CENWS-OD-TS-NR-DMMO

MEMORANDUM FOR: RECORD December 4, 2014

SUBJECT: DETERMINATION REGARDING THE SUITABILITY OF DREDGED MATERIAL FROM THE CITY OF RENTON LOWER CEDAR RIVER SECTION 205 FLOOD HAZARD REDUCTION PROJECT, RENTON, WASHINGTON, FOR UNCONFINED OPEN-WATER PLACEMENT AT THE ELLIOTT BAY DISPOSAL SITE OR IN-WATER BENEFICIAL USE.

1. Introduction. This memorandum reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Washington Departments of Ecology and Natural Resources, and the Environmental Protection Agency) regarding the suitability of up to 120,000 cubic yards (cy) of dredged material from the lower Cedar River for placement at the Elliott Bay non-dispersive open-water disposal site or for in-water beneficial use.

2. Background. The project is located along the lower reach of the Cedar River from the North Boeing Bridge at Lake Washington to the Williams Avenue Bridge in Renton, Washington (Figure 1). Due to the low gradient through the lower reach of the Cedar River, sediment is deposited in the project area. Periodic dredging is required to maintain flow conveyance and provide flood protection. As required in the Project Cooperation Agreement (PCA) Operation and Maintenance Manual between the City of Renton and the U.S. Army Corps of Engineers (USACE, 2004), the City of Renton and King County plan to conduct maintenance dredging. Dredging is currently scheduled for the 2015 in-water construction season (GeoEngineers, 2014b).

   Dredged material from the lower Cedar River has been characterized twice in the last 25 years. Approximately 90,000 cubic yards were characterized in 1992, found suitable for open-water disposal and taken to the Elliott Bay non-dispersive open-water disposal site. In 1997, another 180,000 cubic yards were characterized and found suitable for unrestricted upland reuse. This material was sold by the City of Renton and King County (GeoEngineers, 2014b).

3. Project Summary. The following table includes project summary and tracking information.

Project Summary and Tracking Information

Project ranking	moderate
Proposed dredging volume	120,000 cubic yards
Proposed dredging depth[1]	Variable: 11.5 ft downstream 16.5 ft upstream
1st draft SAP received	February 6, 2014
Draft SAP returned for revisions	February 25, 2014
2nd draft SAP received	March 24, 2014
Draft SAP returned for revisions	April 14, 2014
Final SAP received	May 5, 2014

SAP approved	May 15, 2014
Sampling dates	July 8-9, 2014 August 11-12, 2014
Draft data report received	November 13, 2014
Draft data report returned for revisions	November 26, 2014
Final data report received	December 3, 2014
DAIS Tracking number	CEDAR-1-A-F-361
USACE Permit Application Number	NWS-2013-804
Recency Determination (moderate rank = 5 years)	July 2019

[1]Corps of Engineers Datum – Lake Washington

4. Project Ranking and Sampling Requirements. This project was ranked "moderate" by the DMMP program based on the existence of potential sources of contamination in the vicinity of the project. The sediment in the project area was assumed to be homogeneous because of the rapid depositional environment and mixing of material within the river channel.

   In the Dredged Material Management Program, "surface" material (i.e. the top 4 feet) is treated differently from "subsurface" material (deeper than 4 feet) for the purpose of calculating the number of dredged material management units (DMMUs) and samples needed. However, for this project there was very little material deeper than 4 feet. Therefore, all sediment was considered to be surface sediment.

   The number of samples and DMMUs were calculated using the following guidelines:
   - Maximum volume of sediment represented by each field sample = 4,000 cubic yards
   - Maximum volume of sediment represented by each DMMU = 20,000 cubic yards

   The project was divided into a total of six DMMUs, each consisting of 20,000 cubic yards of material and represented by a composite of sediment samples from five locations. See Figure 2 for the DMMU boundaries.

5. Sampling. Sampling took place in two phases. Downstream DMMUs 1-3, near the mouth of the Cedar River, were accessible by boat and were sampled July 8-9. DMMUs 4-6, located further upstream and inaccessible by boat, were sampled August 11-12 during a period of low summer flow.

   For the downstream DMMUs, sampling attempts were first made with a vibracore sampler. However, recovery was poor and a decision was made in consultation with the DMMP agencies to switch to a power grab for these samples. The upstream sampling stations were located in very shallow water. Here, a stainless steel cylinder was used to isolate the sampling stations from the stream flow, with samples collected manually from within the cylinder with a hand trowel.

   Sediment collected from the five sampling stations within a DMMU was composited for analysis. Due to the high fraction of cobble and gravel in the sediment and the tendency of sediment contaminants to be associated with the finer-grained fraction, anything larger than approximately

¼-inch was removed from the composite samples prior to placing in jars for laboratory analysis.

In addition to the composite samples, fine-grained sediment from one of the five individual sampling stations in each DMMU was collected for analysis of volatiles, the gasoline-fraction of petroleum hydrocarbons and sulfides in order to avoid the volatilization that would have occurred if these samples had been composited with samples from other stations. Bulk sediment, in which the gravel and cobble had not been removed, was collected from these individual stations as well and analyzed for grain size. This was done in order to characterize the in situ nature of the sediment.

Sampling information is provided in Tables 1, 2 and 3.

6. Chemical and Sediment Conventional Analysis. The sediment conventional and chemistry results can be found in Tables 4 to 7. Table 4 includes the grain-size distributions for the bulk sediment samples representing in situ conditions. Table 5 includes the grain-size distributions for the samples sent to the laboratory for chemical analysis. These latter samples had the cobble and large gravel manually removed prior to placing in jars for analysis.

   As can be seen from Table 4, the in situ sediment samples included a cobble fraction ranging from 1 to 31 percent, a gravel fraction ranging from 61 to 89 percent, and a sand fraction ranging from 7 to 17 percent. The fines fraction was less than 1 percent in all samples. The composite samples sent to the lab for chemistry analysis (Table 5) included no cobble, a gravel fraction ranging from 48 to 81 percent, and a sand fraction ranging from 19 to 52 percent. The fines fraction was less than 2 percent in all samples.

   The total solids reflected the coarse-grained nature of the sediment samples, ranging from 86 to 92 percent. The total organic carbon (TOC) concentration (Table 6) ranged from 0.06 to 2.1 percent. Total volatile solids (TVS) were less variable than TOC, with TVS ranging from 1.0 to 2.0 percent. Sulfide and ammonia concentrations were very low.

   The chemical results in Table 6 indicate that there were no exceedances of the DMMP marine screening levels. Consequently, bioassay testing was not required for this project. Dioxin/furan concentrations (Table 7) were very low for the two DMMUs tested for these chemicals. DMMUs 1 and 2 had concentrations of 0.62 and 0.77 pptr TEQ (U = ½ EDL) respectively, well below the site management objective of 4 pptr TEQ for non-dispersive sites (DMMP, 2010).

   All chemical and sediment conventional analytical results were subjected to EPA Stage 2B (EPA, 2009) validation by GeoEngineers. Both lab and validation qualifiers are included in Tables 6 and 7. The DMMP agencies determined that the analytical results, as qualified, were acceptable for decision-making.

7. Sediment Exposed by Dredging. The sediment to be exposed by dredging must either meet the State of Washington Sediment Quality Standards (SQS) or the State's antidegradation standard (Ecology, 2013) as described in DMMP guidance (DMMP, 2008). Comparison of the proposed dredged material to DMMP's SL1 guidelines for freshwater serves as a first-tier indicator for this purpose. The SAP indicated that the freshwater guidelines in effect at the time of the suitability determination would be used in evaluating the lower Cedar River analytical results. For completeness, Table 6 includes both the 2006 interim freshwater guidelines and the 2014 proposed

freshwater guidelines. The analytical results for the dredged material indicate that there were no detected exceedances of either set of SL1 values. For non-detected chemicals, the reporting limits were also below SL1.

There is no reason to believe that the chemical quality of the sediment to be exposed by dredging differs in any way from the proposed dredged material. Therefore, the agencies determined that there was no need for the collection or analysis of Z-samples for this project. Based on the results for the dredged material, the sediment that will be exposed by dredging is not anticipated to have any exceedances of the freshwater SL1 values. Therefore, this project is in compliance with the State of Washington anti-degradation standard.

8. Beneficial-Use Analysis. As indicated in the previous section, the proposed dredged material had no detected or nondetected exceedances of the marine SLs or the freshwater SL1 values. Therefore, with regard to chemical quality, the dredged material is suitable for in-water beneficial use in either a marine or freshwater environment.

9. Suitability Determination. This memorandum documents the evaluation of the suitability of sediment proposed for dredging from the lower Cedar River for beneficial use or open-water disposal. The approved sampling and analysis plan was followed and the data gathered were deemed sufficient and acceptable for regulatory decision-making under the DMMP program.

   Based on the results of the previously described testing, the DMMP agencies conclude that **all 120,000 cubic yards of dredged material are suitable** for placement at the Elliott Bay unconfined open-water disposal site. The dredged material is also suitable, with regard to chemical quality, for beneficial use in a marine or freshwater environment. Upland beneficial use would require additional consultation with the local health district.

   This suitability determination does ***not*** constitute final agency approval of the project. During the public comment period that follows a public notice, the resource agencies will provide input on the overall project. A final decision will be made after full consideration of agency input, and after an alternatives analysis is done under section 404(b)(1) of the Clean Water Act.

   If a Section 404 permit is issued for this project, a pre-dredge meeting with DNR, Ecology and the Corps of Engineers will be required. A dredging and disposal quality control plan must be developed and submitted to the Regulatory Branch of the Seattle District Corps of Engineers at least 7 days prior to the pre-dredge meeting. For placement at the Elliott Bay open-water site, a DNR site use authorization must also be obtained.

10. References.

DMMP, 2008b. *Quality of Post-Dredge Sediment Surfaces (Updated).* A Clarification Paper Prepared by David Fox (USACE), Erika Hoffman (EPA) and Tom Gries (Ecology) for the Dredged Material Management Program, June 2008.

DMMP, 2010. *Dredged Material Management Program – New Interim Guidelines for Dioxin.* DMMP agencies, December 2010.

DMMP, 2013. *Dredged Material Evaluation and Disposal Procedures (User Manual).* Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program, July 2013.

DMMP, 2014. *Implementation of Revised Freshwater Sediment Screening Values.* A draft issue paper prepared by Laura Inouye, Washington Department of Ecology for the DMMP and RSET agencies.

Ecology, 2013. *Sediment Management Standards – Chapter 173-204 WAC*. Washington State Department of Ecology, February 2013.

EPA, 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. U.S. Environmental Protections Agency, January 2009.

GeoEngineers, 2014a. *Dredged Material Characterization Sampling and Analysis Plan, Lower Cedar River Section 205 Flood Hazard Reduction Project, Renton, Washington.* Prepared by GeoEngineers for the City of Renton. April 28, 2014.

GeoEngineers, 2014b. *Dredged Material Characterization Report, Lower Cedar River Section 205 Flood Hazard Reduction Project, Renton, Washington.* Prepared by GeoEngineers for the City of Renton. December 3, 2014.

11. Agency Signatures.

The signed document is on file in the Dredged Material Management Office.

Concur:

Date David Fox, P.E. - Seattle District Corps of Engineers

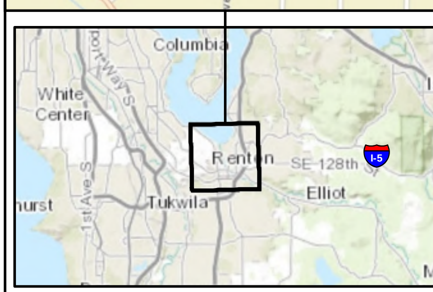
Date Justine Barton - Environmental Protection Agency

Date Laura Inouye, Ph.D. - Washington Department of Ecology

Date Celia Barton - Washington Department of Natural Resources

Copies furnished:

DMMP signatories
Suzanne Anderson, Seattle District Regulatory
Iain Wingard, GeoEngineers
Ron Straka, City of Renton



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Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
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Data Sources: ESRI Data & Maps, Street Data 2013.

Transverse Mercator, Zone 10 N North, North American Datum 1983
North arrow oriented to grid north

Vicinity Map

Lower Cedar 205 Project
Renton, Washington

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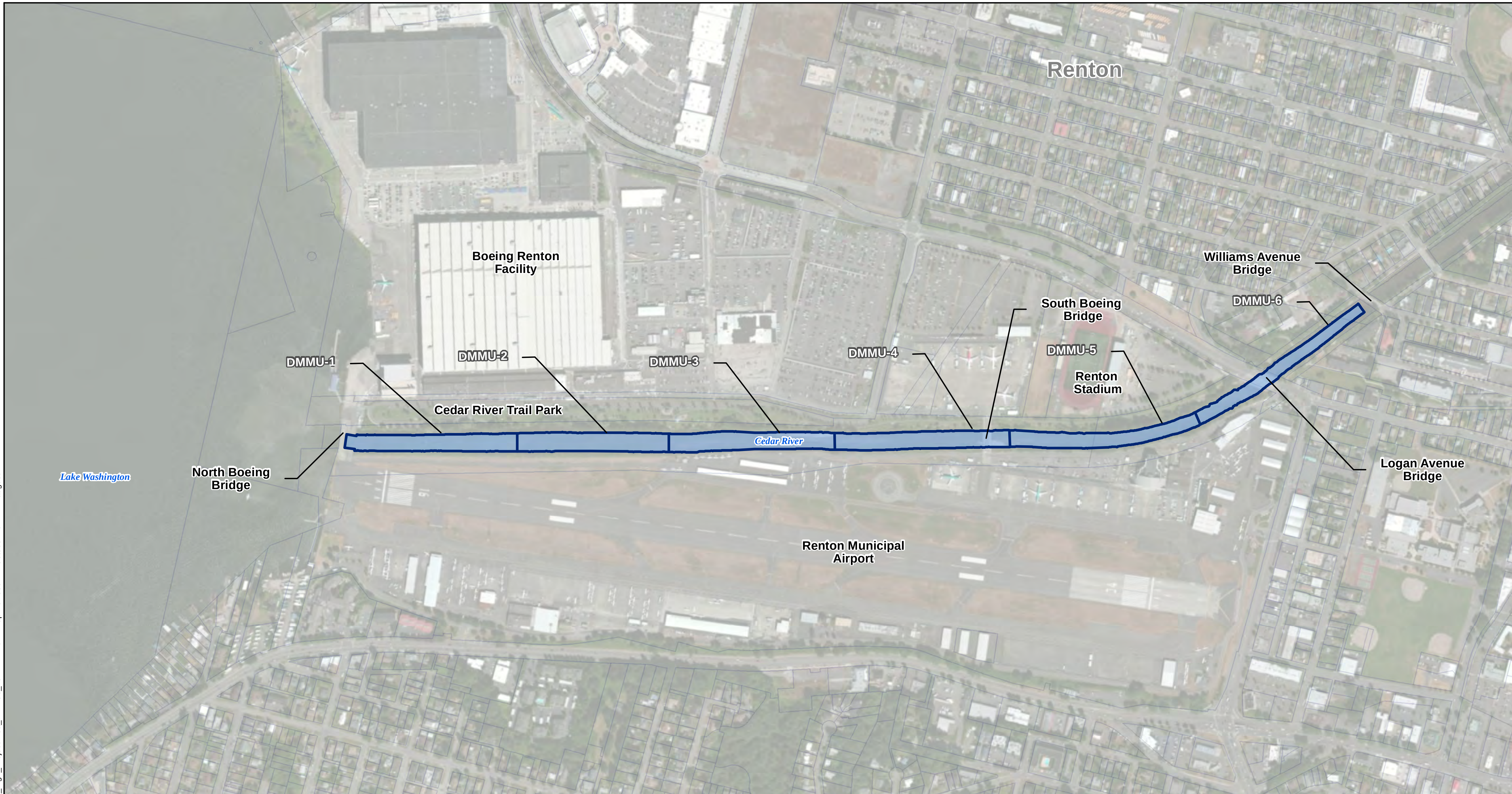
Figure 1

Office: Redmond Path:\\tac\projects\0\0693073\GIS\MXD\069307300_VicinityMap_010714.mxd Map Revised: 1/10/2014 MSA



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Data Source: Esri imagery, 2013.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Legend

- Dredged Material Management Unit (DMMU)
- Lower Cedar 205 Project Area
- King County Tax Parcel Boundary

N E S W

600 0 600
Feet

Project Area and DMMUs

Lower Cedar 205 Project
Renton, Washington

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Figure 2

Table 1

Summary of Sampling Locations

Lower Cedar 205 Project

Renton, Washington

DMMU	Target Sampling Location[2]	Target Coordinates[3] (NAD83) Latitude (DMS)	Target Coordinates[3] (NAD83) Longitude (DMS)	Actual Sampling Location[2]	Date Sampled	Actual Coordinates[4] (NAD83) Latitude (DMS)	Actual Coordinates[4] (NAD83) Longitude (DMS)
DMMU-1 (20,000[1])	DMMU-1-1	N 47° 30' 0.05"	W 122° 12' 56.67"	DMMU-1-1	7/8/2014	N 47° 30' 00.04"	W 122° 12' 56.73"
	DMMU-1-2	N 47° 29' 58.17"	W 122° 12' 55.99"	DMMU-1-2	7/8/2014	N 47° 29' 58.18"	W 122° 12' 56.08"
	DMMU-1-3	N 47° 29' 56.29"	W 122° 12' 55.26"	DMMU-1-3a	7/8/2014	N 47° 29' 56.30"	W 122° 12' 55.33"
				DMMU-1-3b		N 47° 29' 56.32"	W 122° 12' 55.43"
	DMMU-1-4	N 47° 29' 54.37"	W 122° 12' 54.58"	DMMU-1-4	7/8/2014	N 47° 29' 54.39"	W 122° 12' 54.61"
	DMMU-1-5	N 47° 29' 52.50"	W 122° 12' 53.87"	DMMU-1-5	7/8/2014	N 47° 29' 52.51"	W 122° 12' 53.86"
DMMU-2 (20,000[1])	DMMU-2-1	N 47° 29' 50.71"	W 122° 12' 53.22"	DMMU-2-1	7/9/2014	N 47° 29' 50.72"	W 122° 12' 53.22"
	DMMU-2-2	N 47° 29' 49.06"	W 122° 12' 52.64"	DMMU-2-2	7/9/2014	N 47° 29' 49.07"	W 122° 12' 52.65"
	DMMU-2-3	N 47° 29' 47.06"	W 122° 12' 51.91"	DMMU-2-3a	7/9/2014	N 47° 29' 47.08"	W 122° 12' 51.92"
				DMMU-2-3b		N 47° 29' 47.05"	W 122° 12' 52.01"
	DMMU-2-4	N 47° 29' 45.35"	W 122° 12' 51.27"	DMMU-2-4	7/9/2014	N 47° 29' 45.39"	W 122° 12' 51.31"
	DMMU-2-5	N 47° 29' 43.55"	W 122° 12' 50.62"	DMMU-2-5	7/9/2014	N 47° 29' 43.52"	W 122° 12' 50.60"
DMMU-3 (20,000[1])	DMMU-3-1	N 47° 29' 41.57"	W 122° 12' 49.91"	DMMU-3-1	7/9/2014	N 47° 29' 41.55"	W 122° 12' 49.91"
	DMMU-3-2	N 47° 29' 39.65"	W 122° 12' 49.09"	DMMU-3-2	7/9/2014	N 47° 29' 39.69"	W 122° 12' 49.12"
	DMMU-3-3	N 47° 29' 37.68"	W 122° 12' 48.40"	DMMU-3-3a	7/9/2014	N 47° 29' 37.67"	W 122° 12' 48.46"
				DMMU-3-3b		N 47° 29' 37.64"	W 122° 12' 48.49"
	DMMU-3-4	N 47° 29' 35.72"	W 122° 12' 47.72"	DMMU-3-4	7/9/2014	N 47° 29' 35.72"	W 122° 12' 47.82"
	DMMU-3-5	N 47° 29' 34.06"	W 122° 12' 47.05"	DMMU-3-5	7/9/2014	N 47° 29' 34.11"	W 122° 12' 47.14"
DMMU-4 (20,000[1])	DMMU-4-1	N 47° 29' 31.98"	W 122° 12' 46.34"	DMMU-4-1	8/11/2014	N 47° 29' 31.97"	W 122° 12' 46.32"
	DMMU-4-2	N 47° 29' 30.00"	W 122° 12' 45.59"	DMMU-4-2	8/11/2014	N 47° 29' 29.97"	W 122° 12' 45.58"
	DMMU-4-3	N 47° 29' 27.96"	W 122° 12' 44.76"	DMMU-4-3	8/11/2014	N 47° 29' 27.96"	W 122° 12' 44.75"
	DMMU-4-4	N 47° 29' 25.89"	W 122° 12' 43.97"	DMMU-4-4	8/11/2014	N 47° 29' 25.89"	W 122° 12' 43.96"
	DMMU-4-5	N 47° 29' 23.56"	W 122° 12' 43.06"	DMMU-4-5	8/11/2014	N 47° 29' 23.56"	W 122° 12' 43.06"

DMMU	Target Sampling Location[2]	Target Coordinates[3](NAD83)		Actual Sampling Location[2]	Date Sampled	Actual Coordinates[4] (NAD83)	
		Latitude (DMS)	Longitude (DMS)			Latitude (DMS)	Longitude (DMS)
DMMU-5 (20,000[1])	DMMU-5-1	N 47° 29' 21.76"	W 122° 12' 42.37"	DMMU-5-1	8/11/2014	N 47° 29' 21.77"	W 122° 12' 42.37"
	DMMU-5-2	N 47° 29' 19.54"	W 122° 12' 41.77"	DMMU-5-2	8/11/2014	N 47° 29' 19.55"	W 122° 12' 41.75"
	DMMU-5-3	N 47° 29' 17.36"	W 122° 12' 40.95"	DMMU-5-3	8/11/2014	N 47° 29' 17.37"	W 122° 12' 40.84"
	DMMU-5-4	N 47° 29' 15.28"	W 122° 12' 39.74"	DMMU-5-4	8/11/2014	N 47° 29' 15.27"	W 122° 12' 39.87"
	DMMU-5-5	N 47° 29' 13.27"	W 122° 12' 38.08"	DMMU-5-5	8/11/2014	N 47° 29' 13.27"	W 122° 12' 38.03"
DMMU-6 (20,000[1])	DMMU-6-1	N 47° 29' 11.22"	W 122° 12' 35.86"	DMMU-6-1	8/12/2014	N 47° 29' 11.22"	W 122° 12' 35.96"
	DMMU-6-2	N 47° 29' 9.48"	W 122° 12' 33.53"	DMMU-6-2	8/12/2014	N 47° 29' 09.44"	W 122° 12' 33.54"
	DMMU-6-3	N 47° 29' 7.83"	W 122° 12' 30.71"	DMMU-6-3	8/12/2014	N 47° 29' 07.83"	W 122° 12' 30.69"
	DMMU-6-4	N 47° 29' 6.15"	W 122° 12' 27.85"	DMMU-6-4	8/12/2014	N 47° 29' 06.10"	W 122° 12' 27.84"
	DMMU-6-5	N 47° 29' 4.54"	W 122° 12' 24.99"	DMMU-6-5	8/12/2014	N 47° 29' 04.50"	W 122° 12' 25.01"

Notes:

[1] The dredge volume for the Lower Cedar 205 Project at the time of dredging in 2015 is estimated to be less than 120,000 cubic yards. This estimated volume includes the dredge prism configuration based on the project design, a 1-foot overdredge allowance, an additional two years of sediment accumulation at an average annual deposition of 9,700 cubic yards plus a contingency of 10,000 cubic yards to account for potential deposition that is greater than the annual average as described in the Dredge Material Characterization Sampling and Analysis Plan (Appendix A).

[2] Target and actual sampling locations are shown on Figures 3 through 8.

[3] Referenced from Dredged Material Characterization Sampling and Analysis Plan (SAP; Appendix A).

[4] Obtained using a differential global positioning system (DGPS) and/or hand-held Trimble GPS device.

DMMU = Dredged Material Management Unit

NAD83 = North American Datum of 1983.

DMS = degrees, minutes, seconds

Table 2

Summary of Sample Collection Data

Lower Cedar 205 Project
Renton, Washington

DMMU	Target Sampling Location[1]	Actual Sampling Location[1]	Date Sampled	Sampling Method	Water Surface Elevation[2] (ft NAVD88)	Depth of Water Column[3] (ft)	Mudline Elevation[4] (ft NAVD88)	Penetration Depth (ft bml)	Design Dredge Elevation[5] (ft NAVD88)	Dredge Prism Sample	
										Thickness (ft)	Interval (ft NAVD88)
DMMU-1	DMMU-1-1	DMMU-1-1	7/8/2014	Power Grab - Van Veen	18.4	5.1	13.3	0.75	11.5	0.75	13.3 – 12.6
	DMMU-1-2	DMMU-1-2	7/8/2014	Power Grab - Van Veen	18.4	4.8	13.6	0.75	11.5	0.75	13.6 – 12.9
	DMMU-1-3	DMMU-1-3a DMMU-1-3b	7/8/2014	Power Grab - Van Veen	18.4	3.9	14.5	0.75	11.5	0.75	14.5 – 13.8
	DMMU-1-4	DMMU-1-4	7/8/2014	Power Grab - Van Veen	18.4	3.8	14.6	0.75	11.5	0.75	14.6 – 13.9
	DMMU-1-5	DMMU-1-5	7/8/2014	Power Grab - Van Veen	18.4	3.5	14.9	0.75	11.5	0.75	14.9 – 14.2
DMMU-2	DMMU-2-1	DMMU-2-1	7/9/2014	Power Grab - Van Veen	18.4	3.1	15.3	0.75	11.5	0.75	15.3 – 14.5
	DMMU-2-2	DMMU-2-2	7/9/2014	Power Grab - Van Veen	18.4	2.1	16.3	0.75	12	0.75	16.3 – 15.5
	DMMU-2-3	DMMU-2-3a DMMU-2-3b	7/9/2014	Power Grab - Van Veen	18.4	1.4	17	0.75	12	0.75	17 – 16.2
	DMMU-2-4	DMMU-2-4	7/9/2014	Power Grab - Van Veen	18.4	1.3	17.1	0.75	12.5	0.75	17.1 – 16.3
	DMMU-2-5	DMMU-2-5	7/9/2014	Power Grab - Van Veen	18.4	1.4	17	0.75	13	0.75	17 – 16.2
DMMU-3	DMMU-3-1	DMMU-3-1	7/9/2014	Power Grab - Van Veen	n/a	0.9	17	0.75	13	0.75	17 – 16.3
	DMMU-3-2	DMMU-3-2	7/9/2014	Power Grab - Van Veen	n/a	0.8	17	0.75	14	0.75	17 – 16.3
	DMMU-3-3	DMMU-3-3a DMMU-3-3b	7/9/2014	Power Grab - Van Veen	n/a	1.2	17	0.75	14	0.75	17 – 16.3
	DMMU-3-4	DMMU-3-4	7/9/2014	Power Grab - Van Veen	n/a	1.4	17	0.75	14	0.75	17 – 16.3
	DMMU-3-5	DMMU-3-5	7/9/2014	Power Grab - Van Veen	n/a	1.4	18	0.75	14.5	0.75	18 – 17.3
DMMU-4	DMMU-4-1	DMMU-4-1	8/11/2014	Manual - Hand Tools	n/a	0.0	18.5	1.2	14.5	1.2	18.5 – 17.3
	DMMU-4-2	DMMU-4-2	8/11/2014	Manual - Hand Tools	n/a	0.4	19	1.3	15	1.3	19 – 17.7
	DMMU-4-3	DMMU-4-3	8/11/2014	Manual - Hand Tools	n/a	0.9	19	1.6	15.5	1.6	19 – 17.4
	DMMU-4-4	DMMU-4-4	8/11/2014	Manual - Hand Tools	n/a	1.3	18.5	1.4	16	1.4	18.5 – 17.1
	DMMU-4-5	DMMU-4-5	8/11/2014	Manual - Hand Tools	n/a	0.3	19	1.3	16.5	1.3	19 – 17.7

DMMU	Target Sampling Location[1]	Actual Sampling Location[1]	Date Sampled	Sampling Method	Water Surface Elevation[2] (ft NAVD88)	Depth of Water Column[3] (ft)	Mudline Elevation[4] (ft NAVD88)	Penetration Depth (ft bml)	Design Dredge Elevation[5] (ft NAVD88)	Dredge Prism Sample	
										Thickness (ft)	Interval (ft NAVD88)
DMMU-5	DMMU-5-1	DMMU-5-1	8/11/2014	Manual - Hand Tools	n/a	0.7	20	1.3	16.5	1.3	20 -- 18.7
	DMMU-5-2	DMMU-5-2	8/11/2014	Manual - Hand Tools	n/a	0.8	20.5	1.5	17	1.5	20.5 -- 19.0
	DMMU-5-3	DMMU-5-3	8/11/2014	Manual - Hand Tools	n/a	0.8	21	1.7	17	1.7	21 -- 19.3
	DMMU-5-4	DMMU-5-4	8/11/2014	Manual - Hand Tools	n/a	1.2	20.5	1.6	17.5	1.6	20.5 -- 18.9
	DMMU-5-5	DMMU-5-5	8/11/2014	Manual - Hand Tools	n/a	1.2	21.5	1.5	18	1.5	21.5 -- 20.0
DMMU-6	DMMU-6-1	DMMU-6-1	8/12/2014	Manual - Hand Tools	n/a	0.4	21.5	1.5	18.5	1.5	21.5 -- 20.0
	DMMU-6-2	DMMU-6-2	8/12/2014	Manual - Hand Tools	n/a	0.9	21.5	1.3	19	1.3	21.5 -- 20.2
	DMMU-6-3	DMMU-6-3	8/12/2014	Manual - Hand Tools	n/a	0.7	23	1.2	20	1.2	23 -- 21.8
	DMMU-6-4	DMMU-6-4	8/12/2014	Manual - Hand Tools	n/a	1.2	23.5	1.4	21	1.4	23.5 -- 22.1
	DMMU-6-5	DMMU-6-5	8/12/2014	Manual - Hand Tools	n/a	1.5	23.5	1.4	22.5	1.4	23.5 -- 22.1

Notes:

[1] Target and actual sampling locations are shown on Figures 3 through 8.

[2] Water surface elevation for DMMU-1 and DMMU-2 correspond to the elevation of the water surface in Lake Washington. The elevation of the water surface in Lake Washington at the time of sampling was determined from the USACE vertical datum specific to the Lake Washington Ship Canal project (www.nwd-wc.usace.army.mil/nws/hh/www/index.html). The water surface elevations at DMMUs 3 through 6 do not correspond to the Lake Washington water level and therefore were not available.

[3] Measured using a lead line.

[4] Mudline elevation for DMMU-1 and DMMU-2 were determined by subtracting measured depth of water column from the elevation of the water surface in Lake Washington. Mudline elevations for DMMU-3 through DMMU-6 were estimated from the topographic survey completed for the Lower Cedar 205 Project as part of the dredge design because the water surface elevation of the lake was no longer representative of the water surface elevation in the Cedar River.

[5] Referenced from Dredged Material Characterization Sampling and Analysis Plan (SAP; Appendix A).

NAVD88 = North American Vertical Datum 1988

ft = feet

bml = below mud line

n/a = not available

Table 3

Summary of Soil Type Observed at Sampling Locations

Lower Cedar 205 Project

Renton, Washington

DMMU	Actual Sampling Location[1]	Sample ID	Date Sampled	Soil Type
DMMU-1	DMMU-1-1	DMMU-1-1G	7/8/2014	Gray-brown F-C sand (50%) with gravel (50%)
	DMMU-1-2	DMMU-1-2G	7/8/2014	Gray-brown F-C sand (50%) with gravel (50%)
	DMMU-1-3a	DMMU-1-3G	7/8/2014	Gray-brown F-C gravel (70%) with sand (30%)
	DMMU-1-3b	DMMU-1-3G	7/8/2014	Gray-brown F-C gravel (70%) with sand (30%)
	DMMU-1-4	DMMU-1-4G	7/8/2014	Gray-brown F-C gravel (80%) with sand (20%)
	DMMU-1-5	DMMU-1-5G	7/8/2014	Gray-brown F-C gravel (70%) with sand (30%)
DMMU-2	DMMU-2-1	DMMU-2-1G	7/9/2014	Gray-brown F-C gravel (50%) with sand (50%) and cobbles (<1%)
	DMMU-2-2	DMMU-2-2G	7/9/2014	Gray-brown F-C gravel (70%) with sand (30%), cobbles (<1%) and trace organics
	DMMU-2-3a	DMMU-2-3G	7/9/2014	Gray-brown F-C gravel (70%) with sand (30%) and cobbles (<1%)
	DMMU-2-3b	DMMU-2-3G	7/9/2014	Gray-brown F-C gravel (70%) with sand (30%) and cobbles (<1%)
	DMMU-2-4	DMMU-2-4G	7/9/2014	Gray-brown F-C gravel (80%) with sand (10%), cobbles (10%) and trace organics
	DMMU-2-5	DMMU-2-5G	7/9/2014	Gray-brown F-C gravel (70%) with cobbles (20%) and sand (10%)
DMMU-3	DMMU-3-1	DMMU-3-1G	7/9/2014	Gray-brown F-C gravel (70%) with cobbles (20%) and sand (10%)
	DMMU-3-2	DMMU-3-2G	7/9/2014	Gray-brown F-C gravel (80%) with cobbles (15-20%) and sand (5%)
	DMMU-3-3a	DMMU-3-3G	7/9/2014	Gray-brown F-C gravel (70%) with sand (25%) and cobbles (5%)
	DMMU-3-3b	DMMU-3-3G	7/9/2014	Gray-brown F-C gravel (70%) with sand (25%) and cobbles (5%)
	DMMU-3-4	DMMU-3-4G	7/9/2014	Gray-brown F-C gravel (60%) with sand (35%) and cobbles (5%)
	DMMU-3-5	DMMU-3-5G	7/9/2014	Gray-brown F-C gravel (60%) with sand (25-30%) and cobbles (10-15%)
DMMU-4	DMMU-4-1	DMMU-4-1G	8/11/2014	Gray-brown F-C gravel (60%) with sand (40%) and cobbles (<1%)
	DMMU-4-2	DMMU-4-2G	8/11/2014	Gray-brown F-C gravel (60%) with sand (40%) and cobbles (<1%)
	DMMU-4-3	DMMU-4-3G	8/11/2014	Gray-brown F-C gravel (60%) with sand (40%) and cobbles (<1%)
	DMMU-4-4	DMMU-4-4G	8/11/2014	Gray-brown F-C gravel (65%) with sand (30%) and cobbles (5%)
	DMMU-4-5	DMMU-4-5G	8/11/2014	Gray-brown F-C gravel (70%) with sand (20%) and cobbles (10%)
DMMU-5	DMMU-5-1	DMMU-5-1G	8/11/2014	Gray-brown F-C gravel (65%) with sand (25%) and cobbles (10%)
	DMMU-5-2	DMMU-5-2G	8/11/2014	Gray-brown F-C gravel (70%) with sand (30%) and cobbles (<1%)
	DMMU-5-3	DMMU-5-3G	8/11/2014	Gray-brown F-C gravel (60%) with sand (40%) and cobbles (<1%)
	DMMU-5-4	DMMU-5-4G	8/11/2014	Gray-brown F-C gravel (65%) with sand (35%) and cobbles (<1%)
	DMMU-5-5	DMMU-5-5G	8/11/2014	Gray-brown F-C gravel (70%) with sand (30%) and cobbles (<1%)
DMMU-6	DMMU-6-1	DMMU-6-1G	8/12/2014	Gray-brown F-C gravel (70%) with sand (25%) and cobbles (5%)
	DMMU-6-2	DMMU-6-2G	8/12/2014	Gray-brown F-C gravel (70%) with sand (20%) and cobbles (10%)
	DMMU-6-3	DMMU-6-3G	8/12/2014	Gray-brown F-C gravel (70%) with sand (15%) and cobbles (15%)
	DMMU-6-4	DMMU-6-4G	8/12/2014	Gray-brown F-C gravel (55%) with cobbles (30%) and sand (15%)
	DMMU-6-5	DMMU-6-5G	8/12/2014	Gray-brown F-C gravel (55%) with cobbles (25%) and sand (10%)

Notes:

[1] Sampling locations are shown on Figures 3 through 8.

F-C = Fine to Coarse

Table 4

Summary of Bulk Sample Grain Size Data[1]

Lower Cedar 205 Project

Renton, Washington

Actual Sampling Location[2]		DMMU-1-3b	DMMU-2-3b	DMMU-3-3b	DMMU-4-3	DMMU-5-3	DMMU-6-3
Grain Type	Grain Size (micron)	Percent Retained in Each Size Fraction					
Cobbles	**>75,000 to 50,000**	**3.5**	**1.3**	**7.7**	**11.9**	**6.9**	**31.3**
	>75,000	*0.1 U*	*0.1 U*	*0.1 U*	*0.1 U*	*0.1 U*	*18.5*
	75,000 to 50,000	*3.5*	*1.3*	*7.7*	*11.9*	*6.9*	*12.8*
Gravel	**50,000 to 2,000**	**89.3**	**82.1**	**74.9**	**80.7**	**81.3**	**60.9**
	50,000 to 37,500	*10.2*	*3.7*	*10.2*	*11.2*	*12.6*	*6.4*
	37,500 to 25,000	*25.3*	*16.4*	*15.5*	*18.4*	*17.9*	*14.8*
	25,000 to 19,000	*14.4*	*13.8*	*7.8*	*14.6*	*7.9*	*7.9*
	19,000 to 12,500	*15.1*	*14.8*	*11.3*	*15.9*	*13*	*10.8*
	12,500 to 9,500	*6.7*	*6.9*	*6.4*	*6.8*	*6.8*	*6*
	9,500 to 4,750	*10.7*	*15.1*	*13.5*	*9*	*13.3*	*9.2*
	4,750 to 2,000	*6.9*	*11.4*	*10.2*	*4.8*	*9.8*	*5.8*
Sand	**2,000 to 75**	**6.8**	**16.3**	**16.6**	**7.5**	**11.5**	**7.5**
	2,000 to 850	*2.4*	*6.7*	*9.3*	*3.4*	*5.6*	*3.9*
	850 to 425	*0.6*	*6.3*	*4.5*	*2.4*	*3.2*	*2.7*
	425 to 250	*1.1*	*2.5*	*1.8*	*1.3*	*1.8*	*0.8*
	250 to 150	*1.7*	*0.6*	*0.7*	*0.3*	*0.7*	*0.1*
	150 to 75	*1*	*0.2*	*0.3*	*0.1*	*0.2*	*0.1 U*
Total Fines (Silt & Clay)	**<75**	**0.4**	**0.3**	**0.8**	**0.1**	**0.1**	**0.1**

Notes:

[1] Analysis performed using ASTM Method D 422 on bulk sample material representative of in-situ conditions at sampling locations. Analysis was performed on discrete samples collected from the sampling locations positioned in the center of each DMMU.

[2] Sampling locations are shown on Figure 3 through 8.

U = not detected

Table 5

Summary of Composite Sample Grain Size Data[1]

Lower Cedar 205 Project

Renton, Washington

Sample Identification		DMMU-1-COMP	DMMU-2-COMP	DMMU-3-COMP	DMMU-4-COMP	DMMU-5-COMP	DMMU-6-COMP
Grain Type	Grain Size (microns)	Percent Retained in Each Size Fraction					
Gravel	**>2,000**	**80.6**	**76.2**	**61.1**	**47.7**	**54.4**	**53.1**
Sand	**2,000 to 62.5**	**18.7**	**23**	**37.3**	**51.7**	**43.9**	**45.7**
Very Coarse Sand	*2,000 to 1,000*	*6.1*	*6.1*	*16.1*	*13.3*	*15.3*	*18.2*
Coarse Sand	*1,000 to 500*	*5.9*	*8.2*	*9.4*	*13.4*	*12*	*18.3*
Medium Sand	*500 to 250*	*4.3*	*6.5*	*8.1*	*16.6*	*11.2*	*8.1*
Fine Sand	*250 to 125*	*1.9*	*1.8*	*3*	*7.3*	*4.6*	*1*
Very Fine Sand	*125 to 62.5*	*0.5*	*0.4*	*0.7*	*1.1*	*0.8*	*0.1*
Silt	**62.5 to 3.9**	**0.5**	**0.8**	**1.6**	**0.7 U**	**1.7 U**	**1.2 U**
Coarse Silt	*62.5 to 31*	*0.5*	*0.8*	*1.6*	*0.7 U*	*1.7 U*	*1.2 U*
Medium Silt	*31 to 15.6*	*0.5 U*	*0.8 U*	*1.6 U*	*0.7 U*	*1.7 U*	*1.2 U*
Fine Silt	*15.6 to 7.8*	*0.5 U*	*0.8 U*	*1.6 U*	*0.7 U*	*1.7 U*	*1.2 U*
Very Fine Silt	*7.8 to 3.9*	*0.5 U*	*0.8 U*	*1.6 U*	*0.7 U*	*1.7 U*	*1.2 U*
Clay	**3.9 to <1**	**0.5 U**	**0.8 U**	**1.6 U**	**0.7 U**	**1.7 U**	**1.2 U**
Total Fines (Silt & Clay)	**<62.5**	**0.5**	**0.8**	**1.6**	**0.7 U**	**1.7 U**	**1.2 U**

Notes:

[1] Analysis performed using Puget Sound Estuary Protocal (PESP) methodology on composite sample material collected from each DMMU for chemical/conventional analyses. Gravel and cobble larger than approximately 0.25 inch (6.35 mm) were visually removed in field prior to collecting composite sample material in laboratory provided jars for analyses.

[2] Sampling locations are shown on Figure 3 through 8.

U = not detected

Table 6

Summary of Conventional and Chemical Analytical Data

Lower Cedar 205 Project

Renton, Washington

Sample ID[1]	DMMU-1-COMP			DMMU-2-COMP			DMMU-3-COMP			DMMU-4-COMP			DMMU-5-COMP			DMMU-6-COMP			Sediment Quality Guidelines[2]							MTCA Soil Cleanup Levels[3]			Background Values[7]
Sample Date	7/8/2014	Lab Qualifier	Validation Qualifier	7/9/2014	Lab Qualifier	Validation Qualifier	7/9/2014	Lab Qualifier	Validation Qualifier	8/11/2014	Lab Qualifier	Validation Qualifier	8/11/2014	Lab Qualifier	Validation Qualifier	8/12/2014	Lab Qualifier	Validation Qualifier	Marine Water Guidelines			2006 Interim Freshwater Guidelines		2014 Proposed Freshwater Benthic Guidelines		MTCA Method A	MTCA Method B		
Sample Type	Composite			Composite			Composite			Composite			Composite			Composite			SL[4]	BT[5]	ML[6]	SL1[4]	SL2[6]	SL1[4]/SQO	SL2[6]/CSL	Unrestricted Land Use	Carcinogenic	Non-Carcinogenic	
Conventionals[8]																													
Total Solids (%)	**89.61**			**92.3**			**86.27**			**87.1**			**87.69**			**85.93**			---	---	---	---	---	---	---	---	---	---	---
Preserved Total Solids[9] (%)	**83.44**			**87.16**			**87.31**			**81.84**			**86.05**			**84.65**			---	---	---	---	---	---	---	---	---	---	---
Total Volatile Solids (%)	**1.96**		**J**	**1.06**			**1.21**			**1.02**			**1.12**			**1.55**			---	---	---	---	---	---	---	---	---	---	---
Total Organic Carbon (%)	**0.512**			**2.12**			**0.292**			**0.127**			**0.064**			**0.055**			---	---	---	---	---	---	---	---	---	---	---
Ammonia-Nitrogen (mg/kg)	**2.36**		**J**	**1.83**			**2.29**			**2.04**			**0.23**			**0.3**			---	---	---	---	---	230	300	---	---	---	---
Total Sulfides[9] (mg/kg)	1.16	U	U	1.14	U	U	1.13	U	U	1.13	U	U	1.16	U	U	1.05	U	U	---	---	---	---	---	39	61	---	---	---	---
Metals (mg/kg dry weight)																													
Antimony	**1.44**	**J**	**J**	**1.87**	**J**	**J**	**1.45**	**J**	**J**	**1.21**	**J**	**J**	**1.11**	**J**	**J**	**1.34**	**J**	**J**	150	---	200	---	---	---	---	---	---	32	---
Arsenic	**1.77**	**J**	**J**	**3.61**	**J**	**J**	**3.85**	**J**	**J**	5	U	U	5	U	U	**2.02**	**J**	**J**	57	507.1	700	20	51	14	120	20	0.67	24	7
Cadmium	**0.2**			**0.3**			**0.3**			**0.3**			**0.3**			**0.3**			5.1	11.3	14	1.1	1.5	2.1	5.4	2	---	--	1
Chromium	**12.3**		**J**	**18.7**			**15.1**			**20.4**		**J**	**17**			**17.3**			260	260	---	95	100	72	88	2,000	---	120,000	48
Chromium, Hexavalent	---			---			---			0.456	U	UJ	---			---			---	---	---	---	---	---	---	19	---	240	---
Copper	**16.6**			**21.7**			**20**			**18.4**			**22.1**			**24.4**			390	1,027	1,300	80	830	400	1,200	--	---	3,200	36
Lead	**3**			**3**			**4**			**2**			**2**			**2.02**	**J**	**J**	450	975	1,200	340	430	360	> 1,300	250	---	--	24
Mercury	**0.0121**	**J**	**J**	**0.014**	**J**	**J**	**0.0159**	**J**	**J**	**0.05**		**J**	**0.02**			0.0086	J	U	0.41	1.5	2.3	0.28	0.75	0.66	0.8	2	---	--	0.07
Nickel	**13**		**J**	**20**			**16**			**18**			**19**			**23**			---	---	---	60	70	26	110	---	---	1,600	48
Selenium	0.6	U	U	**0.7**			0.6	U	U	0.5	U	U	0.5	U	U	0.5	U	U	---	3	---	---	---	11	> 20	---	---	400	---
Silver	0.3	U	U	0.3	U	U	0.3	U	U	0.3	U	U	0.3	U	U	0.3	U	U	6.1	6.1	8.4	2.0	2.5	0.57	1.7	---	---	400	---
Zinc	**39**			**46**			**38**			**43**			**43**			**41**			410	2,783	3,800	130	400	3,200	>4,200	---	---	24,000	85
Polycyclic Aromatic Hydrocarbons[10] (PAHs; µg/kg dry weight)																													
Total LPAH[11]	4.9		UT	**6.4**		**T**	4.8		UT	4.8		UT	4.8		UT	4.7		UT	5,200	---	29,000	6,600	9,200	---	---	---	---	---	---
Acenaphthylene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	560	---	1,300	470	640	---	---	---	---	---	---
Acenaphthene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	500	---	2,000	1,100	1,300	---	---	---	---	4,800,000	---
Anthracene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	960	---	13,000	1,200	1,200	---	---	---	---	24,000,000	---
Fluorene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	540	---	3,600	1,000	3,000	---	---	---	---	3,200,000	---
Naphthalene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	2,100	---	2,400	500	1,300	---	---	5,000[12]	---	1,600,000	---
Phenanthrene	4.9	U	U	**6.4**			4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	1,500	---	21,000	6,100	7,600	---	---	---	---	---	---
2-Methylnaphthalene	4.9	U	U	**2.4**	**J**	**J**	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	670	---	1,900	470	560	---	---	---	---	320,000	---
Total HPAH[13]	4.9		UT	**3.1**		**JT**	4.8		UT	4.8		UT	4.8		UT	4.7		UT	12,000	---	69,000	31,000	55,000	---	---	---	---	---	---
Benzo(a)anthracene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	1,300	---	5,100	4,300	5,800	---	---	---	1,400	---	---
Benzo(a)pyrene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	1,600	---	3,600	3,300	4,800	---	---	100	140	---	---
Benzo(b)fluoranthene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	---	---	---	---	---	---	---	---	1,400	---	---
Benzo(k)fluoranthene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	---	---	---	---	---	---	---	---	14,000	---	---
Total Benzofluoranthenes	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	3,200	---	9,900	600	4,000	---	---	---	---	---	---
Benzo(ghi)perylene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	19	U	U	670	---	3,200	4,000	5,200	---	---	---	---	---	---
Chrysene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	1,400	---	21,000	5,900	6,400	---	---	---	140,000	---	---
Dibenzo(a,h)anthracene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	230	---	1,900	800	840	---	---	---	---	---	---
Fluoranthene	4.9	U	U	**3.1**	**J**	**J**	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	1,700	4,600	30,000	11,000	15,000	---	---	---	---	3,200,000	---
Indeno(1,2,3-cd)pyrene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	600	---	4,400	4,100	5,300	---	---	---	1,400	--	---
Pyrene	4.9	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.8	U	U	4.7	U	U	2,600	11,980	16,000	8,800	16,000	---	---	---	--	3,200,000	---
Total cPAHs TEQ[14]	3.7		UT	3.6		UT	3.6		UT	3.6		UT	3.6		UT	3.6		UT	---	---	---	---	---	---	---	100	140	---	---
Total PAHs	4.9		UT	**11.9**		**T**	4.8		UT	4.8		UT	4.8		UT	4.7		UT	---	---	---	---	---	17,000	30,000	--	--	--	---

Sample ID[1]	DMMU-1-COMP			DMMU-2-COMP			DMMU-3-COMP			DMMU-4-COMP			DMMU-5-COMP			DMMU-6-COMP			Sediment Quality Guidelines[2]							MTCA Soil Cleanup Levels[3]			Background Values[7]
Sample Date	7/8/2014	Lab Qualifier	Validation Qualifier	7/9/2014	Lab Qualifier	Validation Qualifier	7/9/2014	Lab Qualifier	Validation Qualifier	8/11/2014	Lab Qualifier	Validation Qualifier	8/11/2014	Lab Qualifier	Validation Qualifier	8/12/2014	Lab Qualifier	Validation Qualifier	Marine Water Guidelines			2006 Interim Freshwater Guidelines		2014 Proposed Freshwater Benthic Guidelines		MTCA Method A	MTCA Method B		
Sample Type	Composite			Composite			Composite			Composite			Composite			Composite			SL[4]	BT[5]	ML[6]	SL1[4]	SL2[6]	SL1[4]/SQO	SL2[6]/CSL	Unrestricted Land Use	Carcinogenic	Non-Carcinogenic	
Chlorinated Hydrocarbons (µg/kg dry weight)																													
Hexachlorobenzene	0.99	U	U	0.97	U	U	0.98	U	U	0.95	U	U	0.95	U	U	0.95	U	U	22	168	230	—	—	—	—	—	630	64,000	—
1,2-Dichlorobenzene	20	U	U	19	U	U	20	U	U	19	U	U	19	U	U	19	U	U	35	—	110	—	—	—	—	—	—	7,200,000	—
1,4-Dichlorobenzene	20	U	U	19	U	U	20	U	U	19	U	U	19	U	U	19	U	U	110	—	120	—	—	—	—	—	—	—	—
1,2,4-Trichlorobenzene	20	U	U	19	U	U	20	U	U	19	U	U	19	U	U	19	U	U	31	—	64	—	—	—	—	—	35,000	800,000	—
Phthalates (µg/kg dry weight)																													
Bis(2-ethylhexyl)phthalate	49	U	U	48	U	U	49	U	U	48	U	U	48	U	U	48	U	U	1,300	—	8,300	220	320	500	22,000	—	71,000	1,600,000	—
Butyl benzyl phthalate	20	U	U	19	U	U	20	U	U	19	U	U	19	U	U	19	U	U	63	—	970	260	370	—	—	—	530,000	16,000,000	—
Diethyl phthalate	20	U	U	19	U	U	20	U	U	18	JB	U	17	JB	U	26	B	U	200	—	1,200	—	—	—	—	—	—	64,000,000	—
Dimethyl phthalate	20	U	U	19	U	U	20	U	U	19	U	U	19	U	U	19	U	U	71	—	1,400	46	440	—	—	—	—	—	—
Di-n-butyl phthalate	20	U	U	19	U	U	20	U	U	19	U	U	19	U	U	19	U	U	1,400	—	5,100	—	—	380	1,000	—	—	8,000,000	—
Di-n-octyl phthalate	20	U	U	19	U	U	20	U	U	19	U	U	19	U	U	19	U	U	6,200	—	6,200	26	45	39	> 1,100	—	—	—	—
Phenols (µg/kg dry weight)																													
Pentachlorophenol	99	U	U	97	U	U	97	U	U	95	U	UJ	95	U	UJ	95	U	UJ	400	504	690	—	—	1,200	> 1,200	—	2,500	400,000	—
Phenol	**21**			19	U	U	**40**			19	U	U	19	U	U	19	U	U	420	—	1,200	—	—	120	210	—	—	2,400,000	—
2-Methylphenol	20	U	U	19	U	U	20	U	U	19	U	U	19	U	U	19	U	U	63	—	77	—	—	—	—	—	—	—	—
4-Methylphenol	**170**			19	U	U	**29**			19	U	U	19	U	U	19	U	U	670	—	3,600	—	—	260	2,000	—	—	—	—
2,4-Dimethylphenol[10]	25	U	U	24	U	U	24	U	U	24	U	U	24	U	U	24	U	U	29	—	210	—	—	—	—	—	—	1,600,000	—
Miscellaneous Extractables (µg/kg dry weight)																													
Carbazole	20	U	U	19	U	U	20	U	U	19	U	U	19	U	U	19	U	U	—	—	—	—	—	900	1,100	—	—	—	—
Dibenzofuran	20	U	U	19	U	U	20	U	U	19	U	U	19	U	U	19	U	U	540	—	1,700	400	440	200	680	—	—	80,000	—
Hexachlorobutadiene	0.99	U	U	0.97	U	U	0.98	U	U	0.95	U	U	0.95	U	U	0.95	U	U	11	—	270	—	—	—	—	—	13,000	80,000	—
N-Nitrosodiphenylamine	20	U	U	19	U	U	20	U	U	19	U	U	19	U	U	19	U	U	28	—	130	—	—	—	—	—	200,000	—	—
Benzoic Acid	**63**	**QJ**	**J**	190	U	U	200	U	U	190	U	UJ	190	U	UJ	190	U	UJ	650	—	760	—	—	2,900	3,800	—	—	320,000,000	—
Benzyl Alcohol	**18**	**J**	**J**	19	U	U	20	U	U	19	U	U	19	U	U	19	U	UJ	57	—	870	—	—	—	—	—	—	8,000,000	—
Pesticides (µg/kg dry weight)																													
4,4'-DDD	0.99	U	U	0.97	U	U	0.98	U	U	0.95	U	U	0.95	U	U	0.95	U	U	16	—	—	—	—	310	860	—	4,200	—	—
4,4'-DDE	0.99	U	U	0.97	U	U	0.98	U	U	0.95	U	U	0.95	U	U	0.95	U	U	9	—	—	—	—	21	33	—	2,900	—	—
4,4'-DDT	0.99	U	U	0.97	U	U	0.98	U	U	0.95	U	U	0.95	U	U	0.95	U	U	12	—	—	—	—	100	8,100	3,000	2,900	40,000	—
Total DDT[15]	0.99		UT	0.97		UT	0.98		UT	0.95		UT	0.95		UT	0.95		UT	–	50	69	—	—	—	—	3,000	2,900	40,000	—
Aldrin	0.49	U	U	0.48	U	U	0.49	U	U	0.48	U	U	0.48	U	U	0.47	U	U	9.5	—	—	—	—	—	—	—	59	2,400	—
Dieldrin	0.99	U	U	0.97	U	U	0.98	U	U	0.95	U	U	0.95	U	U	0.95	U	U	1.9	—	1,700	—	—	4.9	9.3	—	63	4,000	—
Beta-BHC	0.49	U	U	0.48	U	U	0.49	U	U	0.48	U	U	0.48	U	U	0.47	U	U	—	—	—	—	—	—	—	—	556	–	—
Gamma-BHC (Lindane)	0.49	U	U	0.48	U	U	0.49	U	U	0.67	Y	U	1.3	Y	U	0.47	U	U	—	—	—	—	—	—	—	10	909	24,000	—
Total Chlordane[16]	2.5		UT	0.97		UT	0.98		UT	0.95		UT	0.95		UT	0.95		UT	2.8	37	—	—	—	—	—	—	2,900	40,000	—
trans-Chlordane	0.49	U	U	0.48	U	U	0.49	U	U	0.48	U	U	0.48	U	U	0.47	U	U	—	—	—	—	—	—	—	—	—	—	—
cis-Chlordane	0.49	U	U	0.48	U	U	0.49	U	U	0.48	U	U	0.48	U	U	0.47	U	U	—	—	—	—	—	—	—	—	—	—	—
oxy-Chlordane	0.99	U	U	0.97	U	U	0.98	U	U	0.95	U	U	0.95	U	U	0.95	U	U	—	—	—	—	—	—	—	—	—	—	—
cis-Nonachlor	0.99	U	U	0.97	U	U	0.98	U	U	0.95	U	U	0.95	U	U	0.95	U	U	—	—	—	—	—	—	—	—	—	—	—
trans-Nonachlor	2.5	Y	U	0.97	U	U	0.98	U	U	0.95	U	U	0.95	U	U	0.95	U	U	—	—	—	—	—	—	—	—	—	—	—
Heptachlor	0.49	U	U	0.48	U	U	0.49	U	U	0.48	U	U	0.48	U	U	0.47	U	U	1.5	—	270	—	—	—	—	—	222	40,000	—
Endrin Ketone	0.99	U	U	0.97	U	U	0.98	U	U	0.95	U	U	0.95	U	U	0.95	U	U	—	—	—	—	—	8.5	<8.5	—	—	—	—

Sample ID[1]	DMMU-1-COMP			DMMU-2-COMP			DMMU-3-COMP			DMMU-4-COMP			DMMU-5-COMP			DMMU-6-COMP			Sediment Quality Guidelines[2]							MTCA Soil Cleanup Levels[3]			Background Values[7]
Sample Date	7/8/2014	Lab Qualifier	Validation Qualifier	7/9/2014	Lab Qualifier	Validation Qualifier	7/9/2014	Lab Qualifier	Validation Qualifier	8/11/2014	Lab Qualifier	Validation Qualifier	8/11/2014	Lab Qualifier	Validation Qualifier	8/12/2014	Lab Qualifier	Validation Qualifier	Marine Water Guidelines			2006 Interim Freshwater Guidelines		2014 Proposed Freshwater Benthic Guidelines		MTCA Method A	MTCA Method B		
Sample Type	Composite			Composite			Composite			Composite			Composite			Composite			SL[4]	BT[5]	ML[6]	SL1[4]	SL2[6]	SL1[4]/SQO	SL2[6]/CSL	Unrestricted Land Use	Carcinogenic	Non-Carcinogenic	
Polychlorinated Bipheyls (PCBs; µg/kg dry weight)																													
PCB-aroclor 1016	4	U	U	3.9	U	U	3.9	U	U	3.8	U	U	3.8	U	U	3.8	U	U	—	—	—	—	—	—	—	—	—	—	—
PCB-aroclor 1221	4	U	U	3.9	U	U	3.9	U	U	3.8	U	U	3.8	U	U	3.8	U	U	—	—	—	—	—	—	—	—	—	—	—
PCB-aroclor 1232	4	U	U	3.9	U	U	5.8	Y	U	3.8	U	U	3.8	U	U	3.8	U	U	—	—	—	—	—	—	—	—	—	—	—
PCB-aroclor 1242	4	U	U	3.9	U	U	3.9	U	U	3.8	U	U	3.8	U	U	3.8	U	U	—	—	—	—	—	—	—	—	—	—	—
PCB-aroclor 1248	4	U	U	3.9	U	U	3.9	U	U	3.8	U	U	3.8	U	U	3.8	U	U	—	—	—	—	—	—	—	—	—	—	—
PCB-aroclor 1254	4	U	U	3.9	U	U	3.9	U	U	3.8	U	U	3.8	U	U	3.8	U	U	—	—	—	—	—	—	—	—	—	—	—
PCB-aroclor 1260	4	U	U	3.9	U	U	**2.6**	**J**	**J**	3.8	U	U	3.8	U	U	3.8	U	U	—	—	—	—	—	—	—	—	—	—	—
Total PCBs[17]	4		UT	3.9		UT	**2.6**		**JT**	3.8		UT	3.8		UT	3.8		UT	130	—	31,000	60	120	110	2,500	1,000	500	—	—
Total PCBs[17, 18]	0.78		UT	0.18		UT	0.89		**JT**	2.99		UT	5.94		UT	6.91		UT	—	38	—	—	—	—	—	—	—	—	—
Volatile Organic Compounds[9] (VOCs; µg/kg dry weight)																													
Benzene	9.7	U	U	8.9	U	U	8.8	U	U	6.1	U	U	7	U	U	6.8	U	U	—	—	—	—	—	—	—	30	18,000	320,000	—
Ethylbenzene	9.7	U	U	8.9	U	U	8.8	U	U	6.1	U	U	7	U	U	6.8	U	U	—	—	—	—	—	—	—	6,000	—	8,000,000	—
Toluene	9.7	U	U	**6**	**J**	**J**	8.8	U	U	6.1	U	U	7	U	U	6.8	U	U	—	—	—	—	—	—	—	7,000	—	6,400,000	—
Xylene[19]	19	U	U	18	U	U	18	U	U	12	U	U	14	U	U	14	U	U	—	—	—	—	—	—	—	9,000	—	16,000,000	—
Petroleum Hydrocarbons (mg/kg dry weight)																													
Gasoline[9]	**2**	**J**	**J**	3.6	U	U	3.5	U	U	2.4	U	U	2.8	U	U	2.7	U	U	—	—	—	—	—	—	—	30/100 [20]	—	—	—
Diesel	**4.9**	**J**	**J**	**6**			**4.3**	**J**	**J**	**8.7**			5.7	U	U	5.7	U	U	—	—	—	—	—	340	510	2,000 [21]	—	—	—
Heavy Oil	12	U	U	12	U	U	12	U	U	11	U	U	11	U	U	11	U	U	—	—	—	—	—	3,600	4,400	2000 [21]	—	—	—
Dioxins and Furans[22] (pg/g)																													
Total Dioxins/Furans TEQ (non-detects = ½ the DL)	0.6183		JT	0.7695		JT	NA			NA			NA			NA			4[23]	—	—	—	—	—	—	—	—	11	—
Total Dioxins/Furans TEQ (non-detects = 0)	0.0709		JT	0.1757		JT	NA			NA			NA			NA			4[23]	—	—	—	—	—	—	—	—	11	—

Notes:

[1] Sampling locations are shown on Figure 3 through 8.

[2] The Sediment Quality Guidelines provided include the 2006 Interim Freshwater Guidelines and Marine Chemistry Guideline Values provided by the DMMO website (http://www.nws.usace.army.mil/Missions/CivilWorks/Dredging/UsersManual.aspx), as well as the updated freshwater benthic guidelines proposed at the 2014 SMARM.

[3] Model Toxics Control Act (Chapter 173-340 WAC) numerical criteria for unrestricted land use.

[4] Screening Level (SL1/SL) is the concentration at or below which there is no reason to believe that the dredged material would result in unacceptable adverse affects if the material was disposed of or was beneficially reused in-water.

[5] Bioaccumulation trigger (BT) values are used as guidelines to identify when bioaccumulation testing is required to assess dredge material for in-water disposal or beneficial reuse. Values are dry weight unless otherwise noted.

[6] Screening Level 2 /Maximum Level (SL2/ML) is the concentration at which more than minor adverse effects are expected to occur if the material was disposed of or beneficially reused in-water.

[7] Natural background concentration for the Puget Sound (Ecology, 1994).

[8] Refer to Table 5 for results of grain size analysis performed on composite samples representative of each DMMU.

[9] Discrete samples DMMU-1-3G, DMMU-2-3G, DMMU-3-3G, DMMU-4-3G, DMMU-5-3G and DMMU-6-3G were analyzed for total sulfides, gasoline-range petroleum hydrocarbons and volatile organic compounds (BETX).

[10] Analyzed using both SW8270 and SW8270-SIM methods. The results of SW8270-SIM method are presented in this table.

[11] Total LPAH = The sum of detected concentrations of acenaphthylene, acenaphthene, anthracene, fluorene, naphthalene, and phenanthrene.

[12] Total of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene.

[13] Total HPAH = The sum of detected concentrations of benzo(a)anthracene, benzo(a)pyrene, total benzofluoranthenes, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3,- c,d)pyrene and pyrene.

[14] The total carcinogenic polycyclic aromatic hydrocarbon (cPAH) concentration is calculated by multiplying the detected concentrations of benzo(a)anthracene, benzo(b+k)fluoranthenes, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene and indeno(g,h,i)perylene by the toxic equivalency factor (TEF) for each individual cPAH and summing the resulting concentrations to develop the total toxic equivalency (TEQ) concentration.

[15] Total DDT is the sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT.

[16] Total chlordane is the sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor and oxychlordane.

[17] Total PCBs is the sum of aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260.

[18] Values normalized to organic carbon and are expressed as mg/kg organic carbon (oc).

[19] Total xylenes is the sum of o-, m- and p-xylene.

[20] The Method A criteria for gasoline-range hydrocarbons is 100 mg/kg if benzene is not present and ethylbenzene, toluene and xylene concentrations comprise less than 1 percent. The Method A criteria is 30 mg/kg for other gasoline-range hydrocarbons mixtures.

[21] The Method A criteria for diesel- and heavy oil-range hydrocarbons is 2,000 mg/kg.

[22] Refer to Table 7 for results of individual dioxin/furan congeners.

[23] Disposal Site Management Objective Value (Dredged Material Management Program New Interim Guidelines for Dioxins, December 6, 2010).

-- = Not tested/established

mg/kg = milligram per kilogram

µg/kg = microgram per kilogram

pg/kg = picogram per gram

BETX = Benzene, ethylbenzene, toluene and xylene

DMMO = Dredged Material Management Office

DMMU = Dredged Material Management Unit

MTCA = Model Toxics Control Act

TEQ = toxicity equivalents

WAC = Washington Administrative Code

U = Analyte not detected above the reporting limit

J = Estimated value

Q = Initial or continuing calibration outside criteria

Y = Elevated reporting limit due to matrix interference

T = Total calculated by summing specific analytical parameters

B = Analyte detected in the method blank

Table 7

Summary of Dioxin/Furan Chemical Analytical Data

Lower Cedar 205 Project
Renton, Washington

Sample ID		DMMU-1-COMP					DMMU-2-COMP				
Results	**TEF**	**Laboratory Result (dry weight)**	**TEQ Result (U = 0)**	**TEQ Result (U = 1/2 DL)**	**Lab Qualifier**	**Validation Qualifier**	**Laboratory Result (dry weight)**	**TEQ Result (U = 0)**	**TEQ Result (U = 1/2 DL)**	**Lab Qualifier**	**Validation Qualifier**
Dioxins and Furans (pg/g)											
2,3,7,8-TCDD	1	0.0655	0	0.0328	U	U	0.0412	0	0.0206	U	U
1,2,3,7,8-PeCDD	1	0.0754	0	0.0377	JEMPC	U	0.0746	0.0746	0.0746	J	J
1,2,3,4,7,8-HxCDD	0.1	0.0714	0	0.0357	JEMPC	U	0.0942	0	0.0471	JEMPC	U
1,2,3,6,7,8-HxCDD	0.1	0.121	0	0.0605	JEMPC	U	0.153	0	0.0765	JEMPC	U
1,2,3,7,8,9-HxCDD	0.1	0.151	0.0151	0.0151	J	J	0.261	0	0.1305	JEMPC	U
1,2,3,4,6,7,8-HpCDD	0.01	3.68	0.0368	0.0368	B		5.84	0.0584	0.0584	B	
OCDD	0.0003	57	0.0171	0.0171	B	J	141	0.0423	0.0423	B	J
2,3,7,8-TCDF	0.1	0.0813	0	0.0407	U	U	0.0334	0	0.0167	U	U
1,2,3,7,8-PeCDF	0.03	0.0575	0.0017	0.0017	J	J	0.0412	0	0.0206	JEMPC	U
2,3,4,7,8-PeCDF	0.3	0.0536	0	0.0268	U	U	0.0275	0	0.0138	JEMPC	U
1,2,3,4,7,8-HxCDF	0.1	0.0556	0	0.0278	U	U	0.0432	0	0.0216	JEMPC	U
1,2,3,6,7,8-HxCDF	0.1	0.0556	0	0.0278	U	U	0.0353	0	0.0177	U	U
2,3,4,6,7,8-HxCDF	0.1	0.0575	0	0.0288	U	U	0.0373	0	0.0187	U	U
1,2,3,7,8,9-HxCDF	0.1	0.0734	0	0.0367	U	U	0.0471	0	0.0236	U	U
1,2,3,4,6,7,8-HpCDF	0.01	0.319	0	0.1595	JEMPC	U	0.324	0	0.162	JEMPC	U
1,2,3,4,7,8,9-HpCDF	0.01	0.0655	0	0.0328	U	U	0.0491	0	0.02455	U	U
OCDF	0.0003	0.683	0.0002	0.0002	BJ	J	1.36	0.0004	0.0004	BJ	J
Total Dioxins/Furans TEQ			0.0709	0.6183		JT		0.1757	0.7695		JT

Notes:

pg/kg = picogram per gram
DMMU = Dredged Material Management Unit
TEQ = toxicity equivalents
U = Analyte not detected above the reporting limit
J = Estimated value
B = Analyte detected in the method blank
EMPC = Estimated Maximum Possible Concentration defined in EPA Statement of Wo
DL = Detection Limit
TEF = Toxicity Equivalency Factor
T = Total calculated by summing specific analytical parameters