CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD April 10, 2007

SUBJECT: DETERMINATION ON THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM THE CITY OF RENTON MUNICIPAL AIRPORT SEAPLANE BASE, LAKE WASHINGTON, KING COUNTY, FOR BENEFICIAL USE OR UNCONFINED OPEN-WATER DISPOSAL AT THE ELLIOTT BAY.

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 16,000 cubic yards (cy) of dredged material from the City of Renton Municipal Airport Seaplane Base for beneficial use or for disposal at the Elliott Bay non-dispersive open-water site.

2. Background. The Renton Seaplane Base serves numerous commercial and recreational seaplanes. The in-water seaplane facilities include a floating dock for passenger boarding and offloading and an aircraft access ramp. The seaplane base is located in close proximity to the mouth of the Cedar River and is subject to sediment deposition, especially during winter storm events. Dredging is required to maintain safe operational depth for seaplane operations (Parametrix, 2006).

3. Project Summary. Table 1 includes project summary and tracking information.

Table 1. Project Summary

Project ranking	moderate
Proposed dredging volume	16,000 cubic yards
Proposed dredging depth	7 feet CED[1]
SAP received	October 17, 2006
SAP approved	October 31, 2006
Sampling dates	November 14, 2006 November 27, 2006
Data report submitted	March 28, 2007
DAIS Tracking number	RMASB-1-A-F-229
USACE Permit Application Number	permit application not yet submitted
Recency Determination (moderate rank = 5 years)	April 2012

[1]Corps of Engineers Datum – Lake Washington

4. Project Ranking and Sampling Requirements. This project was ranked "moderate" by the DMMP program based on its location in Lake Washington (PSDDA, 1988). The sampling and analysis plan (Parametrix, 2006) originally called for dredging of no more than 12,000 cubic yards of

sediment. In a moderate-ranked area the number of samples and analyses are calculated using the following guidelines (PSDDA, 1988):

- Maximum volume of sediment represented by each field sample = 4,000 cubic yards
- Maximum volume of sediment represented by each analysis in the upper 4-feet of the dredging prism (surface sediment) = 16,000 cubic yards
- Maximum volume of sediment represented by each analysis in the subsurface portion of the dredging prism = 24,000 cubic yards

Since the total volume was less than the maximum volume that could be represented by one surface analysis, the entire dredging volume was treated as a single dredged material management unit (DMMU). Three field samples (two surface and one subsurface) were to be composited to represent this DMMU.

5. Sampling. Initial sampling for this project took place on November 14, 2006. Difficulties were encountered on several fronts. First, a major storm during the first week of November resulted in significant new shoaling at the seaplane base. Newly deposited sediment ranged from 4 to 6 feet deep. The sampling crew had 10-foot tubes available but shallower water depths prevented their use at some sampling locations (Currie, 2007). There was not enough clearance to stand the vibracorer upright when using the longer tubes. Therefore, 8-foot tubes were used, but these could not penetrate deep enough to collect Z-samples. A second problem was the nature of the sediment deposits, which appeared to be unconsolidated with high water content. While penetration to the full length of the core tubes was achieved in most cases, the recovery was poor. Finally, the contractor experienced problems penetrating organic debris in the east half of the project. As a result, sediment cores were only obtained in the west half of the project.

   Parametrix consulted with the Dredged Material Management Office after the first day of sampling. Because of the significant accretion of sediment from the flood, it was decided that the dredging area should be split into two DMMUs - west and east - to accommodate what was anticipated to be an exceedance of the maximum allowable material for a single DMMU (a subsequent bathymetric survey indicated that this was not the case – the total volume is anticipated to be 16,000 cubic yards or less). See Attachment 1. Also, discussions ensued about getting heavier-duty sampling equipment out in the field for a second round of sampling to ensure penetration to the full depth required. However, the shallow water made access by a large rig impossible. A medium-duty vibracorer was therefore acquired and the second round of sampling took place on November 27. Tube lengths were restricted to 8 feet because of the shallow water. Problems with recovery and organic debris were again encountered. A more complete account of the two sampling rounds can be found in Attachment 2. Table 2 includes sampling summary information.

Table 2. Sampling Summary

	WEST DMMU	EAST DMMU
DAIS ID:	C1	C2
Number of samples:	2	2
Minimum penetration depth (ft):	6.6	7.0
Maximum penetration depth (ft):	9.3	7.0
Mean penetration depth (ft):	7.9	7.0
Minimum core length (ft):	3.2	4.2

Maximum core length (ft):	7.3	4.8
Mean core length (ft):	5.3	4.5
Minimum recovery (%):	48	67
Maximum recovery (%):	78	69
Mean recovery (%):	63	68

Despite the difficulties encountered, the DMMP agencies concluded that the contractor had made a good-faith effort to collect representative samples, having mobilized twice and having made repeated attempts to achieve good penetration and recovery. Further, the DMMP agencies believe the samples adequately represent the material in the dredging prism. Therefore, the sediment samples were deemed adequate to fully characterize the proposed dredged material.

6. Chemical Analysis. The approved sampling and analysis plan was followed and quality control guidelines specified by the PSEP and DMMP programs were met, with a few minor exceptions. The data were considered sufficient and acceptable for regulatory decision-making under the DMMP program.

   Sediment conventional results (Table 3) show that the proposed dredged material is predominantly sand. The area to the west of the floating dock is partially protected from currents from the Cedar River. The fines content is higher here than in the east half of the project, which is in closer proximity to the mouth of the Cedar River and largely unprotected from its outflow and suspended sediment load.

Table 3. Sediment Conventional Results.

		WEST DMMU	EAST DMMU
DAIS ID:		C1	C2
Volume (cubic yards):		8,000	8,000
GRAIN SIZE	% Gravel	0.5	5.0
	% Sand	78.5	90.6
	% Silt	16.5	3.5
	% Clay	4.5	0.8
	(clay+silt) % Fines	21.0	4.3
Total Solids, %		63.0	78.7
Volatile Solids, %		4.5	3.2
Total Organic Carbon, %		1.66	2.06
Total Sulfides, mg/kg		1.4 u	1.5 u
Total Ammonia, mg N/kg		96.1	69.5

The chemical results indicate that there were no exceedances of DMMP screening levels (Attachment 3; Table 4). Consequently, bioassay testing was not required of this material. Both DMMUs met suitability guidelines, based on chemistry alone, for open-water disposal at either a dispersive or nondispersive site.

7. Sediment Exposed by Dredging. Sediment exposed by dredging must either meet the State of Washington Sediment Quality Standards (SQS) (Ecology, 1995) or the State's antidegradation standard (DMMP, 2001). Comparison of the proposed dredged material to SQS serves as a first-tier indicator for this purpose. Table 5 (Attachment 4) shows that there were no detected exceedances of SQS. However - while undetected - the reporting limits for 1,2,4-trichlorobenzene and hexachlorobenzene exceeded SQS. The DMMP agencies believe the probability that these reporting limit exceedances could be masking actual exceedances of SQS is low. Therefore, the exceedances were deemed insignificant.

   Because the source of the majority of sediment in the project area is the Cedar River, 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 agreed that there was no need for the collection or analysis of Z-samples for this project. The sediment that will be exposed by dredging is not anticipated to have any exceedances of SQS.

8. Beneficial-Use Analysis. As indicated in the previous section, the proposed dredged material had no detected exceedances of SQS (and only two undetected exceedances, which were deemed insignificant). The Sediment Quality Standards pertain to marine sediment; therefore the dredged material is suitable for beneficial use in a marine environment.

   To assess the suitability of the dredged material for beneficial use in a freshwater environment, the freshwater guidelines found in the Sediment Evaluation Framework (RSET, 2006) were used. Table 6 (Attachment 5) shows that there were no exceedances of these guidelines. Therefore, the material is suitable for freshwater use.

   Finally, to assess the suitability for upland beneficial use, the chemical results were compared to the Model Toxics Control Act (MTCA) guidelines (Ecology, 2005). Table 7 (Attachment 6) indicates that the reporting limits for arsenic exceed the Method B guideline for carcinogens. Naturally occurring elevated concentrations of arsenic are found in some sediments in the Puget Sound region. Therefore, while undetected at the reporting limit, Ecology, DNR and the local health district should be consulted if upland beneficial use is contemplated. Lower-level quantification of arsenic may be required. Also, while there is no MTCA Method A guideline for total chromium, the total chromium value does exceed the guideline for chromium VI. Additional analysis may be required for upland beneficial use in order to determine the chromium VI content of the sediment.

9. Suitability Determination. This memorandum documents the evaluation of the suitability of sediment proposed for dredging from the City of Renton Municipal Airport Seaplane Base for beneficial use or open-water disposal. The approved sampling and analysis plan was followed with the exceptions noted above. 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 16,000 cubic yards are suitable** for open-water disposal at the Elliott Bay non-dispersive site. The dredged material is also suitable, from a chemical and toxicity standpoint, for beneficial use in a marine or freshwater environment. Upland beneficial use would require additional consultation with Ecology, DNR and 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 and the Corps of Engineers will be required. A dredging quality control plan must be developed and submitted to the Enforcement Section of the Regulatory Branch of the Seattle District Corps of Engineers at least 7 days prior to the pre-dredge meeting. A DNR site use authorization must also be acquired.

10. References.

Currie, 2007. Personal communication with Stuart Currie, Parametrix, April 2007.

DMMP, 2001. *Quality of Post-Dredge Sediment Surfaces*. A clarification paper prepared by Tom Gries for the DMMP agencies, October 2001.

Ecology, 1995. *Sediment Management Standards – Chapter 173-204 WAC*. Washington State Department of Ecology, December 1995.

Ecology, 2005. *Model Toxics Control Act – Chapter 70.105D RCW and Cleanup Regulation - Chapter 173-340 WAC*. Washington State Department of Ecology, October 2005.

Parametrix, 2006. *City of Renton Municipal Airport Seaplane Base Maintenance Dredging – Sediment Sampling and Analysis Plan*. Prepared by Parametrix, Sumner, Washington for the City of Renton. October 2006.

Parametrix, 2007. *City of Renton Municipal Airport Seaplane Base Maintenance Dredging – Sediment Characterization Report*. Prepared by Parametrix, Sumner, Washington for the City of Renton. March 2007.

PSDDA, 1988. *Evaluation Procedures Technical Appendix – Phase I – Central Puget Sound*. U.S. Army Corps of Engineers Seattle District, U.S. Environmental Protection Agency Region 10, Washington State Department of Ecology, Washington State of Natural Resources. June 1988.

RSET, 2006. *Northwest Regional Sediment Evaluation Framework – Interim Final*. Regional Sediment Evaluation Team. September 2006.

11. **Agency Signatures**.

Concur:

4/10/07 David F. Fox
Date David Fox, P.E. - Seattle District Corps of Engineers

4/18/07 Erika Hoffman
Date Erika Hoffman - Environmental Protection Agency

4/18/07 Laura Inouye
Date Laura Inouye, Ph.D. - Washington Department of Ecology

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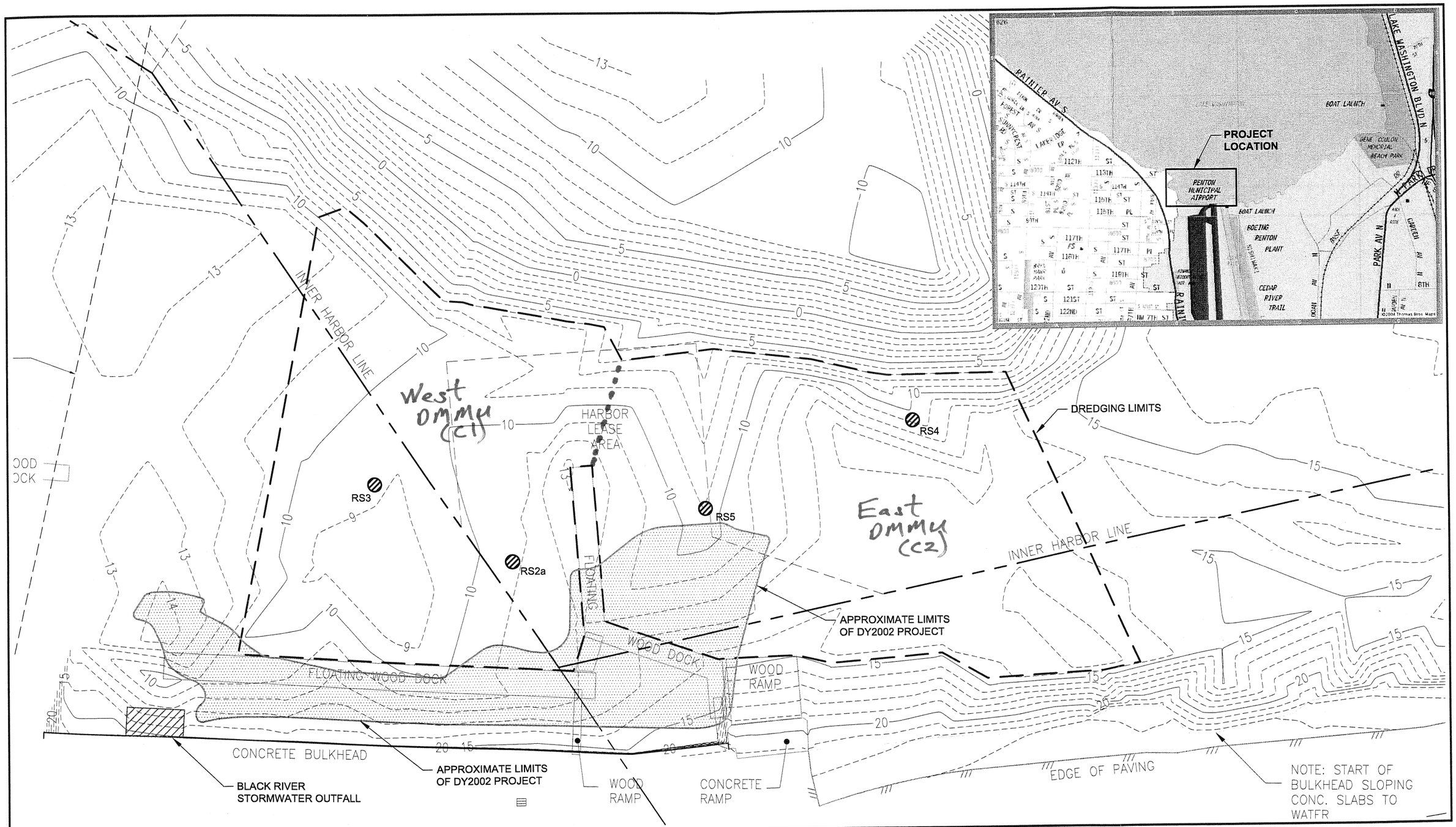

Parametrix DATE: Jan 10, 2007 FILE: SU1779026F-01

0 N 40'
SCALE IN FEET

LEGEND

- DREDGING PROJECT BOUNDARY
- INNER HARBOR LINE
- RS5 EXISTING SEDIMENT SAMPLING LOCATION
- BLACK RIVER STORMWATER OUTFALL
- APPROXIMATE LIMITS OF DY2002 DREDGING PROJECT

NOTES

1. CONTOUR INTERVAL; 1 FOOT
2. VERTICAL DATUM: LAKE WASHINGTON ELEVATION, AS GIVEN BY THE CORPS OF ENGINEERS

Figure 1
Project Location and Sampling Locations
Seaplane Base,
Renton, Washington

Attachment 1

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M E M O R A N D U M

Date: **November 30, 2006**

To: **David Fox and the DMMP agencies**

From: **Peter Leon**

Subject: **Field summary: PSDDA Sampling Event, November 27, 2006**

cc: **Joe Kurrus, Stuart Currie**

Project Number: **215-1779-026**

Project Name: **Renton Airport Seaplane Base PSDDA Sampling**

The summary below was compiled by Parametrix field crew participating in the November 27, 2006 PSDDA sampling event at the request of the DMMP agencies.

Field summary: PSDDA Sampling Event, November 27, 2006

Background: During the initial sampling event at the Renton Airport Seaplane Base (11/14/06), recent high flow events within the Cedar River resulted in significantly changed field conditions than were expected based upon pre-flood surveys. A large volume of recently deposited material from the Cedar River was encountered on site, and the resulting shallow water depths combined with fast flowing currents throughout the project area to create challenging field sampling conditions and limited opportunities to obtain acceptable sediment cores.

Several attempts were made to collect sediment cores throughout the proposed dredging area. Although site conditions allowed successful collection of sediment cores on the western half of the dredging project, shallow water depths and obstructions beneath the sediment surface led to difficulties collecting satisfactory samples from the eastern half of the dredging project. Specifically, two 10' cores were attempted at Station RS-01 in the east dredge area (i.e., east of the north/south floating dock). Due to the presence of a layer or mat of organic debris (leaves, twigs, etc.) in the deposited material both attempts resulted in refusals at approximately 3' penetration, with less than 2' of material recovered from each attempt. The mat of organic material most probably spread the vibratory action of the vibracorer over a larger surface area than normal, effectively stopping penetration. The relatively light weight of the vibracorer used could not overcome the effects of the organic layer to punch through to a greater depth. Penetration may also have been somewhat affected by the strong current from the diverted flow from the mouth of the Cedar River. Upon consultation with the DMMP agencies, Parametrix was directed to mobilize for a second field sampling event.

Summary from November 27, 2006 Sampling Event: The second sampling event was conducted on 11/27/06 with plans to collect two core samples from the east dredge area (Stations RS-04 and RS-05) in order to account for the increased dredge volume. Based on the anticipated water depths and the debris issues at these stations, a boat and sampling equipment from Marine Sampling Systems were selected for this work. The system selected had the capability to use 8' core tubes, with a maximum possible penetration depth of 7'. An additional weight of 120 pounds was added to the vibracorer head to facilitate penetration through organic matter mats or layers. It was anticipated that the maximum core lengths possible, assuming good retention, would be in the range of 5-7'.

Station RS-05 was attempted first. The boat approached the Station from the north and was able to sample within approximately 10' of the specified location (lat/long position recorded). The water depth at this station was ~4-5'. Full core penetration (7') was achieved, with approximately 70% recovery (recovered core length slightly less than 5'). Sediment appeared to be fine gray sand/silt, with some organic material. The core nose did not contain a "plug" of compressed sediment, indicating that some loss may have occurred during retrieval of the core. The recovered core was judged to be acceptable.

Station RS-04 was attempted next. Again the boat approached the Station from the north, but was not able to get within 10' of the specified location due to the shallow water depth. The field crew selected an alternative station (lat/long position recorded), situated as close as possible to the specified location and within the North Boundary line indicated on the sample location figure (attached). Water depth at this location was ~1-2'. Full core penetration (7') was achieved, though several short periods of "hesitation" were noted. These hesitations most probably indicated the presence of debris in the core path. The core retrieved had approximately 50% recovery (recovered core length slightly less than 4'). Sediment appeared to be fine gray sand/silt, with some organic material. The appearance of the core nose indicated that debris was encountered (possibly gravel) and it did not contain a "plug" of compressed sediment, indicating some loss may have occurred during retrieval of the core. The recovered core was judged to be acceptable; however, it was decided to attempt a second core at this location for potentially better recovery.

The second attempt at this station was similar to the first. The boat maneuvered back to the previous location, within 6-8' (lat/long position recorded). Water depth at this location was ~1-2'. Full core penetration (7') was achieved, though several "hesitations", probably due to debris, were again noted. The core retrieved had approximately 50% recovery, though slightly shorter sediment core length (approximately 3.5') than the first attempt. Sediment appeared to be fine gray sand/silt, with some organic material. The appearance of the core nose indicated that debris was encountered (possibly gravel) and it did not contain a "plug" of compressed sediment, indicating that some loss may have occurred during retrieval of the core. The recovered core was judged to be acceptable.

Based on discussions among Bill Jaworski (Marine Sampling Systems), the Parametrix field crew leader on the boat and the senior Parametrix field crew leader, it was decided that recoveries better than achieved were not likely under the existing conditions.

Conclusions: All sediment cores collected during the November 27 field event recovered roughly 3.5-5 ft of material. Given that full core penetration was achieved (7'), we believe based upon best professional judgment that the sediment cores retained materials collected from sediment depths greater than 5'. While some loss of material from the core nose may have occurred, the differences between penetration and recovery are felt to be primarily the result of compression and/or compaction of the loose depositional materials during the coring process. Given that the Cedar River sediment bedload is the primary source of material deposition within the project area, and that site use has not changed significantly in recent history, it is our belief that the samples collected adequately represents the full dredge prism.

Table 4. Chemical results compared to DMMP regulatory guidelines.

CHEMICAL	SL	BT	ML	WEST DMMU		EAST DMMU	
METALS (mg/kg dry)				conc	QL	conc	QL
Antimony	150	---	200	8	u	6	u
Arsenic	57	507	700	8	u	6	u
Cadmium	5.1	11.3	14	0.3	u	0.2	u
Chromium	---	267	---	27.8		21.4	
Copper	390	1,027	1,300	27.1		19.7	
Lead	450	975	1,200	8		2	u
Mercury	0.41	1.5	2.3	0.07	u	0.05	u
Nickel	140	370	370	29		24	
Selenium	---	3.0	---	0.3	u	0.2	u
Silver	6.1	6.1	8.4	0.5	u	0.4	u
Zinc	410	2,783	3,800	60.9		48.1	
LPAH (ug/kg dry)							
2-Methylnaphthalene	670	---	1,900	20	u	20	u
Acenaphthene	500	---	2,000	20	u	20	u
Acenaphthylene	560	---	1,300	20	u	20	u
Anthracene	960	---	13,000	20	u	20	u
Fluorene	540	---	3,600	20	u	20	u
Naphthalene	2,100	---	2,400	20	u	20	u
Phenanthrene	1,500	---	21,000	55		17	j
Total LPAH	5,200	---	29,000	55		17	j
HPAH (ug/kg dry)							
Benzo(a)anthracene	1,300	---	5,100	36		11	j
Benzo(a)pyrene	1,600	---	3,600	40		11	j
Benzo(g,h,i)perylene	670	---	3,200	24		20	u
Benzofluoranthenes	3,200	---	9,900	91		20	u
Chrysene	1,400	---	21,000	56		11	j
Dibenzo(a,h)anthracene	230	---	1,900	20	u	20	u
Fluoranthene	1,700	4,600	30,000	110		29	
Indeno(1,2,3-c,d)pyrene	600	---	4,400	21		20	u
Pyrene	2,600	11,980	16,000	80		30	
Total HPAH	12,000	---	69,000	458		92	
CHLORINATED HYDROCARBONS (ug/kg dry)							
1,2,4-Trichlorobenzene	31	---	64	20	u	20	u
1,2-Dichlorobenzene	35	---	110	20	u	20	u
1,3-Dichlorobenzene	170	---	---	20	u	20	u
1,4-Dichlorobenzene	110	---	120	20	u	20	u
Hexachlorobenzene	22	168	230	20	u	20	u
PHTHALATES (ug/kg dry)							
Bis(2-ethylhexyl)phthalate	1,300	---	8,300	200	b	20	u
Butyl benzyl phthalate	63	---	970	20	u	20	u
Di-n-butyl phthalate	1,400	---	5,100	20	u	20	u
Di-n-octyl phthalate	6,200	---	6,200	20	u	20	u
Diethyl phthalate	200	---	1,200	20	u	20	u
Dimethyl phthalate	71	---	1,400	20	u	20	u

CHEMICAL	SL	BT	ML	WEST DMMU		EAST DMMU	
PHENOLS (ug/kg dry)							
2 Methylphenol	63	---	77	20	u	20	u
2,4-Dimethylphenol	29	---	210	20	u	20	u
4 Methylphenol	670	---	3,600	39		20	u
Pentachlorophenol	400	504	690	99	u	97	u
Phenol	420	---	1,200	20	u	20	u
MISCELLANEOUS EXTRACTABLES (ug/kg dry)							
Benzoic acid	650	---	760	200	u	200	u
Benzyl alcohol	57	---	870	20	u	20	u
Dibenzofuran	540	---	1,700	20	u	20	u
Hexachlorobutadiene	29	---	270	20	u	20	u
Hexachloroethane	1,400	---	14,000	20	u	20	u
N-Nitrosodiphenylamine	28	---	130	20	u	20	u
VOLATILE ORGANICS (ug/kg dry)							
Ethylbenzene	10	---	50	1.3	u	1.2	u
Tetrachloroethene	57	---	210	1.3	u	1.2	u
Total Xylene	40	---	160	2.5	u	2.3	u
Trichloroethene	160	---	1,600	1.3	u	1.2	u
PESTICIDES AND PCBs (ug/kg dry)							
Aldrin	10	---	---	0.98	u	0.97	u
Chlordane	10	37	---	0.98	u	0.97	u
Dieldrin	10	---	---	2	u	1.9	u
Heptachlor	10	---	---	6.4	y	10	y
Lindane	10	---	---	0.98	u	0.97	u
Total DDT	6.9	50	69	2	u	1.9	u
Total PCBs	130	---	3,100	29	y	16	u
Total PCBs (mg/kg OC)	---	38	---	1.8	y	0.8	u

b = analyte detected in an associated method blank
j = estimated concentration
u = undetected
y = reporting limit raised due to interference; compound is not detected at or above this level
QL = laboratory qualifier
OC = organic carbon
SL = screening level
BT = bioaccumulation trigger
ML = maximum level

Table 5. Chemical results compared to SMS regulatory guidelines.

CHEMICAL	SQS	CSL	WEST DMMU		EAST DMMU	
METALS (mg/kg dry)			conc	QL	conc	QL
Arsenic	57	93	8	u	6	u
Cadmium	5.1	6.7	0.3	u	0.2	u
Chromium	260	270	27.8		21.4	
Copper	390	390	27.1		19.7	
Lead	450	530	8		2	u
Mercury	0.41	0.59	0.07	u	0.05	u
Silver	6.1	6.1	0.5	u	0.4	u
Zinc	410	960	60.9		48.1	
LPAH (mg/kg OC)						
2-Methylnaphthalene	38	64	1.2	u	0.97	u
Acenaphthene	16	57	1.2	u	0.97	u
Acenaphthylene	66	66	1.2	u	0.97	u
Anthracene	220	1200	1.2	u	0.97	u
Fluorene	23	79	1.2	u	0.97	u
Naphthalene	99	170	1.2	u	0.97	u
Phenanthrene	100	480	3.31		0.83	j
Total LPAH	370	780	3.31		0.83	j
HPAH (mg/kg OC)						
Benzo(a)anthracene	110	270	2.17		0.53	j
Benzo(a)pyrene	99	210	2.41		0.53	j
Benzo(g,h,i)perylene	34	88	1.45		0.97	u
Benzofluoranthenes	230	450	5.48		0.97	u
Chrysene	110	460	3.37		0.53	j
Dibenzo(a,h)anthracene	12	33	1.2	u	0.97	u
Fluoranthene	160	1200	6.63		1.41	
Indeno(1,2,3-c,d)pyrene	34	88	1.27		0.97	u
Pyrene	1000	1400	4.82		1.46	
Total HPAH	960	5300	27.59		4.47	
CHLORINATED HYDROCARBONS (mg/kg OC)						
1,2,4-Trichlorobenzene	0.81	1.8	1.2	u	0.97	u
1,2-Dichlorobenzene	2.3	2.3	1.2	u	0.97	u
1,4-Dichlorobenzene	3.1	9	1.2	u	0.97	u
Hexachlorobenzene	0.38	2.3	1.2	u	0.97	u
PHTHALATES (mg/kg OC)						
Bis(2-ethylhexyl)phthalate	47	78	12.05	b	0.97	u
Butyl benzyl phthalate	4.9	64	1.2	u	0.97	u
Di-n-butyl phthalate	220	1700	1.2	u	0.97	u
Di-n-octyl phthalate	58	4500	1.2	u	0.97	u
Diethyl phthalate	61	110	1.2	u	0.97	u
Dimethyl phthalate	53	53	1.2	u	0.97	u

CHEMICAL	SQS	CSL	WEST DMMU		EAST DMMU	
PHENOLS (ug/kg dry)						
2 Methylphenol	63	63	20	u	20	u
2,4-Dimethylphenol	29	29	20	u	20	u
4 Methylphenol	670	670	39		20	u
Pentachlorophenol	360	690	99	u	97	u
Phenol	420	1200	20	u	20	u
MISCELLANEOUS EXTRACTABLES (ug/kg dry)						
Benzoic acid	650	650	200	u	200	u
Benzyl alcohol	57	73	20	u	20	u
MISCELLANEOUS EXTRACTABLES (mg/kg OC)						
Dibenzofuran	15	58	1.2	u	0.97	u
Hexachlorobutadiene	3.9	6.2	1.2	u	0.97	u
N-Nitrosodiphenylamine	11	11	1.2	u	0.97	u
PCBs (mg/kg OC)						
Total PCBs (mg/kg carbon)	12	65	1.8	y	0.78	u

b = analyte detected in an associated method blank
j = estimated concentration
u = undetected
y = reporting limit raised due to interference; compound is not detected at or above this level
QL = laboratory qualifier
OC = organic carbon
SMS = Sediment Management Standards
SQS = sediment quality standard
CSL = cleanup screening level

Table 6. Chemical results compared to SEF freshwater guidelines.

CHEMICAL	Interim Freshwater SQG SL1	SL2	WEST DMMU conc	QL	EAST DMMU conc	QL
METALS (mg/kg dry)						
Arsenic	20	51	8	u	6	u
Cadmium	1.1	1.5	0.3	u	0.2	u
Chromium	95	100	27.8		21.4	
Copper	80	830	27.1		19.7	
Lead	340	430	8		2	u
Mercury	0.28	0.75	0.07	u	0.05	u
Nickel	60	70	29		24	
Silver	2.0	2.5	0.5	u	0.4	u
Zinc	130	400	60.9		48.1	
LPAH (ug/kg dry)						
2-Methylnaphthalene	470	560	20	u	20	u
Acenaphthene	1,100	1,300	20	u	20	u
Acenaphthylene	470	640	20	u	20	u
Anthracene	1,200	1,600	20	u	20	u
Fluorene	1,000	3,000	20	u	20	u
Naphthalene	500	1,300	20	u	20	u
Phenanthrene	6,100	7,600	55		17	j
Total LPAH	6,600	9,200	55		17	j
HPAH (ug/kg dry)						
Benzo(a)anthracene	4,300	5,800	36		11	j
Benzo(a)pyrene	3,300	4,800	40		11	j
Benzo(g,h,i)perylene	4,000	5,200	24		20	u
Benzofluoranthenes	600	4,000	91		20	u
Chrysene	5,900	6,400	56		11	j
Dibenzo(a,h)anthracene	800	840	20	u	20	u
Fluoranthene	11,000	15,000	110		29	
Indeno(1,2,3-c,d)pyrene	4,100	5,300	21		20	u
Pyrene	8,800	16,000	80		30	
Total HPAH	31,000	55,000	458		92	
PHTHALATES (ug/kg dry)						
Bis(2-ethylhexyl)phthalate	220	320	200	b	20	u
Butyl benzyl phthalate	260	370	20	u	20	u
Di-n-octyl phthalate	26	45	20	u	20	u
Dimethyl phthalate	46	440	20	u	20	u
MISCELLANEOUS EXTRACTABLES (ug/kg dry)						
Dibenzofuran	400	440	20	u	20	u
PCBs (ug/kg dry)						
Total PCBs	60	120	29	y	16	u

b = analyte detected in an associated method blank
j = estimated concentration
u = undetected
y = reporting limit raised due to interference; compound is not detected at or above this level
QL = laboratory qualifier
SL1 = screening level 1
SL2 = screening level 2
SEF = Sediment Evaluation Framework
SQG = Sediment Quality Guidelines

Table 7. Chemical results compared to MTCA regulatory guidelines.

CHEMICAL	Method A[1]	Method B[2]	WEST DMMU		EAST DMMU	
METALS (mg/kg dry)			conc	QL	conc	QL
Arsenic, inorganic	20	0.67	8	u	6	u
Cadmium	2	---	0.3	u	0.2	u
Chromium (total)	---	---	27.8		21.4	
Chromium VI	19	---	---		---	
Copper	---	---	27.1		19.7	
Lead	250	---	8		2	u
Mercury	2	---	0.07	u	0.05	u
Silver	---	---	0.5	u	0.4	u
Zinc	---	---	60.9		48.1	
LPAH (ug/kg dry)						
Acenaphthene	---	---	20	u	20	u
Anthracene	---	---	20	u	20	u
Fluorene	---	---	20	u	20	u
Naphthalene	5,000	---	20	u	20	u
HPAH (ug/kg dry)						
Benzo(a)anthracene	---	140	36		11	j
Benzo(a)pyrene	100	140	40		11	j
Benzo(b,k)fluoranthenes	---	---	91		20	u
Benzo(b)fluoranthene	---	140	---		---	
Benzo(k)fluoranthenes	---	140	---		---	
Chrysene	---	140	56		11	j
Dibenzo(a,h)anthracene	---	140	20	u	20	u
Fluoranthene	---	---	110		29	
Indeno(1,2,3-c,d)pyrene	---	140	21		20	u
Pyrene	---	---	80		30	
CHLORINATED HYDROCARBONS (ug/kg dry)						
1,2,4-Trichlorobenzene	---	---	20	u	20	u
1,2-Dichlorobenzene	---	---	20	u	20	u
1,4-Dichlorobenzene	---	42,000	20	u	20	u
Hexachlorobenzene	---	630	20	u	20	u
PHTHALATES (ug/kg dry)						
Bis(2-ethylhexyl)phthalate	---	71,000	200	b	20	u
Butyl benzyl phthalate	---	---	20	u	20	u
Di-n-butyl phthalate	---	---	20	u	20	u
Di-n-octyl phthalate	---	---	20	u	20	u
Diethyl phthalate	---	---	20	u	20	u
Dimethyl phthalate	---	---	20	u	20	u

CHEMICAL	Method A[1]	Method B[2]	WEST DMMU		EAST DMMU	
PHENOLS (ug/kg dry)						
2,4-Dimethylphenol	---	---	20	u	20	u
Pentachlorophenol	---	8,300	99	u	97	u
Phenol	---	---	20	u	20	u
MISCELLANEOUS EXTRACTABLES (ug/kg dry)						
Benzoic acid	---	---	200	u	200	u
Benzyl alcohol	---	---	20	u	20	u
Dibenzofuran	---	---	20	u	20	u
Hexachlorobutadiene	---	13,000	20	u	20	u
N-Nitrosodiphenylamine	---	200,000	20	u	20	u
VOLATILE ORGANICS (ug/kg dry)						
Ethylbenzene	6,000	---	1.3	u	1.2	u
Tetrachloroethene	50	1,900	1.3	u	1.2	u
Total Xylene	9,000	---	2.5	u	2.3	u
Trichloroethene	30	2,500	1.3	u	1.2	u
PESTICIDES AND PCBs (ug/kg dry)						
Aldrin	---	59	0.98	u	0.97	u
Chlordane	---	2,900	0.98	u	0.97	u
Dieldrin	---	63	2	u	1.9	u
Heptachlor	---	220	6.4	y	10	y
Heptachlor epoxide	---	110	---		---	
Lindane	10	770	0.98	u	0.97	u
Total DDT	---	---	2	u	1.9	u
DDT	3,000	2,900	---		---	
DDE	---	2,900	---		---	
Total PCBs	1,000	500	29	y	16	u

[1]Soil, Method A, Unrestricted Land Use, Table Value

[2]Soil, Method B, Carcinogen, Standard Formula Value, Direct Contact (ingestion only), unrestricted land use

b = analyte detected in an associated method blank

j = estimated concentration

u = undetected

y = reporting limit raised due to interference; compound is not detected at or above this level

QL = laboratory qualifier