ	0.086	UJ	0.00824	UJ	0.0873	UJ	0.00862	U	0.00882	U	0.00847	UJ	**0.0106**	**J**	0.008	UJ	**0.00847**	**J**	0.00831	UJ
Benzo[k]fluoranthene	207-08-9	mg/kg	0.01	0.0837	UJ	0.082	UJ	0.00785	UJ	0.0832	UJ	0.00821	U	0.0084	U	0.00807	UJ	0.00866	U	0.00762	UJ	0.00782	U	0.00792	UJ
Chrysene	218-01-9	mg/kg	0.001	0.0936	UJ	0.0917	UJ	0.00878	UJ	0.0931	UJ	0.00918	U	0.0094	U	0.00903	UJ	**0.0137**	**J**	0.00853	UJ	0.00874	U	0.00886	UJ
Dibenzo[a,h]anthracene	53-70-3	mg/kg	1	0.131	UJ	0.128	UJ	0.0122	UJ	0.13	UJ	0.0128	U	0.0131	U	0.0126	UJ	0.0135	U	0.0119	UJ	0.0122	U	0.0123	UJ
Indeno[1,2,3-cd]pyrene	193-39-5	mg/kg	0.1	0.133	UJ	0.13	UJ	0.0125	UJ	0.132	UJ	0.0131	U	0.0134	U	0.0128	UJ	0.0138	U	0.0121	UJ	0.0124	UJ	0.0126	UJ

Chemical	CAS	Unit	RPF[a]	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values
Benzo[a]anthracene	56-55-3	mg/kg	0.1	0.00415	0.004065	0.0003895	0.004125	0.000407	0.0004165	0.0004	0.00116	0.000378	0.000778	0.0003925
Benzo[a]pyrene	50-32-8	mg/kg	1	0.0438	0.103	0.004105	0.0435	0.004295	0.004395	0.00422	0.0119	0.003985	0.00409	0.00414
Benzo[b]fluoranthene	205-99-2	mg/kg	0.1	0.00439	0.0043	0.000412	0.004365	0.000431	0.000441	0.0004235	0.00106	0.0004	0.000847	0.0004155
Benzo[k]fluoranthene	207-08-9	mg/kg	0.01	0.0004185	0.00041	0.00003925	0.000416	0.00004105	0.000042	0.00004035	0.0000433	0.0000381	0.0000391	0.0000396
Chrysene	218-01-9	mg/kg	0.001	0.0000468	0.00004585	0.00000439	0.00004655	0.00000459	0.0000047	0.000004515	0.0000137	0.000004265	0.00000437	0.00000443
Dibenzo[a,h]anthracene	53-70-3	mg/kg	1	0.0655	0.064	0.0061	0.065	0.0064	0.00655	0.0063	0.00675	0.00595	0.0061	0.00615
Indeno[1,2,3-cd]pyrene	193-39-5	mg/kg	0.1	0.00665	0.0065	0.000625	0.0066	0.000655	0.00067	0.00064	0.00069	0.000605	0.00062	0.00063
Calculated Carcinogenic PAH TEQ (mg/kg):				**0.1249553**	**0.18232085**	**0.01167514**	**0.12405255**	**0.01223364**	**0.0125192**	**0.012028365**	**0.021617**	**0.011360365**	**0.01247847**	**0.01177203**

Notes:

[a] RPF based on EPA 2023 Regional Screening Levels Users Guide (EPA 2023b).

CAS = Chemical Abstracts Service

J = result is an estimate

mg/kg = milligram(s) per kilogram

N = normal sample

PAH = polycyclic aromatic hydrocarbon

RPF = relative potency factor

TEF = toxicity equivalency factor

TEQ = toxicity equivalence

U = not detected

UJ = not detected/estimate

Attachment L-3.2 Carcinogenic PAH Toxicity Equivalenc

BNSF Wishram Railyard Human Health Risk Evaluation

			Sample Name	BNSF-I500-SC-0.0-0.8-111322		BNSF-J060-SC-0.5-1.5-111422		BNSF-K200-SC-0.0-0.4-110922		BNSF-L320-042922-0-2		BNSF-O280-SC-0.0-0.7-111322		BNSF-SG01-041922-0-10	
			Sample Type	N		N		N		N		N		N	
			Sample Location	I500		J060		K200		L320		O280		SG01	
			Sample Date	11/13/2022		11/14/2022		11/9/2022		4/29/2022		11/13/2022		4/19/2022	
Chemical	CAS	Unit	RPF[a]												
Benzo[a]anthracene	56-55-3	mg/kg	0.1	0.00729	U	**0.00973**	J	0.00741	U	0.0146	UJ	0.00771	U	0.0158	U
Benzo[a]pyrene	50-32-8	mg/kg	1	0.00769	U	**0.00979**	J	0.00782	U	0.0155	UJ	0.00813	U	**0.0185**	J
Benzo[b]fluoranthene	205-99-2	mg/kg	0.1	0.00771	U	**0.0112**	J	0.00784	U	0.0155	UJ	0.00816	U	0.0168	U
Benzo[k]fluoranthene	207-08-9	mg/kg	0.01	0.00735	U	0.00815	U	0.00748	U	0.0147	UJ	0.00778	U	0.016	U
Chrysene	218-01-9	mg/kg	0.001	0.00822	U	**0.00922**	J	0.00836	U	0.0165	UJ	0.00869	U	0.0179	U
Dibenzo[a,h]anthracene	53-70-3	mg/kg	1	0.0115	U	0.0127	U	0.0117	U	0.0231	UJ	0.0121	U	0.025	U
Indeno[1,2,3-cd]pyrene	193-39-5	mg/kg	0.1	0.0117	UJ	0.013	UJ	0.0119	U	0.0234	UJ	0.0124	UJ	0.0254	U

			Sample Name	FD01-041922-0-10		BNSF-SG02-041922-0-10		BNSF-SG03-042722-0-5.5		BNSF-SG11-042822-0-5		BNSF-SG13-042522-0-1.5		BNSF-SG23-042122-0-6	
			Sample Type	FD		N		N		N		N		N	
			Sample Location	SG01		SG02		SG03		SG11		SG13		SG23	
			Sample Date	4/19/2022		4/19/2022		4/27/2022		4/28/2022		4/25/2022		4/21/2022	
Chemical	CAS	Unit	RPF[a]												
Benzo[a]anthracene	56-55-3	mg/kg	0.1	0.00795	U	0.0232	U	**0.384**		0.00762	UJ	0.00739	U	0.00742	U
Benzo[a]pyrene	50-32-8	mg/kg	1	0.00838	U	0.0246	U	**0.434**		0.00804	UJ	0.00779	U	0.00782	U
Benzo[b]fluoranthene	205-99-2	mg/kg	0.1	0.00841	U	0.0246	U	**0.463**		0.00806	UJ	0.00782	U	0.00785	U
Benzo[k]fluoranthene	207-08-9	mg/kg	0.01	0.00802	U	0.0234	U	**0.168**		0.00769	UJ	0.00745	U	0.00748	U
Chrysene	218-01-9	mg/kg	0.001	0.00896	U	0.0262	U	**0.4**		**0.0101**	J	0.00833	U	0.00837	U
Dibenzo[a,h]anthracene	53-70-3	mg/kg	1	0.0125	U	0.0367	U	**0.0588**		0.012	UJ	0.0116	U	0.0117	U
Indeno[1,2,3-cd]pyrene	193-39-5	mg/kg	0.1	0.0127	U	0.0373	U	**0.246**		0.0122	UJ	0.0118	U	0.0119	U

Chemical	CAS	Unit	RPF[a]	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values	TEQ values
Benzo[a]anthracene	56-55-3	mg/kg	0.1	0.0003645	0.000973	0.0003705	0.00073	0.0003855	0.00079	0.0003975	0.00116	0.0384	0.000381	0.0003695	0.000371
Benzo[a]pyrene	50-32-8	mg/kg	1	0.003845	0.00979	0.00391	0.00775	0.004065	0.0185	0.00419	0.0123	0.434	0.00402	0.003895	0.00391
Benzo[b]fluoranthene	205-99-2	mg/kg	0.1	0.0003855	0.00112	0.000392	0.000775	0.000408	0.00084	0.0004205	0.00123	0.0463	0.000403	0.000391	0.0003925
Benzo[k]fluoranthene	207-08-9	mg/kg	0.01	0.00003675	0.00004075	0.0000374	0.0000735	0.0000389	0.00008	0.0000401	0.000117	0.00168	0.00003845	0.00003725	0.0000374
Chrysene	218-01-9	mg/kg	0.001	0.00000411	0.00000922	0.00000418	0.00000825	0.000004345	0.00000895	0.00000448	0.0000131	0.0004	0.0000101	0.000004165	0.000004185
Dibenzo[a,h]anthracene	53-70-3	mg/kg	1	0.00575	0.00635	0.00585	0.01155	0.00605	0.0125	0.00625	0.01835	0.0588	0.006	0.0058	0.00585
Indeno[1,2,3-cd]pyrene	193-39-5	mg/kg	0.1	0.000585	0.00065	0.000595	0.00117	0.00062	0.00127	0.000635	0.001865	0.0246	0.00061	0.00059	0.000595
Calculated Carcinogenic PAH TEQ (mg/kg):				**0.01097086**	**0.01893297**	**0.01115908**	**0.02205675**	**0.011571745**	**0.03398895**	**0.01193758**	**0.0350351**	**0.60418**	**0.01146255**	**0.011086915**	**0.011160085**

Notes:

[a] RPF based on EPA 2023 Regional Screening Levels Users Guide

CAS = Chemical Abstracts Service

J = result is an estimate

mg/kg = milligram(s) per kilogram

N = normal sample

PAH = polycyclic aromatic hydrocarbon

RPF = relative potency factor

TEF = toxicity equivalency factor

TEQ = toxicity equivalence

U = not detected

UJ = not detected/estimate

Attachment L-4
Toxicity Equivalence Calculations for Dioxins and Dioxin-like Compounds

Attachment L-4 Toxicity Equivalence Calculations for Dioxins and Dioxin-like Compounds

BNSF Wishram Railyard Human Health Risk Evaluation

Sample Name				BNSF-D160-042822-0-5		BNSF-E320-042822-0-4		BNSF-E380-042822-0-4		BNSF-E460-042922-0-4		BNSF-H360-042922-0-8		BNSF-I120-042922-0-6		BNSF-L320-042922-0-2		BNSF-SG01-041922-0-10		FD01-041922-0-10	
Sample Type				N		N		N		N		N		N		N		N		FD	
Sample Location				D160		E320		E380		E460		H360		I120		L320		SG01		SG01	
Sample Date				4/28/2022		4/28/2022		4/28/2022		4/29/2022		4/29/2022		4/29/2022		4/29/2022		4/19/2022		4/19/2022	
Chemical	CAS	Unit	TEF																		
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	0.01	**7.5**	J	**24**	J	**2.4**	J	**1.9**	J	**0.94**	J	**1.9**	J	**2.3**	J	**1.5**	J	**3**	J
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	0.01	**1**	J	**11**	J	0.64	UJ	0.7	UJ	**0.61**	J	0.64	UJ	**1.5**	J	**0.7**	J	**1**	J
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	0.01	0.46	UJ	0.41	UJ	0.44	UJ	0.48	UJ	0.41	UJ	0.44	UJ	0.41	UJ	0.45	U	0.43	U
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	0.10	**0.46**	J	**0.7**	J	0.42	UJ	0.46	UJ	0.39	UJ	0.42	UJ	0.39	UJ	0.42	U	0.41	U
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	0.10	0.43	UJ	0.39	UJ	0.41	UJ	0.45	UJ	0.39	UJ	0.41	UJ	0.39	UJ	0.42	U	0.4	U
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	0.10	**0.69**	J	**3.7**	J	0.46	UJ	0.5	UJ	0.43	UJ	0.46	UJ	0.44	UJ	0.47	U	0.45	U
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	0.10	0.4	UJ	0.36	UJ	0.38	UJ	0.42	UJ	0.36	UJ	0.38	UJ	0.36	UJ	0.39	U	0.37	U
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	0.10	0.42	UJ	**1.6**	J	0.4	UJ	0.43	UJ	0.37	UJ	0.39	UJ	0.38	UJ	0.4	U	0.39	U
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	0.10	0.5	UJ	0.45	UJ	0.48	UJ	0.52	UJ	0.45	UJ	0.47	UJ	0.45	UJ	0.48	U	0.47	U
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	1	0.22	UJ	**0.74**	J	0.2	UJ	0.22	UJ	0.19	UJ	0.2	UJ	0.19	UJ	0.21	U	0.2	U
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	0.03	0.23	UJ	**4.6**	J	0.21	UJ	0.23	UJ	0.2	UJ	0.21	UJ	0.2	UJ	0.22	U	0.21	U
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	0.10	0.43	UJ	**0.42**	J	0.41	UJ	0.45	UJ	0.39	UJ	0.41	UJ	0.39	UJ	0.42	U	0.4	U
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	0.30	0.23	UJ	0.21	UJ	0.22	UJ	0.24	UJ	0.21	UJ	0.22	UJ	0.21	UJ	0.22	U	0.22	U
2,3,7,8-TCDD	1746-01-6	ng/kg	1	0.2	UJ	**2.2**	J	0.19	UJ	0.21	UJ	0.18	UJ	0.19	UJ	0.18	UJ	0.19	U	0.19	U
2,3,7,8-TCDF	51207-31-9	ng/kg	0.10	**0.39**	J	**0.23**	J	0.21	UJ	**0.25**	J	**0.21**	J	0.21	UJ	0.2	UJ	0.21	U	**0.3**	J
OCDD	3268-87-9	ng/kg	0.0003	**36**	J	**130**	J	**13**	J	**10**	J	**6.7**	J	**14**	J	**8.8**	J	**11**	J	**22**	J
OCDF	39001-02-0	ng/kg	0.0003	1.5	UJ	**7.1**	J	1.4	UJ	1.6	UJ	1.3	UJ	1.4	UJ	1.4	UJ	1.5	U	1.4	U
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	69782-90-7	ng/kg	0.00003	0.854	UJ	**0.832**	**UJ**	0.709	UJ	1.01	UJ	1.33	J	0.974	UJ	0.942	UJ	0.817	U	0.81	U
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	38380-08-4	ng/kg	0.00003	2.58	J	**3.54**	J	1.66	UJ	2.36	UJ	4.77	J	2.28	UJ	2.2	UJ	1.91	U	1.9	U
PCB-105	32598-14-4	ng/kg	0.00003	**9.22**	J	**12.5**	J	2.44	UJ	**5.83**	J	**14**	J	**5.77**	J	3.24	UJ	**4.32**	J	**4.56**	J
PCB-114	74472-37-0	ng/kg	0.00003	**0.887**	J	**0.802**	J	0.543	UJ	0.771	UJ	**1.77**	J	0.746	UJ	0.721	UJ	0.626	U	0.62	U
PCB-118	31508-00-6	ng/kg	0.00003	**28.9**	J	**26.6**	J	**4.95**	J	**11.6**	J	**40.1**	J	**12.2**	J	**8.39**	J	**10**	J	**9.96**	J
PCB-123	65510-44-3	ng/kg	0.00003	0.609	UJ	**0.97**	J	0.506	UJ	0.718	UJ	**1.38**	J	0.695	UJ	**0.792**	J	0.583	U	**0.607**	J
PCB-126	57465-28-8	ng/kg	0.10	0.339	UJ	0.33	UJ	0.281	UJ	0.399	UJ	0.367	UJ	0.386	UJ	0.373	UJ	0.324	U	0.321	U
PCB-167	52663-72-6	ng/kg	0.00003	1.3	UJ	**1.7**	J	1.08	UJ	1.53	UJ	**2.26**	J	1.48	UJ	1.43	UJ	1.24	U	1.23	U
PCB-169	32774-16-6	ng/kg	0.03	0.326	UJ	0.317	UJ	0.27	UJ	0.384	UJ	0.353	UJ	0.371	UJ	0.359	UJ	0.311	U	0.309	U
PCB-189	39635-31-9	ng/kg	0.00003	0.772	UJ	0.752	UJ	0.641	UJ	0.909	UJ	0.836	UJ	0.88	UJ	0.85	UJ	0.738	U	0.732	U
PCB-77	32598-13-3	ng/kg	0.0001	**2.54**	J	**3.56**	J	1.81	UJ	**3.28**	J	**3.71**	J	2.48	UJ	2.4	UJ	2.08	U	**2.21**	J
PCB-81	70362-50-4	ng/kg	0.0003	0.482	UJ	0.469	UJ	0.4	UJ	0.568	UJ	0.522	UJ	0.549	UJ	0.531	UJ	0.461	U	0.457	U

Chemical	CAS	Unit	TEF	TEQ Values	TEQ Values	TEQ Values	TEQ Values	TEQ Values	TEQ Values	TEQ Values	TEQ Values	TEQ Values
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	0.01	0.075	0.24	0.024	0.019	0.0094	0.019	0.023	0.015	0.03
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	0.01	0.01	0.11	0.0032	0.0035	0.0061	0.0032	0.015	0.007	0.01
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	0.01	0.0023	0.00205	0.0022	0.0024	0.00205	0.0022	0.00205	0.00225	0.00215
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	0.10	0.046	0.07	0.021	0.023	0.0195	0.021	0.0195	0.021	0.0205
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	0.10	0.0215	0.0195	0.0205	0.0225	0.0195	0.0205	0.0195	0.021	0.02
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	0.10	0.069	0.37	0.023	0.025	0.0215	0.023	0.022	0.0235	0.0225
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	0.10	0.02	0.018	0.019	0.021	0.018	0.019	0.018	0.0195	0.0185
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	0.10	0.021	0.16	0.02	0.0215	0.0185	0.0195	0.019	0.02	0.0195
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	0.10	0.025	0.0225	0.024	0.026	0.0225	0.0235	0.0225	0.024	0.0235
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	1	0.11	0.74	0.1	0.11	0.095	0.1	0.095	0.105	0.1
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	0.03	0.00345	0.138	0.00315	0.00345	0.003	0.00315	0.003	0.0033	0.00315
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	0.10	0.0215	0.042	0.0205	0.0225	0.0195	0.0205	0.0195	0.021	0.02
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	0.30	0.0345	0.0315	0.033	0.036	0.0315	0.033	0.0315	0.033	0.033

Attachment L-4 Toxicity Equivalence Calculations for Dioxins and Dioxin-like Compounds

BNSF Wishram Railyard Human Health Risk Evaluation

			Sample Name	**BNSF-SG02-041922-0-10**		**BNSF-SG03-042722-0-5.5**		**BNSF-SG11-042822-0-5**		**BNSF-SG13-042522-0-1.5**		**BNSF-SG23-042122-0-6**	
			Sample Type	**N**		**N**		**N**		**N**		**N**	
			Sample Location	**SG02**		**SG03**		**SG11**		**SG13**		**SG23**	
			Sample Date	**4/19/2022**		**4/27/2022**		**4/28/2022**		**4/25/2022**		**4/21/2022**	
Chemical	CAS	Unit	TEF										
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	0.01	**8.2**		0.52	U	**0.75**	**J**	0.52	U	0.51	U
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	0.01	**2.2**	**J**	0.65	U	0.66	UJ	0.65	U	0.64	U
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	0.01	0.45	U	0.45	U	0.45	UJ	0.45	U	0.44	U
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	0.10	0.42	U	0.42	U	0.43	UJ	0.43	U	0.42	U
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	0.10	0.42	U	0.42	U	0.42	UJ	0.42	U	0.41	U
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	0.10	0.47	U	0.47	U	0.47	UJ	0.47	U	0.46	U
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	0.10	0.39	U	0.39	U	0.39	UJ	0.39	U	0.38	U
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	0.10	**0.42**	**J**	0.4	U	0.41	UJ	0.4	U	0.4	U
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	0.10	0.48	U	0.48	U	0.49	UJ	0.49	U	0.48	U
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	1	**0.22**	**J**	0.21	U	0.21	UJ	0.21	U	0.2	U
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	0.03	0.22	U	0.22	U	0.22	UJ	0.22	U	0.21	U
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	0.10	0.42	U	0.42	U	0.42	UJ	0.42	U	0.41	U
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	0.30	**0.25**	**J**	0.22	U	0.23	UJ	0.23	U	0.22	U
2,3,7,8-TCDD	1746-01-6	ng/kg	1	0.19	U	0.19	U	0.2	UJ	0.19	U	0.19	U
2,3,7,8-TCDF	51207-31-9	ng/kg	0.10	**0.71**	**J**	0.21	U	0.22	UJ	0.21	U	0.21	U
OCDD	3268-87-9	ng/kg	0.0003	**69**		**2.4**	**J**	**4.6**	**J**	2	U	**5.2**	**B**
OCDF	39001-02-0	ng/kg	0.0003	**4.8**	**J**	1.5	U	1.5	UJ	1.5	U	1.4	U
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	69782-90-7	ng/kg	0.00003	**1.72**	**J**	0.822	U	0.876	UJ	0.818	U	0.813	U
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	38380-08-4	ng/kg	0.00003	**6.03**		1.92	U	2.05	UJ	1.91	U	1.9	U
PCB-105	32598-14-4	ng/kg	0.00003	**23.2**	**J**	**2.85**	**J**	**3.51**	**J**	**3.15**	**J**	**6.8**	**J**
PCB-114	74472-37-0	ng/kg	0.00003	**1.19**	**J**	0.629	U	0.671	UJ	0.626	U	**0.724**	**J**
PCB-118	31508-00-6	ng/kg	0.00003	**51.8**		**7.01**	**J**	**8.87**	**J**	**6.45**	**J**	**16.6**	**J**
PCB-123	65510-44-3	ng/kg	0.00003	**1.54**	**J**	0.586	U	0.625	UJ	0.583	U	0.58	U
PCB-126	57465-28-8	ng/kg	0.10	**0.387**	**J**	0.326	U	0.347	UJ	0.324	U	0.322	U
PCB-167	52663-72-6	ng/kg	0.00003	**3.97**	**J**	1.25	U	1.33	UJ	1.24	U	**1.39**	**J**
PCB-169	32774-16-6	ng/kg	0.03	0.311	U	0.313	U	0.334	UJ	0.312	U	0.31	U
PCB-189	39635-31-9	ng/kg	0.00003	0.737	U	0.742	U	0.791	UJ	0.739	U	0.734	U
PCB-77	32598-13-3	ng/kg	0.0001	**4.71**	**J**	2.1	U	2.23	UJ	2.09	U	**3.56**	**J**
PCB-81	70362-50-4	ng/kg	0.0003	0.46	U	0.463	U	0.494	UJ	0.461	U	0.458	U

Chemical	CAS	Unit	TEF	TEQ Values	TEQ Values	TEQ Values	TEQ Values	TEQ Values
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	0.01	0.082	0.0026	0.0075	0.0026	0.00255
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	0.01	0.022	0.00325	0.0033	0.00325	0.0032
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	0.01	0.00225	0.00225	0.00225	0.00225	0.0022
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	0.10	0.021	0.021	0.0215	0.0215	0.021
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	0.10	0.021	0.021	0.021	0.021	0.0205
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	0.10	0.0235	0.0235	0.0235	0.0235	0.023
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	0.10	0.0195	0.0195	0.0195	0.0195	0.019
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	0.10	0.042	0.02	0.0205	0.02	0.02
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	0.10	0.024	0.024	0.0245	0.0245	0.024
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	1	0.22	0.105	0.105	0.105	0.1
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	0.03	0.0033	0.0033	0.0033	0.0033	0.00315
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	0.10	0.021	0.021	0.021	0.021	0.0205
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	0.30	0.075	0.033	0.0345	0.0345	0.033

Attachment L-4 Toxicity Equivalence Calculations for Dioxins and Dioxin-like Compounds

BNSF Wishram Railyard Human Health Risk Evaluation

				BNSF-D160-042822-0-5	BNSF-E320-042822-0-4	BNSF-E380-042822-0-4	BNSF-E460-042922-0-4	BNSF-H360-042922-0-8	BNSF-I120-042922-0-6	BNSF-L320-042922-0-2	BNSF-SG01-041922-0-10	FD01-041922-0-10
Sample Name				BNSF-D160-042822-0-5	BNSF-E320-042822-0-4	BNSF-E380-042822-0-4	BNSF-E460-042922-0-4	BNSF-H360-042922-0-8	BNSF-I120-042922-0-6	BNSF-L320-042922-0-2	BNSF-SG01-041922-0-10	FD01-041922-0-10
Sample Type				N	N	N	N	N	N	N	N	FD
Sample Location				D160	E320	E380	E460	H360	I120	L320	SG01	SG01
Sample Date				4/28/2022	4/28/2022	4/28/2022	4/29/2022	4/29/2022	4/29/2022	4/29/2022	4/19/2022	4/19/2022
2,3,7,8-TCDD	1746-01-6	ng/kg	1	0.1	2.2	0.095	0.105	0.09	0.095	0.09	0.095	0.095
2,3,7,8-TCDF	51207-31-9	ng/kg	0.10	0.039	0.023	0.0105	0.025	0.021	0.0105	0.01	0.0105	0.03
OCDD	3268-87-9	ng/kg	0.0003	0.0108	0.039	0.0039	0.003	0.00201	0.0042	0.00264	0.0033	0.0066
OCDF	39001-02-0	ng/kg	0.0003	0.000225	0.00213	0.00021	0.00024	0.000195	0.00021	0.00021	0.000225	0.00021
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	69782-90-7	ng/kg	0.00003	0.00001281	0.00001248	0.000010635	0.00001515	0.0000399	0.00001461	0.00001413	0.000012255	0.00001215
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	38380-08-4	ng/kg	0.00003	0.0000774	0.0001062	0.0000249	0.0000354	0.0001431	0.0000342	0.000033	0.00002865	0.0000285
PCB-105	32598-14-4	ng/kg	0.00003	0.0002766	0.000375	0.0000366	0.0001749	0.00042	0.0001731	0.0000486	0.0001296	0.0001368
PCB-114	74472-37-0	ng/kg	0.00003	0.00002661	0.00002406	0.000008145	0.000011565	0.0000531	0.00001119	0.000010815	0.00000939	0.0000093
PCB-118	31508-00-6	ng/kg	0.00003	0.000867	0.000798	0.0001485	0.000348	0.001203	0.000366	0.0002517	0.0003	0.0002988
PCB-123	65510-44-3	ng/kg	0.00003	0.000009135	0.0000291	0.00000759	0.00001077	0.0000414	0.000010425	0.00002376	0.000008745	0.00001821
PCB-126	57465-28-8	ng/kg	0.10	0.01695	0.0165	0.01405	0.01995	0.01835	0.0193	0.01865	0.0162	0.01605
PCB-167	52663-72-6	ng/kg	0.00003	0.0000195	0.000051	0.0000162	0.00002295	0.0000678	0.0000222	0.00002145	0.0000186	0.00001845
PCB-169	32774-16-6	ng/kg	0.03	0.00489	0.004755	0.00405	0.00576	0.005295	0.005565	0.005385	0.004665	0.004635
PCB-189	39635-31-9	ng/kg	0.00003	0.00001158	0.00001128	0.000009615	0.000013635	0.00001254	0.0000132	0.00001275	0.00001107	0.00001098
PCB-77	32598-13-3	ng/kg	0.0001	0.000254	0.000356	0.0000905	0.000328	0.000371	0.000124	0.00012	0.000104	0.000221
PCB-81	70362-50-4	ng/kg	0.0003	0.0000723	0.00007035	0.00006	0.0000852	0.0000783	0.00008235	0.00007965	0.00006915	0.00006855
Calculated 2,3,7,8-TCDD TEQ (ng/kg):				**0.633**	**4.251**	**0.442**	**0.496**	**0.425**	**0.443**	**0.437**	**0.446**	**0.476**

Notes:

CAS = Chemical Abstracts Service

J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.

N = normal sample

ng/kg = nanogram(s) per kilogram

PCB = polychlorinated biphenyl

TEF = toxicity equivalency factor

TEQ = toxicity equivalence

U = The analyte was not detected above the reported sample quantitation limit.

UJ = The analyte was below the reported sample quantitation limit. However, the reported value is approximate.

Attachment L-4 Toxicity Equivalence Calculations for Dioxins and Dioxin-like Compounds

BNSF Wishram Railyard Human Health Risk Evaluation

				BNSF-SG02-041922-0-10	BNSF-SG03-042722-0-5.5	BNSF-SG11-042822-0-5	BNSF-SG13-042522-0-1.5	BNSF-SG23-042122-0-6
Sample Name				BNSF-SG02-041922-0-10	BNSF-SG03-042722-0-5.5	BNSF-SG11-042822-0-5	BNSF-SG13-042522-0-1.5	BNSF-SG23-042122-0-6
Sample Type				N	N	N	N	N
Sample Location				SG02	SG03	SG11	SG13	SG23
Sample Date				4/19/2022	4/27/2022	4/28/2022	4/25/2022	4/21/2022
2,3,7,8-TCDD	1746-01-6	ng/kg	1	0.095	0.095	0.1	0.095	0.095
2,3,7,8-TCDF	51207-31-9	ng/kg	0.10	0.071	0.0105	0.011	0.0105	0.0105
OCDD	3268-87-9	ng/kg	0.0003	0.0207	0.00072	0.00138	0.0003	0.00156
OCDF	39001-02-0	ng/kg	0.0003	0.00144	0.000225	0.000225	0.000225	0.00021
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	69782-90-7	ng/kg	0.00003	0.0000516	0.00001233	0.00001314	0.00001227	0.000012195
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	38380-08-4	ng/kg	0.00003	0.0001809	0.0000288	0.00003075	0.00002865	0.0000285
PCB-105	32598-14-4	ng/kg	0.00003	0.000696	0.0000855	0.0001053	0.0000945	0.000204
PCB-114	74472-37-0	ng/kg	0.00003	0.0000357	0.000009435	0.000010065	0.00000939	0.00002172
PCB-118	31508-00-6	ng/kg	0.00003	0.001554	0.0002103	0.0002661	0.0001935	0.000498
PCB-123	65510-44-3	ng/kg	0.00003	0.0000462	0.00000879	0.000009375	0.000008745	0.0000087
PCB-126	57465-28-8	ng/kg	0.10	0.0387	0.0163	0.01735	0.0162	0.0161
PCB-167	52663-72-6	ng/kg	0.00003	0.0001191	0.00001875	0.00001995	0.0000186	0.0000417
PCB-169	32774-16-6	ng/kg	0.03	0.004665	0.004695	0.00501	0.00468	0.00465
PCB-189	39635-31-9	ng/kg	0.00003	0.000011055	0.00001113	0.000011865	0.000011085	0.00001101
PCB-77	32598-13-3	ng/kg	0.0001	0.000471	0.000105	0.0001115	0.0001045	0.000356
PCB-81	70362-50-4	ng/kg	0.0003	0.000069	0.00006945	0.0000741	0.00006915	0.0000687
Calculated 2,3,7,8-TCDD TEQ (ng/kg):				**0.811**	**0.427**	**0.443**	**0.429**	**0.421**

Notes:

CAS = Chemical Abstracts Service

J = The analyte was positively identified: the associated numerical value is the approxi

N = normal sample

ng/kg = nanogram(s) per kilogram

PCB = polychlorinated biphenyl

TEF = toxicity equivalency factor

TEQ = toxicity equivalence

U = The analyte was not detected above the reported sample quantitation limit.

UJ = The analyte was below the reported sample quantitation limit. However, the reported valı

Attachment L-5
Exposure Scenario Calculations – Inputs and Output Files

Site-specific
Recreator Soil Inputs
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Variable	Recreator Soil Default Value	Beach Play Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm^2	0	2.6
AF_{2-6} (skin adherence factor) mg/cm^2	0	2.6
AF_{6-16} (skin adherence factor) mg/cm^2	0	0
AF_{16-30} (skin adherence factor) mg/cm^2	0	0
AF_{rec-a} (skin adherence factor - adult) mg/cm^2	0	0
AF_{rec-c} (skin adherence factor - child) mg/cm^2	0	2.6
AT_{rec} (averaging time)	365	365
BW_{0-2} (body weight) kg	15	15
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	0
BW_{16-30} (body weight) kg	80	0
BW_{rec-a} (body weight - adult) kg	80	0
BW_{rec-c} (body weight - child) kg	15	15
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	0	163524.4
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor)	0	872130.133
ED_{rec} (exposure duration - recreator) years	26	6
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	0
ED_{16-30} (exposure duration) year	10	0
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	0	41
EF_{0-2} (exposure frequency) days/year	0	41
EF_{2-6} (exposure frequency) days/year	0	41
EF_{6-16} (exposure frequency) days/year	0	0
EF_{16-30} (exposure frequency) days/year	0	0
EF_{rec-a} (exposure frequency - adult) days/year	0	0
EF_{rec-c} (exposure frequency - child) days/year	0	41
ET_{rec} (exposure time - recreator) hours/day	0	8
ET_{0-2} (exposure time) hours/day	0	8
ET_{2-6} (exposure time) hours/day	0	8
ET_{6-16} (exposure time) hours/day	0	0
ET_{16-30} (exposure time) hours/day	0	0
ET_{rec-a} (adult exposure time) hours/day	0	0
ET_{rec-c} (child exposure time) hours/day	0	8
THQ (target hazard quotient) unitless	0.1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	0	3280
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor)	0	17493.333
IRS_{0-2} (soil intake rate) mg/day	200	200
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	0
IRS_{16-30} (soil intake rate) mg/day	100	0
IRS_{rec-a} (soil intake rate - adult) mg/day	100	0
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	3835
SA_{2-6} (skin surface area) cm^2/day	2373	3835
SA_{6-16} (skin surface area) cm^2/day	6032	0
SA_{16-30} (skin surface area) cm^2/day	6032	0
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	0
SA_{rec-c} (skin surface area - child) cm^2/day	2373	3835
TR (target risk) unitless	0.000001	0.000001
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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Site-specific Beach Play

Recreator Risk-Based Regional Screening Levels (RSL) for Soil

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	ABS	RBA	Soil Saturation Concentration (mg/kg)
Acenaphthene	83-32-9	No	Yes	Organics	-		-		6.00E-02	I	-		1.00E+00	1.30E-01	1.00E+00	-
Acenaphthylene	208-96-8	No	Yes	Organics	-		-		-		-		1.00E+00	1.30E-01	1.00E+00	-
Arsenic, Inorganic	7440-38-2	No	No	Inorganics	1.50E+00	I	4.30E-03	I	3.00E-04	I	1.50E-05	C	1.00E+00	3.00E-02	6.00E-01	-
Benz[a]anthracene	56-55-3	Yes	Yes	Organics	1.00E-01	E	6.00E-05	E	-		-		1.00E+00	1.30E-01	1.00E+00	-
Benzo[a]pyrene	50-32-8	Yes	No	Organics	1.00E+00	I	6.00E-04	I	3.00E-04	I	2.00E-06	I	1.00E+00	1.30E-01	1.00E+00	-
Benzo[b]fluoranthene	205-99-2	Yes	No	Organics	1.00E-01	E	6.00E-05	E	-		-		1.00E+00	1.30E-01	1.00E+00	-
Benzo[g,h,i]perylene	191-24-2	No	No	Organics	-		-		-		-		1.00E+00	1.30E-01	1.00E+00	-
Benzo[k]fluoranthene	207-08-9	Yes	No	Organics	1.00E-02	E	6.00E-06	E	-		-		1.00E+00	1.30E-01	1.00E+00	-
Cadmium (Diet)	7440-43-9	No	No	Inorganics	-		1.80E-03	I	1.00E-04	A	1.00E-05	A	2.50E-02	1.00E-03	1.00E+00	-
Chromium(III), Insoluble Salts	16065-83-1	No	No	Inorganics	-		-		1.50E+00	I	-		1.30E-02	-	1.00E+00	-
Chrysene	218-01-9	Yes	No	Organics	1.00E-03	E	6.00E-07	E	-		-		1.00E+00	1.30E-01	1.00E+00	-
Cobalt	7440-48-4	No	No	Inorganics	-		9.00E-03	P	3.00E-04	P	6.00E-06	P	1.00E+00	-	1.00E+00	-
Copper	7440-50-8	No	No	Inorganics	-		-		4.00E-02	H	-		1.00E+00	-	1.00E+00	-
Dibenz[a,h]anthracene	53-70-3	Yes	No	Organics	1.00E+00	E	6.00E-04	E	-		-		1.00E+00	1.30E-01	1.00E+00	-
Methylnaphthalene, 1-	90-12-0	No	Yes	Organics	2.90E-02	P	-		7.00E-02	A	-		1.00E+00	1.30E-01	1.00E+00	3.94E+02
Methylnaphthalene, 2-	91-57-6	No	Yes	Organics	-		-		4.00E-03	I	-		1.00E+00	1.30E-01	1.00E+00	-
Naphthalene	91-20-3	No	Yes	Organics	1.20E-01	C	3.40E-05	C	2.00E-02	I	3.00E-03	I	1.00E+00	1.30E-01	1.00E+00	-
Nickel Soluble Salts	7440-02-0	No	No	Inorganics	-		2.60E-04	C	2.00E-02	I	9.00E-05	A	4.00E-02	-	1.00E+00	-
Selenium	7782-49-2	No	No	Inorganics	-		-		5.00E-03	I	2.00E-02	C	1.00E+00	-	1.00E+00	-
Silver	7440-22-4	No	No	Inorganics	-		-		5.00E-03	I	-		4.00E-02	-	1.00E+00	-
TCDD, 2,3,7,8-	1746-01-6	No	Yes	Organics	1.30E+05	C	3.80E+01	C	7.00E-10	I	4.00E-08	C	1.00E+00	3.00E-02	1.00E+00	-
Zinc and Compounds	7440-66-6	No	No	Inorganics	-		-		3.00E-01	I	-		1.00E+00	-	1.00E+00	-

Chemical	S (mg/L)	K_{oc} (cm^3/g)	K_d (cm^3/g)	HLC (atm-m^3/mole)	Henry's Law Constant Used in Calcs (unitless)	H\` and HLC Ref	Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	Chemical Type	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	D_A (cm^2/s)
Acenaphthene	3.90E+00	5.03E+03	3.02E+01	1.84E-04	7.52E-03	PHYSPROP	5.52E+02	PHYSPROP	8.03E+02	YAWS	PAH	5.06E-02	8.33E-06	6.72E-07
Acenaphthylene	1.61E+01	5.03E+03	3.02E+01	1.14E-04	4.66E-03	PHYSPROP	5.53E+02	PHYSPROP	7.92E+02	YAWS	PAH	4.50E-02	6.98E-06	3.70E-07
Arsenic, Inorganic	-	-	2.90E+01	-	-		8.88E+02	PHYSPROP	1.67E+03	CRC	INORGANIC	-	-	-
Benz[a]anthracene	9.40E-03	1.77E+05	1.06E+03	1.20E-05	4.91E-04	PHYSPROP	7.11E+02	PHYSPROP	9.79E+02	YAWS	PAH	2.61E-02	6.75E-06	6.83E-10
Benzo[a]pyrene	1.62E-03	5.87E+05	-	4.57E-07	1.87E-05	PHYSPROP	7.68E+02	PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	PAH	2.55E-02	6.58E-06	-
Benzo[b]fluoranthene	1.50E-03	5.99E+05	-	6.57E-07	2.69E-05	PHYSPROP	7.16E+02	EPI	9.69E+02	EPA 2001 Fact Sheet	PAH	2.50E-02	6.43E-06	-
Benzo[g,h,i]perylene	2.60E-04	1.95E+06	-	3.31E-07	1.35E-05	PHYSPROP	7.59E+02	EPI	1.09E+03	Jobak Method	PAH	2.39E-02	6.09E-06	-
Benzo[k]fluoranthene	8.00E-04	5.87E+05	-	5.84E-07	2.39E-05	PHYSPROP	7.53E+02	PHYSPROP	1.02E+03	EPA 2001 Fact Sheet	PAH	2.50E-02	6.43E-06	-
Cadmium (Diet)	-	-	7.50E+01	-	-		1.04E+03	PHYSPROP	2.29E+03	YAWS	INORGANIC	-	-	-
Chromium(III), Insoluble Salts	-	-	1.80E+06	-	-		-		-		INORGANIC	-	-	-
Chrysene	2.00E-03	1.81E+05	-	5.23E-06	2.14E-04	PHYSPROP	7.21E+02	PHYSPROP	9.79E+02	YAWS	PAH	2.61E-02	6.75E-06	-
Cobalt	-	-	4.50E+01	-	-		3.20E+03	CRC	7.40E+03	YAWS	INORGANIC	-	-	-
Copper	-	-	3.50E+01	-	-		2.87E+03	PHYSPROP	5.12E+03	YAWS	INORGANIC	-	-	-
Dibenz[a,h]anthracene	2.49E-03	1.91E+06	-	1.41E-07	5.76E-06	EPI	7.97E+02	PHYSPROP	9.90E+02	EPA 2001 Fact Sheet	PAH	2.36E-02	6.02E-06	-
Methylnaphthalene, 1-	2.58E+01	2.53E+03	1.52E+01	5.14E-04	2.10E-02	PHYSPROP	5.18E+02	PHYSPROP	7.71E+02	CRC	PAH	5.28E-02	7.85E-06	3.87E-06
Methylnaphthalene, 2-	2.46E+01	2.48E+03	1.49E+01	5.18E-04	2.12E-02	PHYSPROP	5.14E+02	PHYSPROP	7.61E+02	CRC	PAH	5.24E-02	7.78E-06	3.95E-06
Naphthalene	3.10E+01	1.54E+03	9.26E+00	4.40E-04	1.80E-02	PHYSPROP	4.91E+02	PHYSPROP	7.48E+02	CRC	PAH	6.05E-02	8.38E-06	6.20E-06
Nickel Soluble Salts	-	-	6.50E+01	-	-		3.19E+03	CRC	6.99E+03	YAWS	INORGANIC	-	-	-
Selenium	-	-	5.00E+00	-	-		9.58E+02	PHYSPROP	1.77E+03	CRC	INORGANIC	-	-	-
Silver	-	-	8.30E+00	-	-		2.27E+03	PHYSPROP	6.41E+03	CRC	INORGANIC	-	-	-
TCDD, 2,3,7,8-	2.00E-04	2.49E+05	1.49E+03	5.00E-05	2.04E-03	EPI	6.52E+02	EPI	9.78E+02	Approx. from Tcrit=1.5xTBoil	DIOXIN	4.70E-02	6.76E-06	3.46E-09
Zinc and Compounds	-	-	6.20E+01	-	-		1.18E+03	PHYSPROP	3.17E+03	YAWS	INORGANIC	-	-	-

Chemical	Particulate Emission Factor (m^3/kg)	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)	Ingestion SL Adult THQ=1 (mg/kg)	Dermal SL Adult THQ=1 (mg/kg)	Inhalation SL Adult THQ=1 (mg/kg)	Noncarcinogenic SL Adult THI=1 (mg/kg)	Screening Level (mg/kg)
Acenaphthene	1.36E+09	1.41E+05	-	1.41E+05	-	-	-	-	4.01E+04	6.18E+03	-	5.35E+03	-	-	-	-	5.35E+03 nc
Acenaphthylene	1.36E+09	1.89E+05	-	1.89E+05	-	-	-	-	-	-	-	-	-	-	-	-	
Arsenic, Inorganic	1.36E+09	-	-	-	8.66E+00	3.47E+00	9.85E+04	2.48E+00	3.34E+02	1.34E+02	5.45E+05	9.56E+01	-	-	-	-	2.48E+00 ca
Benz[a]anthracene	1.36E+09	4.41E+06	-	4.41E+06	1.46E+01	2.25E+00	4.28E+03	1.95E+00	-	-	-	-	-	-	-	-	1.95E+00 ca
Benzo[a]pyrene	1.36E+09	-	-	-	1.46E+00	2.25E-01	1.32E+05	1.95E-01	2.00E+02	3.09E+01	7.26E+04	2.68E+01	-	-	-	-	1.95E-01 ca
Benzo[b]fluoranthene	1.36E+09	-	-	-	1.46E+01	2.25E+00	1.32E+06	1.95E+00	-	-	-	-	-	-	-	-	1.95E+00 ca
Benzo[g,h,i]perylene	1.36E+09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo[k]fluoranthene	1.36E+09	-	-	-	1.46E+02	2.25E+01	1.32E+07	1.95E+01	-	-	-	-	-	-	-	-	1.95E+01 ca
Cadmium (Diet)	1.36E+09	-	-	-	-	-	2.35E+05	2.35E+05	6.68E+01	3.35E+01	3.63E+05	2.23E+01	-	-	-	-	2.23E+01 nc
Chromium(III), Insoluble Salts	1.36E+09	-	-	-	-	-	-	-	1.00E+06	-	-	1.00E+06	-	-	-	-	1.00E+06 nc max
Chrysene	1.36E+09	-	-	-	1.46E+03	2.25E+02	1.32E+08	1.95E+02	-	-	-	-	-	-	-	-	1.95E+02 ca
Cobalt	1.36E+09	-	-	-	-	-	4.71E+04	4.71E+04	2.00E+02	-	2.18E+05	2.00E+02	-	-	-	-	2.00E+02 nc
Copper	1.36E+09	-	-	-	-	-	-	-	2.67E+04	-	-	2.67E+04	-	-	-	-	2.67E+04 nc
Dibenz[a,h]anthracene	1.36E+09	-	-	-	1.46E+00	2.25E-01	1.32E+05	1.95E-01	-	-	-	-	-	-	-	-	1.95E-01 ca
Methylnaphthalene, 1-	1.36E+09	5.86E+04	-	5.86E+04	2.69E+02	4.14E+01	-	3.59E+01	4.67E+04	7.21E+03	-	6.25E+03	-	-	-	-	3.59E+01 ca
Methylnaphthalene, 2-	1.36E+09	5.80E+04	-	5.80E+04	-	-	-	-	2.67E+03	4.12E+02	-	3.57E+02	-	-	-	-	3.57E+02 nc
Naphthalene	1.36E+09	4.63E+04	-	4.63E+04	6.49E+01	1.00E+01	4.25E+02	8.50E+00	1.34E+04	2.06E+03	3.71E+03	1.21E+03	-	-	-	-	8.50E+00 ca
Nickel Soluble Salts	1.36E+09	-	-	-	-	-	1.63E+06	1.63E+06	1.34E+04	-	3.27E+06	1.33E+04	-	-	-	-	1.33E+04 nc
Selenium	1.36E+09	-	-	-	-	-	-	-	3.34E+03	-	7.26E+08	3.34E+03	-	-	-	-	3.34E+03 nc
Silver	1.36E+09	-	-	-	-	-	-	-	3.34E+03	-	-	3.34E+03	-	-	-	-	3.34E+03 nc
TCDD, 2,3,7,8-	1.36E+09	1.96E+06	-	1.96E+06	5.99E-05	4.01E-05	1.61E-02	2.40E-05	4.67E-04	3.12E-04	2.09E+00	1.87E-04	-	-	-	-	2.40E-05 ca
Zinc and Compounds	1.36E+09	-	-	-	-	-	-	-	2.00E+05	-	-	2.00E+05	-	-	-	-	2.00E+05 nc max

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Site-specific
Recreator Soil Inputs
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Variable	Recreator Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm^2	0	2.6
AF_{2-6} (skin adherence factor) mg/cm^2	0	2.6
AF_{6-16} (skin adherence factor) mg/cm^2	0	0.24
AF_{16-30} (skin adherence factor) mg/cm^2	0	0.24
AF_{rec-a} (skin adherence factor - adult) mg/cm^2	0	0.24
AF_{rec-c} (skin adherence factor - child) mg/cm^2	0	2.6
AT_{rec} (averaging time)	365	365
BW_{0-2} (body weight) kg	15	10
BW_{2-6} (body weight) kg	15	17
BW_{6-16} (body weight) kg	80	44
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	62
BW_{rec-c} (body weight - child) kg	15	14.667
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	0	186383.798
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	0	930224.473
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	10
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	0	41
EF_{0-2} (exposure frequency) days/year	0	41
EF_{2-6} (exposure frequency) days/year	0	41
EF_{6-16} (exposure frequency) days/year	0	41
EF_{16-30} (exposure frequency) days/year	0	41
EF_{rec-a} (exposure frequency - adult) days/year	0	41
EF_{rec-c} (exposure frequency - child) days/year	0	41
ET_{rec} (exposure time - recreator) hours/day	0	8
ET_{0-2} (exposure time) hours/day	0	8
ET_{2-6} (exposure time) hours/day	0	8
ET_{6-16} (exposure time) hours/day	0	8
ET_{16-30} (exposure time) hours/day	0	8
ET_{rec-a} (adult exposure time) hours/day	0	8
ET_{rec-c} (child exposure time) hours/day	0	8
THQ (target hazard quotient) unitless	0.1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	0	4677.05
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	0	20535.664
IRS_{0-2} (soil intake rate) mg/day	200	200
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	100
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	2989
SA_{2-6} (skin surface area) cm^2/day	2373	4258
SA_{6-16} (skin surface area) cm^2/day	6032	6032
SA_{16-30} (skin surface area) cm^2/day	6032	6032
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{rec-c} (skin surface area - child) cm^2/day	2373	3835
TR (target risk) unitless	0.000001	0.000001
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 26JUL2023:14:25:32

Site-specific

Recreator Risk-Based Regional Screening Levels (RSL) for Soil

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; W = TEF applied; E = RPF applied; G = see user guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o(mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	ABS	RBA	Soil Saturation Concentration (mg/kg)	S (mg/L)	K_{oc} (cm^3/g)	K_d (cm^3/g)	HLC (atm-m^3/mole)	Henry's Law Constant Used in Calcs (unitless)	H` and HLC Ref	Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	Chemical Type	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	D_A (cm^2/s)	Particulate Emission Factor (m^3/kg)	Volatilization Factor UnlimitedReservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)	Ingestion SL Adult THQ=1 (mg/kg)	Dermal SL Adult THQ=1 (mg/kg)	Inhalation SL Adult THQ=1 (mg/kg)	Noncarcinogenic SL Adult THI=1 (mg/kg)	Screening Level (mg/kg)
Benzo[a]pyrene	50-32-8	Yes	No	Organics	1.00E+00	U	6.00E-04	U	3.00E-04	U	2.00E-06	U	#######	####	####	-	1.62E-03	5.87E+05	-	4.57E-07	1.87E-05	U	#######	U	9.69E+02	U	PAH	2.55E-02	6.58E-06	-	1.36E+09	-	-	-	1.24E+00	2.11E-01	5.88E+04	1.81E-01	1.96E+02	3.02E+01	7.26E+04	2.62E+01	1.66E+03	8.80E+02	7.26E+04	5.70E+02	1.81E-01 ca

Output generated 26JUL2023:14:25:32

Site-specific
Recreator Soil Inputs
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Variable	Recreator Soil Default Value	Clam Digging Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm^2	0	0
AF_{2-6} (skin adherence factor) mg/cm^2	0	0
AF_{6-16} (skin adherence factor) mg/cm^2	0	0.24
AF_{16-30} (skin adherence factor) mg/cm^2	0	0.24
AF_{rec-a} (skin adherence factor - adult) mg/cm^2	0	0.24
AF_{rec-c} (skin adherence factor - child) mg/cm^2	0	0
AT_{rec} (averaging time)	365	365
BW_{0-2} (body weight) kg	15	0
BW_{2-6} (body weight) kg	15	0
BW_{6-16} (body weight) kg	80	80
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	0
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	0	272171.52
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	0	357225.12
ED_{rec} (exposure duration - recreator) years	26	64
ED_{0-2} (exposure duration) year	2	0
ED_{2-6} (exposure duration) year	4	0
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	54
ED_{rec-c} (exposure duration - child) years	6	0
EF_{rec} (exposure frequency) days/year	0	120
EF_{0-2} (exposure frequency) days/year	0	0
EF_{2-6} (exposure frequency) days/year	0	0
EF_{6-16} (exposure frequency) days/year	0	120
EF_{16-30} (exposure frequency) days/year	0	120
EF_{rec-a} (exposure frequency - adult) days/year	0	120
EF_{rec-c} (exposure frequency - child) days/year	0	0
ET_{rec} (exposure time - recreator) hours/day	0	8
ET_{0-2} (exposure time) hours/day	0	0
ET_{2-6} (exposure time) hours/day	0	0
ET_{6-16} (exposure time) hours/day	0	8
ET_{16-30} (exposure time) hours/day	0	8
ET_{rec-a} (adult exposure time) hours/day	0	8
ET_{rec-c} (child exposure time) hours/day	0	0
THQ (target hazard quotient) unitless	0.1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	0	9600
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	0	12600
IRS_{0-2} (soil intake rate) mg/day	200	0
IRS_{2-6} (soil intake rate) mg/day	200	0
IRS_{6-16} (soil intake rate) mg/day	100	100
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	0
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	0
SA_{2-6} (skin surface area) cm^2/day	2373	0
SA_{6-16} (skin surface area) cm^2/day	6032	11813
SA_{16-30} (skin surface area) cm^2/day	6032	11813
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	11813
SA_{rec-c} (skin surface area - child) cm^2/day	2373	0
TR (target risk) unitless	0.000001	0.000001
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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Site-specific Clam Digging

Recreator Risk-Based Regional Screening Levels (RSL) for Soil

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o(mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	ABS	RBA
Acenaphthene	83-32-9	No	Yes	Organics	-		-		6.00E-02	I	-		#######	1.30E-01	1.00E+00
Acenaphthylene	208-96-8	No	Yes	Organics	-		-		-		-		#######	1.30E-01	1.00E+00
Anthracene	120-12-7	No	Yes	Organics	-		-		3.00E-01	I	-		#######	1.30E-01	1.00E+00
Arsenic, Inorganic	7440-38-2	No	No	Inorganics	1.50E+00	I	4.30E-03	I	3.00E-04	I	1.50E-05	C	#######	3.00E-02	6.00E-01
Benzo[a]pyrene	50-32-8	Yes	No	Organics	1.00E+00	I	6.00E-04	I	3.00E-04	I	2.00E-06	I	#######	1.30E-01	1.00E+00
Benzo[b]fluoranthene	205-99-2	Yes	No	Organics	1.00E-01	E	6.00E-05	E	-		-		#######	1.30E-01	1.00E+00
Benzo[g,h,i]perylene	191-24-2	No	No	Organics	-		-		-		-		#######	1.30E-01	1.00E+00
Benzo[k]fluoranthene	207-08-9	Yes	No	Organics	1.00E-02	E	6.00E-06	E	-		-		#######	1.30E-01	1.00E+00
Cadmium (Diet)	7440-43-9	No	No	Inorganics	-		1.80E-03	I	1.00E-04	A	1.00E-05	A	2.50E-02	1.00E-03	1.00E+00
Chromium(III), Insoluble Salts	16065-83-1	No	No	Inorganics	-		-		1.50E+00	I	-		1.30E-02	-	1.00E+00
Chrysene	218-01-9	Yes	No	Organics	1.00E-03	E	6.00E-07	E	-		-		#######	1.30E-01	1.00E+00
Cobalt	7440-48-4	No	No	Inorganics	-		9.00E-03	P	3.00E-04	P	6.00E-06	P	#######	-	1.00E+00
Copper	7440-50-8	No	No	Inorganics	-		-		4.00E-02	H	-		#######	-	1.00E+00
Fluoranthene	206-44-0	No	No	Organics	-		-		4.00E-02	I	-		#######	1.30E-01	1.00E+00
Fluorene	86-73-7	No	Yes	Organics	-		-		4.00E-02	I	-		#######	1.30E-01	1.00E+00
Methylnaphthalene, 1-	90-12-0	No	Yes	Organics	2.90E-02	P	-		7.00E-02	A	-		#######	1.30E-01	1.00E+00
Methylnaphthalene, 2-	91-57-6	No	Yes	Organics	-		-		4.00E-03	I	-		#######	1.30E-01	1.00E+00
Naphthalene	91-20-3	No	Yes	Organics	1.20E-01	C	3.40E-05	C	2.00E-02	I	3.00E-03	I	#######	1.30E-01	1.00E+00
Nickel Soluble Salts	7440-02-0	No	No	Inorganics	-		2.60E-04	C	2.00E-02	I	9.00E-05	A	4.00E-02	-	1.00E+00
Selenium	7782-49-2	No	No	Inorganics	-		-		5.00E-03	I	2.00E-02	C	#######	-	1.00E+00
Silver	7440-22-4	No	No	Inorganics	-		-		5.00E-03	I	-		4.00E-02	-	1.00E+00
TCDD, 2,3,7,8-	1746-01-6	No	Yes	Organics	1.30E+05	C	3.80E+01	C	7.00E-10	I	4.00E-08	C	#######	3.00E-02	1.00E+00
Zinc and Compounds	7440-66-6	No	No	Inorganics	-		-		3.00E-01	I	-		#######	-	1.00E+00

Chemical	Soil Saturation Concentration (mg/kg)	S (mg/L)	K_{oc} (cm^3/g)	K_d (cm^3/g)	HLC (atm-m^3/mole)	Henry's Law Constant Used in Calcs (unitless)	H` and HLC Ref	Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	Chemical Type	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	D_A (cm^2/s)
Acenaphthene	-	3.90E+00	5.03E+03	3.02E+01	1.84E-04	7.52E-03	PHYSPROP	5.52E+02	PHYSPROP	8.03E+02	YAWS	PAH	5.06E-02	8.33E-06	6.72E-07
Acenaphthylene	-	1.61E+01	5.03E+03	3.02E+01	1.14E-04	4.66E-03	PHYSPROP	5.53E+02	PHYSPROP	7.92E+02	YAWS	PAH	4.50E-02	6.98E-06	3.70E-07
Anthracene	-	4.34E-02	1.64E+04	9.82E+01	5.56E-05	2.27E-03	PHYSPROP	6.13E+02	PHYSPROP	8.73E+02	YAWS	PAH	3.90E-02	7.85E-06	4.85E-08
Arsenic, Inorganic	-	-	-	2.90E+01	-	-		8.88E+02	PHYSPROP	1.67E+03	CRC	INORGANIC	-	-	-
Benzo[a]pyrene	-	1.62E-03	5.87E+05	-	4.57E-07	1.87E-05	PHYSPROP	7.68E+02	PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	PAH	2.55E-02	6.58E-06	-
Benzo[b]fluoranthene	-	1.50E-03	5.99E+05	-	6.57E-07	2.69E-05	PHYSPROP	7.16E+02	EPI	9.69E+02	EPA 2001 Fact Sheet	PAH	2.50E-02	6.43E-06	-
Benzo[g,h,i]perylene	-	2.60E-04	1.95E+06	-	3.31E-07	1.35E-05	PHYSPROP	7.59E+02	EPI	1.09E+03	Jobak Method	PAH	2.39E-02	6.09E-06	-
Benzo[k]fluoranthene	-	8.00E-04	5.87E+05	-	5.84E-07	2.39E-05	PHYSPROP	7.53E+02	PHYSPROP	1.02E+03	EPA 2001 Fact Sheet	PAH	2.50E-02	6.43E-06	-
Cadmium (Diet)	-	-	-	7.50E+01	-	-		1.04E+03	PHYSPROP	2.29E+03	YAWS	INORGANIC	-	-	-
Chromium(III), Insoluble Salts	-	-	-	1.80E+06	-	-		-		-		INORGANIC	-	-	-
Chrysene	-	2.00E-03	1.81E+05	-	5.23E-06	2.14E-04	PHYSPROP	7.21E+02	PHYSPROP	9.79E+02	YAWS	PAH	2.61E-02	6.75E-06	-
Cobalt	-	-	-	4.50E+01	-	-		3.20E+03	CRC	7.40E+03	YAWS	INORGANIC	-	-	-
Copper	-	-	-	3.50E+01	-	-		2.87E+03	PHYSPROP	5.12E+03	YAWS	INORGANIC	-	-	-
Fluoranthene	-	2.60E-01	5.55E+04	-	8.86E-06	3.62E-04	PHYSPROP	6.57E+02	PHYSPROP	9.05E+02	YAWS	PAH	2.76E-02	7.18E-06	-
Fluorene	-	1.69E+00	9.16E+03	5.50E+01	9.62E-05	3.93E-03	PHYSPROP	5.68E+02	PHYSPROP	8.26E+02	YAWS	PAH	4.40E-02	7.89E-06	1.68E-07
Methylnaphthalene, 1-	3.94E+02	2.58E+01	2.53E+03	1.52E+01	5.14E-04	2.10E-02	PHYSPROP	5.18E+02	PHYSPROP	7.71E+02	CRC	PAH	5.28E-02	7.85E-06	3.87E-06
Methylnaphthalene, 2-	-	2.46E+01	2.48E+03	1.49E+01	5.18E-04	2.12E-02	PHYSPROP	5.14E+02	PHYSPROP	7.61E+02	CRC	PAH	5.24E-02	7.78E-06	3.95E-06
Naphthalene	-	3.10E+01	1.54E+03	9.26E+00	4.40E-04	1.80E-02	PHYSPROP	4.91E+02	PHYSPROP	7.48E+02	CRC	PAH	6.05E-02	8.38E-06	6.20E-06
Nickel Soluble Salts	-	-	-	6.50E+01	-	-		3.19E+03	CRC	6.99E+03	YAWS	INORGANIC	-	-	-
Selenium	-	-	-	5.00E+00	-	-		9.58E+02	PHYSPROP	1.77E+03	CRC	INORGANIC	-	-	-
Silver	-	-	-	8.30E+00	-	-		2.27E+03	PHYSPROP	6.41E+03	CRC	INORGANIC	-	-	-
TCDD, 2,3,7,8-	-	2.00E-04	2.49E+05	1.49E+03	5.00E-05	2.04E-03	EPI	6.52E+02	EPI	9.78E+02	Approx. from Tcrit=1.5xTBoil	DIOXIN	4.70E-02	6.76E-06	3.46E-09
Zinc and Compounds	-	-	-	6.20E+01	-	-		1.18E+03	PHYSPROP	3.17E+03	YAWS	INORGANIC	-	-	-

Chemical	Particulate Emission Factor (m^3/kg)	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)	Ingestion SL Adult THQ=1 (mg/kg)	Dermal SL Adult THQ=1 (mg/kg)	Inhalation SL Adult THQ=1 (mg/kg)	Noncarcinogenic SL Adult THI=1 (mg/kg)	Screening Level (mg/kg)
Acenaphthene	1.36E+09	1.41E+05	-	1.41E+05	-	-	-	-	-	-	-	-	1.46E+05	3.96E+04	-	3.12E+04	3.12E+04 nc
Acenaphthylene	1.36E+09	1.89E+05	-	1.89E+05	-	-	-	-	-	-	-	-	-	-	-	-	
Anthracene	1.36E+09	5.23E+05	-	5.23E+05	-	-	-	-	-	-	-	-	7.30E+05	1.98E+05	-	1.56E+05	1.56E+05 nc max
Arsenic, Inorganic	1.36E+09	-	-	-	2.96E+00	2.09E+00	3.16E+03	1.22E+00	-	-	-	-	1.22E+03	8.58E+02	1.86E+05	5.02E+02	1.22E+00 ca
Benzo[a]pyrene	1.36E+09	-	-	-	2.03E+00	5.50E-01	1.72E+04	4.33E-01	-	-	-	-	7.30E+02	1.98E+02	2.48E+04	1.55E+02	4.33E-01 ca
Benzo[b]fluoranthene	1.36E+09	-	-	-	2.03E+01	5.50E+00	1.72E+05	4.33E+00	-	-	-	-	-	-	-	-	4.33E+00 ca
Benzo[g,h,i]perylene	1.36E+09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo[k]fluoranthene	1.36E+09	-	-	-	2.03E+02	5.50E+01	1.72E+06	4.33E+01	-	-	-	-	-	-	-	-	4.33E+01 ca
Cadmium (Diet)	1.36E+09	-	-	-	-	-	7.54E+03	7.54E+03	-	-	-	-	2.43E+02	2.15E+02	1.24E+05	1.14E+02	1.14E+02 nc
Chromium(III), Insoluble Salts	1.36E+09	-	-	-	-	-	-	-	-	-	-	-	3.65E+06	-	-	3.65E+06	3.65E+06 nc max
Chrysene	1.36E+09	-	-	-	2.03E+03	5.50E+02	1.72E+07	4.33E+02	-	-	-	-	-	-	-	-	4.33E+02 ca
Cobalt	1.36E+09	-	-	-	-	-	1.51E+03	1.51E+03	-	-	-	-	7.30E+02	-	7.44E+04	7.23E+02	7.23E+02 nc
Copper	1.36E+09	-	-	-	-	-	-	-	-	-	-	-	9.73E+04	-	-	9.73E+04	9.73E+04 nc
Fluoranthene	1.36E+09	-	-	-	-	-	-	-	-	-	-	-	9.73E+04	2.64E+04	-	2.08E+04	2.08E+04 nc
Fluorene	1.36E+09	2.81E+05	-	2.81E+05	-	-	-	-	-	-	-	-	9.73E+04	2.64E+04	-	2.08E+04	2.08E+04 nc
Methylnaphthalene, 1-	1.36E+09	5.86E+04	-	5.86E+04	9.18E+01	2.49E+01	-	1.96E+01	-	-	-	-	1.70E+05	4.62E+04	-	3.64E+04	1.96E+01 ca
Methylnaphthalene, 2-	1.36E+09	5.80E+04	-	5.80E+04	-	-	-	-	-	-	-	-	9.73E+03	2.64E+03	-	2.08E+03	2.08E+03 nc
Naphthalene	1.36E+09	4.63E+04	-	4.63E+04	2.22E+01	6.02E+00	1.36E+01	3.51E+00	-	-	-	-	4.87E+04	1.32E+04	1.27E+03	1.13E+03	3.51E+00 ca
Nickel Soluble Salts	1.36E+09	-	-	-	-	-	5.22E+04	5.22E+04	-	-	-	-	4.87E+04	-	1.12E+06	4.66E+04	4.66E+04 nc
Selenium	1.36E+09	-	-	-	-	-	-	-	-	-	-	-	1.22E+04	-	2.48E+08	1.22E+04	1.22E+04 nc
Silver	1.36E+09	-	-	-	-	-	-	-	-	-	-	-	1.22E+04	-	-	1.22E+04	1.22E+04 nc
TCDD, 2,3,7,8-	1.36E+09	1.96E+06	-	1.96E+06	2.05E-05	2.41E-05	5.15E-04	1.08E-05	-	-	-	-	1.70E-03	2.00E-03	7.15E-01	9.19E-04	1.08E-05 ca
Zinc and Compounds	1.36E+09	-	-	-	-	-	-	-	-	-	-	-	7.30E+05	-	-	7.30E+05	7.30E+05 nc max

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Site-specific
Recreator Soil Inputs
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Variable	Recreator Soil Default Value	Net Fishing Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm^2	0	0
AF_{2-6} (skin adherence factor) mg/cm^2	0	0
AF_{6-16} (skin adherence factor) mg/cm^2	0	0.19
AF_{16-30} (skin adherence factor) mg/cm^2	0	0.19
AF_{rec-a} (skin adherence factor - adult) mg/cm^2	0	0.19
AF_{rec-c} (skin adherence factor - child) mg/cm^2	0	0
AT_{rec} (averaging time)	365	365
BW_{0-2} (body weight) kg	15	0
BW_{2-6} (body weight) kg	15	0
BW_{6-16} (body weight) kg	80	80
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	0
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	0	101111.92
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	0	132709.395
ED_{rec} (exposure duration - recreator) years	26	64
ED_{0-2} (exposure duration) year	2	0
ED_{2-6} (exposure duration) year	4	0
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	54
ED_{rec-c} (exposure duration - child) years	6	0
EF_{rec} (exposure frequency) days/year	0	119
EF_{0-2} (exposure frequency) days/year	0	0
EF_{2-6} (exposure frequency) days/year	0	0
EF_{6-16} (exposure frequency) days/year	0	119
EF_{16-30} (exposure frequency) days/year	0	119
EF_{rec-a} (exposure frequency - adult) days/year	0	119
EF_{rec-c} (exposure frequency - child) days/year	0	0
ET_{rec} (exposure time - recreator) hours/day	0	8
ET_{0-2} (exposure time) hours/day	0	0
ET_{2-6} (exposure time) hours/day	0	0
ET_{6-16} (exposure time) hours/day	0	8
ET_{16-30} (exposure time) hours/day	0	8
ET_{rec-a} (adult exposure time) hours/day	0	8
ET_{rec-c} (child exposure time) hours/day	0	0
THQ (target hazard quotient) unitless	0.1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	0	4760
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	0	6247.5
IRS_{0-2} (soil intake rate) mg/day	200	0
IRS_{2-6} (soil intake rate) mg/day	200	0
IRS_{6-16} (soil intake rate) mg/day	100	50
IRS_{16-30} (soil intake rate) mg/day	100	50
IRS_{rec-a} (soil intake rate - adult) mg/day	100	50
IRS_{rec-c} (soil intake rate - child) mg/day	200	0
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	0
SA_{2-6} (skin surface area) cm^2/day	2373	0
SA_{6-16} (skin surface area) cm^2/day	6032	5590
SA_{16-30} (skin surface area) cm^2/day	6032	5590
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	5590
SA_{rec-c} (skin surface area - child) cm^2/day	2373	0
TR (target risk) unitless	0.000001	0.000001
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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Site-specific Net Fishing

Recreator Risk-Based Regional Screening Levels (RSL) for Soil

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	ABS	RBA	Soil Saturation Concentration (mg/kg)
Acenaphthene	83-32-9	No	Yes	Organics	-		-		6.00E-02	I	-		1.00E+00	1.30E-01	1.00E+00	-
Acenaphthylene	208-96-8	No	Yes	Organics	-		-		-		-		1.00E+00	1.30E-01	1.00E+00	-
Anthracene	120-12-7	No	Yes	Organics	-		-		3.00E-01	I	-		1.00E+00	1.30E-01	1.00E+00	-
Arsenic, Inorganic	7440-38-2	No	No	Inorganics	1.50E+00	I	4.30E-03	I	3.00E-04	I	1.50E-05	C	1.00E+00	3.00E-02	6.00E-01	-
Benz[a]anthracene	56-55-3	Yes	Yes	Organics	1.00E-01	E	6.00E-05	E	-		-		1.00E+00	1.30E-01	1.00E+00	-
Benzo[a]pyrene	50-32-8	Yes	No	Organics	1.00E+00	I	6.00E-04	I	3.00E-04	I	2.00E-06	I	1.00E+00	1.30E-01	1.00E+00	-
Benzo[b]fluoranthene	205-99-2	Yes	No	Organics	1.00E-01	E	6.00E-05	E	-		-		1.00E+00	1.30E-01	1.00E+00	-
Benzo[g,h,i]perylene	191-24-2	No	No	Organics	-		-		-		-		1.00E+00	1.30E-01	1.00E+00	-
Benzo[k]fluoranthene	207-08-9	Yes	No	Organics	1.00E-02	E	6.00E-06	E	-		-		1.00E+00	1.30E-01	1.00E+00	-
Cadmium (Diet)	7440-43-9	No	No	Inorganics	-		1.80E-03	I	1.00E-04	A	1.00E-05	A	2.50E-02	1.00E-03	1.00E+00	-
Chromium(III), Insoluble Salts	16065-83-1	No	No	Inorganics	-		-		1.50E+00	I	-		1.30E-02	-	1.00E+00	-
Chrysene	218-01-9	Yes	No	Organics	1.00E-03	E	6.00E-07	E	-		-		1.00E+00	1.30E-01	1.00E+00	-
Cobalt	7440-48-4	No	No	Inorganics	-		9.00E-03	P	3.00E-04	P	6.00E-06	P	1.00E+00	-	1.00E+00	-
Copper	7440-50-8	No	No	Inorganics	-		-		4.00E-02	H	-		1.00E+00	-	1.00E+00	-
Dibenz[a,h]anthracene	53-70-3	Yes	No	Organics	1.00E+00	E	6.00E-04	E	-		-		1.00E+00	1.30E-01	1.00E+00	-
Fluoranthene	206-44-0	No	No	Organics	-		-		4.00E-02	I	-		1.00E+00	1.30E-01	1.00E+00	-
Fluorene	86-73-7	No	Yes	Organics	-		-		4.00E-02	I	-		1.00E+00	1.30E-01	1.00E+00	-
Indeno[1,2,3-cd]pyrene	193-39-5	Yes	No	Organics	1.00E-01	E	6.00E-05	E	-		-		1.00E+00	1.30E-01	1.00E+00	-
Methylnaphthalene, 1-	90-12-0	No	Yes	Organics	2.90E-02	P	-		7.00E-02	A	-		1.00E+00	1.30E-01	1.00E+00	3.94E+02
Methylnaphthalene, 2-	91-57-6	No	Yes	Organics	-		-		4.00E-03	I	-		1.00E+00	1.30E-01	1.00E+00	-
Naphthalene	91-20-3	No	Yes	Organics	1.20E-01	C	3.40E-05	C	2.00E-02	I	3.00E-03	I	1.00E+00	1.30E-01	1.00E+00	-
Nickel Refinery Dust	NA	No	No	Inorganics	-		2.40E-04	I	1.10E-02	C	1.40E-05	C	4.00E-02	-	1.00E+00	-
Selenium	7782-49-2	No	No	Inorganics	-		-		5.00E-03	I	2.00E-02	C	1.00E+00	-	1.00E+00	-
Silver	7440-22-4	No	No	Inorganics	-		-		5.00E-03	I	-		4.00E-02	-	1.00E+00	-
TCDD, 2,3,7,8-	1746-01-6	No	Yes	Organics	1.30E+05	C	3.80E+01	C	7.00E-10	I	4.00E-08	C	1.00E+00	3.00E-02	1.00E+00	-
Zinc and Compounds	7440-66-6	No	No	Inorganics	-		-		3.00E-01	I	-		1.00E+00	-	1.00E+00	-

Chemical	S (mg/L)	K_{oc} (cm^3/g)	K_d (cm^3/g)	HLC (atm-m^3/mole)	Henry's Law Constant Used in Calcs (unitless)	H` and HLC Ref	Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	Chemical Type	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	D_A (cm^2/s)	Particulate Emission Factor (m^3/kg)
Acenaphthene	3.90E+00	5.03E+03	3.02E+01	1.84E-04	7.52E-03	PHYSPROP	5.52E+02	PHYSPROP	8.03E+02	YAWS	PAH	5.06E-02	8.33E-06	6.72E-07	1.36E+09
Acenaphthylene	1.61E+01	5.03E+03	3.02E+01	1.14E-04	4.66E-03	PHYSPROP	5.53E+02	PHYSPROP	7.92E+02	YAWS	PAH	4.50E-02	6.98E-06	3.70E-07	1.36E+09
Anthracene	4.34E-02	1.64E+04	9.82E+01	5.56E-05	2.27E-03	PHYSPROP	6.13E+02	PHYSPROP	8.73E+02	YAWS	PAH	3.90E-02	7.85E-06	4.85E-08	1.36E+09
Arsenic, Inorganic	-	-	2.90E+01	-	-		8.88E+02	PHYSPROP	1.67E+03	CRC	INORGANIC	-	-	-	1.36E+09
Benz[a]anthracene	9.40E-03	1.77E+05	1.06E+03	1.20E-05	4.91E-04	PHYSPROP	7.11E+02	PHYSPROP	9.79E+02	YAWS	PAH	2.61E-02	6.75E-06	6.83E-10	1.36E+09
Benzo[a]pyrene	1.62E-03	5.87E+05	-	4.57E-07	1.87E-05	PHYSPROP	7.68E+02	PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	PAH	2.55E-02	6.58E-06	-	1.36E+09
Benzo[b]fluoranthene	1.50E-03	5.99E+05	-	6.57E-07	2.69E-05	PHYSPROP	7.16E+02	EPI	9.69E+02	EPA 2001 Fact Sheet	PAH	2.50E-02	6.43E-06	-	1.36E+09
Benzo[g,h,i]perylene	2.60E-04	1.95E+06	-	3.31E-07	1.35E-05	PHYSPROP	7.59E+02	EPI	1.09E+03	Jobak Method	PAH	2.39E-02	6.09E-06	-	1.36E+09
Benzo[k]fluoranthene	8.00E-04	5.87E+05	-	5.84E-07	2.39E-05	PHYSPROP	7.53E+02	PHYSPROP	1.02E+03	EPA 2001 Fact Sheet	PAH	2.50E-02	6.43E-06	-	1.36E+09
Cadmium (Diet)	-	-	7.50E+01	-	-		1.04E+03	PHYSPROP	2.29E+03	YAWS	INORGANIC	-	-	-	1.36E+09
Chromium(III), Insoluble Salts	-	-	1.80E+06	-	-		-		-		INORGANIC	-	-	-	1.36E+09
Chrysene	2.00E-03	1.81E+05	-	5.23E-06	2.14E-04	PHYSPROP	7.21E+02	PHYSPROP	9.79E+02	YAWS	PAH	2.61E-02	6.75E-06	-	1.36E+09
Cobalt	-	-	4.50E+01	-	-		3.20E+03	CRC	7.40E+03	YAWS	INORGANIC	-	-	-	1.36E+09
Copper	-	-	3.50E+01	-	-		2.87E+03	PHYSPROP	5.12E+03	YAWS	INORGANIC	-	-	-	1.36E+09
Dibenz[a,h]anthracene	2.49E-03	1.91E+06	-	1.41E-07	5.76E-06	EPI	7.97E+02	PHYSPROP	9.90E+02	EPA 2001 Fact Sheet	PAH	2.36E-02	6.02E-06	-	1.36E+09
Fluoranthene	2.60E-01	5.55E+04	-	8.86E-06	3.62E-04	PHYSPROP	6.57E+02	PHYSPROP	9.05E+02	YAWS	PAH	2.76E-02	7.18E-06	-	1.36E+09
Fluorene	1.69E+00	9.16E+03	5.50E+01	9.62E-05	3.93E-03	PHYSPROP	5.68E+02	PHYSPROP	8.26E+02	YAWS	PAH	4.40E-02	7.89E-06	1.68E-07	1.36E+09
Indeno[1,2,3-cd]pyrene	1.90E-04	1.95E+06	-	3.48E-07	1.42E-05	PHYSPROP	8.09E+02	PHYSPROP	1.08E+03	EPA 2001 Fact Sheet	PAH	2.47E-02	6.37E-06	-	1.36E+09
Methylnaphthalene, 1-	2.58E+01	2.53E+03	1.52E+01	5.14E-04	2.10E-02	PHYSPROP	5.18E+02	PHYSPROP	7.71E+02	CRC	PAH	5.28E-02	7.85E-06	3.87E-06	1.36E+09
Methylnaphthalene, 2-	2.46E+01	2.48E+03	1.49E+01	5.18E-04	2.12E-02	PHYSPROP	5.14E+02	PHYSPROP	7.61E+02	CRC	PAH	5.24E-02	7.78E-06	3.95E-06	1.36E+09
Naphthalene	3.10E+01	1.54E+03	9.26E+00	4.40E-04	1.80E-02	PHYSPROP	4.91E+02	PHYSPROP	7.48E+02	CRC	PAH	6.05E-02	8.38E-06	6.20E-06	1.36E+09
Nickel Refinery Dust	-	-	1.50E+02	-	-		-		-		INORGANIC	-	-	-	1.36E+09
Selenium	-	-	5.00E+00	-	-		9.58E+02	PHYSPROP	1.77E+03	CRC	INORGANIC	-	-	-	1.36E+09
Silver	-	-	8.30E+00	-	-		2.27E+03	PHYSPROP	6.41E+03	CRC	INORGANIC	-	-	-	1.36E+09
TCDD, 2,3,7,8-	2.00E-04	2.49E+05	1.49E+03	5.00E-05	2.04E-03	EPI	6.52E+02	EPI	9.78E+02	Approx. from Tcrit=1.5xTBoil	DIOXIN	4.70E-02	6.76E-06	3.46E-09	1.36E+09
Zinc and Compounds	-	-	6.20E+01	-	-		1.18E+03	PHYSPROP	3.17E+03	YAWS	INORGANIC	-	-	-	1.36E+09

Chemical	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)	Ingestion SL Adult THQ=1 (mg/kg)	Dermal SL Adult THQ=1 (mg/kg)	Inhalation SL Adult THQ=1 (mg/kg)	Noncarcinogenic SL Adult THI=1 (mg/kg)	Screening Level (mg/kg)
Acenaphthene	1.41E+05	-	1.41E+05	-	-	-	-	-	-	-	-	2.94E+05	1.07E+05	-	7.83E+04	7.83E+04 nc
Acenaphthylene	1.89E+05	-	1.89E+05	-	-	-	-	-	-	-	-	-	-	-	-	
Anthracene	5.23E+05	-	5.23E+05	-	-	-	-	-	-	-	-	1.47E+06	5.33E+05	-	3.91E+05	3.91E+05 nc max
Arsenic, Inorganic	-	-	-	5.96E+00	5.62E+00	3.18E+03	2.89E+00	-	-	-	-	2.45E+03	2.31E+03	1.88E+05	1.18E+03	2.89E+00 ca
Benz[a]anthracene	4.41E+06	-	4.41E+06	4.09E+01	1.48E+01	5.62E+02	1.07E+01	-	-	-	-	-	-	-	-	1.07E+01 ca
Benzo[a]pyrene	-	-	-	4.09E+00	1.48E+00	1.74E+04	1.09E+00	-	-	-	-	1.47E+03	5.33E+02	2.50E+04	3.85E+02	1.09E+00 ca
Benzo[b]fluoranthene	-	-	-	4.09E+01	1.48E+01	1.74E+05	1.09E+01	-	-	-	-	-	-	-	-	1.09E+01 ca
Benzo[g,h,i]perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo[k]fluoranthene	-	-	-	4.09E+02	1.48E+02	1.74E+06	1.09E+02	-	-	-	-	-	-	-	-	1.09E+02 ca
Cadmium (Diet)	-	-	-	-	-	7.60E+03	7.60E+03	-	-	-	-	4.91E+02	5.78E+02	1.25E+05	2.65E+02	2.65E+02 nc
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	7.36E+06	-	-	7.36E+06	7.36E+06 nc max
Chrysene	-	-	-	4.09E+03	1.48E+03	1.74E+07	1.09E+03	-	-	-	-	-	-	-	-	1.09E+03 ca
Cobalt	-	-	-	-	-	1.52E+03	1.52E+03	-	-	-	-	1.47E+03	-	7.50E+04	1.44E+03	1.44E+03 nc
Copper	-	-	-	-	-	-	-	-	-	-	-	1.96E+05	-	-	1.96E+05	1.96E+05 nc max
Dibenz[a,h]anthracene	-	-	-	4.09E+00	1.48E+00	1.74E+04	1.09E+00	-	-	-	-	-	-	-	-	1.09E+00 ca
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	1.96E+05	7.11E+04	-	5.22E+04	5.22E+04 nc
Fluorene	2.81E+05	-	2.81E+05	-	-	-	-	-	-	-	-	1.96E+05	7.11E+04	-	5.22E+04	5.22E+04 nc
Indeno[1,2,3-cd]pyrene	-	-	-	4.09E+01	1.48E+01	1.74E+05	1.09E+01	-	-	-	-	-	-	-	-	1.09E+01 ca
Methylnaphthalene, 1-	5.86E+04	-	5.86E+04	1.85E+02	6.70E+01	-	4.92E+01	-	-	-	-	3.44E+05	1.24E+05	-	9.13E+04	4.92E+01 ca
Methylnaphthalene, 2-	5.80E+04	-	5.80E+04	-	-	-	-	-	-	-	-	1.96E+04	7.11E+03	-	5.22E+03	5.22E+03 nc
Naphthalene	4.63E+04	-	4.63E+04	4.47E+01	1.62E+01	1.37E+01	6.37E+00	-	-	-	-	9.82E+04	3.55E+04	1.28E+03	1.22E+03	6.37E+00 ca
Nickel Refinery Dust	-	-	-	-	-	5.70E+04	5.70E+04	-	-	-	-	5.40E+04	-	1.75E+05	4.13E+04	4.13E+04 nc
Selenium	-	-	-	-	-	-	-	-	-	-	-	2.45E+04	-	2.50E+08	2.45E+04	2.45E+04 nc
Silver	-	-	-	-	-	-	-	-	-	-	-	2.45E+04	-	-	2.45E+04	2.45E+04 nc
TCDD, 2,3,7,8-	1.96E+06	-	1.96E+06	4.13E-05	6.48E-05	5.19E-04	2.40E-05	-	-	-	-	3.44E-03	5.39E-03	7.21E-01	2.09E-03	2.40E-05 ca
Zinc and Compounds	-	-	-	-	-	-	-	-	-	-	-	1.47E+06	-	-	1.47E+06	1.47E+06 nc max

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Appendix M
Initial Investigation Data from 2018 – Statistical Analysis of Surface Samples

Appendix M. Initial Investigation Data from 2018 – Statistical Analysis of Surface Samples

This appendix provides the field information from the sediment sampling events and includes the following:

- Appendix M-1 – Screening Tables
  - Table M-1 – Analytical and Screening Results from 2018 Investigation Step 1 – Benthic Community Criteria
  - Table M-2 – Analytical and Screening Results from 2018 Investigation Step 1 – Bioaccumulation
  - Table M-3 – Carcinogenic PAH Statistics from 2018 Investigation Step 1
- Appendix M-2 – ProUCL Outputs

Appendix M-1
Screening Tables

Table M-1. Analytical and Screening Results from 2018 Investigation Step 1 -
Benthic Community Criteria

BNSF Wishram Sediment Remedial Investigation Report

Analyte	Sediment Cleanup Objective (SCO)[1]	Cleanup Screening Level (CSL)[1]	Summary Statistics for Site Samples							
			Frequency of Detection	Non-Detects		Detects				Mean[3]
				Minimum	Maximum	Minimum		Maximum		
PAHs (mg/kg)										
1-Methylnaphthalene	NA	NA	1 / 11	0.0256	0.0294	0.335	J260.GS.080818	0.335	J260.GS.080818	0.0537
2-Chloronaphthalene	NA	NA	11 / 11	--	--	0.0256	D200.GS.080718, I400.GS.080918	0.137	J260.GS.080818	0.0374
2-Methylnaphthalene	NA	NA	2 / 11	0.0256	0.0294	0.003	D240.GS.080618	0.332	J260.GS.080818	0.0329
Acenaphthene	NA	NA	1 / 11	0.00768	0.00882	0.139	J260.GS.080818	0.139	J260.GS.080818	0.0196
Acenaphthylene	NA	NA	2 / 11	0.00768	0.0412	0.0063	D240.GS.080618	0.00827	D200.GS.080718	0.00669
Anthracene	NA	NA	2 / 11	0.00768	0.00882	0.00655	D240.GS.080618	0.195	J260.GS.080818	0.0237
Benz[a]anthracene	NA	NA	9 / 11	0.0077	0.00852	0.000966	D420.GS.080618	0.169	J260.GS.080818	0.0207
Benzo(a)pyrene	NA	NA	8 / 11	0.0077	0.00852	0.000869	I400.GS.080918	1.23	J260.GS.080818	0.128
Benzo(b)fluoranthene	NA	NA	8 / 11	0.00768	0.00852	0.00107	D220.GS.080718	0.0527	J260.GS.080818	0.0107
Benzo(ghi)perylene	NA	NA	6 / 11	0.00768	0.00852	0.00251	G200.GS.080718	0.305	J260.GS.080818	0.0318
Benzo(k)fluoranthene	NA	NA	6 / 11	0.00768	0.00852	0.00166	D260.GS.080618	0.403	J260.GS.080818	0.0409
Chrysene	NA	NA	6 / 11	0.00768	0.00882	0.00147	G200.GS.080718	0.741	J260.GS.080818	0.0809
Dibenzo(a,h)anthracene	NA	NA	3 / 11	0.00768	0.0412	0.000823	K120.GS.080818	0.00864	D240.GS.080618	0.00174
Fluoranthene	NA	NA	5 / 11	0.00768	0.0412	0.00135	D220.GS.080718	0.00726	D200.GS.080718	0.0036
Fluorene	NA	NA	3 / 11	0.00768	0.00882	0.00161	D200.GS.080718	0.109	J260.GS.080818	0.0116
Indeno(1,2,3-cd)pyrene	NA	NA	7 / 11	0.00768	0.00852	0.00106	D220.GS.080718	0.0999	J260.GS.080818	0.0118
Naphthalene	NA	NA	3 / 11	0.0256	0.0294	0.00428	D240.GS.080618	0.0605	J260.GS.080818	0.0101
Phenanthrene	NA	NA	4 / 11	0.00768	0.00882	0.00103	D150.GS.080718	0.399	J260.GS.080818	0.0385
Pyrene	NA	NA	9 / 11	0.00768	0.00852	0.000937	D420.GS.080618	1.82	J260.GS.080818	0.174
total_PAH[2]	17	30	10 / 11	0.1065	0.1065	0.087113	K120.GS.080818	6.4519	J260.GS.080818	0.711
TPH (mg/kg)										
Diesel_Range_Organics	340	510	9 / 11	5.49	25.7	2.7	G200.GS.080718	12700	J260.GS.080818	1235
Residual_Range_Organics	3600	4400	11 / 11	--	--	5.95	D420.GS.080618	31000	J260.GS.080818	**3112.95**
Diesel_Range_Organics (silica gel)	340	510	8 / 11	5.55	113	2.39	D420.GS.080618	4830	J260.GS.080818	**470.5**
Residual_Range_Organics (silica gel)	3600	4400	10 / 11	14.2	14.2	5.57	G200.GS.080718	12100	J260.GS.080818	**1236**
VPH (mg/kg)										
C10-C12 Aliphatics	NA	NA	2 / 10	2.8	7.9	4	J260.GS.080818	5.8	D220.GS.080718, D420.GS.080618	3.347
C10-C12 aliphatic (adjusted)	NA	NA	0 / 10	2.6	3.2	--		--		--
C10-C12 Aromatics	NA	NA	10 / 10	--	--	4.5	I400.GS.080918	13	D240.GS.080618	7.3
C12-C13 Aromatics	NA	NA	3 / 10	2.8	5.2	7.5	D220.GS.080718	11	J260.GS.080818	4.61
C5-C6 Aliphatics	NA	NA	1 / 10	2.8	7.9	5.3	D420.GS.080618	5.3	D420.GS.080618	3.113
C5-C6 aliphatics (adjusted)	NA	NA	1 / 10	2.6	3.2	5.3	D420.GS.080618	5.3	D420.GS.080618	2.87
C6-C8 Aliphatics	NA	NA	0 / 10	2.8	7.9	--	--	--	--	--
C6-C8 aliphatic (adjusted)	NA	NA	0 / 10	2.6	3.2	--	--	--	--	--
C8-C10 Aliphatics	NA	NA	0 / 10	2.8	7.9	--	--	--	--	--
C8-C10 aliphatic (adjusted)	NA	NA	0 / 10	2.6	3.2	--	--	--	--	--
C8-C10 Aromatics	NA	NA	0 / 10	2.8	7.9	--	--	--	--	--

Table M-1. Analytical and Screening Results from 2018 Investigation Step 1 - Benthic Community Criteria

BNSF Wishram Sediment Remedial Investigation Report

Analyte	Sediment Cleanup Objective (SCO)[1]	Cleanup Screening Level (CSL)[1]	Summary Statistics for Site Samples									
			Frequency of Detection			Non-Detects		Detects				Mean[3]
						Minimum	Maximum	Minimum		Maximum		
EPH (mg/kg)												
C10-C12 Aliphatics	NA	NA	3	/	10	0.67	3	0.85	D200.GS.080718	21	J260.GS.080818	3.008
C10-C12 Aromatics	NA	NA	0	/	10	1.1	6.2	--	--	--	--	--
C12-C16 Aliphatics	NA	NA	8	/	10	0.6	0.61	0.84	K120.GS.080818	32	J260.GS.080818	7.934
C12-C16 Aromatics	NA	NA	2	/	10	0.56	3.3	1.5	D200.GS.080718	7	J260.GS.080818	1.325
C16-C21 Aliphatics	NA	NA	10	/	10	--	--	1.1	D420.GS.080618, G260.GS.080718	87	J260.GS.080818	26.69
C16-C21 Aromatics	NA	NA	10	/	10	--	--	1.2	D420.GS.080618	180	J260.GS.080818	28.24
C21-C34 Aliphatics	NA	NA	10	/	10	--	--	3.2	D420.GS.080618	310	J260.GS.080818	94.26
C21-C34 Aromatics	NA	NA	10	/	10	--	--	4.1	G260.GS.080718	890	J260.GS.080818	149.57

Notes:

All concentrations are reported on a dry weight basis

Bolded site sample concentrations are detects

Grey shaded site sample concentrations exceed the SCO

Orange text = site sample concentrations are greater than the CSL

EPH = extractable petroleum hydrocarbons

J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.

PAHs - polycyclic aromatic hydrocarbons

U = Not detected at the reporting limit (or method detection limit or estimated detection limit if shown)

VPH = volatile petroleum hydrocarbons

1 - SCOs and CSLs from Table 8-1 of Ecology (2021)

2 - Total PAHs calculated by summing concentrations of individual PAH compounds (when not detected, 1/2 the reported value was used as a surrogate concentrations)

3 - Calculated by ProUCL (Version 5.2) using Kaplan-Meier (KM) method

Table M-1. Analytical and Screening Results from 2018 Investigation Step 1 - Benthic Community Criteria

BNSF Wishram Sediment Remedial Investigation Report

Analyte	Sediment Cleanup Objective (SCO)[1]	Cleanup Screening Level (CSL)[1]	Individual Site Results						
			D150	D200	D220	D240	D260	D420	
			D150-GS-080718	D200-GS-080718	D220-GS-080718	D240-GS-080618	D260-GS-080618	D420-GS-080618	D420-GS-080618-1
			8/7/2018	8/7/2018	8/7/2018	8/6/2018	8/6/2018	8/6/2018	8/6/2018
PAHs (mg/kg)									
1-Methylnaphthalene	NA	NA	0.0282 U	0.0256 U	0.0294 U	0.028 U	0.0283 U	0.0275 U	0.027 U
2-Chloronaphthalene	NA	NA	**0.0282**	**0.0256**	**0.0294**	**0.028**	**0.0283**	**0.0275**	**0.027**
2-Methylnaphthalene	NA	NA	0.0282 U	0.0256 U	0.0294 U	**0.003** J	0.0283 U	0.0275 U	0.027 U
Acenaphthene	NA	NA	0.00847 U	0.00769 U	0.00882 U	0.00839 U	0.00849 U	0.00824 U	0.00811 U
Acenaphthylene	NA	NA	0.00847 U	**0.00827**	0.00882 U	**0.0063** J	0.00849 U	0.00824 U	0.00811 U
Anthracene	NA	NA	0.00847 U	0.00769 U	0.00882 U	**0.00655** J	0.00849 U	0.00824 U	0.00811 U
Benz[a]anthracene	NA	NA	**0.00185** J	**0.0173**	**0.00282** J	**0.0233**	**0.00391** J	0.00824 U	**0.000966** J
Benzo(a)pyrene	NA	NA	**0.00248** J	**0.134**	**0.00188** J	**0.0275**	**0.00424** J	0.00824 U	0.00811 U
Benzo(b)fluoranthene	NA	NA	**0.00286** J	**0.0243**	**0.00107** J	**0.0208**	**0.00521** J	0.00824 U	0.00811 U
Benzo(ghi)perylene	NA	NA	**0.00529** J	0.00769 U	**0.00325** J	0.00839 U	**0.006** J	0.00824 U	0.00811 U
Benzo(k)fluoranthene	NA	NA	**0.00179** J	**0.0177**	**0.00229** J	**0.0143**	**0.00166** J	0.00824 U	0.00811 U
Chrysene	NA	NA	**0.00172** J	**0.113**	0.00882 U	**0.0189**	**0.00324** J	0.00824 U	0.00811 U
Dibenzo(a,h)anthracene	NA	NA	0.00847 U	0.00769 U	0.00882 U	**0.00864**	**0.000931** J	0.00824 U	0.00811 U
Fluoranthene	NA	NA	**0.00268** J	**0.00726** J	**0.00135** J	0.00839 U	**0.00398** J	0.00824 U	0.00811 U
Fluorene	NA	NA	0.00847 U	**0.00161** J	0.00882 U	**0.0021** J	0.00849 U	0.00824 U	0.00811 U
Indeno(1,2,3-cd)pyrene	NA	NA	**0.00183** J	0.00769 U	**0.00106** J	**0.0148**	**0.00272** J	0.00824 U	0.00811 U
Naphthalene	NA	NA	0.0282 U	**0.00579** J	0.0294 U	**0.00428** J	0.0283 U	0.0275 U	0.027 U
Phenanthrene	NA	NA	**0.00103** J	0.00769 U	0.00882 U	**0.0129**	**0.00149** J	0.00824 U	0.00811 U
Pyrene	NA	NA	**0.00437** J	**0.0231**	**0.00257** J	**0.0489**	**0.00531** J	0.00824 U	**0.000937** J
total_PAH[2]	17	30	**0.089375**	**0.401**	**0.09126**	**0.238855**	**0.098121**	0.10305 U	**0.095118**
TPH (mg/kg)									
Diesel_Range_Organics	340	510	**50.4** J	**459**	**40** J	**180**	**81.5**	5.49 U	5.41 U
Residual_Range_Organics	3600	4400	**223**	**1380**	**188**	**781**	**313**	13.7 U	**5.95** J
Diesel_Range_Organics (silica gel)	340	510	113 U	**57.6** J	**20.6** J	**219** J	**7.88** J	5.49 U	**2.39** J
Residual_Range_Organics (silica gel)	3600	4400	**174** J	**179** J	**88.8** J	**907** J	32.3 J6	13.7 U	**7.6** J
VPH (mg/kg)									
C10-C12 Aliphatics	NA	NA		2.9 U	5.8 U	7.9 U	4.7 U	**5.8** J	4.8 U
C10-C12 aliphatic (adjusted)	NA	NA		3 U	3 U	3.1 U	3.2 U	2.8 U	2.8 U
C10-C12 Aromatics	NA	NA		**5.1** J	**11** J	**13** J	**8.1** J	**8.9** J	**9.4** J
C12-C13 Aromatics	NA	NA		2.9 U	**7.5** J	**8** J	4.7 U	5.2 U	4.8 U
C5-C6 Aliphatics	NA	NA		2.9 U	5.8 U	7.9 U	4.7 U	5.2 U	**5.3** J
C5-C6 aliphatics (adjusted)	NA	NA		3 U	3 U	3.1 U	3.2 U	2.8 U	**5.3** J
C6-C8 Aliphatics	NA	NA		2.9 U	5.8 U	7.9 U	4.7 U	5.2 U	4.8 U
C6-C8 aliphatic (adjusted)	NA	NA		3 U	3 U	3.1 U	3.2 U	2.8 U	2.8 U
C8-C10 Aliphatics	NA	NA		2.9 U	5.8 U	7.9 U	4.7 U	5.2 U	4.8 U
C8-C10 aliphatic (adjusted)	NA	NA		3 U	3 U	3.1 U	3.2 U	2.8 U	2.8 U
C8-C10 Aromatics	NA	NA		2.9 U	5.8 U	7.9 U	4.7 U	5.2 U	4.8 U

Table M-1. Analytical and Screening Results from 2018 Investigation Step 1 - Benthic Community Criteria

BNSF Wishram Sediment Remedial Investigation Report

Analyte	Sediment Cleanup Objective (SCO)[1]	Cleanup Screening Level (CSL)[1]	Individual Site Results													
			D150		D200		D220		D240		D260		D420			
			D150-GS-080718		D200-GS-080718		D220-GS-080718		D240-GS-080618		D260-GS-080618		D420-GS-080618		D420-GS-080618-1	
			8/7/2018		8/7/2018		8/7/2018		8/6/2018		8/6/2018		8/6/2018		8/6/2018	
EPH (mg/kg)																
C10-C12 Aliphatics	NA	NA			**0.85**	J	2.8	U	2.9	U	3	U	**3**	J	1.3	U
C10-C12 Aromatics	NA	NA			1.2	U	6.2	U	6.1	U	1.3	U	1.2	U	1.1	U
C12-C16 Aliphatics	NA	NA			**4.3**	J	**16**	J	**19**	J	**2.1**	J	0.6	U	0.59	U
C12-C16 Aromatics	NA	NA			**1.5**	J	3.3	U	3.2	U	0.7	U	0.6	U	0.59	U
C16-C21 Aliphatics	NA	NA			**11**		**55**		**78**		**11**		**1.1**	J	0.82	U
C16-C21 Aromatics	NA	NA			**9.4**		**33**	J	**37**		**5.6**	J	**1.2**	J	**0.92**	J
C21-C34 Aliphatics	NA	NA			**30**		**180**		**270**		**50**		**3.2**	J	**2.9**	J
C21-C34 Aromatics	NA	NA			**31**		**190**		**230**		**47**		**4.6**	J	**3.2**	J

Notes:

All concentrations are reported on a dry weight basis

Bolded site sample concentrations are detects

Grey shaded site sample concentrations exceed the SCO

Orange text = site sample concentrations are greater than the CSL

EPH = extractable petroleum hydrocarbons

J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.

PAHs - polycyclic aromatic hydrocarbons

U = Not detected at the reporting limit (or method detection limit or estimated detection limit if shown)

VPH = volatile petroleum hydrocarbons

1 - SCOs and CSLs from Table 8-1 of Ecology (2021)

2 - Total PAHs calculated by summing concentrations of individual PAH compounds (when not detected, 1/2 the reported value was used as a surrogate concentrations)

3 - Calculated by ProUCL (Version 5.2) using Kaplan-Meier (KM) method

Table M-1. Analytical and Screening Results from 2018 Investigation Step 1 - Benthic Community Criteria

BNSF Wishram Sediment Remedial Investigation Report

Analyte	Sediment Cleanup Objective (SCO)[1]	Cleanup Screening Level (CSL)[1]	Individual Site Results									
			G200		G260		I400		J260		K120	
			G200-GS-080718		G260-GS-080718		I400-GS-080918		J260-GS-080818		K120-GS-080818	
			8/7/2018		8/7/2018		8/9/2018		8/8/2018		8/8/2018	
PAHs (mg/kg)												
1-Methylnaphthalene	NA	NA	0.0277	U	0.0284	U	0.0256	U	**0.335**		0.0257	U
2-Chloronaphthalene	NA	NA	**0.0277**		**0.0284**		**0.0256**		**0.137**		**0.0257**	
2-Methylnaphthalene	NA	NA	0.0277	U	0.0284	U	0.0256	U	**0.332**		0.0257	U
Acenaphthene	NA	NA	0.00832	U	0.00852	U	0.00768	U	**0.139**		0.0077	U
Acenaphthylene	NA	NA	0.00832	U	0.00852	U	0.00768	U	0.0412	U	0.0077	U
Anthracene	NA	NA	0.00832	U	0.00852	U	0.00768	U	**0.195**		0.0077	U
Benz[a]anthracene	NA	NA	**0.00157**	J	0.00852	U	**0.00211**	J	**0.169**		0.0077	U
Benzo(a)pyrene	NA	NA	**0.00202**	J	0.00852	U	**0.000869**	J	**1.23**		0.0077	U
Benzo(b)fluoranthene	NA	NA	**0.00227**	J	0.00852	U	0.00768	U	**0.0527**		**0.00116**	J
Benzo(ghi)perylene	NA	NA	**0.00251**	J	0.00852	U	0.00768	U	**0.305**		**0.0056**	J
Benzo(k)fluoranthene	NA	NA	0.00832	U	0.00852	U	0.00768	U	**0.403**		0.0077	U
Chrysene	NA	NA	**0.00147**	J	0.00852	U	0.00768	U	**0.741**		0.0077	U
Dibenzo(a,h)anthracene	NA	NA	0.00832	U	0.00852	U	0.00768	U	0.0412	U	**0.000823**	J
Fluoranthene	NA	NA	**0.00272**	J	0.00852	U	0.00768	U	0.0412	U	0.0077	U
Fluorene	NA	NA	0.00832	U	0.00852	U	0.00768	U	**0.109**		0.0077	U
Indeno(1,2,3-cd)pyrene	NA	NA	**0.00144**	J	0.00852	U	0.00768	U	**0.0999**		**0.00144**	J
Naphthalene	NA	NA	0.0277	U	0.0284	U	0.0256	U	**0.0605**	J	0.0257	U
Phenanthrene	NA	NA	0.00832	U	0.00852	U	0.00768	U	**0.399**		0.0077	U
Pyrene	NA	NA	**0.00369**	J	0.00852	U	0.00768	U	**1.82**		**0.00104**	J
total_PAH[2]	17	30	**0.08836**		0.1065	U	**0.091299**		**6.4519**		**0.087113**	
TPH (mg/kg)												
Diesel_Range_Organics	340	510	**2.7**	J	**4.53**	J	**54.3**		12700		25.7	U
Residual_Range_Organics	3600	4400	**14**		**12.3**	J	**290**		31000		**35.2**	J
Diesel_Range_Organics (silica gel)	340	510	5.55	U	5.68	U	**14.1**	J	4830		**3.95**	J
Residual_Range_Organics (silica gel)	3600	4400	**5.57**	J	14.2	U	**74.7**		12100		**19.6**	
VPH (mg/kg)												
C10-C12 Aliphatics	NA	NA	3.1	U	3.2	U	2.8	U	**4**	J	4.2	U
C10-C12 aliphatic (adjusted)	NA	NA	2.9	U	2.8	U	2.7	U	3	U	2.6	U
C10-C12 Aromatics	NA	NA	**5.2**	J	**5.3**	J	**4.5**	J	**5**	J	**6.4**	J
C12-C13 Aromatics	NA	NA	3.1	U	3.2	U	2.8	U	**11**		4.2	U
C5-C6 Aliphatics	NA	NA	3.1	U	3.2	U	2.8	U	4	U	4.2	U
C5-C6 aliphatics (adjusted)	NA	NA	2.9	U	2.8	U	2.7	U	3	U	2.6	U
C6-C8 Aliphatics	NA	NA	3.1	U	3.2	U	2.8	U	4	U	4.2	U
C6-C8 aliphatic (adjusted)	NA	NA	2.9	U	2.8	U	2.7	U	3	U	2.6	U
C8-C10 Aliphatics	NA	NA	3.1	U	3.2	U	2.8	U	4	U	4.2	U
C8-C10 aliphatic (adjusted)	NA	NA	2.9	U	2.8	U	2.7	U	3	U	2.6	U
C8-C10 Aromatics	NA	NA	3.1	U	3.2	U	2.8	U	4	U	4.2	U

Table M-1. Analytical and Screening Results from 2018 Investigation Step 1 - Benthic Community Criteria

BNSF Wishram Sediment Remedial Investigation Report

Analyte	Sediment Cleanup Objective (SCO)[1]	Cleanup Screening Level (CSL)[1]	Individual Site Results									
			G200		G260		I400		J260		K120	
			G200-GS-080718		G260-GS-080718		I400-GS-080918		J260-GS-080818		K120-GS-080818	
			8/7/2018		8/7/2018		8/9/2018		8/8/2018		8/8/2018	
EPH (mg/kg)												
C10-C12 Aliphatics	NA	NA	1.3	U	0.67	U	2.6	U	**21**	J	1.2	U
C10-C12 Aromatics	NA	NA	1.2	U	1.2	U	2.3	U	4	U	1.1	U
C12-C16 Aliphatics	NA	NA	**1.3**	J	0.61	U	**2.6**	J	**32**		**0.84**	J
C12-C16 Aromatics	NA	NA	0.62	U	0.61	U	1.2	U	**7**	J	0.56	U
C16-C21 Aliphatics	NA	NA	**3.8**	J	**1.1**	J	**15**		**87**		**3.9**	J
C16-C21 Aromatics	NA	NA	**4.3**	J	**1.4**	J	**8**	J	**180**		**2.5**	J
C21-C34 Aliphatics	NA	NA	**14**		**4.4**	J	**64**		**310**		**17**	
C21-C34 Aromatics	NA	NA	**19**		**4.1**	J	**60**		**890**		**20**	

Notes:

All concentrations are reported on a dry weight basis

Bolded site sample concentrations are detects

Grey shaded site sample concentrations exceed the SCO

Orange text = site sample concentrations are greater than the CSL

EPH = extractable petroleum hydrocarbons

J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.

PAHs - polycyclic aromatic hydrocarbons

U = Not detected at the reporting limit (or method detection limit or estimated detection limit if shown)

VPH = volatile petroleum hydrocarbons

1 - SCOs and CSLs from Table 8-1 of Ecology (2021)

2 - Total PAHs calculated by summing concentrations of individual PAH compounds (when not detected, 1/2 the reported value was used as a surrogate concentrations)

3 - Calculated by ProUCL (Version 5.2) using Kaplan-Meier (KM) method

Table M-2. Analytical and Screening Results from 2018 Investigation Step 1 - Bioaccumulation

BNSF Wishram Sediment Remedial Investigation Report

Analyte	Mean[2]	Preliminary Natural Background Values[3]	Background Data Source
total_PAH[1]	0.711	0.22	Maximum PQL (2022)[4]
Diesel_Range_Organics	1235	58.2	Maximum Detect (2022)
Residual_Range_Organics	3113	318	Maximum Detect (2022)
Diesel_Range_Organics (silica gel)	471	58.2	Maximum Detect (2022)
Residual_Range_Organics (silica gel)	1236	318	Maximum Detect (2022)

Notes:

All concentrations are reported on a dry weight basis

Orange-shaded concentrations exceed preliminary natural background value

PAHs - polycyclic aromatic hydrocarbons

PQL - Practical Quantitation Limit

1 - Total PAHs calculated by summing concentrations of individual PAH compounds (when not detected, 1/2 the reported value was used as a surrogate concentrations)

2 - Same mean concentrations as Table K-1; Calculated by ProUCL (Version 5.2) using Kaplan-Meier (KM) method; **Appendix M-2** provides ProUCL output

3 - background values are in **Appendix F**

4 - PQL for benzo(a)pyrene

Table M-3. Carcinogenic PAH Statistics from 2018 Investigation Step 1
BNSF Wishram Sediment Remedial Investigation Report

Analyte	Frequency of Detection	Non-Detects Minimum	Non-Detects Maximum	Detects Minimum		Detects Maximum		Mean[3]	D150 D150-GS-080718 8/7/2018		D200 D200-GS-080718 8/7/2018		D220 D220-GS-080718 8/7/2018	
PAHs														
Benz[a]anthracene	9 / 11	0.0077	0.00852	0.000966	D420.GS.080618	0.169	J260.GS.080818	0.0207	**0.00185**	J	**0.0173**		**0.00282**	J
Benzo(a)pyrene	8 / 11	0.0077	0.00852	0.000869	I400.GS.080918	1.23	J260.GS.080818	0.128	**0.00248**	J	**0.134**		**0.00188**	J
Benzo(b)fluoranthene	8 / 11	0.00768	0.00852	0.00107	D220.GS.080718	0.0527	J260.GS.080818	0.0107	**0.00286**	J	**0.0243**		**0.00107**	J
Benzo(k)fluoranthene	6 / 11	0.00768	0.00852	0.00166	D260.GS.080618	0.403	J260.GS.080818	0.0409	**0.00179**	J	**0.0177**		**0.00229**	J
Chrysene	6 / 11	0.00768	0.00882	0.00147	G200.GS.080718	0.741	J260.GS.080818	0.0809	**0.00172**	J	**0.113**		0.00882	U
Dibenzo(a,h)anthracene	3 / 11	0.00768	0.0412	0.000823	K120.GS.080818	0.00864	D240.GS.080618	0.00174	0.00847	U	0.00769	U	0.00882	U
Indeno(1,2,3-cd)pyrene	7 / 11	0.00768	0.00852	0.00106	D220.GS.080718	0.0999	J260.GS.080818	0.0118	**0.00183**	J	0.00769	U	**0.00106**	J
Sum TEQ[1]														
cPAH TEQ[2]	10 / 11	0.00643	0.00643	0.0026544	I400.GS.080918	1.31193	J260.GS.080818	0.138	**0.003754**		**0.141829**		**0.003089**	

Notes:

Bolded site sample concentrations are detects

cPAH - carcinogenic polycyclic aromatic hydrocarbons

J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.

PAHs - polycyclic aromatic hydrocarbons

TEQ = toxicity equivalence

U = Not detected at the reporting limit (or method detection limit or estimated detection limit if shown)

1 - Values reported for sum TEQs are TEQ results

2 - Carcinogenic PAHs (cPAH) calculated by summing concentrations of the listed seven individual PAH compounds (when undetected, 1/2 the reported value was used as a surrogate concentration)

3 - Calculated by ProUCL (Version 5.2) using Kaplan-Meier (KM) method

4 - Parent and duplicate value for D420 were not averaged due to no detects in parent sample. The Duplicate value was used for calculation of the KM mean.

Table M-3. Carcinogenic PAH Statistics from 2018 Investigation Step 1

BNSF Wishram Sediment Remedial Investigation Report

Analyte	Individual Site Results								
	D240	D260	D420[4]		G200	G260	I400	J260	K120
	D240-GS-080618	**D260-GS-080618**	**D420-GS-080618**	**D420-GS-080618-1**	**G200-GS-080718**	**G260-GS-080718**	**I400-GS-080918**	**J260-GS-080818**	**K120-GS-080818**
	8/6/2018	**8/6/2018**	**8/6/2018**	**8/6/2018**	**8/7/2018**	**8/7/2018**	**8/9/2018**	**8/8/2018**	**8/8/2018**
PAHs									
Benz[a]anthracene	**0.0233**	**0.00391** J	0.00824 U	**0.000966** J	**0.00157** J	0.00852 U	**0.00211** J	**0.169**	0.0077 U
Benzo(a)pyrene	**0.0275**	**0.00424** J	0.00824 U	0.00811 U	**0.00202** J	0.00852 U	**0.000869** J	**1.23**	0.0077 U
Benzo(b)fluoranthene	**0.0208**	**0.00521** J	0.00824 U	0.00811 U	**0.00227** J	0.00852 U	0.00768 U	**0.0527**	**0.00116** J
Benzo(k)fluoranthene	**0.0143**	**0.00166** J	0.00824 U	0.00811 U	0.00832 U	0.00852 U	0.00768 U	**0.403**	0.0077 U
Chrysene	**0.0189**	**0.00324** J	0.00824 U	0.00811 U	**0.00147** J	0.00852 U	0.00768 U	**0.741**	0.0077 U
Dibenzo(a,h)anthracene	**0.00864**	**0.000931** J	0.00824 U	0.00811 U	0.00832 U	0.00852 U	0.00768 U	0.0412 U	**0.000823** J
Indeno(1,2,3-cd)pyrene	**0.0148**	**0.00272** J	0.00824 U	0.00811 U	**0.00144** J	0.00852 U	0.00768 U	**0.0999**	**0.00144** J
Sum TEQ[1]									
cPAH TEQ[2]	**0.035873**	**0.005716**	0.006221 U	**0.00581415**	**0.003395**	**0.006433**	0.002654 U	**1.31193**	**0.005001**

Notes:

Bolded site sample concentrations are detects

cPAH - carcinogenic polycyclic aromatic hydrocarbons

J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.

PAHs - polycyclic aromatic hydrocarbons

TEQ = toxicity equivalence

U = Not detected at the reporting limit (or method detection limit or estimated detection limit if shown)

1 - Values reported for sum TEQs are TEQ results

2 - Carcinogenic PAHs (cPAH) calculated by summing concentrations of the listed seven individual PAH compounds (when undetected, 1/2 the reported value was used as a surrogate concentration)

3 - Calculated by ProUCL (Version 5.2) using Kaplan-Meier (KM) method

4 - Parent and duplicate value for D420 were not averaged due to no detects in parent sample. The Duplicate value was used for calculation of the KM mean.

Appendix M-2
ProUCL Output

	General Statistics on Uncensored Data
Date/Time of Computation	ProUCL 5.2 3/8/2024 8:45:39 AM
User Selected Options	
From File	ProUCL.Input.SD.xls
Full Precision	OFF

From File: ProUCL.Input.SD.xls

General Statistics for Censored Data Set (with NDs) using Kaplan Meier Method

Variable	NumObs	# Missing	Num Ds	NumNDs	% NDs	Min ND	Max ND	KM Mean	KM Var	KM SD	KM CV
Total Organic Carbon	12	0	12	0	0.00%	N/A	N/A	34608	1.374E+9	37064	1.071
Total Solids	23	0	23	0	0.00%	N/A	N/A	73.44	26.59	5.156	0.0702
Chemical Oxygen Demand	21	2	19	2	9.52%	200	200	611.9	596539	772.4	1.262
1-Methylnaphthalene	11	12	1	10	90.91%	0.0256	0.0294	0.0537	0.00791	0.0889	1.656
2-Chloronaphthalene	11	12	11	0	0.00%	N/A	N/A	0.0374	0.00109	0.0331	0.884
2-Methylnaphthalene	11	12	2	9	81.82%	0.0256	0.0294	0.0329	0.00895	0.0946	2.874
Acenaphthene	11	12	1	10	90.91%	0.00768	0.00882	0.0196	0.00143	0.0378	1.924
Acenaphthylene	11	12	2	9	81.82%	0.00768	0.0412	0.00669	6.2094E-7	7.8800E-4	0.118
Anthracene	11	12	2	9	81.82%	0.00768	0.00882	0.0237	0.00293	0.0542	2.288
Benz[a]anthracene	11	12	9	2	18.18%	0.0077	0.00852	0.0207	0.00225	0.0474	2.296
Benzo(a)pyrene	11	12	8	3	27.27%	0.0077	0.00852	0.128	0.123	0.35	2.734
Benzo(b)fluoranthene	11	12	8	3	27.27%	0.00768	0.00852	0.0107	2.3684E-4	0.0154	1.436
Benzo(ghi)perylene	11	12	6	5	45.45%	0.00768	0.00852	0.0318	0.00746	0.0864	2.713
Benzo(k)fluoranthene	11	12	6	5	45.45%	0.00768	0.00852	0.0409	0.0131	0.115	2.8
Chrysene	11	12	6	5	45.45%	0.00768	0.00882	0.0809	0.0446	0.211	2.609
Dibenzo(a,h)anthracene	11	12	3	8	72.73%	0.00768	0.0412	0.00174	5.9546E-6	0.00244	1.403
Fluoranthene	11	12	5	6	54.55%	0.00768	0.0412	0.0036	4.0447E-6	0.00201	0.559
Fluorene	11	12	3	8	72.73%	0.00768	0.00882	0.0116	9.4882E-4	0.0308	2.656
Indeno(1,2,3-cd)pyrene	11	12	7	4	36.36%	0.00768	0.00852	0.0118	7.9018E-4	0.0281	2.379
Naphthalene	11	12	3	8	72.73%	0.0256	0.0294	0.0101	2.5476E-4	0.016	1.584
Phenanthrene	11	12	4	7	63.64%	0.00768	0.00882	0.0385	0.013	0.114	2.964
Pyrene	11	12	9	2	18.18%	0.00768	0.00852	0.174	0.271	0.521	2.989
Diesel_Range_Organics	11	12	9	2	18.18%	5.49	25.7	1235	13162053	3628	2.939
Residual_Range_Organics	11	12	11	0	0.00%	N/A	N/A	3113	85718809	9258	2.974
Diesel_Range_Organics_SG	11	12	8	3	27.27%	5.55	113	470.5	1904173	1380	2.933
sidual_Range_Organics_SG	11	12	10	1	9.09%	14.2	14.2	1236	11864311	3444	2.787
C10-C12 Aliphatics_VPH	10	13	2	8	80.00%	2.8	7.9	3.347	0.957	0.978	0.292
C10-C12 aliphatic_adj_VPH	10	13	0	10	100.00%	2.6	3.2	N/A	N/A	N/A	N/A
C10-C12 Aromatics_VPH	10	13	10	0	0.00%	N/A	N/A	7.3	8.713	2.952	0.404
C12-C13 Aromatics_VPH	10	13	3	7	70.00%	2.8	5.2	4.61	8.361	2.892	0.627
C5-C6 Aliphatics_VPH	10	13	1	9	90.00%	2.8	7.9	3.113	0.684	0.827	0.266
C5-C6 aliphatics_adj_VPH	10	13	1	9	90.00%	2.6	3.2	2.87	0.656	0.81	0.282
C6-C8 Aliphatics_VPH	10	13	0	10	100.00%	2.8	7.9	N/A	N/A	N/A	N/A
C6-C8 aliphatic_adj_VPH	10	13	0	10	100.00%	2.6	3.2	N/A	N/A	N/A	N/A
C8-C10 Aliphatics_VPH	10	13	0	10	100.00%	2.8	7.9	N/A	N/A	N/A	N/A
C8-C10 aliphatic_adj_VPH	10	13	0	10	100.00%	2.6	3.2	N/A	N/A	N/A	N/A
C8-C10 Aromatics_VPH	10	13	0	10	100.00%	2.8	7.9	N/A	N/A	N/A	N/A
C10-C12 Aliphatics_EPH	10	13	3	7	70.00%	0.67	3	3.008	36.42	6.035	2.006
C10-C12 Aromatics_EPH	10	13	0	10	100.00%	1.1	6.2	N/A	N/A	N/A	N/A
C12-C16 Aliphatics_EPH	10	13	8	2	20.00%	0.6	0.61	7.934	104.4	10.22	1.288
C12-C16 Aromatics_EPH	10	13	2	8	80.00%	0.56	3.3	1.325	3.676	1.917	1.447
C16-C21 Aliphatics_EPH	10	13	10	0	0.00%	N/A	N/A	26.69	1117	33.42	1.252

C16-C21 Aromatics_EPH	10	13	10	0	0.00%	N/A	N/A	28.24	3011	54.87	1.943
C21-C34 Aliphatics_EPH	10	13	10	0	0.00%	N/A	N/A	94.26	13396	115.7	1.228
C21-C34 Aromatics_EPH	10	13	10	0	0.00%	N/A	N/A	149.6	73884	271.8	1.817
total_PAH	11	12	10	1	9.09%	0.107	0.107	0.711	3.304	1.818	2.556

General Statistics for Raw Data Sets using Detected Data Only

Variable	NumObs	# Missing	Minimum	Maximum	Mean	Median	Var	SD	MAD/0.675	Skewness	CV
Total Organic Carbon	12	0	3380	107000	34608	13960	1.374E+9	37064	14796	0.987	1.071
Total Solids	23	0	61.9	84.6	73.44	72.9	26.59	5.156	3.855	-0.00677	0.0702
Chemical Oxygen Demand	19	2	220	2200	655.3	220	675126	821.7	0	1.526	1.254
1-Methylnaphthalene	1	12	0.335	0.335	0.335	0.335	N/A	N/A	0	N/A	N/A
2-Chloronaphthalene	11	12	0.0256	0.137	0.0374	0.028	0.00109	0.0331	7.4129E-4	3.308	0.884
2-Methylnaphthalene	2	12	0.003	0.332	0.168	0.168	0.0541	0.233	0.244	N/A	1.389
Acenaphthene	1	12	0.139	0.139	0.139	0.139	N/A	N/A	0	N/A	N/A
Acenaphthylene	2	12	0.0063	0.00827	0.00729	0.00729	1.9405E-6	0.00139	0.00146	N/A	0.191
Anthracene	2	12	0.00655	0.195	0.101	0.101	0.0178	0.133	0.14	N/A	1.322
Benz[a]anthracene	9	12	9.6600E-4	0.169	0.0248	0.00282	0.00299	0.0547	0.00185	2.881	2.209
Benzo(a)pyrene	8	12	8.6900E-4	1.23	0.175	0.00336	0.184	0.429	0.00294	2.768	2.444
Benzo(b)fluoranthene	8	12	0.00107	0.0527	0.0138	0.00404	3.3153E-4	0.0182	0.00433	1.667	1.32
Benzo(ghi)perylene	6	12	0.00251	0.305	0.0546	0.00545	0.015	0.123	0.00204	2.449	2.246
Benzo(k)fluoranthene	6	12	0.00166	0.403	0.0735	0.0083	0.0261	0.162	0.00974	2.439	2.2
Chrysene	6	12	0.00147	0.741	0.147	0.0111	0.0867	0.294	0.014	2.339	2.009
Dibenzo(a,h)anthracene	3	12	8.2300E-4	0.00864	0.00346	9.3100E-4	2.0091E-5	0.00448	1.6012E-4	1.731	1.294
Fluoranthene	5	12	0.00135	0.00726	0.0036	0.00272	5.0558E-6	0.00225	0.00187	1.332	0.625
Fluorene	3	12	0.00161	0.109	0.0376	0.0021	0.00383	0.0619	7.2646E-4	1.732	1.647
Indeno(1,2,3-cd)pyrene	7	12	0.00106	0.0999	0.0176	0.00183	0.00134	0.0366	0.00114	2.552	2.081
Naphthalene	3	12	0.00428	0.0605	0.0235	0.00579	0.00103	0.032	0.00224	1.728	1.362
Phenanthrene	4	12	0.00103	0.399	0.104	0.0072	0.0388	0.197	0.0088	1.995	1.902
Pyrene	9	12	9.3700E-4	1.82	0.212	0.00437	0.364	0.603	0.00494	2.996	2.842
Diesel_Range_Organics	9	12	2.7	12700	1508	54.3	17634871	4199	73.79	2.993	2.785
Residual_Range_Organics	11	12	5.95	31000	3113	223	85718809	9258	309.9	3.305	2.974
Diesel_Range_Organics_SG	8	12	2.39	4830	644.4	17.35	2865495	1693	21.02	2.818	2.627
sidual_Range_Organics_SG	10	12	5.57	12100	1359	81.75	14316114	3784	111.4	3.133	2.784
C10-C12 Aliphatics_VPH	2	13	4	5.8	4.9	4.9	1.62	1.273	1.334	N/A	0.26
C10-C12 aliphatic_adj_VPH	0	13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C10-C12 Aromatics_VPH	10	13	4.5	13	7.3	5.85	8.713	2.952	1.631	0.987	0.404
C12-C13 Aromatics_VPH	3	13	7.5	11	8.833	8	3.583	1.893	0.741	1.597	0.214
C5-C6 Aliphatics_VPH	1	13	5.3	5.3	5.3	5.3	N/A	N/A	0	N/A	N/A
C5-C6 aliphatics_adj_VPH	1	13	5.3	5.3	5.3	5.3	N/A	N/A	0	N/A	N/A
C6-C8 Aliphatics_VPH	0	13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C6-C8 aliphatic_adj_VPH	0	13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C8-C10 Aliphatics_VPH	0	13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C8-C10 aliphatic_adj_VPH	0	13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C8-C10 Aromatics_VPH	0	13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C10-C12 Aliphatics_EPH	3	13	0.85	21	8.283	3	122.4	11.07	3.188	1.659	1.336
C10-C12 Aromatics_EPH	0	13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C12-C16 Aliphatics_EPH	8	13	0.84	32	9.768	3.45	130	11.4	3.529	1.249	1.167
C12-C16 Aromatics_EPH	2	13	1.5	7	4.25	4.25	15.13	3.889	4.077	N/A	0.915
C16-C21 Aliphatics_EPH	10	13	1.1	87	26.69	11	1117	33.42	12.68	1.155	1.252
C16-C21 Aromatics_EPH	10	13	1.2	180	28.24	6.8	3011	54.87	7.191	2.858	1.943
C21-C34 Aliphatics_EPH	10	13	3.2	310	94.26	40	13396	115.7	45.66	1.188	1.228
C21-C34 Aromatics_EPH	10	13	4.1	890	149.6	39	73884	271.8	41.07	2.715	1.817

total_PAH	10	12	0.0871	6.452	0.773	0.0932	3.992	1.998	0.00724	3.147	2.584

Percentiles using all Detects (Ds) and Non-Detects (NDs)

Variable	NumObs	# Missing	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
Total Organic Carbon	12	0	4693	5908	6453	13960	59950	64900	88570	98200	105240
Total Solids	23	0	68.02	70.52	70.8	72.9	78	78.16	79.4	79.87	83.57
Chemical Oxygen Demand	21	2	220	220	220	220	250	480	2200	2200	2200
1-Methylnaphthalene	11	12	0.0256	0.0257	0.0266	0.028	0.0284	0.0284	0.0294	0.182	0.304
2-Chloronaphthalene	11	12	0.0256	0.0257	0.0266	0.028	0.0284	0.0284	0.0294	0.0832	0.126
2-Methylnaphthalene	11	12	0.0256	0.0256	0.0257	0.0277	0.0284	0.0284	0.0294	0.181	0.302
Acenaphthene	11	12	0.00769	0.0077	0.00797	0.00839	0.00851	0.00852	0.00882	0.0739	0.126
Acenaphthylene	11	12	0.00768	0.0077	0.00797	0.00832	0.00851	0.00852	0.00882	0.025	0.038
Anthracene	11	12	0.00768	0.00769	0.0077	0.00832	0.00851	0.00852	0.00882	0.102	0.176
Benz[a]anthracene	11	12	0.00157	0.00185	0.00198	0.00391	0.0129	0.0173	0.0233	0.0962	0.154
Benzo(a)pyrene	11	12	0.00188	0.00202	0.00225	0.0077	0.018	0.0275	0.134	0.682	1.12
Benzo(b)fluoranthene	11	12	0.00116	0.00227	0.00257	0.00768	0.0147	0.0208	0.0243	0.0385	0.0499
Benzo(ghi)perylene	11	12	0.00325	0.00529	0.00545	0.00768	0.00832	0.00839	0.00852	0.157	0.275
Benzo(k)fluoranthene	11	12	0.00179	0.00229	0.00499	0.00824	0.0114	0.0143	0.0177	0.21	0.364
Chrysene	11	12	0.00172	0.00324	0.00546	0.00824	0.0139	0.0189	0.113	0.427	0.678
Dibenzo(a,h)anthracene	11	12	9.3100E-4	0.00768	0.00769	0.00832	0.00858	0.00864	0.00882	0.025	0.038
Fluoranthene	11	12	0.00268	0.00272	0.00335	0.00768	0.00832	0.00839	0.00852	0.0249	0.0379
Fluorene	11	12	0.0021	0.00768	0.00769	0.00832	0.00851	0.00852	0.00882	0.0589	0.099
Indeno(1,2,3-cd)pyrene	11	12	0.00144	0.00144	0.00164	0.00768	0.00838	0.00852	0.0148	0.0574	0.0914
Naphthalene	11	12	0.00579	0.0256	0.0257	0.0277	0.0284	0.0284	0.0294	0.045	0.0574
Phenanthrene	11	12	0.00149	0.00768	0.00769	0.00824	0.00867	0.00882	0.0129	0.206	0.36
Pyrene	11	12	0.00104	0.00257	0.00313	0.00531	0.0158	0.0231	0.0489	0.934	1.643
Diesel_Range_Organics	11	12	4.53	5.49	15.6	50.4	130.8	180	459	6580	11476
Residual_Range_Organics	11	12	12.3	14	24.6	223	547	781	1380	16190	28038
Diesel_Range_Organics_SG	11	12	3.95	5.55	5.615	14.1	85.3	113	219	2525	4369
sidual_Range_Organics_SG	11	12	7.6	14.2	16.9	74.7	176.5	179	907	6504	10981
C10-C12 Aliphatics_VPH	10	13	2.89	3.06	3.125	4.1	5.525	5.8	6.01	6.955	7.711
C10-C12 aliphatic_adj_VPH	10	13	2.69	2.78	2.8	2.95	3	3.02	3.11	3.155	3.191
C10-C12 Aromatics_VPH	10	13	4.95	5.08	5.125	5.85	9.075	9.72	11.2	12.1	12.82
C12-C13 Aromatics_VPH	10	13	2.89	3.06	3.125	4.45	6.925	7.6	8.3	9.65	10.73
C5-C6 Aliphatics_VPH	10	13	2.89	3.06	3.125	4.1	5.15	5.4	6.01	6.955	7.711
C5-C6 aliphatics_adj_VPH	10	13	2.69	2.78	2.825	3	3.075	3.12	3.41	4.355	5.111
C6-C8 Aliphatics_VPH	10	13	2.89	3.06	3.125	4.1	5.075	5.32	6.01	6.955	7.711
C6-C8 aliphatic_adj_VPH	10	13	2.69	2.78	2.8	2.95	3	3.02	3.11	3.155	3.191
C8-C10 Aliphatics_VPH	10	13	2.89	3.06	3.125	4.1	5.075	5.32	6.01	6.955	7.711
C8-C10 aliphatic_adj_VPH	10	13	2.69	2.78	2.8	2.95	3	3.02	3.11	3.155	3.191
C8-C10 Aromatics_VPH	10	13	2.89	3.06	3.125	4.1	5.075	5.32	6.01	6.955	7.711
C10-C12 Aliphatics_EPH	10	13	0.832	1.13	1.225	2.7	2.975	3	4.8	12.9	19.38
C10-C12 Aromatics_EPH	10	13	1.19	1.2	1.2	1.25	3.575	4.42	6.11	6.155	6.191
C12-C16 Aliphatics_EPH	10	13	0.609	0.794	0.955	2.35	13.08	16.6	20.3	26.15	30.83
C12-C16 Aromatics_EPH	10	13	0.596	0.608	0.613	0.95	2.775	3.22	3.67	5.335	6.667
C16-C21 Aliphatics_EPH	10	13	1.1	3.26	3.825	11	45	59.6	78.9	82.95	86.19
C16-C21 Aromatics_EPH	10	13	1.38	2.28	2.95	6.8	27.1	33.8	51.3	115.7	167.1
C21-C34 Aliphatics_EPH	10	13	4.28	12.08	14.75	40	151	198	274	292	306.4
C21-C34 Aromatics_EPH	10	13	4.55	16.12	19.25	39	157.5	198	296	593	830.6
total_PAH	11	12	0.0884	0.0894	0.0903	0.0951	0.173	0.239	0.401	3.426	5.847

	General Statistics on Uncensored Data
Date/Time of Computation	ProUCL 5.2 3/8/2024 10:03:04 AM
User Selected Options	
From File	ProUCL.Input.cPAH.xls
Full Precision	OFF

From File: ProUCL.Input.cPAH.xls

General Statistics for Censored Datasets (with NDs) using Kaplan Meier Method

Variable	NumObs	# Missing	Num Ds	NumNDs	% NDs	Min ND	Max ND	KM Mean	KM Var	KM SD	KM CV
cPAH	11	0	10	1	9.09%	0.00643	0.00643	0.138	0.139	0.373	2.695

General Statistics for Raw Dataset using Detected Data Only

Variable	NumObs	# Missing	Minimum	Maximum	Mean	Median	Var	SD	MAD/0.675	Skewness	CV
cPAH	10	0	0.00265	1.312	0.152	0.00536	0.168	0.41	0.00314	3.1	2.698

Percentiles using all Detects (Ds) and Non-Detects (NDs)

Variable	NumObs	# Missing	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
cPAH	11	0	0.00309	0.00339	0.00357	0.00572	0.0212	0.0359	0.142	0.727	1.195

Attachment 1
Inundated Lands Initial Investigation Report Final, BNSF Wishram Railyard, Wishram, Washington

BNSF Wishram Railyard, Wishram, Washington

Inundated Lands Initial Investigation Report

Ecology Site Name: BNSF Wishram Track Switching Facility
Ecology Facility/Site ID: 1625461
Cleanup Site ID: 230

Final

May 2019

BNSF Railway Company

BNSF Wishram Track Switching Facility, Wishram, Washington

Project No:	693282
Document Title:	Inundated Lands Initial Investigation Report
Document No.:	GES0509191123PDX
Revision:	Final
Date:	May 2019
Client Name:	BNSF Railway Company
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Executive Summary

Petroleum sheening and nonaqueous phase liquid (NAPL) droplets have been observed occasionally along the approximate 300-foot stretch of the Columbia River adjacent to the site. An initial investigation of the nearshore area adjacent to the BNSF Wishram Railyard was performed in accordance with the Washington State Department of Ecology-approved Nearshore Sediment Initial Investigation Work Plan (CH2M, 2018). The purpose of the nearshore sediment initial investigation was to investigate the potential presence of NAPL in the identified area, characterize the nature and extent of NAPL, if present, and evaluate sediment in the inundated lands against applicable sediment cleanup standards. The initial investigation work involved the following activities:

- Thirty Darts were advanced between 1.5 and 6.0 feet below sediment surface (bss) across the initial nearshore study at a spacing of approximately 20 to 30 feet.
- Five surface sediment grab samples and one sediment core were collected from nearshore locations within the initial study area as well as at the upstream background location (BG-US01).
- Observation of sheens farther from shore than previously reported prompted a sheen survey to determine the outboard extent of the sheens and allow an estimate of those areas likely to be associated with the origin of these impacts.
- Seven sediment cores were advanced in those areas farther from shore that were suspected to be sourcing observed sheens.
- Two offshore locations, where visual, olfactory, and photoionization detector (PID) screening of the recovered sediment core materials indicated the greatest NAPL impacts, were selected for follow-on NAPL mobility core collection and in-laboratory screening and mobility testing.

Key findings from the field and follow-on laboratory analyses performed in the nearshore and offshore areas as part of the initial investigation are as follows:

- Nearshore Area (Initial Study Area)
  - In general, the riprap embankment at the shoreline extends approximately 15 feet south of the shoreline.
  - Dart deployments and associated pre-probing indicated the thickness of soft, penetrable materials beyond the riprap ranges from several inches to approximately 6 feet. Refusals are believed to be due to the presence of buried riprap (within approximately 15 feet of shoreline) or denser alluvial deposits.
  - The fluorescence responses associated with Dakota Technologies, Inc.’s scan of the Darts deployed within the initial study area were notably low and not indicative of the presence of NAPL; the maximum responses at individual locations across the study area ranged from 2.0 to 18.1 percent reference emitter.
  - Nearshore sediment samples obtained through grab sampling and coring indicated the presence of a micaceous fine sand to silty fine sand extending to depths between 0.5 foot and 4.3 feet bss. These fine sands were observed to extend across the entire length of the core advanced within the nearshore area (D200).
  - No visual, olfactory, or PID evidence of NAPL or petroleum-related impacts were encountered within the samples collected from the nearshore areas.
  - Total petroleum hydrocarbons (TPH), diesel-range organics (TPH-DRO), TPH-residual-range organics (TPH-ORO), and polycyclic aromatic hydrocarbons (PAHs) in nearshore surface sediment samples were all below the applicable Sediment Cleanup Objectives (SCOs) with the exception of TPH-DRO at the nearshore core location D200, where a result of 459 milligrams per kilogram (mg/kg) was measured in the non-silica gel treatment/cleanup (SGC) sample here. While this result was in excess of the SCO of 340 mg/kg, the same sample run with SGC was below the SCO at an estimated concentration (J-flagged) of 57.6 mg/kg. In accordance with

cleanup provisions of the Sediment Management Standards under Washington Administrative Code (WAC) 173-204, as described in *Sediment Cleanup User's Manual II: Guidance for Implementing the Cleanup Provisions* (Ecology, 2017b), the three highest concentrations from the available nearshore surface sediment data set were averaged for comparison against the Washington Freshwater Sediment Cleanup Screening Levels (CSLs). The average of the three highest TPH-DRO results for the nearshore area were below the CSL for both SGC and non-SGC samples.

   – The comparison of measured TPH concentrations in collocated surface sediment samples collected subsequently confirmed that the Dart response data is an effective indicator of total TPH concentrations in site sediments and that the Dart survey effectively screened for NAPL and petroleum impacts in sediment across the initial study area.

   – The absence of NAPL in the nearshore areas adjacent to the riprap embankment and physical separation of the defined extent of upland NAPL (KJ, 2019) and the shoreline to the south, suggest that seep migration from the upland portions of the site is not contributing to the observed sheens.

   – Based on this information, the nearshore area does not qualify as a sediment site under applicable standards. Impacts from groundwater discharge, if present, have not affected surface sediment concentrations above standards.

- Offshore Area (Expanded Study Area)

   – The sediment samples obtained through core sampling throughout the offshore area indicated the presence of a micaceous fine sand that extended to depths between 0.5 foot (J260) and 5.5 feet bss (I400). No visual, olfactory, or PID evidence of NAPL or petroleum-related impacts were encountered within these materials. Similar to nearshore core D200, these fine sands were observed to comprise the majority of the material in three of the seven cores.

   – At the remaining 4 locations (G200, G260, J260, and F360), a 2- to 3.5-foot interval of fill material with black, tacky NAPL and an abundance of organic debris consisting of wood and roots was observed at approximately 0.5 foot to 2.5 feet bss.

   – The nearshore Dart, sediment grab sampling, and coring results suggest that the NAPL present below the river is distinct and separate from the upland NAPL, and that it may be associated with historical filling that occurred before the inundation of these lands in 1957.

   – Mobility testing, performed on the most heavily NAPL-impacted intervals associated with the fill, indicate that NAPL is hydraulically immobile, which is consistent with its highly viscous and tacky appearance.

   – Observations indicate that the surface sheens observed at the site are driven by ebullition in areas of the submerged NAPL-affected fill layer away from the shoreline. The presence and abundance of sheens is a function of the organics present, the depth of NAPL bss, the temperature of the sediments, the height of the overlying water column (river stage), and other factors. Once at the surface of the water, the distribution of the sheens is dictated by a combination of the river currents and wind direction, which under the right conditions, drives the sheens to the north and east in the direction of the shoreline where they have typically been observed in the past.

   – A comparison of the offshore surface sediment analytical results against Washington Freshwater SCOs indicate TPH-DRO and TPH-oil (or residual)-range organics (ORO) exceeded their applicable criteria. Specifically, 1 of the 5 samples collected across the expanded study area exceeded the SCO for TPH-DRO (340 mg/kg) and TPH-ORO (3,600 mg/kg) (with and without SGC). This sample was located proximal to the outboard extents of observed sheens at approximately 130 feet from shore at location J260 where the shallowest NAPL-impacted fill materials were observed (0.5 foot bss). At the remaining 3 core locations, NAPL observed was at least 2 feet bss, and concentrations of petroleum-related constituents were all below applicable SCOs.

- The average of the 3 highest TPH results from all samples collected from the offshore area (consistent with expanded study area where some locations showed buried NAPL) exceeded the CSL of 510 mg/kg for TPH-DRO for both SGC and non-SGC samples and the CSL of 4,400 mg/kg for TPH-ORO for the non-SGC results only.
- PAHs measured in surface samples were mostly non-detect or had low level detections. The sum of the 17 PAHs for all samples was below the SCO of 17,000 micrograms per kilogram.

While the general location of the submerged NAPL and the extent of affected surface sediments exceeding criteria has been identified, additional data are required to refine these extents. An addendum to the initial investigation work plan, that details the specific objectives, data collection activities, and means and methods for addressing these data gaps, is being prepared as a separate document. The same data quality objectives of the nearshore inundated land initial investigation will apply but to a different target area. The deeper water in this area will require that some methods for data collection be modified, but not the overall objective.

Contents

Appendixes

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Acronyms and Abbreviations

%PV	percent of the pore volume
%RE	percent of the reference emitter
µg/kg	microgram(s) per kilogram
BNSF	BNSF Railway Company
bss	below sediment surface
cm/sec	centimeter(s) per second
COD	chemical oxygen demand
CSL	Cleanup Screening Level
CSM	conceptual site model
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
g/cm^3	gram(s) per cubic meter
GPS	global positioning system
Jacobs	Jacobs Engineering Group Inc.
LIF	laser-induced fluorescence
LNAPL	light nonaqueous phase liquid
mg/kg	milligram(s) per kilogram
mL/min	milliliter(s) per minute
NAPL	nonaqueous phase liquid
PAH	polycyclic aromatic hydrocarbon
PCC	Pollution Control Commission (State of Washington)
PFS	pore fluid saturations
PID	photoionization detector
RI	remedial investigation
SCO	Sediment Cleanup Objective
SCUM II	*Sediment Cleanup User's Manual II: Guidance for Implementing the Cleanup Provisions*
SGC	silica gel treatment/cleanup
SMS	Sediment Management Standards
SP&S	Spokane, Portland, and Seattle Railway
TOC	total organic carbon
TPH	total petroleum hydrocarbon(s)
TPH-DRO	total petroleum hydrocarbons, diesel-range organics
TPH-ORO	total petroleum hydrocarbons, oil-range or residual-range organics
USACE	U.S. Army Corps of Engineers

UV	ultraviolet
UVOST	Ultra-Violet Optical Screening Tool
VPH	volatile petroleum hydrocarbons
WAC	Washington Administrative Code

1. Introduction

This report presents the results of the initial investigation of the inundated lands adjacent to the BNSF Railway Company (BNSF) Wishram Railyard (site), in Wishram, Washington (Figure 1-1). Petroleum sheening and nonaqueous phase liquid (NAPL) droplets have been observed occasionally along an approximately 300-foot stretch of the Columbia River adjacent to the site (Figure 1-2) (Ecology, 2017a). The site upland is the subject of remedial investigation (RI), with work being performed pursuant to an Agreed Order (No. DE 12897) between the Washington State Department of Ecology (Ecology) and BNSF, dated October 7, 2015. The initial study area shown on Figure 1-2 was developed to include the nearshore areas, where sheens were identified by Ecology in its March 3, 2017 letter, and additional areas to the east and west. During the work, the study area was expanded to include areas farther offshore as shown on Figure 1-2.

Initial investigation activities were conducted in accordance with the Ecology Model Toxics Control Act regulations published in Washington Administrative Code (WAC) 173 340 (Ecology, 2007) and the cleanup provisions of the Sediment Management Standards (SMS) under WAC 173 204, as described in the *Sediment Cleanup User's Manual II: Guidance for Implementing the Cleanup Provisions* (SCUM II) (Ecology, 2017b). All activities were performed in accordance with the means and methods described in the Ecology-approved work plan (CH2M, 2018).

1.1 Site Overview

Wishram is in Klickitat County, Washington, approximately 13 miles northeast of The Dalles, Oregon, and 0.75 mile south of Washington State Route 14, within the southwestern quarter of Section 17, Township 2 north, Range 15, east of the Willamette Meridian. The site location is shown on Figure 1-1. The location of petroleum sheening and approximate area of interest for the nearshore initial investigation is shown on Figure 1-2.

The railyard is approximately 2,000-feet long and ranges from 150- to 720-feet wide. The upland RI area encompasses the westernmost portion of the railyard. This portion of the site is approximately 350-feet long (east to west) and 450-feet wide (north to south) and covers an area of approximately 3.6 acres. The upland portion of the site is bounded by the town of Wishram to the north, the railyard to the east, Lake Celilo to the south and southwest, and the railroad right-of-way to the west. Onsite structures include storage buildings, a maintenance shop (office and tool storage), two mainline tracks, and an active yard track. Current site features are shown on Figure 1-3.

The site was originally developed by the Spokane, Portland, and Seattle Railway between 1910 and 1912. The Spokane, Portland, and Seattle Railway merged with other railroads in 1970 to become the Burlington Northern Railroad, which merged with the Santa Fe Railroad in 1995 to become what is now BNSF. The primary historical use of the railyard was railcar switching. Historically, locomotive fueling/watering and repairs also occurred at Wishram. Most track spurs, early structures, and infrastructure no longer remain. Prominent site features believed to have been present during some portions of the time between 1910 and the present are shown on Figure 1-3.

At the time the railyard was constructed, the Columbia River was free-flowing and occupied a channel approximately 300 feet south and 40 to 50 feet lower than the railyard. Construction of The Dalles Dam in 1957 impounded the Columbia River to create Lake Celilo. As a result, the lands along the southern portion of the railyard were inundated and remain submerged today. The area of interest that was the focus of the nearshore initial investigation is within these inundated lands, the approximate extent of which are shown on Figure 1-3.

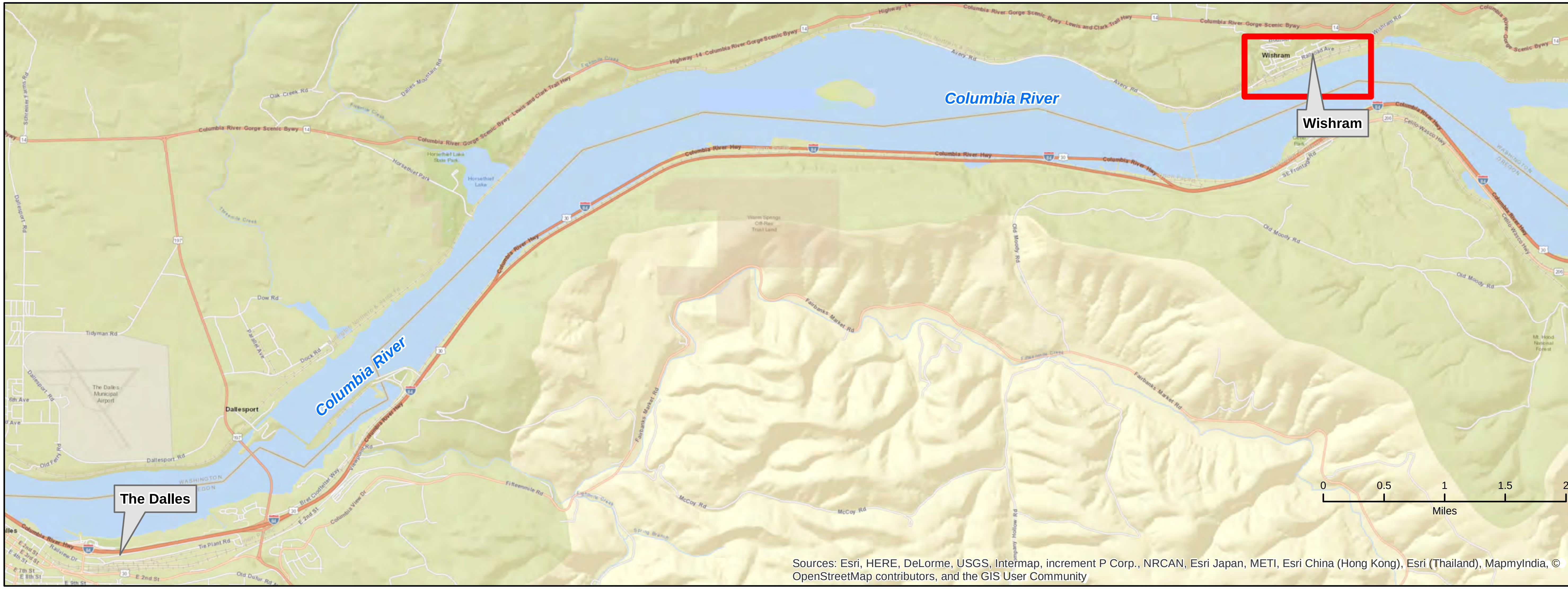
Additional details regarding historical site activities, including historical plat maps, are presented in the site investigation and forthcoming RI report (KJ, 2012, 2019).

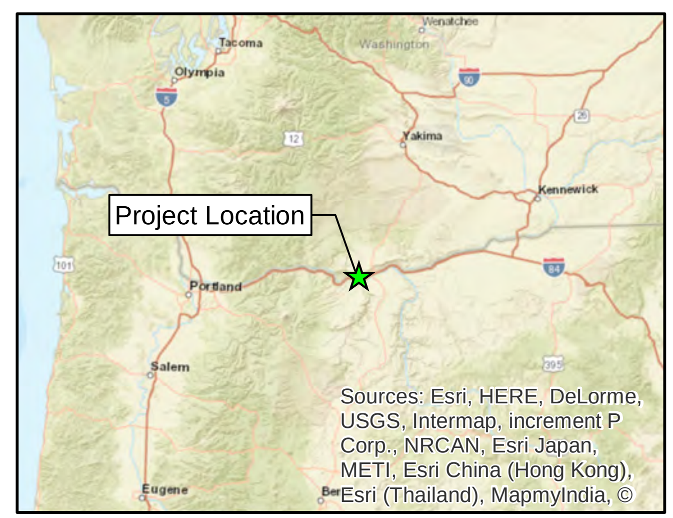
1.2 Investigation Objectives

The purpose of the nearshore sediment initial investigation was to investigate the potential for NAPL to be present in the initial study area, and evaluate sediment in the inundated lands against applicable sediment cleanup standards. The nearshore initial investigation data, in conjunction with data collected in the upland portion of the railyard, was used to develop an integrated conceptual site model (CSM) for the Wishram Railyard and shoreline area. This integrated CSM will be used to support evaluation of potential remedial alternatives for the site as part of a feasibility study.

1.3 Observational Investigation Approach

An observational approach was emphasized in the work plan for the Dart investigation and nearshore sediment data collection based on NAPL observations at the site. During the investigation, NAPL was observed in the inundated lands beyond the nearshore area, where additional investigation activities were conducted to address field observations, as described in this report.





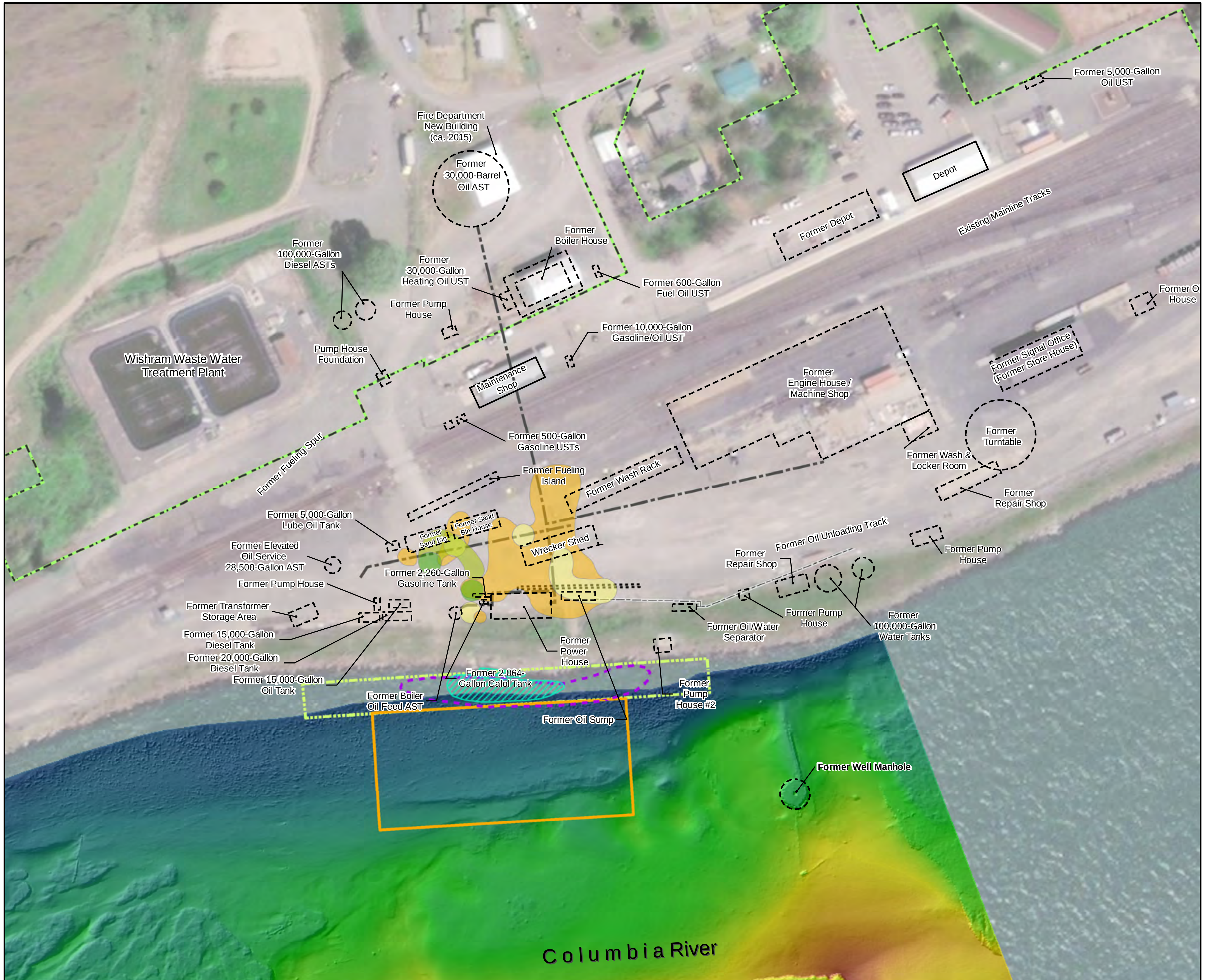
N

0 375 750 1,500
Feet
1:9,000 1 inch = 750 feet

Figure 1-1. Site Location Map
BNSF Wishram Railyard
Wishram, Washington

JACOBS

\\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\INITIAL INVESTIGATION REPORT\FIGURE1-1_SITEMAP.MXD GGEE 2/15/2019 10:44:51



VICINITY MAP

LEGEND

- Existing Site Feature
- Former Site Feature
- Inferred Lateral Extent of Smear Zone Diesel Impacts
- Inferred Lateral Extent of Submerged Diesel Impacts
- Inferred Lateral Extent of Smear Zone Oil Impacts
- Inferred Lateral Extent of Submerged Oil Impacts
- Initial Study Area
- Expanded Study Area
- Former Bunker Fuel / Oil Pipeline
- Former Oil Drain
- Former Oil Trough
- Former Sewer Line (Potential)
- Stormwater Underdrain
- Stormwater Underdrain
- Area of Intermittent NAPL Sheening
- Small-extent NAPL Sheens Observed (Ecology, 2017)
- Approximate BNSF Property Line

Bathymetry (ft NAVD88) (2017)

High : 158

Low : 93

Notes:
[1]Inferred lateral extent of Diesel- or Oil-Like LNAPL based on interpretation of LIF waveforms (July 2013) and soil boring logs (KJ, 2019).
ft = feet
NAPL = nonaqueous phase liquid
NAVD88 = North American Vertical Datum 1988
µg/L = microgram(s) per liter
MTCA = Model Toxics Control Act

N

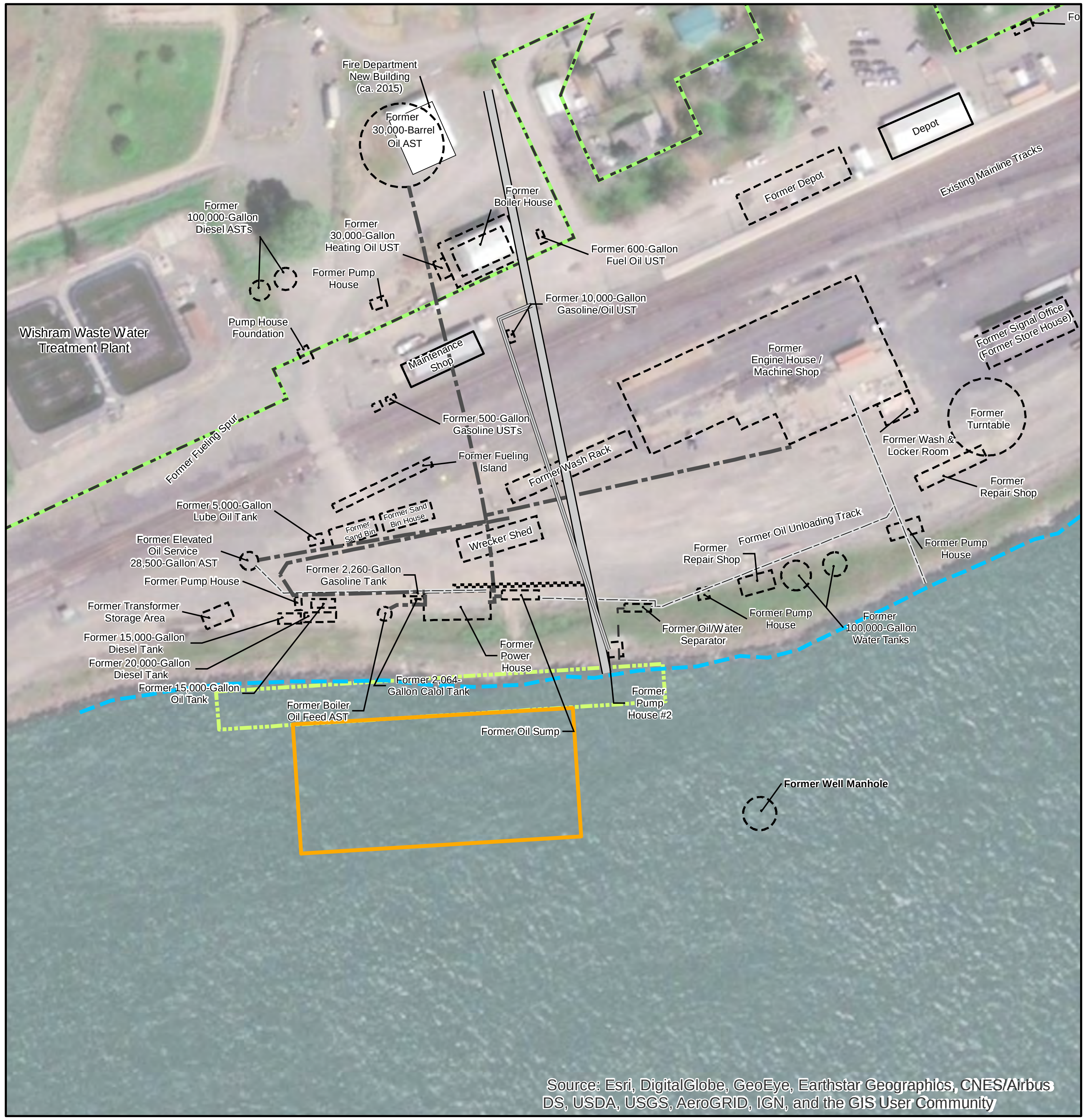
0 62.5 125 250
Feet
1:1,500 1 inch = 125 feet

Figure 1-2. Wishram Railyard **Inundated Lands** Study Area
BNSF Track Switching Facility
Wishram, Washington

JACOBS

\\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\INITIAL INVESTIGATION REPORT\FIGURE1-2_RAILYARD_AND_STUDYAREA.MXD GGEE 2/19/2019 07:56:56

Current Features with Former Feature Footprints (Aerial Date: 2015)



Former Features (Aerial Date: 1951)

LEGEND

- Initial Study Area
- Expanded Study Area
- Current Shoreline
- Former Bunker Fuel / Oil Pipeline
- Former Oil Drain
- Former Oil Trough
- Former Sewer Line (Potential)
- Stormwater Underdrain (A portion removed from service circa 1960)
- Stormwater Underdrain (Rerouted portion circa 1960)
- Approximate BNSF Property Line
- Former Site Feature

N

0 75 150 300
Feet
1:1,800
1 inch = 150 feet

Figure 1-3. Current and Former Site Features
BNSF Wishram Railyard
Wishram, Washington

JACOBS

SLC \\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\INITIAL INVESTIGATION REPORT\FIGURE1-3_CURRENT_AND_FORMER_SITE_FEATURES.MXD GGEE 2/15/2019 15:33:53

2. Initial Investigation Activities

Initial investigation field activities were conducted in phases. The findings of each phase were used to refine the sampling design for each subsequent phase. The first phase was performed as part of the work planning process and included an historical data review and a bathymetric survey of the study area. The results of this work were presented in the work plan and are described and discussed in Sections 3 and 4 as appropriate. Follow-on nearshore investigation activities involved conducting a Dart survey in the Ecology area of interest to screen for the presence or absence of NAPL and the collection and analysis of surface and subsurface sediment samples to:

- Confirm Dart survey NAPL delineation
- Characterize sediment ebullition potential
- Characterize NAPL mobility and pore fluid saturation at any locations with confirmed NAPL
- Compare concentration of chemical constituents in surface sediments to SMS freshwater sediment criteria

Given the absence of any observed impacts within the nearshore area, and observed sheens outside the nearshore area during the field activities, the study area was expanded to offshore areas and additional activities were performed to identify the potential source of the observed sheens. In addition to the tasks described in the work plan, a surface sheen survey was performed by boat. The sheen survey and additional work elements in the expanded study area are presented in Section 2.3.

2.1 Historical Review and Bathymetric Survey Activities

Pre-investigation activities were completed before the submission of the work plan (CH2M, 2018) to assist in work plan development. These activities included reviewing available documentation about the site and surrounding areas including:

- Historical maps and aerial photographs
- Upland data regarding the NAPL nature and extent
- Bathymetric survey results

A summary of the historical review was provided in the work plan. A bathymetric survey of the Columbia River near Wishram was conducted in 2008 by the U.S. Army Corps of Engineers (USACE) and a bathymetric survey was conducted by Solmar Hydro for this project on June 2, 2017. The 2017 bathymetric results are shown on Figure 1-2.

2.2 Nearshore Investigation Activities

Nearshore investigation activities included a Dart survey and sediment grab sampling as described in the following subsections. In addition, one sediment core was advanced within the nearshore area at the location exhibiting the highest Dart fluorescence response. The bulk of the coring was performed outside the nearshore area, thus all core collection activities are described in Section 2.3.2.

2.2.1 Dart Survey

The objective of the Dart survey was to assist with determining the presence or absence of polycyclic aromatic hydrocarbons (PAHs) in the Ecology defined area of interest (Ecology, 2017a). The Dart sampler is a passive sampling device consisting of a continuous rod made from or coated with solid-phase extraction media. PAHs are attracted to and absorb into the solid-phase extraction media which, following removal from the sediment, can be analyzed in the laboratory using laser-induced fluorescence (LIF).

A total of 30 Darts and one duplicate ranging from 3- to 6-feet long were installed between June 19 and June 24, 2018, from a 24-foot-long, aluminum flat-bottom boat equipped with 2 spuds and operated by Gravity Marine of Fall City, Washington. A grid was established to facilitate the naming convention of investigation locations and confirm adequate spacing (Figure 2-1). Darts were deployed across the established nearshore study area at a spacing of approximately 20 to 30 feet (Figure 2-1). In addition, three control/reference Darts were also deployed; two within upland wells containing light nonaqueous phase liquid (LNAPL) (OHM-1) and nearshore dissolved impacts (WMW-16) and one at an upstream location with similar sub-bottom conditions to that of the study area (location identification US01).

Before the deployment of Darts within the sediment, pre-probing was conducted using a 1-inch-diameter, hollow-aluminum pole to estimate the lateral extent of the submerged riprap outboard of the exposed shoreline and to determine the maximum length of the Dart (3, 6, or 9 feet) that could be used at each location. In general, the toe of the riprap slope extended between 15 and 30 feet from the shoreline and the Darts deployed closest to the shoreline represent the approximate extent of the riprap (Figure 2-1). Pre-probing indicated the sediment thicknesses beyond the riprap ranged from several inches to approximately 6 feet and were generally between 1.5 and 6 feet. Refusal with the pre-probing rod was generally interpreted to be a hard rocky or sandy layer. Based on this information, Darts of lengths 3 and 6 feet were used.

Before the advancement of each Dart, a depth-to-top-of-sediment sounding was taken using a graduated leaded line. These measurements were used along with the published USACE Dalles Dam Forebay Levels (USACE, 2018), which represent the pool height above the dam to estimate the top of sediment elevation. Darts were advanced from the boat deck by attaching the top of each Dart to an expandable fiberglass pole using the vendor-supplied drive-head and pushing the tip of the Dart into the sediment until refusal was encountered. The final drive depths of the Darts ranged from 1.8 to 6 feet below sediment surface (bss). A labeled buoy was affixed to the top of the Dart to allow identification and retrieval. Immediately following insertion, the coordinates of each Dart were recorded using the on-board global positioning system (GPS). An approximate soak/equilibration time of 48 hours was targeted before each Dart was retrieved. However, because of weather conditions that limited the safe retrieval of some Darts around the 48-hour mark, final soak times ranged from 40 to 94 hours. Following the soak period, each Dart was retrieved by pulling on the rope that secured the buoy to the top of the Dart.

Darts were immediately placed on clean aluminum foil; any mud or debris was removed by wiping the Dart with a clean paper towel in a direction perpendicular to the length of the Dart. A zip tie was placed around the Dart to mark the depth to which it had been deployed. Each Dart was then wrapped in the foil and labeled. Darts were shipped overnight to Dakota Technologies, Inc. for bench-top fluorescence scanning using the Ultra-Violet Optical Screening Tool (UVOST) LIF reader, which generates a log of fluorescence response over depth. A summary of each Dart deployed, its length, penetration achieved, soak time, location coordinates, and estimated sediment surface elevation is provided in Table 2-1. A copy of the resulting UVOST logs generated by Dakota Technologies, Inc. are provided as Appendix A.

2.2.2 Surface Sediment Grab Sampling

The objective of the sediment grab samples was to characterize the sediments at Dart locations where higher levels of PAHs were likely present, based on the Dart responses. Following receipt of the Dart logs, surface sediment sampling was conducted on August 6 and 7, 2018, using a 26-foot long aluminum boat equipped with 3 spuds and a modified van Veen bottom grab sampler (operated by Gravity Marine). Grab samples were collected from five nearshore locations within the established study area as well as at the upstream background location (BG-US01). Within the initial study area, locations where Dart responses indicated the greatest potential for the presence of PAHs were targeted for surface sediment sampling. In addition, one sample was collected at one location (D420) within the initial study area where Dart responses were consistent with the background Dart response observed at BG-US01. Locations of each surface sediment grab sample are shown on Figure 2-2.

Before deployment of the van Veen grab sampler, a depth-to-top-of-sediment sounding was taken using a graduated weighted line and recorded within the field notes. If recovery was insufficient for sampling (either because of the presence of cobbles or aquatic vegetation), the sampler was reset and deployed within several feet of the first attempt. The material collected during each successful attempt was processed immediately on the deck of the boat and placed on ice for shipment to the various laboratories. At one study area location and the background location, a bulk bioassay sample was collected and placed in a labeled, 5-gallon bucket for potential future analysis pending results of the chemical analyses.

The coordinates of each grab sample were recorded using the on-board GPS following sample collection. A summary of each surface sediment grab sample including its coordinates, analyses, and estimated sediment surface elevations is provided in Table 2-2.

2.3 Offshore Investigation Activities

During completion of the nearshore surface sediment grab sampling and advancement of the first sediment core on August 7, 2018, sheens were observed outboard of grid line E (approximately 60 feet south of the shoreline). Lake levels were lower than typical, the weather was hot with very little wind providing suitable conditions for observation of sheens. The sheens were observed to be migrating on the surface of the water from southwest to northeast toward the shoreline. This movement appeared to be driven by a combination of the river current and light winds coming from the west and northwest. These observations indicated that the sheens were originating from areas outside the work plan established study area (initial study area). In response to these observations, the study area was expanded (Figure 1-2) and investigation activities were modified to include an on-water sheen survey, relocation of planned sediment cores, and collection of additional samples to allow characterization of the offshore area.

2.3.1 Sheen Survey

Given the favorable low-wind conditions, before advancing any additional cores, a visual sheen survey was performed at approximately 1:00 p.m. on August 7, 2018, to determine the outboard extent of the sheens and allow for an estimate of those areas likely to be associated with the origin of these impacts. Gravity Marine navigated along several transects parallel to shore between the F and K grid lines. As the boat was maneuvered slowly along these lines, two Jacobs Engineering Group Inc. (Jacobs) staff (positioned on the port and starboard sides of the boat) scanned the water surface for the presence of sheens. While gas bubbles were consistently observed breaking the surface of the water throughout the survey area at this time, no direct observations of sheens originating with these bubbles were observed. During the survey, sheens were observed to extend to the south (offshore) between the J and I grid lines. The westernmost sheen was observed near grid location J120 and the easternmost sheen was observed in the vicinity of I120. Locations defining the observed outboard extent of the sheens were logged using a tablet equipped with GPS and are shown on Figure 2-3. Given the observed direction of sheen movement (north and east), these locations approximated the outboard extent of those areas where the sub-bottom conditions could be contributing to sheen generation.

2.3.2 Sediment Core Sampling

To assess the offshore area sub-bottom conditions for the presence of NAPL and to characterize the sediments, 8 sediment cores were advanced, from Gravity Marine's 26-foot-long aluminum boat equipped with 3 spuds, between August 7 and 8, 2018. As specified in the work plan, core locations were to be selected to confirm the Dart response results. However, based on the observed sheens and follow-on survey described in Section 2.3.1, the number of cores was increased from 6 to 8 and core locations were selected to cover those areas where sub-bottom conditions were most likely resulting in sheen generation. Location D200 was an exception; it was advanced before the completion of the sheen survey in the location where the highest Dart response (18 percent of the reference emitter [%RE]) was observed. Final core locations are shown on Figure 2-2.

Before advancing each core, a depth-to-top-of-sediment sounding was taken using a graduated weighted line and recorded within the field notes. Coring was performed using a vessel-mounted mobile AMS Power Probe 9100P direct-push unit and 3- or 4-inch plastic core barrels with clear polyethylene liners and dedicated core catchers. A depth of 10 feet bss was targeted for each core, with actual penetrations that ranged from 5.4 to 10.0 feet. Upon reaching the target depth or refusal, the cores were retrieved, brought on the boat deck, capped and labeled, and transported to the land-based mobile core processing trailer. During core processing, the interior polyethylene sleeve containing the cored material was extruded from the outer core liner/barrel. The recovery was measured, and each core was logged and screened using visual, olfactory, and photoionization detector (PID) observations to evaluate NAPL presence. Core recoveries ranged from 61 to 74 percent. Recovered material was assumed to be representative of the upper portions of the core. Copies of the sediment core logs are provided in Appendix B. Per the work plan, samples were to be collected from each core at two depths for the analysis of chemical oxygen demand (COD) and total organic carbon (TOC) to assess the potential for ebullition. One sample was selected from the top foot of each core. At 6 select locations where NAPL or other evidence of petroleum impacts were observed in the cores, a surface sediment sample from the 0-foot to 0.5-foot bss interval was also collected for petroleum-related constituent analysis. The addition of these analytes was made to allow an assessment of the surface sediment beyond where the grab samples were collected and within the footprint of where subsurface sediments showed NAPL impacts. The second sample from each core was collected from the most-impacted interval based on observations and PID readings, then analyzed for COD and TOC in accordance with the work plan. A summary of the cores including their coordinates, sampled intervals and analyses, and estimated sediment surface elevations is provided in Table 2-3.

2.3.3 NAPL Mobility Coring

Following completion of the sediment coring and processing activities, two locations, where visual, olfactory and PID screening indicated the greatest NAPL impacts, were selected for follow-on NAPL mobility core collection (G200 and G260; Figure 2-2). The purpose of these cores was to collect an undisturbed sample from the most impacted areas to allow laboratory testing of the potential mobility of NAPL. Coring was performed using the vessel-mounted mobile direct-push unit and 1.5-inch-diameter macrocore sampler with stainless steel core barrel liners.

Before advancement of the stainless steel lined macrocores, a series of test cores were advanced at each location using disposable clear acetate liners to determine the best means to achieve maximum recovery and at what depth intervals were likely to be associated with the recovered material. Based on this, it was determined that basket catchers would be used and that recovered material was coming from the base of the core. At each location, the core barrel equipped with the stainless steel liner was advanced to 5 feet bss within 5 to 10 feet of the original sediment core. Immediately upon retrieval, the liner was removed from the core barrel and capped at the bottom. Recovery was measured from the top of the liner and the liner was cut right above the height of the recovered material, packed with bubble wrap to fill any remaining void space at the end of the core, and capped and taped. The top and bottom of each core was labeled with its associated depths and was frozen immediately by placing it on its side in a cooler containing dry ice. Coolers containing the intact cores were shipped overnight to TestAmerica Corvallis in Corvallis, Oregon. A summary of NAPL mobility cores including their coordinates, associated intervals, and estimated sediment surface elevations is provided in Table 2-3.

Once at the laboratory, the cores were placed in liquid nitrogen until they froze over the entire diameter of the core, then were immediately cut into 2-inch pucks. These pucks were placed in plastic core caps, covered, and stored at -10 degrees Celsius in a manner that retained the pucks in situ orientation (most shallow end up). To initially screen the samples, photographs were taken of the top surface under white and ultraviolet (UV) (302 nanometers) light after the pucks were allowed to partially thaw. Pucks with surface NAPL fluoresced brownish-orange. This response was confirmed through laboratory TarGOST scans of the puck surfaces (both top and bottom), which were performed at the Dakota Technologies, Inc. laboratory in Fargo, North Dakota. Sample pucks were shipped to and from Dakota Technologies, Inc. on dry ice. Mobility testing, using water drive, was then performed on the two most highly impacted sample pucks from each core (four samples total). This method, as described in Niemet et al. (2015), clamps a thawed puck and its metal sleeve between two reservoirs and passes deaired water through the puck in an upward configuration at flux rates of 0.4 milliliters per minute (mL/min), 0.8 mL/min, and 4 mL/min. The inlet (bottom) pressure is continuously monitored using data acquisition software and a pressure transducer while the water level in the reservoir above the puck slowly increases with flow. Once 50 milliliters of fluid passed through the puck at the lowest flux rate, the water in the upper reservoir was evaluated for presence of NAPL release through visual inspection, odor, and under UV light. The water was then removed from the reservoir, and the flux increased to the next rate. All puck materials were subjected to the Dean Stark extraction (Method API RP 40; API, 1998) at the end of mobility testing for determination of water and NAPL content, and the resulting dried, clean solids are used for grain density measurement. These parameters, along with the initial bulk volume and mass of the material within the puck, are used to calculate pore fluid saturations (PFS) within the puck following the water drive testing. Eight other pucks were also measured for PFS using the Dean Stark method without previous mobility testing. Grain size distribution testing using ASTM D422 was performed on the remaining soils from four intervals (including those with and without NAPL impacts) across each core (eight total samples). The results of the NAPL mobility testing are presented in Section 3.2.4.

Table 2-1. Dart Summary

Inundated Lands Initial Investigation, BNSF Wishram Track Switching Facility, Wishram, Washington

Station Location ID	Dart ID	Location Coordinates (NAD 83 WA South State Plane) (ft)		Time of Deployment		Measured Depth to Bottom (ft from water surface)	Length of Dart Deployed (ft)	Penetration (ft)	Dalles Dam Forebay Elevation at Time of Install (ft NAVD88)	Estimated Sed Surface Elevation (ft NAVD88)[a]	Time of Retrieval		Soak Time (hours)	Notes
		Easting (X)	**Northing (Y)**											
D440	D440-DART	1520786.50	118019.98	6/19/2018	9:30	8.0	3	3	162.6	154.6	6/21/2018	9:04	47.6	Drop cam verified; top 1 foot appears to be just weed mat
D460	D460-DART	1520813.98	118021.12	6/19/2018	10:21	7.2	3	3	162.5	155.3	6/21/2018	8:25	46.1	Drop cam verified
D420	D420-DART	1520771.65	118013.34	6/19/2018	13:21	6.7	6	3.3	162.4	155.7	6/21/2018	8:35	43.2	
D400	D400-DART	1520747.87	118014.08	6/19/2018	13:45	7.7	6	2.5	162.3	154.6	6/21/2018	8:44	43.0	
D400	D400-DART-D	1520748.19	118016.01	6/19/2018	14:07	6.7	3	3	162.3	155.6	6/21/2018	8:50	42.7	
D480	D480-DART	1520830.50	118021.39	6/19/2018	15:35	8.5	6	6	162.4	153.9	6/21/2018	8:12	40.6	
D500	D500-DART	1520860.15	118022.88	6/19/2018	16:12	9.3	3	1.8	162.4	153.1	6/21/2018	8:05	39.9	
D380	D380-DART	1520728.51	118012.91	6/19/2018	16:42	7.6	3	2.7	162.5	154.9	6/21/2018	8:58	40.3	
D360	D360-DART	1520712.79	118007.41	6/20/2018	8:34	7.9	3	3	162.5	154.6	6/24/2018	6:46	94.2	Drop cam verified
E350	E350-DART	1520702.79	117993.91	6/20/2018	9:15	8.6	3	3	162.5	153.9	6/24/2018	6:53	93.6	Drop cam verified
E330	E330-DART	1520675.15	117997.54	6/20/2018	10:35	9.6	6	5.3	162.5	152.9	6/24/2018	6:58	92.4	
E310	E310-DART	1520657.82	117992.86	6/20/2018	11:01	10.7	6	5.4	162.6	151.9	6/24/2018	7:05	92.1	
D280	D280-DART	1520628.62	118007.07	6/20/2018	11:58	7.6	6	4.2	162.6	155.0	6/24/2018	7:14	91.3	
D260	D260-DART	1520610.00	118006.32	6/20/2018	12:39	7.7	6	3.2	162.6	154.9	6/24/2018	7:22	90.7	
D240	D240-DART	1520589.44	118008.28	6/20/2018	14:41	7.4	3	3	162.6	155.2	6/24/2018	7:32	88.8	
D220	D220-DART	1520563.09	118008.51	6/20/2018	14:52	6.6	3	2.8	162.6	156.0	6/24/2018	7:40	88.8	Drop cam verified
D170	D170-DART	1520518.66	118007.08	6/20/2018	15:18	7.2	3	3	162.6	155.4	6/24/2018	7:47	88.5	
D200	D200-DART	1520545.19	118008.96	6/20/2018	15:31	6.7	6	5.8	162.6	155.9	6/24/2018	7:52	88.4	
D150	D150-DART	1520498.34	118008.10	6/20/2018	15:55	7.0	3	2.3	162.6	155.6	6/24/2018	7:58	88.0	Originally called D160; changed to D150 based on grid layout
D120	D120-DART	1520471.57	118009.67	6/20/2018	16:08	6.6	3	2.7	162.7	156.1	6/24/2018	8:01	87.9	
D100	D100-DART	1520446.03	117998.21	6/20/2018	16:36	7.9	3	2.2	162.6	154.7	6/24/2018	8:06	87.5	
D060	D060-DART	1520405.05	118000.05	6/20/2018	16:45	7.1	3	2.5	162.6	155.5	6/24/2018	8:09	87.4	
F320	F320-DART	1520670.37	117974.08	6/24/2018	9:35	9.9	6	5.3	161.7	151.8	6/26/2018	9:24	47.8	
F340	F340-DART	1520693.07	117975.91	6/24/2018	9:51	9.0	3	3	161.7	152.7	6/26/2018	9:31	47.7	
F360	F360-DART	1520715.16	117978.00	6/24/2018	10:15	8.9	3	3	161.7	152.8	6/26/2018	9:37	47.4	
E380	E380-DART	1520726.04	117995.72	6/24/2018	10:36	7.5	3	2.2	161.7	154.2	6/26/2018	9:42	47.1	
E400	E400-DART	1520751.55	117997.37	6/24/2018	10:46	7.4	3	2.3	161.7	154.3	6/26/2018	9:40	46.9	
E290	E290-DART	1520637.78	117993.71	6/24/2018	11:05	9.9	6	5.8	161.8	151.9	6/26/2018	9:54	46.8	
F300	F300-DART	1520651.13	117973.09	6/24/2018	11:14	10.6	3	3	161.8	151.2	6/26/2018	10:00	46.8	
E270	E270-DART	1520621.13	117992.77	6/24/2018	12:00	10.7	3	2.4	161.9	151.2	6/26/2018	10:04	46.1	
E250	E250-DART	1520600.94	117992.40	6/24/2018	12:09	10.8	3	3	161.9	151.1	6/26/2018	10:08	46.0	
BG-US01	BG-US01-DART	1529656.02	119071.33	6/24/2018	13:12	6.5	3	3	162.0	155.5	6/26/2018	10:15	45.0	Background blank (hung in water column)
OHM-1	OHM-1-DART			6/24/2018			3	1.5			6/26/2018		48.0	Existing monitoring well on Wishram yard - sent to lab; partially submerged in LNAPL
WMW-16	WMW-16-DART			6/26/2018	13:00	NA	3	1.5			6/28/2018	13:00	48.0	Existing monitoring well on Wishram yard; partially submerged within water column

[a] Estimated surface water elevation estimated using Dalles Dam Forebay Elevation at Time of Install; data source:

http://www.nwd-wc.usace.army.mil/dd/common/projects/www/tda.html

ft = foot (feet)

LNAPL = light nonaqueous phase liquid

NAD = North American Datum

NAVD88 = North American Vertical Datum of 1988

Table 2-2. Surface Sediment Grab Sample Summary

Inundated Lands Initial Investigation, BNSF Wishram Track Switching Facility, Wishram, Washington

Station Location ID	Location Coordinates (NAD 83 WA South State Plane [ft])		Measured Depth to Bottom (ft from water surface)	Estimated Surface Water Elevation at Time of Collection (ft NAVD88)[a]	Estimated Sediment Surface Elevation (ft NAVD88)	Field Sample ID	Representative Sample Depth (ft bss)	Sample Date and Time		Laboratory Analytical						Notes
	Easting (X)	Northing (Y)								TPH-DRO & -RRO (SGC)	TPH-DRO & -RRO (No SGC)	PAHs	EPH	VPH	COD	
BG-US01	1529652.49	119071.54	3.8	160	156.2	BG-US01-080718	0 - 0.5	8/7/2018	8:55	X	X	X	X	X	X	Upstream (approximately 1.9 miles) background location; bulk bioassay sample collected and placed on hold
D150	1520502.10	117996.33	5.9	160.4	154.5	D150-GS-080718	0 - 0.5	8/7/2018	7:30	X	X	X			X	Collocated Dart had varying waveform with very low-level response at approximately 0.1-2.1 ft bss (bottom); waveform very blue-dominant; maximum response in 0-0.5 ft = 4.7 %RE
D220	1520563.61	117997.21	7.4	160.2	152.8	D220-GS-080718	0 - 0.5	8/7/2018	7:55	X	X	X	X	X	X	Collocated Dart varying waveform with very low-level response at approximately 0.1-2.6 ft bss (bottom); waveform blue-green dominant; maximum response in 0-0.5 ft = 6.9 %RE
D240	1520594.91	117998.50	9.3	161.4	152.1	D240-GS-080618	0 - 0.5	8/6/2018	14:50	X	X	X	X	X	X	Collocated Dart had varying waveform with low-level response at approximately 0-2.7 ft bss (bottom); waveform green-dominant, transitioning to blue-dominant at approximately 1.4 ft bss; maximum response in 0-0.5 ft = 10.5 %RE
D260	1520611.39	117996.78	9.5	161.4	151.9	D260-GS-080618	0 - 0.5	8/6/2018	15:30	X	X	X	X	X	X	Collocated Dart had varying waveform with very low-level response at approximately 0-3.0 ft bss (bottom); waveform blue-green dominant; maximum response in 0-0.5 ft = 5.6 %RE
D420	1520770.20	118013.17	6.3	161.3	155.0	D420-GS-080618	0 - 0.5	8/6/2018	16:55	X	X	X	X	X	X	Collocated Dart had waveform consistent with background response along entire length (0-3.7 ft bss); bulk bioassay sample collected and placed on hold; maximum response in 0-0.5 ft = 2.1 %RE
						D420-GS-080618-1		8/6/2018	17:00	X	X	X	X	X		

[a] Estimated surface water elevation at the time of collection assumed to be represented by the Dalles Dam Forbay Elevation as obtained from:
http://www.nwd-wc.usace.army.mil/dd/common/projects/www/tda.html

Notes:
%RE = percent of the reference emitter
bss = below sediment surface
COD = chemical oxygen demand; analyzed by Stat Lab using method E410.4
EPH = extractable petroleum hydrocarbons; analyzed by Test America using Method NWTPH/EPH
ft = foot (feet)
ID = identification
NAD = North American Datum
NAVD88 = North American Vertical Datum of 1988
PAH = polycyclic aromatic hydrocarbon; analyzed by Pace Analytical using Method 8270 SIM
SGC = silica gel treatment/cleanup
TPH-DRO = total petroleum hydrocarbons as diesel-range organics; analyzed by Pace Analytical using Method NWTPH-Dx
TPH-RRO = total petroleum hydrocarbons as residual-range organics; analyzed by Pace Analytical using Method NWTPH-Dx
VPH = volatile petroleum hydrocarbons; analyzed by Test America using Method NWTPH/VPH

Table 2-3. Core Sample Summary

Inundated Lands Initial Investigation, BNSF Wishram Track Switching Facility, Wishram, Washington

Station Location ID	Actual Location Coordinates (NAD 83 WA South State Plane) (ft)		Measured Depth to Bottom (ft from water surface)	Estimated Surface Water Elevation at Time of Collection (ft NAVD88)[a]	Estimated Sed Surface Elevation (ft NAVD88)	Target Coring Depth (ft bss)	Penetration (ft)	Recovery (ft)	Field Sample ID	Representative Sample Depth (ft bss)	Sample Date and Time		Laboratory Analytical								Notes
	Easting (X)	Northing (Y)											TPH-DRO & -RRO (SGC)	TPH-DRO & -RRO (No SGC)	PAHs	EPH	VPH	COD	TOC	NAPL Mobility	
Lithology Cores																					
D200	1520546.37	118008.00	4.0	160.1	156.1	10	7.0	4.3	D200-GS-080718	0-0.5	8/7/2018	12:30	X	X	X	X	X	X			No NAPL observed; collocated Dart had varying waveform with low-level response at approximately 0.5 ft (highest observed; 18 %RE) and
									D200-SC-080718-A	3.5	8/7/2018	16:40							X		
F360	1520713.94	117981.30	8.8	162.3	153.5	10	6.4	3.9	F360-SC-080818-A	1	8/8/2018	13:10						X	X		NAPL observed from 2.0 to bottom of core at 3.9 ft; collocated Dart showed had waveform consistent with background response along
									F360-SC-080818-A	4	8/8/2018	13:15						X	X		
F400	1520753.13	117980.18	9.1	162.2	153.1	10	10.0	6.5	F400B-SC-080818-A	1	8/8/2018	11:55						X	X		No NAPL observed; no prior Dart
									F400B-SC-080818-B	5	8/8/2018	12:00						X	X		
G200	1520554.09	117949.19	10.2	160.1	149.9	10	6.9	4.3	G200-GS-080718	0-0.5	8/7/2018	18:50	X	X	X	X	X	X			NAPL observed from 2.5 to bottom of core at 4.3 ft; no prior Dart
									G200-SC-080718-A	3.5	8/7/2018	18:40						X	X		
G260	1520611.41	117951.16	10.2	160.1	149.9	10	7.0	4.3	G260-GS-080718	0-0.5	8/7/2018	18:00	X	X	X	X	X	X			NAPL observed from 2.0 to bottom of core at 4.3 ft; no prior dart
									G260-SC-080718-A	3.5	8/7/2018	17:25						X	X		
									G260-SC-080718-A-1	3.5	8/7/2018	17:30						X	X		
									G260-SC-080718-B	4	8/7/2018	17:10						X	X		
I400	1520760.93	117914.32	18.0	162.3	144.3	10	7.8	5.8	I400-GS-080918	0-0.5	8/9/2018	10:00	X	X	X	X	X	X			No NAPL observed; no prior Dart
									I400-SC-080918-A	2.5	8/9/2018	10:15						X	X		
									I400-SC-080918-B	5.5	8/9/2018	11:00						X	X		
J260	1520614.66	117891.71	14.7	161.9	147.2	10	7.4	5.4	J260-GS-080818	0-0.5	8/8/2018	17:40	X	X	X	X	X	X			NAPL observed from 0.5 to 4.0 ft; no prior Dart
									J260-SC-080818-A	2.5	8/8/2018	17:45						X	X		
K120	1520484.45	117855.27	18.9	161.7	142.8	10	5.4	3.7	K120-GS-080818	0-0.5	8/8/2018	16:40	X	X	X	X	X	X			No NAPL observed; no prior Dart
									K120-SC-080818-A	3.4	8/8/2018	16:55						X	X		
Mobility Cores																					
G200	1520556.13	117943.05	12.4	162.9	150.5	5	5.0	2.5	G200-MC-080918	1.5-4.0	8/9/2018	13:30								X	NAPL mobility core based on NAPL observations prior collocated core; assigned representative interval based on trial cores using clear liners and prior lithology core at this location
G260	1520615.35	117942.06	12.1	162.6	150.5	5	5.0	1.8	G200-MC-080918	1.5-3.3	8/9/2018	15:50								X	NAPL mobility core based on NAPL observations prior collocated core; assigned representative interval based on trial cores using clear liners and prior lithology core at this location

[a] Estimated surface water elevation at the time of collection assumed to be represented by the Dalles Dam Forbay Elevation as obtained from:
http://www.nwd-wc.usace.army.mil/dd/common/projects/www/tda.html

Notes:

NAPL Mobility testing first included white and black light core photography and laser-induced fluorescence scanning by Dakota Technologies using the TarGOST tool. Based on the core photography and LIF scanning results those intervals that were likely to represent the highest NAPL saturations were then subjected to water-drive and pore fluid saturation testing (Dean Stark) by TestAmerica, Corvallis, Oregon

%RE = percent of the reference emitter
bss = below sediment surface
COD = chemical oxygen demand; analyzed by Stat Lab using method E410.4
EPH = extractable petroleum hydrocarbons; analyzed by TestAmerica using Method NWTPH/EPH
ft = foot (feet)
ID = identification
LIF = laser-induced fluorescence
NAD = North American Datum
NAPL = nonaqueous phase liquid
NAVD88 = North American Vertical Datum 1988
PAH = polycyclic aromatic hydrocarbon; analyzed by Pace Analytical using Method 8270 SIM
SGC = silica gel treatment/cleanup
TOC = total organic carbon; analyzed by Method U.S. Department of Agriculture LOI
TPH-DRO = total petroleum hydrocarbons as diesel-range organics; analyzed by Pace Analytical using Method NWTPH-Dx
TPH-RRO = total petroleum hydrocarbons as residual-range organics; analyzed by Pace Analytical using Method NWTPH-Dx
VPH = volatile petroleum hydrocarbons; analyzed by TestAmerica using Method NWTPH/VPH

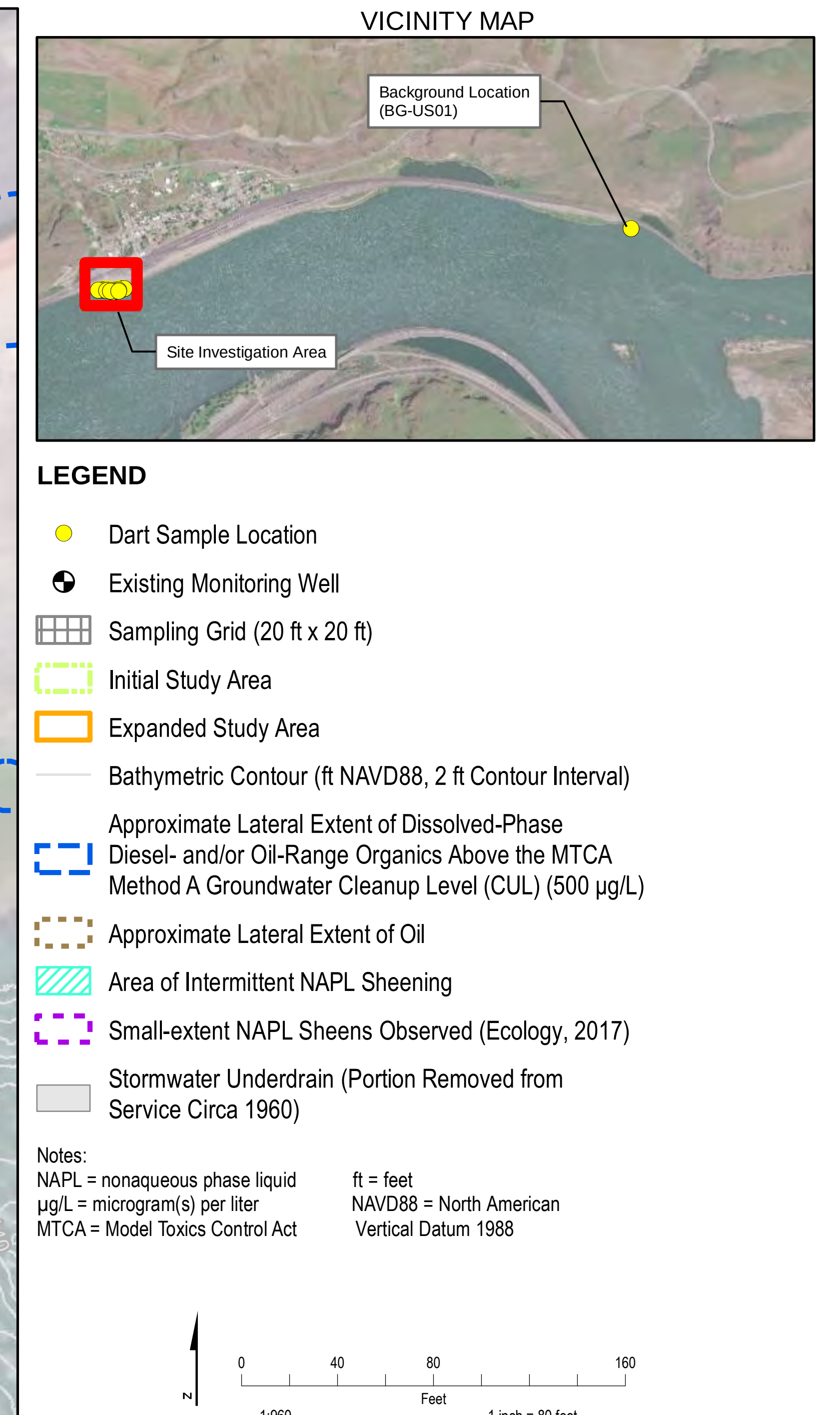


Figure 2-1. June 2018 Dart Sample Locations
BNSF Wishram Railyard
Wishram, Washington

JACOBS

SLC \\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\INITIAL INVESTIGATION REPORT\FIGURE2-1_DART_LOCATIONS.MXD GGEE 12/12/2018 08:50:03

SLC \\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\INITIAL INVESTIGATION REPORT\FIGURE2-2_GRAB_AND_CORE_SAMPLE_LOCATIONS.MXD GGEE 12/12/2018 08:48:20

VICINITY MAP

LEGEND

- Surface Sediment Grab Sample Location
- Lithology Core Sample Location
- Mobility Core Sample Location
- Existing Monitoring Well
- Sampling Grid (20 ft x 20 ft)
- Initial Study
- Expanded Study
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval)
- Approximate Lateral Extent of Dissolved-Phase Diesel- and/or Oil-Range Organics Above the MTCA Method A Groundwater Cleanup Level (CUL) (500 µg/L)
- Approximate Lateral Extent of Oil
- Area of Intermittent NAPL Sheening
- Small-extent NAPL Sheens Observed (Ecology, 2017)
- Stormwater Underdrain (Portion Removed from Service Circa 1960)

Sample ID Notes:

G260 (Total Depth = 7.0 ft)	Total penetration depth of core.
G260-GS (0 - 0.5 ft)	Red Text = Sample selected for petroleum-related contaminants of concern
G260-SC-A (3.5 ft)	
G260-SC-A-1 (3.5 ft)	"-1" = Duplicate sample
G260-SC-B (4 ft)	
G260-MC (1.5 - 3.3 ft)	"-MC" = Mobility sample

Notes:

NAPL = nonaqueous phase liquid
µg/L = microgram(s) per liter
MTCA = Model Toxics Control Act
ft = feet
NAVD88 = North American Vertical Datum 1988

N

0 40 80 160
Feet
1:956
1 inch = 79.65 feet

Figure 2-2. August 2018 Surface Sediment Grab Sample and Core Sample Locations
BNSF Wishram Railyard
Wishram, Washington

JACOBS

VICINITY MAP

LEGEND

- Southernmost Sheens Observed August 7, 2018
- Lithology Core Sample Location
- Existing Monitoring Well
- Sampling Grid (20 ft x 20 ft)
- Initial Study Area
- Expanded Study Area
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval)
- Approximate Lateral Extent of Dissolved-Phase Diesel- and/or Oil-Range Organics Above the MTCA Method A Groundwater Cleanup Level (CUL) (500 µg/L)
- Approximate Lateral Extent of Oil
- Area of Intermittent NAPL Sheening
- Small-extent NAPL Sheens Observed (Ecology, 2017)
- Stormwater Underdrain (Portion Removed from Service Circa 1960)

Notes:
NAPL = nonaqueous phase liquid
µg/L = microgram(s) per liter
MTCA = Model Toxics Control Act
ft = feet
NAVD88 = North American Vertical Datum 1988

N
0 40 80 160
Feet
1:960
1 inch = 80 feet

Figure 2-3. August 2018 Sheen Observations and Core Locations
BNSF Wishram Railyard
Wishram, Washington

JACOBS

SLC \\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\INITIAL INVESTIGATION REPORT\FIGURE2-3_SHEEN_LOCATIONS.MXD GGEE 12/20/2018 11:28:02

3. Results

3.1 Nearshore Area

3.1.1 Dart Survey

Each Dart log, presented in Appendix, A plots the overall (total) fluorescence with depth in the Signal column. The fill color shown in the Signal column is referred to as the waveform and is based on the relative contribution of the instrument's four channels that are each associated with different wavelengths and have been assigned a unique color (blue, green, orange, and red). The leftmost column on each log provides callouts at various depths that illustrate the relative contribution of each of the four colors/ channels to the overall waveform coloration.

The fluorescence responses associated with Dakota Technologies, Inc.'s scan of the Darts deployed within the study area were notably low and not indicative of the presence of NAPL; the maximum responses at individual locations across the study area ranged from 2.0 to 18.1 %RE. Maximum responses associated with the upstream background location (BG-US01) and upland monitoring well WMW-16 were 3.9 and 3.1 %RE, respectively. Conversely the Dart deployed within the upland LNAPL-containing well, OHM-1, had a maximum fluorescence response of 979 %RE. A summary of the data for each Dart is provided in Table 3-1. Table 3-1 includes the maximum response and its associated depth, the average response across the length of the Dart, and the general waveform coloration that ranged from orange and red dominant to blue and green dominant.

Thirteen of the 31 study area locations showed Dart responses consistent with the background reference location and exhibited very low-level responses with maximums less than 10 %RE and average responses that were less than 1.5 %RE. Consistent with the background Dart, the waveforms associated with the fluorescence responses at these locations were orange and red dominant. These responses were generally observed at the eastern and western peripheries of the study area and at locations advanced farther from the shore along the survey grid F-line, as shown on Figure 3-1. While low-level Dart fluorescence responses were also observed at the remaining 18 locations (average responses across each were between 1 and 4.4 %RE), at least a portion of these logs exhibited a waveform with greater relative contributions from the blue and green fluorescence channels than those seen at the background location. The maximum fluorescence response at the majority of these locations was less than 10 %RE. Exceptions to this include the three locations (D200-DART, D240-DART, and D380-DART) highlighted on Figure 3-1, where maximums were observed to range between 10.5 and 18.1 %RE. These marginally higher maximums coincided with intervals with relatively higher contributions from the blue and green fluorescence channels.

Despite the absence of elevated Dart responses indicating the presence of NAPL, the spatial distribution of the variations in the waveform colors and relative intensity of responses across depth at select locations provided a means with which to select the follow-on sediment sampling locations. As described in Sections 2.2.2 and 2.3.2, sediment grab sample locations, and to a lesser extent sediment core locations, were selected to include the range of the observed fluorescence waveforms and intensities. Sediment analytical results and comparisons to the Dart data are presented in Section 3.2.2.

3.1.2 Stratigraphy and Visual Observations

Beyond the toe of the riprap embankment that extends approximately 15 feet from the water line, the sediment samples obtained through grab sampling indicated the presence of a micaceous fine sand to silty fine sand at the surface. Within the top 6 inches, varying amounts of gravel and cobbles and milfoil and other organic debris were also observed. The core advanced at D200 indicated that the fine sand to silty fine sand extended to a depth of at least 4.3 feet in the nearshore area. No visual, olfactory, or PID evidence of NAPL was encountered within the nearshore area.

3.1.3 Petroleum-Related Constituents in Surface Sediment

In accordance with the work plan, petroleum-related analyses were performed on the five surface sediment grab samples collected within the initial study area. In addition, the shallow 0-foot to 0.5-foot interval from core location D200 was also sampled for petroleum constituents. Petroleum-related laboratory analyses for the six surface sediment samples collected across the initial study area and the background sample (BG-US01) included the following:

- Total petroleum hydrocarbons (TPH), diesel-range organics (TPH-DRO) and oil-range or residual-range organics (TPH-ORO) with and without silica gel treatment/cleanup (SGC) using Method NWTPH-Dx
- Volatile petroleum hydrocarbons (VPH) and extractable petroleum hydrocarbons (EPH) using Methods NWTPH/VPH and NWTPH/EPH, respectively
- PAHs using U.S. Environmental Protection Agency (EPA) Method 8270 SIM

Analytical results from the six nearshore surface sediment samples from within the initial study area and from the upstream background location are summarized in Table 3-2, and laboratory analytical reports are included as Appendix C. A comparison of the results to Washington Freshwater Sediment Cleanup Objectives (SCOs), as listed in Table VI, WAC 173-204-563, indicates 1 of the 6 surface samples collected across the initial study area exceeded the SCO for TPH-DRO (340 milligrams per kilogram [mg/kg]). Specifically, at core location D200, where the highest observed Dart fluorescence response was observed but where NAPL was not observed, a DRO concentration of 459 mg/kg was measured in the non-SGC sample. While this result was in excess of the SCO of 340 mg/kg, the same sample run with SGC was below the SCO at an estimated concentration (J-flagged) of 57.6 mg/kg. TPH-ORO concentrations in both the SGC and non-SGC samples from D200 were below the SCO of 3,600 mg/kg. TPH-DRO and -ORO were below the laboratory method detection limits in the surface sediment grab sample collected from the upstream background location (BG-US01).[1] No other constituents as tested for in each surface sediment sample were in excess of the SCO.

Given the exceedance of the SCO for TPH-DRO in the non-SGC surface sediment sample from D200 and in accordance with cleanup provisions of the SMS under WAC 173-204, as described in the SCUM II (Ecology, 2017b), the three highest concentrations from the available nearshore surface sediment data set were averaged for comparison against the Washington Freshwater Sediment Cleanup Screening Levels (CSLs). A summary of the TPH-DRO and TPH-ORO results from across the nearshore areas and the averages of the three highest results from SGC and non-SGC samples are provided in Table 3-3. The averages of the three highest TPH-DRO and TPH-ORO results for the nearshore area were below the CSL for both SGC and non-SGC samples. Based on this information, the nearshore area does not qualify as a sediment site under applicable standards.

3.1.4 Comparison of Sediment Sampling and Dart Results

Sediment grab sample locations and, to a lesser extent, sediment core locations were selected to include the range of fluorescence waveforms and intensities observed in the nearshore Dart data (Section 2.2 and Table 3-2). To confirm the suitability of using the Dart data to identify those areas where surface sediments were most likely to be impacted with petroleum-related constituents, TPH results were compared against the Dart response data collected from the same approximate location and depth interval.

In total, there were six locations where both Dart response and TPH analytical results were available. These included the 0- to 0.5-foot interval locations at D150, D200, D220, D240, D260, and D420. Plots of both the maximum and average Dart responses across the 0- to 0.5-foot intervals (Appendix A) against the sum of their collocated TPH-DRO and TPH-ORO (DRO+ORO) results are provided on Figure 3-2. A

[1] Bulk bioassay samples collected were not analyzed due to initial concentrations below the SCUM II observed at each of the surface sediment grab samples, indicating the site doesn't meet the SCUM II standards for a sediment site

summary of the Dart and TPH results for each sample are shown on Figure 3-2. The one non-detect TPH (DRO at D420) was assigned a proxy value that was equal to the laboratory method detection limit.

Figure 3-2 shows good fits to linear trend lines (r-squared values of 0.96 and 0.97), indicating strong correlations between DRO+ORO results and both the average and maximum Dart responses. These data indicate that Dart response data is an effective indicator of total TPH concentrations in site sediments and that the Dart survey was an effective means with which to screen for petroleum impacts in sediment across the initial study area.

Table 3-1. Dart Results Data Summary

Inundated Lands Initial Investigation, BNSF Wishram Track Switching Facility, Wishram, Washington

Station Location ID	Dart ID	Penetration (ft)	Average Dart Fluorescence Response (%RE)	Maximum Dart Fluorescence Response		Average Dart Fluorescence Response Across Top 0.5 ft bss Interval (%RE)	Waveform Coloration	Notes
				%RE	(ft bss)			
D060	D060-DART	2.5	0.7	2.0	0.6	0.8	orange-red-green	Consistent waveform across depth
D100	D100-DART	2.2	0.7	2.9	1.9	0.8	orange-red-green	Consistent waveform across depth
D120	D120-DART	2.7	0.6	2.1	1.1	0.7	orange-red-green	Consistent waveform across depth
D150	D150-DART	2.3	3.0	4.9	1.3	2.5	blue-green	Consistent waveform across depths below 0.1 ft bss
D170	D170-DART	3	1.8	5.2	2.6	1.6	blue-green	Consistent waveform across depths below 0.1 ft bss
D200	D200-DART	5.8	3.6	18.1	0.4	9.2	orange-green-blue	Consistent waveform across depths below 0.1 ft bss; marginally higher response between 0.1 and 1 ft bss
D220	D220-DART	2.8	3.2	6.9	0.2	2.8	orange-green-blue	Consistent waveform across depths below 0.1 ft bss
D240	D240-DART	3	4.4	10.5	0.2	4.9	orange-green-blue	Consistent waveform across depth
D260	D260-DART	3.2	1.9	5.6	0.1	1.9	orange-green-blue	Consistent waveform across depth
D280	D280-DART	4.2	2.6	12.6	1.8	1.5	blue-green	Waveform becomes more blue dominant below 2 ft bss; highest response of 12.6 %RE is anomalous spike across a <0.01 ft interval
D360	D360-DART	3	2.1	9.1	2.7	1.1	blue-green	Waveform becomes more blue dominant below with depth
D380	D380-DART	2.7	1.7	8.2	0.0	1.1	orange-green-blue	Consistent waveform across depth; marginally higher response at depth (approximately 5 %RE)
D400	D400-DART	2.5	1.6	3.9	1.9	1.2	orange-green-blue	Consistent waveform across depths below 0.3 ft bss
D400	D400-DART-D	3	0.9	4.1	2.7	0.9	orange-red-green	Consistent waveform across depth
D420	D420-DART	3.3	1.1	7.6	3.5	0.8	orange-red-green	Consistent waveform across depth
D440	D440-DART	3	1.2	6.3	0.0	1.9	orange-red-green	Consistent waveform across depth
D460	D460-DART	3	1.2	6.2	1.3	1.0	orange-red-green	Consistent waveform across depth
D480	D480-DART	6	1.0	5.2	4.8	1.7	orange-red-green	Consistent waveform across depth
D500	D500-DART	1.8	0.9	4.1	1.5	0.9	orange-red-green	Consistent waveform across depth
E250	E250-DART	3	1.9	4.6	2.3	1.6	blue-green	Waveform becomes less blue dominant below depth of 2 ft bss
E270	E270-DART	2.4	1.7	6	2.0	1.1	blue-green	Consistent waveform across depths below 0.4 ft bss
E290	E290-DART	5.8	2.2	5.4	2.9	1.5	blue-green	Consistent waveform across depth with exception of less blue dominance between 2.5 to 3 ft bss
E310	E310-DART	5.4	1.9	6.5	4.7	1.4	blue-green	Waveform becomes more blue dominant below 3.5 ft bss
E330	E330-DART	5.3	2.2	5.8	2.1	1.3	orange-green-blue	Waveform becomes less orange dominant below depth of 3 ft bss
E350	E350-DART	3	1.4	9.7	2.8	0.8	blue-green	Waveform becomes more blue dominant below depth of 2 ft bss
E380	E380-DART	2.2	1.5	11.9	2.0	1.1	orange-green-blue	Waveform becomes less orange dominant below depth of 1.6 ft bss
E400	E400-DART	2.3	1.1	3.9	2.1	0.7	blue-green	Waveform becomes more blue dominant below depth of 2 ft bss
F300	F300-DART	3	1.3	10.3	2.1	1.8	orange-red-green	Consistent waveform across depth; highest response of 10.3 %RE is anomalous spike across a less than 0.01 ft interval with adjacent responses 1 to 2 orders of magnitude lower
F320	F320-DART	5.3	1.1	2.6	3.8	0.9	orange-red-green	Consistent waveform across depth
F340	F340-DART	3	0.8	6.5	1.4	0.4	orange-red-green	Consistent waveform across depth
F360	F360-DART	3	1.1	3.4	1.4	1.0	orange-red-green	Consistent waveform across depth
Reference Locations								
BG-US01	BG-US01-DART	3	1.0	3.9	--	--	orange-red-green	Reference Dart; represents upstream (approximately 1.9 miles) background location surface water soak
WMW-16	WMW-16-DART	1.5	1.7	3.1	--	--	orange-green-red	Reference Dart; represents upland in well (WMW-16) groundwater (dissolved constituents) soak
OHM-1	OHM-1-DART	1.5	835	979	--	--	green-orange-blue	Reference Dart; represents upland in well (OHM-1) NAPL soak

Notes:

Estimated surface water elevation estimated using Dalles Dam Forebay Elevation at Time of Install; data source:
http://www.nwd-wc.usace.army.mil/dd/common/projects/www/tda.html

%RE = percent of the reference emitter

bss = below sediment surface

ft = foot (feet)

NAPL = nonaqueous phase liquid

Table 3-2. Nearshore Sediment Analytical Results

Inundated Lands Initial Investigation, BNSF Wishram Track Switching Facility, Wishram, Washington

			Location ID:	BG-US01	D200		D150	D220	D240	D260	D420	
			Field Sample ID:	BG-USO1-GS-080718	D200-GS-080718	D200-SC-080718A	D150-GS-080718	D220-GS-080718	D240-GS-080618	D260-GS-080618	D420-GS-080618	D420-GS-080618-1
			Sample Date:	08/07/2018	08/07/2018	08/07/2018	08/07/2018	08/07/2018	08/06/2018	08/06/2018	08/06/2018	08/06/2018
			Sample Depth (ft):	0-0.5	0-0.5	3.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
General Chemistry		*SCO* [a]	*CSL* [b]									
Total Organic Carbon	mg/kg	--	--			4,580						
Total Solids	%	--	--	75.8	78.1	78.6	70.9	68	71.6	70.7	72.8	73.9
Chemical Oxygen Demand	mg/kg	--	--	220	220	350	220	250	200 U	220	220	
PAHs (SW8270DSIM)												
1-Methylnaphthalene	µg/kg	--	--	26.4 U	25.6 U		28.2 U	29.4 U	28.0 U	28.3 U	27.5 U	27.0 U
2-Chloronaphthalene	µg/kg	--	--	26.4	25.6		28.2	29.4	28.0	28.3	27.5	27.0
2-Methylnaphthalene	µg/kg	--	--	26.4 U	25.6 U		28.2 U	29.4 U	3.00 J	28.3 U	27.5 U	27.0 U
Acenaphthene	µg/kg	--	--	7.91 U	7.69 U		8.47 U	8.82 U	8.39 U	8.49 U	8.24 U	8.11 U
Acenaphthylene	µg/kg	--	--	7.91 U	8.27		8.47 U	8.82 U	6.30 J	8.49 U	8.24 U	8.11 U
Anthracene	µg/kg	--	--	7.91 U	7.69 U		8.47 U	8.82 U	6.55 J	8.49 U	8.24 U	8.11 U
Benz[a]anthracene	µg/kg	--	--	7.91 U	17.3		1.85 J	2.82 J	23.3	3.91 J	8.24 U	0.966 J
Benzo(a)pyrene	µg/kg	--	--	7.91 U	134		2.48 J	1.88 J	27.5	4.24 J	8.24 U	8.11 U
Benzo(b)fluoranthene	µg/kg	--	--	7.91 U	24.3		2.86 J	1.07 J	20.8	5.21 J	8.24 U	8.11 U
Benzo(ghi)perylene	µg/kg	--	--	7.91 U	7.69 U		5.29 J	3.25 J	8.39 U	6.00 J	8.24 U	8.11 U
Benzo(k)fluoranthene	µg/kg	--	--	7.91 U	17.7		1.79 J	2.29 J	14.3	1.66 J	8.24 U	8.11 U
Chrysene	µg/kg	--	--	7.91 U	113		1.72 J	8.82 U	18.9	3.24 J	8.24 U	8.11 U
Dibenzo(a,h)anthracene	µg/kg	--	--	7.91 U	7.69 U		8.47 U	8.82 U	8.64	0.931 J	8.24 U	8.11 U
Fluoranthene	µg/kg	--	--	7.91 U	7.26 J		2.68 J	1.35 J	8.39 U	3.98 J	8.24 U	8.11 U
Fluorene	µg/kg	--	--	7.91 U	1.61 J		8.47 U	8.82 U	2.10 J	8.49 U	8.24 U	8.11 U
Indeno(1,2,3-cd)pyrene	µg/kg	--	--	7.91 U	7.69 U		1.83 J	1.06 J	14.8	2.72 J	8.24 U	8.11 U
Naphthalene	µg/kg	--	--	26.4 U	5.79 J		28.2 U	29.4 U	4.28 J	28.3 U	27.5 U	27.0 U
Phenanthrene	µg/kg	--	--	7.91 U	7.69 U		1.03 J	8.82 U	12.9	1.49 J	8.24 U	8.11 U
Pyrene	µg/kg	--	--	7.91 U	23.1		4.37 J	2.57 J	48.9	5.31 J	8.24 U	0.937 J
Total PAHs (17) [c]	µg/kg	17,000	30,000	26.4 U	378 J		25.9 J	16.3 J	212 J	38.7 J	27.5 U	1.90 J
TPH (NWTPH-DX)												
Diesel-range Organics	mg/kg	340	510	5.28 U	**459**		50.4 J	40 J	180	81.5	5.49 U	5.41 U
Residual-range Organics	mg/kg	3,600	4,400	13.2 U	1,380		223	188	781	313	13.7 U	5.95 J
TPH (NWTPH-DXSG)												
Diesel Range Organics	mg/kg	340	510	5.28 U	57.6 J		113 U	20.6 J	219 J	7.88 J	5.49 U	2.39 J
Residual Range Organics	mg/kg	3,600	4,400	13.2 U	179 J		174 J	88.8 J	907 J	32.3 J6	13.7 U	7.6 J
NWTPH-VPH												
C10-C12 Aliphatics	mg/kg	--	--	3.8 U	2.9 U			5.8 U	7.9 U	4.7 U	5.8 J	4.8 U
C10-C12 Aliphatic (adjusted)	mg/kg	--	--	2.7 U	3 U			3 U	3.1 U	3.2 U	2.8 U	2.8 U
C10-C12 Aromatics	mg/kg	--	--	7 J	5.1 J			11 J	13 J	8.1 J	8.9 J	9.4 J
C12-C13 Aromatics	mg/kg	--	--	3.8 U	2.9 U			7.5 J	8 J	4.7 U	5.2 U	4.8 U
C5-C6 Aliphatics	mg/kg	--	--	3.8 J	2.9 U			5.8 U	7.9 U	4.7 U	5.2 U	5.3 J
C5-C6 Aliphatics (adjusted)	mg/kg	--	--	3.8 J	3 U			3 U	3.1 U	3.2 U	2.8 U	5.3 J
C6-C8 Aliphatics	mg/kg	--	--	3.8 U	2.9 U			5.8 U	7.9 U	4.7 U	5.2 U	4.8 U
C6-C8 Aliphatic (adjusted)	mg/kg	--	--	2.7 U	3 U			3 U	3.1 U	3.2 U	2.8 U	2.8 U
C8-C10 Aliphatics	mg/kg	--	--	3.8 U	2.9 U			5.8 U	7.9 U	4.7 U	5.2 U	4.8 U
C8-C10 Aliphatic (adjusted)	mg/kg	--	--	2.7 U	3 U			3 U	3.1 U	3.2 U	2.8 U	2.8 U
C8-C10 Aromatics	mg/kg	--	--	3.8 U	2.9 U			5.8 U	7.9 U	4.7 U	5.2 U	4.8 U
NWTPH-EPH												
C10-C12 Aliphatics	mg/kg	--	--	0.65 U	0.85 J			2.8 U	2.9 U	3 U	3 J	1.3 U
C10-C12 Aromatics	mg/kg	--	--	1.1 U	1.2 U			6.2 U	6.1 U	1.3 U	1.2 U	1.1 U
C12-C16 Aliphatics	mg/kg	--	--	0.58 U	4.3 J			16 J	19 J	2.1 J	0.6 U	0.59 U
C12-C16 Aromatics	mg/kg	--	--	0.58 U	1.5 J			3.3 U	3.2 U	0.7 U	0.6 U	0.59 U
C16-C21 Aliphatics	mg/kg	--	--	0.81 U	11			55	78	11	1.1 J	0.82 U
C16-C21 Aromatics	mg/kg	--	--	0.85 U	9.4			33 J	37	5.6 J	1.2 J	0.92 J
C21-C34 Aliphatics	mg/kg	--	--	1.6 U	30			180	270	50	3.2 J	2.9 J
C21-C34 Aromatics	mg/kg	--	--	1.3 U	31			190	230	47	4.6 J	3.2 J

[a] Washington Freshwater SCOs

[b] Washington Freshwater Sediment CSLs

[c] Sum of the 17 PAH listed in Table 8-1 of Washington State Department of Ecology SCUM II, updated December 2017

Notes:
µg/kg = microgram(s) per kilogram
CSL = Cleanup Screening Level
EPH = extractable petroleum hydrocarbons
ft = foot (feet)
J = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
J6 = The sample matrix interfered with the ability to make any accurate determination; spike value is low.
mg/kg = milligram(s) per kilogram
PAH = polycyclic aromatic hydrocarbon
SCO = Sediment Cleanup Objective
SCUM II = Sediment Cleanup User's Manual II
TPH = total petroleum hydrocarbons
VPH = volatile petroleum hydrocarbons
U = Not detected at the reporting limit (or method detection limit or estimated detection limit if shown).

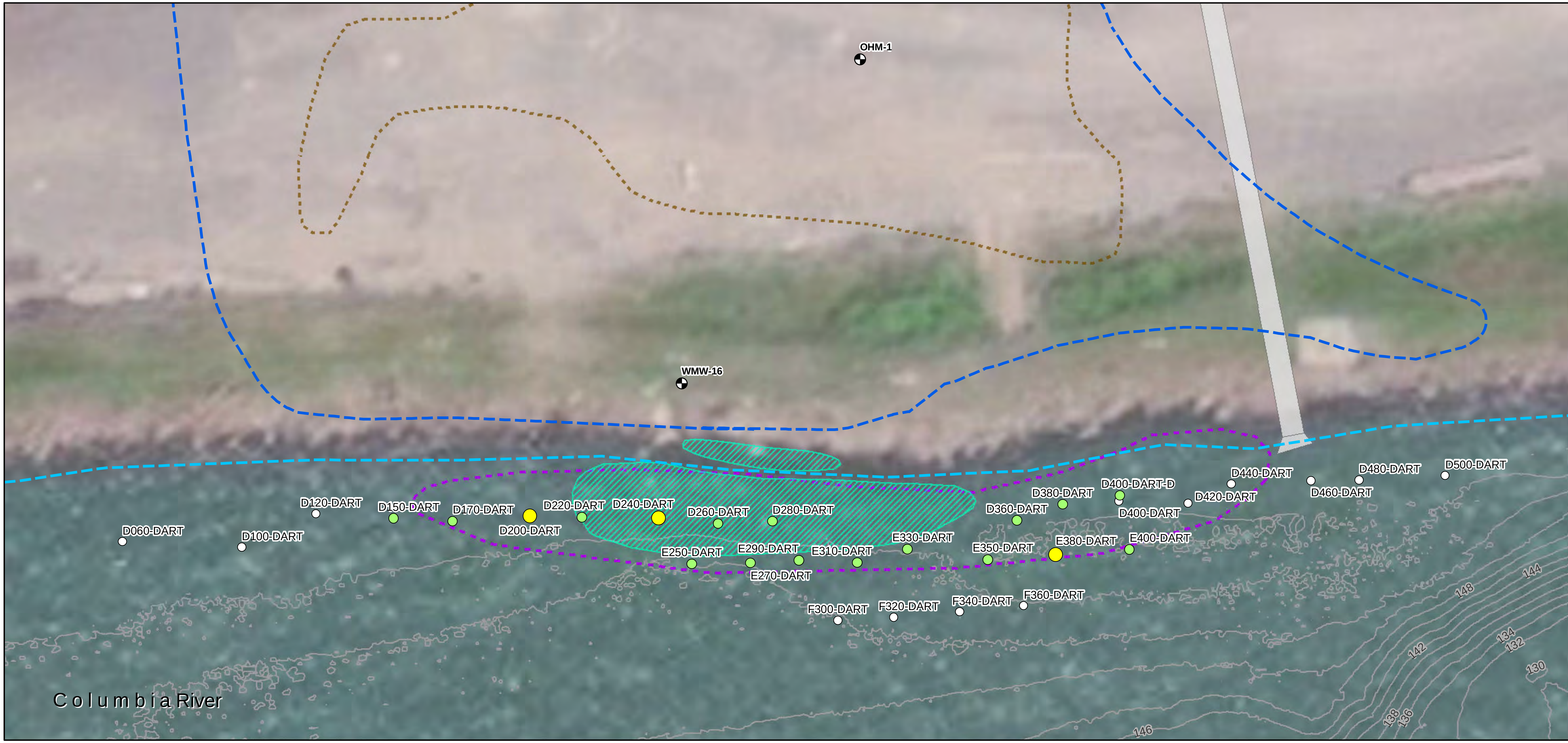
Table 3-3. Evaluation of Nearshore Sediment Results against Cleanup Screening Levels

Inundated Lands Initial Investigation, BNSF Wishram Track Switching Facility, Wishram, Washington

Sample ID	NS/OS/BG		Diesel Range Organics No SGC	Diesel Range Organics with SGC	Residual Range Organics No SGC	Residual Range Organics with SGC
		CSL[a]:	**510**		**4,400**	
BG-USO1-GS-080718	BG		5.28	5.28	13.2	13.2
D150-GS-080718	NS		50.4	***113***	223	174
D200-GS-080718	NS		***459***	57.6	***1,380***	***179***
D220-GS-080718	NS		40	20.6	188	88.8
D240-GS-080618	NS		***180***	***219***	***781***	***907***
D260-GS-080618	NS		81.5	7.88	313	32.3
D420-GS-080618	NS		5.49	5.49	13.7	13.7
D420-GS-080618-1	NS		5.41	2.39	6.0	7.6
Average of 3 Highest Concentrations (shaded if in excess of CSL)						
Nearshore			240	130	825	420

[a] Washington Freshwater Sediment CSLs

Notes:
All concentrations reported in mg/kg.
The three highest concentrations site wide shown in bold and italics.
BG = background
CSL Cleanup Screening Level
ID = identification
mg/kg = milligram(s) per kilogram
NS = nearshore
OS = offshore
SGC= silica gel treatment/cleanup



LEGEND

- Very Low Level Response Consistent with Background
- Very Low Level Response (Generally <10% RE Maximum) with Blue-green Waveform that is Inconsistent with Background
- Low Level Response (Maximum Response Between 10 and 18%RE) with Blue-green Waveform that is Inconsistent with Background
- Existing Monitoring Well
- Current Shoreline
- Approximate Lateral Extent of Dissolved-Phase Diesel- and/or Oil-Range Organics Above the MTCA Method A Groundwater Cleanup Level (CUL) (500 µg/L)
- Approximate Lateral Extent of Oil
- Area of Intermittent NAPL Sheening
- Small-extent NAPL Sheens Observed (Ecology, 2017)
- Stormwater Underdrain (Portion Removed from Service Circa 1960)
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval)

Notes:
NAPL = nonaqueous phase liquid
µg/L = microgram(s) per liter
MTCA = Model Toxics Control Act
UST = underground storage tank

N
0 17.5 35 70
Feet
1:420
1 inch = 35 feet

Figure 3-1. Dart Results
BNSF Track Switching Facility
Wishram, Washington

JACOBS

SLC \\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\INITIAL INVESTIGATION REPORT\FIGURE3-1_DART_RESULTS.MXD GGEE 1/21/2019 12:14:23

3.2 Offshore Area

3.2.1 Stratigraphy and Visual Observations

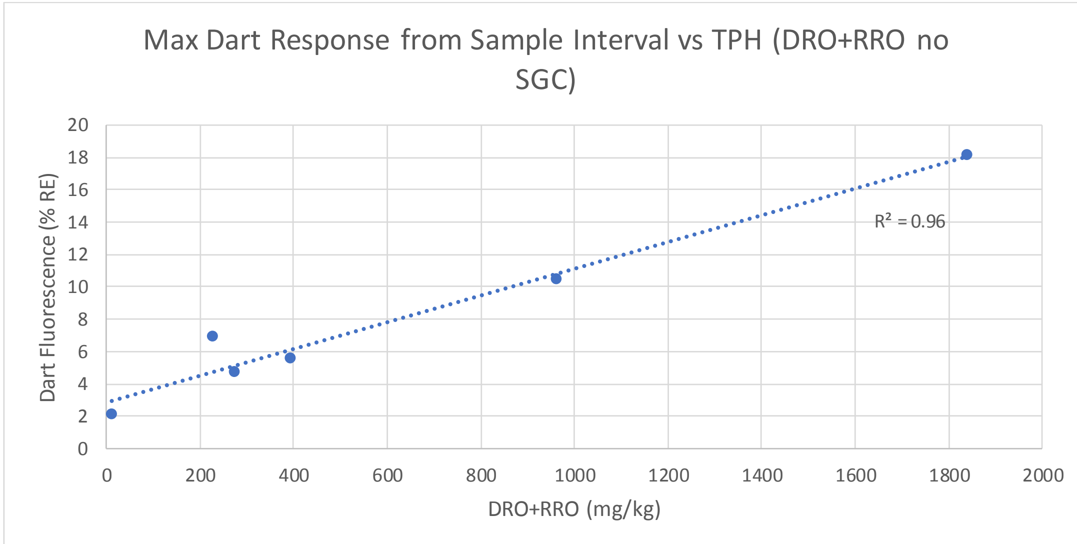
The sediment samples obtained through core sampling indicated the presence of a micaceous fine sand that extended to depths of between 0.5 foot (J260) and 5.5 feet bss (I400). No visual, olfactory, or PID evidence of NAPL or petroleum-related impacts were encountered within these materials. These fine sands were observed to comprise the majority of the material in three of the seven offshore cores. At the remaining 4 locations (G200, G260, J260, and F360), a 2- to 3.5-foot interval of highly plastic disturbed silty sand with no apparent bedding structure and an abundance of organic debris, consisting of wood and roots, was observed approximately 0.5 foot to 2.5 feet bss. In each instance where this interval was present, a black, tacky NAPL was also observed and PID screening results were elevated. At the location where the bottom of the NAPL-impacted interval was encountered (J260), a micaceous fine sand with laminar structure, no odor, no staining, and no elevated PID screening results was noted. These four core locations, highlighted on Figure 3-3, represented the only locations where NAPL was observed during the investigation. The presence of anthropogenic debris at one location, consisting of the remnants of a glass jar and its metal lid (G200 at 4.2 feet bss), and the absence of bedding structure within the NAPL-impacted intervals encountered suggest that these materials represent a layer of fill that was emplaced, likely before the inundation of these lands that resulted from the construction of The Dalles Dam. Bedrock was not encountered within the study area during the initial investigation. Figure 3-4 presents two cross-sections (A-A' and B-B') that illustrate the observed sediment conditions across both the nearshore and offshore areas.

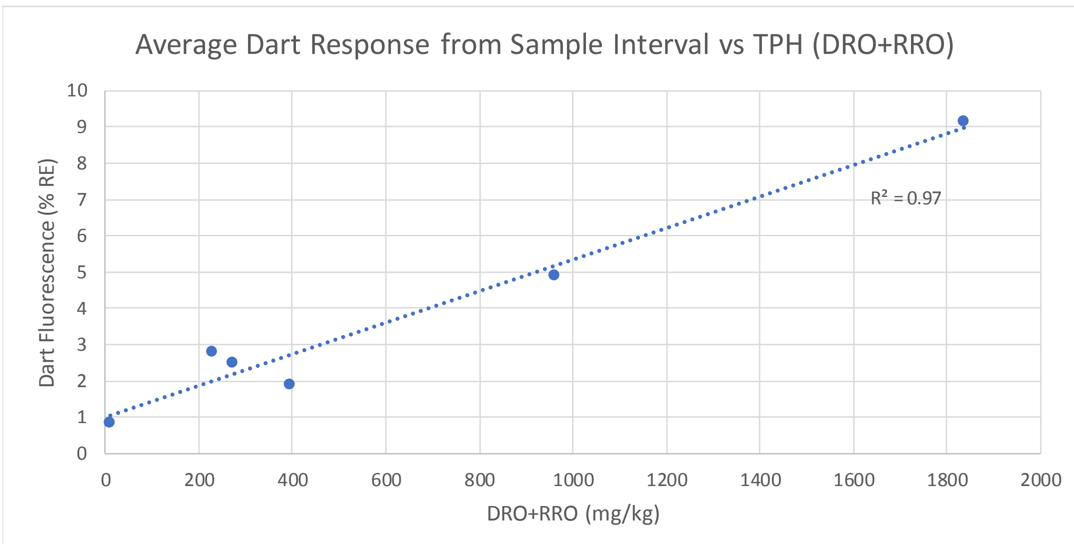
3.2.2 Petroleum-Related Constituents in Surface Sediment

The shallow 0-foot to 0.5-foot interval from offshore core locations G200, G260, I400, J260, and K120 were sampled for petroleum constituents as listed in Section 3.1.3. Analytical results from the offshore surface sediment samples taken from cores within the expanded study area are summarized in Table 3-4, and laboratory analytical reports are included as Appendix C.

Shallow samples collected from within the offshore area exceeded the SCO for TPH-DRO (340 mg/kg) and TPH-ORO (3,600 mg/kg) (with and without SGC). Specifically, at core location J260 where NAPL was closest to the sediment surface at a depth of 0.5 to 4 feet bss, TPH-DRO concentrations with and without SGC were 4,830 and 12,700 mg/kg, respectively. Concentrations of TPH-ORO with and without SGC were 12,100 and 31,000 mg/kg, respectively. At the remaining 3 core locations where NAPL was observed it was greater than 2 feet bss and results from the overlying sediment were all below applicable SCOs. No other constituents as tested for in each surface sediment sample were in excess of the SCO.

Given the exceedance of the SCO in the surface sediment sample collected from J260 for TPH-DRO and TPH-ORO, the three highest concentrations from the offshore area (consistent with expanded study area where some locations showed buried NAPL) were calculated for comparison against the Washington Freshwater Sediment CSLs. A summary of the TPH-DRO and TPH-ORO results from across the offshore area and the averages of the three highest results from SGC and non-SGC samples are provided in Table 3-5. TPH-DRO results from both SGC and non-SGC analyses exceed the CSL of 510 mg/kg. For TPH-ORO, the average of the 3 highest results exceeded the CSL of 4,400 mg/kg for the non-SGC results only.





Data for 0-0.5 ft interval

	TPH	Dart Response (%RE)	
	DRO+RRO	Max	Average
D150	273.4	4.7	2.5
D220	228	6.9	2.8
D240	961	10.5	4.9
D260	394.5	5.6	1.9
D420	11.44	2.1	0.84
D200	1839	18.1	9.15

Notes:

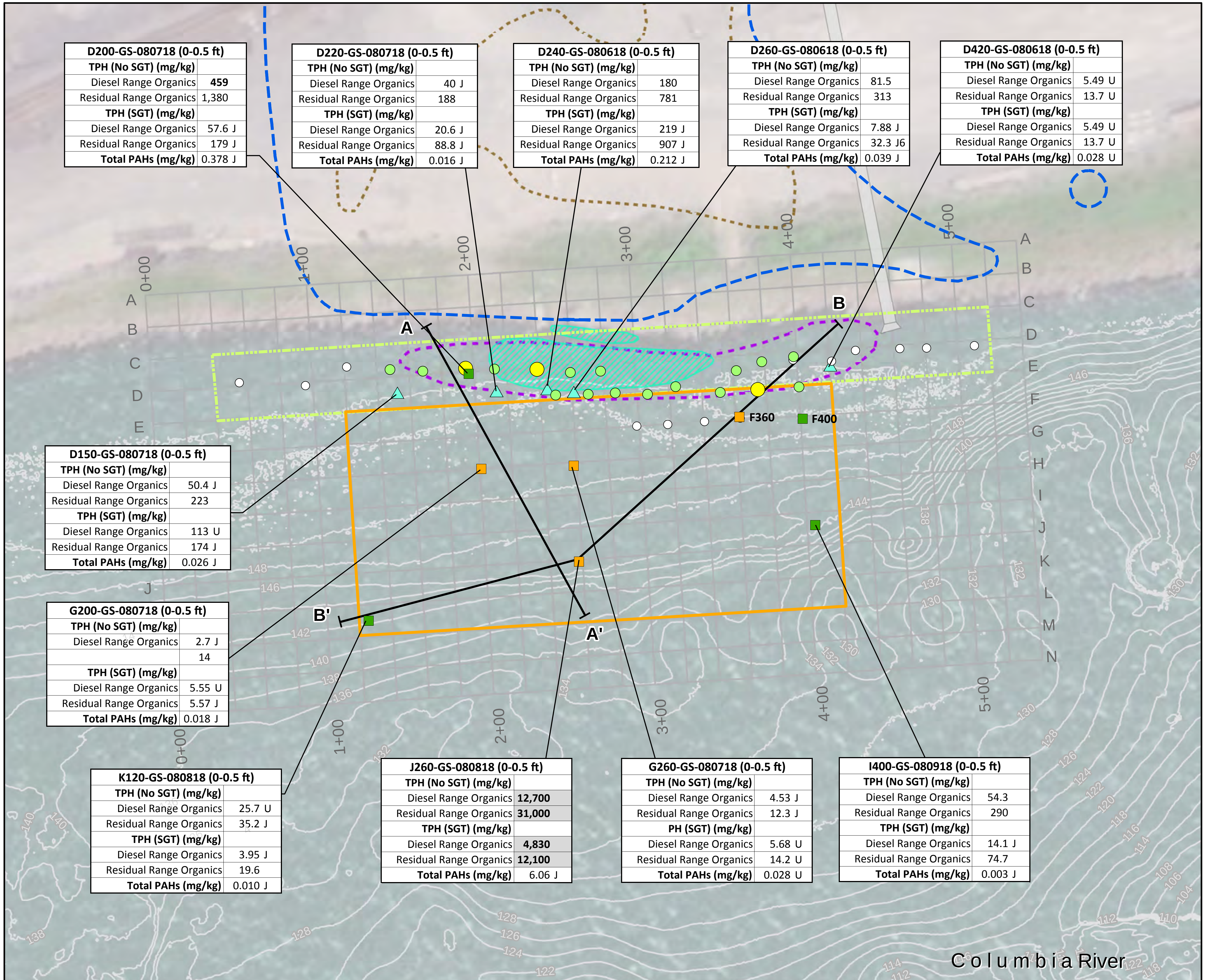
TPH - total petroleuem hydrocarbons

DRO+RRO - sum of diesel range and residual range organics

mg/kg - milligrams per kilogram

%RE - percent of the reference emitter

Figure 3-2. Plots of Dart Response vs. Total Petroleum Hydrocarbon Results
BNSF Wishram Railyard
Wishram, Washington



D200-GS-080718 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	**459**
Residual Range Organics	1,380
TPH (SGT) (mg/kg)	
Diesel Range Organics	57.6 J
Residual Range Organics	179 J
Total PAHs (mg/kg)	0.378 J

D220-GS-080718 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	40 J
Residual Range Organics	188
TPH (SGT) (mg/kg)	
Diesel Range Organics	20.6 J
Residual Range Organics	88.8 J
Total PAHs (mg/kg)	0.016 J

D240-GS-080618 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	180
Residual Range Organics	781
TPH (SGT) (mg/kg)	
Diesel Range Organics	219 J
Residual Range Organics	907 J
Total PAHs (mg/kg)	0.212 J

D260-GS-080618 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	81.5
Residual Range Organics	313
TPH (SGT) (mg/kg)	
Diesel Range Organics	7.88 J
Residual Range Organics	32.3 J6
Total PAHs (mg/kg)	0.039 J

D420-GS-080618 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	5.49 U
Residual Range Organics	13.7 U
TPH (SGT) (mg/kg)	
Diesel Range Organics	5.49 U
Residual Range Organics	13.7 U
Total PAHs (mg/kg)	0.028 U

D150-GS-080718 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	50.4 J
Residual Range Organics	223
TPH (SGT) (mg/kg)	
Diesel Range Organics	113 U
Residual Range Organics	174 J
Total PAHs (mg/kg)	0.026 J

G200-GS-080718 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	2.7 J
	14
TPH (SGT) (mg/kg)	
Diesel Range Organics	5.55 U
Residual Range Organics	5.57 J
Total PAHs (mg/kg)	0.018 J

K120-GS-080818 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	25.7 U
Residual Range Organics	35.2 J
TPH (SGT) (mg/kg)	
Diesel Range Organics	3.95 J
Residual Range Organics	19.6
Total PAHs (mg/kg)	0.010 J

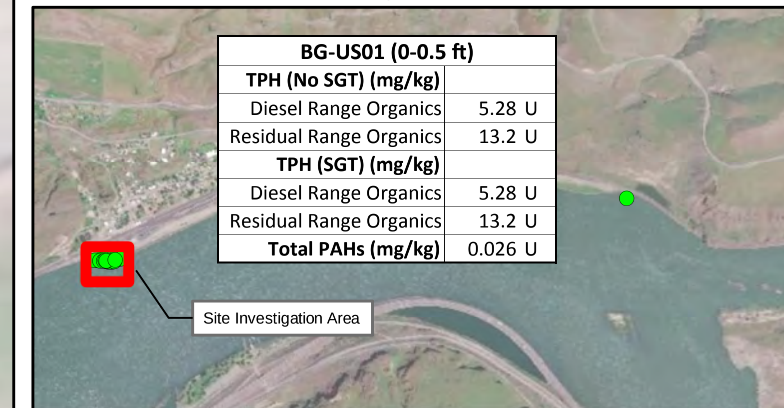
J260-GS-080818 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	**12,700**
Residual Range Organics	**31,000**
TPH (SGT) (mg/kg)	
Diesel Range Organics	**4,830**
Residual Range Organics	**12,100**
Total PAHs (mg/kg)	6.06 J

G260-GS-080718 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	4.53 J
Residual Range Organics	12.3 J
PH (SGT) (mg/kg)	
Diesel Range Organics	5.68 U
Residual Range Organics	14.2 U
Total PAHs (mg/kg)	0.028 U

I400-GS-080918 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	54.3
Residual Range Organics	290
TPH (SGT) (mg/kg)	
Diesel Range Organics	14.1 J
Residual Range Organics	74.7
Total PAHs (mg/kg)	0.003 J

SLC \\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\INITIAL INVESTIGATION REPORT\FIGURE3-2_CORE_RESULTSV2.MXD GGEE 4/22/2019 11:41:21

VICINITY MAP



BG-US01 (0-0.5 ft)	
TPH (No SGT) (mg/kg)	
Diesel Range Organics	5.28 U
Residual Range Organics	13.2 U
TPH (SGT) (mg/kg)	
Diesel Range Organics	5.28 U
Residual Range Organics	13.2 U
Total PAHs (mg/kg)	0.026 U

LEGEND

- Core Location with NAPL Observed
- Core Location with no NAPL Observed
- Surface Sediment Grab Sample Location
- Very Low Level Response Consistent with Background
- Very Low Level Response (Generally <10% RE Maximum) with Blue-green Waveform that is Inconsistent with Background
- Low Level Response (Maximum Response Between 10 and 18%RE) with Blue-green Waveform that is Inconsistent with Background
- Section Line (See Figure 3-3)
- Sampling Grid (20 ft x 20 ft)
- Initial Study
- Expanded Study
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval)
- Approximate Lateral Extent of Dissolved-Phase Diesel- and/or Oil-Range Organics Above the MTCA Method A Groundwater Cleanup Level (CUL) (500 µg/L)
- Approximate Lateral Extent of Oil
- Area of Intermittent NAPL Sheening
- Small-extent NAPL Sheens Observed (Ecology, 2017)
- Stormwater Underdrain (Portion Removed from Service Circa 1960)

Notes:
NAPL = nonaqueous phase liquid
µg/L = microgram(s) per liter
MTCA = Model Toxics Control Act
ft = feet
NAVD88 = North American Vertical Datum 1988

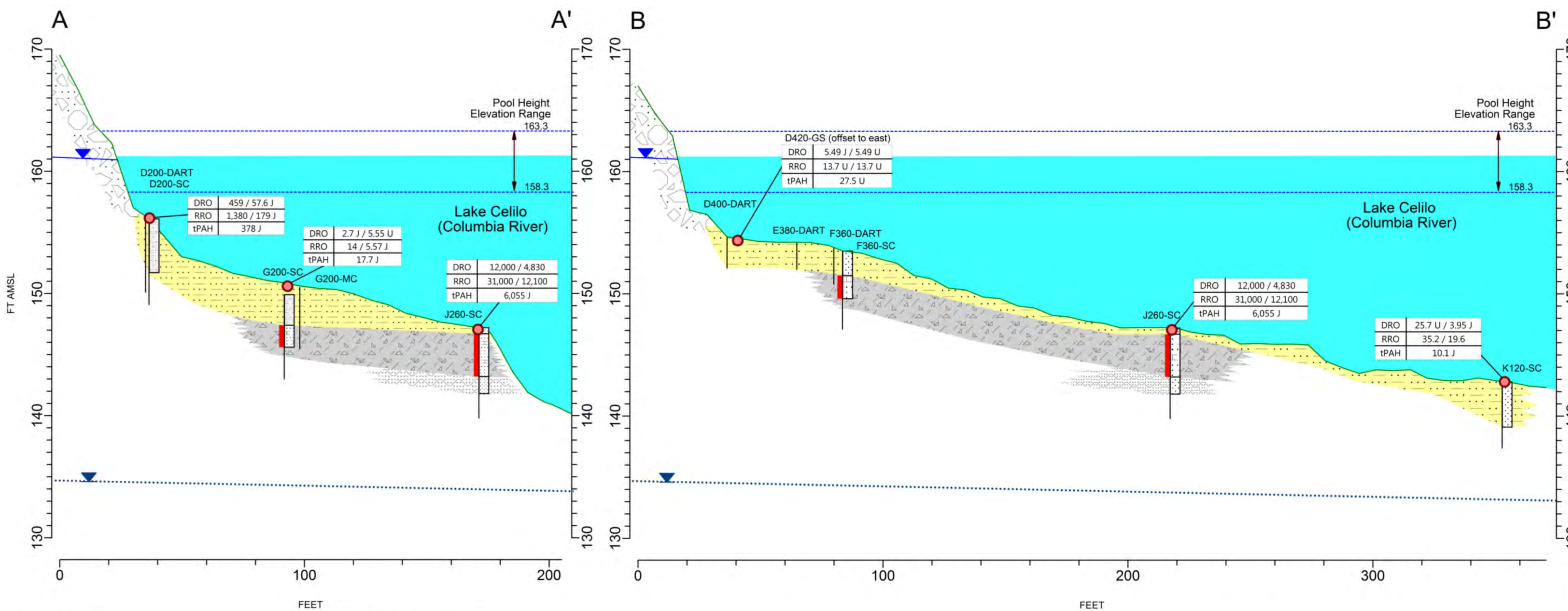
0 25 50 100
Feet
1:780
1 inch = 65 feet

	SCO[1]	CSL[2]
Diesel Range Organics	340	510
Residual Range Organics	3600	4400
Total PAHs	17	30

1 - Washington Freshwater Sediment Cleanup Objectives (SCO)
2 - Washington Freshwater Sediment Cleanup Screening Levels (CSL)
Values in **bold** are in excess of the SCO
Shaded values are in excess of the CSL
U = Not Detected at the reporting limit (or MDL or EDL if shown)
J = Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value. J6 = The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Figure 3-3. August 2018 Surface Sediment Sampling Results
BNSF Wishram Railyard
Wishram, Washington

JACOBS



LEGEND

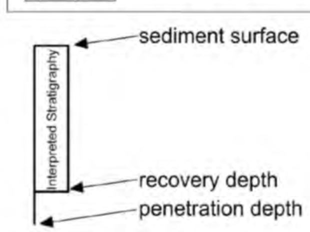
- Approximate current water table
- Approximate pre-1957 water table
- Interval of observed viscous petroleum NAPL
- Surface sediment sample collected

Interpreted Stratigraphy

- Rip-Rap
- River Sediment
- Submerged Fill
- Alluvial Sands

Observed Core Lithology

- Micaceous Fine Sand
- Micaceous Silty Fine Sand
- Sandy Silt w/Organic Debris



Analytical Results

Parameter	Result
Diesel Range Organics (DRO)	non-SGC / SGC (mg/kg)
Residual Range Organics (RRO)	non-SGC / SGC (mg/kg)
Total Polycyclic Aromatic Hydrocarbons (tPAH)	(ug/kg)

Notes:
mg/kg - milligrams per kilogram
SGC - silica gel treatment/cleanup
NAPL - non-aqueous phase liquid

Figure 3-4. Cross-Sections
BNSF Wishram Railyard
Wishram, Washington

Table 3-4. Offshore Sediment Analytical Results

Inundated Lands Initial Investigation, BNSF Wishram Track Switching Facility, Wishram, Washington

			Location ID:	F360		F400		G200		G260				I400			J260		K120	
			Field Sample ID:	F360-SC-080818-A	F360-SC-080818-B	F400B-SC-080818-A	F400B-SC-080818-B	G200-GS-080718	G200-SC-080718-A	G260-GS-080718	G260-SC-080718-A	G260-SC-080718-A-1	G260-SC-080718-B	I400-GS-080918	I400-SC-080918-A	I400-SC-080918-B	J260-GS-080818	J260-SC-080818-A	K120-GS-080818	K120-SC-080818-A
			Sample Date:	08/08/2018	08/08/2018	08/08/2018	08/08/2018	08/07/2018	08/07/2018	08/07/2018	08/07/2018	08/07/2018	08/07/2018	08/09/2018	08/09/2018	08/09/2018	08/08/2018	08/08/2018	08/08/2018	08/08/2018
			Sample Depth (ft):	1	4	1	5	0-0.5	3.5	0-0.5	3.5	3.5	4	0-0.5	2.5	5.5	0-0.5	2.5	0-0.5	3.4
General Chemistry		*SCO*[a]	*CSL*[b]																	
Total Organic Carbon	mg/kg	--	--	5,710	57,700	3,380	7,510		91,000		86,400	107,000	66,700		18,600	6,700		37,100		9,320
Total Solids	%	--	--	75.5	61.9	79.9	71	72.1	66	70.4	67.4	73.8	84.6	78.2	71.5	73.9	72.9	68.1	77.9	79.6
Chemical Oxygen Demand	mg/kg	--	--	480	2,200	220	250	220	2200	220	2,200	2,200	2,200	200 U	220	250	220	2,200	220	220
PAHs (SW8270DSIM)																				
1-Methylnaphthalene	µg/kg	--	--					27.7 U		28.4 U				25.6 U			335		25.7 U	
2-Chloronaphthalene	µg/kg	--	--					27.7		28.4				25.6			137		25.7	
2-Methylnaphthalene	µg/kg	--	--					27.7 U		28.4 U				25.6 U			332		25.7 U	
Acenaphthene	µg/kg	--	--					8.32 U		8.52 U				7.68 U			139		7.70 U	
Acenaphthylene	µg/kg	--	--					8.32 U		8.52 U				7.68 U			41.2 U		7.70 U	
Anthracene	µg/kg	--	--					8.32 U		8.52 U				7.68 U			195		7.70 U	
Benz[a]anthracene	µg/kg	--	--					1.57 J		8.52 U				2.11 J			169		7.70 U	
Benzo(a)pyrene	µg/kg	--	--					2.02 J		8.52 U				0.869 J			1,230		7.70 U	
Benzo(b)fluoranthene	µg/kg	--	--					2.27 J		8.52 U				7.68 U			52.7		1.16 J	
Benzo(ghi)perylene	µg/kg	--	--					2.51 J		8.52 U				7.68 U			305		5.60 J	
Benzo(k)fluoranthene	µg/kg	--	--					8.32 U		8.52 U				7.68 U			403		7.70 U	
Chrysene	µg/kg	--	--					1.47 J		8.52 U				7.68 U			741		7.70 U	
Dibenzo(a,h)anthracene	µg/kg	--	--					8.32 U		8.52 U				7.68 U			41.2 U		0.823 J	
Fluoranthene	µg/kg	--	--					2.72 J		8.52 U				7.68 U			41.2 U		7.70 U	
Fluorene	µg/kg	--	--					8.32 U		8.52 U				7.68 U			109		7.70 U	
Indeno(1,2,3-cd)pyrene	µg/kg	--	--					1.44 J		8.52 U				7.68 U			99.9		1.44 J	
Naphthalene	µg/kg	--	--					27.7 U		28.4 U				25.6 U			60.5 J		25.7 U	
Phenanthrene	µg/kg	--	--					8.32 U		8.52 U				7.68 U			399		7.70 U	
Pyrene	µg/kg	--	--					3.69 J		8.52 U				7.68 U			1820		1.04 J	
Total PAHs (17)[c]	µg/kg	17,000	30,000					17.7 J		28.4 U				2.98 J			6,055 J		10.1 J	
TPH (NWTPH-DX)																				
Diesel Range Organics	mg/kg	340	510					2.7 J		4.53 J				54.3			**12,700**		25.7 U	
Residual Range Organics	mg/kg	3600	4400					14		12.3 J				290			**31,000**		35.2 J	
TPH (NWTPH-DXSG)																				
Diesel-range Organics	mg/kg	340	510					5.55 U		5.68 U				14.1 J			**4,830**		3.95 J	
Residual-range Organics	mg/kg	3600	4400					5.57 J		14.2 U				74.7			**12,100**		19.6	
NWTPH-VPH																				
C10-C12 Aliphatics	mg/kg	--	--					3.1 U		3.2 U				2.8 U			4 J		4.2 U	
C10-C12 Aliphatic (adjusted)	mg/kg	--	--					2.9 U		2.8 U				2.7 U			3 U		2.6 U	
C10-C12 Aromatics	mg/kg	--	--					5.2 J		5.3 J				4.5 J			5 J		6.4 J	
C12-C13 Aromatics	mg/kg	--	--					3.1 U		3.2 U				2.8 U			11		4.2 U	
C5-C6 Aliphatics	mg/kg	--	--					3.1 U		3.2 U				2.8 U			4 U		4.2 U	
C5-C6 Aliphatics (adjusted)	mg/kg	--	--					2.9 U		2.8 U				2.7 U			3 U		2.6 U	
C6-C8 Aliphatics	mg/kg	--	--					3.1 U		3.2 U				2.8 U			4 U		4.2 U	
C6-C8 Aliphatic (adjusted)	mg/kg	--	--					2.9 U		2.8 U				2.7 U			3 U		2.6 U	
C8-C10 Aliphatics	mg/kg	--	--					3.1 U		3.2 U				2.8 U			4 U		4.2 U	
C8-C10 Aliphatic (adjusted)	mg/kg	--	--					2.9 U		2.8 U				2.7 U			3 U		2.6 U	
C8-C10 Aromatics	mg/kg	--	--					3.1 U		3.2 U				2.8 U			4 U		4.2 U	
NWTPH-EPH																				
C10-C12 Aliphatics	mg/kg	--	--					1.3 U		0.67 U				2.6 U			21 J		1.2 U	
C10-C12 Aromatics	mg/kg	--	--					1.2 U		1.2 U				2.3 U			4 U		1.1 U	
C12-C16 Aliphatics	mg/kg	--	--					1.3 J		0.61 U				2.6 J			32		0.84 J	
C12-C16 Aromatics	mg/kg	--	--					0.62 U		0.61 U				1.2 U			7 J		0.56 U	
C16-C21 Aliphatics	mg/kg	--	--					3.8 J		1.1 J				15			87		3.9 J	
C16-C21 Aromatics	mg/kg	--	--					4.3 J		1.4 J				8 J			180		2.5 J	
C21-C34 Aliphatics	mg/kg	--	--					14		4.4 J				64			310		17	
C21-C34 Aromatics	mg/kg	--	--					19		4.1 J				60			890		20	

[a] Washington Freshwater SCOs

[b] Washington Freshwater Sediment CSLs

[c] Sum of the 17 PAHs listed in Table 8-1 of Washington State Department of Ecology SCUM II, updated December 2017

Notes:

µg/kg = microgram(s) per kilogram

CSL = Cleanup Screening Levels

EPH = extractable petroleum hydrocarbons

ft = foot (feet)

ID = identification

J = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

mg/kg = milligram(s) per kilogram

PAH = polycyclic aromatic hydrocarbon

SCO = Sediment Cleanup Objective

SCUM II = Sediment Cleanup User's Manual II

TPH = total petroleum hydrocarbons

VPH = volatile petroleum hydrocarbons

U = Not detected at the reporting limit (or method detection limit or estimated detection limit if shown)

Values in **bold** are in excess of the SCO.

Shaded values are in excess of the CSL.

Table 3-5. Evaluation of Offshore Sediment Results against Cleanup Screening Levels
Inundated Lands Initial Investigation, BNSF Wishram Track Switching Facility, Wishram, Washington

Sample ID	Nearshore/Offshore/ Background		Diesel Range Organics		Residual Range Organics	
			No SGC	with SGC	No SGC	with SGC
		CSL[a]:	**510**		**4,400**	
G200-GS-080718	OS		2.7 J	5.55 U	14	5.57 J
G260-GS-080718	OS		4.53 J	*5.68 U*	12.3 J	14.2 U
I400-GS-080918	OS		*54.3*	*14.1 J*	*290*	*74.7*
J260-GS-080818	OS		*12,700*	*4,830*	*31,000*	*12,100*
K120-GS-080818	OS		*25.7 U*	3.95 J	*35.2 J*	*19.6*
Average of Three Highest Concentrations (shaded if in excess of CSL)						
Offshore			**4,260**	**1,617**	**10,442**	4,065

[a] Washington Freshwater Sediment CSL

Notes:
All concentrations reported in mg/kg.
The three highest concentrations sitewide are shown in bold and italics.

CSL Cleanup Screening Level
ID = identification
J (flag) = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
OS = offshore
SGC = silica gel treatment/cleanup
U (flag) = Not detected at the reporting limit (or method detection limit or estimated detection limit if shown).

Within the offshore area, PAHs were mostly non-detect or had low-level detections where total PAH results (sum of detected concentration across the 17 PAHs) (Ecology, 2017b; Table 8-1) ranged from 2.9 to 6,055 micrograms per kilogram (µg/kg) (J260), and were all below the SCO of 17,000 µg/kg.

Consistent with the nearshore area surface sediment, samples from offshore indicated only limited low-level detections of the VPH fractions (often estimated). Where EPH fractions were detected, between 70 and 80 percent of the detections consisted of both aliphatics and aromatics in the carbon range C21-C34. Again, this is consistent with the TPH results, as higher concentrations of TPH-ORO were observed relative to the TPH-DRO.

3.2.3 Total Organic Carbon and Chemical Oxygen Demand in Surface and Subsurface Sediment

Sediment COD and TOC data were collected from the eight lithology core sample locations shown on Figure 2-2 at depths ranging from 1.0 to 5.5 feet bss. The sample depths were chosen to represent the primary gas production zone, which is generally considered as the top 5 feet of soft sediment. Ponar grab samples for COD also were collected from five surface sediment grab sample locations shown on Figure 2-2 (D150, D220, D240, D260, and D420).

TOC concentrations ranged between 3,380 and 107,000 mg/kg with a median value of 4,563 mg/kg. The higher TOC concentrations (ranging from 37,100 mg/kg to 107,000 mg/kg) were observed farther from shore at F360, G200, G260, and J260 at depths ranging from 2.5 to 4 feet bss (Figure 3-3). These high TOC samples were collocated with occurrences of organic debris, roots, and free-phase NAPL identified in the sediment core logs (Appendix B). The high TOC samples were also collocated with the maximum observed COD concentration of 2,200 mg/kg (Table 3-4), suggesting that these samples were potentially influenced by NAPL present in the sample. In contrast, the COD/TOC ratio, which is an indicator of the ease of biodegradability of the organic carbon, was observed to decrease with depth and was higher in samples from 0.5 foot to 2.5 feet bss with values ranging from 0.05 to 0.08. This is consistent with observations at other sites as fresh organic matter is more labile than the more recalcitrant organic matter found at depth. These results were used to estimate gas ebullition potential in site sediments as discussed in Section 4.4.1.

3.2.4 Nonaqueous Phase Liquid Mobility

Soils from the mobility cores advanced within offshore NAPL-affected areas at G200 and G260 were characterized in detail as part of this study through core photography, TarGOST screening, and PFS and grain-size distribution testing of samples collected from across each core. NAPL mobility testing using water drive was also performed on the two most highly-impacted intervals. A copy of the NAPL mobility laboratory testing report that includes all these data is included as Appendix D.

Results of the grain-size analysis are presented in Appendix D. Grain-size results and the core photography (Appendix D) indicate that the NAPL affected intervals in each core (samples WISH-3, WISH-6, and WISH-7) consisted of silt with trace fine and coarse sand, and trace clay. Above these intervals (WISH-1 and WISH-5), sediments consisted predominantly of fine sand with some silt. Grain-size distribution results for those samples containing minimal fines that included the fine sands overlying locations where NAPL was observed were used to estimate a range of hydraulic conductivities for these materials using the Kozeny-Carmen method as modified by others and shown in Carrier (2003). Results of this calculation estimate a range of hydraulic conductivities of approximately 4.3 x 10^{-3} centimeters per second (cm/sec) (G200, 1.7 to 2.0 feet [bss]) to 8.4 x 10^{-3} cm/sec (G260, 1.7 to 2.5 feet bss)

PFS LNAPL and water saturations) were calculated from the Dean Stark Extraction data at 6 discrete 0.1- to 0.2-foot intervals across each of the 2 soil cores where TarGOST screening and photography indicated NAPL presence. First, the masses provided by the laboratory had to be converted to a volume basis using the matrix density. The bulk sample volume and bulk solids volume were calculated using the wet bulk density and grain density values, respectively, using measurements from the laboratory for the materials in each core segment. A water density of 1 gram per cubic centimeter (g/cm^3) was assumed for water. NAPL density was assumed to be 0.96 g/cm^3 based on measurements of NAPL collected from upland wells in 2016 (KJ, 2019). For calculation purposes, it was assumed that the pore volume of these saturated samples was filled completely with water and NAPL, and no air was present. Therefore, the pore volume represents the sum of the water and NAPL volumes. Porosity is based on the bulk sample volume, and PFS are based on the pore volume.

PFS results are included at the end of Appendix D and are shown as profiles across depth on Figure 3-5 adjacent to the TarGOST screening profiles and observed lithology. LNAPL saturations ranged from less than 1 to 42 percent of the pore volume (%PV). Water drive testing performed on the 2 sub-samples from each core with the highest TarGOST responses (peak responses ranging from 168 to 229 %RE) and with measured NAPL saturations of (ranging from 16 to 38 %PV) indicated no mobile fractions of NAPL. This is consistent with the tacky and viscous nature of the NAPL that was observed in the field and indicates that the submerged NAPL at the site is not hydraulically mobile.

Since the samples tested did not produce any NAPL during the water drive testing, the actual residual NAPL saturation could not be quantified to anything other than something greater than was tested for mobility, which was as high as 38 %PV.

3.3 Data Quality Evaluation

Analytical parameters that went through the data validation process include: PAHs by SW8270-SIM, DRO and ORO with and without SGC by NWTPH-Dx, EPH by NWTPH-EPH, VPH by NWTPH-VPH, TOC by USDA LOI, Total Solids and Percent Moisture.

From the data validation process qualifications applied include:

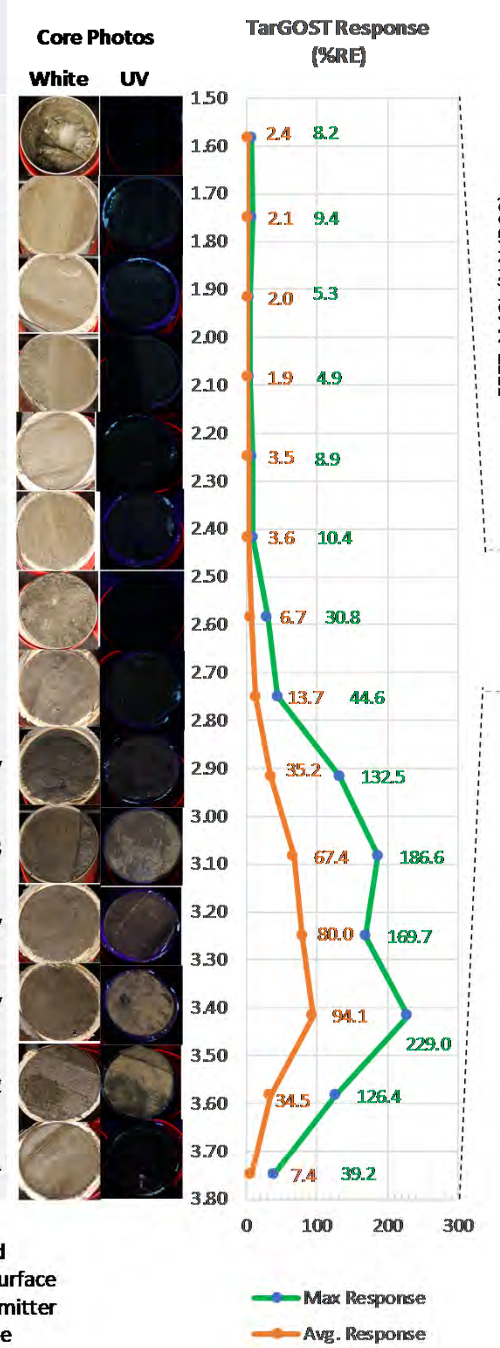
- **U-MBL/EBL/TBL** – Results are qualified as non-detected and are not discernably different from the concentrations associated with the contaminated method, equipment, or trip blank.
- **UJ-BSL** – Analytes qualified are not detected with estimated quantitation limits and potential low bias due to the associated blank spike/blank spike duplicate sample not meeting recovery acceptance criteria.
- **UJ/J-SSL** – Results or quantitation limits are estimated and potentially biased low due to the associated spiked surrogate not meeting recovery acceptance criteria.
- **UJ/J-OT** – The laboratory noted that there was an elevated baseline in the NWTPH-VPH samples. The narrative suggests that the results are potentially biased high or reported with reporting limits biased high. Data are available for use at an estimated level.

Additional information concerning the data quality issues identified and the basis for applied data qualifiers are presented in the data validation reports included in Appendix D.

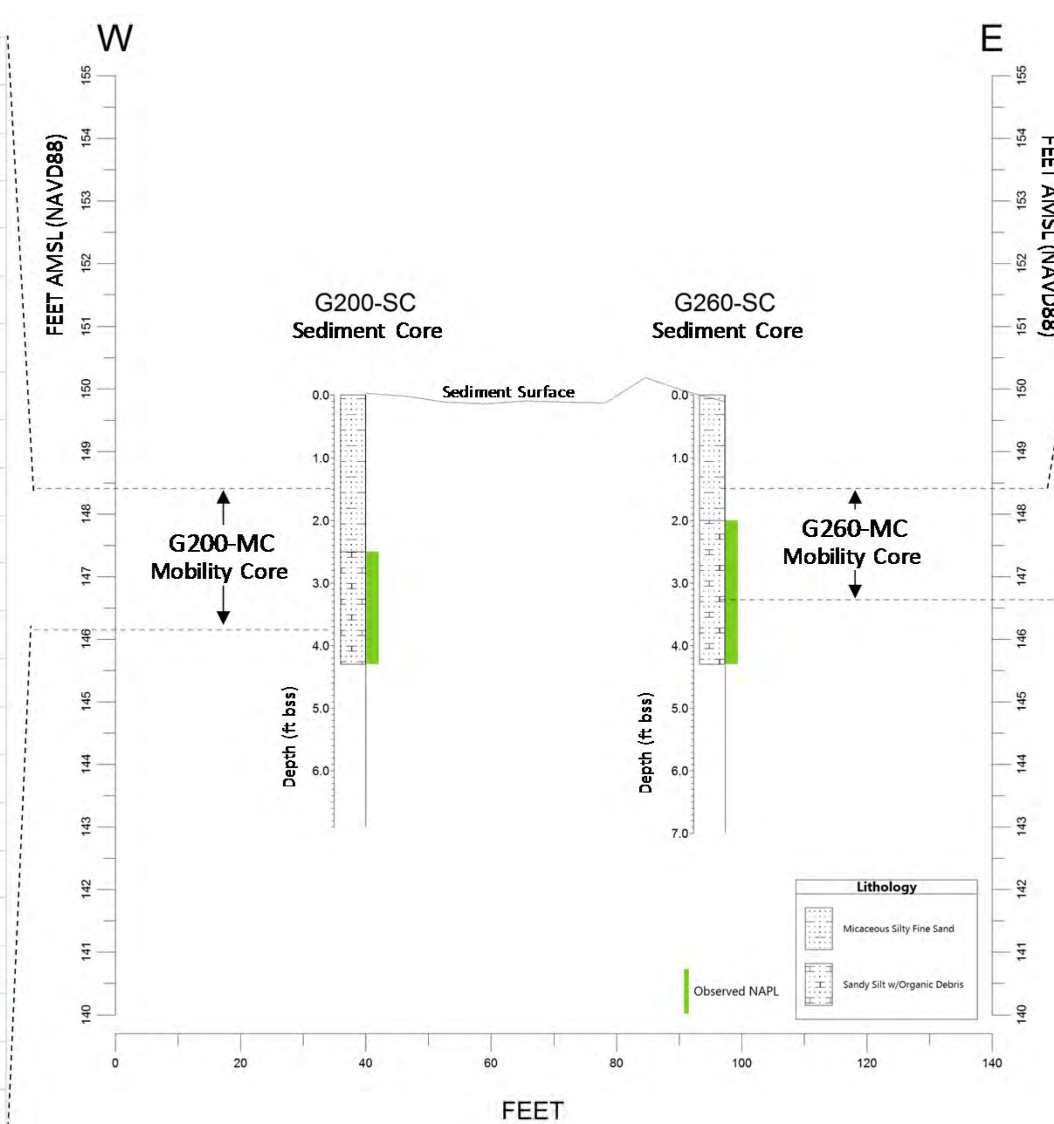
Based on the types of qualifiers added and the general level of data validation, the data for this investigation are considered acceptable for use, meeting the data quality objectives established in the sampling and analysis plan (CH2M, 2018; Appendix C). Quality assurance checks were conducted by the project team and analytical laboratories in accordance with the sampling and analysis plan requirements. Quality assurance data presented in the analytical data packages (Appendix C) and data validation reports (Appendix E) indicate that the analytical data, are of acceptable precision, accuracy, representativeness, completeness, comparability, and sensitivity.

G200

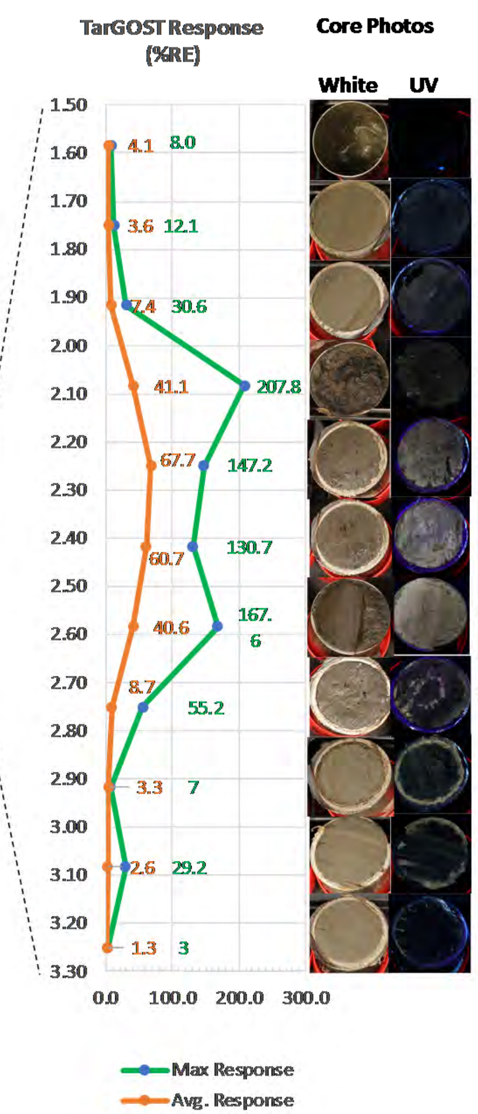
Lab ID	Approximate Depth of Core Segment (ft bss) Top	Bottom	Water Drive Mobility (Y/N)	NAPL Saturation (%PV)
G200-B	1.5	1.7	--	--
G200-C	1.7	1.8	--	--
G200-D	1.8	2.0	--	--
G200-E	2.0	2.2	--	--
G200-F	2.2	2.3	--	--
G200-G	2.3	2.5	--	--
G200-H	2.5	2.7	--	--
G200-I	2.7	2.8	--	--
G200-J	2.8	3.0	--	27
G200-K	3.0	3.2	N	33
G200-L	3.2	3.3	--	37
G200-M	3.3	3.5	N	27
G200-N	3.5	3.7	--	12
G200-O	3.7	3.8	--	<1



-- analysis not performed
ft bss feet below sediment surface
%RE percent of reference emitter
%PV percent of pore volume



G260



Lab ID	Approximate Depth of Core Segment (ft bss) Top	Bottom	Water Drive Mobility (Y/N)	NAPL Saturation (%PV)
G260-A	1.5	1.7	--	--
G260-B	1.7	1.8	--	--
G260-C	1.8	2.0	--	<1
G260-D	2.0	2.2	N	38
G260-E	2.2	2.3	--	17
G260-F	2.3	2.5	--	42
G260-G	2.5	2.7	N	16
G260-H	2.7	2.8	--	3
G260-I	2.8	3.0	--	--
G260-J	3.0	3.2	--	--
G260-K	3.2	3.3	--	--

Figure 3-5. NAPL Mobility Core Results
BNSF Wishram Railyard
Wishram, Washington

JACOBS

4. Updated Conceptual Site Model

This section describes the updated CSM for the site with a focus on the offshore area of interest (Figure 4-1). The updated CSM builds off the baseline CSM presented in the approved work plan (CH2M, 2018) using the data generated as part of the work described above in Section 2 as well as newly available relevant data associated with upland RI efforts. Consistent with the EPA's *Environmental Cleanup Best Management Practices: Effective Use of the Project Life Cycle Conceptual Site Model* (EPA, 2011), the CSM presented represents a Characterization Stage CSM that will be updated in the future as appropriate, based on future key data collection efforts.

4.1 Sources and Chemicals of Interest

Primary sources of NAPL and petroleum-related constituents related to the historical upland railyard operations are detailed in the site investigation and forthcoming RI report (KJ, 2019). These included various aboveground storage tanks, underground storage tanks, and product and steam lines associated with fueling and maintenance operations and onsite utilities (including power generation). In most cases, contaminated soil and NAPL in the immediate vicinity of the sources were removed and disposed of offsite.

The primary release mechanisms from the historical sources are unknown, but may include surface spills, overfilling, surface leaks, or subsurface leaks, resulting in NAPL-impacted surface and subsurface soil within the upland area. In some instances, sufficient NAPL was released to cause saturation of pore spaces in the soil allowing vertical migration of NAPL as a separate phase to the top of the present-day water table approximately 10 feet bss or to the top of the historical water table approximately 40 to 50 feet bss. Based on the presence of measurable NAPL in monitoring wells downgradient of the petroleum storage and operations area, NAPL appears to have migrated laterally on top of whichever water table was present at the time of the release. NAPL that remains within the upland area at the site today consists of a submerged highly viscous (7,390 centistokes at 50 degrees Fahrenheit) oil-based Bunker C with limited ongoing mobility. The extent of this NAPL does not extend to the current shoreline, and investigations within the inundated lands have not shown the presence of NAPL within nearshore areas. Fractions of dissolved lighter-range (that is, TPH-DRO) are also present in the upland groundwater, the downgradient extent of which is currently being investigated.

Within the inundated lands, which are the subject of this report, a separate occurrence of viscous NAPL consistent with Bunker C has been identified in the offshore area within a submerged layer approximately 40 feet to 60 feet from the shoreline. Contaminants associated with these impacts include TPH-DRO, TPH-ORO, and bunker C related PAHs. The absence of bedding structure and disturbed nature of these materials suggests they were emplaced within the former lands that were subsequently inundated by the construction of The Dalles Dam in 1957, and that they are a separate release than those previously identified within the upland portions of the site. This is also supported by the lack of NAPL mobility that has been observed in cores taken from the most impacted intervals/areas. While the primary sources associated with the submerged NAPL present beneath Lake Celilo are unknown, the RI Work Plan Addendum (KJ, 2016) included a summary of 1950 and 1951 correspondences between Spokane, Portland & Seattle Railway (SP&S) personnel and the State of Washington Pollution Control Commission (PCC), as well as internal SP&S communications related to potential releases of petroleum hydrocarbons at the railyard that may have affected the inundated lands (BNSF, 2017). These include:

- A release described in a November 20, 1950 letter from SP&S to the PCC and in an internal December 1, 1950 SP&S document as an accidental spill due to a broken valve on the service tank while fueling a locomotive that had occurred some years prior to 1950. The oil was trenched across the track to accumulate in a swamp and allowed to dry to the consistency of asphalt. The December 1, 1950 letter also notes evidence of a new oil spill just upstream from the Power House since the November 20, 1950 letter (KJ, 2016)
- A PCC Field Engineer, Mr. Alfred Neale, visited the railyard and in a letter dated February 26, 1951, noted three sewer outfalls that discharged wastes to the Columbia River. The documents record that Mr. Neale inspected the facility and observed waste oils on the banks of the Columbia River in the

vicinity of the outfall (potentially Former Pump House #2 location) nearest to the oil/water separator. He also observed an open ditch a short distance downstream which had an outfall for conveyance of sewage wastes to the river that terminated over 100 feet from the river.

The relationship between these observed releases (either from the elevated oil service tank or waste oils on the river bank) and the NAPL observed in the offshore portion of the inundated lands is unknown.

4.2 Geologic and Hydrogeologic Conditions

The local geology at the site, as determined by soil borings completed to date, consists of varying thickness of surface fill (sand and gravel reportedly sourced from nearby sand dunes and river deposits), followed by 10- to 95-foot-thick sequences of glacio-fluvial sediment (and silt) deposited on eroded Columbia River Basalt Group bedrock during ice-age floods. Up to 100 feet of the shoreline, water depths extend up to 15 feet as the riverbed dips to the south at a slope of approximately 8 percent. Beyond this distance, steeper slopes of approximately 20 percent are present and water depths increase to over 30 feet within approximately 160 feet of the shoreline. Overlying the glacio-fluvial deposits within the river and beyond the toe of the riprap embankment are surface sediments consisting of micaceous fine sand to silty fine sand with varying amounts of organics that have been observed at thicknesses of up to approximately 5 feet. In select locations farther from the shoreline, a 2- to 3.5-foot interval of highly plastic silty sand fill containing wood, roots, and limited amounts of inorganic debris is present at depths of 0.5 to 2.5 feet bss. It is estimated, using the date of inundation (1957) and the range of measured thicknesses of sediment observed in 2018, that the rate of sediment accumulation in the area of the site ranges from approximately 0.1 to 1 inch per year

The uppermost hydrogeologic unit at the site is the glaciofluvial aquifer, consisting of unconsolidated sand and silt deposited during the Missoula Floods. The aquifer is unconfined. Numerous monitoring wells have been installed at the railyard. The wells are screened in the sand/silt deposits, which can be up to 95-feet thick in the western section of the railyard. The deposits are generally homogeneous, and, in some areas, the sand and silt overlie a thin layer of gravel just above bedrock (KJ, 2016). Given the presence of exposed bedrock surfaces east and west of the initial sediment study area of interest, as shown on historical aerial photographs and local bathymetry, the glaciofluvial aquifer likely pinches out to the south just beyond the former shoreline of the Columbia River (Figure 1-3), approximately 350 feet from the current shoreline (CH2M, 2018). Groundwater occurs in the unconfined sand/silt alluvial aquifer at 10 to 12 feet bss beneath the railyard. Before construction of the dam and creation of Lake Celilo, the unconfined water table was likely at least 30 to 50 feet deeper. While groundwater flow across the railyard is generally south toward the lake at a very shallow gradient, it has been estimated that during 10 months of the year, the nearshore portions of Lake Celilo in the vicinity of the railyard is a losing water body where flow directions and periods of groundwater discharge are controlled by the lake level. Daily oscillations in the Columbia River stage (typically 1 to 2 feet) occur because of variable discharge rates from The Dalles Dam (KJ, 2019).

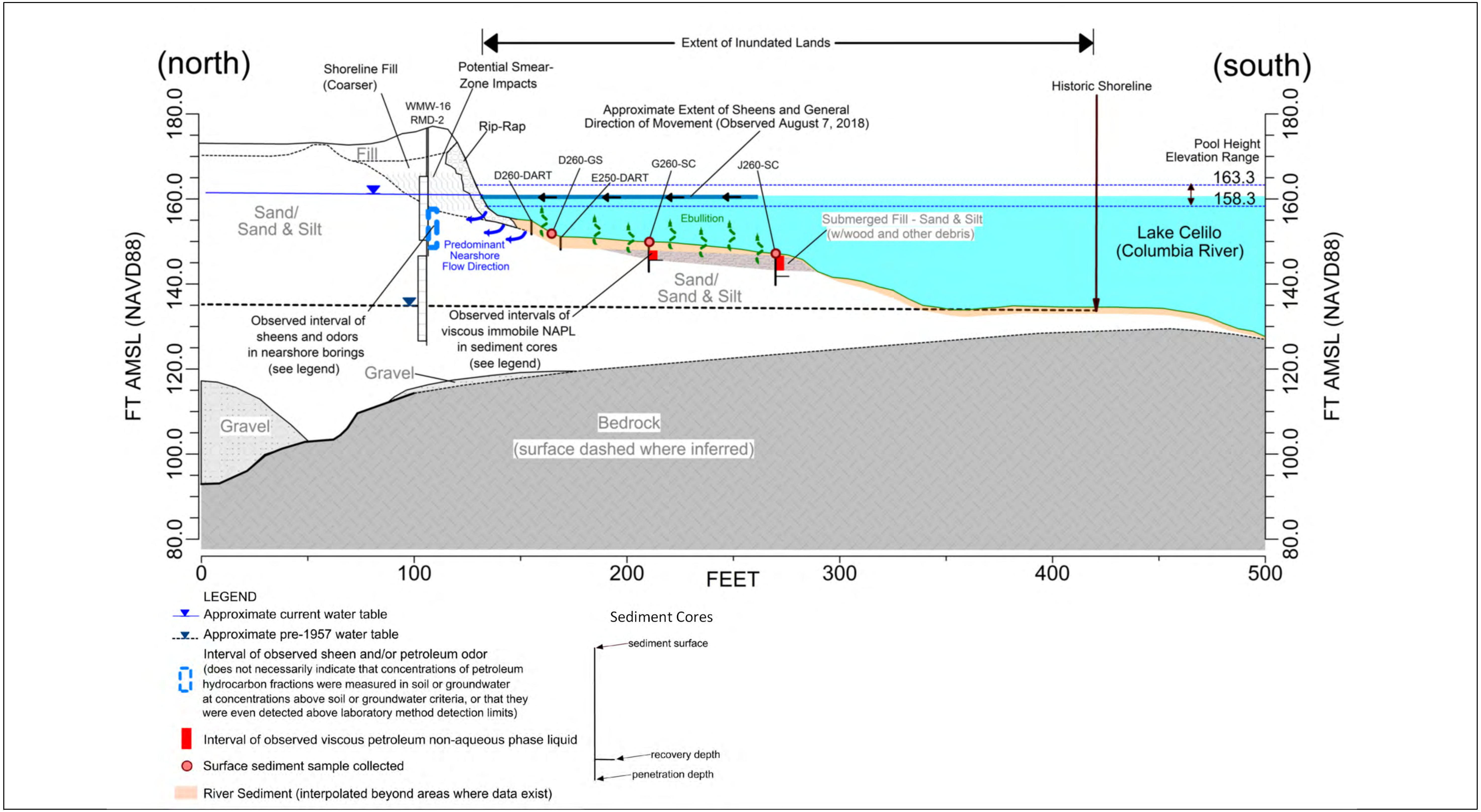


Figure 4-1. Nearshore/Offshore Conceptual Site Model1
BNSF Wishram Railyard
Wishram, Washington

JACOBS

4.3 Nature and Extent

4.3.1 Nonaqueous Phase Liquid

A black, tacky, viscous NAPL has been observed approximately 0.5 foot to 2.5 feet bss within a fill layer containing organic and, to a lesser extent, inorganic debris. The fractions of TPH measured in surface sediments immediately adjacent to NAPL-affected fill (core location J260), as well as the appearance and odor of the fill suggest NAPL consists of a heavy fuel oil (for example, Bunker C oil). The coring and Dart response data collected to date indicate NAPL is not present within the nearshore areas but is located within former upland areas (now inundated) between approximately 40 and 130 feet south of the current shoreline (Figure 3-2).

While the general extents of NAPL have been identified as part of the initial investigation, there are areas where further refinement and delineation are required. Specifically, the southern extent beyond location J260, and the areas west of G200, and southwest of G260 remain areas of uncertainty. Additionally, given the capability of the coring equipment and the depths to the top of the sediment surface, the vertical extent of the observed NAPL impacts could only be established at core J260. At the remaining three locations where NAPL was observed, the vertical extents require confirmation.

4.3.2 Chemicals of Interest

Analytical results from 9 of the 11 surface sediment samples, collected across the initial and expanded study areas, indicate concentrations of TPH-DRO and TPH-ORO hydrocarbon ranges are below Washington Freshwater SCO and CSLs. Of the seven samples collected within the nearshore area and analyzed for TPH-DRO and -TPH-ORO and PAHs, only one location had a detection above the SCO. This was for TPH-DRO in the non-SGC sample at location D200. However, the average of the three highest TPH-DRO results across the nearshore area are below the CSL. TPH-ORO and total PAHs were below their respective SCOs and CSLs in all surface sediment samples from the nearshore area.

Within the offshore area, concentrations of TPH-DRO and TPH-ORO were found at core location J260 in excess of the SCO for both TPH-DRO (340 mg/kg) and TPH-ORO (3,600 mg/kg). This surface sediment sample collected from 0 to 0.5 foot bss was immediately adjacent to an occurrence of the NAPL-impacted fill layer that was observed to extend from 0.5 foot to 4 feet. The average of the three highest concentrations in soft sediment from the offshore area is above the CSL for TPH-DRO and TPH-ORO. Concentrations of TPH-DRO and TPH-ORO exceeding the SCO observed in surface sediment at J260 require further lateral delineation, particularly south and east of this location.

Total PAH concentrations in surface sediment across the offshore area were all below the SCO of 17,000 μg/kg and the CSL of 30,000 μg/kg. The maximum total PAH concentration of 6,055 μg/kg was detected in the surface sediment sample from core location J260.

4.4 Nonaqueous Phase Liquid Release and Transport Mechanisms

4.4.1 Gas Ebullition

As related to environmental transport, gas ebullition is a natural process whereby methane and other gases generated from biodegradation of organic matter are released from water bodies via gas bubbles. Gas ebullition occurs when the buoyant force of the gas bubble exceeds the combined cohesive forces in the sediment and the hydrostatic pressure exerted by the water column. As these bubbles are generated, hydrophobic NAPL droplets can coat or be entrained within the gas bubbles and then get carried to the sediment surface. Once within the water column or at the water surface, the bubbles either burst, creating a sheen, or remain on the surface until enough gas escapes to make the droplet less dense than water and appear as a LNAPL bleb.

In freshwater ecosystems, gas bubble formation is limited to the near surface sediment and is influenced by several factors that include sediment physicochemical properties, biogeochemical processes, and the height of the water column. In most cases, ebullition is caused by labile organic matter in the sediment. At Wishram, there are no records of vegetation being removed from the shoreline before it was inundated in 1957 after the construction of The Dalles Dam. During 2018 initial investigation activities performed in June and August, an abundance of vegetation (primarily milfoil) was observed to be growing throughout the study area. Gas bubbles were also observed to be rising through the water column and breaking at the surface. However, during field efforts, the generation of NAPL blebs and sheens were not observed in conjunction with these bubbles. During the August 2018 field efforts, the rate of ebullition and abundance of sheens both appeared to increase during periods of lower water, which, according to the published USACE Dalles Dam Forbay Levels (USACE, 2018) fluctuated between a maximum of 162.93-feet NAVD88 on August 9, 2018, and a minimum 160.02-feet NAVD88 on August 7, 2018, (period of greatest abundance of observed sheens; Section 2.3.1. Wind conditions were favorable for sheen observation (3 to 8 miles per hour) during the days preceding and following August 7, 2018.

Gas ebullition potential in sediment samples collected from across the study area was evaluated using the gas ebullition model presented in *Field Measurements and Modeling of Ebullition Facilitated Flux of Heavy Metals and Polycyclic Aromatic Hydrocarbons from Sediments to the Water Column* (Viana et al., 2012), and the TOC and COD concentrations measured in surface and subsurface sediment at the site as input parameters. Details on these calculations are presented in Appendix F. The estimated gas ebullition rates for the site ranged between 6.5 to 6.8 liters per square meter per day with little spatial variability. The estimated rates are consistent with field measurements reported in the literature (Appendix F). These rates are indicative of high gas production in the sediments associated with the site, resulting from the high TOC content observed in deeper sediment (4 to 10 percent at depths of 2.5 to 4.0 feet bss) and more labile carbon substrate observed at shallow depths. This is further validated by field observations of ebullition during the recent sampling event. The NAPL occurrence depth coincides with the ebullition active zone of 0 to 5 feet bss (Viana et al., 2012; Costello, 2003), suggesting that gas ebullition could be responsible for the mobilization of free phase NAPL and contribute to NAPL transport to the water column.

4.4.2 Seep Migration

Seep migration was described by Ecology as *NAPL seepage because of NAPL drainage and mobility at low water* (Ecology, 2017a). A NAPL seep is defined as a NAPL release where:

- NAPL is moving under a sustained NAPL gradient
- A NAPL source is located at some distance from the seep and provides the driving force
- A recent or ongoing NAPL release is typically in association with the discharge
- NAPL saturations are above residual

The absence of NAPL in the nearshore areas adjacent to the riprap embankment and physical separation of the defined extent of upland NAPL (KJ, 2019) and the shoreline to the south (Figure 1-2) suggest that seep migration from the upland portions of the site is not contributing to the observed sheens. Furthermore, the maximum distance of the sheens from the shoreline observed on August 7, 2018, and the direction of their movement to the northeast do not support the notion that the sheens originate from the riprap embankment or from sediments within the nearshore areas just beyond this embankment, but are instead coming from areas farther from the offshore area where submerged NAPL was observed within the fill layer bss.

The absence of mobility in the intact cores, taken from the submerged NAPL found within the fill layer during the initial investigation, indicates that seepage of NAPL from these areas is unlikely even if there were sufficient head present across this interval.

Discharge of dissolved-phase constituents detected in groundwater at the shoreline would only occur during periods when the river is a gaining water body. This pathway is currently being evaluated as part of the upland investigation activities. Dissolved phase discharges associated with the submerged NAPL farther from the shoreline would require the presence of upward hydraulic gradients in these areas. The solubility of the NAPL constituents of concern and whether there is a potential for dissolved phase discharges associated with the offshore NAPL impacts has not been evaluated to date.

4.4.3 Sheen Migration

Sheen migration was described by Ecology as *NAPL wicking along the capillary fringe* (Ecology, 2017a). This is analogous to a NAPL sheen discharge (Sale and Lyverse, 2014) where:

- Very limited amount of oil is discharged as a sheen on the water surface
- Ephemeral sheen behavior may be observed
- Former seeps have occurred
- Discharge occurs along the groundwater-air interface
- NAPL saturations are close to or below residual

For the reasons highlighted in Section 4.4.2, NAPL sheens at the site are believed to be sourcing from the submerged NAPL impacts associated with the layer of fill present in the inundated lands. Therefore, there is no capillary fringe or groundwater-air interface along which sheen migration could occur based on available data. No evidence has been collected to date that suggests sheens are present within the nearshore upland soils, nor have sheens been observed to be originating from the riprap embankment. The presence of the sheens in proximity to the shoreline can be explained by the transport at the water surface from areas farther offshore (where they have originated) through a combination of winds and current. This phenomenon was consistently observed during the field work performed during August 2018.

4.4.4 Bank Erosion

Bank erosion was identified by Ecology as a potential NAPL-transport mechanism. As stated in the work plan (CH2M, 2018), this is not considered a viable pathway for NAPL transport at the site since the bank in the area of interest is heavily armored. The presence of sediment thicknesses of up to 5 feet in the nearshore area and the depositional material within the interstitial voids in the riprap indicate that there are insufficient currents in the impounded Lake Celilo to erode the shoreline here.

4.5 Potential Exposure Pathways and Receptors

Potentially affected media are limited to surface water across the study area and sediment in areas where the submerged NAPL is present. Exposure pathways and potential receptors associated with the offshore area have not been evaluated to date, but could include those related to Washington state designated uses (WAC 173-201A) as shown in Table 4-1.

Table 4-1. Columbia River Designated Uses
Inundated Lands Initial Investigation, BNSF Wishram Track Switching Facility, Wishram, Washington

Aquatic Life Use	Recreation Use	Water Supply Use	Miscellaneous Use
Spawning/Rearing	Primary Contact	Domestic	Wildlife Habitat
Salmonid Migration		Industrial	Harvesting
		Agricultural	Commerce/Navigation
		Stock	Boating
			Aesthetics

4.6 Inundated Lands Characterization Stage Conceptual Site Model

Figure 4-1 presents a current inundated lands characterization stage CSM developed by updating the preliminary stage CSM presented in the Ecology-approved Work Plan (CH2M, 2018) with the information collected during the Initial Sediment Investigation as well as any relevant findings associated with recent upland investigations (KJ, 2019). The key components of the CSM are as follows:

- A black, tacky, viscous NAPL consistent with heavy fuel oil (Bunker C) is present within a distinct 2- to 4-foot-thick fill layer beneath 0.5 to 2.5 feet of generally clean river sediments. This fill layer exhibits little soil structure and significant organic debris and was likely emplaced during grading and filling in upland areas subsequently inundated as a result of the creation of Lake Celilo.
- Occurrences of NAPL within the inundated lands have been observed between 40 and 130 feet south of the current riprap shoreline and appear isolated from upland impacts. Observations for the shoreline upland boreholes and cores and Darts immediately south of the riprap show no evidence of NAPL-impregnated soil or sediment in these areas.
- Sheen and odor are observed in upland soil cores, but these are considered less significant indicators of a NAPL discharge. Furthermore, hydraulic studies performed as part of recent upland work have shown that the river is predominantly a losing water body in which groundwater flows away from the river approximately 10 out of 12 months of the year.
- Observations of sheens at distances of up to 130 feet south of the shoreline and the direction of their movement at the surface toward the shoreline indicates they are originating not from the shoreline, but from the submerged NAPL present farther from shore. This is consistent with the absence of any direct observations of sheens originating along the riprap shoreline.
- Testing of these NAPL-impacted soils indicates there is no direct hydraulic mobility of NAPL, which is consistent with its viscous and tacky nature. Observations of gas bubbles within the water column, their proximity to the submerged NAPL and outboard extent of observed sheens, as well as the estimates of elevated gas generation potential associated with the sediments and soils collocated with NAPL indicate ebullition is the primary mechanism responsible for the sheens.
- Consistent with the ebullition process, the rate of gas bubble generation and the abundance of sheens appear to increase during periods of lower water observed during the August 2018 field efforts.

Based on these observations, the source of the sheens observed in offshore inundated lands historically associated with the railroad is likely the isolated NAPL found 0.5 to 2.5 feet beneath the river sediment within the submerged fill layer. The intermittent sheening observed is the result of ebullition, with the gases developed by the decaying organic matter associated with the submerged fill. A greater abundance of gas-bubbles and sheening occurs during periods of low water when the overlying water column is reduced and during hot periods when the temperature of the sediments rises. A combination of the winds and current carry the sheens toward the shoreline where they are seen most often from the shoreline and where globules have been observed to accumulate during relatively warm and calm weather conditions.

5. Next Steps

To address the identified impacts within the offshore area and satisfy the requirements for initial and RIs in accordance with WAC 173-204-510 and 520 and SCUM II guidance, additional data collection is needed. An addendum to the existing work plan is being prepared and will be submitted separately. The work plan addendum will identify the specific data needed to further characterize the horizontal and vertical extent of the NAPL-affected interval and related chemicals. These data will be used to refine the CSM and site boundaries associated with the offshore NAPL and observed sheens.

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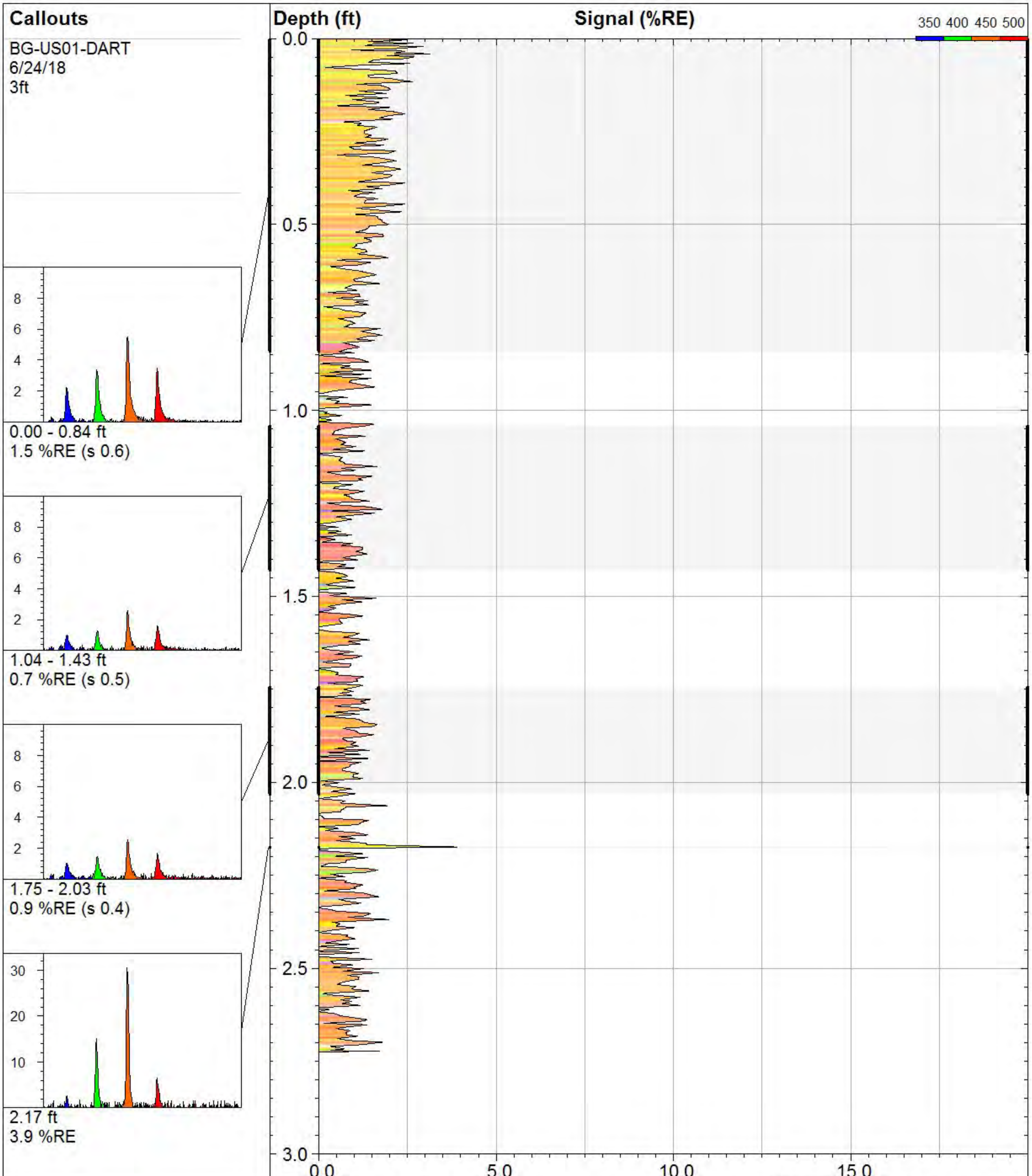
Appendix A
Dart Response Logs



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Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.9 %RE @ 2.17 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-28 12:05 CDT**

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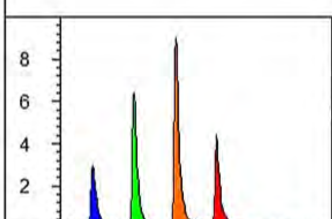
Callouts

MW-16-DART
7/4/18
3ft

Note 1.66:
Pink flagging tape tied here.



1.83 - 2.31 ft
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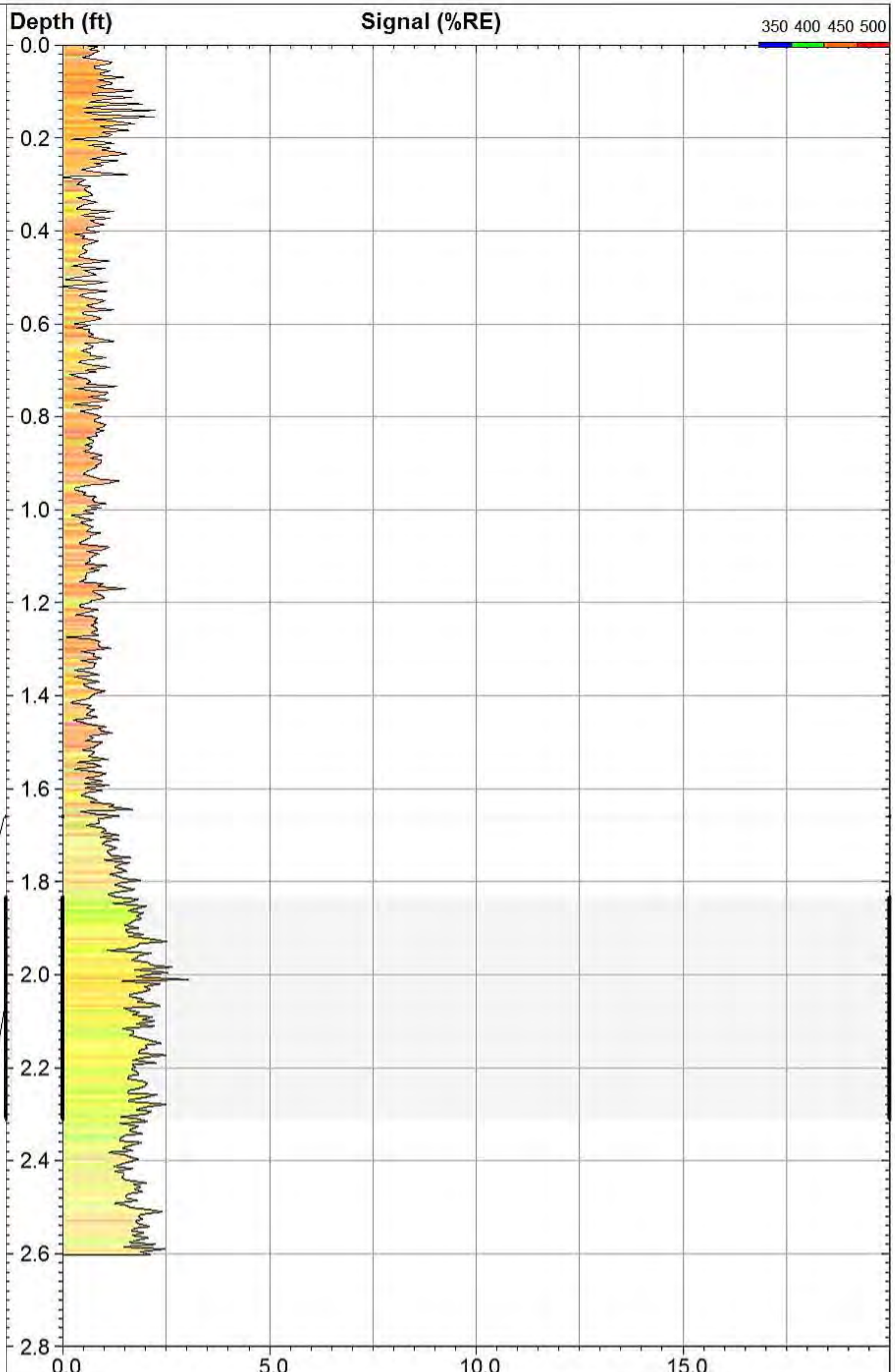

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MW-16-DART		**Darts By Dakota** www.DakotaTechnologies.com
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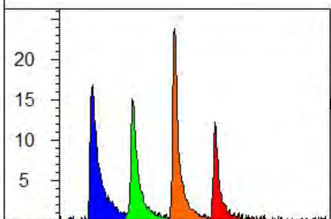
Operator / Unit: **RWS / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-07-04 10:23 CDT**

Callouts

OMH-1-DART
6/24/18
3ft

1.5ft hung in well



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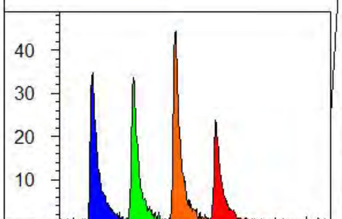

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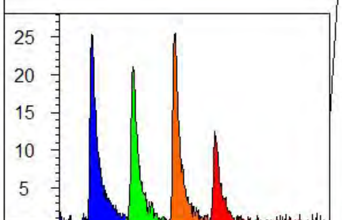

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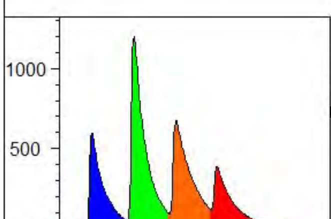

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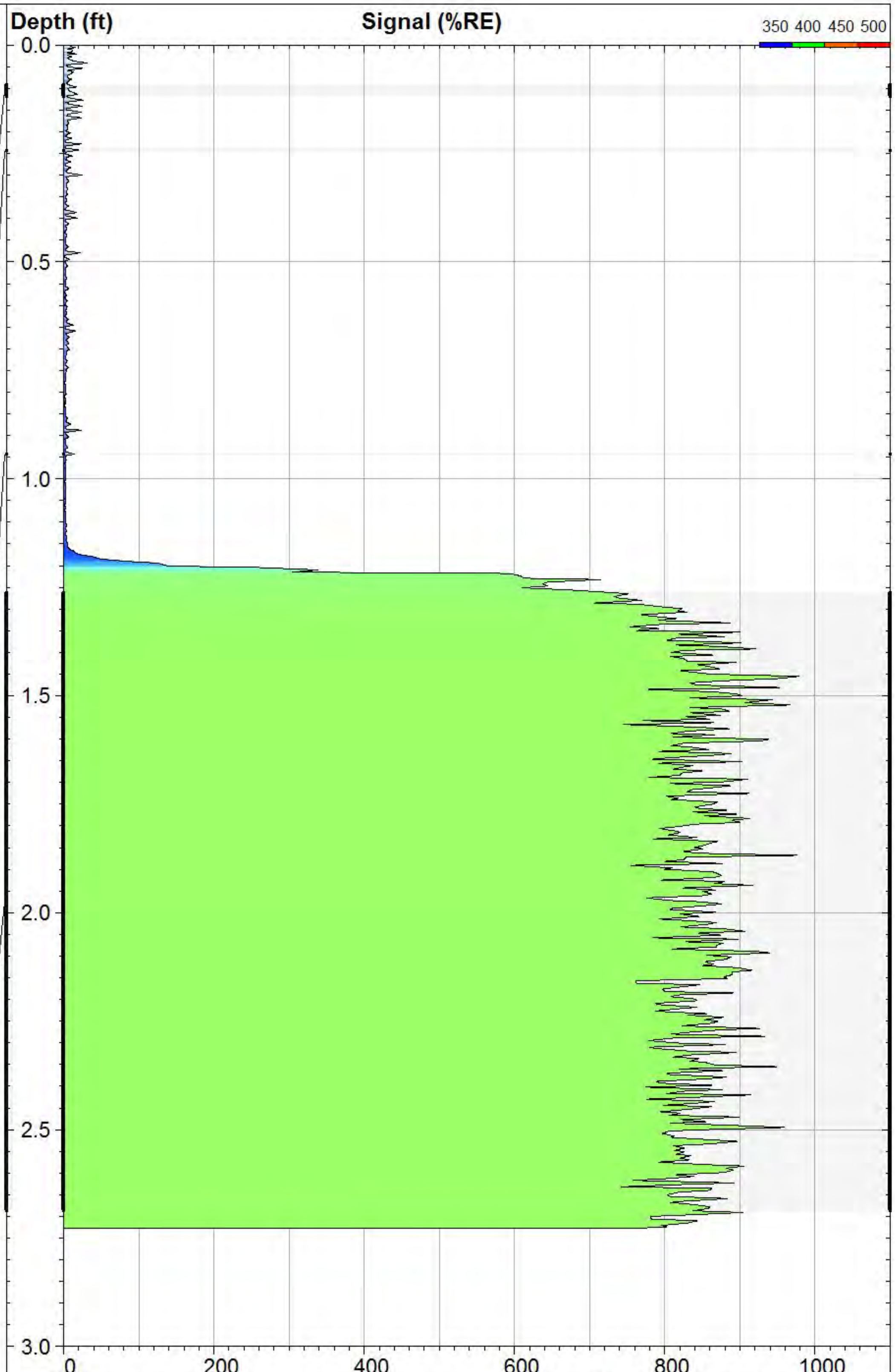

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OHM-1-DART

Darts By Dakota
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Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.73 ft**
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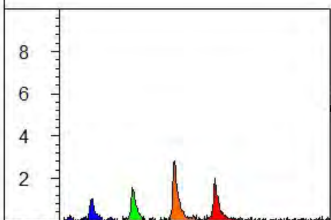
Callouts

D-060-DART
6/20/18
2.5ft



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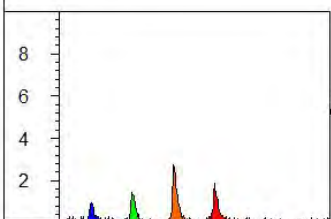

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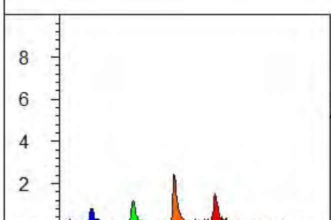

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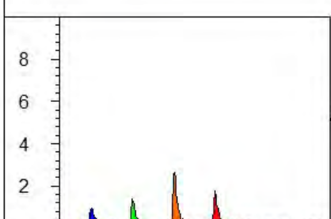

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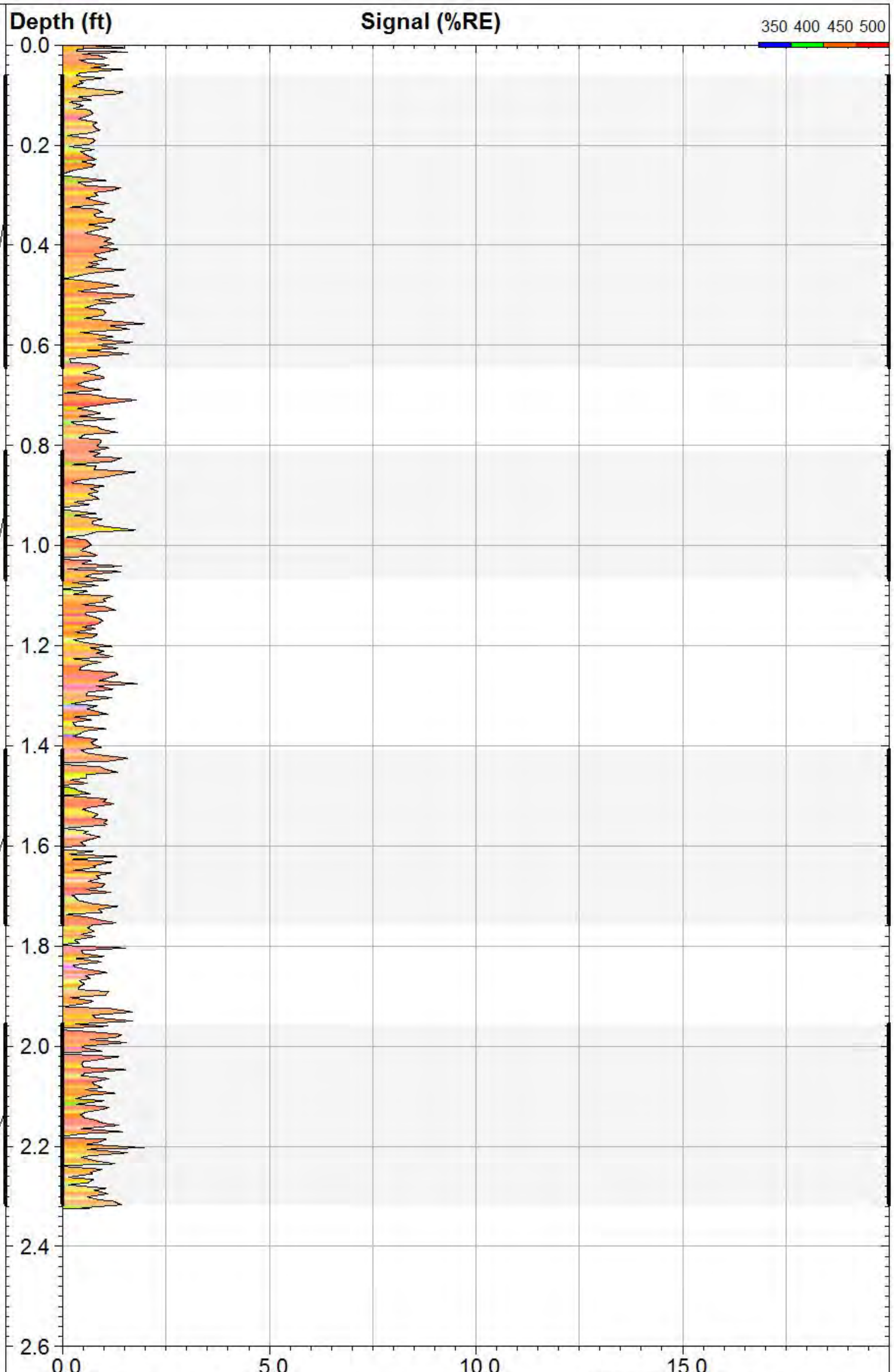

D-060-DART		**Darts By Dakota** www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.32 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.0 %RE @ 0.56 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-27 08:52 CDT**

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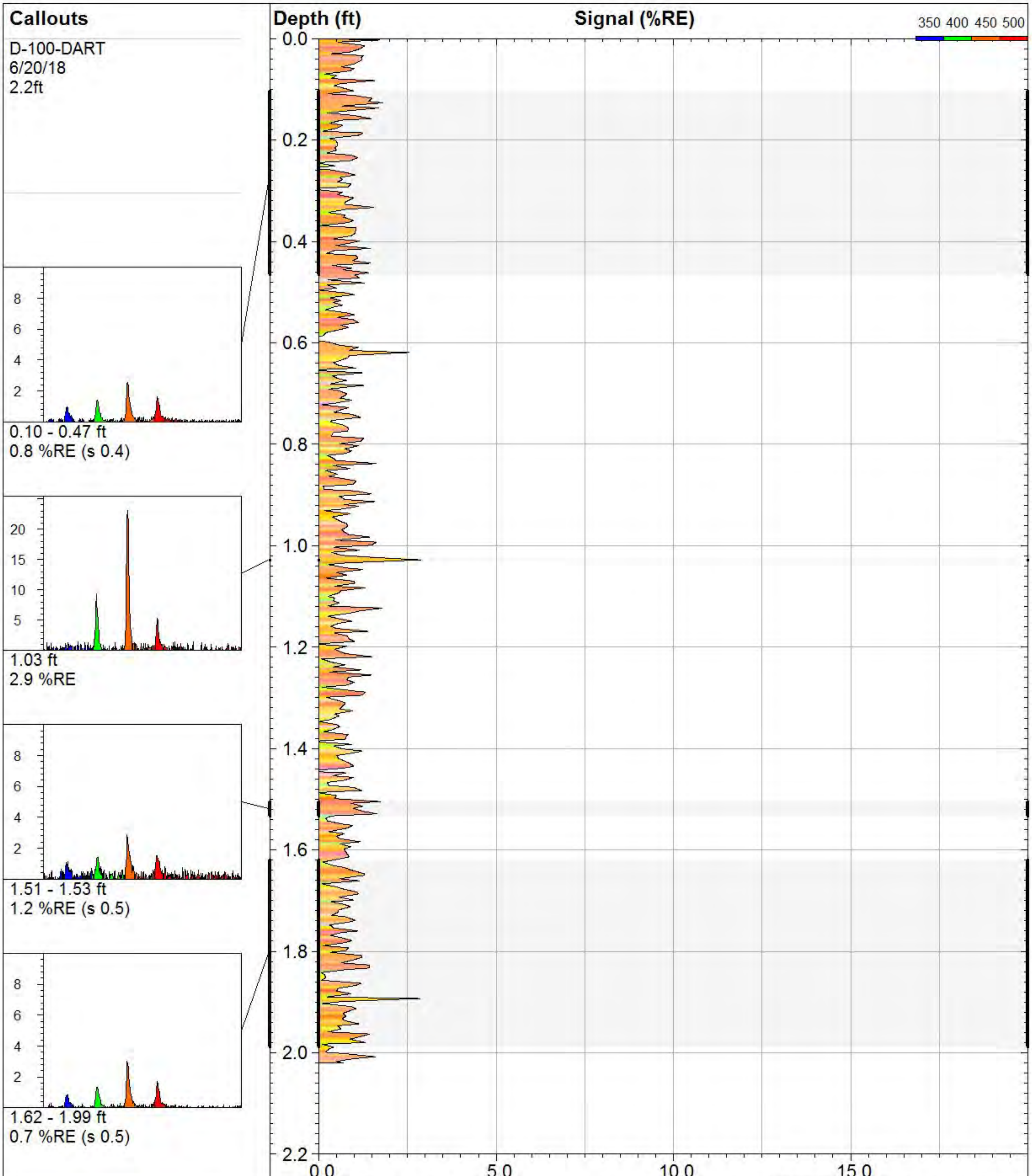
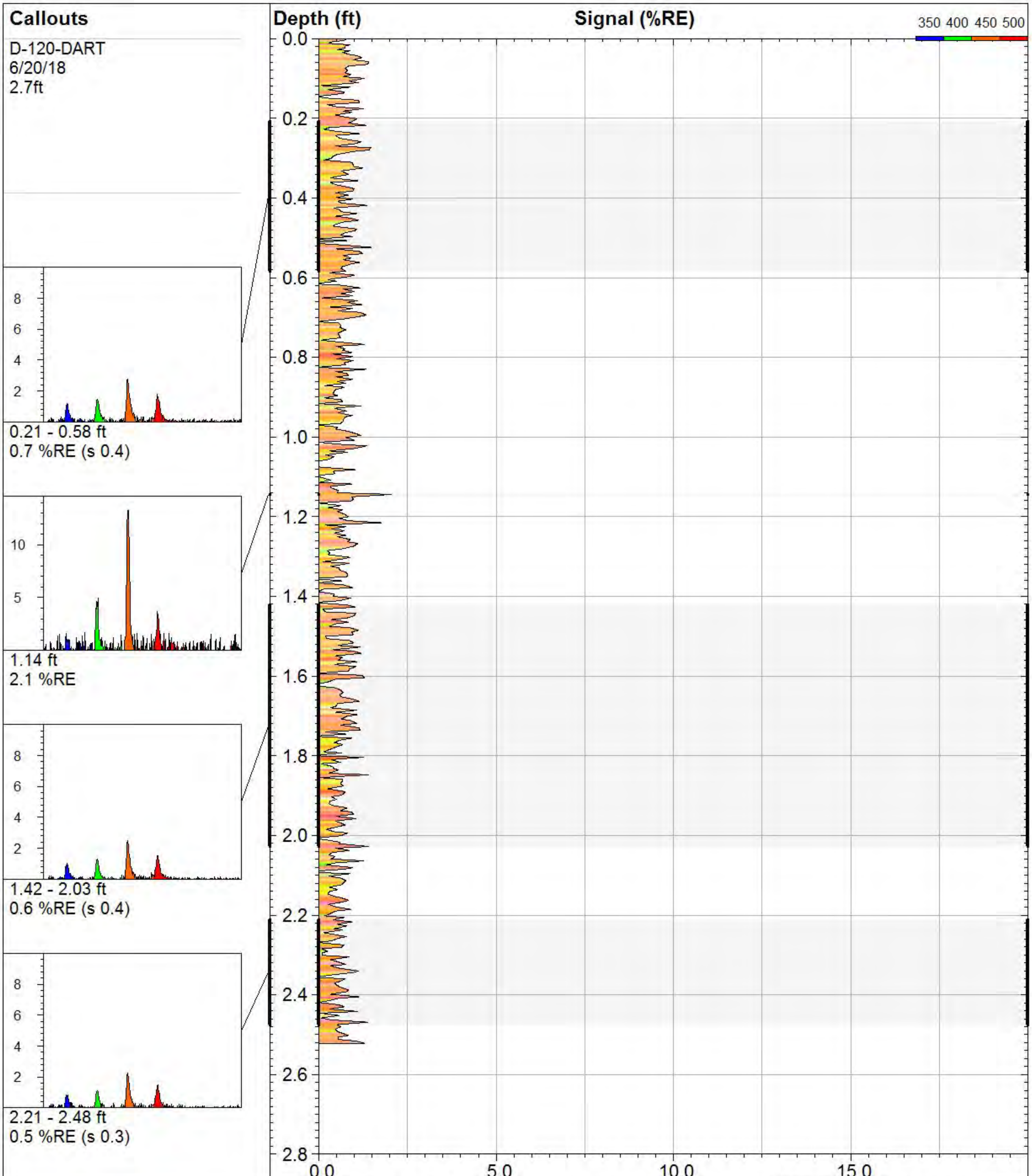


DAKOTA TECHNOLOGIES Fargo, ND 701.237.4908 www.DakotaTechnologies.com	**D-100-DART**		**Darts By Dakota** www.DakotaTechnologies.com
	Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.02 ft**
	Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.9 %RE @ 1.89 ft**
	Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-27 08:39 CDT**



D-120-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.52 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.1 %RE @ 1.14 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-27 08:25 CDT**

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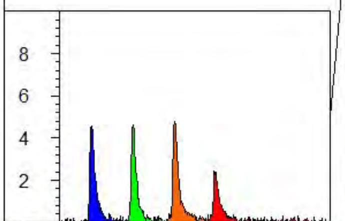
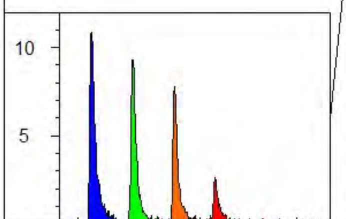
Callouts

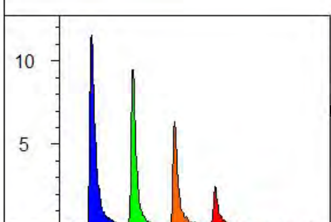
D-150-DART
6/20/18
2.3ft



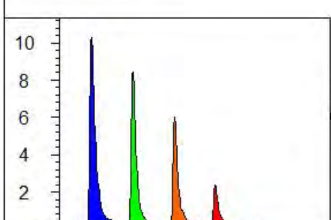
0.01 - 0.05 ft
2.0 %RE (s 0.5)



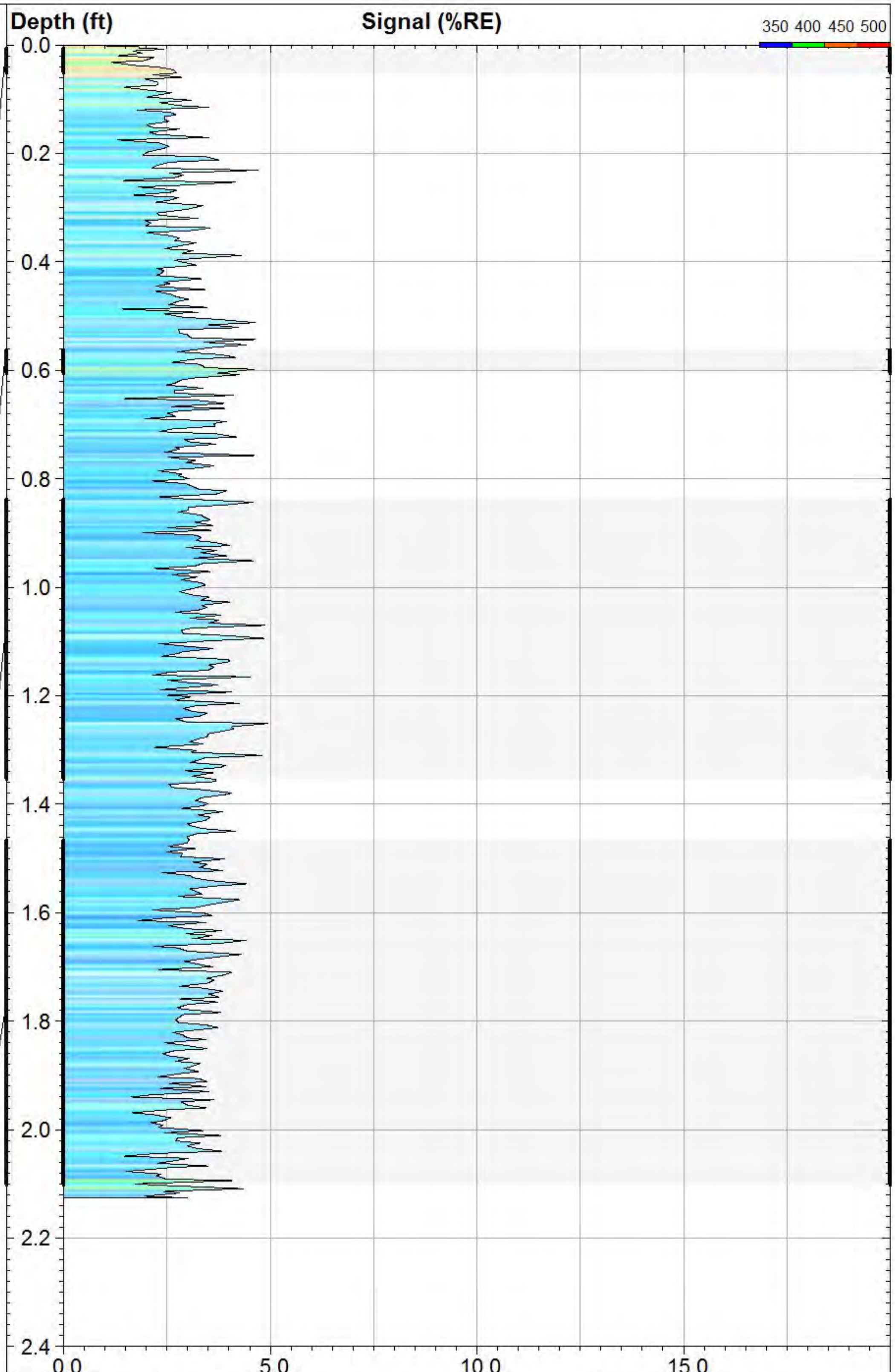
0.56 - 0.61 ft
3.5 %RE (s 0.6)



0.84 - 1.35 ft
3.3 %RE (s 0.6)



1.47 - 2.10 ft
3.0 %RE (s 0.6)



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D-150-DART

Darts By Dakota
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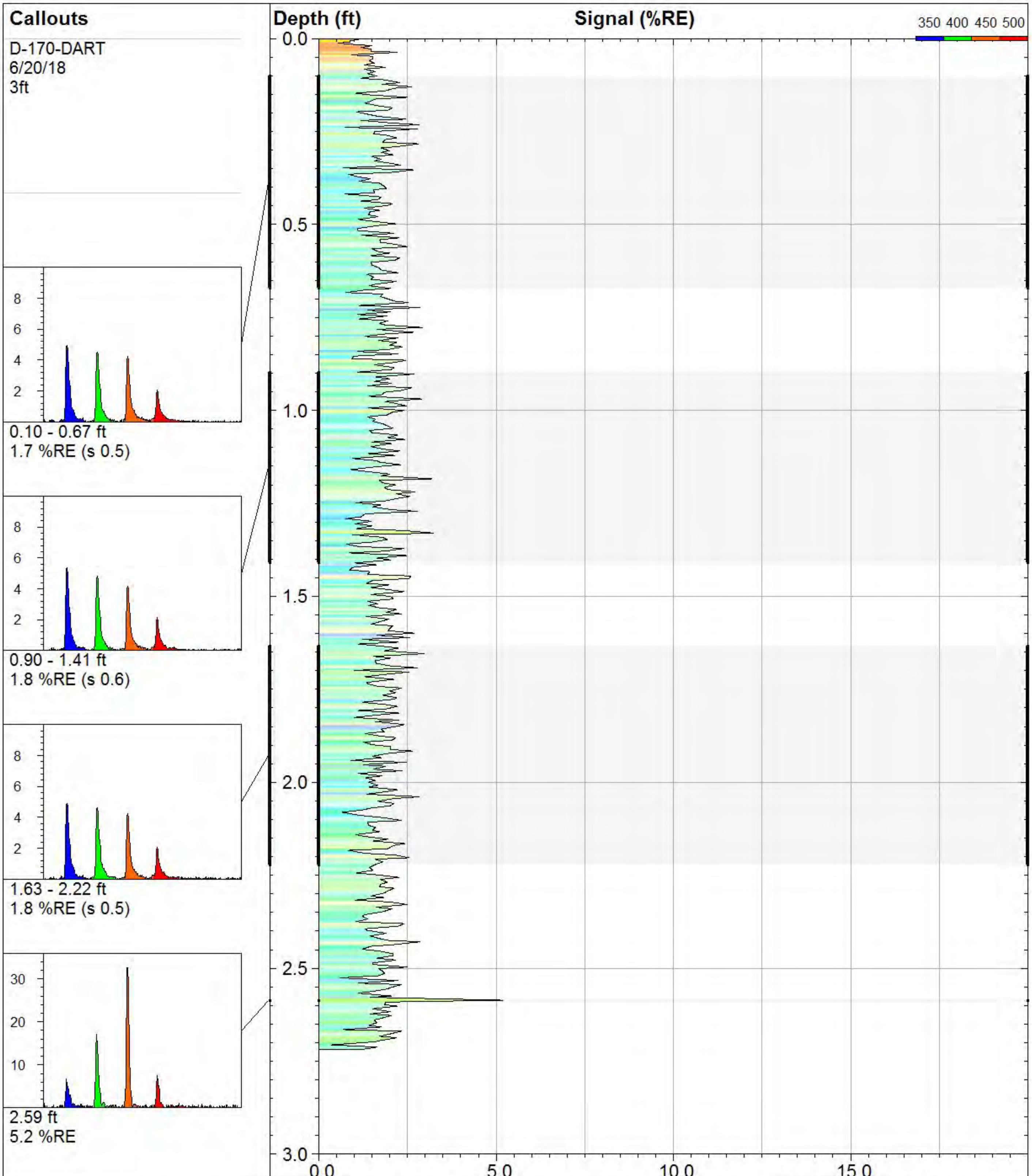
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.13 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.9 %RE @ 1.25 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-26 16:28 CDT**

Callouts

D-170-DART
6/20/18
3ft



D-170-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.72 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **5.2 %RE @ 2.59 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-26 16:16 CDT**

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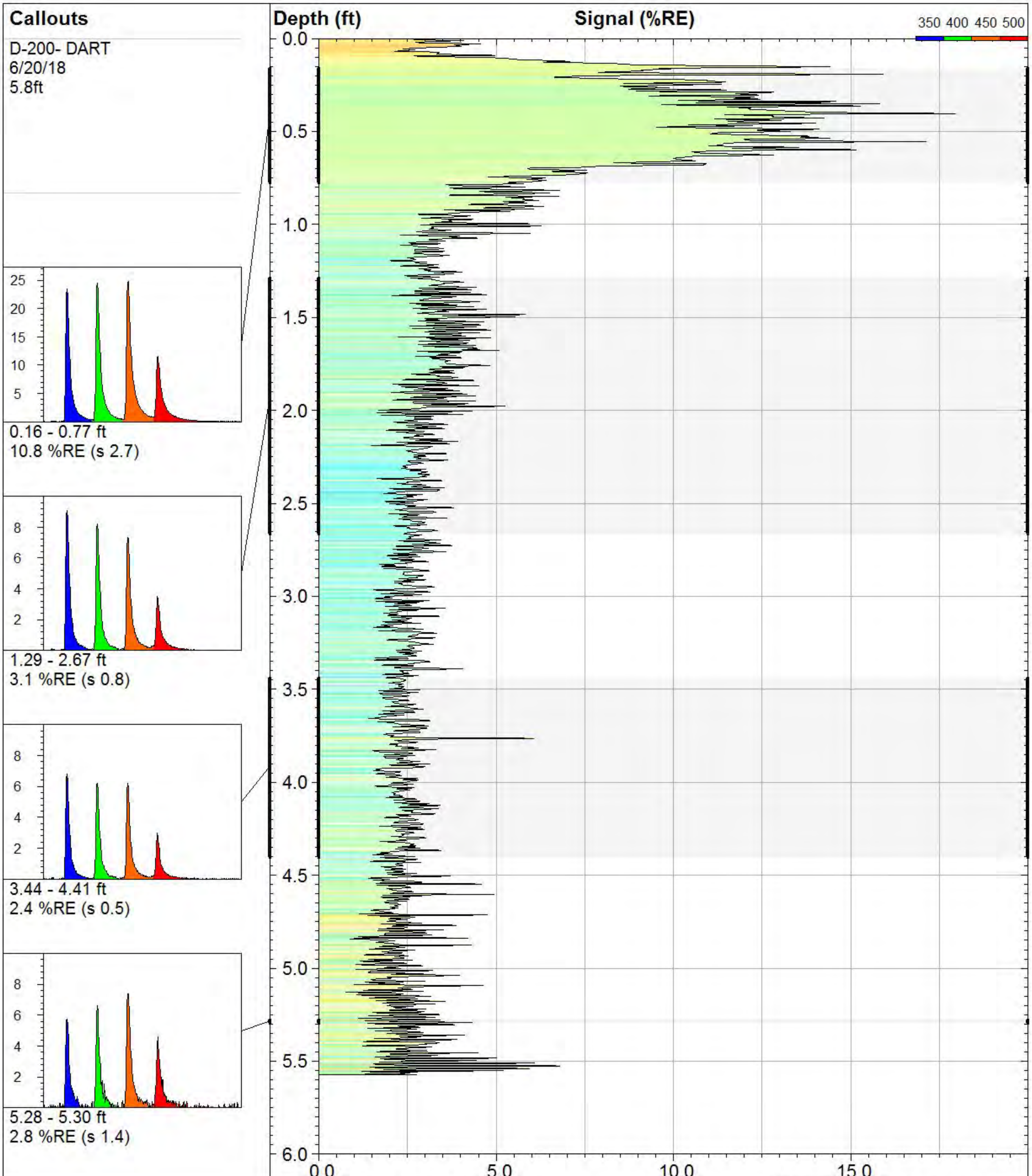

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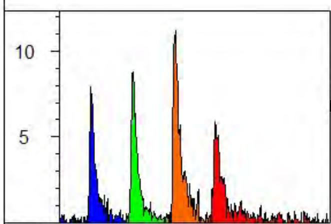
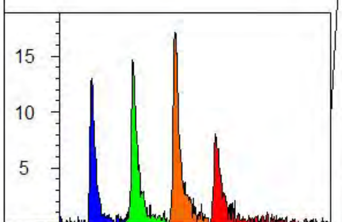
D-200-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **5.57 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **18.1 %RE @ 0.40 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-26 13:46 CDT**

Callouts

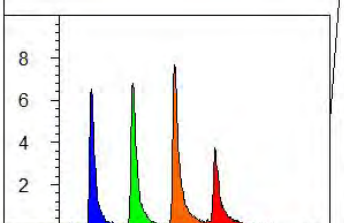
D-220-DART
6/20/18
2.8ft



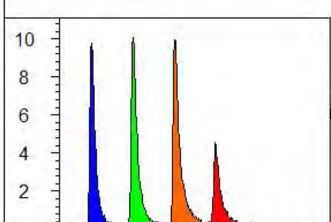
0.13 ft
4.6 %RE



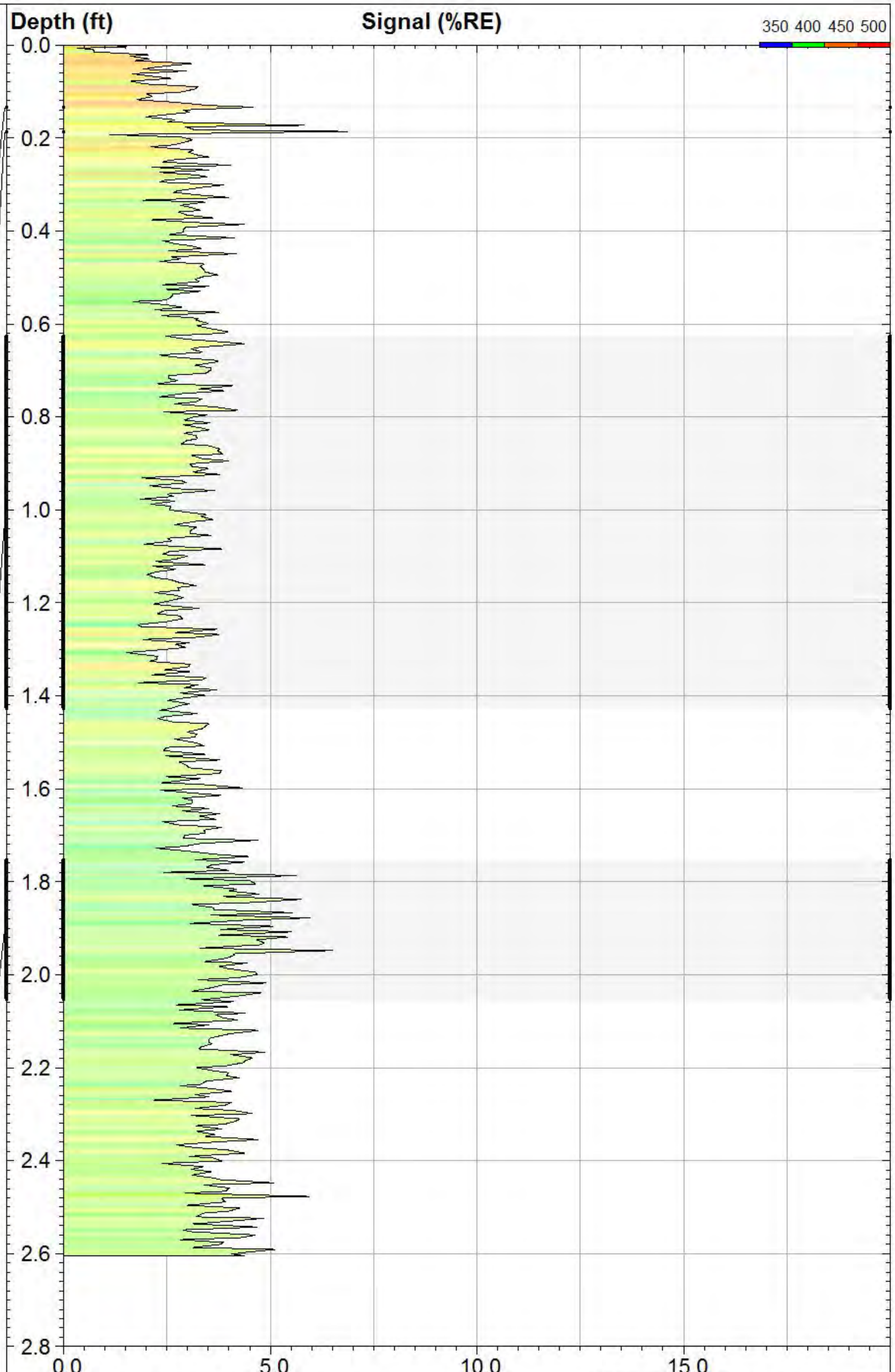
0.19 ft
6.9 %RE



0.63 - 1.43 ft
2.9 %RE (s 0.6)



1.75 - 2.05 ft
4.2 %RE (s 0.9)



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D-220-DART

Darts By Dakota
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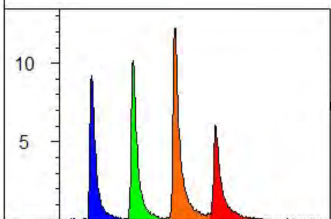
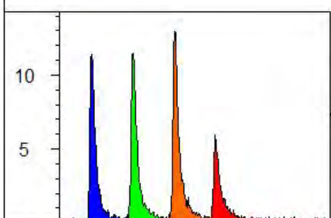
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.61 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **6.9 %RE @ 0.19 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-26 15:24 CDT**

Callouts

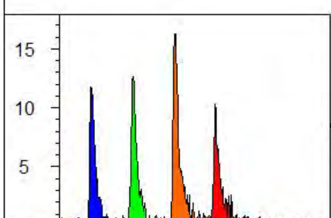
D-240- DART
6/20/18
3ft



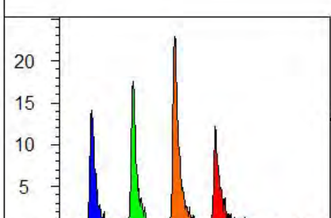
0.01 - 0.50 ft
4.9 %RE (s 1.4)



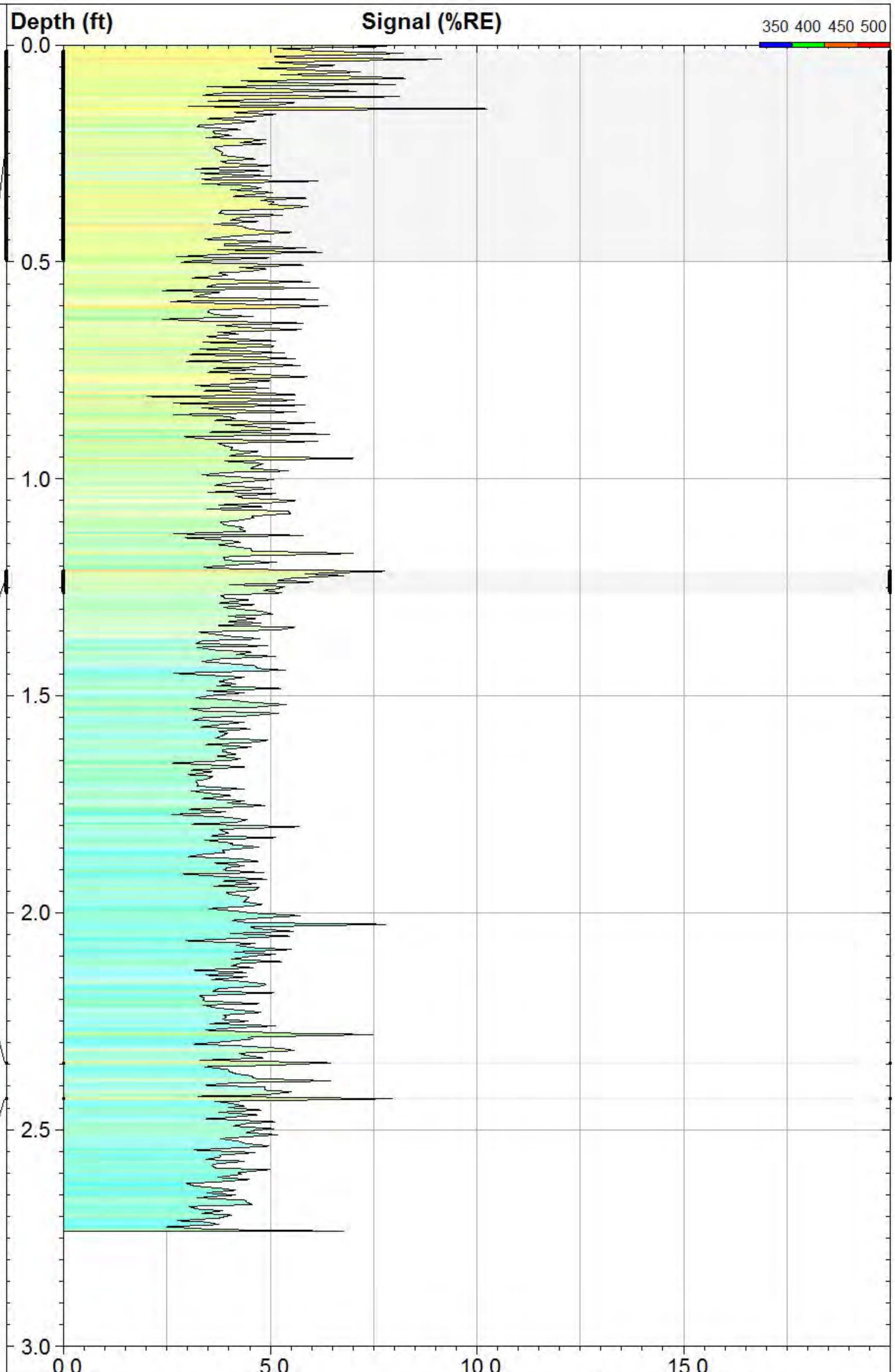
1.21 - 1.26 ft
5.6 %RE (s 1.0)



2.35 ft
6.5 %RE



2.43 ft
8.0 %RE



D-240-DART		**Darts By Dakota** www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.73 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **10.5 %RE @ 0.15 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-26 14:49 CDT**

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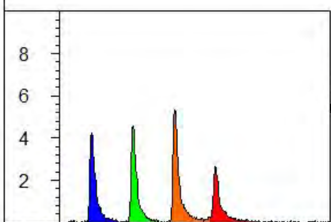
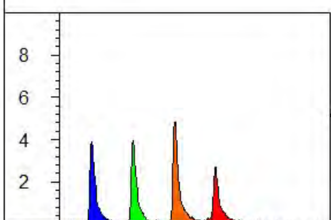
Callouts

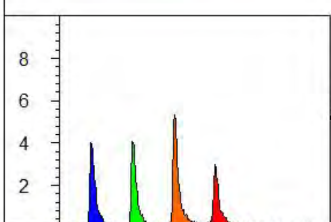
D-260- DART
6/20/18
3.2ft



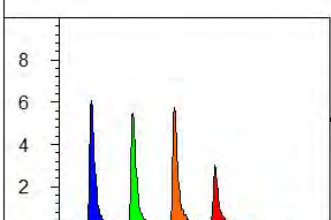
0.03 - 0.56 ft
1.9 %RE (s 0.7)



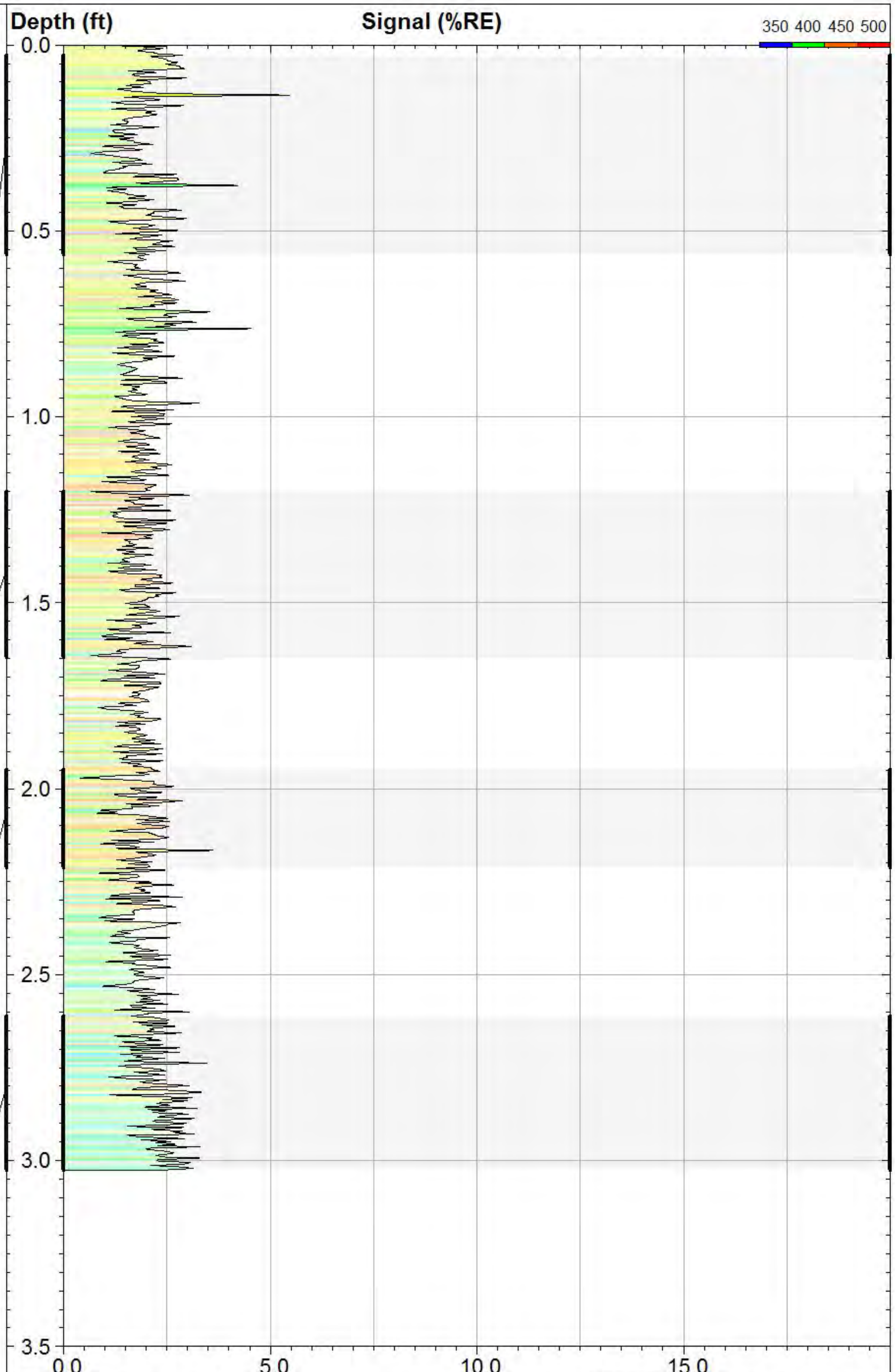
1.20 - 1.65 ft
1.8 %RE (s 0.5)



1.95 - 2.21 ft
1.9 %RE (s 0.6)



2.61 - 3.03 ft
2.3 %RE (s 0.6)



D-260-DART

Darts By Dakota
www.DakotaTechnologies.com

Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **3.03 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **5.6 %RE @ 0.14 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-26 14:17 CDT**

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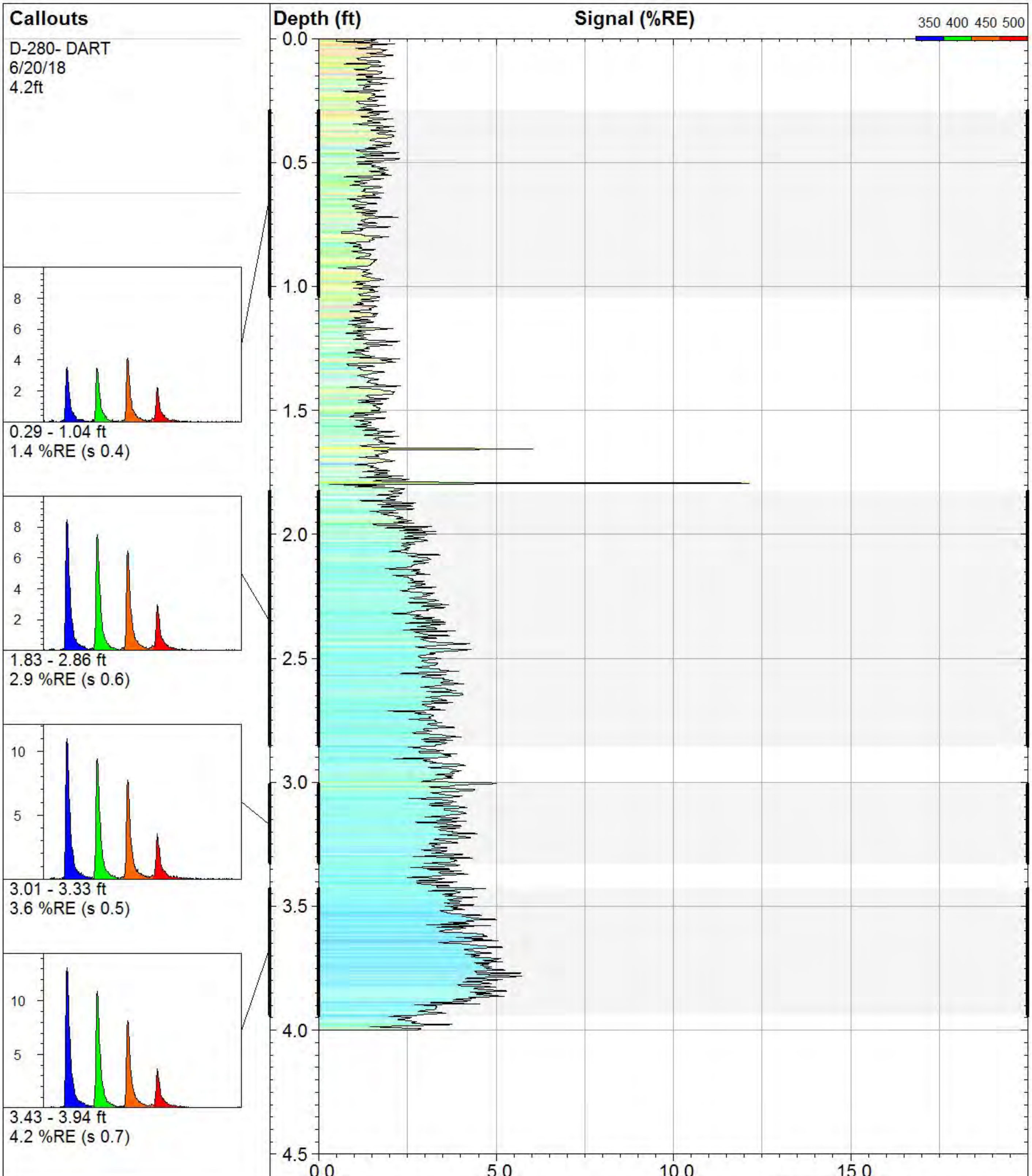

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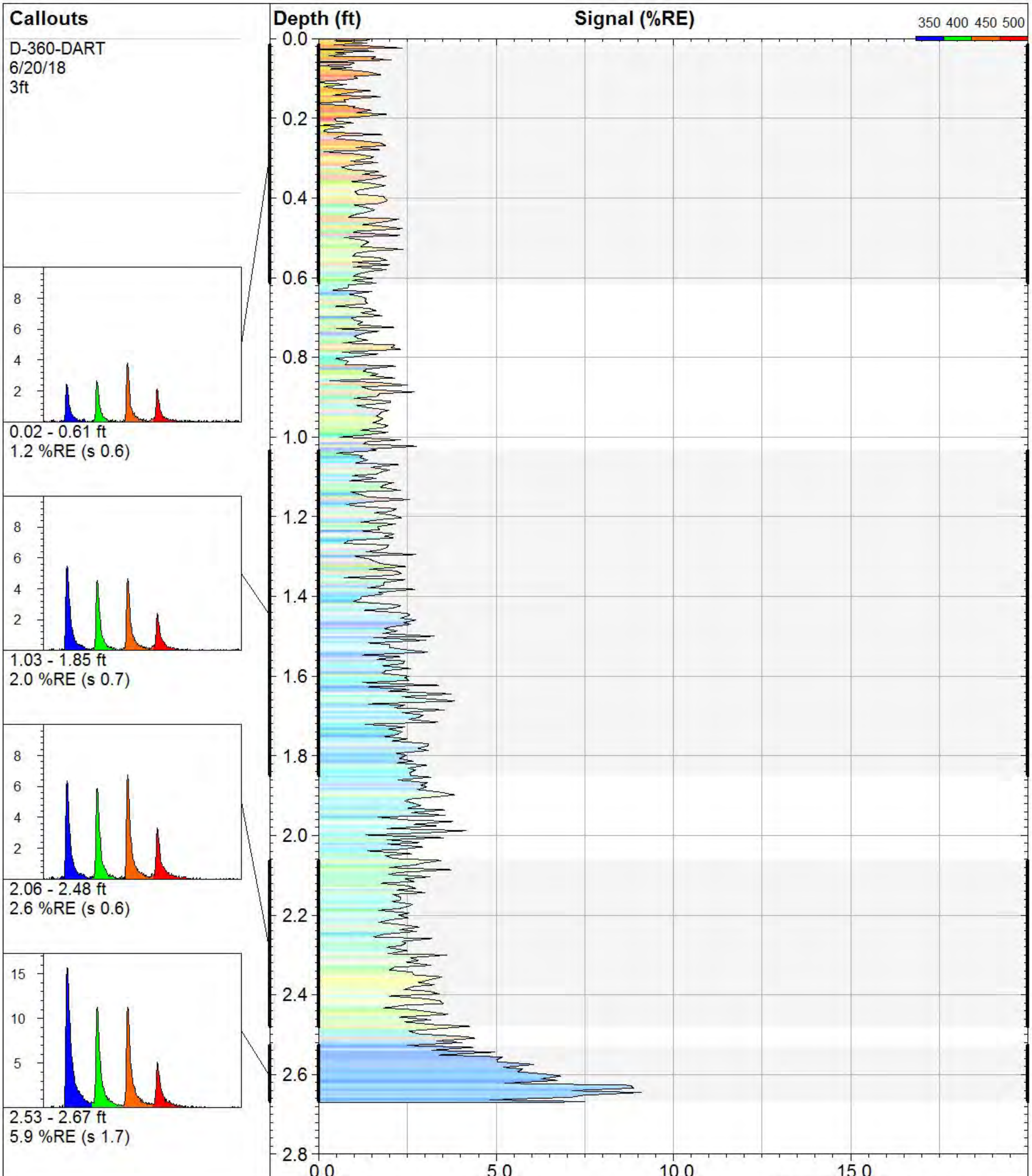
D-280-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **4.00 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **12.6 %RE @ 1.79 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-26 11:37 CDT**



D-360-DART		**Darts By Dakota** www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.67 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **9.1 %RE @ 2.65 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-26 16:05 CDT**

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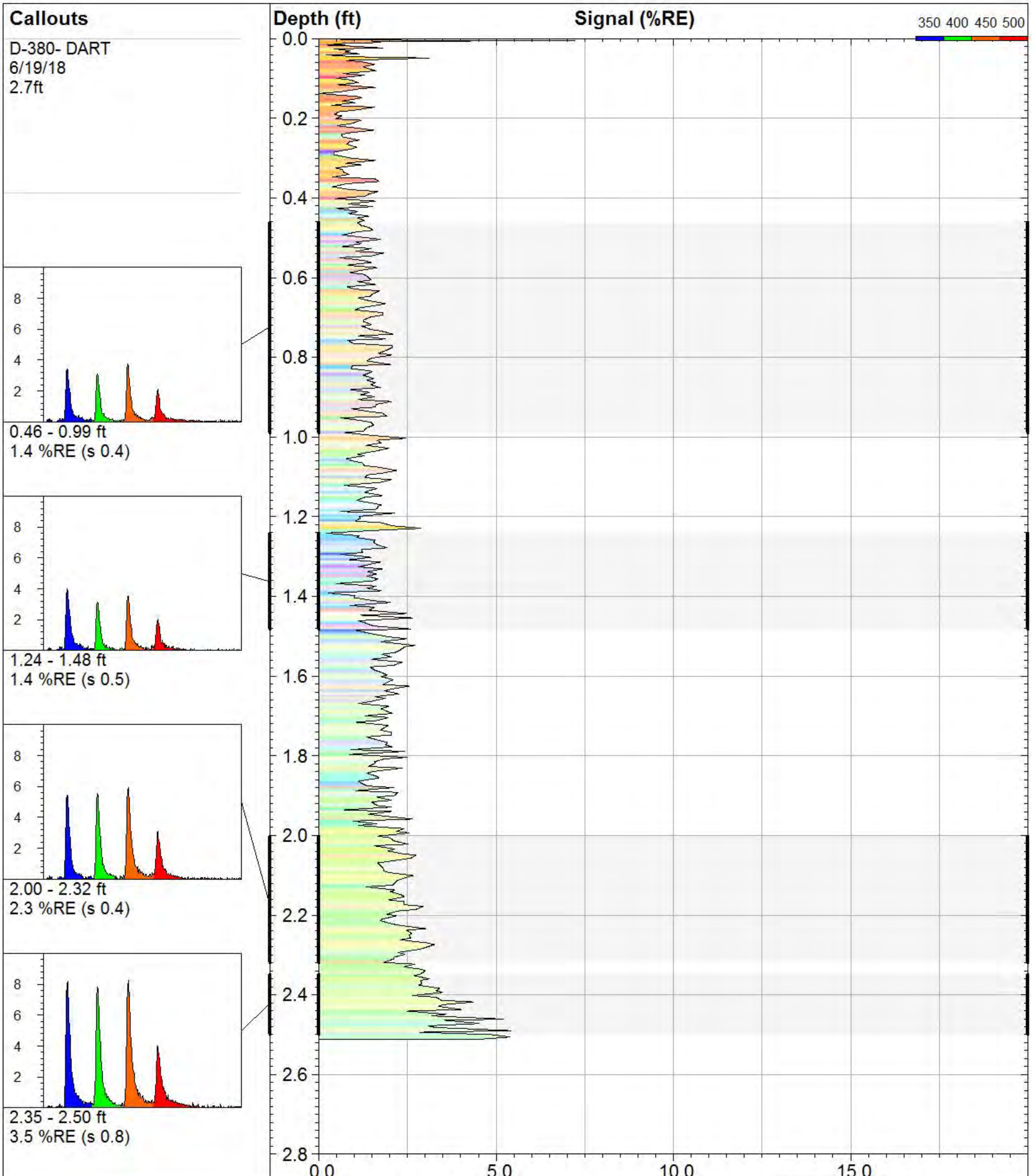

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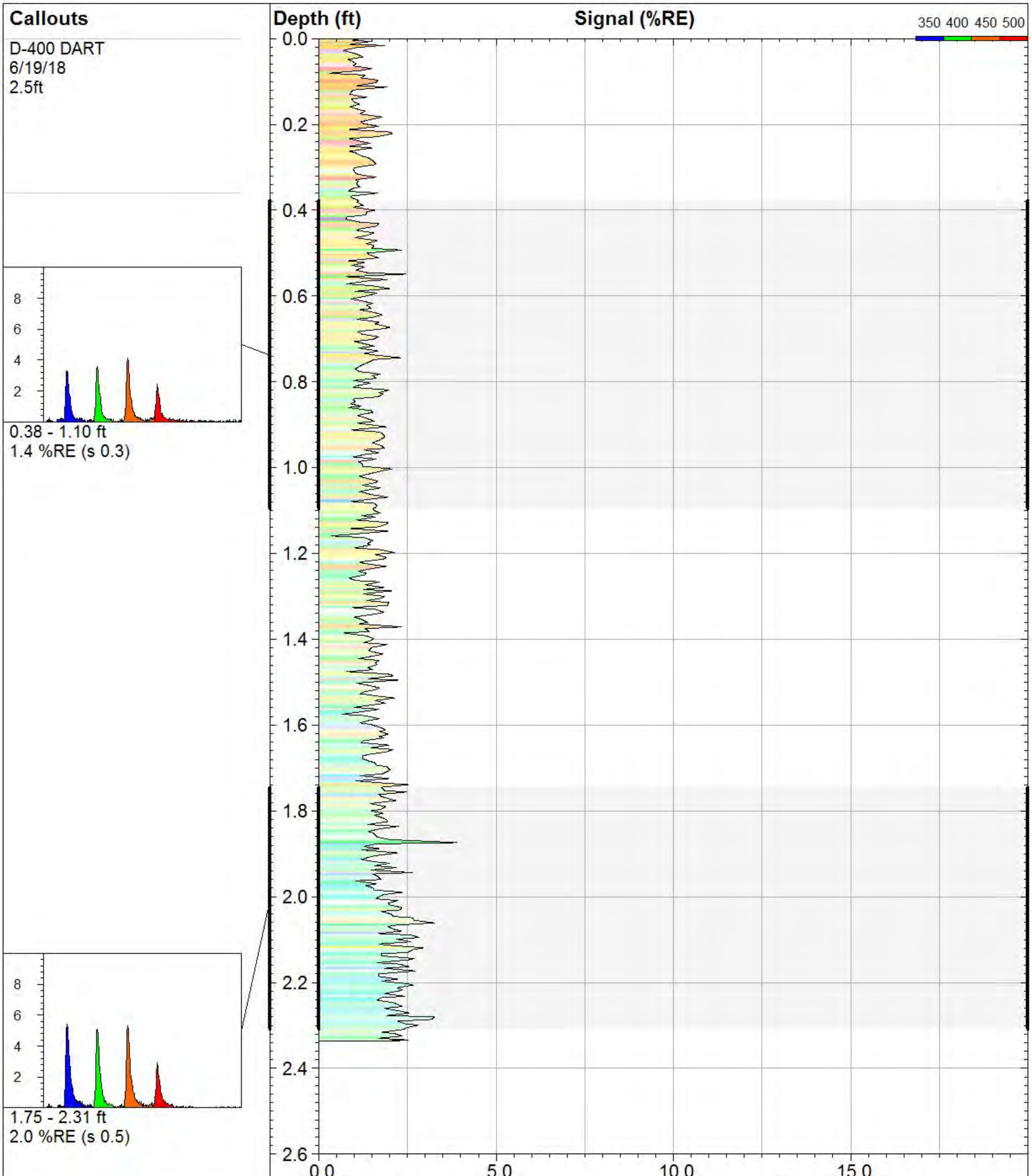
D-380-DART

Darts By Dakota
www.DakotaTechnologies.com

Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.51 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **8.2 %RE @ 0.01 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-22 15:04 CDT**



D-400-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.34 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.9 %RE @ 1.87 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-22 10:39 CDT**

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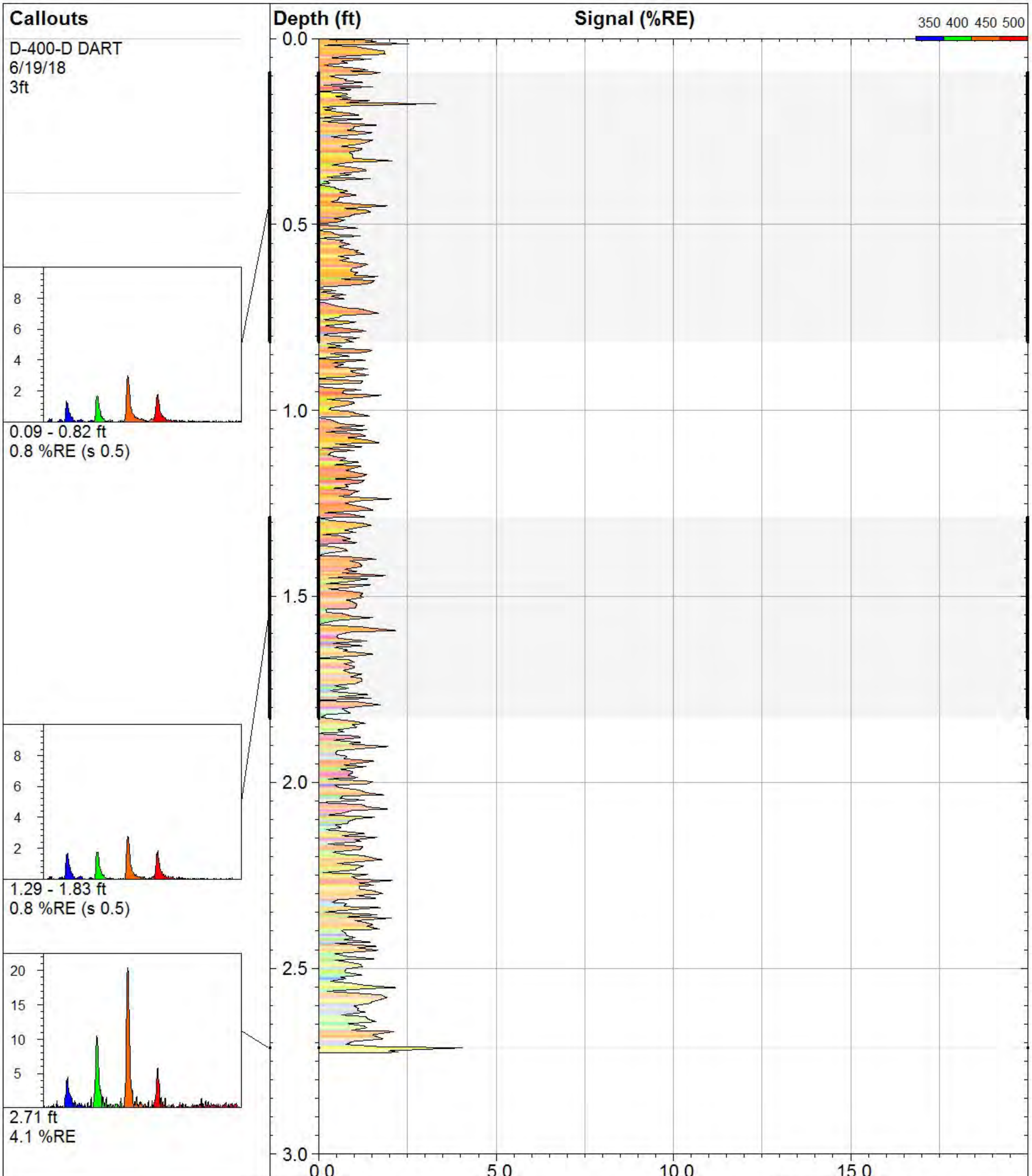

D-400-D-DART		**Darts By Dakota** www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.73 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.1 %RE @ 2.71 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-22 14:19 CDT**

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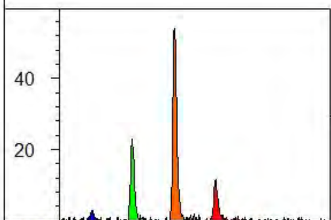
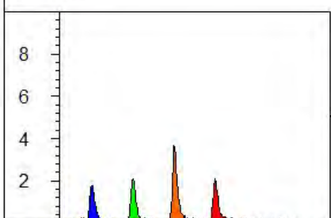
Callouts

D-420 DART
6/19/18
3.3ft

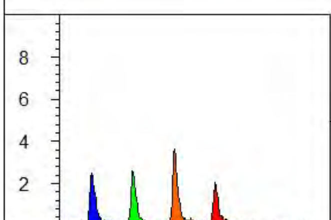
Small tear at 1.2' fiberglass pole visible



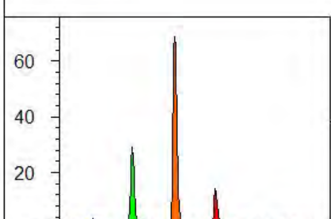
1.17 ft
5.6 %RE
fiberglass



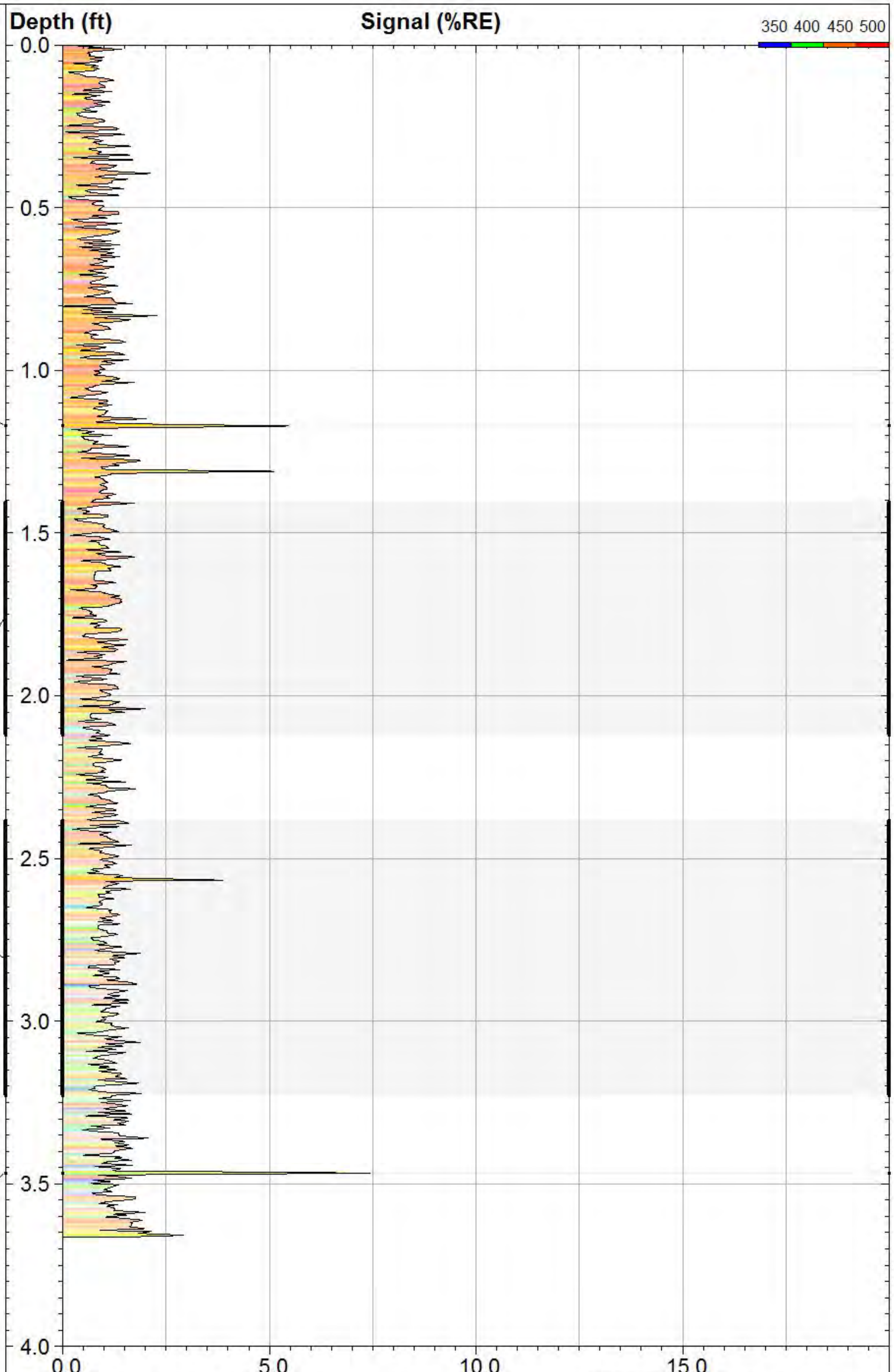
1.40 - 2.12 ft
0.9 %RE (s 0.4)



2.38 - 3.23 ft
1.1 %RE (s 0.4)



3.47 ft
7.6 %RE



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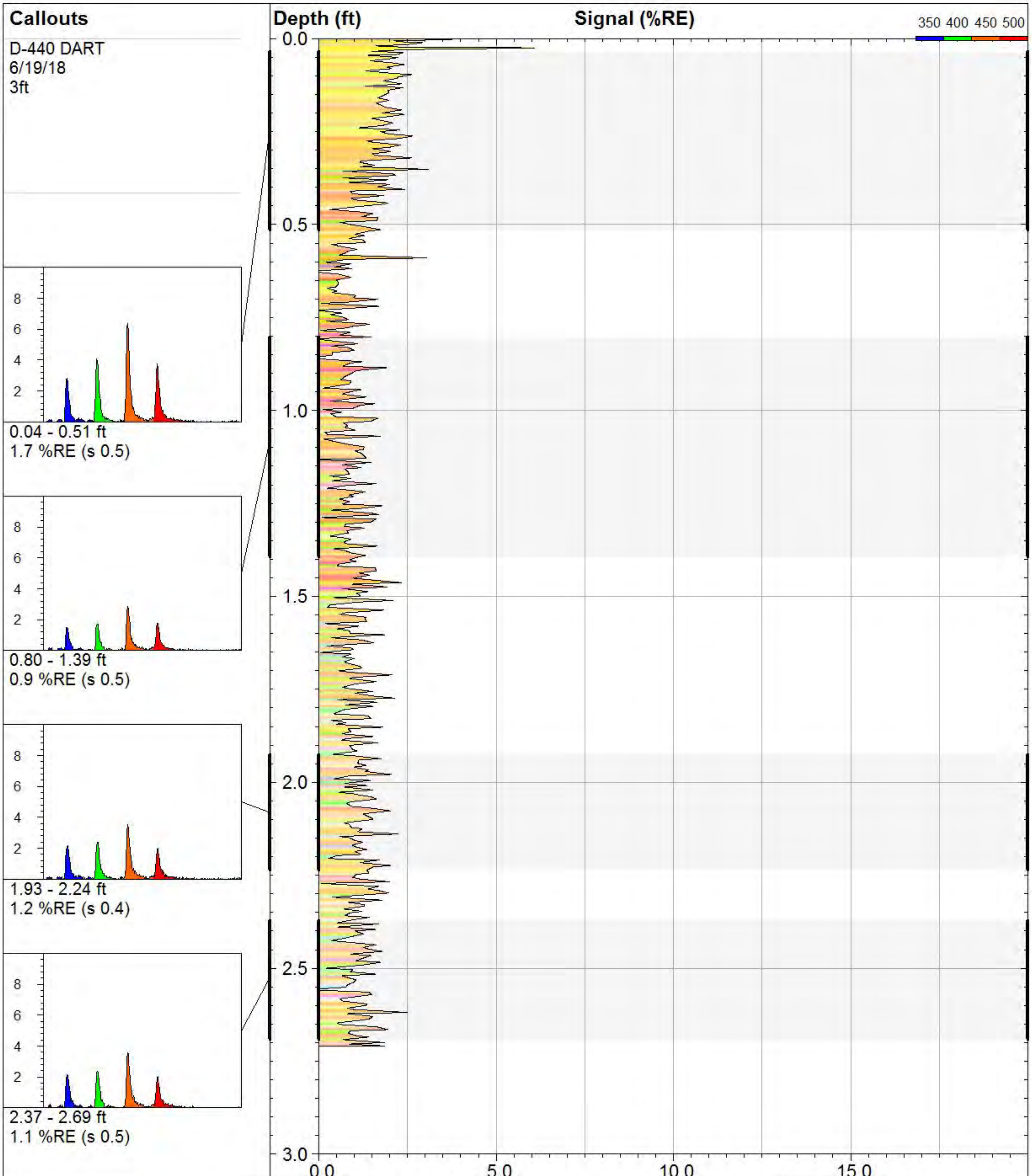
D-420-DART

Darts By Dakota
www.DakotaTechnologies.com

Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **3.66 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **7.6 %RE @ 3.47 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-22 10:56 CDT**



D-440-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.71 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **6.3 %RE @ 0.03 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-22 14:03 CDT**

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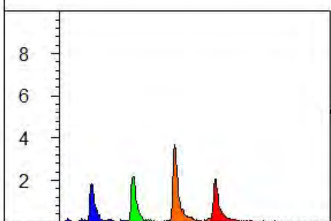
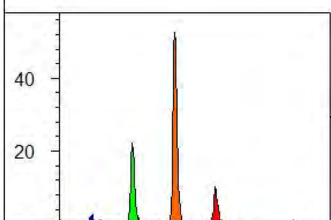
Callouts

D-460- DART
6/19/18
3ft

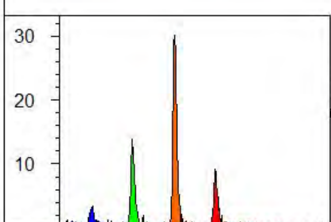
Tear at .19-.25ft fibeglass exposed



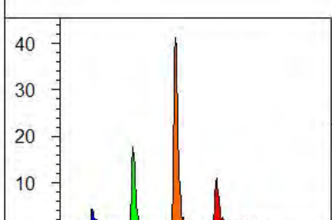
0.11 - 0.95 ft
1.0 %RE (s 0.5)



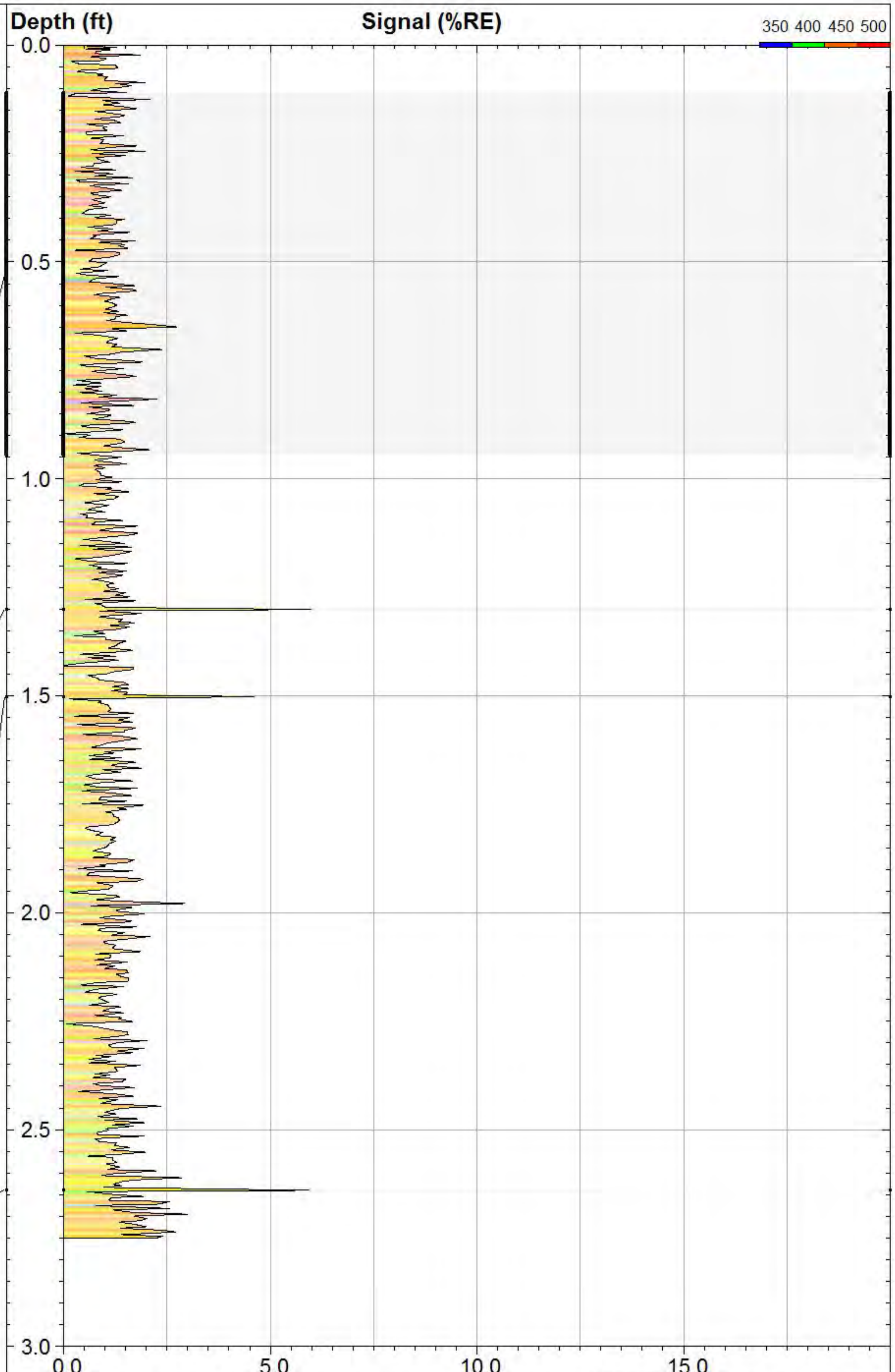
1.30 ft
6.2 %RE



1.50 ft
4.7 %RE



2.64 ft
5.9 %RE



D-460-DART		**Darts By Dakota** www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.75 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **6.2 %RE @ 1.30 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-22 14:33 CDT**

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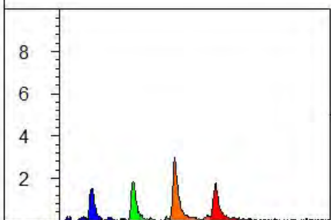
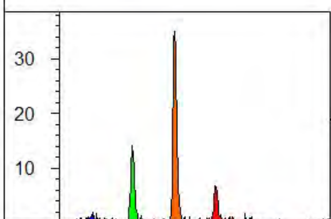
Callouts

D-480 DART
6/19/18
6ft

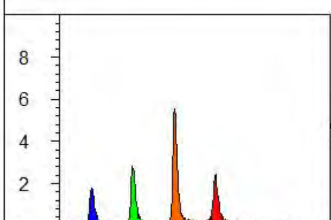
Tears between 4.75-5ft
fiberglass pole visible



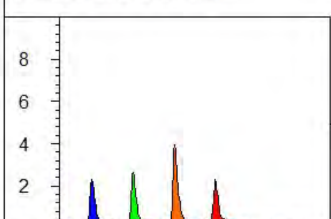
0.99 - 2.38 ft
0.8 %RE (s 0.4)



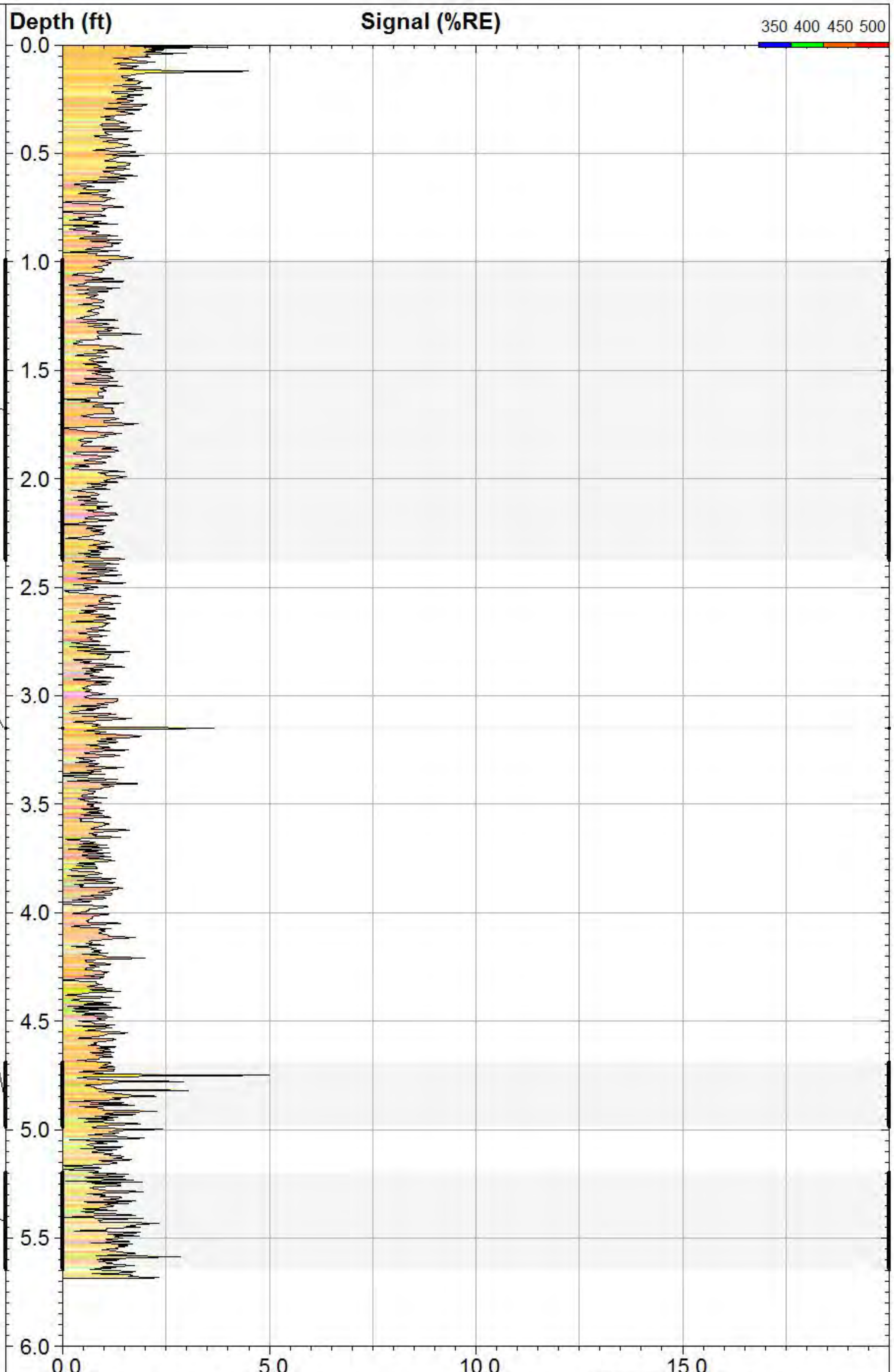
3.15 ft
3.8 %RE



4.69 - 4.99 ft
1.2 %RE (s 0.8)
Tear in Dart material



5.20 - 5.64 ft
1.2 %RE (s 0.5)



D-480-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **5.69 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **5.2 %RE @ 4.75 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-22 11:29 CDT**

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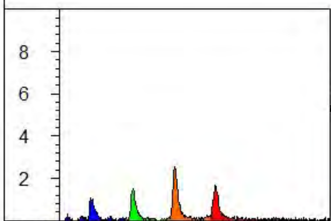
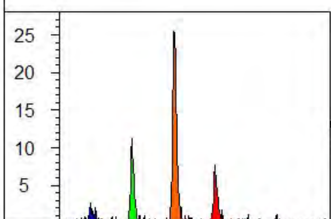
Callouts

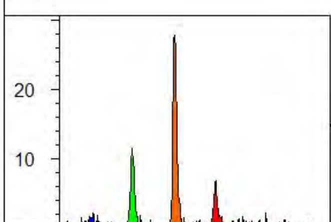
D-500 DART
6/19/18
1.8ft



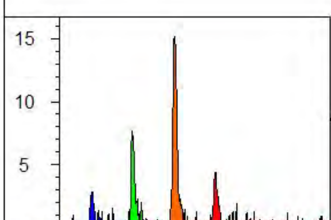
0.00 - 0.54 ft
0.8 %RE (s 0.4)



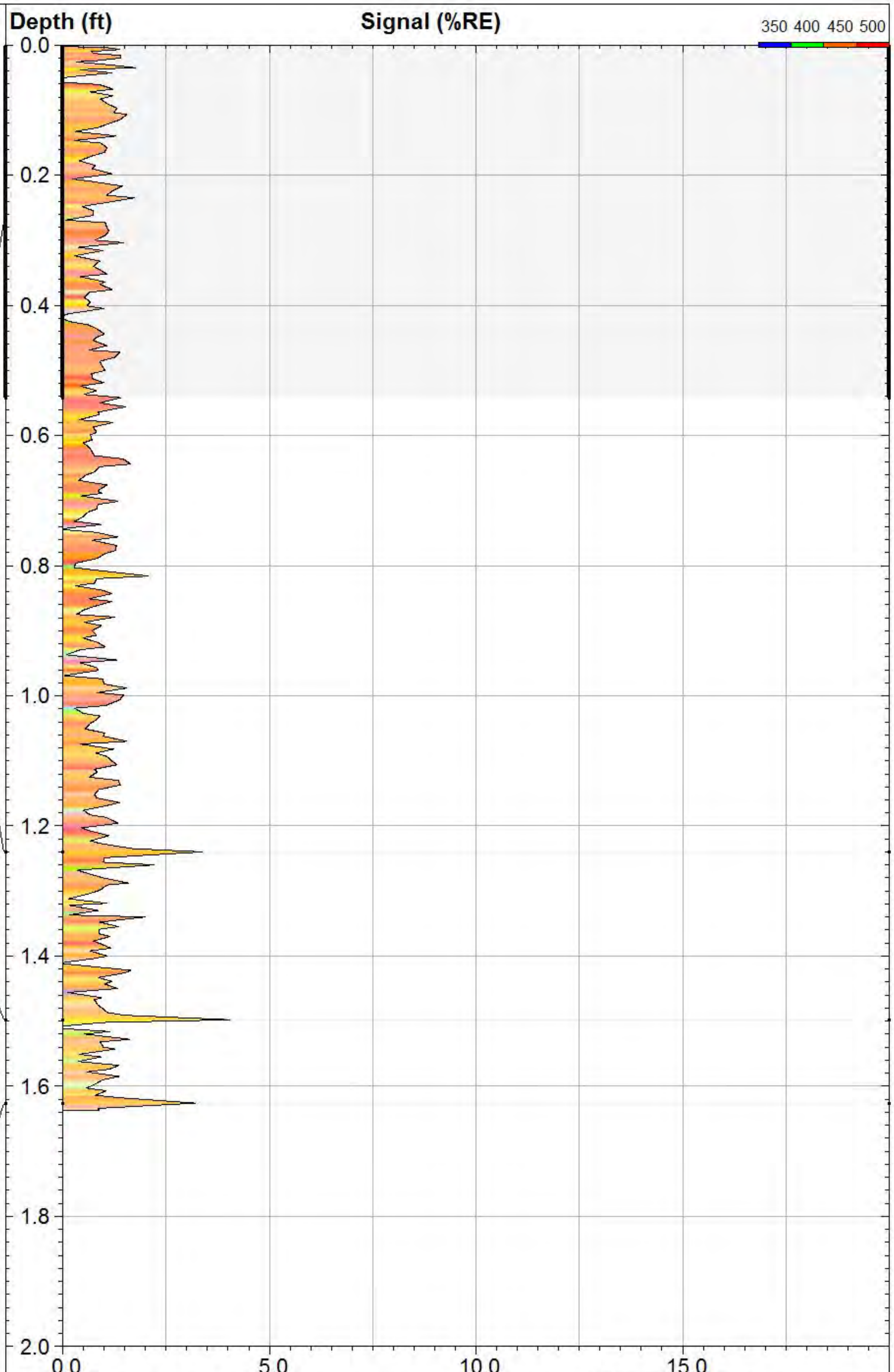
1.24 ft
3.4 %RE



1.50 ft
4.1 %RE



1.63 ft
3.2 %RE



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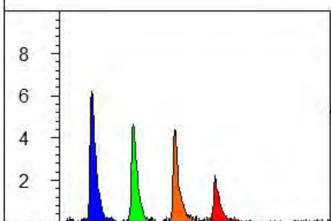
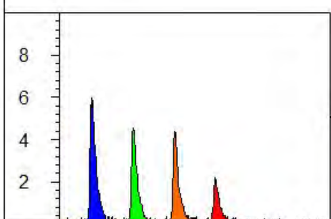
D-500-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **1.64 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.1 %RE @ 1.50 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-22 12:03 CDT**

Callouts

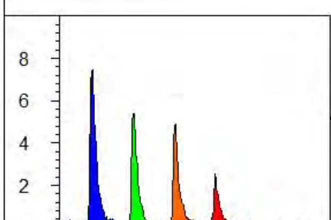
E-250-DART
6/24/18
3ft



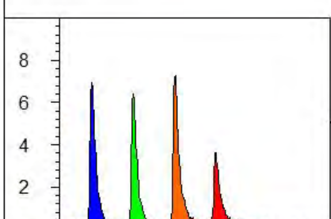
0.09 - 0.92 ft
1.7 %RE (s 0.4)



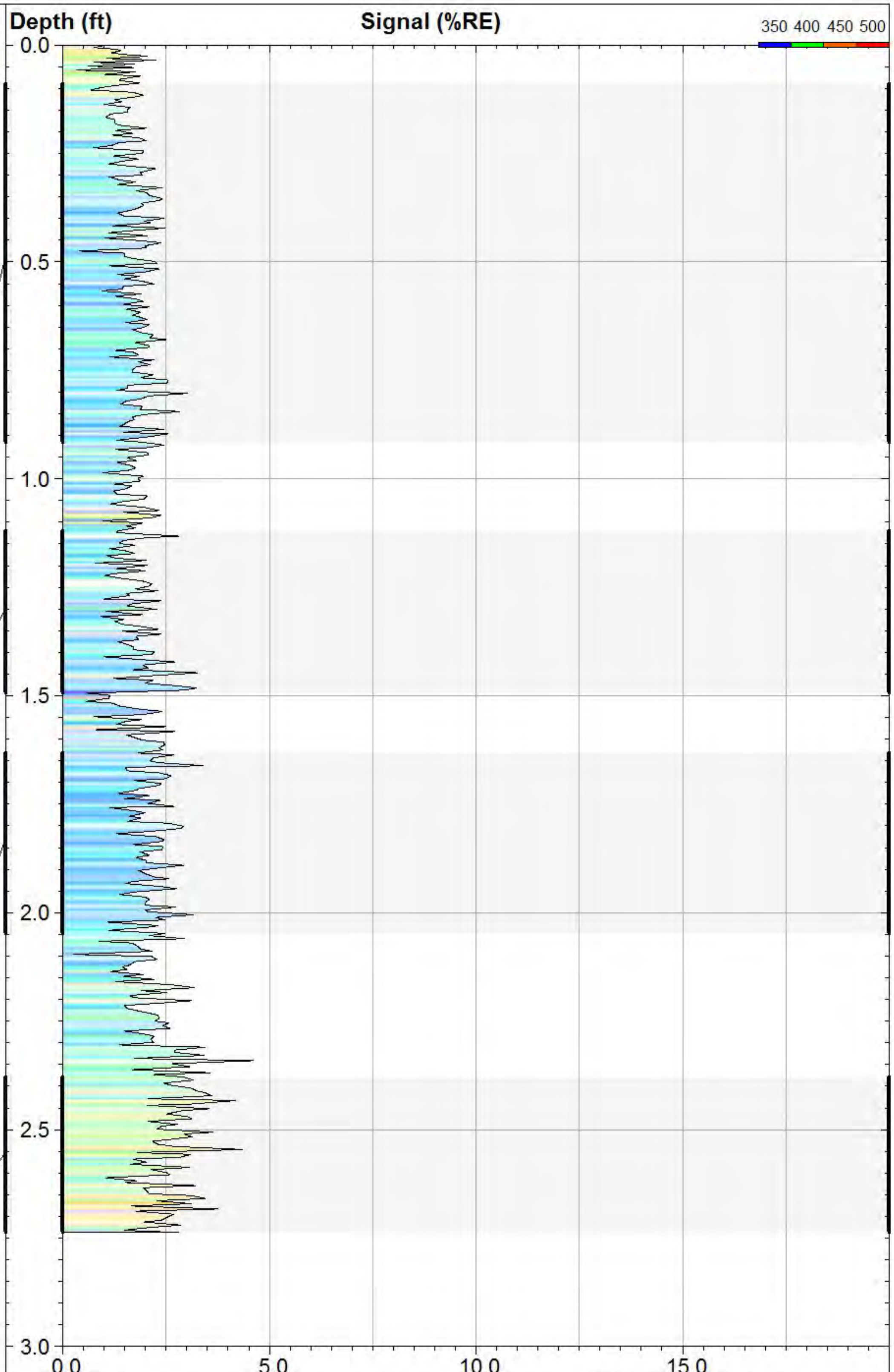
1.12 - 1.49 ft
1.8 %RE (s 0.6)



1.63 - 2.05 ft
2.1 %RE (s 0.5)



2.38 - 2.74 ft
2.6 %RE (s 0.7)



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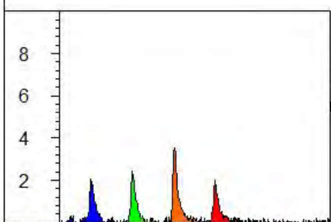
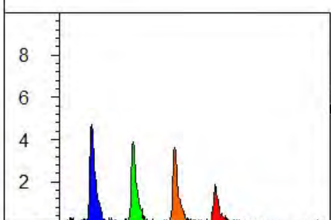
E-250-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.74 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **4.6 %RE @ 2.34 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-28 14:00 CDT**

Callouts

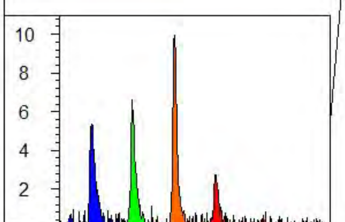
E-270-DART
6/24/18
2.4ft



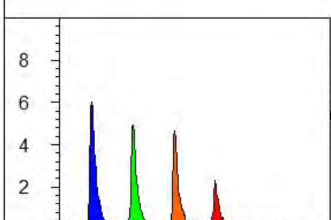
0.01 - 0.28 ft
1.0 %RE (s 0.5)



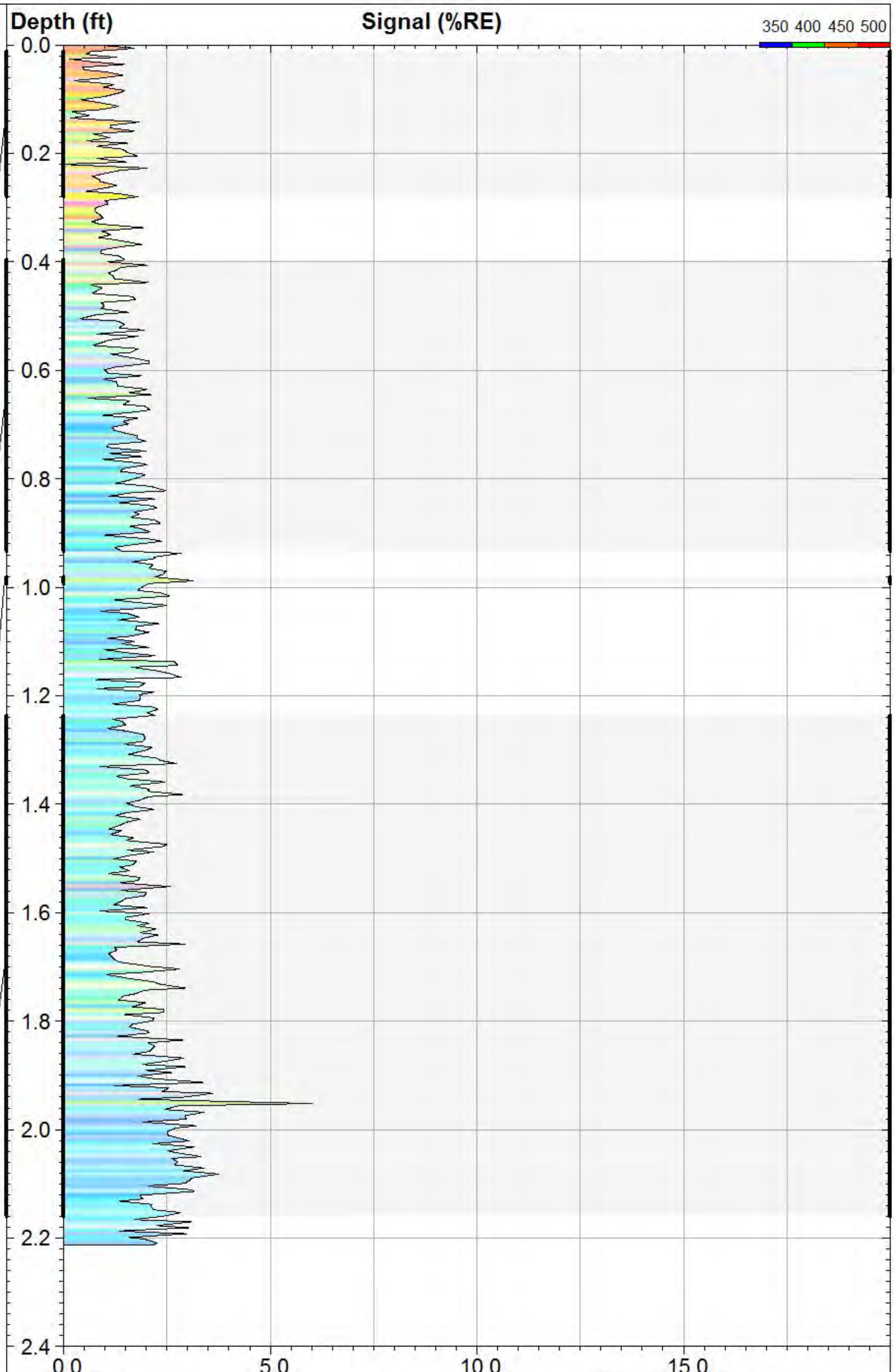
0.40 - 0.93 ft
1.5 %RE (s 0.5)



0.98 - 0.99 ft
2.5 %RE (s 0.6)



1.24 - 2.16 ft
2.1 %RE (s 0.7)



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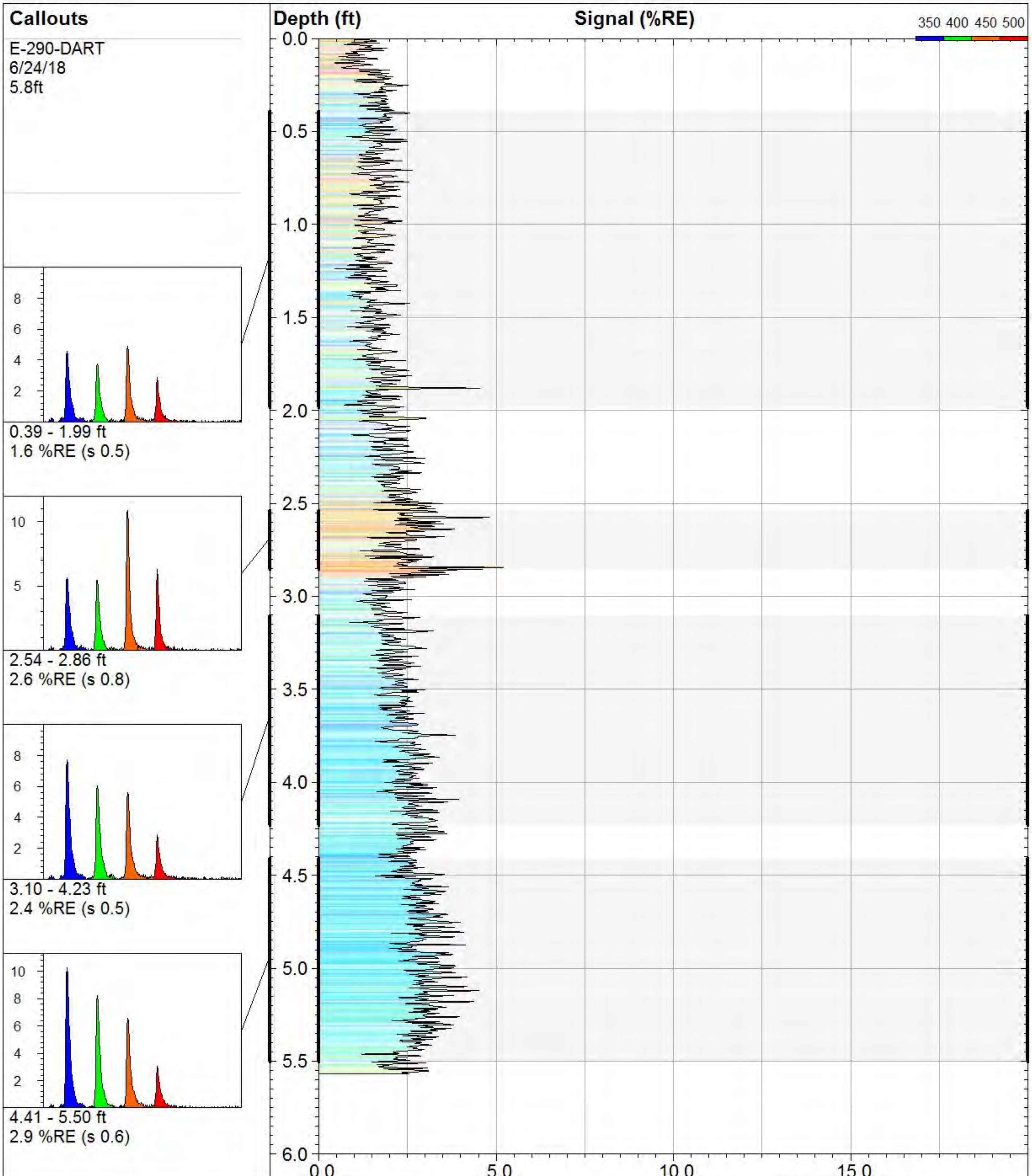
E-270-DART		**Darts By Dakota** www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.21 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **6.0 %RE @ 1.95 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-28 11:55 CDT**



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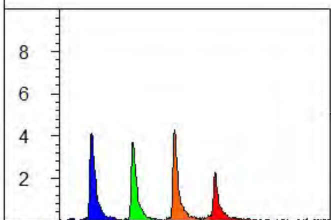
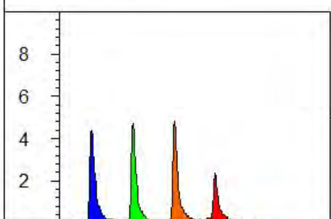
E-290-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **5.57 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **5.4 %RE @ 2.85 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-28 11:09 CDT**

Callouts

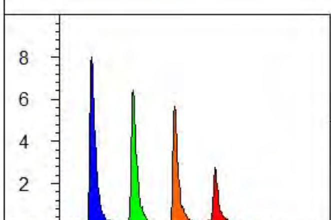
E-310- DART
6/20/18
5.4ft



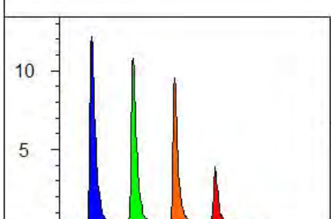
0.94 - 1.94 ft
1.4 %RE (s 0.4)



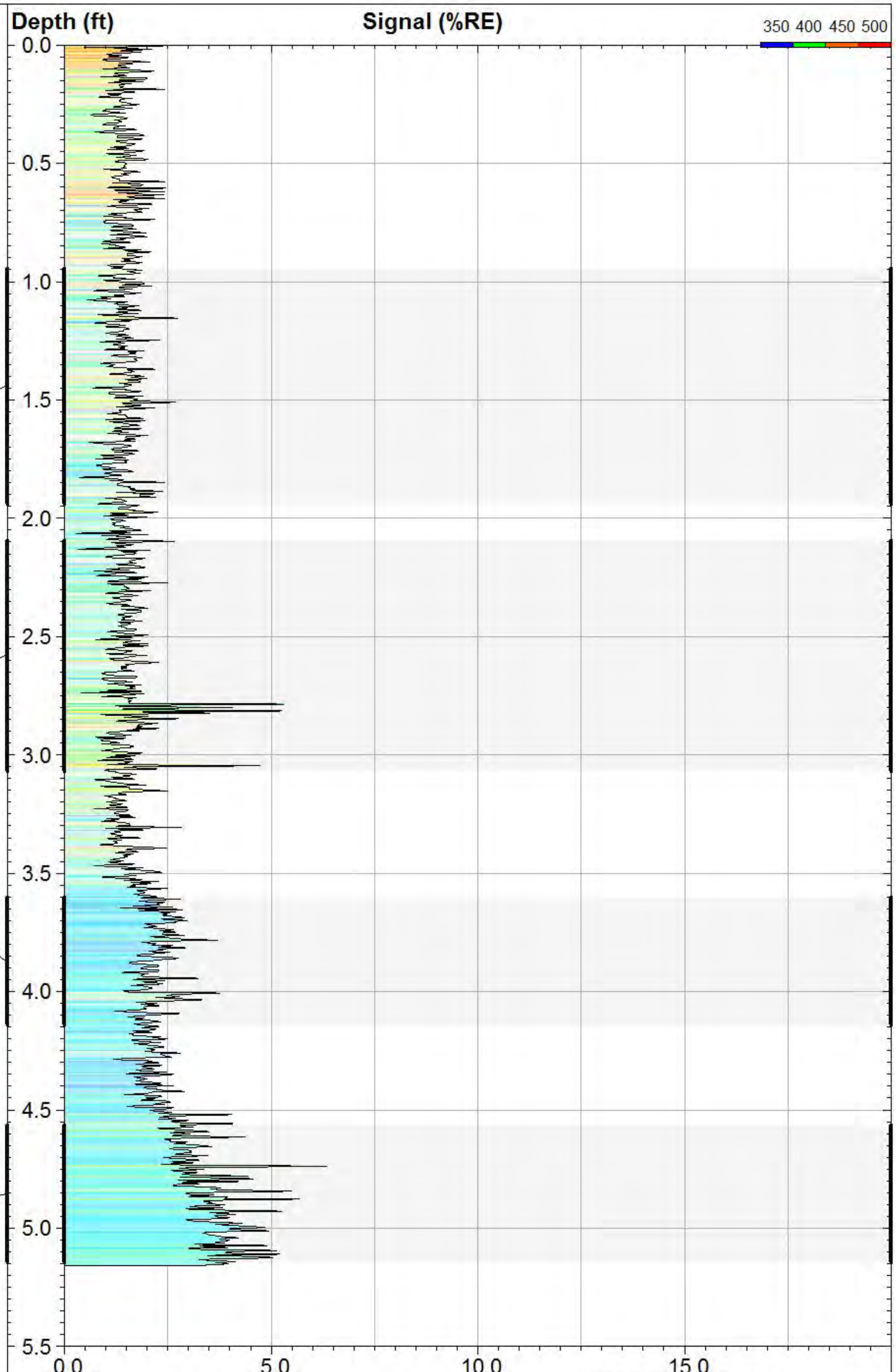
2.09 - 3.07 ft
1.5 %RE (s 0.6)



3.60 - 4.14 ft
2.2 %RE (s 0.5)



4.56 - 5.15 ft
3.5 %RE (s 0.8)



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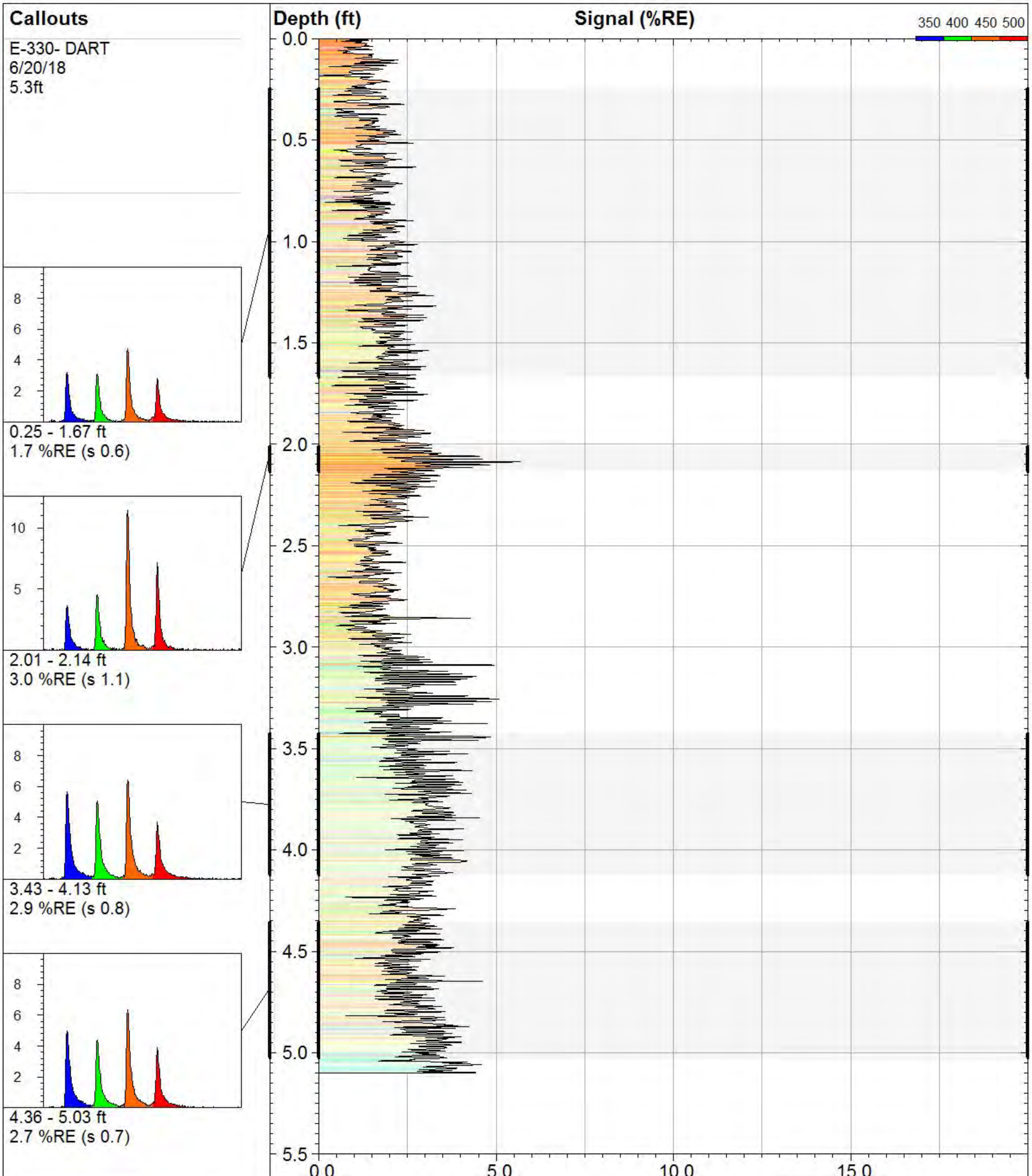
E-310-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **5.16 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **6.5 %RE @ 4.74 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-26 11:08 CDT**



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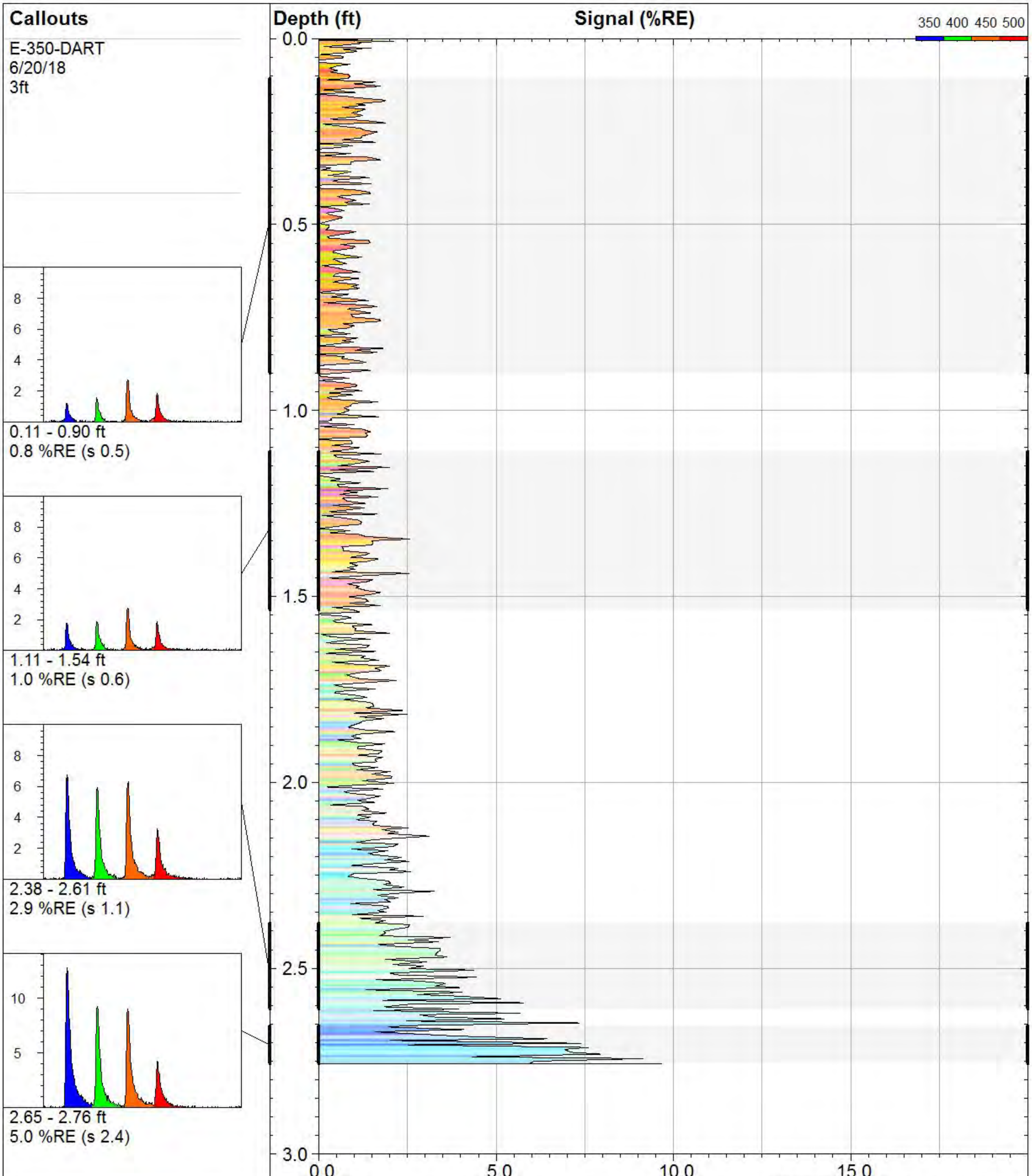
E-330-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **5.10 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **5.8 %RE @ 2.09 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-26 13:00 CDT**



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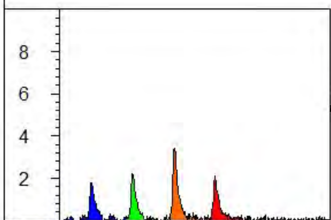
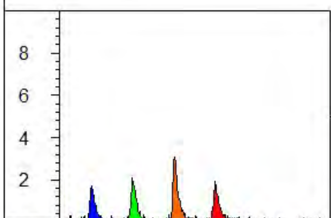
E-350-DART		Darts By Dakota www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.76 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **9.7 %RE @ 2.76 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-26 15:41 CDT**

Callouts

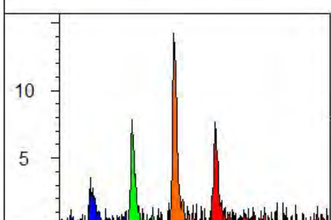
E-380-DART
6/24/18
2.2ft



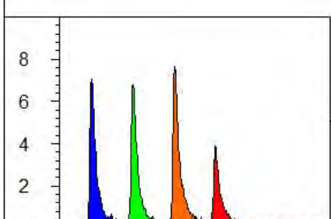
0.10 - 0.50 ft
1.2 %RE (s 0.7)



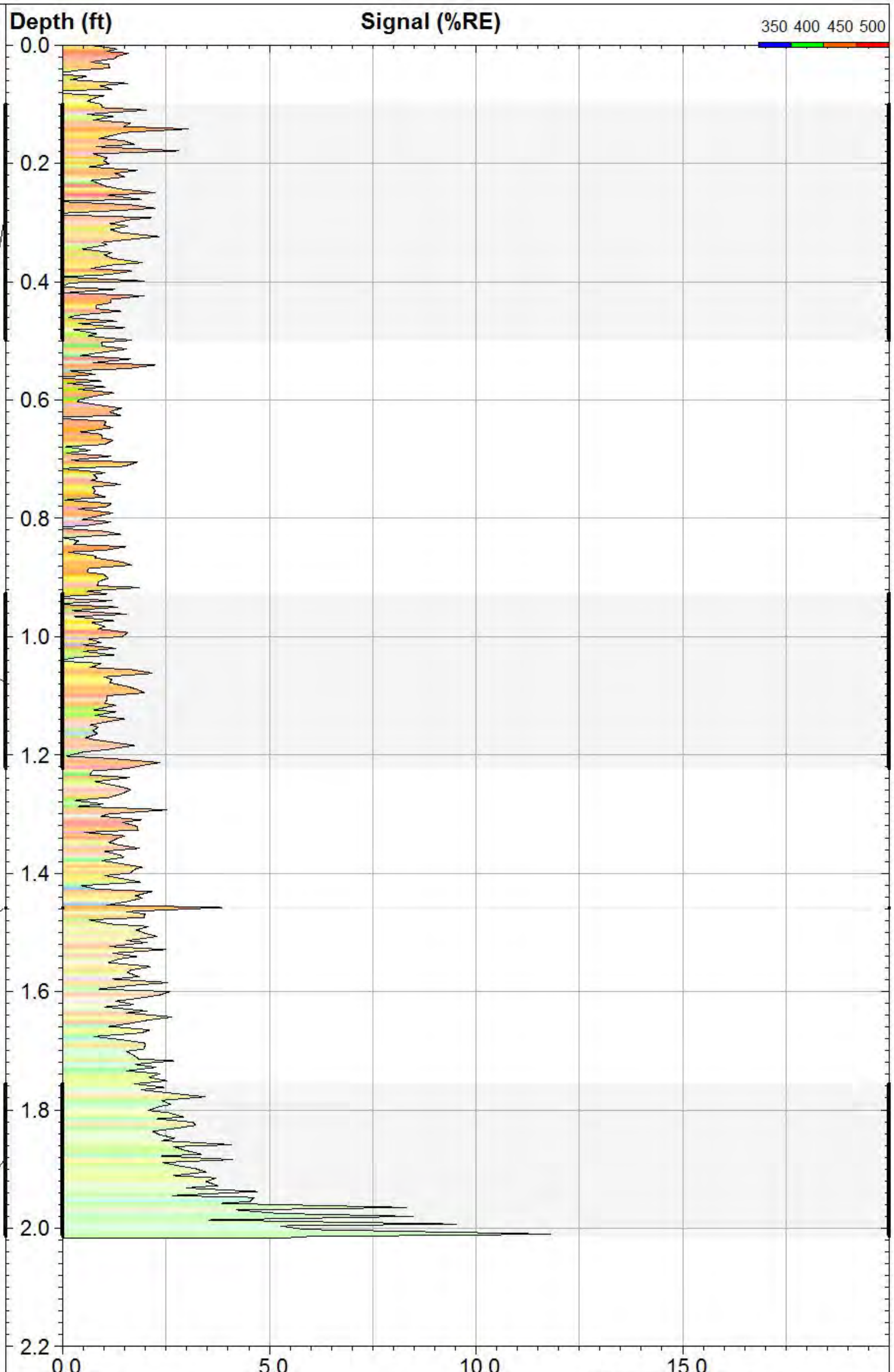
0.93 - 1.22 ft
1.0 %RE (s 0.6)



1.46 ft
3.9 %RE



1.76 - 2.01 ft
3.8 %RE (s 2.0)



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E-380-DART

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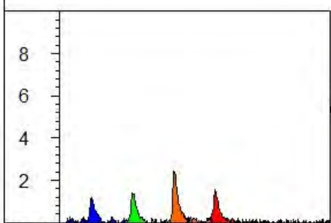
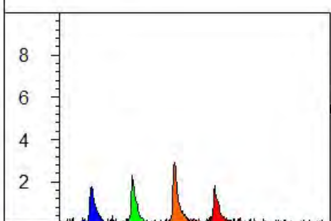
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.02 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **11.9 %RE @ 2.01 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-28 14:14 CDT**

Callouts

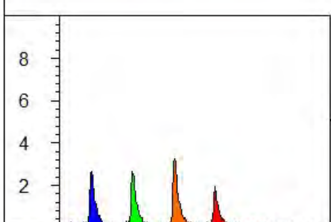
E-400-DART
6/24/18
2.3ft



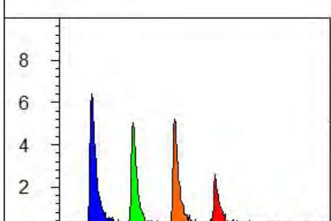
0.06 - 0.49 ft
0.7 %RE (s 0.5)



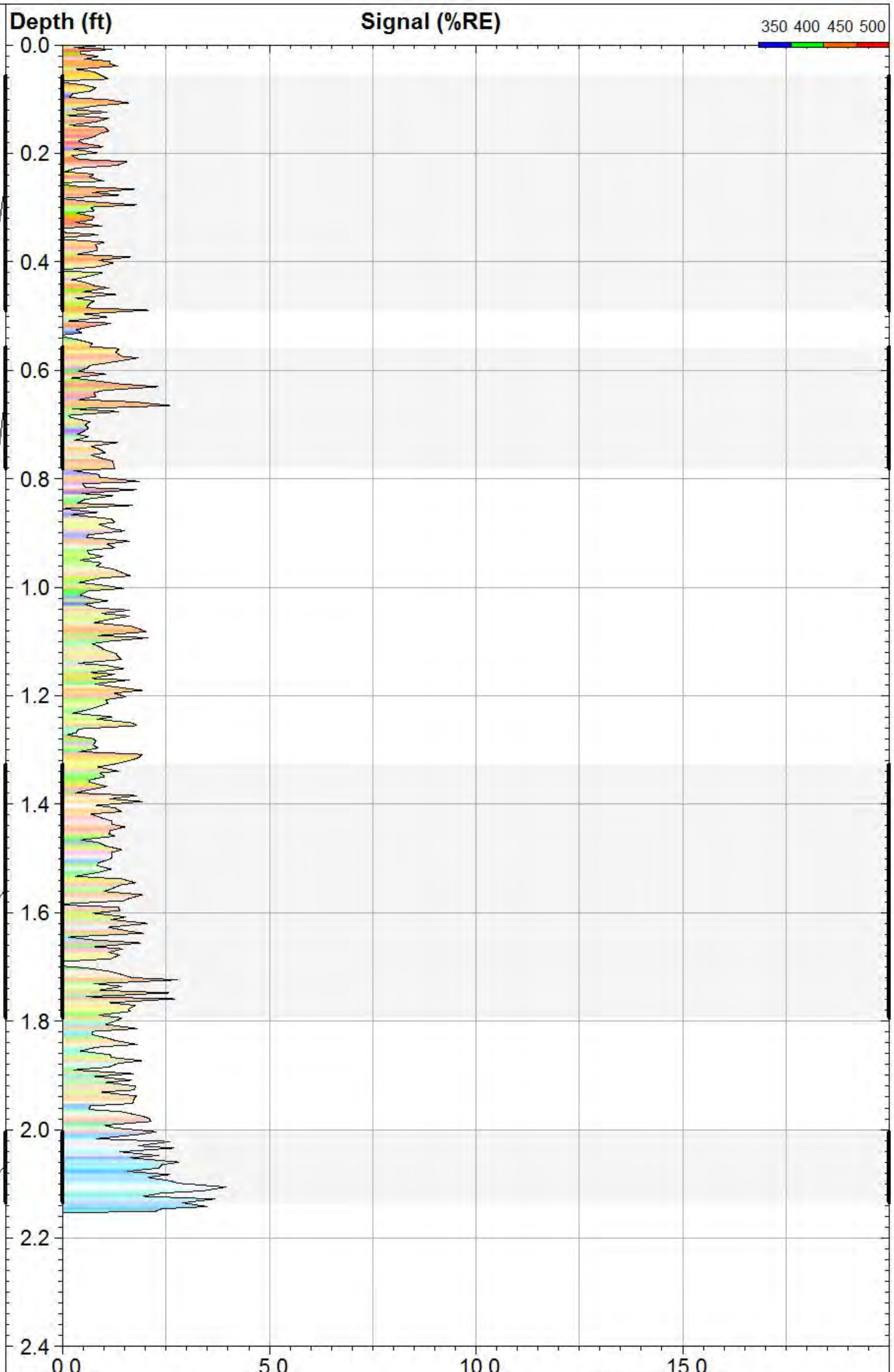
0.56 - 0.78 ft
0.9 %RE (s 0.6)



1.33 - 1.79 ft
1.2 %RE (s 0.6)



2.00 - 2.14 ft
2.4 %RE (s 0.7)



E-400-DART

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Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.15 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.9 %RE @ 2.11 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-28 14:27 CDT**

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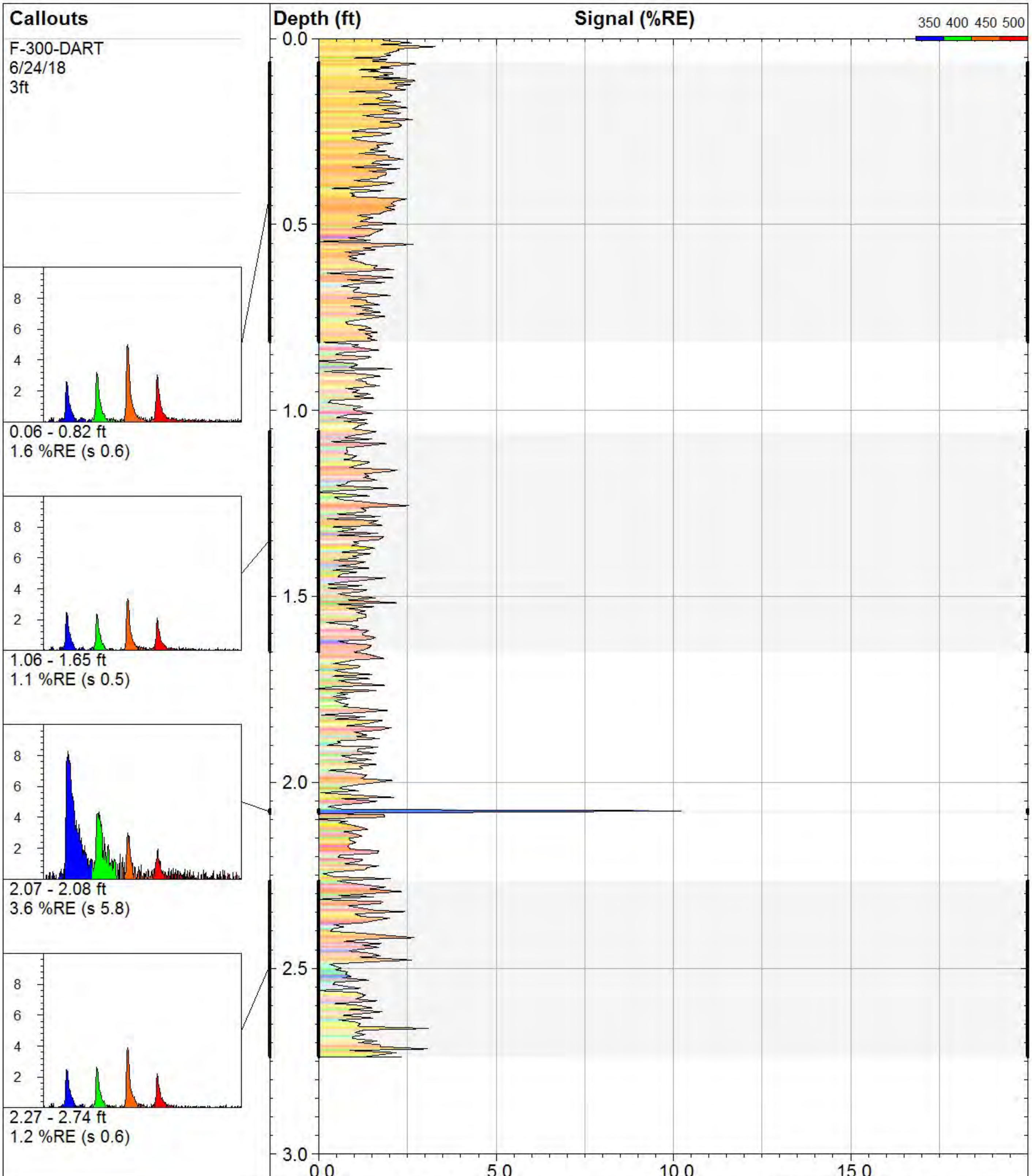

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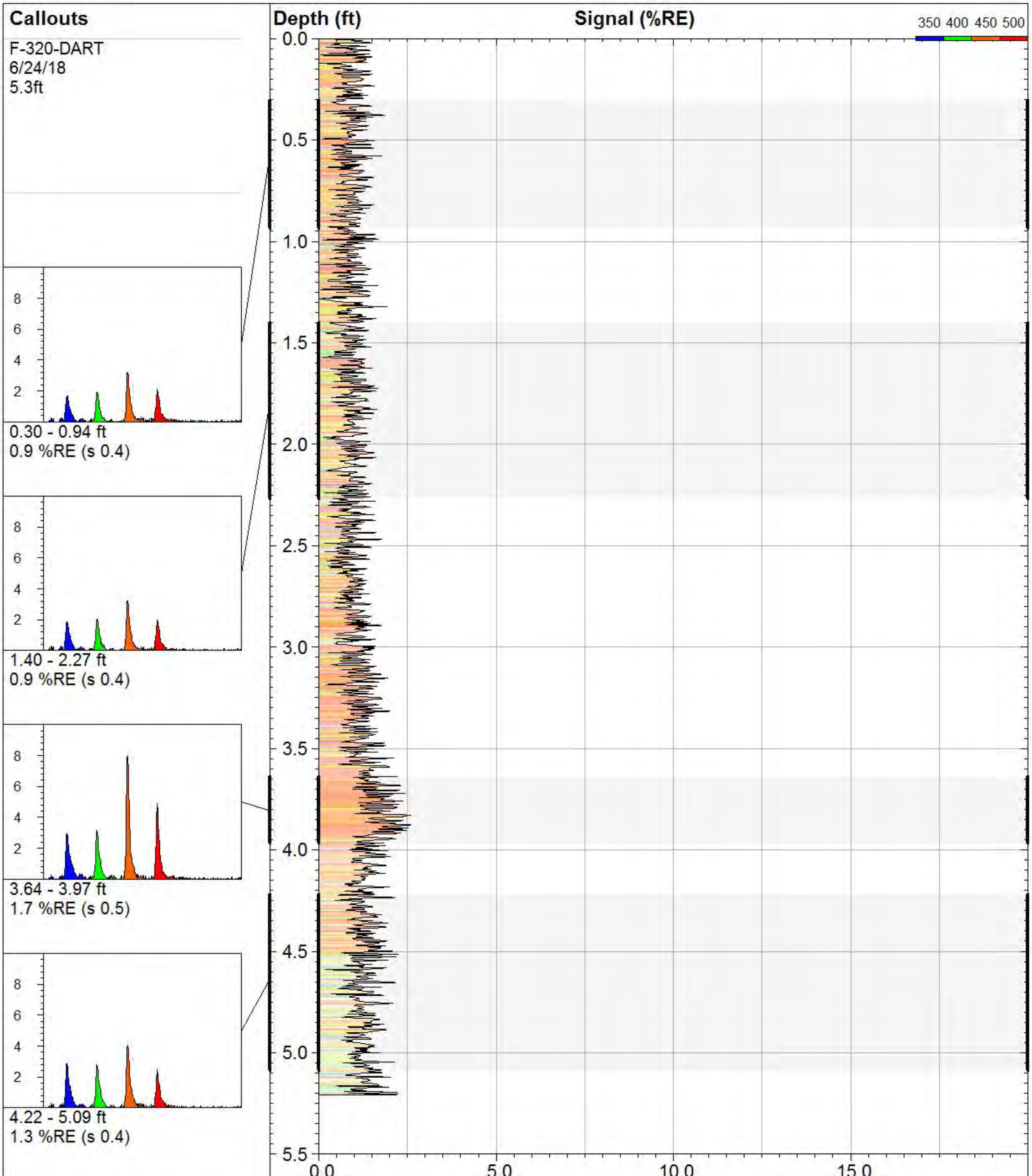
F-300-DART

Darts By Dakota
www.DakotaTechnologies.com

Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.74 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **10.3 %RE @ 2.08 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-28 14:36 CDT**



F-320-DART		**Darts By Dakota** www.DakotaTechnologies.com
Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **5.21 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **2.6 %RE @ 3.83 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-28 10:44 CDT**

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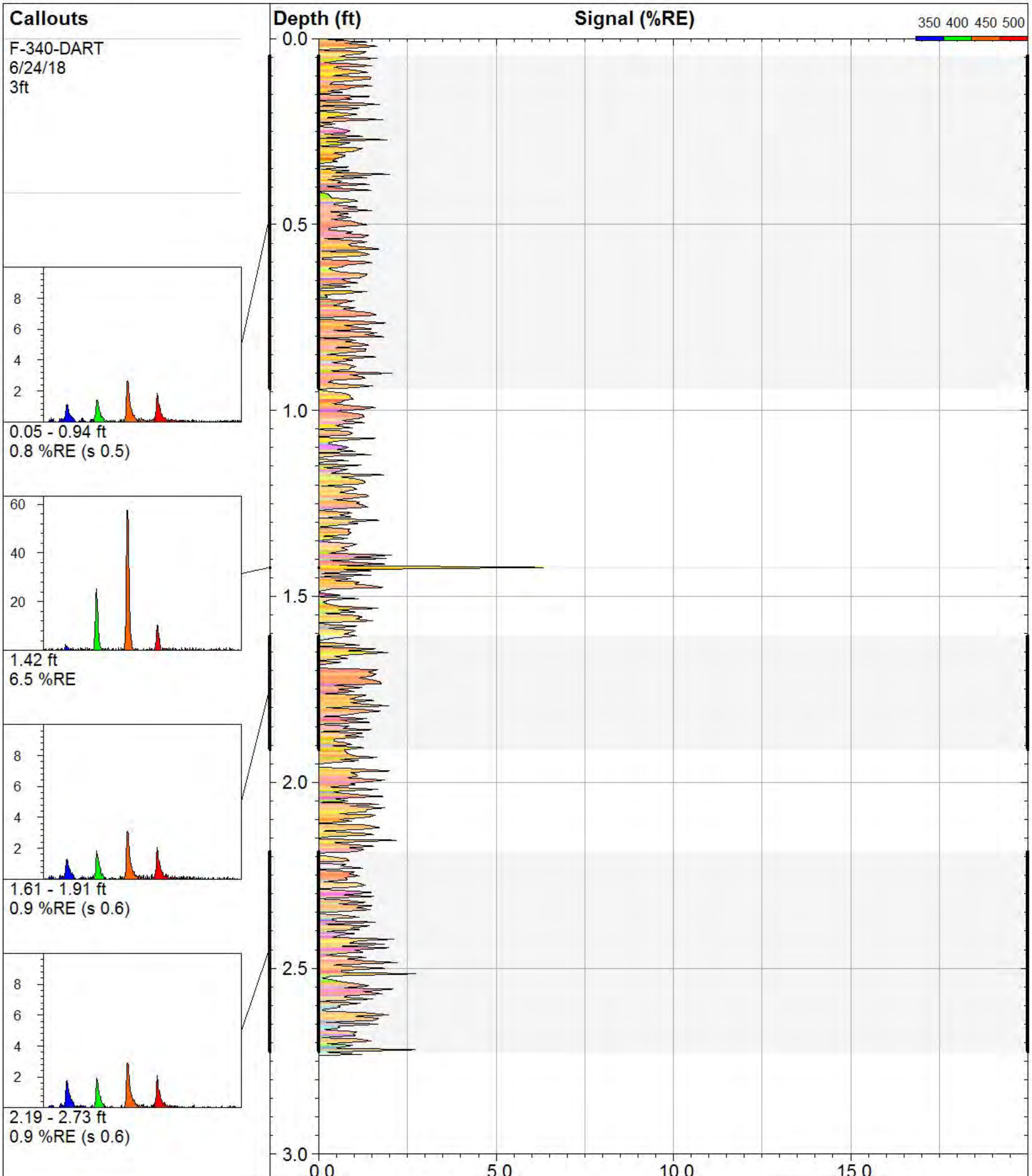

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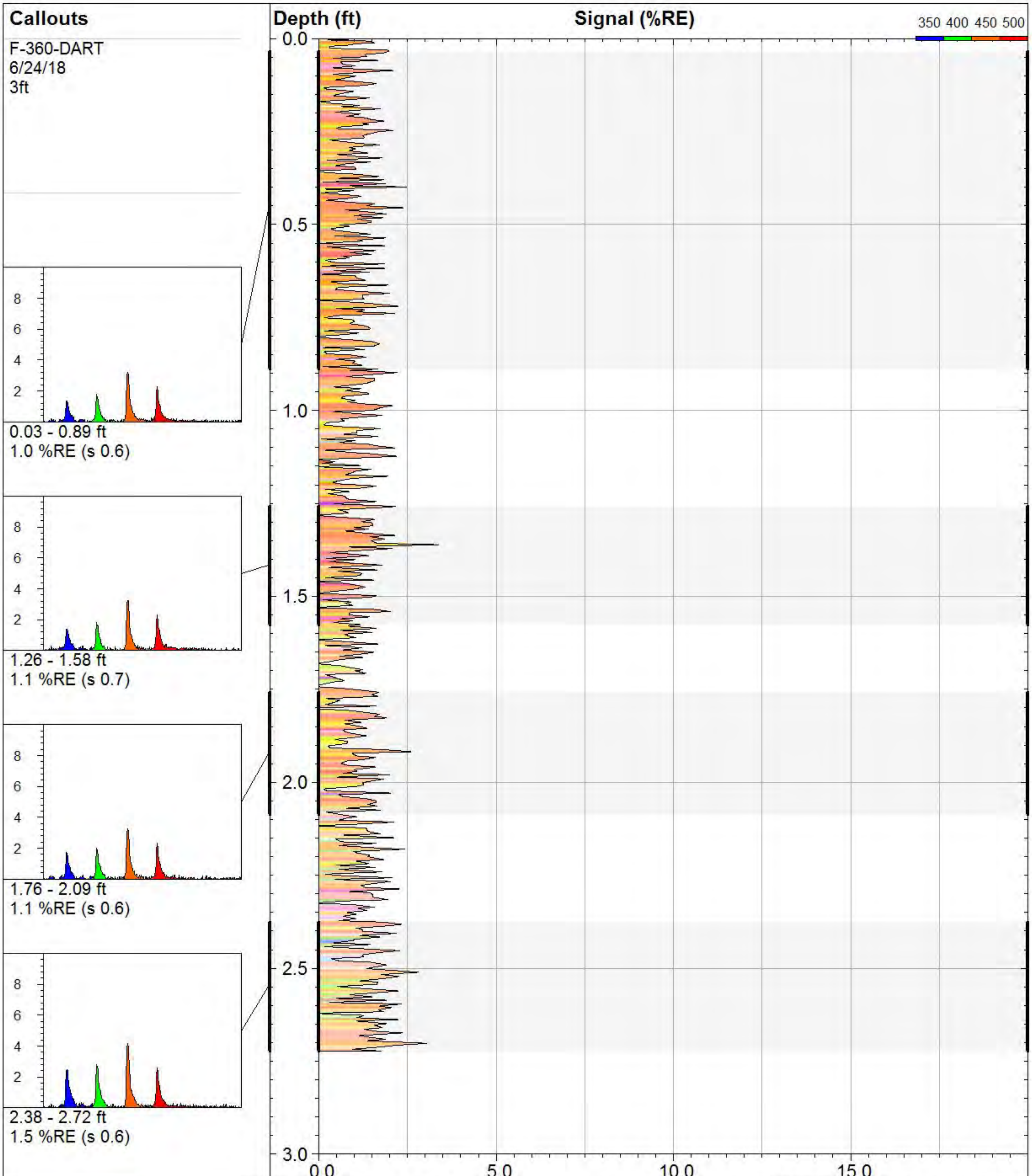
F-340-DART

Darts By Dakota
www.DakotaTechnologies.com

Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.73 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **6.5 %RE @ 1.42 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-28 15:01 CDT**



F-360-DART

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Site: **Wishram**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **2.72 ft**
Client / Job: **Jacobs /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **3.4 %RE @ 1.36 ft**
Operator / Unit: **T. Rudolph / UVOST01**	*Elevation:* **Unavailable**	*Date & Time:* **2018-06-28 15:21 CDT**

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Appendix B
Sediment Core Logs

JACOBS

Site Name: BNSF Track Switching Facility
Project Number: 693282
Project Location: Wishram, WA
Survey Duration:

Station ID:	D200	**Easting (X) (ft):**	1520546.37		**Attempt 1**	**Refusal? Y/N**
Sampling:	Yes	**Northing (Y) (ft):**	118008.00	**Penetration (ft):**	7.0 ft bss	
Crew/Company:	Gravity	**Datum:**	NAVD88	**Recovery (ft):**	4.3 ft bss	
		Depth (ft):	4.0	**Date/Time:**	8/7/2018	
		Water Surface Elevation:	160.1			
		St. Arrival:	12:00		**Attempt 2**	**Refusal? Y/N**
Vessel:	26-foot aluminum flat-bottom w/3 spuds	**St. Depart:**	12:30	**Penetration (ft):**		
Collection:	Direct-Push (Power Pro 9100 P)	**Logged by:**	J. Ulrich	**Recovery (ft):**		
Collector Information:				**Date/Time:**		

Note: Location Coordinates reference NAD 83 WA South State Plane

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
0	Silty sand	SW-SM	Olive gray	Well-graded	Non-cohesive		Wet	Fine-grained					0.0 / 0.0			Micaceous, roots/woody debris, chunks of rock chert/basalt 0-6" saturated cannot note consistency Collected surface grab sample "D200-GS-080718" for NWTPH Ox, EPH10 First 2-4" shells, woody debris, milfoil roots
0.5													0.0 / 0.0			
1													0.0 / 0.0			
1.5													0.0 / 0.0			
2													0.0 / 0.0			
2.5													0.0 / 0.0	A		Collected sediment sample from core for COD/TOC only at 16:40 core "D200-SC-080718"
3													0.0 / 0.0			
3.5													0.0 / 0.0			
4													0.0 / 0.0			
4.3													0.0 / 0.0			End of recovery 4.3 ft bss

Additional Notes/Comments: Sediment samples/cores collected in river below sediment surface

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
4.5																
5																
5.5																
6																
6.5																
7																
7.5																
8																
8.5																
9																

Sample Summary (check boxes for analysis):

Sample ID	Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)														
D200-GS-080718		8/7/2018	0-0.5 ft														
D200-SC-080718-A		8/7/2018 16:40	3 ft														

Reviewed by: DF Date: 12/20/2018

JACOBS

Site Name: BNSF Track Switching Facility
Project Number: 693282
Project Location: Wishram, WA
Survey Duration:

Station ID:	F360	**Easting (X) (ft):**	1520713.94	**Attempt 1**	**Refusal? Y/N**
Sampling:	Yes	**Northing (Y) (ft):**	117981.3	**Penetration (ft):**	6.4 ft bss
Crew/Company:	Gravity	**Datum:**	NAVD88	**Recovery (ft):**	3.9 ft bss
		Depth (ft):	8.8	**Date/Time:**	8/8/2018
		Water Surface Elevation:	162.3		
		St. Arrival:	7:30	**Attempt 2**	**Refusal? Y/N**
Vessel:	26-foot aluminum flat-bottom w/3 spuds	**St. Depart:**	8:30	**Penetration (ft):**	
Collection:	Direct-Push (Power Pro 9100 P)	**Logged by:**	J. Ulrich	**Recovery (ft):**	
Collector Information:				**Date/Time:**	

Note: Location Coordinates reference NAD 83 WA South State Plane

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
0	Sand	SW	Olive gray	Well-graded			dry	Fine-grained, >massive					0.0 / 0.0			Micaceous Bi-valves present upper 6" - 1 ft Collect sample "F360-SC-080818-A" at 1310 for TOC and COD
0.5													0.0 / 0.0	A		
1																
1.5													0.0 / 0.0			
2	Sandy silt	SM-SW	Olive gray		Increasing plasticity toward bottom		moist						0.0 / 0.0		free product observed throughout	Angular pebble, some woody debris present, free product observed throughout, greatest toward bottom of core,
2.5													0.0 / 3.6			
3													0.0 / 8.7			
3.5													0.0 / 14.3			Collect sample "F360-SC-080818" at 1315 TOC and COD
3.9													0.0 / 48.6			Most prevalent/ free product, few minor lenses of oxidation last 3" End of recovery at 3.9 ft bss
4																
5																

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
5.5																
6																End of boring 6.0 ft bss
7																
7.5																
8																
8.5																
9																
9.5																
10																
10.5																

Sample Summary (check boxes for analysis):

Sample ID	Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)													
F360-SC-080818-A		8/8/2018 13:10	0.5 ft													
F360-SC-080818		8/8/2018 13:15	3.9 ft													

Reviewed by: DF Date: 12/20/2018

JACOBS

Site Name: BNSF Track Switching Facility
Project Number: 693282
Project Location: Wishram, WA
Survey Duration:

Station ID:	F400 A (first 2 ft only) and F400B	Easting (X) (ft):	1520753.13		Attempt 1		Refusal? Y/N
Sampling:	Yes	Northing (Y) (ft):	117980.18	Penetration (ft):	2.5 ft bss		
Crew/Company:	Gravity	Datum:	NAVD88	Recovery (ft):	1.8 ft bss		
		Depth (ft):	9.1	Date/Time:	8/8/2018		
		Water Surface Elevation:	162.2				
		St. Arrival:	8:45		Attempt 2		Refusal? Y/N
Vessel:	26-foot aluminum flat-bottom w/3 spuds	St. Depart:	10:50	Penetration (ft):	10 ft bss		
Collection:	Direct-Push (Power Pro 9100 P)	Logged by:	J. Ulrich	Recovery (ft):	6.5 ft bss		
Collector Information:				Date/Time:	8/8/2018		

Note: Location Coordinates reference NAD 83 WA South State Plane

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
0	Sand	SW	Olive gray	Well-graded			dry	Fine-grained	no odor				0.0 / 0.0		no staining	Micaceous, clean sand, no odor/staining, some gravel, cobbles present in upper 6", zebra muscles (?)/bivalves in 0-6" Woody debris present from ~0.5-2 ft
0.5													0.0 / 0.0			Collect sample "F400B-SC-080818-A" at 1 ft BSS for TOC/COD
1													0.0 / 0.0	A		
1.5													0.0 / 0.0			
2	Silty sand	SW-SM	Olive gray	Well-graded	Low plasticity		dry	Fine-grained	no odor				0.0 / 0.0		no staining	Micaceous, clean, no staining, no odor
2.5													0.0 / 0.0			
3													0.0 / 0.0			
3.5													0.0 / 0.0			
4													0.0 / 0.0			
4.5	Silt	SM	Olive gray		Increasing plasticity, non-cohesive		wet	Fine-grained					0.0 / 0.0			Increasing plasticity near bottom of interval
5													0.0 / 0.0	B		Collect sample "F400B-SC-080818-B" at 5 ft bss for TOC and COD

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
5.5	Silty sand	SM-SW	Olive gray	Well-graded	Low plasticity		dry	Fine-grained					0.0 / 0.0			Micaceous, clean
6																
6.5													0.0 / 0.0			End of recovery 6.5 ft bss
7																
7.5																
8																
8.5																
9																
9.5																
10																End of boring 10 ft bss

Sample Summary (check boxes for analysis):

Sample ID	Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)
F400B-SC-080818-A		8/8/2018 11:55	1 ft
F400B-SC-080818-B		8/8/2018 12:00	5 ft

Reviewed by: DF Date: 12/20/2018

Site Name: BNSF Track Switching Facility
Project Number: 693282
Project Location: Wishram, WA
Survey Duration:

Station ID:	G200	**Easting (X) (ft):**	1520554.09		**Attempt 1** / **Refusal? Y/N**
Sampling:	Yes	**Northing (Y) (ft):**	117949.19	**Penetration (ft):**	6.9 ft bss
Crew/Company:	Gravity	**Datum:**	NAVD88	**Recovery (ft):**	4.3 ft bss
		Depth (ft):	10.2	**Date/Time:**	8/7/2018
		Water Surface Elevation:	160.1		
		St. Arrival:	15:00		**Attempt 2** / **Refusal? Y/N**
Vessel:	26-foot aluminum flat-bottom w/3 spuds	**St. Depart:**	15:20	**Penetration (ft):**	
Collection:	Direct-Push (Power Pro 9100 P)	**Logged by:**	J. Ulrich	**Recovery (ft):**	
Collector Information:				**Date/Time:**	

Note: Location Coordinates reference NAD 83 WA South State Plane

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
0.5	Silty sand	SW-SM	Olive gray	Well-graded	Non-cohesive		Moist	Fine-grained					0.7			Strong petro odor when casing brought to surface, small marks of smeared product like (smell, etc.) substance on outside of casing Bi-valves present in upper 0-6", micaceous
1													1.3			
1.5																
2																
2.5	Silt with sand	SM	Dark gray with black staining		High plasticity			Fine-grained								Some woody debris, distinct free product throughout, often in "roots" and finer woody strains/debris, much less debris than G260 location
3																
3.5														A		
4																Broken glass jar and metal lid observed at 4.2 feet
4.3																End of recovery at 4.3 ft BSS
4.5																

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
5																
5.5																
6																
6.9																End of boring at 6.9 ft BSS
7																
8																
8.5																
9																
9.5																
10																

Sample Summary (check boxes for analysis):

Sample ID	Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)	
G200-GS-080718		8/7/2018 18:50	0.5	
G200-SC-080718-A		8/7/2018 18:40	3.5	

Reviewed by: DF Date: 12/20/2018

JACOBS

Site Name: BNSF Track Switching Facility
Project Number: 693282
Project Location: Wishram, WA
Survey Duration:

Station ID:	G260	Easting (X) (ft):	1520611.41		Attempt 1 — Refusal? Y/N
Sampling:	Yes	Northing (Y) (ft):	117951.16	Penetration (ft):	7.0 ft bss
Crew/Company:	Gravity	Datum:	NAVD88	Recovery (ft):	4.25 ft bss
		Depth (ft):	10.2	Date/Time:	8/7/2018
		Water Surface Elevation:	160.1		
		St. Arrival:	14:00		Attempt 2 — Refusal? Y/N
Vessel:	26-foot aluminum flat-bottom w/3 spuds	St. Depart:	14:15	Penetration (ft):	
Collection:	Direct-Push (Power Pro 9100 P)	Logged by:	J. Ulrich	Recovery (ft):	
Collector Information:				Date/Time:	

Note: Location Coordinates reference NAD 83 WA South State Plane

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
0	Silty sand	SW-SM	Olive gray	Well-graded	Non-cohesive		Damp	Fine-grained					0.0 / 0.1			Recovered 4.25 ft of material, petro odor noted when casing brought to surface micaceous, zebra (?) muscles at 1st 1-4"
0.5																
1													0.0 / 0.5			
1.5													0.0 / 0.3			
2	Silt with sand	SM	Dark gray-black staining		High plasticity			Fine-grained					0.0 / 2.8		Free product	Distinct lithology change /contamination present down in woody debris, dark gray-black staining particularly in woody debris, present throughout, black iridescent free product most notable in woody debris
2.5													0.0 / 23.2			
3													0.2 / 98.7			
3.5													0.5 / 101.99			
4					increasingly stiff near bottom (last 6")								0.4 / 114.9			
4.25																End of recovery 4.25 ft bss

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
4.5																
5																
5.5																
6																
6.5																
7																End of boring at 7.0 ft BSS
7.5																
8																
8.5																
9																

Sample Summary (check boxes for analysis):

Sample ID	Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)
G260-GS-080718		8/7/2018 18:00	0-0.5
G260-SC-080718-A		8/7/2018 17:25	3.5
G260-SC-080718-A-1		8/7/2018 17:30	3.5
G260-SC-080718-B		8/7/2018 17:10	4

Reviewed by: DF Date: 12/20/2018

JACOBS

Site Name: BNSF Track Switching Facility
Project Number: 693282
Project Location: Wishram, WA
Survey Duration:

Station ID:	I400	**Easting (X) (ft):**	1520760.93	**Attempt 1**	**Refusal? Y/N**
Sampling:	Yes	**Northing (Y) (ft):**	117914.32	**Penetration (ft):**	7.8 ft bss
Crew/Company:	Gravity	**Datum:**	NAVD88	**Recovery (ft):**	5.8 ft bss
		Depth (ft):	18.0	**Date/Time:**	8/9/2018
		Water Surface Elevation:	162.3		
		St. Arrival:	8:50	**Attempt 2**	**Refusal? Y/N**
Vessel:	26-foot aluminum flat-bottom w/3 spuds	**St. Depart:**	9:22	**Penetration (ft):**	
Collection:	Direct-Push (Power Pro 9100 P)	**Logged by:**	J. Ulrich	**Recovery (ft):**	
Collector Information:				**Date/Time:**	

Note: Location Coordinates reference NAD 83 WA South State Plane

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
0	Sand	SP	Olive gray-olive	Poorly-graded	Non-cohesive		Moist	Fine-grained	No odor				0.0 / 0.0		No staining	Clean sand, micaceous, no odor/staining 0-0.5 ft bss grab sample "I400-GS-08"
0.5													0.0 / 0.0			
1													0.0 / 0.0			
1.5													0.0 / 0.0			Same as above, bivalves and minor "roots"/organic matter
2		SP											0.0 / 0.0			
2.5	Silty sand	SM	dark gray	Soft	non-cohesive	discontinuous	moist						0.0 / 0.0	A		Darker/ stiff/ brittle silt-rich section, slightly cemented from 2.5-2.9 ft bss, Core sample at 2.5 ft bss
3	Sand	SP		Poorly-graded				Fine-grained					0.0 / 0.0			Transitions back to poorly-graded, fine-grained micaceous sand
3.5													0.0 / 0.0			
4													0.0 / 0.0			
4.5													0.0 / 0.0			

Additional Notes/Comments: Field team indicates penetration depth of 5.8 ft bss, with observation of recovery to 7.8 ft bss (expansion/vacuuming up additional when retrieving) ? Did not see same recovery in core when logging

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
5													0.0 / 0.0			
5.5	Gravel	GW		Well-graded									0.0 / 0.0			Gravel, sub-rounded - well-rounded pebbles and river rock up to 2.5 in diameter
5.8														B		Core sample at bottom End of recovery at 5.8 ft BSS
6																
6.5																
7																
7.8																End of boring at 7.8 ft BSS
8																
8.5																
9																

Sample Summary (check boxes for analysis):

Sample ID	Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)
I400-GS-08		8/9/2018 10:00	0-0.5
I400-SC-080918-A		8/9/2018 10:15	2.5
I400-SC-080918-B		8/9/2018 11:00	5.8

Reviewed by: DF Date: 12/20/2018

Site Name: BNSF Track Switching Facility
Project Number: 693282
Project Location: Wishram, WA
Survey Duration:

Station ID:	J260	**Easting (X) (ft):**	1520614.66	**Attempt 1**	**Refusal? Y/N**
Sampling:	Yes	**Northing (Y) (ft):**	117891.71	**Penetration (ft):**	7.4 ft bss
Crew/Company:	Gravity	**Datum:**	NAVD88	**Recovery (ft):**	5.4 ft bss
		Depth (ft):	14.7	**Date/Time:**	8/8/2018
		Water Surface Elevation:	161.9		
		St. Arrival:	13:32	**Attempt 2**	**Refusal? Y/N**
Vessel:	26-foot aluminum flat-bottom w/3 spuds	**St. Depart:**	14:15	**Penetration (ft):**	
Collection:	Direct-Push (Power Pro 9100 P)	**Logged by:**	J. Ulrich	**Recovery (ft):**	
Collector Information:				**Date/Time:**	

Note: Location Coordinates reference NAD 83 WA South State Plane

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
0	Sand	SW / SW-SM	Olive gray / dark brown	Well sorted	Cemented silty sand			Fine-grained	Light to no odor				0.0 / 0.0			Micaceous, bivalve in upper 3-4", transitions to heavily rooted with dense cementation around "root" structures
0.5	Silty sand	SM		Med. density	Low plasticity, decreasing plasticity	Lacking structure / turbation (bio?)			Light to no odor				0.0 / 3.6		Dark black NAPL, iridescent, very tacky	Micaceous, "roots"/organic matter, NAPL present, particularly in organic matter clusters, increasing sand content at bottom 4"
1													0.0 / 26.8			
1.5													0.0 / 20.8			
2									Strong petro like odor				0.0 / 15.1			
2.5													0.0 / 79.3			core sampled at 2.5 ft bss
3													0.0 / 62.4			
													0.0 / 23.2			
3.5													0.0 / 72.5			
4	Sand	SW	Olive gray	Well graded, dense					No odor				0.0 / 18.4		No staining	Micaceous, laminar, minor small "roots"/ organic debris, no staining / no odor
4.5													0.0 / 15.3			

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
5													0.0 / 4.0			
5.4													0.0 / 2.2			End of recovery 5.4 ft bss
6																
6.5																
7																
7.4																End of boring @ 7.4 ft bss
8																
8.5																
9																
9.5																

Sample Summary (check boxes for analysis):

Sample ID	Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)	
J260-GS-080818		8/8/2018 17:40	0-0.5	
J260-SC-080818-A		8/8/2018 17:45	2.5	

Reviewed by: DF Date:

Site Name: BNSF Track Switching Facility
Project Number: 693282
Project Location: Wishram, WA
Survey Duration:

Station ID:	K120	Easting (X) (ft):	1520484.45		Attempt 1	Refusal? Y/N
Sampling:	Yes	Northing (Y) (ft):	117855.27	Penetration (ft):	5.4 ft bss
Crew/Company:	Gravity	Datum:	NAVD88	Recovery (ft):	3.7 ft bss
		Depth (ft):	18.9	Date/Time:	8/8/2018
		Water Surface Elevation:	161.7		
		St. Arrival:	14:45		Attempt 2 Refusal? Y/N
Vessel:	26-foot aluminum flat-bottom w/3 spuds	St. Depart:	15:18	Penetration (ft):	
Collection:	Direct-Push (Power Pro 9100 P)	Logged by:	J. Ulrich	Recovery (ft):	
Collector Information:				Date/Time:	

Note: Location Coordinates reference NAD 83 WA South State Plane

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
0	Sand	SW	Olive gray	Well-graded			dry	Fine-grained, massive					0.0 / 0.0			Collect surface grab sample, "K120-GS-080818" at 0-6" at 1640 oxidized zone about 3-6" bss, med. orangish/brown, bivalves present in upper 1 ft
0.5													0.0 / 0.0			
1.1		SW					moist									Same as above but with inclusion of black, high plasticity silt/clay lens discontinuous ~2-3". Does not exhibit on sides of core
1.5																
2													0.0 / 0.2	A		Sandy/silt intrusion, low plasticity at 2.3-2.5 ft
2.5																
3																
3.5		SW														Collect core sample "K120-SC-080818-A" at 1655 Same as above with minimal organic debris
3.7													0.0 / 0.0			Same as above, compact/dense sand at bottom 3" End of recovery at 3.7 ft bss
4.5																

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Breathing Zone / Headspace PID Reading (ppm)	Sample IDs (Single Letter)	Evidence of Contamination	Comments
5																
5.4																End of boring 5.4 ft bss
6																
6.5																
7																
7.5																
8																
8.5																
9																
9.5																

Sample Summary (check boxes for analysis):

Sample ID	Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)													
K120-GS-080818		8/8/2018 16:40	0-0.5 ft													
K120-SC-080818-A		8/8/2018 16:55	3.4													

Reviewed by: DF Date: 12/20/2018

Sediment Core Log Key

MAJOR DIVISIONS			GRAPHIC SYMBOL	GROUP SYMBOL	DESCRIPTION
COARSE-GRAINED MATERIAL	GRAVELS	CLEAN GRAVELS		GW	Well-graded gravel Well-graded gravel with sand
				GP	Poorly graded gravel Poorly graded gravel with sand
		GRAVELS WITH FINES		GW-GM	Well-graded gravel with silt Well-graded gravel with silt and sand
				GW-GC	Well-graded gravel with clay Well graded gravel with clay and sand
				GP-GM	Poorly graded gravel with silt Poorly graded gravel with silt and sand
				GP-GC	Poorly graded gravel with clay Poorly graded gravel with clay and sand
				GM	Silty gravel Silty gravel with sand
				GC	Clayey gravel Clayey gravel with sand
	SANDS	CLEAN SANDS		SW	Well-graded sands Well-graded sand and gravel
				SP	Poorly-graded sands Poorly graded sand with gravel
		SANDS WITH FINES		SW-SM	Well-graded sand with silt Well-graded sand with silt and gravel
				SW-SC	Well-graded sand with clay Well-graded sand with clay and gravel
				SP-SM	Poorly-graded sand with silt Poorly-graded sand with silt and gravel
				SP-SC	Poorly-graded sand with clay Poorly-graded sand with clay and gravel
				SM	Silty sand Silty sand and with gravel
				SC	Clayey sand Clayey sand and with gravel
FINE-GRAINED MATERIALS	SILTS AND CLAYS			CL	Lean clay * Lean clay with sand or gravel * Sandy lean clay * Sandy lean clay with gravel * Gravelly lean clay * Gravelly lean clay with sand
				ML	Silt * Silty with sand or gravel * Sandy silt * Sandy silt with gravel * Gravelly silt * Gravelly silt with sand
				CH	Fat clay * Fat clay with sand or gravel * Sandy fat clay * Gravelly fat clay * Gravelly fat clay with sand
				MH	Elastic silt * Elastic silt with sand or gravel * Sandy elastic silt * Sandy elastic silt with gravel * Gravelly elastic silt * Gravelly elastic silt with sand
				OL/OH	Organic silt * Organic silt with sand or gravel * Sandy organic silt * Sandy organic soil with gravel * Gravelly organic soil * Gravelly organic soil with sand

Well Graded (Engineering) = Poorly Sorted (Geological) = grains of all different sizes mixed together

Poorly Graded (Engineering) = Well Sorted (Geological) = grains are all same size

∩	Shell hash
λλλλ	Peat/organic matter

CONSISTENCY
Penetration of thumb:
<0.25 cm = hard (H)
0.25 - 2.0 cm = firm (F)
2.0 - 4.0 cm = soft (S)
>4.0 cm = very soft (VS)

CEMENTATION
N = not cemented
W = weakly cemented
M = Moderately cemented
S = Strongly cemented

STRUCTURE
H = Homogeneous
S = Stratified
L = Laminated
M = Mottled

COLOR
from Munsell chart

MAXIMUM PARTICLE SIZE
SC = Small Cobble
CP = Coarse Pebble
MP = Medium Pebble
SP = Small Pebble
CS = Coarse Sand
MS = Medium Sand
FS = Fine Sand
VFS = Very Fine Sand
Z = Silt

SA = Sub-angular
VA = Very angular

ODOR
N = None
UNC = Unclassified
S = Sulfur-like
T = Tar-like
PHC = Petroleum hydrocarbon-like

Quantifying Descriptors
Strong
Moderate
Faint

Moisture Content
Wet
Moist
Dry

VISIBLE CONTAMINATION DESCRIPTORS

which can be distinguished by its tendency to break up on the water surface at angles whereas petroleum sheen will be continuous and will not break up.

the soil.

Coated - soil grains are coated with free product – there is not sufficient free-phase material present to saturate the pore spaces.

Blebs - observed discrete sphericals of tar/free product - but for the most part the soil matrix was not visibly contaminated or saturated. Typically this is residual product.

Saturated - the entirety of the pore space for a sample is saturated with NAPL. Care should be taken to ensure that you’re not observing water saturating the pore spaces if you use this term. Depending on viscosity, free-phase saturated materials may freely drain from a soil sample.

Appendix C
Laboratory Analytical Reports

STAT Analysis Corporation
2242 West Harrison St., Suite 200, Chicago, IL 60612-3766
Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com
Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

September 05, 2018

CH2M Hill
2020 SW 4th Avenue
Portland, OR 97201
Telephone:
Fax: (503) 736-2063

Analytical Report for STAT Work Order: 18080529 Revision 0

RE: 693282, BNSF-Wishram, Wishram, WA

Dear Carrie Andrews:

STAT Analysis received 26 samples for the referenced project on 8/14/2018 12:02:00 PM. The analytical results are presented in the following report.

All analyses were performed in accordance with methods as referenced on the analytical report. Those analytical results expressed on a dry weight basis are also noted on the analytical report.

Thank you for the opportunity to serve you and I look forward to working with you in the future. If you have any questions regarding the enclosed materials, please contact me at (312) 733-0551.

Sincerely,

Craig Chawla
Project Manager

STAT Analysis Corporation **Date:** September 05, 2018

Client: CH2M Hill
Project: 693282, BNSF-Wishram, Wishram, WA
Work Order: 18080529 Revision 0

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Tag Number	Collection Date	Date Received
18080529-001A	D240-GS-080618		8/6/2018 2:50:00 PM	8/14/2018
18080529-002A	D260-GS-080618		8/6/2018 3:30:00 PM	8/14/2018
18080529-003A	D420-GS-080618		8/6/2018 4:55:00 PM	8/14/2018
18080529-004A	D150-GS-080718		8/7/2018 7:30:00 AM	8/14/2018
18080529-005A	D220-GS-080718		8/7/2018 7:55:00 AM	8/14/2018
18080529-006A	BG-US01-080718		8/7/2018 8:50:00 AM	8/14/2018
18080529-007A	D200-GS-080718		8/7/2018 12:30:00 PM	8/14/2018
18080529-008A	D200-SC-080718-A		8/7/2018 4:40:00 PM	8/14/2018
18080529-009A	G260-SC-080718-A		8/7/2018 5:25:00 PM	8/14/2018
18080529-010A	G260-SC-080718-A-1		8/7/2018 5:30:00 PM	8/14/2018
18080529-011A	G260-SC-080718-B		8/7/2018 5:10:00 PM	8/14/2018
18080529-012A	G260-GS-080718		8/7/2018 6:00:00 PM	8/14/2018
18080529-013A	G200-GS-080718		8/7/2018 6:50:00 PM	8/14/2018
18080529-014A	G200-SC-080718		8/7/2018 6:40:00 PM	8/14/2018
18080529-015A	F400B-SC-080818-A		8/8/2018 11:55:00 AM	8/14/2018
18080529-016A	F400B-SC-080818-B		8/8/2018 12:00:00 PM	8/14/2018
18080529-017A	F360-SC-080818-A		8/8/2018 1:10:00 PM	8/14/2018
18080529-018A	F360-SC-080818-B		8/8/2018 1:15:00 PM	8/14/2018
18080529-019A	K120-GS-080818		8/8/2018 4:40:00 PM	8/14/2018
18080529-020A	K120-SC-080818-A		8/8/2018 4:55:00 PM	8/14/2018
18080529-021A	J260-GS-080818		8/8/2018 5:40:00 PM	8/14/2018
18080529-022A	J260-SC-080818-A		8/8/2018 5:45:00 PM	8/14/2018
18080529-023A	I400-GS-080918		8/9/2018 10:00:00 AM	8/14/2018
18080529-024A	I400-SC-080918-A		8/9/2018 10:10:00 AM	8/14/2018
18080529-025A	I400-SC-080918-B		8/9/2018 10:15:00 AM	8/14/2018
18080529-026A	Unlabeled Bag		8/9/2018 11:00:00 AM	8/14/2018

STAT Analysis Corporation **Date:** *September 05, 2018*

CLIENT:	CH2M Hill
Project:	693282, BNSF-Wishram, Wishram, WA
Work Order:	18080529 Revision 0

CASE NARRATIVE

The soil samples in this work order were analyzed for COD by preparing a suspension of 1 gram in 10 mL of lab grade water. The samples were mixed using a stir bar and magnetic mixer. Results are expressed on an as received basis.

STAT Analysis Corporation
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Accreditations:IEPA ELAP 100445;ORELAP IL300001;AIHA-LAP, LLC 101160;NVLAP LabCode 101202-0

Date Reported: September 05, 2018
Date Printed: September 05, 2018

ANALYTICAL RESULTS

Client: CH2M Hill
Project: 693282, BNSF-Wishram, Wishram, WA
Work Order: 18080529 Revision 0

Lab ID: 18080529-001 **Collection Date:** 8/6/2018 2:50:00 PM
Client Sample ID: D240-GS-080618 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	ND	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-002 **Collection Date:** 8/6/2018 3:30:00 PM
Client Sample ID: D260-GS-080618 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-003 **Collection Date:** 8/6/2018 4:55:00 PM
Client Sample ID: D420-GS-080618 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-004 **Collection Date:** 8/7/2018 7:30:00 AM
Client Sample ID: D150-GS-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-005 **Collection Date:** 8/7/2018 7:55:00 AM
Client Sample ID: D220-GS-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	250	200	*	mg/Kg	1	8/21/2018

Qualifiers:

ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
HT - Sample received past holding time	E - Value above quantitation range
* - Non-accredited parameter	H - Holding time exceeded

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Accreditations:IEPA ELAP 100445;ORELAP IL300001;AIHA-LAP, LLC 101160;NVLAP LabCode 101202-0

Date Reported: September 05, 2018
Date Printed: September 05, 2018

ANALYTICAL RESULTS

Client: CH2M Hill
Project: 693282, BNSF-Wishram, Wishram, WA
Work Order: 18080529 Revision 0

Lab ID: 18080529-006 **Collection Date:** 8/7/2018 8:50:00 AM
Client Sample ID: BG-US01-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-007 **Collection Date:** 8/7/2018 12:30:00 PM
Client Sample ID: D200-GS-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-008 **Collection Date:** 8/7/2018 4:40:00 PM
Client Sample ID: D200-SC-080718-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	350	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-009 **Collection Date:** 8/7/2018 5:25:00 PM
Client Sample ID: G260-SC-080718-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Lab ID: 18080529-010 **Collection Date:** 8/7/2018 5:30:00 PM
Client Sample ID: G260-SC-080718-A-1 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Qualifiers:

ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
HT - Sample received past holding time
* - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
H - Holding time exceeded

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Date Reported: September 05, 2018
Date Printed: September 05, 2018

ANALYTICAL RESULTS

Client: CH2M Hill
Project: 693282, BNSF-Wishram, Wishram, WA
Work Order: 18080529 Revision 0

Lab ID: 18080529-011 **Collection Date:** 8/7/2018 5:10:00 PM
Client Sample ID: G260-SC-080718-B **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Lab ID: 18080529-012 **Collection Date:** 8/7/2018 6:00:00 PM
Client Sample ID: G260-GS-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-013 **Collection Date:** 8/7/2018 6:50:00 PM
Client Sample ID: G200-GS-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-014 **Collection Date:** 8/7/2018 6:40:00 PM
Client Sample ID: G200-SC-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Lab ID: 18080529-015 **Collection Date:** 8/8/2018 11:55:00 AM
Client Sample ID: F400B-SC-080818-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Qualifiers:

ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
HT - Sample received past holding time	E - Value above quantitation range
* - Non-accredited parameter	H - Holding time exceeded

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Date Reported: September 05, 2018
Date Printed: September 05, 2018

ANALYTICAL RESULTS

Client: CH2M Hill
Project: 693282, BNSF-Wishram, Wishram, WA
Work Order: 18080529 Revision 0

Lab ID: 18080529-016 **Collection Date:** 8/8/2018 12:00:00 PM
Client Sample ID: F400B-SC-080818-B **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	250	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-017 **Collection Date:** 8/8/2018 1:10:00 PM
Client Sample ID: F360-SC-080818-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	480	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-018 **Collection Date:** 8/8/2018 1:15:00 PM
Client Sample ID: F360-SC-080818-B **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Lab ID: 18080529-019 **Collection Date:** 8/8/2018 4:40:00 PM
Client Sample ID: K120-GS-080818 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-020 **Collection Date:** 8/8/2018 4:55:00 PM
Client Sample ID: K120-SC-080818-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
HT - Sample received past holding time
* - Non-accredited parameter
RL - Reporting / Quantitation Limit for the analysis
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
H - Holding time exceeded

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Date Reported: September 05, 2018
Date Printed: September 05, 2018

ANALYTICAL RESULTS

Client: CH2M Hill
Project: 693282, BNSF-Wishram, Wishram, WA
Work Order: 18080529 Revision 0

Lab ID: 18080529-021 **Collection Date:** 8/8/2018 5:40:00 PM
Client Sample ID: J260-GS-080818 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-022 **Collection Date:** 8/8/2018 5:45:00 PM
Client Sample ID: J260-SC-080818-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Lab ID: 18080529-023 **Collection Date:** 8/9/2018 10:00:00 AM
Client Sample ID: I400-GS-080918 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	ND	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-024 **Collection Date:** 8/9/2018 10:10:00 AM
Client Sample ID: I400-SC-080918-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-025 **Collection Date:** 8/9/2018 10:15:00 AM
Client Sample ID: I400-SC-080918-B **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	250	200	*	mg/Kg	1	8/21/2018

Qualifiers:

ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
HT - Sample received past holding time
* - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
H - Holding time exceeded

WD

STAT Analysis Corporation
2242 W. Harrison Suite 200, Chicago, Illinois 60612 Phone: (312) 733-0551 Fax: (312) 733-2386
e-mail address: STATinfo@STATAnalysis.com

CHAIN OF CUSTODY RECORD **Nº: 917130** **Page: 1 of 2**

Company: CH2m | JACOBS
Project Number: 693282 Client Tracking No.:
Project Name: BNSF-Wishram
Project Location: Wishram, WA
Sampler(s): Jennifer Ulrich
Report To: Carrie Andrews / Bernd?? Phone: 503 348 9500 Fax:
QC Level: 1 ___ 2 ___ 3 ___ 4 ___ e-mail: carrie.andrews@jacobs.com

Quote No.:
P.O. No.:
Turn Around Time (Days): 1 2 3 4 5-7 10
Results Needed: / / am/pm

Client Sample Number/Description:	Date Taken	Time Taken	Matrix	Comp.	Grab	Preserv.	No. of Containers	8260	Additional Information:	Lab No.:
D240-GS-080618	8/6/18	1150	SS		X		1	1		001
D260-GS-080618	8/6/18	1530	SS		X		1	1		002
D420-GS-080618	8/6/18	1655	SS		X		1	1		003
D150-GS-080718	8/7/18	0730	SS		X		1	1		004
D220-GS-080718	8/7/18	0755	SS		X		1	1		005
BG-HS01-080718	8/7/18	0850	SS		X		1	1		006
D200-GS-080718	8/7/18	1230	SS		X		1	1		007
D200-SC-080718-A	8/7/18	1640	SS		X		1	1		008
G260-SC-080718-A	8/7/18	1725	SS		X		1	1		009
G260-SC-080718-A-1	8/7/18	1730	SS		X		1	1		010
G260-SC-080718-B	8/7/18	1710	SS		X		1	1		011
G260-GS-080718	8/7/18	1800	SS		X		1	1		012
G200-GS-080718	8/7/18	1850	SS		X		1	1		013
G200-SC-080718	8/7/18	1840	SS		X		1	1		014
F400B-SC-080818-A	8/8/18	1155	SS		X		1	1		015
F400B-SC-080818-B	8/8/18	1200	SS		X		1	1		016
F360-SC-080818-A	8/8/18	1310	SS		X		1	1		017
F360-SC-080818-B	8/8/18	1315	SS		X		1	1		018
K120-GS-080818	8/8/18	1640	SS		X		1	1		019
K120-SC-080818-A	8/8/18	1655	SS		X		1	1		020

Relinquished by: (Signature) Jennifer Ulrich Date/Time: 8/13/18 1200
Received by: (Signature) 7822 8084 9759 Date/Time:
Relinquished by: (Signature) FedEx Date/Time:
Received by: (Signature) Elln Date/Time: 8/14/18 12:02
Relinquished by: (Signature) Date/Time:
Received by: (Signature) Date/Time:

Comments:

Preservation Code: A = None B = HNO_3 C = NaOH D = H_2SO_4 E = HCl F = 5035/EnCore G = Other

Laboratory Work Order No.: 18080529

Received on Ice: Yes ✓ No
Temperature: 3.3 °C

STAT Analysis Corporation
2242 W. Harrison Suite 200, Chicago, Illinois 60612 Phone: (312) 733-0551 Fax: (312) 733-2386
e-mail address: STATinfo@STATAnalysis.com

COD

CHAIN OF CUSTODY RECORD

Nº: 917131

Company: CH2M
Project Number: 693282
Client Tracking No.:
Project Name: BNSF-WISHRAM
Project Location: Wishram, WA
Sampler(s): JWF
Report To: Carrie Andrews
Phone: 503 348 9500
Fax:
QC Level: 1 ___ 2 ___ 3 ___ 4 ___
e-mail: carrie.andrews@Jacobs.com

Quote No.:
P.O. No.:
Turn Around Time (Days): 1 2 3 4 5-7 10
Results Needed: / / am/pm

Client Sample Number/Description:	Date Taken	Time Taken	Matrix	Comp.	Grab	Preserv.	No. of Containers	A / B	Additional Information:	Lab No.:
J2160-GS-080818	8/8/18	1740	SS		X		1	1		021
J2160-SC-080818-A	8/8/18	1745	SS		X		1	1		022
I400-GS-080918	8/9/18	1000	SS		X		1	1		023
I400-SC-080918-A	8/9/18	1010	SS		X		1	1		024
I400-SC-080918-B	8/9/18	1015	SS		X		1	1		025
UNLABELED BAG	8/9/18	1100	SS						HOLD FOR ANALYSIS	026

Relinquished by: (Signature) Jennifer Ulrich	Date/Time: 8/13/18 1200	
Received by: (Signature) 782280849759	Date/Time:	
Relinquished by: (Signature) FedEx	Date/Time:	
Received by: (Signature) [illegible]	Date/Time: 8/14/18 12:02	
Relinquished by: (Signature)	Date/Time:	
Received by: (Signature)	Date/Time:	

Comments:

Preservation Code: A = None B = HNO_3 C = NaOH D = H_2SO_4 E = HCl F = 5035/EnCore G = Other

Laboratory Work Order No.: 18080529

Received on Ice: Yes ✓ No

Temperature: 3.3 °C

STAT Analysis Corporation

Sample Receipt Checklist

Client Name CH2 - PORTLAND

Work Order Number 18080529

Date and Time Received: 8/14/2018 12:02:00 PM

Received by: EAA

Checklist completed by: (Signature) Date 8/14/18

Reviewed by: A.A (Initials) Date 8/15/18

Matrix:

Carrier name FedEx

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels/containers?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container or Temp Blank temperature in compliance?	Yes ☑	No ☐	Temperature 3.3 °C
Water - VOA vials have zero headspace?	No VOA vials submitted ☐	Yes ☐	No ☐
Water - Samples pH checked?	Yes ☐	No ☐	Checked by:
Water - Samples properly preserved?	Yes ☐	No ☐	pH Adjusted?

Any No response must be detailed in the comments section below.

Comments:

Client / Person contacted:

Date contacted:

Contacted by:

Response:

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

1 2 3 4 5 6 7 8 9 10 11

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-79568-1
Client Project/Site: BNSF-Wishram

For:
CH2M Hill, Inc.
2020 SW 4th Ave
Suite 300
Portland, Oregon 97201

Attn: Ms. Carrie Andrews

Kristine D. Allen

Authorized for release by:
9/28/2018 4:15:57 PM
Kristine Allen, Manager of Project Management
(253)248-4970
kristine.allen@testamericainc.com

Designee for

Elaine Walker, Project Manager II
(253)248-4972
elaine.walker@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Job ID: 580-79568-1

Laboratory: TestAmerica Seattle

Narrative

Job Narrative
580-79568-1

Receipt
Thirteen samples were received on 8/14/2018 9:45 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 5.4º C.

Receipt Exceptions

The container submitted for the following sample was not sufficiently sealed: TB-01-080618 (580-79568-13). Loss of volatiles may have occurred.

Grain Size is requested on the COC however containers were not given for this analysis.

GC/MS VOA
Method(s) 5035: The following sample was provided to the laboratory with a significantly different initial weight than the required (10g): The weight should not deviate by more than 20%. The amount provided was below this amount.: D240-GS-080618 (580-79568-1), D420-GS-080618-1 (580-79568-4), D220-GS-080718 (580-79568-5), D200-GS-080718 (580-79568-7), G200-GS-080718 (580-79568-9), K120-GS-080818 (580-79568-10), J260-GS-080818 (580-79568-11), and I400-GS-080918 (580-79568-12).

The tare weight for sample D420-GS-080618 (580-79568-3) was estimated; no mass was listed and the tare weight was illegible on the container label.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

GC VOA
Method(s) NWTPH/VPH: Result may be elevated due to elevated baseline on instrument. Insufficient hold time remaining for reanalysis for the following samples: D240-GS-080618 (580-79568-1), D260-GS-080618 (580-79568-2), D420-GS-080618 (580-79568-3), D420-GS-080618-1 (580-79568-4), D220-GS-080718 (580-79568-5), BG-US01-080718 (580-79568-6), D200-GS-080718 (580-79568-7), G260-GS-080718 (580-79568-8), G200-GS-080718 (580-79568-9), K120-GS-080818 (580-79568-10), J260-GS-080818 (580-79568-11), I400-GS-080918 (580-79568-12), TB-01-080618 (580-79568-13), (CCB 490-537369/22), (CCV 490-537369/2), (CCV 490-537369/24), (CCV 490-537369/30), (LCS 490-537369/19), (LCS 490-537369/26), (LCSD 490-537369/20), (LCSD 490-537369/27), (MB 490-537369/28) and (MB 490-537369/3)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

GC Semi VOA
Method(s) NWTPH/EPH: Surrogate recovery for the following samples were outside control limits: D240-GS-080618 (580-79568-1), D260-GS-080618 (580-79568-2) and D220-GS-080718 (580-79568-5). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) NWTPH/EPH: Surrogate recovery for the following samples were outside of acceptance limits: D420-GS-080618-1 (580-79568-4) and BG-US01-080718 (580-79568-6). There was insufficient sample to perform a re-extraction; therefore, the data have been reported.

Method(s) NWTPH/EPH: The laboratory control sample duplicate (LCSD) for preparation batch 580-281918 and 580-284550 and analytical batch 580-284723 recovered outside acceptance limits for 1-chlorooctadecane (59 %R, >60% required), and C10-C12 aliphatic compounds (69 %R, >70% required).

Method(s) NWTPH/EPH: The following samples were re-prepared outside of preparation holding time due to failing C10-C12 Aliphatics in the original extraction's LCS/LCSD: D240-GS-080618 (580-79568-1), D260-GS-080618 (580-79568-2), D420-GS-080618 (580-79568-3), D420-GS-080618-1 (580-79568-4), D220-GS-080718 (580-79568-5), BG-US01-080718 (580-79568-6), D200-GS-080718 (580-79568-7), G260-GS-080718 (580-79568-8), G200-GS-080718 (580-79568-9), K120-GS-080818 (580-79568-10), J260-GS-080818 (580-79568-11) and I400-GS-080918 (580-79568-12).

Job ID: 580-79568-1 (Continued)

Laboratory: TestAmerica Seattle (Continued)

Method(s) NWTPH/EPH: Surrogate 1-Chlorooctadecane failed in the below samples. Since the samples are out-of-hold re-extracts, the data is qualified and reported. K120-GS-080818 (580-79568-10) and I400-GS-080918 (580-79568-12)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Organic Prep
Method(s) 3550B: A deviation from the Standard Operating Procedure (SOP) occurred. Details are as follows: Insufficient amount of available spike; agreed to use 100uL instead

VOA Prep
Method(s) 5035: Sample already had methanol removed and no mass was listed and the tare weight was scratched up. The tare weight was estimated.
D420-GS-080618 (580-79568-3)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Definitions/Glossary

Client: CH2M Hill, Inc.
Project/Site: BNSF-Wishram

TestAmerica Job ID: 580-79568-1

Qualifiers

GC VOA

Qualifier	Qualifier Description
*	LCS or LCSD is outside acceptance limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

GC Semi VOA

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
X	Surrogate is outside control limits
*	LCS or LCSD is outside acceptance limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample ID: D240-GS-080618
Date Collected: 08/06/18 14:50
Date Received: 08/14/18 09:45

Lab Sample ID: 580-79568-1
Matrix: Solid
Percent Solids: 65.3

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		20	7.9	mg/Kg	☼	08/18/18 19:11	08/20/18 17:48	1
C6-C8 aliphatic (adjusted)	ND		7.7	3.1	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		20	7.9	mg/Kg	☼	08/18/18 19:11	08/20/18 17:48	1
C8-C10 aliphatic (adjusted)	ND		7.7	3.1	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		7.7	3.1	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		20	7.9	mg/Kg	☼	08/18/18 19:11	08/20/18 17:48	1
C10-C12 Aliphatics	ND		20	7.9	mg/Kg	☼	08/18/18 19:11	08/20/18 17:48	1
C5-C6 aliphatics (adjusted)	ND		7.7	3.1	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		20	7.9	mg/Kg	☼	08/18/18 19:11	08/20/18 17:48	1
C10-C12 Aromatics	**13**	**J ***	20	7.9	mg/Kg	☼	08/18/18 19:11	08/20/18 17:48	1
C12-C13 Aromatics	**8.0**	**J**	20	7.9	mg/Kg	☼	08/18/18 19:11	08/20/18 17:48	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*101*		*60 - 140*	*08/18/18 19:11*	*08/20/18 17:48*	*1*
2,5-Dibromotoluene (pid)	*107*		*60 - 140*	*08/18/18 19:11*	*08/20/18 17:48*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		36	6.1	mg/Kg	☼	08/18/18 11:53	09/23/18 22:51	5
C12-C16 Aromatics	ND		36	3.2	mg/Kg	☼	08/18/18 11:53	09/23/18 22:51	5
C16-C21 Aromatics	**37**		36	4.7	mg/Kg	☼	08/18/18 11:53	09/23/18 22:51	5
C21-C34 Aromatics	**230**		36	7.3	mg/Kg	☼	08/18/18 11:53	09/23/18 22:51	5
C10-C12 Aliphatics	ND	H	30	2.9	mg/Kg	☼	09/06/18 09:37	09/19/18 23:29	1
C10-C12 Aliphatics	ND	*	36	3.5	mg/Kg	☼	08/18/18 11:53	09/23/18 22:51	5
C12-C16 Aliphatics	**19**	**J**	36	3.2	mg/Kg	☼	08/18/18 11:53	09/23/18 22:51	5
C16-C21 Aliphatics	**78**		36	4.5	mg/Kg	☼	08/18/18 11:53	09/23/18 22:51	5
C21-C34 Aliphatics	**270**		36	8.8	mg/Kg	☼	08/18/18 11:53	09/23/18 22:51	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*88*		*60 - 140*	*09/06/18 09:37*	*09/19/18 23:29*	*1*
1-Chlorooctadecane	*55*	*X*	*60 - 140*	*08/18/18 11:53*	*09/23/18 22:51*	*5*
o-Terphenyl	*52*	*X*	*60 - 140*	*08/18/18 11:53*	*09/23/18 22:51*	*5*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**65.3**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**34.7**		0.1	0.1	%			08/16/18 09:59	1

Client Sample ID: D260-GS-080618
Lab Sample ID: 580-79568-2
Date Collected: 08/06/18 15:30
Matrix: Solid
Date Received: 08/14/18 09:45
Percent Solids: 62.7

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		12	4.7	mg/Kg	☼	08/18/18 19:11	08/20/18 18:21	1
C6-C8 aliphatic (adjusted)	ND		8.0	3.2	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		12	4.7	mg/Kg	☼	08/18/18 19:11	08/20/18 18:21	1
C8-C10 aliphatic (adjusted)	ND		8.0	3.2	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		8.0	3.2	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		12	4.7	mg/Kg	☼	08/18/18 19:11	08/20/18 18:21	1
C10-C12 Aliphatics	ND		12	4.7	mg/Kg	☼	08/18/18 19:11	08/20/18 18:21	1
C5-C6 aliphatics (adjusted)	ND		8.0	3.2	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		12	4.7	mg/Kg	☼	08/18/18 19:11	08/20/18 18:21	1
C10-C12 Aromatics	**8.1**	**J ***	12	4.7	mg/Kg	☼	08/18/18 19:11	08/20/18 18:21	1
C12-C13 Aromatics	ND		12	4.7	mg/Kg	☼	08/18/18 19:11	08/20/18 18:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*100*		*60 - 140*	*08/18/18 19:11*	*08/20/18 18:21*	*1*
2,5-Dibromotoluene (pid)	*107*		*60 - 140*	*08/18/18 19:11*	*08/20/18 18:21*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		7.9	1.3	mg/Kg	☼	08/18/18 11:53	09/23/18 23:16	1
C12-C16 Aromatics	ND		7.9	0.70	mg/Kg	☼	08/18/18 11:53	09/23/18 23:16	1
C16-C21 Aromatics	**5.6**	**J**	7.9	1.0	mg/Kg	☼	08/18/18 11:53	09/23/18 23:16	1
C21-C34 Aromatics	**47**		7.9	1.6	mg/Kg	☼	08/18/18 11:53	09/23/18 23:16	1
C10-C12 Aliphatics	ND	H	31	3.0	mg/Kg	☼	09/06/18 09:37	09/19/18 23:55	1
C10-C12 Aliphatics	ND	*	7.9	0.76	mg/Kg	☼	08/18/18 11:53	09/23/18 23:16	1
C12-C16 Aliphatics	**2.1**	**J**	7.9	0.70	mg/Kg	☼	08/18/18 11:53	09/23/18 23:16	1
C16-C21 Aliphatics	**11**		7.9	0.97	mg/Kg	☼	08/18/18 11:53	09/23/18 23:16	1
C21-C34 Aliphatics	**50**		7.9	1.9	mg/Kg	☼	08/18/18 11:53	09/23/18 23:16	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*89*		*60 - 140*	*09/06/18 09:37*	*09/19/18 23:55*	*1*
1-Chlorooctadecane	*57*	*X*	*60 - 140*	*08/18/18 11:53*	*09/23/18 23:16*	*1*
o-Terphenyl	*59*	*X*	*60 - 140*	*08/18/18 11:53*	*09/23/18 23:16*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**62.7**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**37.3**		0.1	0.1	%			08/16/18 09:59	1

Client Sample Results

Client: CH2M Hill, Inc.
Project/Site: BNSF-Wishram

TestAmerica Job ID: 580-79568-1

Client Sample ID: D420-GS-080618

Lab Sample ID: 580-79568-3

Date Collected: 08/06/18 16:55
Date Received: 08/14/18 09:45

Matrix: Solid
Percent Solids: 72.7

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		13	5.2	mg/Kg	☼	08/18/18 19:11	08/20/18 18:53	1
C6-C8 aliphatic (adjusted)	ND		6.9	2.8	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		13	5.2	mg/Kg	☼	08/18/18 19:11	08/20/18 18:53	1
C8-C10 aliphatic (adjusted)	ND		6.9	2.8	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		6.9	2.8	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		13	5.2	mg/Kg	☼	08/18/18 19:11	08/20/18 18:53	1
C10-C12 Aliphatics	**5.8**	**J**	13	5.2	mg/Kg	☼	08/18/18 19:11	08/20/18 18:53	1
C5-C6 aliphatics (adjusted)	ND		6.9	2.8	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		13	5.2	mg/Kg	☼	08/18/18 19:11	08/20/18 18:53	1
C10-C12 Aromatics	**8.9**	**J ***	13	5.2	mg/Kg	☼	08/18/18 19:11	08/20/18 18:53	1
C12-C13 Aromatics	ND		13	5.2	mg/Kg	☼	08/18/18 19:11	08/20/18 18:53	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*102*		*60 - 140*	*08/18/18 19:11*	*08/20/18 18:53*	*1*
2,5-Dibromotoluene (pid)	*108*		*60 - 140*	*08/18/18 19:11*	*08/20/18 18:53*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		6.9	1.2	mg/Kg	☼	08/18/18 11:53	09/23/18 23:42	1
C12-C16 Aromatics	ND		6.9	0.60	mg/Kg	☼	08/18/18 11:53	09/23/18 23:42	1
C16-C21 Aromatics	**1.2**	**J**	6.9	0.88	mg/Kg	☼	08/18/18 11:53	09/23/18 23:42	1
C21-C34 Aromatics	**4.6**	**J**	6.9	1.4	mg/Kg	☼	08/18/18 11:53	09/23/18 23:42	1
C10-C12 Aliphatics	**3.0**	**J H**	14	1.3	mg/Kg	☼	09/06/18 09:37	09/20/18 00:20	1
C10-C12 Aliphatics	ND	*	6.9	0.66	mg/Kg	☼	08/18/18 11:53	09/23/18 23:42	1
C12-C16 Aliphatics	ND		6.9	0.60	mg/Kg	☼	08/18/18 11:53	09/23/18 23:42	1
C16-C21 Aliphatics	**1.1**	**J**	6.9	0.84	mg/Kg	☼	08/18/18 11:53	09/23/18 23:42	1
C21-C34 Aliphatics	**3.2**	**J**	6.9	1.6	mg/Kg	☼	08/18/18 11:53	09/23/18 23:42	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*123*		*60 - 140*	*09/06/18 09:37*	*09/20/18 00:20*	*1*
1-Chlorooctadecane	*79*		*60 - 140*	*08/18/18 11:53*	*09/23/18 23:42*	*1*
o-Terphenyl	*81*		*60 - 140*	*08/18/18 11:53*	*09/23/18 23:42*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**72.7**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**27.3**		0.1	0.1	%			08/16/18 09:59	1

Client Sample Results

Client: CH2M Hill, Inc.
Project/Site: BNSF-Wishram

TestAmerica Job ID: 580-79568-1

Client Sample ID: D420-GS-080618-1

Date Collected: 08/06/18 17:00
Date Received: 08/14/18 09:45

Lab Sample ID: 580-79568-4

Matrix: Solid
Percent Solids: 72.2

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	**5.3**	**J**	12	4.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:26	1
C6-C8 aliphatic (adjusted)	ND		6.9	2.8	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		12	4.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:26	1
C8-C10 aliphatic (adjusted)	ND		6.9	2.8	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		6.9	2.8	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		12	4.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:26	1
C10-C12 Aliphatics	ND		12	4.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:26	1
C5-C6 aliphatics (adjusted)	**5.3**	**J**	6.9	2.8	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		12	4.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:26	1
C10-C12 Aromatics	**9.4**	**J ***	12	4.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:26	1
C12-C13 Aromatics	ND		12	4.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:26	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*102*		*60 - 140*	*08/18/18 19:11*	*08/20/18 19:26*	*1*
2,5-Dibromotoluene (pid)	*108*		*60 - 140*	*08/18/18 19:11*	*08/20/18 19:26*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		6.8	1.1	mg/Kg	☼	08/18/18 11:53	09/24/18 00:07	1
C12-C16 Aromatics	ND		6.8	0.59	mg/Kg	☼	08/18/18 11:53	09/24/18 00:07	1
C16-C21 Aromatics	**0.92**	**J**	6.8	0.86	mg/Kg	☼	08/18/18 11:53	09/24/18 00:07	1
C21-C34 Aromatics	**3.2**	**J**	6.8	1.4	mg/Kg	☼	08/18/18 11:53	09/24/18 00:07	1
C10-C12 Aliphatics	ND	H	14	1.3	mg/Kg	☼	09/06/18 09:37	09/20/18 00:46	1
C10-C12 Aliphatics	ND	*	6.8	0.65	mg/Kg	☼	08/18/18 11:53	09/24/18 00:07	1
C12-C16 Aliphatics	ND		6.8	0.59	mg/Kg	☼	08/18/18 11:53	09/24/18 00:07	1
C16-C21 Aliphatics	ND		6.8	0.82	mg/Kg	☼	08/18/18 11:53	09/24/18 00:07	1
C21-C34 Aliphatics	**2.9**	**J**	6.8	1.6	mg/Kg	☼	08/18/18 11:53	09/24/18 00:07	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*79*		*60 - 140*	*09/06/18 09:37*	*09/20/18 00:46*	*1*
1-Chlorooctadecane	*64*		*60 - 140*	*08/18/18 11:53*	*09/24/18 00:07*	*1*
o-Terphenyl	*51*	*X*	*60 - 140*	*08/18/18 11:53*	*09/24/18 00:07*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**72.2**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**27.8**		0.1	0.1	%			08/16/18 09:59	1

1 2 3 4 5 6 7 8 9 10 11

Client Sample ID: D220-GS-080718 Lab Sample ID: 580-79568-5

Date Collected: 08/07/18 07:55 **Matrix: Solid**
Date Received: 08/14/18 09:45 **Percent Solids: 66.1**

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		15	5.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:58	1
C6-C8 aliphatic (adjusted)	ND		7.6	3.0	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		15	5.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:58	1
C8-C10 aliphatic (adjusted)	ND		7.6	3.0	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		7.6	3.0	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		15	5.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:58	1
C10-C12 Aliphatics	ND		15	5.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:58	1
C5-C6 aliphatics (adjusted)	ND		7.6	3.0	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		15	5.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:58	1
C10-C12 Aromatics	**11**	**J ***	15	5.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:58	1
C12-C13 Aromatics	**7.5**	**J**	15	5.8	mg/Kg	☼	08/18/18 19:11	08/20/18 19:58	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*101*		*60 - 140*	*08/18/18 19:11*	*08/20/18 19:58*	*1*
2,5-Dibromotoluene (pid)	*106*		*60 - 140*	*08/18/18 19:11*	*08/20/18 19:58*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		37	6.2	mg/Kg	☼	08/18/18 11:53	09/24/18 00:32	5
C12-C16 Aromatics	ND		37	3.3	mg/Kg	☼	08/18/18 11:53	09/24/18 00:32	5
C16-C21 Aromatics	**33**	**J**	37	4.7	mg/Kg	☼	08/18/18 11:53	09/24/18 00:32	5
C21-C34 Aromatics	**190**		37	7.4	mg/Kg	☼	08/18/18 11:53	09/24/18 00:32	5
C10-C12 Aliphatics	ND	H	29	2.8	mg/Kg	☼	09/06/18 09:37	09/20/18 01:12	1
C10-C12 Aliphatics	ND	*	37	3.6	mg/Kg	☼	08/18/18 11:53	09/24/18 00:32	5
C12-C16 Aliphatics	**16**	**J**	37	3.3	mg/Kg	☼	08/18/18 11:53	09/24/18 00:32	5
C16-C21 Aliphatics	**55**		37	4.5	mg/Kg	☼	08/18/18 11:53	09/24/18 00:32	5
C21-C34 Aliphatics	**180**		37	8.9	mg/Kg	☼	08/18/18 11:53	09/24/18 00:32	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*63*		*60 - 140*	*09/06/18 09:37*	*09/20/18 01:12*	*1*
1-Chlorooctadecane	*44*	*X*	*60 - 140*	*08/18/18 11:53*	*09/24/18 00:32*	*5*
o-Terphenyl	*50*	*X*	*60 - 140*	*08/18/18 11:53*	*09/24/18 00:32*	*5*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**66.1**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**33.9**		0.1	0.1	%			08/16/18 09:59	1

Client: CH2M Hill, Inc.
Project/Site: BNSF-Wishram

TestAmerica Job ID: 580-79568-1

Client Sample ID: BG-US01-080718

Date Collected: 08/07/18 08:50
Date Received: 08/14/18 09:45

Lab Sample ID: 580-79568-6

Matrix: Solid
Percent Solids: 73.0

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	**3.8**	**J**	9.6	3.8	mg/Kg	☼	08/18/18 19:11	08/20/18 20:32	1
C6-C8 aliphatic (adjusted)	ND		6.9	2.7	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		9.6	3.8	mg/Kg	☼	08/18/18 19:11	08/20/18 20:32	1
C8-C10 aliphatic (adjusted)	ND		6.9	2.7	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		6.9	2.7	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		9.6	3.8	mg/Kg	☼	08/18/18 19:11	08/20/18 20:32	1
C10-C12 Aliphatics	ND		9.6	3.8	mg/Kg	☼	08/18/18 19:11	08/20/18 20:32	1
C5-C6 aliphatics (adjusted)	**3.8**	**J**	6.9	2.7	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		9.6	3.8	mg/Kg	☼	08/18/18 19:11	08/20/18 20:32	1
C10-C12 Aromatics	**7.0**	**J ***	9.6	3.8	mg/Kg	☼	08/18/18 19:11	08/20/18 20:32	1
C12-C13 Aromatics	ND		9.6	3.8	mg/Kg	☼	08/18/18 19:11	08/20/18 20:32	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*99*		*60 - 140*	*08/18/18 19:11*	*08/20/18 20:32*	*1*
2,5-Dibromotoluene (pid)	*106*		*60 - 140*	*08/18/18 19:11*	*08/20/18 20:32*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		6.6	1.1	mg/Kg	☼	08/18/18 11:53	09/24/18 00:57	1
C12-C16 Aromatics	ND		6.6	0.58	mg/Kg	☼	08/18/18 11:53	09/24/18 00:57	1
C16-C21 Aromatics	ND		6.6	0.85	mg/Kg	☼	08/18/18 11:53	09/24/18 00:57	1
C21-C34 Aromatics	ND		6.6	1.3	mg/Kg	☼	08/18/18 11:53	09/24/18 00:57	1
C10-C12 Aliphatics	ND	H	6.7	0.65	mg/Kg	☼	09/06/18 09:37	09/20/18 01:38	1
C10-C12 Aliphatics	ND	*	6.6	0.63	mg/Kg	☼	08/18/18 11:53	09/24/18 00:57	1
C12-C16 Aliphatics	ND		6.6	0.58	mg/Kg	☼	08/18/18 11:53	09/24/18 00:57	1
C16-C21 Aliphatics	ND		6.6	0.81	mg/Kg	☼	08/18/18 11:53	09/24/18 00:57	1
C21-C34 Aliphatics	ND		6.6	1.6	mg/Kg	☼	08/18/18 11:53	09/24/18 00:57	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*88*		*60 - 140*	*09/06/18 09:37*	*09/20/18 01:38*	*1*
1-Chlorooctadecane	*61*		*60 - 140*	*08/18/18 11:53*	*09/24/18 00:57*	*1*
o-Terphenyl	*52*	*X*	*60 - 140*	*08/18/18 11:53*	*09/24/18 00:57*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**73.0**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**27.0**		0.1	0.1	%			08/16/18 09:59	1

Client Sample ID: D200-GS-080718

Date Collected: 08/07/18 12:30
Date Received: 08/14/18 09:45

Lab Sample ID: 580-79568-7

Matrix: Solid
Percent Solids: 67.4

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		7.2	2.9	mg/Kg	☼	08/18/18 19:11	08/20/18 21:05	1
C6-C8 aliphatic (adjusted)	ND		7.4	3.0	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		7.2	2.9	mg/Kg	☼	08/18/18 19:11	08/20/18 21:05	1
C8-C10 aliphatic (adjusted)	ND		7.4	3.0	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		7.4	3.0	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		7.2	2.9	mg/Kg	☼	08/18/18 19:11	08/20/18 21:05	1
C10-C12 Aliphatics	ND		7.2	2.9	mg/Kg	☼	08/18/18 19:11	08/20/18 21:05	1
C5-C6 aliphatics (adjusted)	ND		7.4	3.0	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		7.2	2.9	mg/Kg	☼	08/18/18 19:11	08/20/18 21:05	1
C10-C12 Aromatics	**5.1**	**J ***	7.2	2.9	mg/Kg	☼	08/18/18 19:11	08/20/18 21:05	1
C12-C13 Aromatics	ND		7.2	2.9	mg/Kg	☼	08/18/18 19:11	08/20/18 21:05	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*93*		*60 - 140*	*08/18/18 19:11*	*08/20/18 21:05*	*1*
2,5-Dibromotoluene (pid)	*101*		*60 - 140*	*08/18/18 19:11*	*08/20/18 21:05*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		7.3	1.2	mg/Kg	☼	08/18/18 11:53	09/24/18 01:22	1
C12-C16 Aromatics	**1.5**	**J**	7.3	0.65	mg/Kg	☼	08/18/18 11:53	09/24/18 01:22	1
C16-C21 Aromatics	**9.4**		7.3	0.94	mg/Kg	☼	08/18/18 11:53	09/24/18 01:22	1
C21-C34 Aromatics	**31**		7.3	1.5	mg/Kg	☼	08/18/18 11:53	09/24/18 01:22	1
C10-C12 Aliphatics	**0.85**	**J H**	7.2	0.69	mg/Kg	☼	09/06/18 09:37	09/20/18 02:03	1
C10-C12 Aliphatics	ND	*	7.3	0.70	mg/Kg	☼	08/18/18 11:53	09/24/18 01:22	1
C12-C16 Aliphatics	**4.3**	**J**	7.3	0.65	mg/Kg	☼	08/18/18 11:53	09/24/18 01:22	1
C16-C21 Aliphatics	**11**		7.3	0.90	mg/Kg	☼	08/18/18 11:53	09/24/18 01:22	1
C21-C34 Aliphatics	**30**		7.3	1.8	mg/Kg	☼	08/18/18 11:53	09/24/18 01:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*74*		*60 - 140*	*09/06/18 09:37*	*09/20/18 02:03*	*1*
1-Chlorooctadecane	*64*		*60 - 140*	*08/18/18 11:53*	*09/24/18 01:22*	*1*
o-Terphenyl	*65*		*60 - 140*	*08/18/18 11:53*	*09/24/18 01:22*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**67.4**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**32.6**		0.1	0.1	%			08/16/18 09:59	1

Client Sample ID: G260-GS-080718

Date Collected: 08/07/18 18:00
Date Received: 08/14/18 09:45

Lab Sample ID: 580-79568-8

Matrix: Solid
Percent Solids: 70.7

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		8.0	3.2	mg/Kg	☼	08/18/18 19:11	08/20/18 21:37	1
C6-C8 aliphatic (adjusted)	ND		7.1	2.8	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		8.0	3.2	mg/Kg	☼	08/18/18 19:11	08/20/18 21:37	1
C8-C10 aliphatic (adjusted)	ND		7.1	2.8	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		7.1	2.8	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		8.0	3.2	mg/Kg	☼	08/18/18 19:11	08/20/18 21:37	1
C10-C12 Aliphatics	ND		8.0	3.2	mg/Kg	☼	08/18/18 19:11	08/20/18 21:37	1
C5-C6 aliphatics (adjusted)	ND		7.1	2.8	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		8.0	3.2	mg/Kg	☼	08/18/18 19:11	08/20/18 21:37	1
C10-C12 Aromatics	**5.3**	**J ***	8.0	3.2	mg/Kg	☼	08/18/18 19:11	08/20/18 21:37	1
C12-C13 Aromatics	ND		8.0	3.2	mg/Kg	☼	08/18/18 19:11	08/20/18 21:37	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*97*		*60 - 140*	*08/18/18 19:11*	*08/20/18 21:37*	*1*
2,5-Dibromotoluene (pid)	*105*		*60 - 140*	*08/18/18 19:11*	*08/20/18 21:37*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		7.0	1.2	mg/Kg	☼	08/18/18 11:53	09/24/18 02:12	1
C12-C16 Aromatics	ND		7.0	0.61	mg/Kg	☼	08/18/18 11:53	09/24/18 02:12	1
C16-C21 Aromatics	**1.4**	**J**	7.0	0.89	mg/Kg	☼	08/18/18 11:53	09/24/18 02:12	1
C21-C34 Aromatics	**4.1**	**J**	7.0	1.4	mg/Kg	☼	08/18/18 11:53	09/24/18 02:12	1
C10-C12 Aliphatics	ND	H	7.0	0.67	mg/Kg	☼	09/06/18 09:37	09/20/18 02:54	1
C10-C12 Aliphatics	ND	*	7.0	0.67	mg/Kg	☼	08/18/18 11:53	09/24/18 02:12	1
C12-C16 Aliphatics	ND		7.0	0.61	mg/Kg	☼	08/18/18 11:53	09/24/18 02:12	1
C16-C21 Aliphatics	**1.1**	**J**	7.0	0.85	mg/Kg	☼	08/18/18 11:53	09/24/18 02:12	1
C21-C34 Aliphatics	**4.4**	**J**	7.0	1.7	mg/Kg	☼	08/18/18 11:53	09/24/18 02:12	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*79*		*60 - 140*	*09/06/18 09:37*	*09/20/18 02:54*	*1*
1-Chlorooctadecane	*67*		*60 - 140*	*08/18/18 11:53*	*09/24/18 02:12*	*1*
o-Terphenyl	*76*		*60 - 140*	*08/18/18 11:53*	*09/24/18 02:12*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**70.7**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**29.3**		0.1	0.1	%			08/16/18 09:59	1

1 2 3 4 5 6 7 8 9 10 11

Client Sample ID: G200-GS-080718

Date Collected: 08/07/18 18:50
Date Received: 08/14/18 09:45

Lab Sample ID: 580-79568-9

Matrix: Solid
Percent Solids: 70.1

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		7.7	3.1	mg/Kg	☼	08/18/18 19:11	08/20/18 22:10	1
C6-C8 aliphatic (adjusted)	ND		7.1	2.9	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		7.7	3.1	mg/Kg	☼	08/18/18 19:11	08/20/18 22:10	1
C8-C10 aliphatic (adjusted)	ND		7.1	2.9	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		7.1	2.9	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		7.7	3.1	mg/Kg	☼	08/18/18 19:11	08/20/18 22:10	1
C10-C12 Aliphatics	ND		7.7	3.1	mg/Kg	☼	08/18/18 19:11	08/20/18 22:10	1
C5-C6 aliphatics (adjusted)	ND		7.1	2.9	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		7.7	3.1	mg/Kg	☼	08/18/18 19:11	08/20/18 22:10	1
C10-C12 Aromatics	**5.2**	**J ***	7.7	3.1	mg/Kg	☼	08/18/18 19:11	08/20/18 22:10	1
C12-C13 Aromatics	ND		7.7	3.1	mg/Kg	☼	08/18/18 19:11	08/20/18 22:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*96*		*60 - 140*	*08/18/18 19:11*	*08/20/18 22:10*	*1*
2,5-Dibromotoluene (pid)	*103*		*60 - 140*	*08/18/18 19:11*	*08/20/18 22:10*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		7.0	1.2	mg/Kg	☼	08/18/18 11:53	09/24/18 02:37	1
C12-C16 Aromatics	ND		7.0	0.62	mg/Kg	☼	08/18/18 11:53	09/24/18 02:37	1
C16-C21 Aromatics	**4.3**	**J**	7.0	0.90	mg/Kg	☼	08/18/18 11:53	09/24/18 02:37	1
C21-C34 Aromatics	**19**		7.0	1.4	mg/Kg	☼	08/18/18 11:53	09/24/18 02:37	1
C10-C12 Aliphatics	ND	H	14	1.3	mg/Kg	☼	09/06/18 09:37	09/20/18 03:20	1
C10-C12 Aliphatics	ND	*	7.0	0.67	mg/Kg	☼	08/18/18 11:53	09/24/18 02:37	1
C12-C16 Aliphatics	**1.3**	**J**	7.0	0.62	mg/Kg	☼	08/18/18 11:53	09/24/18 02:37	1
C16-C21 Aliphatics	**3.8**	**J**	7.0	0.86	mg/Kg	☼	08/18/18 11:53	09/24/18 02:37	1
C21-C34 Aliphatics	**14**		7.0	1.7	mg/Kg	☼	08/18/18 11:53	09/24/18 02:37	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*74*		*60 - 140*	*09/06/18 09:37*	*09/20/18 03:20*	*1*
1-Chlorooctadecane	*66*		*60 - 140*	*08/18/18 11:53*	*09/24/18 02:37*	*1*
o-Terphenyl	*71*		*60 - 140*	*08/18/18 11:53*	*09/24/18 02:37*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**70.1**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**29.9**		0.1	0.1	%			08/16/18 09:59	1

Client Sample ID: K120-GS-080818

Lab Sample ID: 580-79568-10

Date Collected: 08/08/18 16:40
Matrix: Solid
Date Received: 08/14/18 09:45
Percent Solids: 77.3

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		10	4.2	mg/Kg	☼	08/18/18 19:11	08/20/18 22:42	1
C6-C8 aliphatic (adjusted)	ND		6.5	2.6	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		10	4.2	mg/Kg	☼	08/18/18 19:11	08/20/18 22:42	1
C8-C10 aliphatic (adjusted)	ND		6.5	2.6	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		6.5	2.6	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		10	4.2	mg/Kg	☼	08/18/18 19:11	08/20/18 22:42	1
C10-C12 Aliphatics	ND		10	4.2	mg/Kg	☼	08/18/18 19:11	08/20/18 22:42	1
C5-C6 aliphatics (adjusted)	ND		6.5	2.6	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		10	4.2	mg/Kg	☼	08/18/18 19:11	08/20/18 22:42	1
C10-C12 Aromatics	**6.4**	**J ***	10	4.2	mg/Kg	☼	08/18/18 19:11	08/20/18 22:42	1
C12-C13 Aromatics	ND		10	4.2	mg/Kg	☼	08/18/18 19:11	08/20/18 22:42	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*95*		*60 - 140*	*08/18/18 19:11*	*08/20/18 22:42*	*1*
2,5-Dibromotoluene (pid)	*102*		*60 - 140*	*08/18/18 19:11*	*08/20/18 22:42*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		6.4	1.1	mg/Kg	☼	08/18/18 11:53	09/24/18 03:02	1
C12-C16 Aromatics	ND		6.4	0.56	mg/Kg	☼	08/18/18 11:53	09/24/18 03:02	1
C16-C21 Aromatics	**2.5**	**J**	6.4	0.82	mg/Kg	☼	08/18/18 11:53	09/24/18 03:02	1
C21-C34 Aromatics	**20**		6.4	1.3	mg/Kg	☼	08/18/18 11:53	09/24/18 03:02	1
C10-C12 Aliphatics	ND	H	13	1.2	mg/Kg	☼	09/06/18 09:37	09/20/18 03:45	1
C10-C12 Aliphatics	ND	*	6.4	0.61	mg/Kg	☼	08/18/18 11:53	09/24/18 03:02	1
C12-C16 Aliphatics	**0.84**	**J**	6.4	0.56	mg/Kg	☼	08/18/18 11:53	09/24/18 03:02	1
C16-C21 Aliphatics	**3.9**	**J**	6.4	0.78	mg/Kg	☼	08/18/18 11:53	09/24/18 03:02	1
C21-C34 Aliphatics	**17**		6.4	1.5	mg/Kg	☼	08/18/18 11:53	09/24/18 03:02	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*58*	*X*	*60 - 140*	*09/06/18 09:37*	*09/20/18 03:45*	*1*
1-Chlorooctadecane	*74*		*60 - 140*	*08/18/18 11:53*	*09/24/18 03:02*	*1*
o-Terphenyl	*77*		*60 - 140*	*08/18/18 11:53*	*09/24/18 03:02*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**77.3**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**22.7**		0.1	0.1	%			08/16/18 09:59	1

Client Sample ID: J260-GS-080818
Lab Sample ID: 580-79568-11

Date Collected: 08/08/18 17:40
Matrix: Solid
Date Received: 08/14/18 09:45
Percent Solids: 78.7

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		10	4.1	mg/Kg	☼	08/18/18 19:11	08/21/18 17:21	1
C6-C8 aliphatic (adjusted)	ND		6.4	2.5	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		10	4.1	mg/Kg	☼	08/18/18 19:11	08/21/18 17:21	1
C8-C10 aliphatic (adjusted)	ND		6.4	2.5	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		6.4	2.5	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		10	4.1	mg/Kg	☼	08/18/18 19:11	08/21/18 17:21	1
C10-C12 Aliphatics	**4.1**	**J**	10	4.1	mg/Kg	☼	08/18/18 19:11	08/21/18 17:21	1
C5-C6 aliphatics (adjusted)	ND		6.4	2.5	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		10	4.1	mg/Kg	☼	08/18/18 19:11	08/21/18 17:21	1
C10-C12 Aromatics	**5.3**	**J ***	10	4.1	mg/Kg	☼	08/18/18 19:11	08/21/18 17:21	1
C12-C13 Aromatics	**11**		10	4.1	mg/Kg	☼	08/18/18 19:11	08/21/18 17:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*87*		*60 - 140*	*08/18/18 19:11*	*08/21/18 17:21*	*1*
2,5-Dibromotoluene (pid)	*86*		*60 - 140*	*08/18/18 19:11*	*08/21/18 17:21*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		25	4.3	mg/Kg	☼	08/18/18 11:53	09/24/18 03:27	1
C12-C16 Aromatics	**6.5**	**J**	25	2.2	mg/Kg	☼	08/18/18 11:53	09/24/18 03:27	1
C16-C21 Aromatics	**180**		25	3.2	mg/Kg	☼	08/18/18 11:53	09/24/18 03:27	1
C21-C34 Aromatics	**890**		25	5.1	mg/Kg	☼	08/18/18 11:53	09/24/18 03:27	1
C10-C12 Aliphatics	**21**	**J H**	130	12	mg/Kg	☼	09/06/18 09:37	09/20/18 04:11	1
C10-C12 Aliphatics	ND	*	25	2.4	mg/Kg	☼	08/18/18 11:53	09/24/18 03:27	1
C12-C16 Aliphatics	**32**		25	2.2	mg/Kg	☼	08/18/18 11:53	09/24/18 03:27	1
C16-C21 Aliphatics	**87**		25	3.1	mg/Kg	☼	08/18/18 11:53	09/24/18 03:27	1
C21-C34 Aliphatics	**310**		25	6.1	mg/Kg	☼	08/18/18 11:53	09/24/18 03:27	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*71*		*60 - 140*	*09/06/18 09:37*	*09/20/18 04:11*	*1*
1-Chlorooctadecane	*66*		*60 - 140*	*08/18/18 11:53*	*09/24/18 03:27*	*1*
o-Terphenyl	*80*		*60 - 140*	*08/18/18 11:53*	*09/24/18 03:27*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**78.7**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**21.3**		0.1	0.1	%			08/16/18 09:59	1

Client Sample ID: I400-GS-080918

Date Collected: 08/09/18 10:00
Date Received: 08/14/18 09:45

Lab Sample ID: 580-79568-12

Matrix: Solid
Percent Solids: 74.1

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		7.1	2.8	mg/Kg	☼	08/18/18 19:11	08/20/18 23:15	1
C6-C8 aliphatic (adjusted)	ND		6.7	2.7	mg/Kg	☼		08/31/18 07:23	1
C6-C8 Aliphatics	ND		7.1	2.8	mg/Kg	☼	08/18/18 19:11	08/20/18 23:15	1
C8-C10 aliphatic (adjusted)	ND		6.7	2.7	mg/Kg	☼		08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		6.7	2.7	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aliphatics	ND		7.1	2.8	mg/Kg	☼	08/18/18 19:11	08/20/18 23:15	1
C10-C12 Aliphatics	ND		7.1	2.8	mg/Kg	☼	08/18/18 19:11	08/20/18 23:15	1
C5-C6 aliphatics (adjusted)	ND		6.7	2.7	mg/Kg	☼		08/31/18 07:23	1
C8-C10 Aromatics	ND		7.1	2.8	mg/Kg	☼	08/18/18 19:11	08/20/18 23:15	1
C10-C12 Aromatics	**4.5**	**J ***	7.1	2.8	mg/Kg	☼	08/18/18 19:11	08/20/18 23:15	1
C12-C13 Aromatics	ND		7.1	2.8	mg/Kg	☼	08/18/18 19:11	08/20/18 23:15	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*94*		*60 - 140*	*08/18/18 19:11*	*08/20/18 23:15*	*1*
2,5-Dibromotoluene (pid)	*102*		*60 - 140*	*08/18/18 19:11*	*08/20/18 23:15*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		13	2.3	mg/Kg	☼	08/18/18 11:53	09/24/18 03:52	1
C12-C16 Aromatics	ND		13	1.2	mg/Kg	☼	08/18/18 11:53	09/24/18 03:52	1
C16-C21 Aromatics	**8.0**	**J**	13	1.7	mg/Kg	☼	08/18/18 11:53	09/24/18 03:52	1
C21-C34 Aromatics	**60**		13	2.7	mg/Kg	☼	08/18/18 11:53	09/24/18 03:52	1
C10-C12 Aliphatics	ND	H	27	2.6	mg/Kg	☼	09/06/18 09:37	09/20/18 04:36	1
C10-C12 Aliphatics	ND	*	13	1.3	mg/Kg	☼	08/18/18 11:53	09/24/18 03:52	1
C12-C16 Aliphatics	**2.6**	**J**	13	1.2	mg/Kg	☼	08/18/18 11:53	09/24/18 03:52	1
C16-C21 Aliphatics	**15**		13	1.6	mg/Kg	☼	08/18/18 11:53	09/24/18 03:52	1
C21-C34 Aliphatics	**64**		13	3.2	mg/Kg	☼	08/18/18 11:53	09/24/18 03:52	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*52*	*X*	*60 - 140*	*09/06/18 09:37*	*09/20/18 04:36*	*1*
1-Chlorooctadecane	*73*		*60 - 140*	*08/18/18 11:53*	*09/24/18 03:52*	*1*
o-Terphenyl	*86*		*60 - 140*	*08/18/18 11:53*	*09/24/18 03:52*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**74.1**		0.1	0.1	%			08/16/18 09:59	1
Percent Moisture	**25.9**		0.1	0.1	%			08/16/18 09:59	1

Client Sample Results

Client Sample ID: TB-01-080618
Date Collected: 08/06/18 09:00
Date Received: 08/14/18 09:45

Lab Sample ID: 580-79568-13
Matrix: Solid

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		5.0	2.0	mg/Kg		08/18/18 19:11	08/20/18 17:16	1
C6-C8 aliphatic (adjusted)	ND		5.0	2.0	mg/Kg			08/31/18 07:23	1
C6-C8 Aliphatics	ND		5.0	2.0	mg/Kg		08/18/18 19:11	08/20/18 17:16	1
C8-C10 aliphatic (adjusted)	ND		5.0	2.0	mg/Kg			08/31/18 07:23	1
C10-C12 aliphatic (adjusted)	ND		5.0	2.0	mg/Kg			08/31/18 07:23	1
C8-C10 Aliphatics	ND		5.0	2.0	mg/Kg		08/18/18 19:11	08/20/18 17:16	1
C10-C12 Aliphatics	**2.4**	**J**	5.0	2.0	mg/Kg		08/18/18 19:11	08/20/18 17:16	1
C5-C6 aliphatics (adjusted)	ND		5.0	2.0	mg/Kg			08/31/18 07:23	1
C8-C10 Aromatics	ND		5.0	2.0	mg/Kg		08/18/18 19:11	08/20/18 17:16	1
C10-C12 Aromatics	**4.2**	**J ***	5.0	2.0	mg/Kg		08/18/18 19:11	08/20/18 17:16	1
C12-C13 Aromatics	ND		5.0	2.0	mg/Kg		08/18/18 19:11	08/20/18 17:16	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*104*		*60 - 140*	*08/18/18 19:11*	*08/20/18 17:16*	*1*
2,5-Dibromotoluene (pid)	*112*		*60 - 140*	*08/18/18 19:11*	*08/20/18 17:16*	*1*

1 2 3 4 5 6 7 8 9 10 11

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Lab Sample ID: MB 490-537369/28
Client Sample ID: Method Blank
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 537369

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		5.0	2.0	mg/Kg			08/21/18 16:49	1
C6-C8 Aliphatics	ND		5.0	2.0	mg/Kg			08/21/18 16:49	1
C8-C10 Aliphatics	ND		5.0	2.0	mg/Kg			08/21/18 16:49	1
C10-C12 Aliphatics	ND		5.0	2.0	mg/Kg			08/21/18 16:49	1
C8-C10 Aromatics	ND		5.0	2.0	mg/Kg			08/21/18 16:49	1
C10-C12 Aromatics	ND		5.0	2.0	mg/Kg			08/21/18 16:49	1
C12-C13 Aromatics	ND		5.0	2.0	mg/Kg			08/21/18 16:49	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*92*		*60 - 140*		*08/21/18 16:49*	*1*
2,5-Dibromotoluene (pid)	*93*		*60 - 140*		*08/21/18 16:49*	*1*

Lab Sample ID: MB 490-537369/3
Client Sample ID: Method Blank
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 537369

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	ND		5.0	2.0	mg/Kg			08/20/18 16:40	1
C6-C8 Aliphatics	ND		5.0	2.0	mg/Kg			08/20/18 16:40	1
C8-C10 Aliphatics	ND		5.0	2.0	mg/Kg			08/20/18 16:40	1
C10-C12 Aliphatics	ND		5.0	2.0	mg/Kg			08/20/18 16:40	1
C8-C10 Aromatics	ND		5.0	2.0	mg/Kg			08/20/18 16:40	1
C10-C12 Aromatics	ND		5.0	2.0	mg/Kg			08/20/18 16:40	1
C12-C13 Aromatics	ND		5.0	2.0	mg/Kg			08/20/18 16:40	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,5-Dibromotoluene (fid)	*111*		*60 - 140*		*08/20/18 16:40*	*1*
2,5-Dibromotoluene (pid)	*116*		*60 - 140*		*08/20/18 16:40*	*1*

Lab Sample ID: LCS 490-537369/19
Client Sample ID: Lab Control Sample
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 537369

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C5-C6 Aliphatics	15.0	13.8		mg/Kg		92	70 - 130
C6-C8 Aliphatics	10.0	8.52		mg/Kg		85	70 - 130
C8-C10 Aliphatics	30.0	28.3		mg/Kg		94	70 - 130
C10-C12 Aliphatics	10.0	10.7		mg/Kg		107	70 - 130
C8-C10 Aromatics	20.0	20.8		mg/Kg		104	70 - 130
C10-C12 Aromatics	5.00	8.82	*	mg/Kg		176	70 - 130
C12-C13 Aromatics	10.0	10.0		mg/Kg		100	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,5-Dibromotoluene (fid)	*92*		*60 - 140*
2,5-Dibromotoluene (pid)	*100*		*60 - 140*

Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC) (Continued)

Lab Sample ID: LCS 490-537369/26
Matrix: Solid
Analysis Batch: 537369

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C5-C6 Aliphatics	15.0	15.9		mg/Kg		106	70 - 130
C6-C8 Aliphatics	10.0	10.2		mg/Kg		102	70 - 130
C8-C10 Aliphatics	30.0	29.1		mg/Kg		97	70 - 130
C10-C12 Aliphatics	10.0	12.4		mg/Kg		124	70 - 130
C8-C10 Aromatics	20.0	19.5		mg/Kg		97	70 - 130
C10-C12 Aromatics	5.00	7.88	*	mg/Kg		158	70 - 130
C12-C13 Aromatics	10.0	9.68		mg/Kg		97	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,5-Dibromotoluene (fid)	*95*		*60 - 140*
2,5-Dibromotoluene (pid)	*94*		*60 - 140*

Lab Sample ID: LCSD 490-537369/20
Matrix: Solid
Analysis Batch: 537369

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
C5-C6 Aliphatics	15.0	13.3		mg/Kg		89	70 - 130	3	25
C6-C8 Aliphatics	10.0	8.67		mg/Kg		87	70 - 130	2	25
C8-C10 Aliphatics	30.0	26.9		mg/Kg		90	70 - 130	5	25
C10-C12 Aliphatics	10.0	9.98		mg/Kg		100	70 - 130	7	25
C8-C10 Aromatics	20.0	20.0		mg/Kg		100	70 - 130	4	25
C10-C12 Aromatics	5.00	8.60	*	mg/Kg		172	70 - 130	3	25
C12-C13 Aromatics	10.0	9.55		mg/Kg		95	70 - 130	5	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
2,5-Dibromotoluene (fid)	*91*		*60 - 140*
2,5-Dibromotoluene (pid)	*99*		*60 - 140*

Lab Sample ID: LCSD 490-537369/27
Matrix: Solid
Analysis Batch: 537369

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
C5-C6 Aliphatics	15.0	16.3		mg/Kg		109	70 - 130	3	25
C6-C8 Aliphatics	10.0	10.2		mg/Kg		102	70 - 130	0	25
C8-C10 Aliphatics	30.0	29.8		mg/Kg		99	70 - 130	2	25
C10-C12 Aliphatics	10.0	12.5		mg/Kg		125	70 - 130	1	25
C8-C10 Aromatics	20.0	19.7		mg/Kg		98	70 - 130	1	25
C10-C12 Aromatics	5.00	7.67	*	mg/Kg		153	70 - 130	3	25
C12-C13 Aromatics	10.0	9.26		mg/Kg		93	70 - 130	4	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
2,5-Dibromotoluene (fid)	*94*		*60 - 140*
2,5-Dibromotoluene (pid)	*93*		*60 - 140*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Lab Sample ID: MB 580-281918/1-B
Matrix: Solid
Analysis Batch: 284723

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 281918

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aromatics	ND		5.0	0.84	mg/Kg		08/18/18 11:53	09/23/18 21:35	1
C12-C16 Aromatics	ND		5.0	0.44	mg/Kg		08/18/18 11:53	09/23/18 21:35	1
C16-C21 Aromatics	ND		5.0	0.64	mg/Kg		08/18/18 11:53	09/23/18 21:35	1
C21-C34 Aromatics	ND		5.0	1.0	mg/Kg		08/18/18 11:53	09/23/18 21:35	1
C10-C12 Aliphatics	ND		5.0	0.48	mg/Kg		08/18/18 11:53	09/23/18 21:35	1
C12-C16 Aliphatics	ND		5.0	0.44	mg/Kg		08/18/18 11:53	09/23/18 21:35	1
C16-C21 Aliphatics	ND		5.0	0.61	mg/Kg		08/18/18 11:53	09/23/18 21:35	1
C21-C34 Aliphatics	ND		5.0	1.2	mg/Kg		08/18/18 11:53	09/23/18 21:35	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctadecane	*76*		*60 - 140*	*08/18/18 11:53*	*09/23/18 21:35*	*1*
o-Terphenyl	*83*		*60 - 140*	*08/18/18 11:53*	*09/23/18 21:35*	*1*

Lab Sample ID: LCS 580-281918/2-B
Matrix: Solid
Analysis Batch: 284723

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 281918

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C10-C12 Aromatics	6.67	5.33		mg/Kg		80	70 - 130
C12-C16 Aromatics	20.0	16.9		mg/Kg		84	70 - 130
C16-C21 Aromatics	33.3	29.9		mg/Kg		90	70 - 130
C21-C34 Aromatics	53.3	49.9		mg/Kg		94	70 - 130
C10-C12 Aliphatics	6.67	5.30		mg/Kg		79	70 - 130
C12-C16 Aliphatics	13.3	11.9		mg/Kg		89	70 - 130
C16-C21 Aliphatics	20.0	19.2		mg/Kg		96	70 - 130
C21-C34 Aliphatics	40.0	41.9		mg/Kg		105	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1-Chlorooctadecane	*70*		*60 - 140*
o-Terphenyl	*86*		*60 - 140*

Lab Sample ID: LCSD 580-281918/3-B
Matrix: Solid
Analysis Batch: 284723

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 281918

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
C10-C12 Aromatics	6.67	4.89	J	mg/Kg		73	70 - 130	9	25
C12-C16 Aromatics	20.0	15.8		mg/Kg		79	70 - 130	6	25
C16-C21 Aromatics	33.3	29.3		mg/Kg		88	70 - 130	2	25
C21-C34 Aromatics	53.3	48.1		mg/Kg		90	70 - 130	4	25
C10-C12 Aliphatics	6.67	4.63	J *	mg/Kg		69	70 - 130	13	25
C12-C16 Aliphatics	13.3	10.7		mg/Kg		80	70 - 130	10	25
C16-C21 Aliphatics	20.0	17.7		mg/Kg		88	70 - 130	9	25
C21-C34 Aliphatics	40.0	37.7		mg/Kg		94	70 - 130	11	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
1-Chlorooctadecane	*59*	*X*	*60 - 140*

1 2 3 4 5 6 7 8 9 10 11

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC) (Continued)

Lab Sample ID: LCSD 580-281918/3-B **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 284723 **Prep Batch: 281918**

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
o-Terphenyl	*83*		*60 - 140*

Lab Sample ID: MB 580-283342/1-B **Client Sample ID: Method Blank**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 284424 **Prep Batch: 283342**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aliphatics	ND		5.0	0.48	mg/Kg		09/06/18 09:37	09/19/18 22:11	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
1-Chlorooctadecane	*94*		*60 - 140*	*09/06/18 09:37*	*09/19/18 22:11*	*1*

Lab Sample ID: LCS 580-283342/2-B **Client Sample ID: Lab Control Sample**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 284424 **Prep Batch: 283342**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C10-C12 Aliphatics	1.33	1.62	J	mg/Kg		122	70 - 130

Surrogate	LCS %Recovery	LCS Qualifier	Limits
1-Chlorooctadecane	*106*		*60 - 140*

Lab Sample ID: LCSD 580-283342/3-B **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 284424 **Prep Batch: 283342**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
C10-C12 Aliphatics	1.33	1.51	J	mg/Kg		113	70 - 130	7	25

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
1-Chlorooctadecane	*105*		*60 - 140*

Client Sample ID: D240-GS-080618

Lab Sample ID: 580-79568-1

Date Collected: 08/06/18 14:50
Date Received: 08/14/18 09:45

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: D240-GS-080618

Lab Sample ID: 580-79568-1

Date Collected: 08/06/18 14:50
Date Received: 08/14/18 09:45

Matrix: Solid
Percent Solids: 65.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 17:48	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/19/18 23:29	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		5	284723	09/23/18 22:51	JCM	TAL SEA

Client Sample ID: D260-GS-080618

Lab Sample ID: 580-79568-2

Date Collected: 08/06/18 15:30
Date Received: 08/14/18 09:45

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: D260-GS-080618

Lab Sample ID: 580-79568-2

Date Collected: 08/06/18 15:30
Date Received: 08/14/18 09:45

Matrix: Solid
Percent Solids: 62.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 18:21	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/19/18 23:55	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284723	09/23/18 23:16	JCM	TAL SEA

Client Sample ID: D420-GS-080618 — **Lab Sample ID: 580-79568-3**

Date Collected: 08/06/18 16:55 — **Matrix: Solid**

Date Received: 08/14/18 09:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: D420-GS-080618 — **Lab Sample ID: 580-79568-3**

Date Collected: 08/06/18 16:55 — **Matrix: Solid**

Date Received: 08/14/18 09:45 — **Percent Solids: 72.7**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 18:53	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/20/18 00:20	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284723	09/23/18 23:42	JCM	TAL SEA

Client Sample ID: D420-GS-080618-1 — **Lab Sample ID: 580-79568-4**

Date Collected: 08/06/18 17:00 — **Matrix: Solid**

Date Received: 08/14/18 09:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: D420-GS-080618-1 — **Lab Sample ID: 580-79568-4**

Date Collected: 08/06/18 17:00 — **Matrix: Solid**

Date Received: 08/14/18 09:45 — **Percent Solids: 72.2**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 19:26	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/20/18 00:46	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284723	09/24/18 00:07	JCM	TAL SEA

Client Sample ID: D220-GS-080718

Lab Sample ID: 580-79568-5

Date Collected: 08/07/18 07:55
Date Received: 08/14/18 09:45

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: D220-GS-080718

Lab Sample ID: 580-79568-5

Date Collected: 08/07/18 07:55
Date Received: 08/14/18 09:45

Matrix: Solid
Percent Solids: 66.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 19:58	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/20/18 01:12	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		5	284723	09/24/18 00:32	JCM	TAL SEA

Client Sample ID: BG-US01-080718

Lab Sample ID: 580-79568-6

Date Collected: 08/07/18 08:50
Date Received: 08/14/18 09:45

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: BG-US01-080718

Lab Sample ID: 580-79568-6

Date Collected: 08/07/18 08:50
Date Received: 08/14/18 09:45

Matrix: Solid
Percent Solids: 73.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 20:32	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/20/18 01:38	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284723	09/24/18 00:57	JCM	TAL SEA

Client Sample ID: D200-GS-080718

Lab Sample ID: 580-79568-7

Date Collected: 08/07/18 12:30
Matrix: Solid
Date Received: 08/14/18 09:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: D200-GS-080718

Lab Sample ID: 580-79568-7

Date Collected: 08/07/18 12:30
Matrix: Solid
Date Received: 08/14/18 09:45
Percent Solids: 67.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 21:05	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/20/18 02:03	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284723	09/24/18 01:22	JCM	TAL SEA

Client Sample ID: G260-GS-080718

Lab Sample ID: 580-79568-8

Date Collected: 08/07/18 18:00
Matrix: Solid
Date Received: 08/14/18 09:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: G260-GS-080718

Lab Sample ID: 580-79568-8

Date Collected: 08/07/18 18:00
Matrix: Solid
Date Received: 08/14/18 09:45
Percent Solids: 70.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 21:37	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/20/18 02:54	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284723	09/24/18 02:12	JCM	TAL SEA

Client Sample ID: G200-GS-080718

Lab Sample ID: 580-79568-9

Date Collected: 08/07/18 18:50
Date Received: 08/14/18 09:45
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: G200-GS-080718

Lab Sample ID: 580-79568-9

Date Collected: 08/07/18 18:50
Date Received: 08/14/18 09:45
Matrix: Solid
Percent Solids: 70.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 22:10	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/20/18 03:20	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284723	09/24/18 02:37	JCM	TAL SEA

Client Sample ID: K120-GS-080818

Lab Sample ID: 580-79568-10

Date Collected: 08/08/18 16:40
Date Received: 08/14/18 09:45
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: K120-GS-080818

Lab Sample ID: 580-79568-10

Date Collected: 08/08/18 16:40
Date Received: 08/14/18 09:45
Matrix: Solid
Percent Solids: 77.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 22:42	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/20/18 03:45	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284723	09/24/18 03:02	JCM	TAL SEA

Client Sample ID: J260-GS-080818
Lab Sample ID: 580-79568-11

Date Collected: 08/08/18 17:40
Matrix: Solid
Date Received: 08/14/18 09:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: J260-GS-080818
Lab Sample ID: 580-79568-11

Date Collected: 08/08/18 17:40
Matrix: Solid
Date Received: 08/14/18 09:45
Percent Solids: 78.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/21/18 17:21	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/20/18 04:11	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284723	09/24/18 03:27	JCM	TAL SEA

Client Sample ID: I400-GS-080918
Lab Sample ID: 580-79568-12

Date Collected: 08/09/18 10:00
Matrix: Solid
Date Received: 08/14/18 09:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	281716	08/16/18 09:59	BAH	TAL SEA

Client Sample ID: I400-GS-080918
Lab Sample ID: 580-79568-12

Date Collected: 08/09/18 10:00
Matrix: Solid
Date Received: 08/14/18 09:45
Percent Solids: 74.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 23:15	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH
Total/NA	Prep	3550B			283342	09/06/18 09:37	KMS	TAL SEA
Total/NA	Fraction	EPH Frac			283882	09/13/18 10:06	KMS	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284424	09/20/18 04:36	JCM	TAL SEA
Total/NA	Prep	3550B			281918	08/18/18 11:53	BAH	TAL SEA
Total/NA	Fraction	EPH Frac			284550	09/21/18 08:58	BAH	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	284723	09/24/18 03:52	JCM	TAL SEA

Lab Chronicle

Client: CH2M Hill, Inc.
Project/Site: BNSF-Wishram

TestAmerica Job ID: 580-79568-1

Client Sample ID: TB-01-080618
Date Collected: 08/06/18 09:00
Date Received: 08/14/18 09:45

Lab Sample ID: 580-79568-13
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			537113	08/18/18 19:11	DHC	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	537369	08/20/18 17:16	FKG	TAL NSH
Total/NA	Analysis	NWTPH/VPH		1	539936	08/31/18 07:23	FKG	TAL NSH

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Laboratory: TestAmerica Seattle

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
Alaska (UST)	State Program	10	17-024	01-19-19
ANAB	DoD ELAP		L2236	01-19-19
ANAB	ISO/IEC 17025		L2236	01-19-19
California	State Program	9	2901	11-05-18
Montana (UST)	State Program	8	N/A	04-30-20
Nevada	State Program	9	WA000502019-1	07-31-19
Oregon	NELAP	10	WA100007	11-05-18
US Fish & Wildlife	Federal		LE058448-0	07-31-19
USDA	Federal		P330-14-00126	02-10-20
Washington	State Program	10	C553	02-17-19

Laboratory: TestAmerica Nashville

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
A2LA	ISO/IEC 17025		0453.07	12-31-19
Alaska (UST)	State Program	10	UST-087	06-30-19
Arizona	State Program	9	AZ0473	05-05-19
Arkansas DEQ	State Program	6	88-0737	04-25-19
California	State Program	9	2938	10-31-18
Connecticut	State Program	1	PH-0220	12-31-19
Florida	NELAP	4	E87358	06-30-19
Georgia	State Program	4	NA: NELAP & A2LA	12-31-19
Illinois	NELAP	5	200010	12-09-18
Iowa	State Program	7	131	04-01-20
Kansas	NELAP	7	E-10229	10-31-18
Kentucky (UST)	State Program	4	19	06-30-19
Kentucky (WW)	State Program	4	90038	12-31-18
Louisiana	NELAP	6	30613	06-30-19
Maine	State Program	1	TN00032	11-03-19
Maryland	State Program	3	316	03-31-19
Massachusetts	State Program	1	M-TN032	06-30-19
Minnesota	NELAP	5	047-999-345	12-31-18
Mississippi	State Program	4	N/A	06-30-19
Montana (UST)	State Program	8	NA	02-24-20
Nevada	State Program	9	TN00032	07-31-19
New Hampshire	NELAP	1	2963	10-09-18
New Jersey	NELAP	2	TN965	06-30-19
New York	NELAP	2	11342	03-31-19
North Carolina (WW/SW)	State Program	4	387	12-31-18
North Dakota	State Program	8	R-146	06-30-19
Ohio VAP	State Program	5	CL0033	07-06-19
Oklahoma	State Program	6	9412	08-31-19
Oregon	NELAP	10	TN200001	04-26-19
Pennsylvania	NELAP	3	68-00585	07-31-19
Rhode Island	State Program	1	LAO00268	12-30-18
South Carolina	State Program	4	84009 (001)	02-28-19
Tennessee	State Program	4	2008	02-23-20
Texas	NELAP	6	T104704077	08-31-19
USDA	Federal		P330-13-00306	12-01-19

Laboratory: TestAmerica Nashville (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
Utah	NELAP	8	TN00032	07-31-19
Virginia	NELAP	3	460152	06-14-19
Washington	State Program	10	C789	07-19-19
West Virginia DEP	State Program	3	219	02-28-19
Wisconsin	State Program	5	998020430	08-31-19
Wyoming (UST)	A2LA	8	453.07	12-31-19

Sample Summary

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-79568-1	D240-GS-080618	Solid	08/06/18 14:50	08/14/18 09:45
580-79568-2	D260-GS-080618	Solid	08/06/18 15:30	08/14/18 09:45
580-79568-3	D420-GS-080618	Solid	08/06/18 16:55	08/14/18 09:45
580-79568-4	D420-GS-080618-1	Solid	08/06/18 17:00	08/14/18 09:45
580-79568-5	D220-GS-080718	Solid	08/07/18 07:55	08/14/18 09:45
580-79568-6	BG-US01-080718	Solid	08/07/18 08:50	08/14/18 09:45
580-79568-7	D200-GS-080718	Solid	08/07/18 12:30	08/14/18 09:45
580-79568-8	G260-GS-080718	Solid	08/07/18 18:00	08/14/18 09:45
580-79568-9	G200-GS-080718	Solid	08/07/18 18:50	08/14/18 09:45
580-79568-10	K120-GS-080818	Solid	08/08/18 16:40	08/14/18 09:45
580-79568-11	J260-GS-080818	Solid	08/08/18 17:40	08/14/18 09:45
580-79568-12	I400-GS-080918	Solid	08/09/18 10:00	08/14/18 09:45
580-79568-13	TB-01-080618	Solid	08/06/18 09:00	08/14/18 09:45

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Loc: 580
79568

TestAmerica Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.testamericainc.com

EPH | VPH

☐ Rush
☐ Short Hold

Chain of Custody Record

Client: CH2M/Jacobs	Client Contact: Carrie Andrews
Address: 2020 4th Ave, Ste. 300	Telephone Number (Area Code)/Fax Number:
City: Portland; State: OR; Zip Code: 97201	Date: 8/13/18
Project Name and Location (State): BNSF-Wishram; State: WA	Chain of Custody Number: 37667
Sampler: Jennifer Ulrich	Lab Contact: Kristine Ellen
Billing Contact: Carrie Andrews	Lab Number:
Contract/Purchase Order/Quote No.:	Page 1 of 2

no preserve

Analysis (Attach list if more space is needed)

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Soil	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	EPH/Grain Size	VPH (MeOH)	Special Instructions/Conditions of Receipt
D240-GS-080618	8/6/18	1450			X								1	2	
D260-GS-080618	8/6/18	1530			X								1	2	
D420-GS-080618	8/6/18	1655			X								1	1	
D420-GS-080618-1	8/6/18	1700			X								1	2	
~~D150-GS-080718~~	~~8/7/18~~	~~0730~~			~~X~~								~~1~~	~~2~~	NOT INCLUDED
D220-GS-080718	8/7/18	0755			X								1	2	
BG-USA-080718	8/7/18	0850			X								1	2	
D200-GS-080718	8/7/18	1230			X								1	2	
G260-GS-080718	8/7/18	1800			X								1	2	
G200-GS-080718	8/7/18	1850			X								1	2	~~*Remember~~
~~J260~~ K120-GS-080818	8/8/18	1640			X								1	2	~~*Remember~~
J260-GS-080818	8/8/18	1740			X								1	2	~~*Remember~~

Cooler: ☑ Yes ☐ No Cooler Temp: ______

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☑ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days): ☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☐ Other ______

QC Requirements (Specify)

Relinquished By (Sign/Print)	Date	Time	Received By (Sign/Print)	Date	Time
1. Jennifer Ulrich / Jennifer Ulrich	8/13/18	1200	1. Ken Hobbs / Ken Hobbs	8-14-18	0945
2.			2.		
3.			3.		

Comments

Therm. ID: A2 Cor: 5.4° Unc: 5.3°
Cooler Dsc: Lrg Grn FedEx: P.O
Packing: Bubble UPS:
Cust. Seal: Yes No Lab Cour:
Wet Packs/Dry Ice/None Other:

DISTRIBUTION: WHITE – Stays with the Samples; CANA...

580-79568 Chain of Custody

TAL-8274-580 (02/...)

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.testamericainc.com

EPH/VPH

☐ Rush
☐ Short Hold

Chain of Custody Record

Client: CH2M	Client Contact: Carrie Andrews	Date: 8/13/18	Chain of Custody Number: 37452
Address: 2020 4th Ave, Ste. 300	Telephone Number (Area Code)/Fax Number: 503 348 9500	Lab Number	Page 2 of 2
City: Portland · State: OR · Zip Code: 97201	Sampler: Jennifer Ulrich	Lab Contact	
Project Name and Location (State): BNSF - Wishram WA	Billing Contact: Carrie Andrews		
Contract/Purchase Order/Quote No.			

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Soil	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	EPH / Grain size	VPH	Special Instructions/ Conditions of Receipt
I400-GS-080918	8/9/18	1000			X		6						1	2	
TB-01-080618	8/6/18	0900		X										2	

Cooler: ☒ Yes ☐ No Cooler Temp: ______

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days): ☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☐ Other ______

QC Requirements (Specify)

1. Relinquished By Sign/Print: Jennifer Ulrich / Jennifer Ulrich	Date: 8/13/18	Time: 1200	1. Received By Sign/Print: Ken Hobbs / Ken Hobbs	Date: 8-14-18	Time: 945
2. Relinquished By Sign/Print	Date	Time	2. Received By Sign/Print	Date	Time
3. Relinquished By Sign/Print	Date	Time	3. Received By Sign/Print	Date	Time

Comments

DISTRIBUTION: WHITE – Stays with the Samples; CANARY – Returned to Client with Report; PINK – Field Copy

TAL-8274-580 (0210)

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

COOLER RECEIPT FORM

580-79568 Chain of Custody

Cooler Received/Opened On 8/17/2018 @ 1055

Time Samples Removed From Cooler 17:06 Time Samples Placed In Storage 17:18 (2 Hour Window)

1. Tracking # 6262 (last 4 digits, FedEx) Courier: FedEx

IR Gun ID 17610176 pH Strip Lot ______ Chlorine Strip Lot ______

2. Temperature of rep. sample or temp blank when opened: 2.9 *Degrees Celsius*
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 1 (Front)
5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) JJ

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA
8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

● Larger than this.

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # ______

I certify that I unloaded the cooler and answered questions 7-14 (intial) JJ

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES...NO...NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) JJ

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) JJ

I certify that I attached a label with the unique LIMS number to each container (intial) JJ

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...# ______

BIS = Broken in shipment
Cooler Receipt Form.doc LF-1 Revised 8/23/17
End of Form

TestAmerica Seattle

5755 8th Street East
Tacoma, WA 98424
Phone (253) 922-2310 Fax (253) 922-5047

Chain of Custody Record

580-79568

TestAmerica — THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Walker, Elaine M	COC No: 580-58205.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: elaine.walker@testamericainc.com — Washington	Page: Page 1 of 2
Company: TestAmerica Laboratories, Inc		Accreditations Required (See note):	Job #: 580-79568-1
Address: 2960 Foster Creighton Drive, ,	Due Date Requested: 8/21/2018		
City: Nashville	TAT Requested (days):		
State, Zip: TN, 37204			
Phone: 615-726-0177(Tel) 615-726-3404(Fax)	PO #:		
Email:	WO #:		
Project Name: BNSF-Wishram	Project #: 58012524		
Site:	SSOW#:		

Analysis Requested

Preservation Codes:

A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	NWTPH_VPH/5035FM_Calc Northwest VPH	NWTPH_VPH_Calc/ NW VPH (Adjusted Ranges)	Total Number of containers	Special Instructions/Note:
				Preservation Code:						
D240-GS-080618 (580-79568-1)	8/6/18	14:50 Pacific		Solid			X	X	1	
D260-GS-080618 (580-79568-2)	8/6/18	15:30 Pacific		Solid			X	X	1	
D420-GS-080618 (580-79568-3)	8/6/18	16:55 Pacific		Solid			X	X	1	
D420-GS-080618-1 (580-79568-4)	8/6/18	17:00 Pacific		Solid			X	X	1	
D220-GS-080718 (580-79568-5)	8/7/18	07:55 Pacific		Solid			X	X	1	
BG-US01-080718 (580-79568-6)	8/7/18	08:50 Pacific		Solid			X	X	1	
D200-GS-080718 (580-79568-7)	8/7/18	12:30 Pacific		Solid			X	X	1	
G260-GS-080718 (580-79568-8)	8/7/18	18:00 Pacific		Solid			X	X	1	
G200-GS-080718 (580-79568-9)	8/7/18	18:50 Pacific		Solid			X	X	1	

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to TestAmerica Laboratories, Inc.

Possible Hazard Identification *Unconfirmed*	*Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)* ☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For ________ Months*
Deliverable Requested: I, II, III, IV, Other (specify) — Primary Deliverable Rank: 2	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
[signature]	8-16-18 1414	TASea	[signature]	08/17/18 10:55	TA-NAS
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: 2.9

Ver: 09/20/2016

11 10 9 8 7 6 5 4 3 2 1

TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Phone (253) 922-2310 Fax (253) 922-5047

Chain of Custody Record

Loc: 580
79568

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Walker, Elaine M	Carrier Tracking No(s):	COC No: 580-58205.2
Client Contact: Shipping/Receiving	Phone:	E-Mail: elaine.walker@testamericainc.com	State of Origin: Washington	Page: Page 2 of 2
Company: TestAmerica Laboratories, Inc		Accreditations Required (See note):		Job #: 580-79568-1
Address: 2960 Foster Creighton Drive, ,	Due Date Requested: 8/21/2018			
City: Nashville	TAT Requested (days):			
State, Zip: TN, 37204				
Phone: 615-726-0177(Tel) 615-726-3404(Fax)	PO #:			
Email:	WO #:			
Project Name: BNSF-Wishram	Project #: 58012524			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	NWTPH_VPH/5035FM_Calc Northwest VPH	NWTPH_VPH_Calc/ NW VPH (Adjusted Ranges)	Total Number of containers	Special Instructions/Note:
			Preservation Code:							
K120-GS-080818 (580-79568-10)	8/8/18	16:40 Pacific		Solid			X	X	1	
J260-GS-080818 (580-79568-11)	8/8/18	17:40 Pacific		Solid			X	X	1	
I400-GS-080918 (580-79568-12)	8/9/18	10:00 Pacific		Solid			X	X	1	
TB-01-080618 (580-79568-13)	8/6/18	09:00 Pacific		Solid			X	X	1	

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody.

Possible Hazard Identification
Unconfirmed

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
Return To Client *Disposal By Lab* *Archive For ________ Months*

Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
[signature]	8-16-18 1414	TASea	Jeremias Jordan	08/17/18 10:55	TA-NAS
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks: 2.9

Ver: 09/20/2016

Login Sample Receipt Checklist

Client: CH2M Hill, Inc. Job Number: 580-79568-1

Login Number: 79568 **List Source: TestAmerica Seattle**
List Number: 1
Creator: Gall, Brandon A

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	Lab does not accept radioactive samples.
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	False	Container rec'd broken. Sufficient sample in remaining containers for analysis.
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

August 22, 2018

Jacobs - BNSF Region 1

Sample Delivery Group:	L1017281
Samples Received:	08/14/2018
Project Number:	
Description:	BNSF-Wishram Railyard
Site:	BNSF-WISHRAM
Report To:	Jennifer Ulrich 2020 SW 4th Ave, Ste 300 Portland, OR 97201

Entire Report Reviewed By:

Mark W. Beasley
Project Manager

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7 Gl
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9 Sc

D240-GS-080618 L1017281-01 Solid

Collected by | Collected date/time 08/06/18 14:50 | Received date/time 08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153813	1	08/17/18 13:35	08/17/18 13:48	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1152767	10	08/16/18 07:34	08/17/18 05:20	DMW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	100	08/16/18 13:54	08/17/18 19:11	MTJ
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 07:25	DMG

D260-GS-080618 L1017281-02 Solid

Collected by | Collected date/time 08/06/18 15:30 | Received date/time 08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153813	1	08/17/18 13:35	08/17/18 13:48	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1152767	10	08/16/18 07:34	08/17/18 05:33	DMW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	2	08/16/18 13:54	08/17/18 00:30	DMW
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 06:22	DMG

D420-GS-080618 L1017281-03 Solid

Collected by | Collected date/time 08/06/18 16:55 | Received date/time 08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153813	1	08/17/18 13:35	08/17/18 13:48	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1152767	1	08/16/18 07:34	08/17/18 04:39	DMW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	1	08/16/18 13:54	08/17/18 01:08	DMW
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 03:54	DMG

D420-GS-080618-1 L1017281-04 Solid

Collected by | Collected date/time 08/06/18 17:00 | Received date/time 08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153813	1	08/17/18 13:35	08/17/18 13:48	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1152767	1	08/16/18 07:34	08/17/18 04:53	DMW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	1	08/16/18 13:54	08/17/18 01:21	DMW
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 04:15	DMG

D150-GS-080718 L1017281-05 Solid

Collected by | Collected date/time 08/07/18 07:30 | Received date/time 08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153814	1	08/17/18 13:18	08/17/18 13:31	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1152767	10	08/16/18 07:34	08/17/18 05:47	DMW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	20	08/16/18 13:54	08/17/18 03:16	DMW
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 07:04	DMG

D220-GS-080718 L1017281-06 Solid

Collected by | Collected date/time 08/07/18 07:55 | Received date/time 08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153814	1	08/17/18 13:18	08/17/18 13:31	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1152767	10	08/16/18 07:34	08/17/18 06:00	DMW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	10	08/16/18 13:54	08/17/18 03:28	DMW
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 05:39	DMG

BG-USO1-GS-080718 L1017281-07 Solid

Collected by	Collected date/time	Received date/time
	08/07/18 08:50	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153814	1	08/17/18 13:18	08/17/18 13:31	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1152767	1	08/16/18 07:34	08/17/18 05:06	DMW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	1	08/16/18 13:54	08/17/18 02:12	DMW
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 04:36	DMG

D200-GS-080718 L1017281-08 Solid

Collected by	Collected date/time	Received date/time
	08/07/18 12:30	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153814	1	08/17/18 13:18	08/17/18 13:31	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1152767	20	08/16/18 07:34	08/17/18 06:14	DMW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	20	08/16/18 13:54	08/17/18 19:24	MTJ
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 07:46	DMG

D200-SC-080718A L1017281-09 Solid

Collected by	Collected date/time	Received date/time
	08/07/18 16:40	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153814	1	08/17/18 13:18	08/17/18 13:31	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:09	JER

G260-SC-080718-A L1017281-10 Solid

Collected by	Collected date/time	Received date/time
	08/07/18 17:25	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153814	1	08/17/18 13:18	08/17/18 13:31	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:05	JER

G260-SC-080718-A-1 L1017281-11 Solid

Collected by	Collected date/time	Received date/time
	08/07/18 17:30	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153814	1	08/17/18 13:18	08/17/18 13:31	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:06	JER

G260-SC-080718-B L1017281-12 Solid

Collected by	Collected date/time	Received date/time
	08/07/18 17:10	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153814	1	08/17/18 13:18	08/17/18 13:31	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:06	JER

G260-GS-080718 L1017281-13 Solid

Collected by	Collected date/time	Received date/time
	08/07/18 18:00	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153814	1	08/17/18 13:18	08/17/18 13:31	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1153401	1	08/17/18 14:33	08/18/18 00:58	AAT
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	1	08/16/18 13:54	08/17/18 02:24	DMW
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 04:57	DMG

	Collected by	Collected date/time	Received date/time
		08/07/18 18:50	08/14/18 08:45

G200-GS-080718 L1017281-14 Solid

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153814	1	08/17/18 13:18	08/17/18 13:31	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1153401	1	08/17/18 14:33	08/18/18 01:11	AAT
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	1	08/16/18 13:54	08/17/18 02:37	DMW
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 05:18	DMG

	Collected by	Collected date/time	Received date/time
		08/07/18 18:40	08/14/18 08:45

G200-SC-080718-A L1017281-15 Solid

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153815	1	08/17/18 13:07	08/17/18 13:16	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:06	JER

	Collected by	Collected date/time	Received date/time
		08/08/18 11:55	08/14/18 08:45

F400B-SC-080818-A L1017281-16 Solid

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153815	1	08/17/18 13:07	08/17/18 13:16	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:10	JER

	Collected by	Collected date/time	Received date/time
		08/08/18 12:00	08/14/18 08:45

F400B-SC-080818-B L1017281-17 Solid

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153815	1	08/17/18 13:07	08/17/18 13:16	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:08	JER

	Collected by	Collected date/time	Received date/time
		08/08/18 13:10	08/14/18 08:45

F360-SC-080818-A L1017281-18 Solid

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153815	1	08/17/18 13:07	08/17/18 13:16	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:08	JER

	Collected by	Collected date/time	Received date/time
		08/08/18 13:15	08/14/18 08:45

F360-SC-080818-B L1017281-19 Solid

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153815	1	08/17/18 13:07	08/17/18 13:16	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:06	JER

	Collected by	Collected date/time	Received date/time
		08/08/18 16:40	08/14/18 08:45

K120-GS-080818 L1017281-20 Solid

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153815	1	08/17/18 13:07	08/17/18 13:16	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1153401	5	08/17/18 14:33	08/18/18 01:25	AAT
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	1	08/16/18 13:54	08/17/18 02:49	DMW
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 06:00	DMG

	Collected by	Collected date/time	Received date/time
K120-SC-080818-A L1017281-21 Solid		08/08/18 16:55	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153815	1	08/17/18 13:07	08/17/18 13:16	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:07	JER

	Collected by	Collected date/time	Received date/time
J260-GS-080818 L1017281-22 Solid		08/08/18 17:40	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153815	1	08/17/18 13:07	08/17/18 13:16	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1153401	1000	08/17/18 14:33	08/18/18 01:52	AAT
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	200	08/16/18 13:54	08/17/18 19:38	MTJ
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	5	08/15/18 20:50	08/16/18 08:07	DMG

	Collected by	Collected date/time	Received date/time
J260-SC-080818-A L1017281-23 Solid		08/08/18 17:45	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153815	1	08/17/18 13:07	08/17/18 13:16	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:06	JER

	Collected by	Collected date/time	Received date/time
I400-GS-080918 L1017281-24 Solid		08/09/18 10:00	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153815	1	08/17/18 13:07	08/17/18 13:16	KDW
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT	WG1153401	10	08/17/18 14:33	08/18/18 01:39	AAT
Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT	WG1152768	5	08/16/18 13:54	08/17/18 03:02	DMW
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG1152773	1	08/15/18 20:50	08/16/18 06:43	DMG

	Collected by	Collected date/time	Received date/time
I400-SC-080918-A L1017281-25 Solid		08/09/18 10:10	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153817	1	08/17/18 12:53	08/17/18 13:04	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:07	JER

	Collected by	Collected date/time	Received date/time
I400-SC-080918-B L1017281-26 Solid		08/09/18 10:15	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Total Solids by Method 2540 G-2011	WG1153817	1	08/17/18 12:53	08/17/18 13:04	KDW
Wet Chemistry by Method USDA LOI	WG1153690	1	08/20/18 16:38	08/21/18 14:07	JER

	Collected by	Collected date/time	Received date/time
EB-01-080718 L1017281-27 GW		08/07/18 16:00	08/14/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Semi Volatile Organic Compounds (GC/MS) by Method 8270C-SIM	WG1152148	1	08/14/18 17:05	08/15/18 07:47	ADF

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Mark W. Beasley
Project Manager

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	71.6		1	08/17/2018 13:48	WG1153813

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	180		18.6	55.9	10	08/17/2018 05:20	WG1152767
Residual Range Organics (RRO)	781		46.5	140	10	08/17/2018 05:20	WG1152767
(S) o-Terphenyl	*64.6*			*18.0-148*		*08/17/2018 05:20*	WG1152767

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	219	J	186	559	100	08/17/2018 19:11	WG1152768
Residual Range Organics (RRO)	907	J	465	1400	100	08/17/2018 19:11	WG1152768
(S) o-Terphenyl	*135*	J7		*18.0-148*		*08/17/2018 19:11*	WG1152768

Sample Narrative:

L1017281-01 WG1152768: diluted due to viscosity

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	0.00655	J	0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Acenaphthene	U		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Acenaphthylene	0.00630	J	0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Benzo(a)anthracene	0.0233		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Benzo(a)pyrene	0.0275		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Benzo(b)fluoranthene	0.0208		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Benzo(g,h,i)perylene	U		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Benzo(k)fluoranthene	0.0143		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Chrysene	0.0189		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Dibenz(a,h)anthracene	0.00864		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Fluoranthene	U		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Fluorene	0.00210	J	0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Indeno(1,2,3-cd)pyrene	0.0148		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Naphthalene	0.00428	J	0.00280	0.0280	1	08/16/2018 07:25	WG1152773
Phenanthrene	0.0129		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
Pyrene	0.0489		0.000839	0.00839	1	08/16/2018 07:25	WG1152773
1-Methylnaphthalene	U		0.00280	0.0280	1	08/16/2018 07:25	WG1152773
2-Methylnaphthalene	0.00300	J	0.00280	0.0280	1	08/16/2018 07:25	WG1152773
2-Chloronaphthalene	U		0.00280	0.0280	1	08/16/2018 07:25	WG1152773
(S) Nitrobenzene-d5	*106*			*14.0-149*		*08/16/2018 07:25*	WG1152773
(S) 2-Fluorobiphenyl	*68.8*			*34.0-125*		*08/16/2018 07:25*	WG1152773
(S) p-Terphenyl-d14	*68.3*			*23.0-120*		*08/16/2018 07:25*	WG1152773

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	70.7		1	08/17/2018 13:48	WG1153813

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	81.5		18.8	56.6	10	08/17/2018 05:33	WG1152767
Residual Range Organics (RRO)	313		47.1	141	10	08/17/2018 05:33	WG1152767
(S) o-Terphenyl	*95.3*			*18.0-148*		*08/17/2018 05:33*	WG1152767

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	7.88	J	3.78	11.3	2	08/17/2018 00:30	WG1152768
Residual Range Organics (RRO)	32.3	J6	9.44	28.3	2	08/17/2018 00:30	WG1152768
(S) o-Terphenyl	*80.0*			*18.0-148*		*08/17/2018 00:30*	WG1152768

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	U		0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Acenaphthene	U		0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Acenaphthylene	U		0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Benzo(a)anthracene	0.00391	J	0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Benzo(a)pyrene	0.00424	J	0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Benzo(b)fluoranthene	0.00521	J	0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Benzo(g,h,i)perylene	0.00600	J	0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Benzo(k)fluoranthene	0.00166	J	0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Chrysene	0.00324	J	0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Dibenz(a,h)anthracene	0.000931	J	0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Fluoranthene	0.00398	J	0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Fluorene	U		0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Indeno(1,2,3-cd)pyrene	0.00272	J	0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Naphthalene	U		0.00283	0.0283	1	08/16/2018 06:22	WG1152773
Phenanthrene	0.00149	J	0.000849	0.00849	1	08/16/2018 06:22	WG1152773
Pyrene	0.00531	J	0.000849	0.00849	1	08/16/2018 06:22	WG1152773
1-Methylnaphthalene	U		0.00283	0.0283	1	08/16/2018 06:22	WG1152773
2-Methylnaphthalene	U		0.00283	0.0283	1	08/16/2018 06:22	WG1152773
2-Chloronaphthalene	U		0.00283	0.0283	1	08/16/2018 06:22	WG1152773
(S) Nitrobenzene-d5	*100*			*14.0-149*		*08/16/2018 06:22*	WG1152773
(S) 2-Fluorobiphenyl	*43.8*			*34.0-125*		*08/16/2018 06:22*	WG1152773
(S) p-Terphenyl-d14	*58.6*			*23.0-120*		*08/16/2018 06:22*	WG1152773

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	72.8		1	08/17/2018 13:48	WG1153813

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	U		1.83	5.49	1	08/17/2018 04:39	WG1152767
Residual Range Organics (RRO)	U		4.57	13.7	1	08/17/2018 04:39	WG1152767
(S) o-Terphenyl	*83.3*			*18.0-148*		*08/17/2018 04:39*	WG1152767

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	U		1.83	5.49	1	08/17/2018 01:08	WG1152768
Residual Range Organics (RRO)	U		4.57	13.7	1	08/17/2018 01:08	WG1152768
(S) o-Terphenyl	*71.5*			*18.0-148*		*08/17/2018 01:08*	WG1152768

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Acenaphthene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Acenaphthylene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Benzo(a)anthracene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Benzo(a)pyrene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Benzo(b)fluoranthene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Benzo(g,h,i)perylene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Benzo(k)fluoranthene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Chrysene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Dibenz(a,h)anthracene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Fluoranthene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Fluorene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Indeno(1,2,3-cd)pyrene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Naphthalene	U		0.00275	0.0275	1	08/16/2018 03:54	WG1152773
Phenanthrene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
Pyrene	U		0.000824	0.00824	1	08/16/2018 03:54	WG1152773
1-Methylnaphthalene	U		0.00275	0.0275	1	08/16/2018 03:54	WG1152773
2-Methylnaphthalene	U		0.00275	0.0275	1	08/16/2018 03:54	WG1152773
2-Chloronaphthalene	U		0.00275	0.0275	1	08/16/2018 03:54	WG1152773
(S) Nitrobenzene-d5	*105*			*14.0-149*		*08/16/2018 03:54*	WG1152773
(S) 2-Fluorobiphenyl	*56.0*			*34.0-125*		*08/16/2018 03:54*	WG1152773
(S) p-Terphenyl-d14	*78.5*			*23.0-120*		*08/16/2018 03:54*	WG1152773

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	73.9		1	08/17/2018 13:48	WG1153813

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	U		1.80	5.41	1	08/17/2018 04:53	WG1152767
Residual Range Organics (RRO)	5.95	J	4.50	13.5	1	08/17/2018 04:53	WG1152767
(S) o-Terphenyl	*67.5*			*18.0-148*		*08/17/2018 04:53*	WG1152767

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	2.39	J	1.80	5.41	1	08/17/2018 01:21	WG1152768
Residual Range Organics (RRO)	7.60	J	4.50	13.5	1	08/17/2018 01:21	WG1152768
(S) o-Terphenyl	*76.7*			*18.0-148*		*08/17/2018 01:21*	WG1152768

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Acenaphthene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Acenaphthylene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Benzo(a)anthracene	0.000966	J	0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Benzo(a)pyrene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Benzo(b)fluoranthene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Benzo(g,h,i)perylene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Benzo(k)fluoranthene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Chrysene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Dibenz(a,h)anthracene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Fluoranthene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Fluorene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Indeno(1,2,3-cd)pyrene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Naphthalene	U		0.00270	0.0270	1	08/16/2018 04:15	WG1152773
Phenanthrene	U		0.000811	0.00811	1	08/16/2018 04:15	WG1152773
Pyrene	0.000937	J	0.000811	0.00811	1	08/16/2018 04:15	WG1152773
1-Methylnaphthalene	U		0.00270	0.0270	1	08/16/2018 04:15	WG1152773
2-Methylnaphthalene	U		0.00270	0.0270	1	08/16/2018 04:15	WG1152773
2-Chloronaphthalene	U		0.00270	0.0270	1	08/16/2018 04:15	WG1152773
(S) Nitrobenzene-d5	*103*			*14.0-149*		*08/16/2018 04:15*	WG1152773
(S) 2-Fluorobiphenyl	*58.0*			*34.0-125*		*08/16/2018 04:15*	WG1152773
(S) p-Terphenyl-d14	*60.2*			*23.0-120*		*08/16/2018 04:15*	WG1152773

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	70.9		1	08/17/2018 13:31	WG1153814

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	50.4	J	18.8	56.4	10	08/17/2018 05:47	WG1152767
Residual Range Organics (RRO)	223		47.0	141	10	08/17/2018 05:47	WG1152767
(S) o-Terphenyl	*126*			*18.0-148*		*08/17/2018 05:47*	WG1152767

Sample Narrative:

L1017281-05 WG1152767: Dilution due to matrix impact during extract concentration procedure

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	U		37.7	113	20	08/17/2018 03:16	WG1152768
Residual Range Organics (RRO)	174	J	94.1	282	20	08/17/2018 03:16	WG1152768
(S) o-Terphenyl	*121*	J7		*18.0-148*		*08/17/2018 03:16*	WG1152768

Sample Narrative:

L1017281-05 WG1152768: diluted due to viscosity

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	U		0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Acenaphthene	U		0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Acenaphthylene	U		0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Benzo(a)anthracene	0.00185	J	0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Benzo(a)pyrene	0.00248	J	0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Benzo(b)fluoranthene	0.00286	J	0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Benzo(g,h,i)perylene	0.00529	J	0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Benzo(k)fluoranthene	0.00179	J	0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Chrysene	0.00172	J	0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Dibenz(a,h)anthracene	U		0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Fluoranthene	0.00268	J	0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Fluorene	U		0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Indeno(1,2,3-cd)pyrene	0.00183	J	0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Naphthalene	U		0.00282	0.0282	1	08/16/2018 07:04	WG1152773
Phenanthrene	0.00103	J	0.000847	0.00847	1	08/16/2018 07:04	WG1152773
Pyrene	0.00437	J	0.000847	0.00847	1	08/16/2018 07:04	WG1152773
1-Methylnaphthalene	U		0.00282	0.0282	1	08/16/2018 07:04	WG1152773
2-Methylnaphthalene	U		0.00282	0.0282	1	08/16/2018 07:04	WG1152773
2-Chloronaphthalene	U		0.00282	0.0282	1	08/16/2018 07:04	WG1152773
(S) Nitrobenzene-d5	*95.1*			*14.0-149*		*08/16/2018 07:04*	WG1152773
(S) 2-Fluorobiphenyl	*61.0*			*34.0-125*		*08/16/2018 07:04*	WG1152773
(S) p-Terphenyl-d14	*72.6*			*23.0-120*		*08/16/2018 07:04*	WG1152773

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	68.0		1	08/17/2018 13:31	WG1153814

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	40.0	J	19.5	58.8	10	08/17/2018 06:00	WG1152767
Residual Range Organics (RRO)	188		48.9	147	10	08/17/2018 06:00	WG1152767
(S) o-Terphenyl	*126*			*18.0-148*		*08/17/2018 06:00*	WG1152767

Sample Narrative:

L1017281-06 WG1152767: Dilution due to matrix impact during extract concentration procedure

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	20.6	J	19.5	58.8	10	08/17/2018 03:28	WG1152768
Residual Range Organics (RRO)	88.8	J	48.9	147	10	08/17/2018 03:28	WG1152768
(S) o-Terphenyl	*93.4*			*18.0-148*		*08/17/2018 03:28*	WG1152768

Sample Narrative:

L1017281-06 WG1152768: diluted due to viscosity

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	U		0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Acenaphthene	U		0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Acenaphthylene	U		0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Benzo(a)anthracene	0.00282	J	0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Benzo(a)pyrene	0.00188	J	0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Benzo(b)fluoranthene	0.00107	J	0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Benzo(g,h,i)perylene	0.00325	J	0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Benzo(k)fluoranthene	0.00229	J	0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Chrysene	U		0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Dibenz(a,h)anthracene	U		0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Fluoranthene	0.00135	J	0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Fluorene	U		0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Indeno(1,2,3-cd)pyrene	0.00106	J	0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Naphthalene	U		0.00294	0.0294	1	08/16/2018 05:39	WG1152773
Phenanthrene	U		0.000882	0.00882	1	08/16/2018 05:39	WG1152773
Pyrene	0.00257	J	0.000882	0.00882	1	08/16/2018 05:39	WG1152773
1-Methylnaphthalene	U		0.00294	0.0294	1	08/16/2018 05:39	WG1152773
2-Methylnaphthalene	U		0.00294	0.0294	1	08/16/2018 05:39	WG1152773
2-Chloronaphthalene	U		0.00294	0.0294	1	08/16/2018 05:39	WG1152773
(S) Nitrobenzene-d5	*99.7*			*14.0-149*		*08/16/2018 05:39*	WG1152773
(S) 2-Fluorobiphenyl	*76.4*			*34.0-125*		*08/16/2018 05:39*	WG1152773
(S) p-Terphenyl-d14	*88.1*			*23.0-120*		*08/16/2018 05:39*	WG1152773

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	75.8		1	08/17/2018 13:31	WG1153814

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	U		1.75	5.28	1	08/17/2018 05:06	WG1152767
Residual Range Organics (RRO)	U		4.39	13.2	1	08/17/2018 05:06	WG1152767
(S) o-Terphenyl	*82.2*			*18.0-148*		*08/17/2018 05:06*	WG1152767

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	U		1.75	5.28	1	08/17/2018 02:12	WG1152768
Residual Range Organics (RRO)	U		4.39	13.2	1	08/17/2018 02:12	WG1152768
(S) o-Terphenyl	*62.2*			*18.0-148*		*08/17/2018 02:12*	WG1152768

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Acenaphthene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Acenaphthylene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Benzo(a)anthracene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Benzo(a)pyrene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Benzo(b)fluoranthene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Benzo(g,h,i)perylene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Benzo(k)fluoranthene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Chrysene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Dibenz(a,h)anthracene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Fluoranthene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Fluorene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Indeno(1,2,3-cd)pyrene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Naphthalene	U		0.00264	0.0264	1	08/16/2018 04:36	WG1152773
Phenanthrene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
Pyrene	U		0.000791	0.00791	1	08/16/2018 04:36	WG1152773
1-Methylnaphthalene	U		0.00264	0.0264	1	08/16/2018 04:36	WG1152773
2-Methylnaphthalene	U		0.00264	0.0264	1	08/16/2018 04:36	WG1152773
2-Chloronaphthalene	U		0.00264	0.0264	1	08/16/2018 04:36	WG1152773
(S) Nitrobenzene-d5	*101*			*14.0-149*		*08/16/2018 04:36*	WG1152773
(S) 2-Fluorobiphenyl	*49.4*			*34.0-125*		*08/16/2018 04:36*	WG1152773
(S) p-Terphenyl-d14	*56.2*			*23.0-120*		*08/16/2018 04:36*	WG1152773

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	78.1		1	08/17/2018 13:31	WG1153814

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	459		34.2	102	20	08/17/2018 06:14	WG1152767
Residual Range Organics (RRO)	1380		85.4	256	20	08/17/2018 06:14	WG1152767
(S) o-Terphenyl	*68.1*	J7		*18.0-148*		*08/17/2018 06:14*	WG1152767

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	57.6	J	34.2	102	20	08/17/2018 19:24	WG1152768
Residual Range Organics (RRO)	179	J	85.4	256	20	08/17/2018 19:24	WG1152768
(S) o-Terphenyl	*79.1*	J7		*18.0-148*		*08/17/2018 19:24*	WG1152768

Sample Narrative:

L1017281-08 WG1152768: diluted due to viscosity

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	U		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Acenaphthene	U		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Acenaphthylene	0.00827		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Benzo(a)anthracene	0.0173		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Benzo(a)pyrene	0.134		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Benzo(b)fluoranthene	0.0243		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Benzo(g,h,i)perylene	U		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Benzo(k)fluoranthene	0.0177		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Chrysene	0.113		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Dibenz(a,h)anthracene	U		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Fluoranthene	0.00726	J	0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Fluorene	0.00161	J	0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Indeno(1,2,3-cd)pyrene	U		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Naphthalene	0.00579	J	0.00256	0.0256	1	08/16/2018 07:46	WG1152773
Phenanthrene	U		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
Pyrene	0.0231		0.000769	0.00769	1	08/16/2018 07:46	WG1152773
1-Methylnaphthalene	U		0.00256	0.0256	1	08/16/2018 07:46	WG1152773
2-Methylnaphthalene	U		0.00256	0.0256	1	08/16/2018 07:46	WG1152773
2-Chloronaphthalene	U		0.00256	0.0256	1	08/16/2018 07:46	WG1152773
(S) Nitrobenzene-d5	*90.1*			*14.0-149*		*08/16/2018 07:46*	WG1152773
(S) 2-Fluorobiphenyl	*52.9*			*34.0-125*		*08/16/2018 07:46*	WG1152773
(S) p-Terphenyl-d14	*59.3*			*23.0-120*		*08/16/2018 07:46*	WG1152773

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	78.6		1	08/17/2018 13:31	WG1153814

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	4580		3.33	10.0	1	08/21/2018 14:09	WG1153690

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	67.4		1	08/17/2018 13:31	WG1153814

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	86400		3.33	10.0	1	08/21/2018 14:05	WG1153690

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	73.8		1	08/17/2018 13:31	WG1153814

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	107000		3.33	10.0	1	08/21/2018 14:06	WG1153690

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	84.6		1	08/17/2018 13:31	WG1153814

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	66700		3.33	10.0	1	08/21/2018 14:06	WG1153690

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	70.4		1	08/17/2018 13:31	WG1153814

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	4.53	J	1.89	5.68	1	08/18/2018 00:58	WG1153401
Residual Range Organics (RRO)	12.3	J	4.73	14.2	1	08/18/2018 00:58	WG1153401
(S) o-Terphenyl	*57.1*			*18.0-148*		*08/18/2018 00:58*	WG1153401

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	U		1.89	5.68	1	08/17/2018 02:24	WG1152768
Residual Range Organics (RRO)	U		4.73	14.2	1	08/17/2018 02:24	WG1152768
(S) o-Terphenyl	*61.2*			*18.0-148*		*08/17/2018 02:24*	WG1152768

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Acenaphthene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Acenaphthylene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Benzo(a)anthracene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Benzo(a)pyrene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Benzo(b)fluoranthene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Benzo(g,h,i)perylene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Benzo(k)fluoranthene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Chrysene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Dibenz(a,h)anthracene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Fluoranthene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Fluorene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Indeno(1,2,3-cd)pyrene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Naphthalene	U		0.00284	0.0284	1	08/16/2018 04:57	WG1152773
Phenanthrene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
Pyrene	U		0.000852	0.00852	1	08/16/2018 04:57	WG1152773
1-Methylnaphthalene	U		0.00284	0.0284	1	08/16/2018 04:57	WG1152773
2-Methylnaphthalene	U		0.00284	0.0284	1	08/16/2018 04:57	WG1152773
2-Chloronaphthalene	U		0.00284	0.0284	1	08/16/2018 04:57	WG1152773
(S) Nitrobenzene-d5	*102*			*14.0-149*		*08/16/2018 04:57*	WG1152773
(S) 2-Fluorobiphenyl	*57.4*			*34.0-125*		*08/16/2018 04:57*	WG1152773
(S) p-Terphenyl-d14	*76.5*			*23.0-120*		*08/16/2018 04:57*	WG1152773

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	72.1		1	08/17/2018 13:31	WG1153814

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	2.70	J	1.84	5.55	1	08/18/2018 01:11	WG1153401
Residual Range Organics (RRO)	14.0		4.62	13.9	1	08/18/2018 01:11	WG1153401
(S) o-Terphenyl	*67.1*			*18.0-148*		*08/18/2018 01:11*	WG1153401

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	U		1.84	5.55	1	08/17/2018 02:37	WG1152768
Residual Range Organics (RRO)	5.57	J	4.62	13.9	1	08/17/2018 02:37	WG1152768
(S) o-Terphenyl	*62.5*			*18.0-148*		*08/17/2018 02:37*	WG1152768

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	U		0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Acenaphthene	U		0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Acenaphthylene	U		0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Benzo(a)anthracene	0.00157	J	0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Benzo(a)pyrene	0.00202	J	0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Benzo(b)fluoranthene	0.00227	J	0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Benzo(g,h,i)perylene	0.00251	J	0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Benzo(k)fluoranthene	U		0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Chrysene	0.00147	J	0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Dibenz(a,h)anthracene	U		0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Fluoranthene	0.00272	J	0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Fluorene	U		0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Indeno(1,2,3-cd)pyrene	0.00144	J	0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Naphthalene	U		0.00277	0.0277	1	08/16/2018 05:18	WG1152773
Phenanthrene	U		0.000832	0.00832	1	08/16/2018 05:18	WG1152773
Pyrene	0.00369	J	0.000832	0.00832	1	08/16/2018 05:18	WG1152773
1-Methylnaphthalene	U		0.00277	0.0277	1	08/16/2018 05:18	WG1152773
2-Methylnaphthalene	U		0.00277	0.0277	1	08/16/2018 05:18	WG1152773
2-Chloronaphthalene	U		0.00277	0.0277	1	08/16/2018 05:18	WG1152773
(S) Nitrobenzene-d5	*89.2*			*14.0-149*		*08/16/2018 05:18*	WG1152773
(S) 2-Fluorobiphenyl	*57.4*			*34.0-125*		*08/16/2018 05:18*	WG1152773
(S) p-Terphenyl-d14	*65.6*			*23.0-120*		*08/16/2018 05:18*	WG1152773

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	66.0		1	08/17/2018 13:16	WG1153815

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	91000		3.33	10.0	1	08/21/2018 14:06	WG1153690

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	79.9		1	08/17/2018 13:16	WG1153815

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	3380		3.33	10.0	1	08/21/2018 14:10	WG1153690

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	71.0		1	08/17/2018 13:16	WG1153815

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	7510		3.33	10.0	1	08/21/2018 14:08	WG1153690

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	75.5		1	08/17/2018 13:16	WG1153815

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	5710		3.33	10.0	1	08/21/2018 14:08	WG1153690

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	61.9		1	08/17/2018 13:16	WG1153815

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	57700		3.33	10.0	1	08/21/2018 14:06	WG1153690

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	77.9		1	08/17/2018 13:16	WG1153815

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	U		8.56	25.7	5	08/18/2018 01:25	WG1153401
Residual Range Organics (RRO)	35.2	J	21.4	64.2	5	08/18/2018 01:25	WG1153401
(S) o-Terphenyl	*69.9*			*18.0-148*		*08/18/2018 01:25*	WG1153401

Sample Narrative:

L1017281-20 WG1153401: Cannot run at lower dilution due to viscosity of extract

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	3.95	J	1.71	5.13	1	08/17/2018 02:49	WG1152768
Residual Range Organics (RRO)	19.6		4.27	12.8	1	08/17/2018 02:49	WG1152768
(S) o-Terphenyl	*61.1*			*18.0-148*		*08/17/2018 02:49*	WG1152768

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	U		0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Acenaphthene	U		0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Acenaphthylene	U		0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Benzo(a)anthracene	U		0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Benzo(a)pyrene	U		0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Benzo(b)fluoranthene	0.00116	J	0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Benzo(g,h,i)perylene	0.00560	J	0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Benzo(k)fluoranthene	U		0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Chrysene	U		0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Dibenz(a,h)anthracene	0.000823	J	0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Fluoranthene	U		0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Fluorene	U		0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Indeno(1,2,3-cd)pyrene	0.00144	J	0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Naphthalene	U		0.00257	0.0257	1	08/16/2018 06:00	WG1152773
Phenanthrene	U		0.000770	0.00770	1	08/16/2018 06:00	WG1152773
Pyrene	0.00104	J	0.000770	0.00770	1	08/16/2018 06:00	WG1152773
1-Methylnaphthalene	U		0.00257	0.0257	1	08/16/2018 06:00	WG1152773
2-Methylnaphthalene	U		0.00257	0.0257	1	08/16/2018 06:00	WG1152773
2-Chloronaphthalene	U		0.00257	0.0257	1	08/16/2018 06:00	WG1152773
(S) Nitrobenzene-d5	*104*			*14.0-149*		*08/16/2018 06:00*	WG1152773
(S) 2-Fluorobiphenyl	*90.0*			*34.0-125*		*08/16/2018 06:00*	WG1152773
(S) p-Terphenyl-d14	*92.3*			*23.0-120*		*08/16/2018 06:00*	WG1152773

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	79.6		1	08/17/2018 13:16	WG1153815

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	9320		3.33	10.0	1	08/21/2018 14:07	WG1153690

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	72.9		1	08/17/2018 13:16	WG1153815

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	12700		1820	5490	1000	08/18/2018 01:52	WG1153401
Residual Range Organics (RRO)	31000		4570	13700	1000	08/18/2018 01:52	WG1153401
(S) o-Terphenyl	*111*	J7		*18.0-148*		*08/18/2018 01:52*	WG1153401

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	4830		366	1100	200	08/17/2018 19:38	WG1152768
Residual Range Organics (RRO)	12100		915	2740	200	08/17/2018 19:38	WG1152768
(S) o-Terphenyl	*0.000*	J7		*18.0-148*		*08/17/2018 19:38*	WG1152768

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	0.195		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Acenaphthene	0.139		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Acenaphthylene	U		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Benzo(a)anthracene	0.169		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Benzo(a)pyrene	1.23		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Benzo(b)fluoranthene	0.0527		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Benzo(g,h,i)perylene	0.305		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Benzo(k)fluoranthene	0.403		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Chrysene	0.741		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Dibenz(a,h)anthracene	U		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Fluoranthene	U		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Fluorene	0.109		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Indeno(1,2,3-cd)pyrene	0.0999		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Naphthalene	0.0605	J	0.0137	0.137	5	08/16/2018 08:07	WG1152773
Phenanthrene	0.399		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
Pyrene	1.82		0.00412	0.0412	5	08/16/2018 08:07	WG1152773
1-Methylnaphthalene	0.335		0.0137	0.137	5	08/16/2018 08:07	WG1152773
2-Methylnaphthalene	0.332		0.0137	0.137	5	08/16/2018 08:07	WG1152773
2-Chloronaphthalene	U		0.0137	0.137	5	08/16/2018 08:07	WG1152773
(S) Nitrobenzene-d5	*63.7*			*14.0-149*		*08/16/2018 08:07*	WG1152773
(S) 2-Fluorobiphenyl	*88.8*			*34.0-125*		*08/16/2018 08:07*	WG1152773
(S) p-Terphenyl-d14	*77.5*			*23.0-120*		*08/16/2018 08:07*	WG1152773

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	68.1		1	08/17/2018 13:16	WG1153815

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	37100		3.33	10.0	1	08/21/2018 14:06	WG1153690

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	78.2		1	08/17/2018 13:16	WG1153815

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-NO SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	54.3		17.0	51.2	10	08/18/2018 01:39	WG1153401
Residual Range Organics (RRO)	290		42.6	128	10	08/18/2018 01:39	WG1153401
(S) o-Terphenyl	*75.4*			*18.0-148*		*08/18/2018 01:39*	WG1153401

Semi-Volatile Organic Compounds (GC) by Method NWTPHDX-SGT

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Diesel Range Organics (DRO)	14.1	J	8.53	25.6	5	08/17/2018 03:02	WG1152768
Residual Range Organics (RRO)	74.7		21.4	64.0	5	08/17/2018 03:02	WG1152768
(S) o-Terphenyl	*55.4*			*18.0-148*		*08/17/2018 03:02*	WG1152768

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL (dry) mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Acenaphthene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Acenaphthylene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Benzo(a)anthracene	0.00211	J	0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Benzo(a)pyrene	0.000869	J	0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Benzo(b)fluoranthene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Benzo(g,h,i)perylene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Benzo(k)fluoranthene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Chrysene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Dibenz(a,h)anthracene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Fluoranthene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Fluorene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Indeno(1,2,3-cd)pyrene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Naphthalene	U		0.00256	0.0256	1	08/16/2018 06:43	WG1152773
Phenanthrene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
Pyrene	U		0.000768	0.00768	1	08/16/2018 06:43	WG1152773
1-Methylnaphthalene	U		0.00256	0.0256	1	08/16/2018 06:43	WG1152773
2-Methylnaphthalene	U		0.00256	0.0256	1	08/16/2018 06:43	WG1152773
2-Chloronaphthalene	U		0.00256	0.0256	1	08/16/2018 06:43	WG1152773
(S) Nitrobenzene-d5	*108*			*14.0-149*		*08/16/2018 06:43*	WG1152773
(S) 2-Fluorobiphenyl	*89.8*			*34.0-125*		*08/16/2018 06:43*	WG1152773
(S) p-Terphenyl-d14	*94.6*			*23.0-120*		*08/16/2018 06:43*	WG1152773

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	71.5		1	08/17/2018 13:04	WG1153817

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	18600		3.33	10.0	1	08/21/2018 14:07	WG1153690

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	73.9		1	08/17/2018 13:04	WG1153817

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	6700		3.33	10.0	1	08/21/2018 14:07	WG1153690

Semi Volatile Organic Compounds (GC/MS) by Method 8270C-SIM

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Anthracene	U		0.0140	0.0500	1	08/15/2018 07:47	WG1152148
Acenaphthene	U		0.0100	0.0500	1	08/15/2018 07:47	WG1152148
Acenaphthylene	U		0.0120	0.0500	1	08/15/2018 07:47	WG1152148
Benzo(a)anthracene	U		0.00410	0.0500	1	08/15/2018 07:47	WG1152148
Benzo(a)pyrene	U		0.0116	0.0500	1	08/15/2018 07:47	WG1152148
Benzo(b)fluoranthene	0.00261	B J	0.00212	0.0500	1	08/15/2018 07:47	WG1152148
Benzo(g,h,i)perylene	U		0.00227	0.0500	1	08/15/2018 07:47	WG1152148
Benzo(k)fluoranthene	U		0.0136	0.0500	1	08/15/2018 07:47	WG1152148
Chrysene	U		0.0108	0.0500	1	08/15/2018 07:47	WG1152148
Dibenz(a,h)anthracene	U		0.00396	0.0500	1	08/15/2018 07:47	WG1152148
Fluoranthene	0.0519		0.0157	0.0500	1	08/15/2018 07:47	WG1152148
Fluorene	0.0211	J	0.00850	0.0500	1	08/15/2018 07:47	WG1152148
Indeno(1,2,3-cd)pyrene	U		0.0148	0.0500	1	08/15/2018 07:47	WG1152148
Naphthalene	0.329		0.0198	0.250	1	08/15/2018 07:47	WG1152148
Phenanthrene	0.0791		0.00820	0.0500	1	08/15/2018 07:47	WG1152148
Pyrene	0.0293	J	0.0117	0.0500	1	08/15/2018 07:47	WG1152148
1-Methylnaphthalene	0.0293	J	0.00821	0.250	1	08/15/2018 07:47	WG1152148
2-Methylnaphthalene	0.0445	J	0.00902	0.250	1	08/15/2018 07:47	WG1152148
2-Chloronaphthalene	U		0.00647	0.250	1	08/15/2018 07:47	WG1152148
(S) Nitrobenzene-d5	*86.3*			*31.0-160*		*08/15/2018 07:47*	WG1152148
(S) 2-Fluorobiphenyl	*108*			*48.0-148*		*08/15/2018 07:47*	WG1152148
(S) p-Terphenyl-d14	*117*			*37.0-146*		*08/15/2018 07:47*	WG1152148

Method Blank (MB)

(MB) R3334836-1 08/17/18 13:48

Analyte	MB Result %	MB Qualifier	MB MDL %	MB RDL %
Total Solids	0.000			

L1017280-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1017280-01 08/17/18 13:48 • (DUP) R3334836-3 08/17/18 13:48

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	86.6	85.6	1	1.10		10

Laboratory Control Sample (LCS)

(LCS) R3334836-2 08/17/18 13:48

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	49.9	99.9	85.0-115	

Method Blank (MB)

(MB) R3334835-1 08/17/18 13:31

Analyte	MB Result %	MB Qualifier	MB MDL %	MB RDL %
Total Solids	0.00100			

L1017281-12 Original Sample (OS) • Duplicate (DUP)

(OS) L1017281-12 08/17/18 13:31 • (DUP) R3334835-3 08/17/18 13:31

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	84.6	86.6	1	2.28		10

Laboratory Control Sample (LCS)

(LCS) R3334835-2 08/17/18 13:31

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	49.9	99.9	85.0-115	

Method Blank (MB)

(MB) R3334834-1 08/17/18 13:16

Analyte	MB Result %	MB Qualifier	MB MDL %	MB RDL %
Total Solids	0.000			

L1017281-20 Original Sample (OS) • Duplicate (DUP)

(OS) L1017281-20 08/17/18 13:16 • (DUP) R3334834-3 08/17/18 13:16

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	77.9	78.0	1	0.0467		10

Laboratory Control Sample (LCS)

(LCS) R3334834-2 08/17/18 13:16

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	50.0	100	85.0-115	

Method Blank (MB)

(MB) R3334832-1 08/17/18 13:04

Analyte	MB Result %	MB Qualifier	MB MDL %	MB RDL %
Total Solids	0.000			

L1017283-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1017283-01 08/17/18 13:04 • (DUP) R3334832-3 08/17/18 13:04

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	81.6	81.5	1	0.149		10

Laboratory Control Sample (LCS)

(LCS) R3334832-2 08/17/18 13:04

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	50.0	100	85.0-115	

Method Blank (MB)

(MB) R3335388-1 08/21/18 14:12

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
TOC (Total Organic Carbon)	U		3.33	10.0

L1017281-09 Original Sample (OS) • Duplicate (DUP)

(OS) L1017281-09 08/21/18 14:09 • (DUP) R3335388-4 08/21/18 14:09

Analyte	Original Result mg/kg	DUP Result mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC (Total Organic Carbon)	4580	5020	1	9.14		20

L1017281-26 Original Sample (OS) • Duplicate (DUP)

(OS) L1017281-26 08/21/18 14:07 • (DUP) R3335388-5 08/21/18 14:07

Analyte	Original Result mg/kg	DUP Result mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC (Total Organic Carbon)	6700	6960	1	3.87		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3335388-2 08/21/18 14:24 • (LCSD) R3335388-3 08/21/18 14:30

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
TOC (Total Organic Carbon)	3890	6780	7000	174	180	39.6-180			3.16	20

Method Blank (MB)

(MB) R3334388-1 08/16/18 11:15

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Diesel Range Organics (DRO)	U		1.33	4.00
Residual Range Organics (RRO)	U		3.33	10.0
(S) o-Terphenyl	*79.6*			*18.0-148*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3334388-2 08/16/18 11:29 • (LCSD) R3334388-3 08/16/18 11:42

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Diesel Range Organics (DRO)	25.0	18.4	18.3	73.6	73.2	50.0-150			0.545	20
Residual Range Organics (RRO)	25.0	17.9	16.8	71.6	67.2	50.0-150			6.34	20
(S) o-Terphenyl				*67.6*	*64.9*	*18.0-148*				

L1016957-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1016957-04 08/17/18 01:02 • (MS) R3334388-4 08/17/18 01:16 • (MSD) R3334388-5 08/17/18 01:29

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Diesel Range Organics (DRO)	31.0	1100	1480	1280	1220	576	10	50.0-150	V	V	14.4	20
Residual Range Organics (RRO)	31.0	U	ND	ND	0.000	0.000	10	50.0-150	J6	J6	0.000	20
(S) o-Terphenyl					*68.3*	*71.8*		*18.0-148*				

Method Blank (MB)

(MB) R3334684-1 08/17/18 19:47

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Diesel Range Organics (DRO)	U		1.33	4.00
Residual Range Organics (RRO)	U		3.33	10.0
(S) o-Terphenyl	*61.4*			*18.0-148*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3334684-2 08/17/18 20:00 • (LCSD) R3334684-3 08/17/18 20:14

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Diesel Range Organics (DRO)	25.0	15.2	15.4	60.8	61.6	50.0-150			1.31	20
Residual Range Organics (RRO)	25.0	16.2	16.0	64.8	64.0	50.0-150			1.24	20
(S) o-Terphenyl				*60.4*	*60.7*	*18.0-148*				

L1017312-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1017312-02 08/17/18 20:27 • (MS) R3334684-4 08/17/18 20:41 • (MSD) R3334684-5 08/17/18 20:55

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Diesel Range Organics (DRO)	32.0	3.60	17.6	18.3	43.6	46.0	1	50.0-150	J6	J6	4.29	20
Residual Range Organics (RRO)	32.0	6.47	22.0	22.4	48.6	49.8	1	50.0-150	J6	J6	1.73	20
(S) o-Terphenyl					*42.8*	*38.6*		*18.0-148*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3334595-1 08/16/18 23:53

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Diesel Range Organics (DRO)	U		1.33	4.00
Residual Range Organics (RRO)	U		3.33	10.0
(S) o-Terphenyl	*83.5*			*18.0-148*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3334595-2 08/17/18 00:05 • (LCSD) R3334595-3 08/17/18 00:18

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Diesel Range Organics (DRO)	25.0	19.2	21.0	76.8	84.0	50.0-150			8.96	20
Residual Range Organics (RRO)	25.0	16.0	16.4	64.0	65.6	50.0-150			2.47	20
(S) o-Terphenyl				*71.3*	*76.0*	*18.0-148*				

L1017281-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1017281-02 08/17/18 00:30 • (MS) R3334595-4 08/17/18 00:43 • (MSD) R3334595-5 08/17/18 00:56

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Diesel Range Organics (DRO)	35.4	7.88	32.4	32.3	69.3	68.9	1	50.0-150			0.438	20
Residual Range Organics (RRO)	35.4	32.3	33.1	36.9	2.40	13.2	1	50.0-150	J6	J6	10.9	20
(S) o-Terphenyl					*74.9*	*73.3*		*18.0-148*				

Method Blank (MB)

(MB) R3333750-3 08/15/18 01:14

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Anthracene	U		0.0140	0.0500
Acenaphthene	U		0.0100	0.0500
Acenaphthylene	U		0.0120	0.0500
Benzo(a)anthracene	U		0.00410	0.0500
Benzo(a)pyrene	U		0.0116	0.0500
Benzo(b)fluoranthene	0.00284	J	0.00212	0.0500
Benzo(g,h,i)perylene	0.00249	J	0.00227	0.0500
Benzo(k)fluoranthene	U		0.0136	0.0500
Chrysene	U		0.0108	0.0500
Dibenz(a,h)anthracene	U		0.00396	0.0500
Fluoranthene	U		0.0157	0.0500
Fluorene	U		0.00850	0.0500
Indeno(1,2,3-cd)pyrene	U		0.0148	0.0500
Naphthalene	U		0.0198	0.250
Phenanthrene	U		0.00820	0.0500
Pyrene	U		0.0117	0.0500
1-Methylnaphthalene	U		0.00821	0.250
2-Methylnaphthalene	U		0.00902	0.250
2-Chloronaphthalene	U		0.00647	0.250
(S) Nitrobenzene-d5	*93.0*			*31.0-160*
(S) 2-Fluorobiphenyl	*108*			*48.0-148*
(S) p-Terphenyl-d14	*113*			*37.0-146*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3333750-1 08/15/18 00:31 • (LCSD) R3333750-2 08/15/18 00:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Anthracene	2.00	2.31	2.44	115	122	64.0-142			5.47	20
Acenaphthene	2.00	2.10	2.16	105	108	66.0-132			2.82	20
Acenaphthylene	2.00	2.20	2.26	110	113	65.0-132			2.69	20
Benzo(a)anthracene	2.00	2.17	2.25	108	112	59.0-134			3.62	20
Benzo(a)pyrene	2.00	2.28	2.33	114	117	61.0-145			2.17	20
Benzo(b)fluoranthene	2.00	2.16	2.23	108	111	57.0-136			3.19	20
Benzo(g,h,i)perylene	2.00	2.32	2.39	116	119	54.0-140			2.97	20
Benzo(k)fluoranthene	2.00	2.31	2.43	115	122	57.0-141			5.06	20
Chrysene	2.00	2.17	2.28	108	114	63.0-140			4.94	20
Dibenz(a,h)anthracene	2.00	2.49	2.55	124	128	49.0-141			2.38	20
Fluoranthene	2.00	2.35	2.40	117	120	65.0-143			2.11	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3333750-1 08/15/18 00:31 • (LCSD) R3333750-2 08/15/18 00:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Fluorene	2.00	2.20	2.26	110	113	64.0-129			2.69	20
Indeno(1,2,3-cd)pyrene	2.00	2.41	2.47	120	123	53.0-141			2.46	20
Naphthalene	2.00	2.12	2.18	106	109	68.0-129			2.79	20
Phenanthrene	2.00	2.14	2.24	107	112	62.0-132			4.57	20
Pyrene	2.00	2.10	2.15	105	108	58.0-156			2.35	20
1-Methylnaphthalene	2.00	2.26	2.32	113	116	68.0-137			2.62	20
2-Methylnaphthalene	2.00	2.14	2.21	107	111	68.0-134			3.22	20
2-Chloronaphthalene	2.00	2.14	2.20	107	110	65.0-129			2.76	20
(S) Nitrobenzene-d5				*90.5*	*92.5*	*31.0-160*				
(S) 2-Fluorobiphenyl				*104*	*107*	*48.0-148*				
(S) p-Terphenyl-d14				*110*	*115*	*37.0-146*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3334164-3 08/16/18 01:05

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Anthracene	U		0.000600	0.00600
Acenaphthene	U		0.000600	0.00600
Acenaphthylene	U		0.000600	0.00600
Benzo(a)anthracene	U		0.000600	0.00600
Benzo(a)pyrene	U		0.000600	0.00600
Benzo(b)fluoranthene	U		0.000600	0.00600
Benzo(g,h,i)perylene	U		0.000600	0.00600
Benzo(k)fluoranthene	U		0.000600	0.00600
Chrysene	U		0.000600	0.00600
Dibenz(a,h)anthracene	U		0.000600	0.00600
Fluoranthene	U		0.000600	0.00600
Fluorene	U		0.000600	0.00600
Indeno(1,2,3-cd)pyrene	U		0.000600	0.00600
Naphthalene	U		0.00200	0.0200
Phenanthrene	U		0.000600	0.00600
Pyrene	U		0.000600	0.00600
1-Methylnaphthalene	U		0.00200	0.0200
2-Methylnaphthalene	U		0.00200	0.0200
2-Chloronaphthalene	U		0.00200	0.0200
(S) Nitrobenzene-d5	*114*			*14.0-149*
(S) 2-Fluorobiphenyl	*99.4*			*34.0-125*
(S) p-Terphenyl-d14	*97.8*			*23.0-120*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3334164-1 08/16/18 00:23 • (LCSD) R3334164-2 08/16/18 00:44

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Anthracene	0.0800	0.0702	0.0721	87.8	90.1	50.0-125			2.67	20
Acenaphthene	0.0800	0.0725	0.0713	90.6	89.1	52.0-120			1.67	20
Acenaphthylene	0.0800	0.0743	0.0726	92.9	90.8	51.0-120			2.31	20
Benzo(a)anthracene	0.0800	0.0731	0.0722	91.4	90.3	46.0-121			1.24	20
Benzo(a)pyrene	0.0800	0.0657	0.0671	82.1	83.9	42.0-121			2.11	20
Benzo(b)fluoranthene	0.0800	0.0745	0.0752	93.1	94.0	42.0-123			0.935	20
Benzo(g,h,i)perylene	0.0800	0.0708	0.0702	88.5	87.8	43.0-128			0.851	20
Benzo(k)fluoranthene	0.0800	0.0743	0.0728	92.9	91.0	45.0-128			2.04	20
Chrysene	0.0800	0.0735	0.0733	91.9	91.6	48.0-127			0.272	20
Dibenz(a,h)anthracene	0.0800	0.0744	0.0732	93.0	91.5	43.0-132			1.63	20
Fluoranthene	0.0800	0.0773	0.0766	96.6	95.8	49.0-129			0.910	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3334164-1 08/16/18 00:23 • (LCSD) R3334164-2 08/16/18 00:44

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Fluorene	0.0800	0.0733	0.0729	91.6	91.1	50.0-120			0.547	20
Indeno(1,2,3-cd)pyrene	0.0800	0.0731	0.0727	91.4	90.9	44.0-131			0.549	20
Naphthalene	0.0800	0.0699	0.0682	87.4	85.3	50.0-120			2.46	20
Phenanthrene	0.0800	0.0685	0.0681	85.6	85.1	48.0-120			0.586	20
Pyrene	0.0800	0.0808	0.0791	101	98.9	48.0-135			2.13	20
1-Methylnaphthalene	0.0800	0.0764	0.0771	95.5	96.4	52.0-122			0.912	20
2-Methylnaphthalene	0.0800	0.0736	0.0733	92.0	91.6	52.0-120			0.408	20
2-Chloronaphthalene	0.0800	0.0718	0.0701	89.8	87.6	50.0-120			2.40	20
(S) Nitrobenzene-d5				*125*	*113*	*14.0-149*				
(S) 2-Fluorobiphenyl				*102*	*98.6*	*34.0-125*				
(S) p-Terphenyl-d14				*100*	*98.4*	*23.0-120*				

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
MDL	Method Detection Limit.
MDL (dry)	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
RDL (dry)	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
B	The same analyte is found in the associated blank.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
J7	Surrogate recovery cannot be used for control limit evaluation due to dilution.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T 104704245-17-14
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

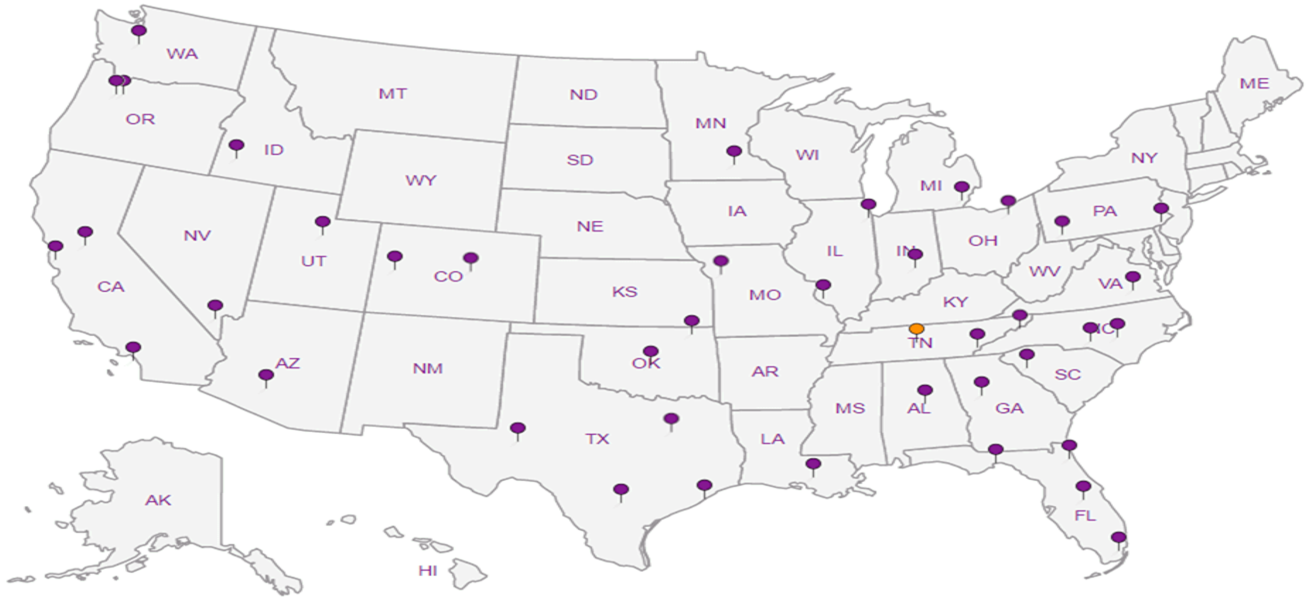
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



NWTPH-Dx | PAH | TOC

Jacobs - BNSF Region 1	Billing Information:	Pres Chk	Analysis / Container / Preservative	Chain of Custody Page 1 of 3
2020 SW 4th Ave, Ste 300 Portland, OR 97201	Carrie Andrews 2020 SW 4th Ave, Ste 300 Portland, OR 97201			ESC LAB SCIENCES a subsidiary of Pace Analytical 12065 Lebanon Rd Mount Juliet, TN 37122 Phone: 615-758-5858 Phone: 800-767-5859 Fax: 615-758-5859
Report to: Jennifer Ulrich	Email To: carrie.andrews@ch2m.com; jennifer.ulrich@ch2m.com			
Project Description: BNSF-Wishram Railyard	City/State Collected: Wishram, WA			L# L1017281 E176
Phone: 503-348-9500 Fax:	Client Project #	Lab Project # BNSF1JACOBS-WISHRAM		Acctnum: BNSF1JACOBS Template: T137632 Prelogin: P659706 TSR: 134 - Mark W. Beasley PB: 6-22-18
Collected by (print): Jennifer Ulrich	Site/Facility ID # BNSF-Wishram	P.O. #		
Collected by (signature): Jennifer Ulrich Immediately Packed on Ice N ___ Y X	Rush? (Lab MUST Be Notified) ___ Same Day ___ Five Day ___ Next Day ___ 5 Day (Rad Only) ___ Two Day ___ 10 Day (Rad Only) ___ Three Day	Quote # Date Results Needed		Shipped Via: FedEX Ground

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	NWTPHDX w/SGT 4ozClr-NoPres	NWTPHDX w/out SGT 4ozClr-NoPres	PAHSIMLVID 40mlAmb-NoPres-WT	SV8270PAHSIMD, TS 4ozClr-NoPres	TOC 4ozClr-NoPres						Remarks	Sample # (lab only)
D240-GS-080618	G	SS	0-6"	8/6/18	1450	3	X	X		X								-01
D260-GS-080618	G	SS	0-6"	8/6/18	1530	3	X	X		X								02
D420-GS-080618	G	SS	0-6"	8/6/18	1655	3	X	X		X								03
D420-GS-080618-1	G	SS	0-6"	8/6/18	1700	3	X	X		X								04
D150-GS-080718	G	SS	0-6"	8/7/18	0730	3	X	X		X								05
D220-GS-080718	G	SS	0-6"	8/7/18	0755	3	X	X		X								06
~~BGUS01-GS~~ BG-US01-GS-080718	G	SS	0-6"	8/7/18	0850	3	X	X		X								07
D200-GS-080718	G	SS	0-6"	8/7/18	1230	3	X	X		X								.08
D200-GC-080718-A	G	SS	~~[illegible]~~	8/7/18	1640	~~3~~ 1	~~X~~	~~X~~		~~X~~	X						TOC only	09
G260-SC-080718-A	G	SS	~~[illegible]~~ 3.5'	8/7/18	1725	~~3~~ 1	~~X~~	~~X~~		~~X~~	X						TOC only	10

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other ______

Remarks:

pH ______ Temp ______

Flow ______ Other ______

Samples returned via:
__ UPS __ FedEx __ Courier __ ______

Tracking #

Sample Receipt Checklist
COC Seal Present/Intact: _NP ✓Y _N
COC Signed/Accurate: ✓Y _N
Bottles arrive intact: ✓Y _N
Correct bottles used: ✓Y _N
Sufficient volume sent: ✓Y _N
If Applicable
VOA Zero Headspace: _Y _N
Preservation Correct/Checked: _Y _N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR	
Jennifer Ulrich	8/13/18	1200			L. Smith
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 1.0 °C Bottles Received: 54	If preservation required by Login: Date/Time
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature) 801	Date: 8/14/18 Time: 845	Hold: Condition: NCF / OK

NWTPH-Dx | PAH | TOC

Jacobs - BNSF Region 1 2020 SW 4th Ave, Ste 300 Portland, OR 97201	Billing Information: **Carrie Andrews** **2020 SW 4th Ave, Ste 300** **Portland, OR 97201**
Report to: **Jennifer Ulrich**	Email To: **carrie.andrews@ch2m.com; jennifer.ulrich@ch2m.com**
Project Description: **BNSF-Wishram Railyard**	City/State Collected: Wishram, WA
Phone: **503-348-9500** Fax:	Client Project #
	Lab Project # **BNSF1JACOBS-WISHRAM**
Collected by (print): Jennifer Ulrich	Site/Facility ID #
	P.O. #
Collected by (signature): Jennifer Ulrich	Quote #
Immediately Packed on Ice N ___ Y X	*Rush?* (Lab MUST Be Notified) ___ Same Day ___ Five Day ___ Next Day ___ 5 Day (Rad Only) ___ Two Day ___ 10 Day (Rad Only) ___ Three Day Date Results Needed

Pres Chk

Analysis / Container / Preservative

Chain of Custody Page 1 of 3

ESC LAB SCIENCES

a subsidiary of Pace Analytical

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# L1017281

Table #

Acctnum: **BNSF1JACOBS**

Template: **T137632**

Prelogin: **P659706**

TSR: **134 - Mark W. Beasley**

PB: 6-22-18

Shipped Via: **FedEX Ground**

Sample ID	Comp/Grab	Matrix *	Depth ft	Date	Time	No. of Cntrs	NWTPHDX w/SGT 4ozClr-NoPres	NWTPHDX w/out SGT 4ozClr-NoPres	PAHSIMLVID 40mlAmb-NoPres-WT	SV8270PAHSIMD, TS 4ozClr-NoPres	TOC 4ozClr-NoPres						Remarks	Sample # (lab only)
G260-SC-080718-A-1	G	SS	~~0.5-1~~ 3.5	8/7/18	1730	~~3~~ 1	~~X~~	~~X~~		~~X~~	X						TOC only	-01
G260-SC-080718-B	G	SS	~~0~~ 4	8/7/18	1710	~~3~~ 1	~~X~~	~~X~~		~~X~~	X						TOC only	02
G260-GS-080718	G	SS	0.5	8/7/18	1800	3	X	X		X	~~X~~							13
G200-GS-080718	G	~~GW~~	0.5	8/7/18	1850	3	X	X	~~X~~	X								14
G200-SC-080718-A	G	SS	3.5	8/7/18	1840	~~3~~ 1	~~X~~		~~X~~	~~X~~	~~X~~	X					~~TOC only~~	15
F400B-SC-080818-A	G	SS	1	8/8/18	1155	1					X						TOC only	16
F400B-SC-080818-B	G	SS	5	8/8/18	1200	1					X						TOC only	17
F360-SC-080818-A	G	SS	1 ~~0.5~~	8/8/18	1310	1					X						↓	18
F360-SC-080818-B	G	SS	4	8/8/18	1315	1					X						↓	19
~~G260~~ K120-GS-080818	G	SS	0.5	8/8/18	1640	3	X	X		X	~~X~~							20

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other ________

Remarks:

pH ______ Temp ______

Flow ______ Other ______

Samples returned via:
__ UPS __ FedEx __ Courier __ ______

Tracking #

Sample Receipt Checklist
COC Seal Present/Intact: __NP ✓Y __N
COC Signed/Accurate: ✓Y __N
Bottles arrive intact: ✓Y __N
Correct bottles used: ✓Y __N
Sufficient volume sent: ✓Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N

L-5MMAR

Relinquished by : (Signature) Jennifer Ulrich	Date: 8/13/18	Time: 1200	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 1.0°C ℃ Bottles Received: 54	If preservation required by Login: Date/Time
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature) 8G	Date: 8/14/18 Time: 845	Hold: Condition: NCF / OK

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Fax 253-922-5047
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NWTPH-Dx / PAH / TOC

☐ Rush

☐ Short Hold

Chain of Custody Record

Client: 2020 4th Ave Ste. 300	Client Contact: Carrie Andrews	Date: 8/13/18	Chain of Custody Number: 37668
Address: Portland OR 97201	Telephone Number (Area Code)/Fax Number: 503 348 9500	Lab Number	Page 3 of 3
City / State / Zip Code	Sampler: J. Ulrich	Lab Contact: Kristine Ellen	
Project Name and Location (State): BNSF - Wishram	Billing Contact: Carrie Andrews		
Contract/Purchase Order/Quote No.			

Special Instructions/ Conditions of Receipt: L1017281

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Soil	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	NWTPH-Dx W/SGT	NWTPH-Dx W/OUT SGT	SV8270 PAH LMD	TOC Only	SV8270 PAH SIM	Special Instructions/Conditions of Receipt
~~J260~~ K120-SC-080818-A	8/8/18	1655			X											1		TOC ONLY -21
J260-GS-080818	8/8/18	1740			X								1	1	1			22
J260-SC-080818-A	8/8/18	1745			X											1		TOC ONLY 23
I400-GS-080918	8/9/18	1000			X								1	1	1			24
I400-SC-080918-A	8/9/18	1010			X											1		TOC ONLY 25
I400-SC-080918-B	8/9/18	1015			X											1		TOC ONLY 26
EB-01-080718	8/7/18	1600		X													2	27
TB-01-080618	8/6/18	0900		X													1	

Cooler: ☒ Yes ☐ No Cooler Temp: ______

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days): ☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☐ Other ______

QC Requirements (Specify)

1. Relinquished By Sign/Print: Jennifer Ulrich / Jennifer Ulrich	Date: 8/13/18	Time: 1200	1. Received By Sign/Print: 8G Kevin Turner	Date: 8/14/18	Time: 8:45
2. Relinquished By Sign/Print	Date	Time	2. Received By Sign/Print	Date	Time
3. Relinquished By Sign/Print	Date	Time	3. Received By Sign/Print	Date	Time

Comments

DISTRIBUTION: WHITE – Stays with the Samples; CANARY – Returned to Client with Report; PINK – Field Copy

1.0°c L.5 MR/HR COSI

TAL-8274-580 (0210) NCF

Jeremy W. Watkins

Pace Analytical®
National Center for Testing & Innovation

Login #: L1017281	Client: BNSF1JACOBS	Date: 8/14/18	Evaluated by: Jeremy

Non-Conformance (check applicable items)

	Sample Integrity		Chain of Custody Clarification		
	Parameter(s) past holding time	x	Login Clarification Needed		**If Broken Container:**
	Improper temperature		Chain of custody is incomplete		Insufficient packing material around container
	Improper container type		Please specify Metals requested.		Insufficient packing material inside cooler
	Improper preservation		Please specify TCLP requested.		Improper handling by carrier (FedEx / UPS / Courie
	Insufficient sample volume.		Received additional samples not listed on coc.		Sample was frozen
	Sample is biphasic.		Sample ids on containers do not match ids on coc		Container lid not intact
	Vials received with headspace.		Trip Blank not received.		**If no Chain of Custody:**
	Broken container		Client did not "X" analysis.		Received by:
	Broken container:		Chain of Custody is missing		Date/Time:
	Sufficient sample remains				Temp./Cont. Rec./pH:
					Carrier:
					Tracking#

Login Comments: Received a 40ml-HCL-BLK, client is requesting PAHSIMLVI. Please advise.

Client informed by:		Call		Email		Voice Mail	Date: 8/14/18	Time: 1440
TSR Initials: MB	Client Contact: Jennifer Ulrich							

Login Instructions:

Place trip blank on hold

Treatability Report for

BNSF Wishram

ASL Report #: T1092
Project ID: 921884.OTC

Attn: Dusty.Berggren@Jacobs.com
CC: carrie.andrews@jacobs.com

Authorized and Released By:

Applied Research Scientist II
Ester Gordon
541.243.0981
January 15, 2019

TestAmerica ASL
1100 NE Circle Boulevard, Suite 310
Corvallis, OR 97330
1-541-243-0980
www.testamericainc.com

Sample Receipt Comments

Two 2 inch diameter core samples were received at TestAmerica ASL on August 14, 2018. Per client specifications, the two sample names were changed from “G200-MC-081018” and “G260-MC-081018” as indicated on the Chain of Custody, to G200-MC-080918 and G260-MC-080918.

Sample G200-MC-080918 (T1092-01) consisted of 1.5 to 3.8 feet below sediment surface (bss) and sample G260-MC-080918 (T1092-02) was 1.5 to 3.3 bss. The samples were shipped on dry ice and arrived as ASL at -43 °C. They were stored at -10°C until testing began.

Sample Cross-Reference

Sample Name [Client ID]	**ASL Sample ID** [SDG]	**Samples Analyzed** [Lab ID]
G200-MC-080918	T1092-01	G200-C G200-D G200-E G200-F G200-G G200-J G200-K G200-L G200-M G200-N G200-O
G260-MC-080918	T1092-02	G260-B G260-C G260-D G260-E G260-F G260-G G260-H G260-J G260-K

TestAmerica ASL Treatability Report #: T1092

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CASE NARRATIVE
SPECIAL ANALYTICS

Lab Name: TestAmerica ASL ASL SDG: T1092
Project Name: *BNSF Wishram* PO Number: 131004734

<u>Method(s):</u>

Analyses: Soil Core Cutting and NAPL Photography
Water Drive at Three Flow Settings (CH2M/Jacobs Proprietary Method)
Dean Stark Analysis of Pore Fluid Saturation (API RP40 (1998) Section 4.3, *modified*)
Grain Density (API RP40 (1998) Section 5.3.2.1, *modified*)
Grain Size (ASTM D422)

Overview: The two frozen core samples received at the lab were cut into segments 2 inches in length. These core segments (pucks) were capped on both ends and stored at -10 °C until testing began.

The core segments were first allowed to warm to room temperature. They were then photographed under white and UV lighting, and the physical parameters (length, width, mass) were measured. The core segments were then re-frozen and shipped on dry ice to Dakota labs for TarGOST scanning (results not included in TestAmerica Report). Based on photography and TarGOST results, two segments from each core were selected by the Jacobs project team for water drive analysis, and four other notably contaminated pucks were selected from each core for Dean Stark extraction only.

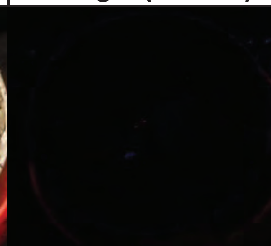
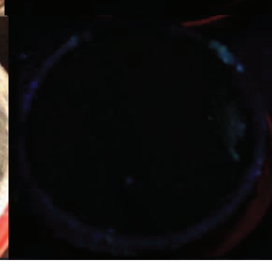
Two of the selected pucks from each core were subjected to water drive testing, passing one pore volume of fluid through the puck for each of three flow rates. During application of flow, pressure at the base of the puck was measured utilizing a pressure transducer connected to a data logger that recorded in volts. Voltage was then converted to pressure (pounds per square inch, PSI) using the instrument-specified conversion factor. The average voltage recorded over the last five minutes of each run that exhibited a consistent pressure trend was reported as the Steady Run Volt Output (steady state voltage). Note that some runs exhibited a gentle slope in the voltage output over the duration of each run and did not reach a true steady state; those with steep slopes or inconsistent trends were flagged in the Water Drive Summaries.

Post water drive (PWD), the eluate was observed under white and UV light to determine NAPL mobility (by presence/absence only). A representative subsample of the soil was then removed from the core sleeve and extracted by the Dean Stark method for determination of pore fluid saturations. Residual solids from the Dean Stark analysis were first air-dried until visibly dry, and then baked at 105 °C for at least 12 hours. These clean, dry solids were then used to measure the average grain density of the sample. After grain density was measured, dried soil samples were combined to create enough mass for grain size analysis (see Grain Size Case Narrative); soil combinations were guided by the Jacobs project team and included some as-received air dried samples that did not undergo extraction for pore fluid saturation.

Four of the selected pucks from each core were allowed to warm to room temperature and extracted by the Dean Stark method for determination of pore fluid saturations. Grain density was also measured on the baked clean, dry solids of these samples post Dean Stark (PDS). After grain density was measured, dried soil samples were combined to create enough mass for grain size analysis (see Grain Size Case Narrative); soil combinations were guided by the Jacobs project team and included some as-received air dried samples that did not undergo extraction for pore fluid saturation.

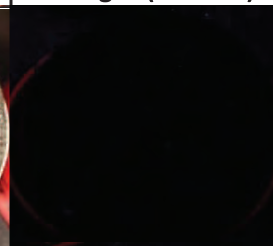
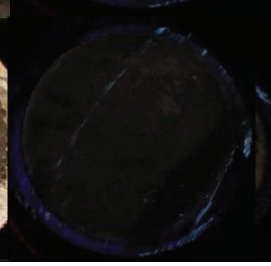
Core Photo Log
BNSF Wishram Yard

Sample ID: G200-MC-080918

LAB ID (SDG ID)		Top		Approximate Depth of Core Segment (feet below sediment surface, bss)	
		White Light	UV Light (302 nm)	Top	Bottom
G200-B T1092-01B	Pre-Mobility			1.50	1.67
G200-C T1092-01C	Pre-Mobility			1.67	1.83
G200-D T1092-01D	Pre-Mobility			1.83	2.00
G200-E T1092-01E	Pre-Mobility			2.00	2.17
G200-F T1092-01F	Pre-Mobility			2.17	2.33
G200-G T1092-01G	Pre-Mobility			2.33	2.50

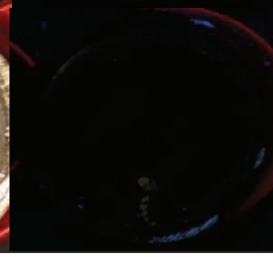
Core Photo Log
BNSF Wishram Yard

Sample ID: G200-MC-080918

LAB ID (SDG ID)		Top		Approximate Depth of Core Segment (feet below sediment surface, bss)	
		White Light	UV Light (302 nm)	Top	Bottom
G200-H T1092-01H	Pre-Mobility			2.50	2.67
G200-I T1092-01I	Pre-Mobility			2.67	2.83
G200-J T1092-01J	Pre-Mobility			2.83	3.00
G200-K T1092-01K	Pre-Mobility			3.00	3.17
G200-L T1092-01L	Pre-Mobility			3.17	3.33
G200-M T1092-01M	Pre-Mobility			3.33	3.50

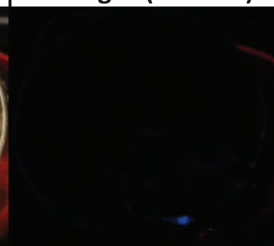
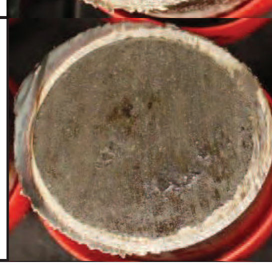
Core Photo Log
BNSF Wishram Yard

Sample ID: G200-MC-080918

LAB ID (SDG ID)		Top		Approximate Depth of Core Segment (feet below sediment surface, bss)	
		White Light	UV Light (302 nm)	Top	Bottom
G200-N T1092-01N	Pre-Mobility			3.50	3.67
G200-O T1092-01O	Pre-Mobility			3.67	3.83

Core Photo Log
BNSF Wishram Yard

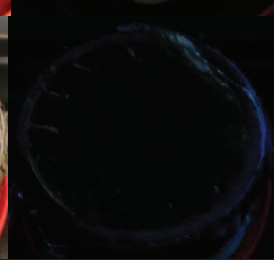
Sample ID: G260-MC-080918

LAB ID (SDG ID)		Top		Approximate Depth of Core Segment (feet below sediment surface, bss)	
		White Light	UV Light (302 nm)	Top	Bottom
G260-A T1092-02A	Pre-Mobility			1.50	1.67
G260-B T1092-02B	Pre-Mobility			1.67	1.83
G260-C T1092-02C	Pre-Mobility			1.83	2.00
G260-D T1092-02D	Pre-Mobility			2.00	2.17
G260-E T1092-02E	Pre-Mobility			2.17	2.33
G260-F T1092-02F	Pre-Mobility			2.33	2.50

Core Photo Log
BNSF Wishram Yard

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample ID: G260-MC-080918

LAB ID (SDG ID)		Top		Approximate Depth of Core Segment (feet below sediment surface, bss)	
		White Light	UV Light (302 nm)	Top	Bottom
G260-G T1092-02G	Pre-Mobility			2.50	2.67
G260-H T1092-02H	Pre-Mobility			2.67	2.83
G260-I T1092-02I	Pre-Mobility			2.83	3.00
G260-J T1092-02J	Pre-Mobility			3.00	3.17
G260-K T1092-02K	Pre-Mobility			3.17	3.33

TestAmerica ASL

Core Measurements

BNSF Wishram Yard

Sample ID	Sample Depth Range (ft bss)	Core Height (mm)	Inner Diameter (mm)	Mass with Sleeve (g)	Sleeve Mass (g)	Total Bulk Volume, V_B (cm^3)	Analyses Performed: Water Drive Mobility	Dean-Stark Extraction	Grain Density	Grain Size Distribution
G200-J	2.83 - 3.00	48.2	42.8	153.0	53.67	69.3		x	PDS	PDS
G200-K	3.00 - 3.17	49.8	41.8	158.6	54.62	68.4	x	PWD	PDS	PDS
G200-L	3.17 - 3.33	45.2	42.6	154.1	50.34	64.3		x	PDS	PDS
G200-M	3.33 - 3.50	47.8	42.3	162.5	53.01	67.1	x	PWD	PDS	PDS
G200-N	3.50 - 3.67	50.2	42.1	186.9	55.85	69.9		x	PDS	PDS
G200-O	3.67 - 3.83	37.5	42.7	120.7	47.24	53.7		x	PDS	PDS
G260-C	1.83-2.00	48.5	42.6	167.0	52.75	69.2		x	PDS	PDS
G260-D	2.00-2.17	51.8	42.2	157.0	56.81	72.6	x	PWD	PDS	PDS
G260-E	2.17-2.33	48.5	41.8	161.2	53.20	66.5		x	PDS	PDS
G260-F	2.33-2.50	46.4	42.6	148.0	51.10	66.2		x	PDS	PDS
G260-G	2.50-2.67	49.0	42.7	162.2	54.50	70.2	x	PWD	PDS	PDS
G260-H	2.67-2.83	45.5	41.8	165.0	51.78	62.3		x	PDS	PDS

Notes:

PWD = Post Water Drive

PDS = Post Dean Stark

bss = below sediment surface

Water Drive for Three Flow Settings

Benchsheet

BNSF Wishram Yard

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample and Setup Information

Sample ID:	**G200-K**	Analyst:	EG
Lab ID:	T1092-01K	Date/Time:	10/17/2018 10:08
Mass of Sample w/ Sleeve (g):	158.56	Water Drive ID:	Orion M365 (Original) #1
Sample Height (mm):	49.81	Number of Syringes:	1
Sample Diameter (mm):	41.82	Syringe size (mL):	60

Water Drive Test	Run 1	Run 2	Run 3
Flow Target Rate (mL/min):	**0.400**	**0.800**	**4.000**
Coarse Dial Setting:	1	1	1
Percentage Setting:	0.5%	1.0%	5.0%
Theoretical Flow Rate (mL/min):	0.387	0.774	3.870
Target Effluent Volume (mL):	50.0	50.0	50.0
Initial Syringe Volume (mL):	60	60	60
Start Date/Time:	10/17/2018 10:08	10/17/2018 12:50	10/17/2018 14:22
Stop Date/Time:	10/17/2018 11:47	10/17/2018 13:53	10/17/2018 14:45
Final Syringe Volume (mL):	10	10	10
Flow Rate Check (mL/min):	0.505	0.794	2.174

Pressure	Run 1	Run 2	Run 3
Transducer (High or Low):	High	High	High
Voltage Multiplier (psi/V):	3	3	3
Steady Run Volt Output (V):	0.08	0.12	0.38 †
Applied Pressure (psi):	0.25	0.36	1.15 †

Observations	Run 1	Run 2	Run 3
Volume Accumulated on Top (mL):	46	50	52
Clear/Color?	clear yellow tint	clear yellow tint	clear slight yellow tint
Sheen?	no	no	no
Blebs w/ approx. vol (mL)?	no	no	no
Odor?	slight odor	slight odor	med. odor
Fluoresce Under UV light?	yes	yes	yes

† Run did not achieve flat steady state, but gradually increased over time.

Post-Water Drive

Mass of Sample w/ Sleeve (g): 160.98

Notes: Eluate examined under 302 nm UV light Post-Water Drive.

Water Drive Raw Data Summary
BNSF Wishram Yard

Sample Name: G200-K
Lab ID: T1092-01K
Test Start: 10/17/2018

Run Time [Hours]	Pressure [PSI]
0.00	0.48
0.03	0.45
0.07	0.21
0.10	0.21
0.14	0.21
0.17	0.21
0.21	0.21
0.26	0.21
0.29	0.21
0.33	0.21
0.36	0.21
0.39	0.21
0.43	0.24
0.46	0.21
0.50	0.21
0.53	0.24
0.57	0.24
0.60	0.21
0.64	0.24
0.67	0.24
0.71	0.21
0.74	0.24
0.78	0.24
0.81	0.24
0.85	0.24
0.88	0.24
0.92	0.21
0.95	0.24
0.99	0.21
1.02	0.24
1.06	0.24
1.09	0.24
1.13	0.24
1.16	0.24
1.19	0.24
1.23	0.24
1.26	0.24
1.30	0.24
1.33	0.24
1.37	0.24
1.40	0.24
1.44	0.24
1.47	0.24
1.51	0.24
1.54	0.27
1.58	0.24

Run Time [Hours]	Pressure [PSI]
1.61	0.24
1.64	0.24
1.66	0.24
*1.66 **	0.30
1.68	0.15
1.71	0.15
1.75	0.12
1.78	0.15
1.82	0.10
1.85	0.10
1.89	0.10
1.92	0.12
1.96	0.10
2.72	0.27
2.76	0.30
2.79	0.27
2.83	0.33
2.86	0.30
2.89	0.30
2.93	0.30
2.96	0.33
3.00	0.30
3.03	0.30
3.07	0.33
3.10	0.33
3.14	0.33
3.17	0.30
3.21	0.33
3.24	0.36
3.28	0.33
3.31	0.30
3.34	0.33
3.38	0.33
3.41	0.33
3.45	0.36
3.48	0.33
3.52	0.36
3.55	0.33
3.59	0.36
3.62	0.36
3.66	0.36
3.69	0.36
3.73	0.36
3.75	0.36
*4.23 **	0.86
4.25	1.09

Run Time [Hours]	Pressure [PSI]
4.28	1.12
4.32	1.15
4.35	1.18
4.39	0.12
4.42	0.15
4.46	0.12
4.49	0.12
4.55	1.06
4.58	1.24
4.62	1.27
4.63	0.18

**Flow rate change*

NOTE: Data collection software may not have been paused for full interim between Runs at differing flow rates. Thus, total Run Time of the raw data may exceed total time of flow recorded on the Water Drive Summary Benchsheet.

Water Drive for Three Flow Settings
Benchsheet
BNSF Wishram Yard

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample and Setup Information

Sample ID:	**G200-M**	Analyst:	EG
Lab ID:	T1092-01M	Date/Time:	10/18/2018 10:58
Mass of Sample w/ Sleeve (g):	162.47	Water Drive ID:	Orion M365 (Original) #1
Sample Height (mm):	47.79	Number of Syringes:	1
Sample Diameter (mm):	42.27	Syringe size (mL):	60

Water Drive Test	Run 1	Run 2	Run 3
Flow Target Rate (mL/min):	**0.400**	**0.800**	**4.000**
Coarse Dial Setting:	1	1	1
Percentage Setting:	0.5%	1.0%	5.0%
Theoretical Flow Rate (mL/min):	0.387	0.774	3.870
Target Effluent Volume (mL):	50.0	50.0	50.0
Initial Syringe Volume (mL):	60	60	60
Start Date/Time:	10/18/2018 10:58	10/18/2018 13:06	10/18/2018 14:16
Stop Date/Time:	10/18/2018 12:58	10/18/2018 14:10	10/18/2018 14:29
Final Syringe Volume (mL):	10	10.0	10.0
Flow Rate Check (mL/min):	0.417	0.781	3.846

Pressure	Run 1	Run 2	Run 3
Transducer (High or Low):	High	High	High
Voltage Multiplier (psi/V):	3	3	3
Steady Run Volt Output (V):	0.30	0.66	1.78 †
Applied Pressure (psi):	0.90	1.98	5.34 †

Observations	Run 1	Run 2	Run 3
Volume Accumulated on Top (mL):	49	50	50
Clear/Color?	yellow tint	slight yellow tint	slight yellow tint
Sheen?	no	no	no
Blebs w/ approx. vol (mL)?	no	no	no
Odor?	yes	yes	yes
Fluoresce Under UV light?	yes	yes	yes

† Run did not achieve flat steady state, but gradually decreased over time.

Post-Water Drive

Mass of Sample w/ Sleeve (g): 163.97

Notes: Eluate examined under 302 nm UV light Post-Water Drive.

Water Drive Raw Data Summary
BNSF Wishram Yard

Sample Name: G200-M
Lab ID: T1092-01M
Test Start: 10/18/2018

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Run Time [Hours]	Pressure [PSI]
0.01	1.82
0.03	1.15
0.07	0.95
0.10	0.92
0.14	0.92
0.17	0.95
0.21	0.95
0.24	1.00
0.28	0.97
0.31	0.97
0.35	1.00
0.38	1.00
0.42	1.03
0.45	1.03
0.49	1.03
0.52	1.03
0.56	1.03
0.59	1.03
0.62	1.03
0.66	1.03
0.69	1.03
0.73	1.03
0.76	1.03
0.80	1.06
0.83	1.06
0.87	1.03
0.90	1.06
0.94	0.95
0.97	0.92
1.01	0.92
1.04	0.89
1.08	0.89
1.11	0.89
1.14	0.89
1.18	0.89
1.21	0.92
1.25	0.86
1.28	0.89
1.32	0.89
1.35	0.89
1.39	0.92
1.42	0.92
1.46	0.92
1.49	0.92
1.53	0.92

Run Time [Hours]	Pressure [PSI]
1.56	0.92
1.60	0.89
1.63	0.89
1.65	0.95
1.67	0.92
1.70	0.92
1.74	0.92
1.77	0.95
1.81	0.92
1.84	0.95
1.88	0.92
1.91	0.95
1.94	0.92
1.98	0.95
2.01	0.39
*2.14 **	0.15
2.15	0.56
2.19	1.59
2.22	1.71
2.26	1.79
2.29	1.85
2.32	1.85
2.36	1.88
2.39	1.97
2.43	1.97
2.46	2.00
2.50	2.06
2.53	2.06
2.57	2.06
2.60	2.00
2.64	2.00
2.67	2.00
2.71	2.06
2.74	2.06
2.78	2.06
2.81	2.06
2.85	2.00
2.88	2.00
2.92	1.97
2.93	1.97
*3.03 **	2.00
3.06	2.00
3.09	1.97
3.12	1.94
3.16	1.97

Run Time [Hours]	Pressure [PSI]
3.19	1.97
3.23	0.21
3.26	0.12
3.30	0.10
3.33	6.01
3.37	5.63
3.40	5.55
3.44	5.37
3.47	5.31
3.49	5.34
3.51	5.31
3.52	5.28

**Flow rate change*

NOTE: Data collection software may not have been paused for full interim between Runs at differing flow rates. Thus, total Run Time of the raw data may exceed total time of flow recorded on the Water Drive Summary Benchsheet.

Water Drive for Three Flow Settings
Benchsheet
BNSF Wishram Yard

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample and Setup Information

Sample ID:	**G260-D**	Analyst:	EG
Lab ID:	T1092-02D	Date/Time:	10/19/2018 12:49
Mass of Sample w/ Sleeve (g):	157.00	Water Drive ID:	#2
Sample Height (mm):	51.81	Number of Syringes:	1
Sample Diameter (mm):	42.24	Syringe size (mL):	60

Water Drive Test	Run 1	Run 2	Run 3
Flow Target Rate (mL/min):	**0.400**	**0.800**	**4.000**
Coarse Dial Setting:	1	1	1
Percentage Setting:	0.5%	1.0%	5.0%
Theoretical Flow Rate (mL/min):	0.387	0.774	3.870
Target Effluent Volume (mL):	50.0	50.0	50.0
Initial Syringe Volume (mL):	60	60	60
Start Date/Time:	10/19/2018 12:53	10/19/2018 14:57	10/19/2018 16:12
Stop Date/Time:	10/19/2018 14:50	10/19/2018 16:04	10/19/2018 16:25
Final Syringe Volume (mL):	10	10	10
Flow Rate Check (mL/min):	0.427	0.746	3.846

Pressure	Run 1	Run 2	Run 3
Transducer (High or Low):	High	High	High
Voltage Multiplier (psi/V):	3	3	3
Steady Run Volt Output (V):	0.08	0.09	0.28
Applied Pressure (psi):	0.23	0.28	0.85

Observations	Run 1	Run 2	Run 3
Volume Accumulated on Top (mL):	46	50	50
Clear/Color?	yellow tint	slight yellow tint	slight yellow tint
Sheen?	no	no	no
Blebs w/ approx. vol (mL)?	no	no	no
Odor?	yes	yes	yes
Fluoresce Under UV light?	yes	yes	yes

Post-Water Drive

Mass of Sample w/ Sleeve (g): 157.19

Notes: Eluate examined under 302 nm UV light Post-Water Drive.

Water Drive Raw Data Summary
BNSF Wishram Yard

Sample Name: G260-D
Lab ID: T1092-02D
Test Start: 10/19/2018

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Run Time [Hours]	Pressure [PSI]
0.00	0.12
0.03	0.12
0.07	0.12
0.10	0.12
0.13	0.15
0.17	0.12
0.20	0.15
0.23	0.15
0.27	0.15
0.30	0.15
0.33	0.15
0.37	0.15
0.40	0.15
0.43	0.18
0.47	0.15
0.50	0.18
0.53	0.18
0.57	0.18
0.60	0.15
0.63	0.18
0.67	0.18
0.70	0.18
0.73	0.15
0.77	0.15
0.80	0.15
0.83	0.18
0.87	0.18
0.90	0.15
0.93	0.15
0.97	0.15
1.00	0.18
1.03	0.36
1.07	0.21
1.10	0.21
1.13	0.21
1.17	0.21
1.20	0.21
1.23	0.21
1.27	0.21
1.30	0.21
1.33	0.21
1.37	0.21
1.40	0.21
1.43	0.21
1.47	0.24

Run Time [Hours]	Pressure [PSI]
1.50	0.24
1.53	0.21
1.57	0.21
1.60	0.21
1.63	0.21
1.67	0.21
1.70	0.24
1.73	0.21
1.77	0.21
1.80	0.24
1.83	0.21
1.87	0.21
1.90	0.24
1.93	0.21
1.95	0.18
*2.06 **	0.12
2.07	0.04
2.10	0.21
2.13	0.24
2.17	0.24
2.20	0.24
2.23	0.27
2.27	0.24
2.30	0.27
2.33	0.27
2.37	0.24
2.40	0.27
2.43	0.27
2.47	0.27
2.50	0.24
2.53	0.27
2.57	0.27
2.60	0.27
2.63	0.27
2.67	0.27
2.70	0.27
2.73	0.30
2.77	0.27
2.80	0.30
2.83	0.27
2.87	0.27
2.90	0.27
2.93	0.30
2.97	0.33
3.00	0.30

Run Time [Hours]	Pressure [PSI]
3.03	0.30
3.07	0.30
3.10	0.30
3.13	0.30
3.15	0.18
*3.31 **	0.10
3.33	0.83
3.37	0.83
3.40	0.83
3.43	0.83
3.47	0.83
3.50	0.83
3.53	0.86

**Flow rate change*

NOTE: Data collection software may not have been paused for full interim between Runs at differing flow rates. Thus, total Run Time of the raw data may exceed total time of flow recorded on the Water Drive Summary Benchsheet.

Water Drive for Three Flow Settings

Benchsheet

BNSF Wishram Yard

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample and Setup Information

Sample ID:	**G260-G**	Analyst:	EG
Lab ID:	T1092-02G	Date/Time:	10/22/2018 13:32
Mass of Sample w/ Sleeve (g):	162.22	Water Drive ID:	Pump #1
Sample Height (mm):	48.95	Number of Syringes:	1
Sample Diameter (mm):	42.72	Syringe size (mL):	60

Water Drive Test	Run 1	Run 2	Run 3
Flow Target Rate (mL/min):	**0.400**	**0.800**	**4.000**
Coarse Dial Setting:	1	1	1
Percentage Setting:	0.5%	1.0%	5.0%
Theoretical Flow Rate (mL/min):	0.387	0.774	3.870
Target Effluent Volume (mL):	50.0	50.0	50.0
Initial Syringe Volume (mL):	60	60	60
Start Date/Time:	10/22/2018 13:32	10/22/2018 15:39	10/22/2018 16:48
Stop Date/Time:	10/22/2018 15:34	10/22/2018 16:42	10/22/2018 17:02
Final Syringe Volume (mL):	10	10.0	4
Flow Rate Check (mL/min):	0.410	0.794	4.000

Pressure	Run 1	Run 2	Run 3
Transducer (High or Low):	High	High	High
Voltage Multiplier (psi/V):	3	3	3
Steady Run Volt Output (V):	0.10	0.15	0.53
Applied Pressure (psi):	0.31	0.44	1.60

Observations	Run 1	Run 2	Run 3
Volume Accumulated on Top (mL):	48	50	56
Clear/Color?	slightly opaque/yellow tint	clear/yellow tint	clear/ slight yellow tint
Sheen?	no	no	no
Blebs w/ approx. vol (mL)?	no	no	no
Odor?	yes	yes	yes
Fluoresce Under UV light?	yes	yes	yes

Post-Water Drive

Mass of Sample w/ Sleeve (g): 151.12

Notes: Eluate examined under 302 nm UV light Post-Water Drive.
Some solids retained on the filter post water drive.

Water Drive Raw Data Summary
BNSF Wishram Yard

Sample Name: G260-G
Lab ID: T1092-02G
Test Start: 10/22/2018

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Run Time [Hours]	Pressure [PSI]
0.01	0.24
0.03	0.27
0.07	0.24
0.10	0.33
0.13	0.27
0.17	0.27
0.20	0.27
0.23	0.27
0.27	0.27
0.30	0.27
0.33	0.27
0.37	0.27
0.40	0.27
0.43	0.30
0.47	0.30
0.50	0.30
0.53	0.27
0.57	0.27
0.60	0.27
0.63	0.30
0.67	0.30
0.70	0.30
0.73	0.27
0.77	0.27
0.80	0.27
0.83	0.30
0.87	0.30
0.90	0.30
0.93	0.30
0.97	0.27
1.00	0.30
1.03	0.30
1.07	0.30
1.10	0.30
1.13	0.27
1.17	0.33
1.20	0.30
1.23	0.30
1.27	0.33
1.30	0.27
1.33	0.30
1.37	0.30
1.40	0.30
1.43	0.33
1.47	0.30

Run Time [Hours]	Pressure [PSI]
1.50	0.27
1.53	0.33
1.57	0.30
1.60	0.30
1.63	0.30
1.67	0.33
1.70	0.33
1.73	0.30
1.77	0.33
1.80	0.33
1.83	0.30
1.87	0.33
1.90	0.33
1.93	0.33
1.95	0.30
1.97	0.30
2.00	0.30
2.03	0.33
2.04	0.15
*2.04 **	0.15
2.06	0.10
2.07	0.10
2.10	0.10
2.13	0.30
2.17	0.39
2.20	0.42
2.23	0.39
2.27	0.39
2.30	0.45
2.33	0.42
2.37	0.42
2.40	0.42
2.43	0.45
2.47	0.42
2.50	0.42
2.53	0.42
2.57	0.42
2.60	0.42
2.63	0.42
2.67	0.45
2.70	0.45
2.73	0.42
2.77	0.42
2.80	0.45
2.83	0.45

Run Time [Hours]	Pressure [PSI]
2.87	0.42
2.90	0.45
*2.90 **	0.45
2.93	0.45
2.97	0.45
3.00	0.45
3.03	0.42
3.07	0.45
3.10	0.45
3.13	0.45
3.15	0.45
3.17	0.45
3.20	0.12
3.23	0.12
3.27	0.10
3.30	1.65
3.31	1.62
3.33	1.59
3.37	1.62
3.40	1.65
3.43	1.65
3.47	1.68
3.50	1.65
3.51	0.42

**Flow rate change*

NOTE: Data collection software may not have been paused for full interim between Runs at differing flow rates. Thus, total Run Time of the raw data may exceed total time of flow recorded on the Water Drive Summary Benchsheet.

TestAmerica ASL

Dean Stark Extraction and Grain Density Summary

BNSF Wishram Yard

T1092-01

Sample ID	Sample Depth Range (ft bgs)	Wet Bulk Density (g/cm^3)	Dry Bulk Density (g/cm^3)	Wet Sample Mass (g)	Media Mass: Solids (g)	Media Mass: Water (g)	Media Mass: NAPL (g)	Grain Density (g/cm^3)
G200-J	2.83 - 3.00	1.43	0.87	54.17	33.03	15.5 *	5.64	2.23
G200-K, PWD	3.00 - 3.17	1.52	0.89	54.86	32.29	14.7	6.92	1.75
G200-L	3.17 - 3.33	1.61	1.07	54.07	35.73	11.7	6.60	2.18
G200-M, PWD	3.33 - 3.50	1.63	1.16	67.30	47.66	14.4	5.22	2.06
G200-N	3.50 - 3.67	1.87	1.52	57.83	46.83	9.70	1.30	2.21
G200-O	3.67 - 3.83	1.37	1.00	43.86	31.95	12.9	-0.96	2.01

Notes:

* Water mass estimated volumetrically as opposed to gravimetrically like all the others.

PWD = Post Water Drive

TestAmerica ASL

Dean Stark Extraction and Grain Density Summary

BNSF Wishram Yard

T1092-02

Sample ID	Sample Depth Range (ft bgs)	Wet Bulk Density (g/cm^3)	Dry Bulk Density (g/cm^3)	Wet Sample Mass (g)	Media Mass: Solids (g)	Media Mass: Water (g)	Media Mass: NAPL (g)	Grain Density (g/cm^3)
G260-C	1.83-2.00	1.65	1.26	58.1	44.15	14.5	-0.56	1.96
G260-D, PWD	2.00-2.17	1.38	0.86	68.0	42.45	16.1	9.42	1.92
G260-E	2.17-2.33	1.62	1.09	57.6	38.70	15.9	3.05	2.17
G260-F	2.33-2.50	1.46	1.07	58.8	43.09	9.28	6.44	1.99
G260-G, PWD	2.50-2.67	1.54	1.03	61.7	41.59	17.0	3.15	2.04
G260-H	2.67-2.83	1.82	1.31	65.2	47.09	17.7	0.47	2.00

Notes:

PWD = Post Water Drive

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Tel 541.243.0974

CASE NARRATIVE
SPECIAL ANALYTICS

Lab Name: TestAmerica ASL — ASL SDG: T1092
Project Name: *BNSF Wishram* — PO Number: 131004734

Method(s):

Analyses: Grain Size (ASTM D422)

Overview: The distribution of particle sizes larger than 75 µm is determined by sieving, while the distribution of particle sizes smaller than 75 µm is determined by a sedimentation process using a hydrometer.

Exceptions: Solid samples from core segments used for mobility and/or pore fluid saturation analysis were oven-baked at 105°C instead of the method-specified air drying. The solids mass of each individual sample segment was insufficient for measurement of grain size distribution, as ASTM 422 specifies a sample mass of 300-500 grams dry. To increase the amount of soil mass for testing, several adjacent segments with similar properties were combined according to the instruction of the Jacobs project team. These combinations are summarized in the table below with the total amount of dry solids mass used in the grain size distribution analysis. Each combined sample had sufficient analysis for the hydrometer portion of the test, but due to the limited mass, was below method specifications for the sieve analysis (grain size > 75 µm). Accordingly, results of the sieve analysis may not represent the greater soil profile as accurately as a sample size within the recommended mass range.

GRAIN SIZE Sample Combinations

Lab ID	SDG ID	Sample Mass [g]	Sample Notes *	Total Sample Mass † [g]
WISH-1	G200-C	92.64	As-Received, Air Dried	
	G200-D	102.82	As-Received, Air Dried	
	G200-E	89.66	As-Received, Air Dried	
	G200-F	92.14	As-Received, Air Dried	
	G200-G	83.53	As-Received, Air Dried	460.79
WISH-3	G200-J	32.91	Post DS Baked	
	G200-K	32.33	Post DS Baked	
	G200-L	35.65	Post DS Baked	100.89 †
WISH-4	G200-M	47.65	Post DS Baked	
	G200-N	46.87	Post DS Baked	
	G200-N	54.23	As-Received, Air Dried ‡	
	G200-O	32.02	Post DS Baked	180.77 †
WISH-5	G260-B	86.57	As-Received, Air Dried	
	G260-C	43.93	Post DS Baked	
	G260-C	40.98	As-Received, Air Dried ‡	171.48 †
WISH-6	G260-D	42.39	Post DS Baked	
	G260-E	37.80	Post DS Baked	80.19 †
WISH-7	G260-F	42.43	Post DS Baked	
	G260-G	41.80	Post DS Baked	
	G260-H	46.43	Post DS Baked	130.66 †
WISH-8	G260-J	68.31	As-Received, Air Dried	
	G260-K	48.27	As-Received, Air Dried	116.58 †

* All Air-Dried samples were dried on small trays in a fume hood until visibly dry.

‡ This portion of the soil sample did not undergo extraction by Dean Stark.

† Total Sample Mass was less than method recommended minimum for determination of grain sizes >75 µm. All hydrometer analyses (determination of grain sizes <75 µm) were conducted with enough sample mass per the method.

DS = Dean Stark extraction for pore fluid saturation

TestAmerica ASL

Particle Size Distribution (ASTM D422) - Report

TestAmerica THE LEADER IN ENVIRONMENTAL TESTING

Analyst: PC | Lab ID: WISH-1

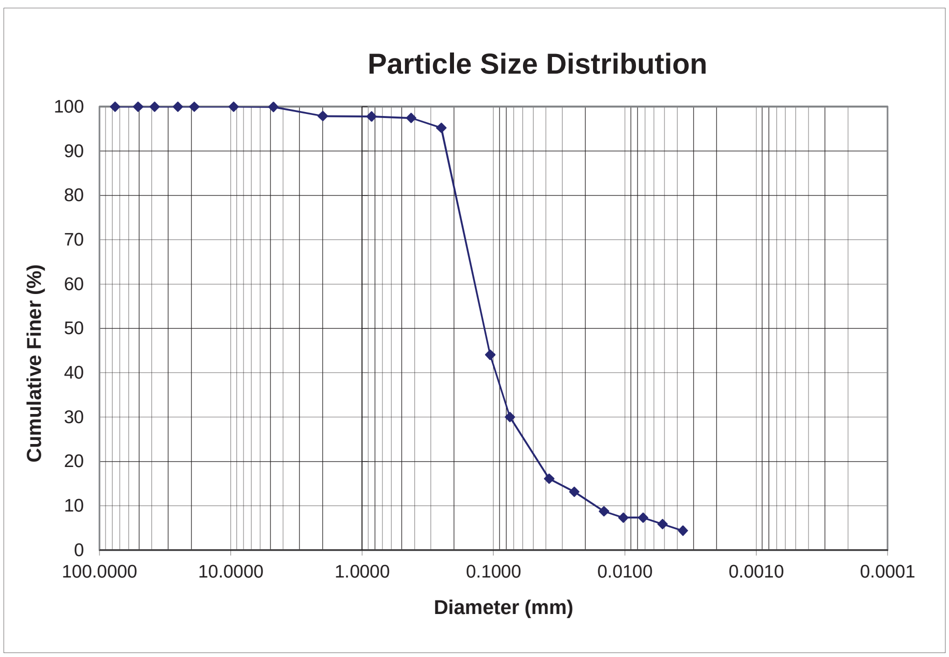
Date: 1/5/2019 | Client ID: G200-C - G200-G

Soil Description	Sieve No	Weight %
Gravel	4	0.1
Coarse Sand	10	2.1
Medium Sand	40	0.4
Fine Sand	200	67.4
Silt/Clay	<200	30.0

Sample Mass (g): 459.86

	Sieve #	Diameter (mm)	Weight Retained (g)	Weight Retained %	Cumulative Retained %	Cumulative Finer %
Sieve Analysis	3"	76.20	0.00	0.00	0.00	100.00
	2"	50.80	0.00	0.00	0.00	100.00
	1.5"	38.10	0.00	0.00	0.00	100.00
	1"	25.40	0.00	0.00	0.00	100.00
	3/4"	19.05	0.00	0.00	0.00	100.00
	3/8"	9.525	0.00	0.00	0.00	100.00
	4	4.750	0.25	0.05	0.05	99.95
	10	2.000	9.50	2.07	2.12	97.88
	20	0.850	0.55	0.12	2.24	97.76
	40	0.425	1.48	0.32	2.56	97.44
	60	0.250	10.21	2.22	4.78	95.22
	140	0.106	235.29	51.17	55.95	44.05
	200	0.075	64.56	14.04	69.99	30.01

	Hydrometer Time	Diameter (mm)		Weight Retained %	Cumulative Retained %	Cumulative Finer %
Hydrometer Analysis	2	0.038		25.18	95.17	16.10
	5	0.024		0.88	96.05	13.17
	15	0.014		1.32	97.36	8.78
	30	0.010		0.44	97.80	7.32
	60	0.007		0.00	97.80	7.32
	120	0.005		0.44	98.24	5.85
	250	0.004		0.44	98.68	4.39



TestAmerica ASL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Particle Size Distribution (ASTM D422) - Report

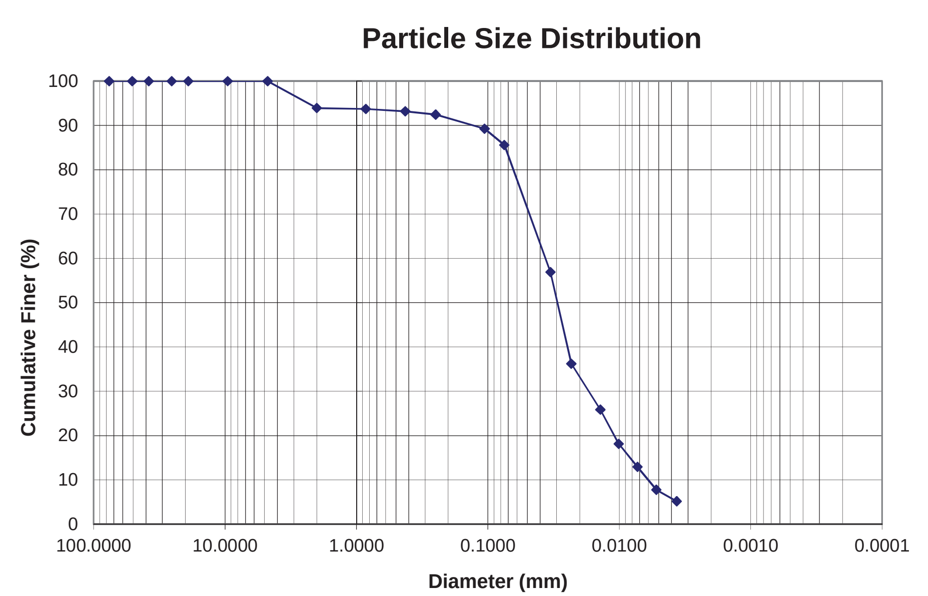
Analyst: PC
Date: 1/5/2019
Lab ID: WISH-3
Client ID: G200-J - G200-L

Soil Description	Sieve No	Weight %
Gravel	4	0.0
Coarse Sand	10	6.1
Medium Sand	40	0.8
Fine Sand	200	7.6
Silt/Clay	<200	85.6

Sample Mass (g): 101.25

	Sieve #	Diameter (mm)	Weight Retained (g)	Weight Retained %	Cumulative Retained %	Cumulative Finer %
Sieve Analysis	3"	76.20	0.00	0.00	0.00	100.00
	2"	50.80	0.00	0.00	0.00	100.00
	1.5"	38.10	0.00	0.00	0.00	100.00
	1"	25.40	0.00	0.00	0.00	100.00
	3/4"	19.05	0.00	0.00	0.00	100.00
	3/8"	9.525	0.00	0.00	0.00	100.00
	4	4.750	0.00	0.00	0.00	100.00
	10	2.000	6.16	6.08	6.08	93.92
	20	0.850	0.20	0.20	6.29	93.71
	40	0.425	0.57	0.56	6.85	93.15
	60	0.250	0.76	0.75	7.59	92.41
	140	0.106	3.22	3.18	10.77	89.23
	200	0.075	3.73	3.68	14.45	85.55

	Hydrometer Time	Diameter (mm)		Weight Retained %	Cumulative Retained %	Cumulative Finer %
Hydrometer Analysis	2	0.033		36.89	51.34	56.88
	5	0.023		17.70	69.03	36.20
	15	0.014		8.85	77.88	25.86
	30	0.010		6.64	84.52	18.10
	60	0.007		4.42	88.94	12.93
	120	0.005		4.42	93.36	7.76
	250	0.004		2.21	95.58	5.17



TestAmerica ASL

Particle Size Distribution (ASTM D422) - Report

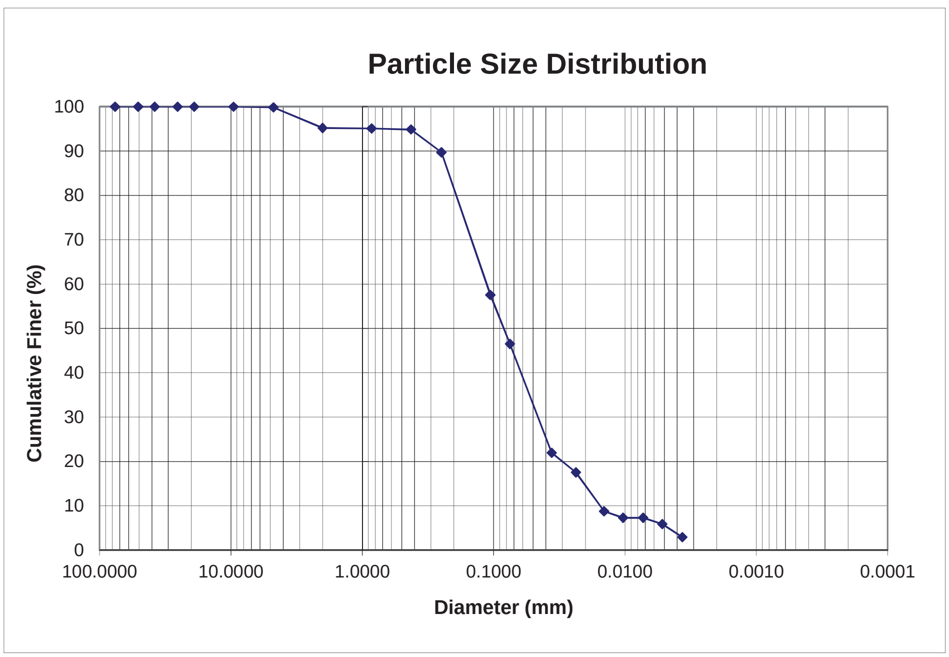
Analyst: PC
Date: 1/5/2019
Lab ID: WISH-4
Client ID: G200-M - G200O

Soil Description	Sieve No	Weight %
Gravel	4	0.2
Coarse Sand	10	4.6
Medium Sand	40	0.3
Fine Sand	200	48.4
Silt/Clay	<200	46.5

Sample Mass (g): 180.38

	Sieve #	Diameter (mm)	Weight Retained (g)	Weight Retained %	Cumulative Retained %	Cumulative Finer %
Sieve Analysis	3"	76.20	0.00	0.00	0.00	100.00
	2"	50.80	0.00	0.00	0.00	100.00
	1.5"	38.10	0.00	0.00	0.00	100.00
	1"	25.40	0.00	0.00	0.00	100.00
	3/4"	19.05	0.00	0.00	0.00	100.00
	3/8"	9.525	0.00	0.00	0.00	100.00
	4	4.750	0.35	0.19	0.19	99.81
	10	2.000	8.33	4.62	4.81	95.19
	20	0.850	0.21	0.12	4.93	95.07
	40	0.425	0.40	0.22	5.15	94.85
	60	0.250	9.31	5.16	10.31	89.69
	140	0.106	58.00	32.15	42.46	57.54
	200	0.075	19.97	11.07	53.53	46.47

	Hydrometer Time	Diameter (mm)		Weight Retained %	Cumulative Retained %	Cumulative Finer %
Hydrometer Analysis	2	0.036		36.28	89.82	21.92
	5	0.024		2.04	91.85	17.53
	15	0.014		4.07	95.93	8.77
	30	0.010		0.68	96.61	7.31
	60	0.007		0.00	96.61	7.31
	120	0.005		0.68	97.28	5.84
	250	0.004		1.36	98.64	2.92



TestAmerica ASL

Particle Size Distribution (ASTM D422) - Report

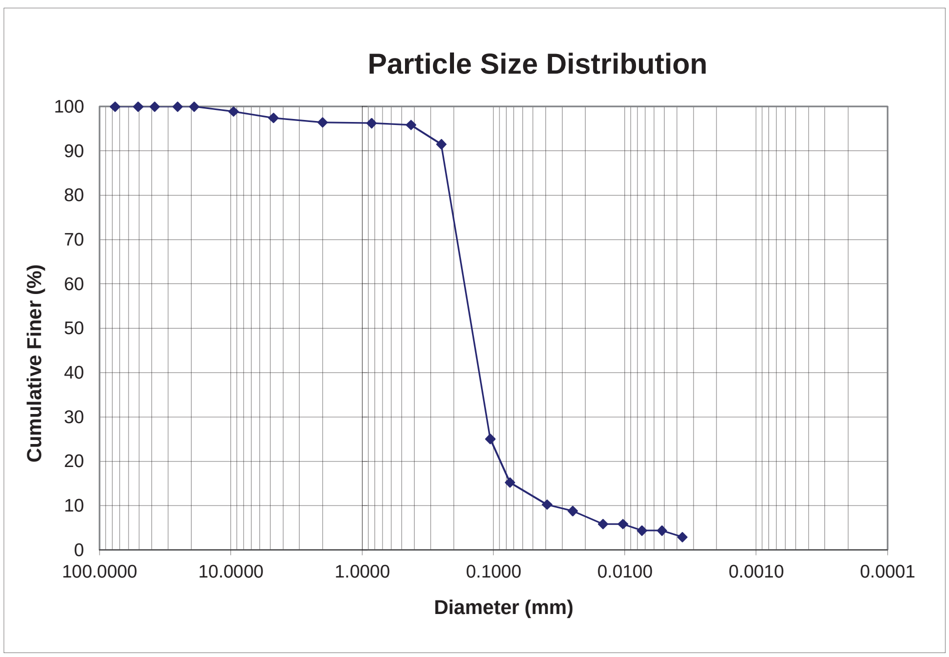
TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Analyst:	PC	Lab ID:	WISH-5
Date:	1/5/2019	Client ID:	G260-B, G260-C

Soil Description	Sieve No	Weight %		
Gravel	4	2.6		
Coarse Sand	10	1.0		
Medium Sand	40	0.6		
Fine Sand	200	80.6		
Silt/Clay	<200	15.2	Sample Mass (g):	171.14

	Sieve #	Diameter (mm)	Weight Retained (g)	Weight Retained %	Cumulative Retained %	Cumulative Finer %
Sieve Analysis	3"	76.20	0.00	0.00	0.00	100.00
	2"	50.80	0.00	0.00	0.00	100.00
	1.5"	38.10	0.00	0.00	0.00	100.00
	1"	25.40	0.00	0.00	0.00	100.00
	3/4"	19.05	0.00	0.00	0.00	100.00
	3/8"	9.525	1.91	1.12	1.12	98.88
	4	4.750	4.43	2.59	2.59	97.41
	10	2.000	1.67	0.98	3.56	96.44
	20	0.850	0.27	0.16	3.72	96.28
	40	0.425	0.73	0.43	4.15	95.85
	60	0.250	7.45	4.35	8.50	91.50
	140	0.106	113.70	66.44	74.94	25.06
	200	0.075	16.82	9.83	84.77	15.23

	Hydrometer Time	Diameter (mm)		Weight Retained %	Cumulative Retained %	Cumulative Finer %
Hydrometer Analysis	2	0.039		13.67	98.44	10.27
	5	0.025		0.22	98.66	8.80
	15	0.015		0.45	99.11	5.87
	30	0.010		0.00	99.11	5.87
	60	0.007		0.22	99.33	4.40
	120	0.005		0.00	99.33	4.40
	250	0.004		0.22	99.55	2.93



TestAmerica ASL

Particle Size Distribution (ASTM D422) - Report

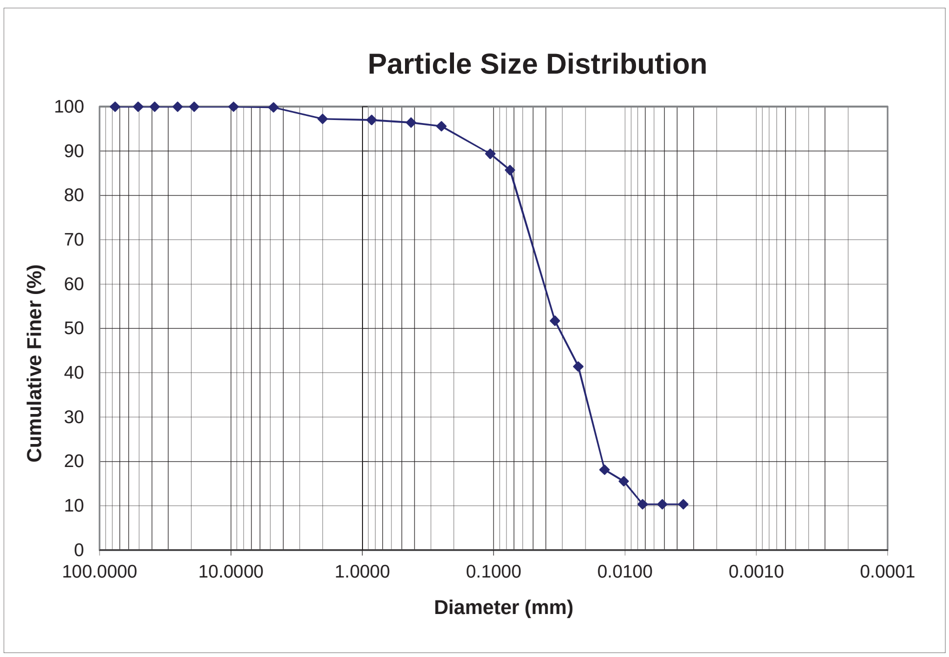
Analyst: PC
Lab ID: WISH-6
Date: 1/5/2019
Client ID: G260-D, G260-E

Soil Description	Sieve No	Weight %
Gravel	4	0.2
Coarse Sand	10	2.6
Medium Sand	40	0.8
Fine Sand	200	10.7
Silt/Clay	<200	85.7

Sample Mass (g): 79.55

	Sieve #	Diameter (mm)	Weight Retained (g)	Weight Retained %	Cumulative Retained %	Cumulative Finer %
Sieve Analysis	3"	76.20	0.00	0.00	0.00	100.00
	2"	50.80	0.00	0.00	0.00	100.00
	1.5"	38.10	0.00	0.00	0.00	100.00
	1"	25.40	0.00	0.00	0.00	100.00
	3/4"	19.05	0.00	0.00	0.00	100.00
	3/8"	9.525	0.00	0.00	0.00	100.00
	4	4.750	0.14	0.18	0.18	99.82
	10	2.000	2.06	2.59	2.77	97.23
	20	0.850	0.19	0.24	3.00	97.00
	40	0.425	0.49	0.61	3.61	96.39
	60	0.250	0.66	0.83	4.45	95.55
	140	0.106	4.93	6.20	10.65	89.35
	200	0.075	2.92	3.67	14.32	85.68

	Hydrometer Time	Diameter (mm)		Weight Retained %	Cumulative Retained %	Cumulative Finer %
Hydrometer Analysis	2	0.034		41.38	55.70	51.70
	5	0.023		8.86	64.56	41.36
	15	0.014		19.93	84.50	18.10
	30	0.010		2.21	86.71	15.51
	60	0.007		4.43	91.14	10.34
	120	0.005		0.00	91.14	10.34
	250	0.004		0.00	91.14	10.34



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TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Particle Size Distribution (ASTM D422) - Report

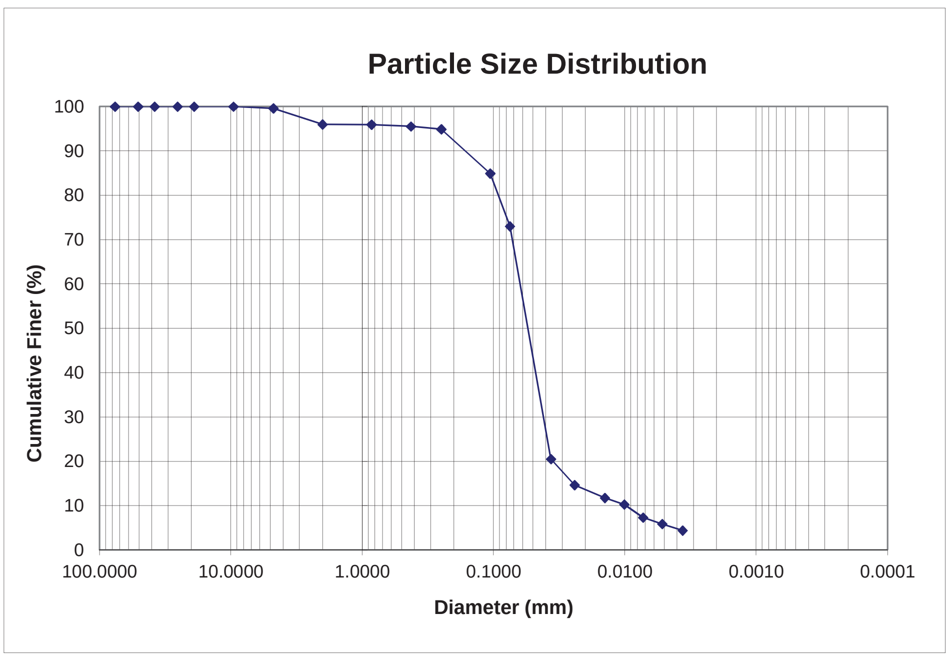
Analyst: PC
Date: 1/5/2019
Lab ID: WISH-7
Client ID: G260-F - G260-H

Soil Description	Sieve No	Weight %
Gravel	4	0.4
Coarse Sand	10	3.6
Medium Sand	40	0.4
Fine Sand	200	22.5
Silt/Clay	<200	73.0

Sample Mass (g): 130.27

	Sieve #	Diameter (mm)	Weight Retained (g)	Weight Retained %	Cumulative Retained %	Cumulative Finer %
Sieve Analysis	3"	76.20	0.00	0.00	0.00	100.00
	2"	50.80	0.00	0.00	0.00	100.00
	1.5"	38.10	0.00	0.00	0.00	100.00
	1"	25.40	0.00	0.00	0.00	100.00
	3/4"	19.05	0.00	0.00	0.00	100.00
	3/8"	9.525	0.00	0.00	0.00	100.00
	4	4.750	0.56	0.43	0.43	99.57
	10	2.000	4.70	3.61	4.04	95.96
	20	0.850	0.10	0.07	4.11	95.89
	40	0.425	0.49	0.37	4.49	95.51
	60	0.250	0.85	0.65	5.14	94.86
	140	0.106	13.02	9.99	15.13	84.87
	200	0.075	15.48	11.88	27.01	72.99

	Hydrometer Time	Diameter (mm)		Weight Retained %	Cumulative Retained %	Cumulative Finer %
Hydrometer Analysis	2	0.037		58.01	85.02	20.53
	5	0.024		4.28	89.30	14.66
	15	0.014		2.14	91.44	11.73
	30	0.010		1.07	92.51	10.26
	60	0.007		2.14	94.65	7.33
	120	0.005		1.07	95.72	5.86
	250	0.004		1.07	96.79	4.40



TestAmerica ASL

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Particle Size Distribution (ASTM D422) - Report

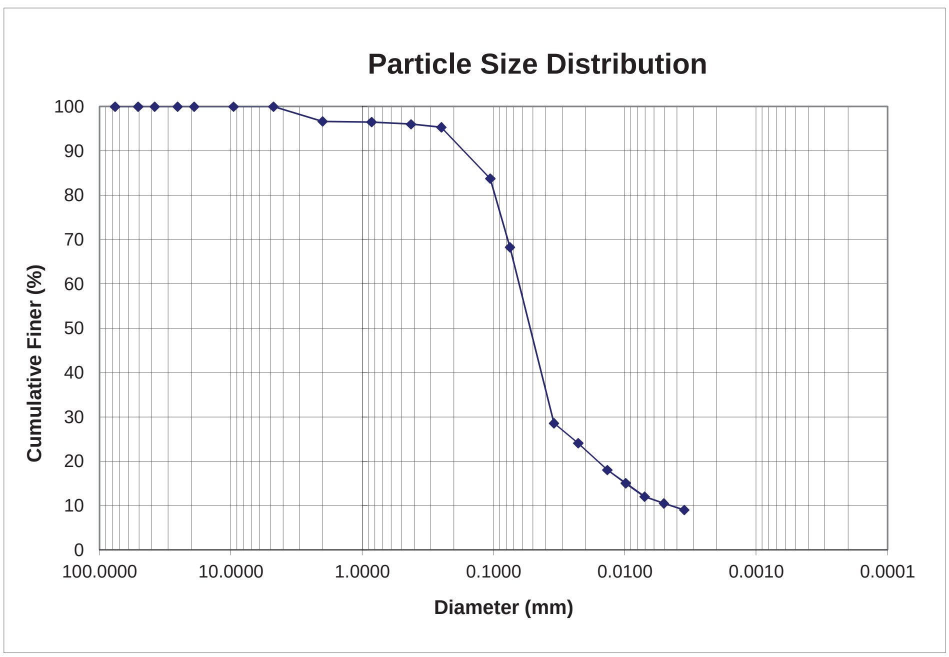
Analyst: PC
Date: 1/5/2019
Lab ID: WISH-8
Client ID: G260-I - G260-K

Soil Description	Sieve No	Weight %
Gravel	4	0.0
Coarse Sand	10	3.4
Medium Sand	40	0.6
Fine Sand	200	27.8
Silt/Clay	<200	68.3

Sample Mass (g): 116.17

	Sieve #	Diameter (mm)	Weight Retained (g)	Weight Retained %	Cumulative Retained %	Cumulative Finer %
Sieve Analysis	3"	76.20	0.00	0.00	0.00	100.00
	2"	50.80	0.00	0.00	0.00	100.00
	1.5"	38.10	0.00	0.00	0.00	100.00
	1"	25.40	0.00	0.00	0.00	100.00
	3/4"	19.05	0.00	0.00	0.00	100.00
	3/8"	9.525	0.00	0.00	0.00	100.00
	4	4.750	0.00	0.00	0.00	100.00
	10	2.000	3.91	3.37	3.37	96.63
	20	0.850	0.17	0.15	3.51	96.49
	40	0.425	0.53	0.46	3.97	96.03
	60	0.250	0.84	0.72	4.69	95.31
	140	0.106	13.41	11.55	16.24	83.76
	200	0.075	18.01	15.51	31.74	68.26

	Hydrometer Time	Diameter (mm)		Weight Retained %	Cumulative Retained %	Cumulative Finer %
Hydrometer Analysis	2	0.035		48.73	80.48	28.60
	5	0.023		3.08	83.56	24.09
	15	0.014		4.11	87.67	18.06
	30	0.010		2.06	89.72	15.05
	60	0.007		2.06	91.78	12.04
	120	0.005		1.03	92.81	10.54
	250	0.004		1.03	93.83	9.03



TEST AMERICA Chain of Custody Record [CVO] LAB#: T1092

Client: CH2M

Project #: 693282

Project Name: BNSF-WISHRAM

Project location: WISHRAM, WA

Sampler: J. Ulrich

Report to: Carrie Andrews Phone: 503 348 9500

email: carrie.andrews@jacobs.com

SAMPLE ID	DATE TAKEN	TIME TAKEN	MATRIX	PRESERV ~~Collection Method Grab~~	No. of Containers	Analysis NAPL mobility
G200-MC-081018	8/10/18	1330	SS	Dry ice	1	X
G260-MC-081018	8/10/18	1550	SS	Dry ice	1	X

Relinquished By: Jennifer Ulrich DATE/TIME: 8/13/18 1200

Received By: [signature] TA-ASL DATE/TIME: 8/14/18 0945

Received on Ice: Yes ☒ No ☐ Dry

Temperature: -43 °C

Appendix D
NAPL Mobility Testing Results

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Pore Fluid Saturations

BNSF Wishram Yard

Sample ID	Sample Depth Range (ft bgs)	NAPL Density * (g/cm^3)	Media Volumes: Bulk Sample (cm^3)	Solids (cm^3)	Water (cm^3)	NAPL (cm^3)	Air (cm^3)	Pore Volume, P_V (cm^3)	Porosity (%V_B)	Pore Volume Saturation: Water (% P_V)	NAPL (% P_V)	Air (% P_V)
G200-J	2.83 - 3.00	0.96	37.80	14.8	15.5	5.9	1.6	21.4	57%	73%	27%	8%
G200-K, PWD	3.00 - 3.17	0.96	36.11	18.5	14.7	7.2	-4.3	21.9	61%	67%	33%	-20%
G200-L	3.17 - 3.33	0.96	33.53	16.4	11.7	6.9	-1.4	18.6	55%	63%	37%	-8%
G200-M, PWD	3.33 - 3.50	0.96	36.19	23.2	14.4	5.4	-6.8	19.8	55%	73%	27%	-34%
G200-N	3.50 - 3.67	0.96	30.85	21.1	9.7	1.4	-1.3	11.1	36%	88%	12%	-12%
G200-O	3.67 - 3.83	0.96	32.10	15.9	12.9	-1.0	4.3	11.9	37%	108%	-8%	36%

Notes:

*No location-specific NAPL density measured. Assumed density of 0.96 g/cm^3 per previous upland study.

Pore Volume is estimated as the sum of the water and NAPL phases as these were saturated samples.

PWD = Post Water Drive

JACOBS

Pore Fluid Saturations

BNSF Wishram Yard

Sample ID	Sample Depth Range (ft bgs)	NAPL Density* (g/cm^3)	Media Volumes: Bulk Sample (cm^3)	Media Volumes: Solids (cm^3)	Media Volumes: Water (cm^3)	Media Volumes: NAPL (cm^3)	Media Volumes: Air (cm^3)	Pore Volume, P_V (cm^3)	Porosity ($\%V_B$)	Pore Volume Saturation: Water ($\% P_V$)	Pore Volume Saturation: NAPL ($\% P_V$)	Pore Volume Saturation: Air ($\% P_V$)
G260-C	1.83 - 2.00	0.96	35.17	22.6	14.5	-0.6	-1.3	13.9	39%	104%	-4%	-9%
G260-D, PWD	2.00 - 2.17	0.96	49.25	22.2	16.1	9.8	1.2	25.9	53%	62%	38%	5%
G260-E	2.17 - 2.33	0.96	35.49	17.8	15.9	3.2	-1.3	19.0	54%	83%	17%	-7%
G260-F	2.33 - 2.50	0.96	40.15	21.7	9.3	6.7	2.5	16.0	40%	58%	42%	16%
G260-G, PWD	2.50 - 2.67	0.96	41.24	20.4	17.0	3.3	0.6	20.2	49%	84%	16%	3%
G260-H	2.67 - 2.83	0.96	35.90	23.5	17.7	0.5	-5.8	18.2	51%	97%	3%	-32%

Notes:

*No location-specific NAPL density measured. Assumed density of 0.96 g/cm^3 per previous upland study.

Pore Volume is estimated as the sum of the water and NAPL phases as these were saturated samples.

PWD = Post Water Drive

Appendix E
Data Validation

JACOBS

Memorandum

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Dallas, Texas 75201
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Subject **Data Validation Summary**

Project Name BNSF-Wishram Railyard

Attention Carrie Andrews/PDX
Gretchen Gee/PDX

From Tiffany Hill

Date January 22, 2019

1. Introduction

The following data validation report discusses the data validation process and findings for STAT Analysis Corporation in Chicago, IL for Sample Delivery Group (SDG) 18080529. Based on the deliverable the validation performed is in line with a level 2 validation.

Samples were analyzed using the following analytical methods:

- COD by E410.4 (Note: lab is not accredited for solid matrices, utilizing a modified method due to the matrix.)

The samples included in this SDG are listed in the table below.

Table 1. Sample IDs

Sample ID	Lab ID	Matrix
D240-GS-080618	18080529-001A	Soil
D260-GS-080618	18080529-002A	Soil
D420-GS-080618	18080529-003A	Soil
D150-GS-080718	18080529-004A	Soil
D220-GS-080718	18080529-005A	Soil
BG-US01-080718	18080529-006A	Soil
D200-GS-080718	18080529-007A	Soil
D200-SC-080718-A	18080529-008A	Soil
G260-SC-080718-A	18080529-009A	Soil
G260-SC-080718-A-1	18080529-010A	Soil
G260-SC-080718-B	18080529-011A	Soil

Table 1. Sample IDs

Sample ID	Lab ID	Matrix
G260-GS-080718	18080529-012A	Soil
G200-GS-080718	18080529-013A	Soil
G200-SC-080718	18080529-014A	Soil
F400B-SC-080818-A	18080529-015A	Soil
F400B-SC-080818-B	18080529-016A	Soil
F360-SC-080818-A	18080529-017A	Soil
F360-SC-080818-B	18080529-018A	Soil
K120-GS-080818	18080529-019A	Soil
K120-SC-080818-A	18080529-020A	Soil
J260-GS-080818	18080529-021A	Soil
J260-SC-080818-A	18080529-022A	Soil
I400-GS-080918	18080529-023A	Soil
I400-SC-080918-A	18080529-024A	Soil
I400-SC-080918-B	18080529-025A	Soil

2. Data Evaluation

Data was evaluated with guidance found in the following guidance documents: National Functional Guidelines for Inorganic Superfund Methods Data Review (January 2017) as applicable:

- Data Completeness
- Technical Holding Times

3. Overall Evaluation of Data/Potential Usability Issues

Specific details regarding qualification of the data are addressed in the sections below. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte, the validator has chosen the qualifier that best indicates possible bias in the results and qualified these data accordingly.

3.1 Data Completeness

The SDGs were received complete and intact.

3.2 Technical Holding Times

According to the chain of custody records, sampling was performed on 8/6/18-8/9/18. Samples were received at the laboratory on 8/14/18. All sample preparation analysis was performed within holding time requirements.

4. Conclusion

These data can be used in the project decision-making process as qualified by the data quality evaluation process.

Qualification Flags

Exclude	More appropriate data exist for this analyte.
R	Data were rejected for use.
UL	Analyte not detected, quantitation limit is potentially biased low.
UJ	Analyte not detected, estimated quantitation limit.
U	Analyte not detected.
B	Not detected substantially above the level reported in laboratory or field blanks.
L	Analyte present, estimated value potentially biased low.
K	Analyte present, estimated value potentially biased high.
N	Analyte identification presumptive; no second column analysis performed or GC/MS tentative identification.
J	Analyte present, estimated value.
NJ	Analysis indicates the presence of an analyte that was "tentatively identified" and the associated value represents its approximate concentration.
None	Placeholder for calculating quality control issues that do not require flagging.
=	Analyte was detected at a concentration greater than the quantitation limit.

Qualifier Code Reference

Value	Description
%SOL	High Moisture content
2C	Second Column – Poor Dual Column Reproducibility
2S	Second Source – Bad reproducibility between tandem detectors
BD	Blank Spike/Blank Spike Duplicate(LCS/LCSD) Precision
BRL	Below Reporting Limit
BSH	Blank Spike/LCS – High Recovery
BSL	Blank Spike/LCS – Low Recovery
CC	Continuing Calibration
CCH	Continuing Calibration Verification – High Recovery
CCL	Continuing Calibration Verification – Low Recovery
DL	Redundant Result – due to Dilution
EBL	Equipment Blank Contamination

Value	Description
EMPC	Estimated Possible Maximum Concentration
ESH	Extraction Standard - High Recovery
ESL	Extraction Standard - Low Recovery
FBL	Field Blank Contamination
FD	Field Duplicate
HT	Holding Time
ICB	Initial Calibration – Bad Linearity or Curve Function
ICH	Initial Calibration – High Relative Response Factors
ICL	Initial Calibration – Low Relative Response Factors
ISH	Internal Standard – High Recovery
ISL	Internal Standard – Low Recovery
LD	Lab Duplicate Reproducibility
LR	Concentration Exceeds Linear Range
MBL	Method Blank Contamination
MDP	Matrix Spike/Matrix Spike Duplicate Precision
MI	Matrix interference obscuring the raw data
MSH	Matrix Spike and/or Matrix Spike Duplicate – High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate – Low Recovery
OT	Other
PD	Pesticide Degradation
RE	Redundant Result - due to Reanalysis or Re-extraction
SD	Serial Dilution Reproducibility
SSH	Spiked Surrogate – High Recovery
SSL	Spiked Surrogate – Low Recovery
TBL	Trip Blank Contamination
TN	Tune

Attachment 1
Analytical Results

STAT Analysis Corporation
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Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com
Accreditations:IEPA ELAP 100445;ORELAP IL300001;AIHA-LAP, LLC 101160;NVLAP LabCode 101202-0

Date Reported: September 05, 2018
Date Printed: September 05, 2018

ANALYTICAL RESULTS

Client: CH2M Hill
Project: 693282, BNSF-Wishram, Wishram, WA
Work Order: 18080529 Revision 0

Lab ID: 18080529-001 **Collection Date:** 8/6/2018 2:50:00 PM
Client Sample ID: D240-GS-080618 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	ND	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-002 **Collection Date:** 8/6/2018 3:30:00 PM
Client Sample ID: D260-GS-080618 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-003 **Collection Date:** 8/6/2018 4:55:00 PM
Client Sample ID: D420-GS-080618 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-004 **Collection Date:** 8/7/2018 7:30:00 AM
Client Sample ID: D150-GS-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-005 **Collection Date:** 8/7/2018 7:55:00 AM
Client Sample ID: D220-GS-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	250	200	*	mg/Kg	1	8/21/2018

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
HT - Sample received past holding time
* - Non-accredited parameter
RL - Reporting / Quantitation Limit for the analysis
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
H - Holding time exceeded

TAH 1/22/19

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Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com
Accreditations:IEPA ELAP 100445;ORELAP IL300001;AIHA-LAP, LLC 101160;NVLAP LabCode 101202-0

Date Reported: September 05, 2018
Date Printed: September 05, 2018

ANALYTICAL RESULTS

Client: CH2M Hill
Project: 693282, BNSF-Wishram, Wishram, WA
Work Order: 18080529 Revision 0

Lab ID: 18080529-006
Collection Date: 8/7/2018 8:50:00 AM
Client Sample ID: BG-US01-080718
Matrix: Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-007
Collection Date: 8/7/2018 12:30:00 PM
Client Sample ID: D200-GS-080718
Matrix: Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-008
Collection Date: 8/7/2018 4:40:00 PM
Client Sample ID: D200-SC-080718-A
Matrix: Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	350	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-009
Collection Date: 8/7/2018 5:25:00 PM
Client Sample ID: G260-SC-080718-A
Matrix: Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Lab ID: 18080529-010
Collection Date: 8/7/2018 5:30:00 PM
Client Sample ID: G260-SC-080718-A-1
Matrix: Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Qualifiers:

ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
HT - Sample received past holding time
* - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
H - Holding time exceeded

TAH 1/22/19

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Date Reported: September 05, 2018
Date Printed: September 05, 2018

ANALYTICAL RESULTS

Client: CH2M Hill
Project: 693282, BNSF-Wishram, Wishram, WA
Work Order: 18080529 Revision 0

Lab ID: 18080529-011 **Collection Date:** 8/7/2018 5:10:00 PM
Client Sample ID: G260-SC-080718-B **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Lab ID: 18080529-012 **Collection Date:** 8/7/2018 6:00:00 PM
Client Sample ID: G260-GS-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-013 **Collection Date:** 8/7/2018 6:50:00 PM
Client Sample ID: G200-GS-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-014 **Collection Date:** 8/7/2018 6:40:00 PM
Client Sample ID: G200-SC-080718 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Lab ID: 18080529-015 **Collection Date:** 8/8/2018 11:55:00 AM
Client Sample ID: F400B-SC-080818-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Qualifiers:

ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
HT - Sample received past holding time	E - Value above quantitation range
* - Non-accredited parameter	H - Holding time exceeded

TAH 1/22/19

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Date Reported: September 05, 2018
Date Printed: September 05, 2018

ANALYTICAL RESULTS

Client: CH2M Hill
Project: 693282, BNSF-Wishram, Wishram, WA
Work Order: 18080529 Revision 0

Lab ID: 18080529-016 **Collection Date:** 8/8/2018 12:00:00 PM
Client Sample ID: F400B-SC-080818-B **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	250	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-017 **Collection Date:** 8/8/2018 1:10:00 PM
Client Sample ID: F360-SC-080818-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	480	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-018 **Collection Date:** 8/8/2018 1:15:00 PM
Client Sample ID: F360-SC-080818-B **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Lab ID: 18080529-019 **Collection Date:** 8/8/2018 4:40:00 PM
Client Sample ID: K120-GS-080818 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-020 **Collection Date:** 8/8/2018 4:55:00 PM
Client Sample ID: K120-SC-080818-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
HT - Sample received past holding time
* - Non-accredited parameter
RL - Reporting / Quantitation Limit for the analysis
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
H - Holding time exceeded

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Date Reported: September 05, 2018
Date Printed: September 05, 2018

ANALYTICAL RESULTS

Client: CH2M Hill
Project: 693282, BNSF-Wishram, Wishram, WA **Work Order:** 18080529 Revision 0

Lab ID: 18080529-021 **Collection Date:** 8/8/2018 5:40:00 PM
Client Sample ID: J260-GS-080818 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-022 **Collection Date:** 8/8/2018 5:45:00 PM
Client Sample ID: J260-SC-080818-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/19/2018**		Analyst: **MD**
Chemical Oxygen Demand	2200	2000	*	mg/Kg	1	8/19/2018

Lab ID: 18080529-023 **Collection Date:** 8/9/2018 10:00:00 AM
Client Sample ID: I400-GS-080918 **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	ND	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-024 **Collection Date:** 8/9/2018 10:10:00 AM
Client Sample ID: I400-SC-080918-A **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	220	200	*	mg/Kg	1	8/21/2018

Lab ID: 18080529-025 **Collection Date:** 8/9/2018 10:15:00 AM
Client Sample ID: I400-SC-080918-B **Matrix:** Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Chemical Oxygen Demand	**E410.4**			Prep Date: **8/21/2018**		Analyst: **MD**
Chemical Oxygen Demand	250	200	*	mg/Kg	1	8/21/2018

Qualifiers:

ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
HT - Sample received past holding time
* - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
H - Holding time exceeded

TAH 1/22/19

VPH/EPH Validation Summary

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Subject **Wishram VPH/EPH Validation**

Project Name Wishram Nearshore Initial Investigation

From Tiffany Hill

Date October 9, 2018

Project No 693282

---

1. Introduction

The following data validation report discusses the data validation process and findings for Test America in Tacoma, WA for Sample Delivery Group (SDG) J79568-1.

Samples were analyzed using the following analytical methods:

- NWTPH-VPH
- NWTPH-EPH
- Percent Solids, Percent Moisture

The samples included in this SDG are listed in the table below.

Table 1. Sample IDs

Sample ID	Lab ID	Matrix
D240-GS-080618	580-79568-1	Soil
D260-GS-080618	580-79568-2	Soil
D420-GS-080618	580-79568-3	Soil
D420-GS-080618-1	580-79568-4	Soil
D220-GS-080718	580-79568-5	Soil
BG-US01-GS-080718	580-79568-6	Soil
D200-GS-080718	580-79568-7	Soil
G260-GS-080718	580-79568-8	Soil
G200-GS-080718	580-79568-9	Soil
K120-GS-080818	580-79568-10	Soil
J260-GS-080818	580-79568-11	Soil
I400-GS-080918	580-79568-12	Soil
TB-01-080618	580-79568-13	QC

2. Data Evaluation

Data was evaluated in accordance with the analytical methods and with the criteria found in the following guidance documents: National Functional Guidelines for Superfund Organic Methods Data Review (September 2017) as applicable:

- Data Completeness
- Technical Holding Times
- Blanks
- Laboratory Control Samples
- Surrogate Recoveries

2.1 Overall Evaluation of Data/Potential Usability Issues

Specific details regarding qualification of the data are addressed in the sections below. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte, the validator has chosen the qualifier that best indicates possible bias in the results and qualified these data accordingly.

2.2 Data Completeness

The SDGs were received complete and intact.

2.3 Technical Holding Times

Per the chain of custody records, sampling was performed on 8/6/18-8/9/18. Samples were received at the laboratory on 8/14/18. All sample preparation analysis was initially performed within holding time requirements. An LCS failed to meet acceptance criteria for all samples for C10-C12 Aliphatics. Samples were re-extracted outside of holding time beyond use. Initial results were used for reporting.

2.4 Blanks

A few compounds were detected in the associated trip blank as listed below. Affected data are summarized in the tables below. Impacted samples were flagged U-TBL.

Table 2. Trip Blank Detections

Sample ID	Analyte	Reported Concentration (mg/kg)
TB-01-080618	C10-C12 Aliphatics	2.4 J
TB-01-080618	C10-C12 Aromatics	4.2 J

Table 3. Sample Results Impacted by Equipment Blank Detections

Sample	Analyte	Concentration (mg/kg)	Original Qualifier	Final Qualifier
D240-GS-080618	C10-C12 Aromatics	13	J	U-TBL
D260-GS-080618	C10-C12 Aromatics	8.1	J	U-TBL
D420-GS-080618	C10-C12 Aliphatics	5.8	J	U-TBL
	C10-C12 Aromatics	8.9	J	U-TBL
D420-GS-080618-1	C10-C12 Aromatics	9.4	J	U-TBL

Table 3. Sample Results Impacted by Equipment Blank Detections

Sample	Analyte	Concentration (mg/kg)	Original Qualifier	Final Qualifier
D220-GS-080718	C10-C12 Aromatics	11	J	U-TBL
BG-US01-080718	C10-C12 Aromatics	7.0	J	U-TBL
D200-GS-080718	C10-C12 Aromatics	5.1	J	U-TBL
G260-GS-080718	C10-C12 Aromatics	5.3	J	U-TBL
G200-GS-080718	C10-C12 Aromatics	5.2	J	U-TBL
K120-GS-080818	C10-C12 Aromatics	6.4	J	U-TBL
J260-GS-080818	C10-C12 Aromatics	5.3	J	U-TBL
I400-GS-080918	C10-C12 Aromatics	4.5	J	U-TBL

2.5 Laboratory Control Spike

In all NWTPH-EPH samples the associated LCS failed to meet criteria for C10-C12 Aliphatics. All samples are qualified UJ-BSL.

2.6 Surrogate Spike

Samples D240-GS-080618, D260-GS-080618, D420-GS-080618-1, D220-GS-080718, and BG-US01-080718 were UJ/J-SSL qualified due to the failure of associated surrogates for NWTPH-EPH analysis.

2.7 Other

All other analytes for NWTPH-VPH were qualified as estimated UJ/J-OT due to noted elevated baseline described in the laboratory case narrative. Such narration suggests that the results are potentially biased high or reported with reporting limits biased high. Data is available for use at an estimated level.

2.8 Conclusion

These data can be used in the project decision-making process as qualified by the data quality evaluation process.

Qualification Flags

Exclude	More appropriate data exist for this analyte.
R	Data were rejected for use.
UL	Analyte not detected, quantitation limit is potentially biased low.
UJ	Analyte not detected, estimated quantitation limit.
U	Analyte not detected.
B	Not detected substantially above the level reported in laboratory or field blanks.
L	Analyte present, estimated value potentially biased low.

K	Analyte present, estimated value potentially biased high.
N	Analyte identification presumptive; no second column analysis performed or GC/MS tentative identification.
J	Analyte present, estimated value.
NJ	Analysis indicates the presence of an analyte that was "tentatively identified" and the associated value represents its approximate concentration.
None	Placeholder for calculating quality control issues that do not require flagging.
=	Analyte was detected at a concentration greater than the quantitation limit.

Qualifier Code Reference

Value	Description
%SOL	High Moisture content
2C	Second Column – Poor Dual Column Reproducibility
2S	Second Source – Bad reproducibility between tandem detectors
BD	Blank Spike/Blank Spike Duplicate(LCS/LCSD) Precision
BRL	Below Reporting Limit
BSH	Blank Spike/LCS – High Recovery
BSL	Blank Spike/LCS – Low Recovery
CC	Continuing Calibration
CCH	Continuing Calibration Verification – High Recovery
CCL	Continuing Calibration Verification – Low Recovery
DL	Redundant Result – due to Dilution
EBL	Equipment Blank Contamination
EMPC	Estimated Possible Maximum Concentration
ESH	Extraction Standard - High Recovery
ESL	Extraction Standard - Low Recovery
FBL	Field Blank Contamination
FD	Field Duplicate
HT	Holding Time
ICB	Initial Calibration – Bad Linearity or Curve Function
ICH	Initial Calibration – High Relative Response Factors
ICL	Initial Calibration – Low Relative Response Factors
ISH	Internal Standard – High Recovery
ISL	Internal Standard – Low Recovery
LD	Lab Duplicate Reproducibility

Value	Description
LR	Concentration Exceeds Linear Range
MBL	Method Blank Contamination
MDP	Matrix Spike/Matrix Spike Duplicate Precision
MI	Matrix interference obscuring the raw data
MSH	Matrix Spike and/or Matrix Spike Duplicate – High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate – Low Recovery
OT	Other
PD	Pesticide Degradation
RE	Redundant Result - due to Reanalysis or Re-extraction
SD	Serial Dilution Reproducibility
SSH	Spiked Surrogate – High Recovery
SSL	Spiked Surrogate – Low Recovery
TBL	Trip Blank Contamination
TN	Tune

TPH/PAH Data Validation Summary

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Memorandum

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Subject	**Data Validation Summary**
Project Name	BNSF – Wishram Railyard
Attention	Carrie Andrews/PDX Gretchen Gee/PDX
From	Tiffany Hill/CVO
Date	August 27, 2018
Project No	693282

1. Introduction

The following data validation report discusses the data validation process and findings for Pace Analytical in Mount Juliet, TN for Sample Delivery Group (SDG) L107281.

Samples were analyzed using the following analytical methods:

- SW8270-SIM, PAHs
- NWTPH-Dx, DRO and RRO with and without silica gel treatment
- USDA LOI, TOC
- SM2540G, Total Solids

The samples included in this SDG are listed in the table below.

Table 1. Sample IDs

Sample ID	Lab ID	Matrix
D240-GS-080618	L1017281-01	Soil
D240-GS-080618	L1017281-02	Soil
D420-GS-080618	L1017281-03	Soil
D420-GS-080618-1	L1017281-04	Soil
D150-GS-080718	L1017281-05	Soil
D220-GS-080718	L1017281-06	Soil
BG-USO1-GS-080718	L1017281-07	Soil
D200-GS-080718	L1017281-08	Soil
D200-SC-080718A	L1017281-09	Soil
G260-SC-080718-A	L1017281-10	Soil

Table 1. Sample IDs

Sample ID	Lab ID	Matrix
G260-SC-080718-A-1	L1017281-11	Soil
G260-SC-080718-B	L1017281-12	Soil
G260-GS-080718	L1017281-13	Soil
G200-GS-080718	L1017281-14	Soil
G200-SC-080718-A	L1017281-15	Soil
F400B-SC-080818-A	L1017281-16	Soil
F400B-SC-080818-B	L1017281-17	Soil
F360-SC-080818-A	L1017281-18	Soil
F360-SC-080818-B	L1017281-19	Soil
K120-GS-080818	L1017281-20	Soil
K120-SC-080818-A	L1017281-21	Soil
J260-GS-080818	L1017281-22	Soil
J260-SC-080818-A	L1017281-23	Soil
I400-GS-080918	L1017281-24	Soil
I400-SC-080918-A	L1017281-25	Soil
I400-SC-080918-B	L1017281-26	Soil
EB-01-080718	L1017281-27	Aqueous

2. Data Evaluation

Data was evaluated in accordance with the analytical methods and with the criteria found in the following guidance documents: National Functional Guidelines for Superfund Organic Methods Data Review (September 2017) as applicable:

- Data Completeness
- Technical Holding Times
- Blanks
- Laboratory Control Samples
- Surrogate Recoveries

3. Overall Evaluation of Data/Potential Usability Issues

Specific details regarding qualification of the data are addressed in the sections below. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte, the validator has chosen the qualifier that best indicates possible bias in the results and qualified these data accordingly.

3.1 Data Completeness

The SDGs were received complete and intact.

3.2 Technical Holding Times

According to the chain of custody records, sampling was performed on 8/6/18-8/9/18. Samples were received at the laboratory on 8/14/18. All sample preparation analysis was performed within holding time requirements.

3.3 Blanks

Several compounds were detected in the associated equipment blank as listed below. Affected data are summarized in the tables below. The equipment blank, EB-01-080718 had a detection of benzo(b)fluoranthene in its associated method blank. The result in the sample was U-MBL qualified.

Table 2. Equipment Blank Detections

Sample ID	Analyte	Reported Concentration (µg/L)
EB-01-080718	Fluoranthene	0.0519
EB-01-080718	Fluorene	0.0211 J
EB-01-080718	Naphthalene	0.329
EB-01-080718	Phenanthrene	0.0791
EB-01-080718	Pyrene	0.0293 J
EB-01-080718	1-methylnaphthalene	0.0293 J
EB-01-080718	2-methylnaphthalene	0.0445 J

Table 3. Sample Results Impacted by Equipment Blank Detections

Sample	Analyte	Concentration (mg/kg)	Original Qualifier	Final Qualifier
D240-GS-080618	Naphthalene	0.00428	J	U-EBL
	2-Methylnaphthalene	0.003	J	U-EBL
D260-GS-080618	Fluoranthene	0.00398	J	U-EBL
	Phenanthrene	0.00149	J	U-EBL
	Pyrene	0.00531	J	U-EBL
D420-GS-080618-1	Pyrene	0.000937	J	U-EBL
D150-GS-080718	Fluoranthene	0.00268	J	U-EBL
	Phenanthrene	0.00103	J	U-EBL
	Pyrene	0.00437	J	U-EBL
D220-GS-080718	Fluoranthene	0.00135	J	U-EBL
	Pyrene	0.00257	J	U-EBL
D200-GS-080718	Fluoranthene	0.00726	J	U-EBL
	Fluorene	0.00161	J	U-EBL
	Naphthalene	0.00579	J	U-EBL

Table 3. Sample Results Impacted by Equipment Blank Detections

Sample	Analyte	Concentration (mg/kg)	Original Qualifier	Final Qualifier
G200-GS-080718	Fluoranthene	0.00272	J	U-EBL
	Pyrene	0.00369	J	U-EBL
K120-GS-080818	Pyrene	0.00104	J	U-EBL
J260-GS-080818	Naphthalene	0.0605	J	U-EBL
EB-01-080718	Benzo(b)fluoranthene	0.00261	BJ	U-MBL

4. Conclusion

These data can be used in the project decision-making process as qualified by the data quality evaluation process.

Please do not hesitate to contact us about this validation report.

Sincerely,

Tiffany Hill

Qualification Flags

Exclude	More appropriate data exist for this analyte.
R	Data were rejected for use.
UL	Analyte not detected, quantitation limit is potentially biased low.
UJ	Analyte not detected, estimated quantitation limit.
U	Analyte not detected.
B	Not detected substantially above the level reported in laboratory or field blanks.
L	Analyte present, estimated value potentially biased low.
K	Analyte present, estimated value potentially biased high.
N	Analyte identification presumptive; no second column analysis performed or GC/MS tentative identification.
J	Analyte present, estimated value.
NJ	Analysis indicates the presence of an analyte that was "tentatively identified" and the associated value represents its approximate concentration.
None	Placeholder for calculating quality control issues that do not require flagging.
=	Analyte was detected at a concentration greater than the quantitation limit.

Qualifier Code Reference

Value	Description
%SOL	High Moisture content
2C	Second Column – Poor Dual Column Reproducibility
2S	Second Source – Bad reproducibility between tandem detectors
BD	Blank Spike/Blank Spike Duplicate(LCS/LCSD) Precision
BRL	Below Reporting Limit
BSH	Blank Spike/LCS – High Recovery
BSL	Blank Spike/LCS – Low Recovery
CC	Continuing Calibration
CCH	Continuing Calibration Verification – High Recovery
CCL	Continuing Calibration Verification – Low Recovery
DL	Redundant Result – due to Dilution
EBL	Equipment Blank Contamination
EMPC	Estimated Possible Maximum Concentration
ESH	Extraction Standard - High Recovery
ESL	Extraction Standard - Low Recovery
FBL	Field Blank Contamination
FD	Field Duplicate
HT	Holding Time
ICB	Initial Calibration – Bad Linearity or Curve Function

Value	Description
ICH	Initial Calibration – High Relative Response Factors
ICL	Initial Calibration – Low Relative Response Factors
ISH	Internal Standard – High Recovery
ISL	Internal Standard – Low Recovery
LD	Lab Duplicate Reproducibility
LR	Concentration Exceeds Linear Range
MBL	Method Blank Contamination
MDP	Matrix Spike/Matrix Spike Duplicate Precision
MI	Matrix interference obscuring the raw data
MSH	Matrix Spike and/or Matrix Spike Duplicate – High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate – Low Recovery
OT	Other
PD	Pesticide Degradation
RE	Redundant Result - due to Reanalysis or Re-extraction
SD	Serial Dilution Reproducibility
SSH	Spiked Surrogate – High Recovery
SSL	Spiked Surrogate – Low Recovery
TBL	Trip Blank Contamination
TN	Tune

Appendix F
Calculated Estimates of Ebullition Potential

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Memorandum

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Subject	**Gas Ebullition Potential in Sediment Samples at the Wishram Rail Yard**
Project Name	BNSF Wishram Initial Investigation
Attention	Carrie Andrews
From	Raja Kaliappan
Date	December 2018

1. Introduction

Gas ebullition potential in sediment samples collected from the nearshore areas associated with the BNSF Railroad Company (BNSF) Wishram rail yard (site) was evaluated using a literature gas ebullition model (Viana et al., 2012). The model provides an estimate of the expected gas ebullition rate using sediment temperature, total organic carbon (TOC), and chemical oxygen demand (COD) as input parameters. The empirical model was developed from field observations of ebullition fluxes over a period of 1 year in Bubbly Creek (south fork of the Chicago River) and is as follows:

$$GF_m = 7.39 + 12.3\,T - 186\,S_{labile}$$

Where, GF_m is the molar gas flux in millimoles per square meter per day (mmol/m^2/d), T is the sediment temperature in degrees Celsius, and S_{labile} is the labile fraction of the organic carbon that readily contributes to gas generation, which is estimated as the ratio of sediment COD to TOC values in milligrams per kilogram (mg/kg).

Sediment COD and TOC data were collected from eight sediment coring locations from depths ranging from 1.0 to 5.5 feet below sediment surface (bss) (Figure F-1). The sample depths were chosen to represent the primary gas production zone, which is generally considered as the top 5 feet of soft sediment. Ponar grab samples were collected from five locations (D150, D220, D240, D260, and D420) in addition to the eight sediment core locations and analyzed for COD and TOC. As the grab samples were only analyzed for sediment COD and average TOC concentration from the 1-foot sample collected at F360 and F400 were used for grab samples in estimating gas ebullition rates. The average of the sediment temperature measurements at G200 and G260 were used in the model. Estimated ebullition rates in mmol/m^2/d were converted to liters per square meter per day (L/m^2/d). The model results and trends in sediment data are discussed in the following sections.

2. Sediment Characteristics

TOC concentrations ranged between 3,380 and 107,000 mg/kg with a median value of 4,563 mg/kg. The higher TOC concentrations (ranging from 37,100 mg/kg to 91,000 mg/kg) were observed farther from shore at F360, G200, G260, and J260 at depths ranging from 2.5 to 4 feet bss (Figures F-3 and F-4). These high TOC samples were collocated with occurrence of organic debris, roots, and free phase nonaqueous phase liquid (NAPL) identified in the sediment core logs. The high TOC samples were also collocated with the maximum observed COD concentration of 2,200 mg/kg (Table F-1), suggesting that these samples were potentially influenced by NAPL present in the sample. In contrast, the COD/TOC ratio, which is an indicator of the ease of biodegradability of the organic carbon, was observed to decrease with depth and was higher in samples from 0.5 to 2.5 feet bss with values ranging from 0.05 to 0.08 (Figure F-5). This is consistent with observations at other sites as fresh organic matter is more labile than the more recalcitrant organic matter found at depth.

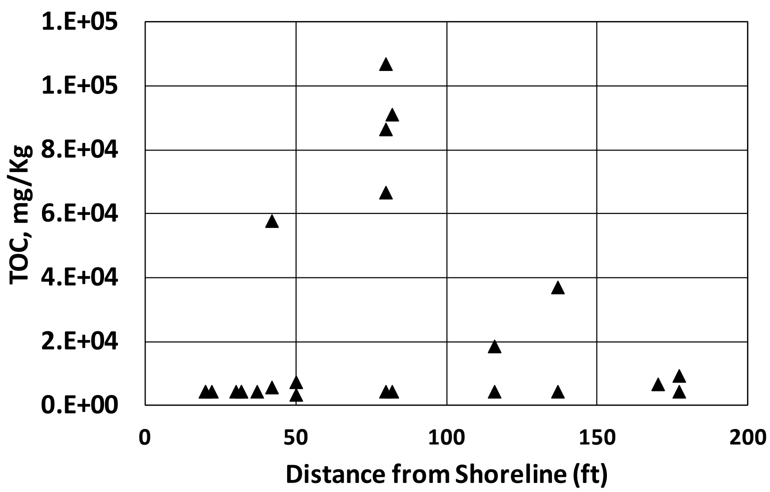


Figure F-3. Variation in TOC Concentration as a Function of Distance from the Shoreline

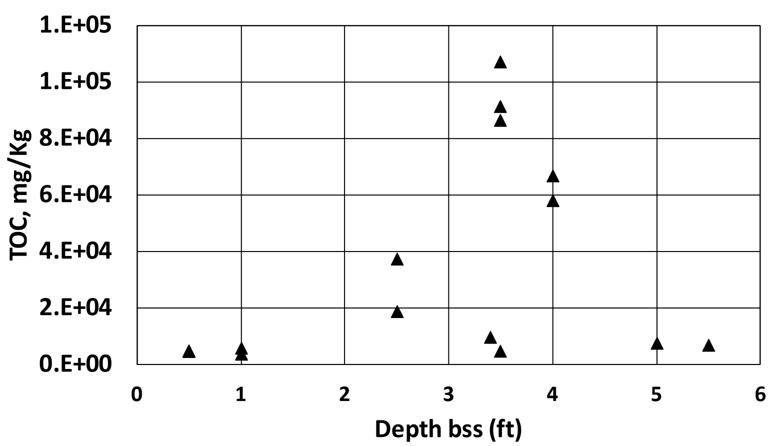


Figure F-4. Variation in TOC Concentration as a Function of Sample Depth

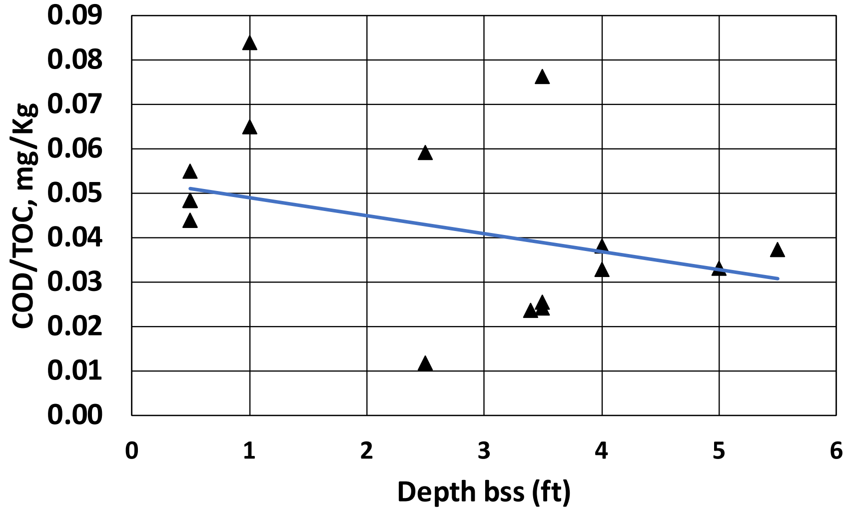


Figure F-5. Decrease in COD/TOC Ratio with Increasing Sample Depth

3. Gas Ebullition Rates

The estimated gas ebullition rates ranged between 6.5 and 6.8 L/m^2/d with little spatial variability as shown in Figures F-6 and F-7. The estimated rates were primarily influenced by the high sediment temperature at the time of sampling and is consistent with field measurements reported in the literature. Predicted ebullition rates were in the range of field measured fluxes observed in Bubbly Creek (Chicago River) that ranged between 1.4 and 9.1 L/m^2/d with a mean value of 5.5 L/m^2/d (Rockne et al., 2010). The predicted rates are indicative of high gas production in the sediments associated with the railroad property, resulting from the high TOC content observed in deeper sediment (4 to 9 percent at depths of 2.5 to 4.0 feet bss) and more labile carbon substrate observed at shallow depths. This is further validated by field observations of ebullition during the recent sampling event conducted by Jacobs Engineering Group Inc. (Jacobs) in August 2018. The NAPL occurrence depth coincides with the ebullition active zone of 0 to 5 feet bss (Viana et al., 2012; Costello and Talsma, 2003), suggesting that gas ebullition could be responsible for the mobilization of free phase NAPL and contribute to NAPL transport to the water column.

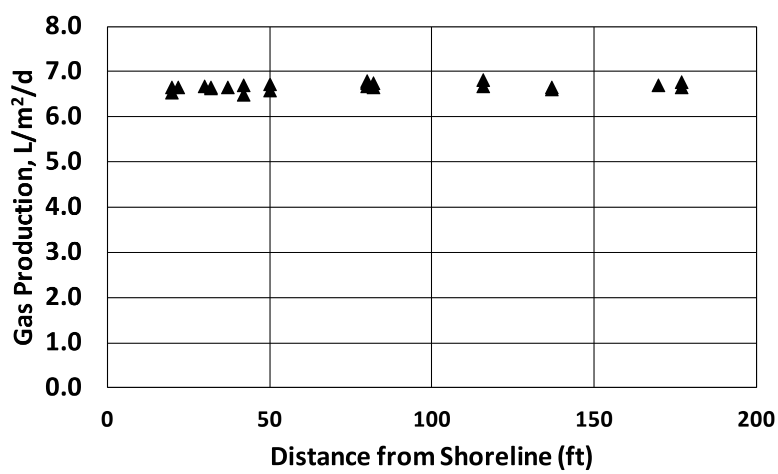


Figure F-6. Variation in Predicted Gas Ebullition Rates as a Function of Distance from the Shoreline

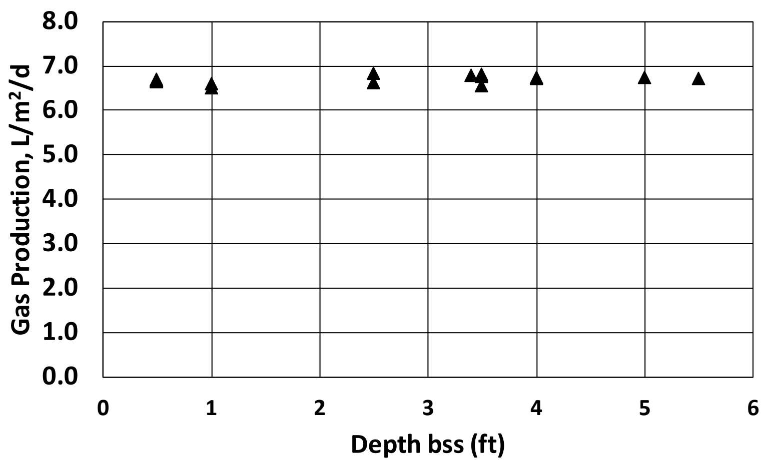


Figure F-7. Variation in Predicted Gas Ebullition Rates as a Function of Sample Depth

4. References

Costello, Michael, and D. Talsma. 2003. "Remedial design modeling at a superfund sediment site." *Proceedings of the Second International Conference on Remediation of Contaminated Sediments, Venice, Italy.*

Rockne, K, P Viana, and K. Yin. 2010. *Sediment Ebullition and Flux Studies at Bubbly Creek, Chicago, IL.* Final. United State Army Corps of Engineers Chicago District.

Viana, P.Z., K. Yin, and K.J. Rockne. 2012. “Field Measurements and Modeling of Ebullition Facilitated Flux of Heavy Metals and Polycyclic Aromatic Hydrocarbons from Sediments to the Water Column.” *Environmental Science and Technology*, Vol. 46, pp. 12046-1205

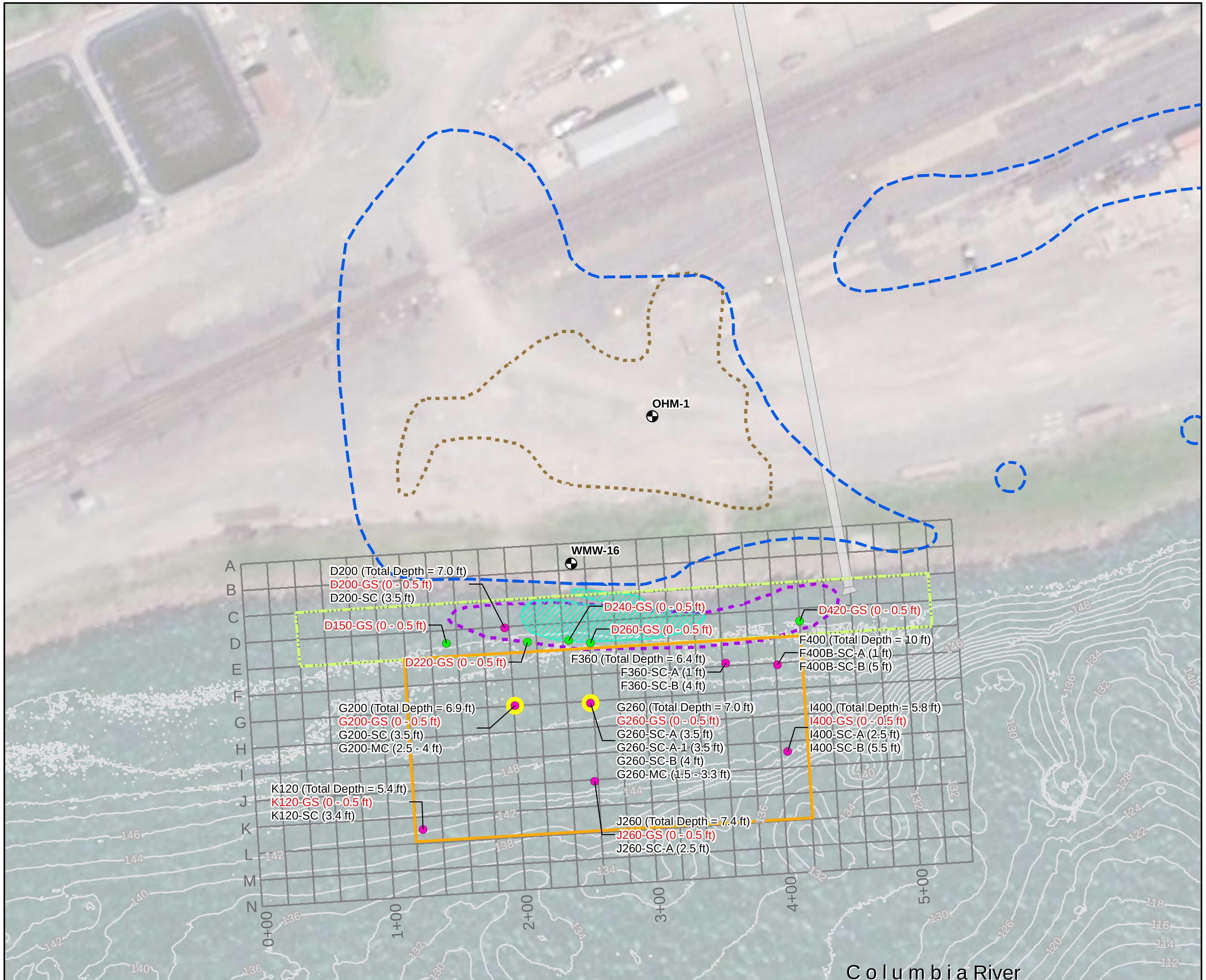
Table F-1. Input Parameters and Estimated Gas Ebullition Rates

Parameter	Units	D150-GS-080718	D200-GS-080718	D200-SC-080718A	D220-GS-080718	D240-GS-080618	D260-GS-080618	D420-GS-080618	D420-GS-080618-1	F360-SC-080818-A	F360-SC-080818-B	F400B-SC-080818-A	F400B-SC-080818-B	G200-GS-080718	G200-SC-080718-A	G260-GS-080718	G260-SC-080718-A	G260-SC-080718-A-1	G260-SC-080718-B	I400-GS-080918	I400-SC-080918-A	I400-SC-080918-B	J260-GS-080818	J260-SC-080818-A	K120-GS-080818	K120-SC-080818-A	Maximum	Minimum	Average	Median
Sample Depth		0.5	0.5	3.5	0.5	0.5	0.5	0.5		1	4	1	5	0.5	3.5	0.5	3.5	3.5	4	0.5	2.5	5.5	0.5	2.5	0.5	3.4	6	1	2	1
Distance from Shoreline	feet	37.0	20.0	20.0	32.0	30.0	32.0	22.0		42.0	42.0	50.0	50.0	82.0	82.0	80.0	80.0	80.0	80.0	116.0	116.0	170.0	137.0	137.0	177.0	177.0				
TOC	mg/kg	4,545	4,545	4,580	4,545	4,545	4,545	4,545		5,710	57,700	3,380	7,510	4,545	91,000	4,545	86,400	107,000	66,700	4,545	18,600	6,700	4,545	37,100	4,545	9,320	107,000	3,380	22,987	4,563
TOC	%	0.5	0.5	0.5	0.5	0.5		0.5	0.0	0.6	5.8	0.3	0.8	0.5	9.1	0.5	8.6	10.7	6.7	0.5	1.9	0.7	0.5	3.7	0.5	0.9	10.7	0.0	2.3	0.5
COD	mg/kg	220	220	350	250	200	220	220		480	2,200	220	250	220	2,200	220	2,200	2,200	2,200	200	220	250	220	2,200	220	220	2,200	200	733	220
COD/TOC Ratio		0.05	0.05	0.08	0.06	0.04	0.05	0.05		0.08	0.04	0.07	0.03	0.05	0.02	0.05	0.03	0.02	0.03	0.04	0.01	0.04	0.05	0.06	0.05	0.02	0.08	0.01	0.04	0
Temperature	°C	22.70	22.70	22.70	22.70	22.70	22.70	22.70		22.70	22.70	22.70	22.70	22.66	22.66	22.74	22.74	22.74	22.74	22.70	22.70	22.70	22.70	22.70	22.70	22.70	23	23	23	23
Gas Production	mmol/m^2/d	277.6	277.6	272.4	276.4	278.4	277.6	277.6		271.0	279.5	274.5	280.4	277.1	281.6	278.1	282.4	283.3	281.0	278.4	284.4	279.7	277.6	275.6	277.6	282.2	284	271	278	278
Gas Production[b]	L/m^2/d	6.7	6.7	6.5	6.6	6.7	6.7	6.7		6.5	6.7	6.6	6.7	6.7	6.8	6.7	6.8	6.8	6.7	6.7	6.8	6.7	6.7	6.6	6.7	6.8	6.8	6.5	6.7	6.7

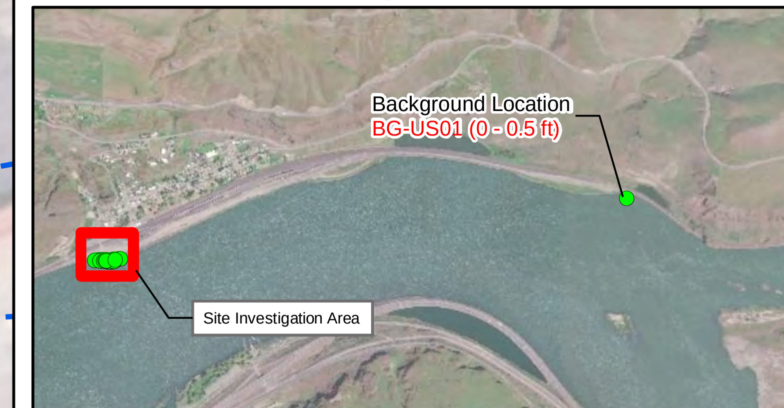
[a] Average TOC results from the 1- foot sample collected at F360 and F400 were used as input TOC for all grab sample locations.

[b] Gas flux in L/m^2/d was calculated from the model output (mmol/m^2/d) assuming a molar gas volume of 22.4 L/mole at standard temperature and pressure.

Notes:
°C = degree(s) Celsius
COD = chemical oxygen demand
L/m^2/d = liter(s) per square meter per day
L/mole = liter(s) per mole
mg/kg = milligram(s) per kilogram
mmol/m^2/d = millimole(s) per square meter per day
TOC = total organic carbon



VICINITY MAP



LEGEND

- Surface Sediment Grab Sample Location
- Lithology Core Sample Location
- Mobility Core Sample Location
- Existing Monitoring Well
- Sampling Grid (20 ft x 20 ft)
- Initial Study
- Expanded Study
- Bathymetric Contour (ft NAVD88, 2 ft Contour Interval)
- Approximate Lateral Extent of Dissolved-Phase Diesel- and/or Oil-Range Organics Above the MTCA Method A Groundwater Cleanup Level (CUL) (500 µg/L)
- Approximate Lateral Extent of Oil
- Area of Intermittent NAPL Sheening
- Small-extent NAPL Sheens Observed (Ecology, 2017)
- Stormwater Underdrain (Portion Removed from Service Circa 1960)

Sample ID Notes:

G260 (Total Depth = 7.0 ft)	Total penetration depth of core.
G260-GS (0 - 0.5 ft)	Red Text = Sample selected for petroleum-related contaminants of concern
G260-SC-A (3.5 ft)	
G260-SC-A-1 (3.5 ft)	"-1" = Duplicate sample
G260-SC-B (4 ft)	
G260-MC (1.5 - 3.3 ft)	"-MC" = Mobility sample

Notes:

NAPL = nonaqueous phase liquid
µg/L = microgram(s) per liter
MTCA = Model Toxics Control Act
ft = feet
NAVD88 = North American Vertical Datum 1988

N

0 40 80 160
Feet
1:956
1 inch = 79.65 feet

Figure F-1. August Surface Sediment Grab Sample and Core Sample Locations
BNSF Wishram Railyard
Wishram, Washington

JACOBS

SLC \\PDXFPP01\PROJ\BNSFRAILWAYCOMPANY\693282WISHRAMRIFS\GIS\MAPFILES\INITIAL INVESTIGATION REPORT\FIGUREE-1_GRAB_AND_CORE_SAMPLE_LOCATIONS.MXD GGEE 1/10/2019 14:58:48

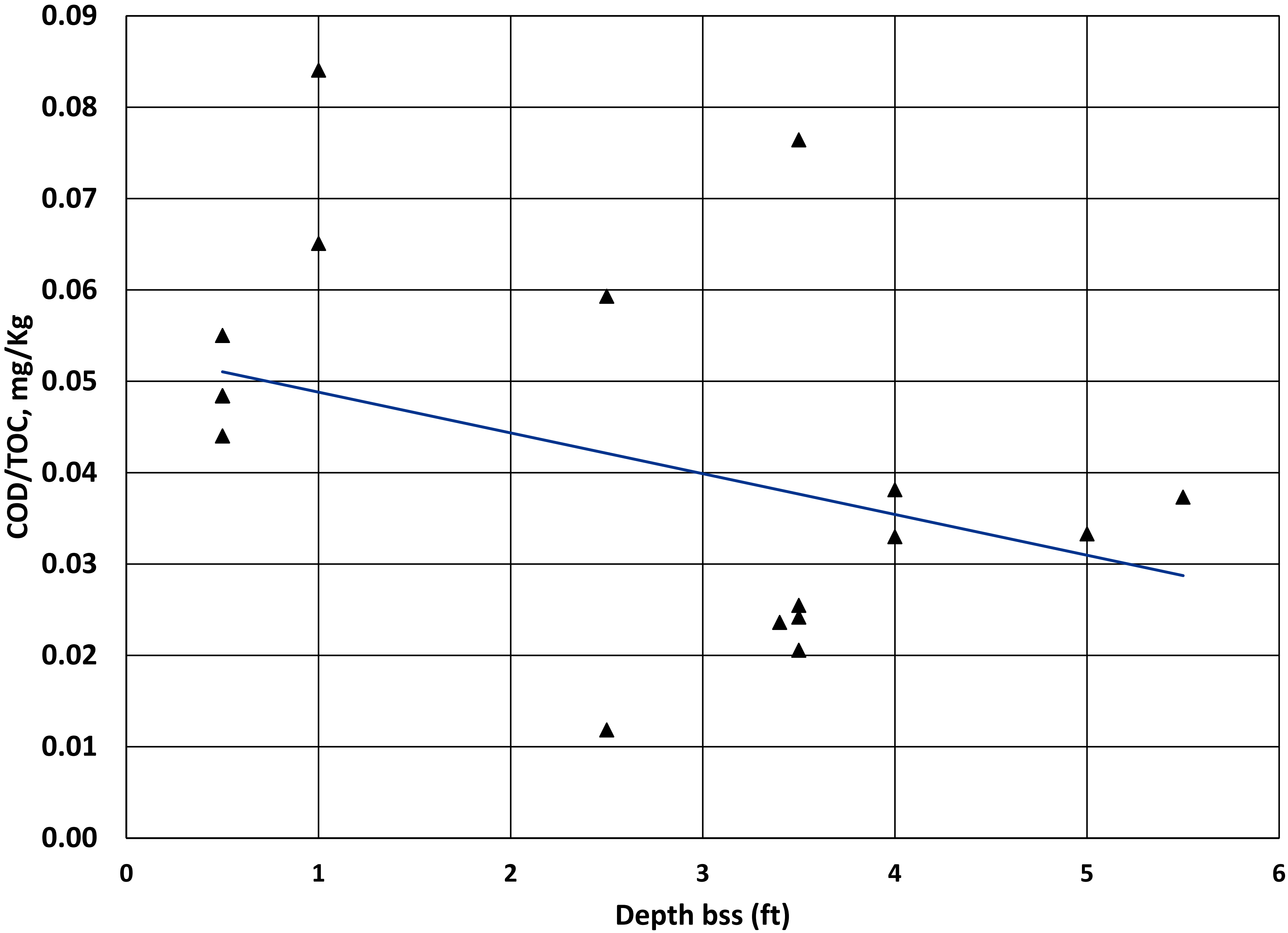


Figure F-2. Total Organic Carbon and Chemical Oxygen Demand Evaluation
BNSF Wishram Railyard
Wishram, Washington