Columbia Slough Sediment Quality Investigation For the 1135 Study

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Columbia Slough 1135 Study

Introduction

The purpose of this report is to characterize the sediment of the Columbia Slough from river mile (RM) 5.5 to 8.5, based on the sampling event described. Frequent reference will be made to the project "Sampling and Analysis Plan (SAP) attached to this report and listed as a reference. The project description, site history and assessment are detailed in section 1 of the SAP. The sampling and analysis objectives listed below are those stated in the (SAP) (sec. 2.0). This report will outline the procedures used to accomplish these goals.

SAMPLING AND ANALYSIS OBJECTIVES

The sediment characterization program objectives and constraints are summarized below:

- To characterize sediments in accordance with the draft regional dredge material testing manual, the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River.
- Collect, handle and analyze representative sediment core samples of the purposed dredging prism in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- To characterize sediments to be dredged for evaluation of environmental impact.
- Only physical and chemical characterization will be conducted.

Ten gravity core samples and 5 surface grab samples were taken by the Corps of Engineers, Portland District personnel on March 31, 1998. They were submitted for physical and chemical analyses to Sound Analytical Services. Penetration of the corer ranged from 6.0' to 8.9', with core recoveries of 3.8' to 5.6'. The cores taken were classified as, medium to fine-grained sandy silt with layers of sand and organic matter. Each core was divided into two samples. The top portion, above the bottom 1-foot, was composited to represent the dredging prism and the bottom 1-foot was composited to represent the new surface material exposed after dredging. All samples were submitted for physical and chemical analyses, to include, 9 inorganic metals, total organic carbon (TOC), acid volatile sulfide (AVS), and pesticides/polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs).

Historical Data

Metals - Metals data submitted to the Corps of Engineers by the City of Portland, Bureau of Environmental Services (BES) referenced 46 sample identification numbers sampled on various dates and locations form river mile (RM) 5.5 to RM 8.5 of the Lower Columbia Slough. Of the 46 samples identified, 21 contained metals in excess of the 1998 adopted screening levels (SL). Zinc was detected above the SL in 10 of the samples. Mercury was detected above the SL in 12 of the samples. Lead was detected above the SL in 3 of the samples. Cadmium, copper and nickel were detected above the SL in 1 sample each. Copper was the only metal to exceed the maximum level (ML). (Exceeding the ML indicates that there is reason to believe that the material would likely fail the standard suite of biological tests and thus be unacceptable for unconfined aquatic disposal.)

Organics - Organics data submitted by (BES) to the Corps, for river mile (RM) 5.5 to RM 8.5 of the Lower Columbia Slough, referenced 21 sample identification numbers sampled on various dates. Of the 21 samples identified, 9 contained organics in excess of the adopted screening levels (SL). Pesticides were detected above the SL in 5 samples. Polynuclear aromatic hydrocarbons (PAHs) were detected above the SL in 10 samples, 3 of the 10 samples, also, exceeded the ML. Phenols were detected above the SL in 3 samples. Benzyl alcohol and benzoic acid were detected above SL in 1 sample each.

Current Sampling Event

Methods/ Results

Physical and Total Volatile Solids (TVS): Data for these analyses are presented in Table 1. All but one of the 25 samples submitted for Chemical analysis exceeded 20% fines. Four of the 25 samples exceeded 5% volatile solids. All but one of the core samples was classified as fine-grained sandy silt. The surface grab samples, taken near shore in the purposed site of bench construction, were classified as silty sand. Median grain size for the core samples is 0.072 mm, with an average of 27.5 % sand and 71.2 % fines. The median grain size for surface samples is 0.12 mm, with an average of 65.6 % sand and 33.7 % fines.

Metals, Total Organic Carbon (TOC), Acid Volatile Sulfide (AVS), and Glycol: Data for these analyses are presented in Table 2. Twenty-seven samples were run for these analyses, which includes 2 blind replicates for quality control (QC). The Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area screening level (SL) for mercury (Hg) was exceeded 16 times. The maximum screening level (ML) for Hg was exceeded 5 times. The maximum sample value for Hg was 4.9 mg/kg and mean value 1.18mg/kg. The SL for silver (Ag) was exceeded 2 times (maximum value 8.3 mg/kg, mean value 1.91mg/kg). The SL for zinc (Zn) was exceeded 6 times (maximum value 910 mg/kg, mean value 318mg/kg). Of the 5 samples analyzed for glycol, none was detected at the practical quantitation limit (PQL) reported by the laboratory.

Pesticide/PCBs: Data for these analyses are presented in Table 3. Twenty-five of the 27 analysis for total DDT exceeded the SL, of which, 10 exceeded the ML (maximum sample value 349 ug/kg, mean value 88.9 ug/kg). The pesticide Dieldrin exceeded the SL in 3 samples (maximum value 15 ug/kg, mean value 2.4 ug/kg). Total PCBs were exceeded in 14 of the 27 samples analyzed (maximum value 990 ug/kg, mean value 274 ug/kg).

Polynuclear Aromatic Hydrocarbons (PAHs): Data for PAHs are presented in Tables 4 & 5. Both low and high density PAHs were detected in all the samples. However, only sample CS-GC- 02B exceeded the current SL for PAHs (Phenanthrene - maximum value 1800 ug/kg, mean value 380 ug/kg) and 3 high PAHs - maximum values –Benzo (g,h,i)perylene 900 ug/kg, Fluoranthene 2800 ug/kg, Pyrene 2700 ug/kg, mean values 256 ug/kg, 619 ug/kg, 672 ug/kg, respectively). The total PAH's SL was not exceeded in any samples tested.

Discussion/Conclusion

There are 5 combined sewer outfalls (CSO), somewhat evenly separated, within the study area. Starting with sample CS-GC-01, taken upstream from the CSO near river mile (RM) 8.5, odd numbered core samples "GC designation" were taken upstream from a CSO and even numbered samples taken down stream from the CSO (see map Figure 1). All of the 10 core samples were taken at mid-channel, at least 100 meters from the CSOs. The surface grab samples were taken near the shore, one sample from with-in each of the five-purposed bench construction areas. While there was no clear pattern of contamination associated with the "upstream" or "downstream" proximity to the CSOs, the "downstream" samples did tended to show higher levels of contaminates than the "upstream" samples. There was a pattern, of contamination, between composite "A" (material representing the proposed dredging prism) or the area represented by composite "B" (material representing one foot below the dredging prism). Seven of 10 "A" samples were more contaminated than "B" samples for both total PCBs and Total DDT. The surface grab samples were consistently greater in mean grain size (0.1151 mm) and sand (65.6%), than the core samples (0.0719 mm) grain size and (27.5 %) sand, with generally lower total volatile solids (TVS). The larger physical grain size and lower TVS is consistent with a lower contaminate level in all methods analyzed for.

Due to the high level of many contaminants in the samples that represent the purposed dredging prism material, it would not be suitable for in-water disposal without further testing at the Tier III (DMEF) biological testing. The possibility of dredging and capping would be a consideration, if conditions of water quality and turbidity were addressed during dredging, placement and capping. Due to its fine grain size, it is unlikely that this material would be suitable for construction material in the purposed benches.

The surface samples show that a less contaminated, "cleaner", layer of sediment is present on top of "more contaminated" sediment. Consideration should be given to leaving this "cleaner" layer in place and avoid the reintroduction of contaminates by dredging. Placing clean fill on the less contaminated sediment layer would reduce the amount of contamination reintroduced into the water column during construction, than by placing the clean fill on the "more contaminated" material after it has been exposed by dredging.

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Table 1, Columbia Slough 1135 Study

Physical Analysis

Sample I.D.	median grain size mm		sand % <2.0 - 0.063mm	silt % <0.063 - 0.0034mm	clay % <0.0034mm	volitle solids %
CS-GC-01A	0.0553		37.56	57.57	4.64	4.49
CS-GC-01B	0.0453		23.10	66.46	10.34	5.00
CS-GC-02A	0.0755		28.69	60.00	10.40	9.48
CS-GC-02B	0.0610		16.20	68.88	14.19	11.09
CS-GC-03A	0.0496		11.74	82.10	5.81	0.06
CS-GC-03B	0.0464	0.0531*	5.91	77.19	16.65	6.61
CS-GC-04A	0.0814		32.11	53.89	12.96	12.79
CS-GC-04B	0.1123		47.14	48.35	7.47	7.54
CS-GC-05A	0.0527		21.10	59.02	19.77	8.08
CS-GC-05B	0.1512		18.25	63.01	15.57	7.85
CS-GC-06A	0.0511		29.53	55.91	14.32	7.10
CS-GC-06B	0.0801		38.27	49.93	10.63	8.28
CS-GC-07A	0.0513		13.50	78.67	7.69	8.26
CS-GC-07B	0.0493		21.26	61.99	16.43	5.75
CS-GC-08A	0.0634		18.52	67.73	13.41	9.38
CS-GC-08B	0.0964		51.99	27.79	19.68	19.75
CS-GC-09A	0.0655		27.34	63.64	8.80	12.93
CS-GC-09B	0.0747		43.69	41.66	13.99	8.86
CS-GC-10A	0.0658		26.40	63.58	9.48	7.56
CS-GC-10B	0.1092		37.61	27.91	15.85	15.90
Core Average	**0.0719**		**27.50**	**58.80**	**12.40**	**8.84**

CS-P-01	0.0626		56.05	43.70	0.00	4.84
CS-P-02	0.0649		62.76	36.96	0.00	5.39
CS-P-03	0.1465		88.85	10.97	0.00	2.33
CS-P-04	0.1430	0.1540*	50.94	44.31	2.53	5.96
CS-P-05	0.1586		69.39	28.94	0.92	5.21
Surface Average	**0.1151**		**65.60**	**33.00**	**0.69**	**4.75**

* Duplicate analysis run

Table 2, Columbia Slough 1135 Study **Metals, TOC, AVS and Glycol**

Metals, Total Organic Carbon (TOC), Acid Volatile Solids (AVS), Glycol												
Sample I.D.	**Metals**									**TOC**	**AVS**	**Glycol**
	As	**Cd**	**Cr**	**Cu**	**Pb**	**Hg**	**Ni**	**Ag**	**Zn**			
	ppm - mg/kg									ppm - mg/kg		
CS-GC-01A	3.2	3.2	33	29	88	**0.42**	19	0.4	170	18000	18	ND<18
CS-GC-01B	3.5	1.1	19	40	93	0.24	23	0.96	210	15000	51	-
CS-GC-02A	3.4	1.9	27	54	210	**0.66**	22	2.7	330	26000	44	ND<18
CS-GC-02B	4	4.6	23	100	260	**4.9**	21	6.8	**910**	48000	15	-
CS-GC-03A	4	1.4	54	47	110	**0.69**	36	0.7	260	24000	29	ND<18
CS-GC-03B	4.5	1.3	58	49	180	**0.68**	29	3.9	230	23000	42	-
CS-GC-04A	9	1.5	69	61	360	**1.3**	31	8.3	**410**	55000	74	-
CS-GC-04B	1.7	0.78	23	24	37	0.3	15	0.97	98	24000	4.8	-
CS-GC-05A	6	1.3	62	51	210	**2.7**	28	0.82	300	37000	78	-
CS-GC-05AA	5.8	1.1	49	43	150	**2.6**	25	1.2	240	32000	18	-
CS-GC-05B	7	2	26	45	91	**0.73**	22	1.3	380	31000	91	-
CS-GC-06A	5	1.2	63	38	110	**0.89**	20	0.8	230	26000	71	-
CS-GC-06B	6.3	1.6	21	38	88	0.23	19	0.92	290	20000	90	-
CS-GC-07A	8.4	1.9	66	65	200	**2.5**	33	4.6	**750**	46000	240	-
CS-GC-07B	5	1.3	37	43	96	**3.5**	20	2.3	310	25000	23	-
CS-GC-08A	8.7	1.9	72	69	290	**1.5**	34	1.4	**490**	52000	230	-
CS-GC-08AA	7.9	1.8	62	74	160	**0.9**	44	1.1	410	41000	11	-
CS-GC-08B	11	1.9	29	49	66	0.31	25	0.59	310	30000	150	-
CS-GC-09A	6.7	1.7	67	69	130	0.40	49	2.6	380	49000	9.2	-
CS-GC-09B	8.3	1.2	20	34	61	0.32	20	0.73	230	15000	56	-
CS-GC-10A	5.8	1.5	50	61	120	**0.58**	38	1.3	330	33000	15	-
CS-GC-10B	7.3	2	35	51	120	**1.4**	24	3.3	**410**	49000	150	-
CS-P-01	4.7	0.87	35	51	49	0.33	17	0.65	210	18000	3.4	ND<18
CS-P-02	3.6	0.85	32	33	50	0.15	17	0.51	190	20000	2.7	ND<18
CS-P-03	1.6	0.24	15	15	14	<0.1	10	<0.13	66	11000	<2	-
CS-P-04	4.5	0.7	32	38	45	<0.16	19	0.51	240	24000	4.1	-
CS-P-05	3.6	0.68	29	30	37	<0.18	20	0.32	200	28000	3.8	-
Mean	5.6	1.54	41	48	127	1.18	25	1.91	318	30370	58.6	
Maximum Level	8.7	4.60	6.9	100.0	360.0	4.9	49	8.3	910	55000	240	
Screening level (SL)	57	5.1	*	390	450	0.41	140	6.1	410			
Maximum (SL)	700	14	*	1300	1200	2.3	370	8.4	3800			

(-) = No analysis requested * EPA, Region 10 Screening level not established. (<) Indicates non-detect (ND) at value shown - method reporting limit (MRL).

Table 3, Columbia Slough 1135 Study

PCBs/Pesticides

Sample I.D.	Aroclor 1242	Aroclor 1254	Aroclor 1260	Total PCBs	Aldrin	alpha-BHC	beta-BHC	delta-BHC	gamma-BHC	4,4'-DDE	4,4'-DDD	4,4'-DDT	Total DDT	Dieldrin	Heptachlor	Heptachlor epoxide	Endosulfan sulfate	Methoxychlor
CS-GC-01A	<7	48	44	92	<.54	<.5	<.5	<.5	<.7	24	18	4.4	46.4	<.99	<.5	<.5	<.99	<5
CS-GC-01B	<7	31	22	53	<.54	<.5	2	<.5	<.7	55	15	2.4	72.4	<.99	<.5	<.5	<.99	<5
CS-GC-02A	<7	240	110	350	<.54	<.5	1.8	<.5	<.7	78.0	94	9.2	181.2	<.99	<.5	0.6	<.99	<5
CS-GC-02B	<7	64	43	107	<.54	<.5	<.5	3.6	<.7	2.5	<.99	10	12.5	<.99	<.5	0.84	1.4	<5
CS-GC-03A	<7	40	35	75	0.76	<.5	2	<.5	<.7	20	13	2.3	35.3	<.99	<.5	<.5	<.99	<5
CS-GC-03B	<7	91	120	211	<.54	<.5	1.9	<.5	<.7	29	15	7.5	51.5	<.99	<.5	<.5	<.99	<5
CS-GC-04A	<7	450	180	630	<.54	<.5	2.3	<.5	<.7	110	100	47	257	<.99	<.5	<.5	<.99	<5
CS-GC-04B	<7	<5	8.3	8.3	<.54	<.5	<.5	<.5	<.7	8.1	23	67	98.1	<.99	<.5	<.5	<.99	<5
CS-GC-05A	<7	280	140	420	9.1	<.5	2.9	<.5	<.7	140	29	8	177	11	<.5	<.5	<.99	<5
CS-GC-05AA	<7	640	350	990	<.54	<.5	<.5	<.5	<.7	290	48	11	349	15	<.5	<.5	<.99	<5
CS-GC-05B	<7	80	<5	80	1.3	<.5	1	0.79	<.7	69	4.8	3.3	77.1	1.5	<.5	<.5	<.99	<5
CS-GC-06A	<7	250	72	322	<.54	<.5	2.5	1.4	<.7	210	<.99	<.99	210	<.99	1.7	<.5	<.99	<5
CS-GC-06B	<7	21	<5	21	<.54	<.5	<.5	<.5	<.7	2	<.99	<.99	2	<.99	<.5	<.5	<.99	<5
CS-GC-07A	490	180	67	737	6.5	<.5	<.5	2.1	3.4	98	<.99	5.8	103.8	4.4	<.5	<.5	<.99	<5
CS-GC-07B	<7	82	30	112	1.2	<.5	<.5	1.1	<.7	63	7.5	4.6	75.1	<.99	<.5	<.5	<.99	<5
CS-GC-08A	590	160	180	930	4.6	<.5	<.5	<.5	2.1	200	<.99	8	208	15	7.2	<.5	<.99	<5
CS-GC-08AA	<7	59	90	149	2	<.5	2.5	<.5	<.7	18	7.2	<.99	25.2	<.99	<.5	<.5	<.99	6.7
CS-GC-08B	<7	94	35	129	<.54	<.5	<.5	<.5	<.7	7.3	7.3	2.8	17.4	2.5	<.5	2.3	<.99	<5
CS-GC-09A	200	160	94	454	<.54	<.5	2.9	<.5	<.7	64	17	8.5	89.5	5.8	2.4	7.2	1.9	9.2
CS-GC-09B	<7	36	23	59	<.54	<.5	<.5	<.5	<.7	23	3.4	2.3	28.7	<.99	<.5	<.5	4	<5
CS-GC-10A	180	110	95	385	<.54	<.5	2.3	<.5	<.7	26	10	3	39	3.7	2.4	1.9	<.99	9.1
CS-GC-10B	500	<5	240	740	<.54	<.5	<.5	<.5	<.7	130	17	11	158	<.99	<.5	12	<.99	<5
CS-P-01	<7	22	24	46	1	<.5	1.1	<.5	<.7	9.2	4.7	1.6	15.5	<.99	<.5	<.5	1.7	<5
CS-P-02	<7	28	22	50	<.54	0.65	4.3	1	<.7	8.4	3.3	4.2	15.9	<.99	<.5	<.5	2.2	<5
CS-P-03	<7	20	26	46	<.54	0.38	1.5	<.5	<.7	4.1	2.6	<.99	6.7	1.1	0.93	<.5	<.99	<5
CS-P-04	<7	31	42	73	1.7	0.76	2.1	<.5	<.7	11	9	<.99	20	2.3	3.1	<.5	1.4	9
CS-P-05	<7	40	93	133	1.7	<.5	1.6	<.5	<.7	13	14	1	28	3.5	<.5	<.5	1.8	6.7
Mean	73	121	81	274	1.1	0.07	1.3	0.4	0.2	63.4	17.1	8.3	88.9	2.4	2.70	0.92	0.5	1.5
Maximum	590	640	350	990	9.1	0.76	4.3	2.1	3.4	290	100	67	349	15	7.2	12	4	9.2
Screening Level (SL)		Total PCB =130			10		10				Total DDT = 6.9			10	10			
Maximum (SL)		Total PCB =3100			10		10				Total DDT = 69			10	10			

* Table shows only analytes where detection was noted in at least one sample.

(<) Indicates non-detect at value shown - method reporting limit (MRL).

Table 4, Columbia Slough 1135 Study

Low - Polynuclear Aromatic Hydrocarbons (PAHs)

Sample I.D.	Acenapththene	Acenaphthylene	Anthracene	Fluorene	2-Methylnapthalene	Naphthalene	Phenanthrene	Total Low PAHs
CS-GC-01A	9.2	17	32	26	2.7	17	180	283.9
CS-GC-01B	28	30	73	43	16	88	410	688
CS-GC-02A	56	54	120	85	25	180	820	1340
CS-GC-02B	150	180	290	190	23	320	**1800**	2953
CS-GC-03A	20	13	26	23	8	18	150	258
CS-GC-03B	17	17	38	23	6.9	31	160	292.9
CS-GC-04A	46	42	110	86	20	120	390	814
CS-GC-04B	2.7	10	15	6.5	4.7	23	61	122.9
CS-GC-05A	46	36	160	96	35	130	540	1043
CS-GC-05AA	37	40	200	84	30	99	570	1060
CS-GC-05B	34	48	130	56	17	99	480	864
CS-GC-06A	31	40	88	50	20	110	400	739
CS-GC-06B	10	26	33	19	7.6	60	190	345.6
CS-GC-07A	66	48	78	71	8	27	300	598
CS-GC-07B	29	37	60	44	15	94	330	609
CS-GC-08A	72	72	190	95	37	160	630	1256
CS-GC-08AA	37	42	91	53	19	84	290	616
CS-GC-08B	29	39	130	58	25	81	440	802
CS-GC-09A	49	43	90	57	20	110	330	699
CS-GC-09B	10	23	40	18	14	70	200	375
CS-GC-10A	46	44	94	43	21	110	290	648
CS-GC-10B	75	75	220	110	39	220	1000	1739
CS-P-01	5.1	9.8	19	11	4.4	13	80	142.3
CS-P-02	5	8.3	17	11	3.9	12	79	136.2
CS-P-03	5.3	2	3.8	3.9	<2.4	2.5	16	33.5
CS-P-04	6.3	8.4	17	8.8	4.5	15	62	122
CS-P-05	4	6.8	14	7.3	2.5	8.2	51	93.8
Mean	34	38	88	51	16	85	380	681
Maximum	150	180	290	190	39	320	1800	2953
Screening Level (SL)	500	560	960	540	670	2100	1500	5200
Maximum (SL)	2000	1300	13000	3600	1900	2400	21000	29000

Table 5, Columbia Slough 1135 Study

High -Polynuclear Aromatic Hydrocarbons (PAHs)

Sample I.D.	Benz(a)anthracene	Benzo(b)fluroanthene	Benzo(k)fluroanthene	Benzo(g,h,i)perylene	Benzo(a)pyrene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Pyrene	Total High PAHs
CS-GC-01A	95	150	63	140	140	160	<14	320	83	240	1391
CS-GC-01B	150	200	71	190	170	220	<13	670	120	670	2461
CS-GC-02A	300	420	120	390	390	460	39	1200	200	1300	4819
CS-GC-02B	600	890	440	**900**	940	890	<74	**2800**	500	**2700**	10660
CS-GC-03A	130	180	70	160	160	190	<8.9	310	93	350	1643
CS-GC-03B	160	180	71	180	210	240	<9	340	96	440	1917
CS-GC-04A	260	340	130	290	300	380	<21	900	160	920	3680
CS-GC-04B	48	65	24	60	57	53	<5.9	170	35	180	692
CS-GC-05A	190	200	67	190	200	190	<19	920	110	680	2747
CS-GC-05AA	190	240	62	230	230	350	<13	690	120	720	2832
CS-GC-05B	140	160	100	220	190	250	<15	660	130	670	2520
CS-GC-06A	150	190	62	180	160	210	<15	570	96	550	2168
CS-GC-06B	83	110	40	120	110	110	<6.4	380	71	340	1364
CS-GC-07A	240	290	62	340	340	460	<23	590	170	760	3252
CS-GC-07B	71	130	38	120	96	140	<14	400	79	380	1454
CS-GC-08A	510	460	220	550	520	740	<23	1200	280	1500	5980
CS-GC-08AA	280	410	130	350	330	480	66	600	190	730	3566
CS-GC-08B	160	150	41	140	140	230	<8.6	610	74	700	2245
CS-GC-09A	320	390	180	410	410	510	<20	700	220	870	4010
CS-GC-09B	72	80	34	96	87	110	<6.3	280	53	320	1132
CS-GC-10A	300	320	160	330	380	440	43	470	200	680	3323
CS-GC-10B	510	490	150	430	530	560	<33	1300	290	1600	5860
CS-P-01	93	210	56	160	<1.5	130	<1.5	170	130	220	1169
CS-P-02	83	340	200	300	330	130	<1.5	150	260	160	1953
CS-P-03	21	17	11	16	17	25	<1.2	37	12	47	203
CS-P-04	98	360	130	340	370	130	<1.8	160	200	220	2008
CS-P-05	73	130	49	76	110	130	<1.6	120	65	200	953
Mean	197	263	16	256	256	293	6	619	150	672	2815
Maximum	600	890	440	900	940	890	66	2800	500	2700	10660
Screening Level (SL)	1300	[3,200	]	670	1600	1400	230	1700	600	2600	12000
Maximum (SL)	5100	[9,900	]	3200	3600	21000	1900	30000	4400	16000	69000

(<) Indicates non-detect at value shown - method reporting limit (MRL).

Figure 1, Columbia Slough 1135

Sediment Sample Site Locations