

December 2001

Skipanon Entrance Channel and Boat Basin Sediment Quality Evaluation

ABSTRACT

This evaluation was conducted following procedures set forth in the Inland Testing Manual and the Ocean Disposal Testing Manual (Green Book), developed jointly by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency to assess dredged material. Guidelines used are those developed to implement the Clean Water Act and the Marine Protection, Research and Sanctuary Act. These guidelines and associated screening levels are those adopted for use in the Dredge Material Evaluation Framework for the Lower Columbia River Management Area, November 1998.

A total of seven (7) sediment samples were collected from the Skipanon Federal channel and boat basin entrance channel on September 12, 2001. All samples were submitted for physical analyses including total volatile solids and also were analyzed for metals (9 inorganic), total organic carbon, pesticides and polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbons and organotin. One (1) sample was analyzed for dioxin/furan.

The level for silver in sample SKIP-GC-06 was initially found to be above the SL; this result was suspected to be a lab error. To verify the results, the lab reanalyzed this sample in duplicate; these showed good correlation, were below the SL for silver and therefore, did not verify the earlier hit for silver. In sample SKIP-GC-04, total DDT was found at 7.1 ug/kg, which exceeds the SL for this contaminant. The sediment represented by this sample needs to be further characterized under Tier III testing to determine its suitability for disposal. None of the other contaminants tested were found to be at or above their respective SLs in the remaining six (6) samples. Therefore, with the exception of SKIP-GC-04, the sediments represented by these samples are determined to be suitable for unconfined, in-water placement without further characterization.

INTRODUCTION

This report characterizes the sediment to be dredged at the Skipanon Federal channel and boat basin entrance channel for the purposes of dredging and disposal. The sampling and analysis objectives are stated in the Sampling and Analysis Plan (SAP September 2001), and are also listed below. This report will outline the procedures used to accomplish these objectives.

Sampling and Analysis Objectives

- Characterize sediments in accordance with the regional dredge material testing manual, the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF; to be expanded to include all of Oregon).

- Collect, handle and analyze representative sediment of the proposed dredging prism, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- Characterize sediments to be dredged for evaluation of suitable disposal methods.
- Conduct physical and chemical characterization only for this sediment evaluation, unless DMEF screening levels are exceeded and further characterization (Tier III Biological Assays) is needed to determine disposal method.

PREVIOUS STUDIES

The U.S. Army Corps of Engineers (Corps), Portland District, routinely evaluates sediment from its projects on a 5-year rotation. Physical and chemical evaluation sampling was performed at the Skipanon Federal channel and boat basin entrance channel starting in 1981, 1986 (as part of the proposed Coal Channel) and continued in 1987, 1991 and 1996. The results of these studies revealed the sediment, especially in Federal channel areas, to be predominately silt or sandy silt with volatile solids >5% (with some exceptions). Contaminant levels have exceeded guidance levels for some chemicals of concern (CoCs). Some material from past dredging was not determined to be suitable for unconfined, in-water disposal.

In the August 1996 sampling event, 9 samples were collected using a gravity core-sampling device. All samples were submitted for physical and chemical analyses, including AVS, total organic carbon (TOC), 8 inorganic metals plus organotin, polynuclear aromatic hydrocarbons (PAHs), pesticides and polychlorinated biphenyls (PCBs), as well as bulk TBT. Due to previously high results, it was anticipated that DDT might exceed screening levels, but analysis showed low levels ≤ 1.0 ug/kg. None of the CoCs exceeded the current DMEF screening levels. This material was determined to be suitable for unconfined in-water placement.

CURRENT SAMPLING EVENT/DISCUSSION

A total of seven (7) sediment samples were collected from the Skipanon Federal channel and boat basin entrance channel on September 12, 2001 (see Figure 1 and Table 1). The samples were collected using a gravity core sampling device. All samples were submitted for physical analyses including total volatile solids (TVS) and were analyzed for metals (9 inorganic), total organic carbon (TOC), pesticides and polychlorinated biphenyls (PCBs), phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbons (PAHs) and organotin (TBT). One (1) sample was analyzed for dioxin/furan.

Table 1. Sample Location Coordinates

SKIP-GC-01	46° 10' 0.24"	SKIP-GC-05	46° 10' 11.46"
	123° 55' 10.98"		123° 54' 47.7"
SKIP-GC-02	46° 10' 4.14"	SKIP-GC-06	46° 10' 31.26"
	123° 55' 10.5"		123° 54' 36.54"
SKIP-GC-03	46° 10' 5.1"	SKIP-GC-07	46° 10' 52.08"
	123° 55' 4.32"		123° 54' 25.98"
SKIP-GC-04	46° 10' 5.7"		
	123° 54' 57.06"		

RESULTS

Physical and Volatile Solids (ASTM methods). Seven (7) samples were submitted for physical and TVS analyses and the data are presented in Table 1. All samples exceeded 20% fines and/or 5% volatile solids. Four samples were classified as “elastic silt,” two samples were classified as “silt,” and one sample was classified as “silt with sand.” Mean grain size for all the samples is 0.0465 mm, with no gravel, 9.06% sand and 90.94% fines. Volatile solids for all the samples ranged from 5.89% to 8.76%.

Metals (EPA method 6020/7471), Total Organic Carbon (EPA method 9060). Seven (7) samples were submitted for testing and the data are presented in Table 2. The TOC ranged from 16,000 to 28,000 mg/kg in the samples.

Low levels of most metals were found but did not approach the screening level (SL), except for silver. In one sample (SKIP-GC-06), the level for silver was found to exceed the SL. This result was suspected to be in error since the lab was having a problem with their silver analyses (the sediment evaluation reports that showed a lab problem with the silver analysis are listed on the reference page). To verify the results, the lab reanalyzed this sample in duplicate, and the levels of silver were found to be 0.88 mg/kg and 0.62 mg/kg (duplicate), which show good correlation and are below the SL.

Organotin (TBT; pore water method). Seven (7) samples were tested and the data are presented in Table 3. Organotin was not detected at the method detection limit (MDL) in the samples.

Pesticides/PCBs (EPA method 8081A/8082), Phenols, Phthalates and Miscellaneous Extractables (EPA method 8270). Seven (7) samples were tested for pesticides/PCBs and the data are presented in Table 4. No PCBs were found at the MDL in any of the samples. In one sample (SKIP-GC-04), total DDT was found at 7.1 ug/kg and exceeded the SL, and in another sample total DDT was found to be 95.6% of the SL.

One phenol and two phthalate compounds were detected in all samples, and the values were well below their respective SLs (<3.4%). 2,6-Dinitrotoluene also was found in all samples at low levels. No miscellaneous extractables were found at the MDL in any of the samples.

Polynuclear Aromatic Hydrocarbons (EPA method 8270C). Seven (7) samples were tested and the data are presented in Tables 5 and 6. Most “low molecular weight” PAHs were not detected at the MDL in the samples, except for phenanthrene, which ranged from 0.23% to 1.4% of the SL. Low levels of most “high molecular weight” PAHs were found in all samples and most values ranged below 2% of the SL. The highest values were for fluoranthene, which ranged from 0.41% to 4% of the SL and benzo(g,h,i)perylene, which ranged from 0.42% to 3.4% of the SL in the samples.

Dioxins/Furans (Method SW846 8290). One (1) sample was tested and the data are presented in Table 7. Dioxin (2,3,7,8-TCDD) and furan (2,3,7,8-TCDF) were not found at the MDL. The total toxic equivalent concentration value for the sample is 3.076 ng/kg, which is below the guidance concentration value of <15 ng/kg.

CONCLUSION

Collection and evaluation of the sediment data was completed using guidelines from the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF). The DMEF is a regional manual developed jointly with regional EPA, Corps, Oregon Department of Environmental Quality and Washington Departments of Ecology and Natural Resources. This document is a guideline for implementing the Clean Water Act (40 CFR 230), Section 404 (b)(1), and for the Marine Protection, Research and Sanctuary Act (MPRSA). The screening levels used are those adopted for use in the DMEF, final November 1998. The DMEF tiered testing approach requires that material in excess of 20% fines and greater than 5% volatile solids, as well as any material with prior history or is suspected (“reason to believe”) of being contaminated, be subjected to chemical as well as physical analyses.

A total of seven (7) sediment samples were collected from the Skipanon Federal channel and boat basin entrance channel on September 12, 2001. All samples were submitted for physical and chemical analyses. One (1) sample was analyzed for dioxin/furan.

The level for silver in sample SKIP-GC-06 was initially found to be above the SL; this result was suspected to be a lab error. To verify the results, the lab reanalyzed this sample in duplicate; these showed good correlation, were below the SL for silver and therefore, did not verify the earlier hit for silver.

In sample SKIP-GC-04, total DDT was found at 7.1 ug/kg, which exceeds the SL for this contaminant. The sediment represented by this sample needs to be further characterized under Tier III testing to determine its suitability for disposal. None of the other

contaminants tested were found to be at or above their respective SLs in the remaining six (6) samples. Therefore, with the exception of SKIP-GC-04, the sediments represented by these samples are determined to be suitable for unconfined, in-water placement without further characterization.

REFERENCES

1. U.S. Army Corps of Engineers, Portland District and Seattle District; U.S. Environmental Protection Agency, Region 10; Oregon Department of Environmental Quality; Washington State Department of Natural Resources and Department of Ecology. 1998 Final. Dredge Material Evaluation Framework for the Lower Columbia River Management Area.
2. U.S. Environmental Protection Agency and U.S. Army Corps of Engineers. February 1998. Evaluation of Dredged Material Proposed for Discharge in Inland and Near Coastal Waters - Testing Manual (referred to as the "Inland Testing Manual").
3. Clean Water Act, 40 CFR 230 (b)(1).
4. U.S. Army Corps of Engineers. September 2001. Sediment Sampling and Analysis Plan, Skipanon Channel and Boat Basin. Portland District.
5. U.S. Army Corps of Engineers. November 1996. Skipanon Channel Sediment Evaluation. Portland District.
6. U.S. Army Corps of Engineers. 1991. Skipanon River Sediment Evaluation. Portland District.

The following reports, prepared by the U.S. Army Corps of Engineers, Portland District, December 2001, also showed a lab problem with the silver analysis:

Coquille River and Boat Basin, Sediment Quality Evaluation
Chetco River and Boat Basin, Sediment Quality Evaluation
Oregon Slough Entrance Channel, Sediment Quality Evaluation
Columbia River Channel Deepening (CRCD), Station #76 (CR-BC-76),
Sediment Quality Evaluation

Table 1. Skipanon Channel and Boat Basin

Sampled September 12, 2001

Physical Analysis & Volatile Solids

Sample I.D.	Grain Size (mm)		Percent			
	Median	Mean	Gravel	Sand	Silt/Clay	Volatile Solids
SKIP-GC-01	0.016	0.0846	0.00	7.71	92.29	8.76
SKIP-GC-02	0.017	0.0473	0.00	3.00	97.00	8.30
SKIP-GC-03	0.014	0.0413	0.00	10.29	89.71	8.12
SKIP-GC-04	0.028	0.0438	0.00	11.95	88.05	7.36
SKIP-GC-05	0.016	0.0372	0.00	6.24	93.76	7.76
SKIP-GC-06	0.022	0.0327	0.00	7.98	92.02	5.89
SKIP-GC-07	0.020	0.0383	0.00	16.27	83.73	6.03
Mean	0.019	0.0465	0.00	9.06	90.94	7.46
Minimum	0.014	0.0327		3.00	83.73	5.89
Maximum	0.028	0.0846		16.27	97.00	8.76

Table 2. Skipanon Channel and Boat Basin

Sampled September 12, 2001

Inorganic Metals and TOC

Sample I.D.	As	Sb	Cd	Cu	Pb	Hg	Ni	Ag	Zn	TOC
	mg/kg (ppm)									
SKIP-GC-01	10.0	1.0 J, B1	2.1	60	25	0.15	20	1.6	160	28000
SKIP-GC-02	10.0	3.6 J, B2	2.4	59	22	0.13	22	0.74 J	170	26000
SKIP-GC-03	11.0	2.8 J, B2	2.2	76	21	0.13	21	0.53 J	180	27000
SKIP-GC-04	11.0	2.2 J, B2	3.3	58	26	0.16	21	0.65 J	200	19000
SKIP-GC-05	9.6	1.7 J, B1	3.2	55	26	0.11	25	0.53 J	190	22000
SKIP-GC-06	6.9	1.3 J, B1	2.0	41	17	0.097	18	6.9*	130	17000
SKIP-GC-07	6.6	0.75 J, B1	1.4	32	13	0.12	17	0.38 J	110	16000
Screening level (SL)	57	150	5.1	390	450	0.41	140	6.1	410	

* Silver (Ag) for SKIP-CG-06 was reanalyzed on 10/4/01; the result = 0.88 mg/kg (duplicate = 0.62 mg/kg).

J = Estimated value (reported values are above the MDL, but below the PQL).

B1 = Low-level contamination was present in the method blank (reported level was < 10 times blank concentration).

B2 = Low-level contamination was present in the method blank (reported level was > 10 times blank concentration).

Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).

Table 3. Skipanon Channel and Boat Basin

Sampled September 12, 2001

Organotin
Interstitial (Pore) Water

Sample I.D.	Tetrabutyltin	Tributyltin	Dibutyltin	Monobutyltin	Total TBT
	ug/L (ppb)				
SKIP-GC-01	<0.0029	<0.0041	<0.0029	<0.0028	ND
SKIP-GC-02	<0.003	<0.0042	<0.003	<0.0028	ND
SKIP-GC-03	<0.0034	<0.0047	<0.0034	<0.0032	ND
SKIP-GC-04	<0.0027	<0.0039	<0.0027	<0.0026	ND
SKIP-GC-05	<0.0035	<0.005	<0.0035	<0.0034	ND
Screening level (SL)	+	+	+	+	0.15
TBT = Total organotin (interstitial water). Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).					

Table 4. Skipanon Channel and Boat Basin

Sampled September 12, 2001

Pesticides, PCBs*, Phenols, Phthalates and Extractables

Sample I.D.	Pesticides				Phenols	Phthalates		Extractables	Other	
	ug/kg (ppb)									
	4,4'-DDD	4,4'-DDE	4,4'-DDT	Total DDT	3-& 4-Methylphenol	bis(2-Ethylhexyl)phthalate	Butylbenzylphthalate	Benzoic Acid	Dibenzo-furan	2,6-Dinitro-toluene
SKIP-GC-01	<0.53	3.4 J, C2	<0.71	3.4	9.3 J	45 J B1	33 J	<12	<4.1	13 J
SKIP-GC-02	1.8 J, C2	3.9 J, C2	<0.65	5.7	13 J	55 J B1	27 J	<12	<4.1	21 J
SKIP-GC-03	2.4 J, C1	<0.53	<0.6	2.4	17 J	61 J B1	16 J	<9	<3.1	14 J
SKIP-GC-04	4.8 C1	2.3 J, C1	<0.49	7.1	12 J	53 J B1	13 J	<8.6	<2.9	18 J
SKIP-GC-05	4.3 C1	2.3 J, C1	<0.5	6.6	16 J	53 J B1	10 J	<9.1	<3.1	19 J
SKIP-GC-06	<0.34	1.9 J, C1	<0.45	1.9	7.6 J	48 J B1	5.3 J	<8.1	<2.8	12 J
SKIP-GC-07	0.87 J, C1	1.0 J, C1	<0.44	1.87	12 J	52 J B1	10 J	<7.2	<2.5	12 J
Screen level (SL)	DDD + DDE + DDT = 6.9				670	8300	970	650	540	**

* **No PCBs** were found in any sample at the MDL (SL = 130 ppb).

** SL not established.

J = Estimated value (reported values are above the MDL, but below the PQL).

C1 = Second column confirmation was performed. The relative percent difference value (RPD) between the results on the two columns was evaluated and determined to be $\leq 40\%$.

C2 = Second column confirmation was performed. The RPD between the results on the two columns was evaluated and determined to be $> 40\%$. The higher result was reported unless anomalies were noted.

Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).

Table 5. Skipanon Channel and Boat Basin

Sampled September 12, 2001

Polynuclear Aromatic Hydrocarbons (PAHs)
Low Molecular Weight Analytes
ug/kg (ppb)

Sample I.D.	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	2-Methyl naphthalene	Naphthalene	Phenanthrene	Total Low PAHs
SKIP-GC-01	<1.8	<1.6	<0.9	<1.7	<0.56	<1.7	5.7	5.7
SKIP-GC-02	<1.7	<1.5	<0.88	<1.6	<0.55	<1.6	21.0	21.0
SKIP-GC-03	<1.3	3.4	<0.66	<1.2	<0.41	<1.2	8.4	11.8
SKIP-GC-04	<1.2	<1.1	<0.63	<1.2	<0.39	<1.2	3.5	3.5
SKIP-GC-05	<1.3	<1.2	<0.68	<1.3	<0.42	<1.3	5.1	5.1
SKIP-GC-06	<1.2	<1.0	<0.6	<1.1	<0.37	<1.1	3.6	3.6
SKIP-GC-07	<1.1	<0.93	<0.54	<1.0	<0.33	<1.0	6.2	6.2
Screen level (SL)	500	560	960	540	670	2100	1500	5200
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit)								

Table 6. Skipanon Channel and Boat Basin

Sampled September 12, 2001

Polynuclear Aromatic Hydrocarbons (PAHs)
High Molecular Weight Analytes
ug/kg (ppb)

Sample I.D.	Benzo(a)-anthracene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo-(g,h,i)-perylene	Chrysene	Pyrene	Benzo(a)-pyrene	Dibenz(a,h)-anthracene	Indeno-(1,2,3-cd)-pyrene	Fluoranthene	Total High PAHs
SKIP-GC-01	6.4 J	9.7	5.0	6.8	13.0	24.0	15.0	<0.83	<0.83	24.0	97.5
SKIP-GC-02	11	20	6	<0.58	27.0	48.0	20	<0.82	<0.82	68.0	200.0
SKIP-GC-03	12	17	3.2	23	18	29	26	<0.61	<0.61	30	158.2
SKIP-GC-04	6	7.6	<1.1	<0.42	14	8.6	9.6	<0.59	<0.59	7.8	53.6
SKIP-GC-05	7.5	13	<1.2	6.4	14	28	13	<0.63	5.1	30	117.0
SKIP-GC-06	4.5 J	4.8	3.6	3.8	6.9	9.6	7.4	<0.56	<0.56	7.2	47.8
SKIP-GC-07	3.2 J	5.1	2.6	2.8	5.8	6.6	4.3	<0.5	<0.5	7	37.4
Screen level (SL)	1300	b + k = 3200		670	1400	2600	1600	230	600	1700	12000
J = Estimated value (reported values are above the MDL, but below the PQL). Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).											

Table 7. Skipanon Channel and Boat Basin

Sampled September 12, 2001

Dioxins/Furans (ng/kg, ppt)

Sample I.D.	Dioxin/Furan	Result	½ MDL	TEF	TEQ	Guidance*
SKIP-GC-03 - Dioxin	2,3,7,8-TCDD	<0.32	0.16	1.0	0.16	A bulk sediment 2,3,7,8-tetrachlorodibenzo-p-dioxin concentration of 5 ng/kg, or a total toxic equivalent concentration of 15 ng/kg will trigger the requirement to perform bioaccumulation testing.
	Total TCDD	2.4		0	0	
	1,2,3,7,8-PeCDD	<0.59	0.295	0.5	0.15	
	Total PeCDD	<3.0	1.5	0	0	
	1,2,3,4,7,8-HxCDD	<0.55	0.275	0.1	0.03	
	1,2,3,6,7,8-HxCDD	<3.7	1.85	0.1	0.185	
	1,2,3,7,8,9-HxCDD	<2.1	1.05	0.1	0.105	
	Total HxCDD	20		0	0	
	1,2,3,4,6,7,8-HpCDD	59		0.01	0.59	
	Total HpCDD	160		0	0	
OCDD	950		0.001	0.95		
SKIP-GC-03 - Furan	2,3,7,8-TCDF	<0.70 CON	0.35	0.1	0.035	
	Total TCDF	13		0	0	
	1,2,3,7,8-PeCDF	<0.51	0.255	0.05	0.013	
	2,3,4,7,8-PeCDF	<0.87	0.435	0.05	0.022	
	Total PeCDF	23		0	0	
	1,2,3,4,7,8-HxCDF	<2.5	1.25	0.1	0.125	
	1,2,3,6,7,8-HxCDF	<1.5	0.75	0.1	0.075	
	2,3,4,6,7,8-HxCDF	<1.3	0.65	0.1	0.065	
	1,2,3,7,8,9-HxCDF	<0.32	0.16	0.1	0.016	
	Total HxCDF	40		0	0	
1,2,3,4,6,7,8-HpCDF	49		0.01	0.49		
1,2,3,4,7,8,9-HpCDF	<1.2	0.6	0.01	0.006		
Total HpCDF	100		0	0		
OCDF	59		0.001	0.059		
Total Dioxins/Furans TEQ					3.076	<15 ng/kg
CON = Confirmation analysis MDL = Method Detection Limit TEQ = Toxicity Equivalency Quotient TEF = Toxicity Equivalency Factors *Guidance = Puget Sound Dredged Disposal Analysis (PSDDA) Program (Feb 2000) and U.S. EPA Toxicity Equivalency Factors (U.S. EPA 1989; Ahlborg et al. 1994)						

Figure 1. Skipanon Channel Sampling Locations

