Bonneville Second Powerhouse Forebay Sediment Evaluation

Abstract

In July 1997 seven sediment samples were collected from Bonneville Second Powerhouse forebay and water supply conduits. Two of the samples were taken from the downstream portion of the south Auxiliary Water Supply (AWS) conduit by divers inspecting the inside of the south AWS. Three additional samples were taken from the surface of the sediment deposits at the north end of the forebay. The final two samples were collected from the sediment and woody debris removed from the north AWS intake trash rack by clamshell and stockpiled on Cascade Island, at the south end of the Elevation 90 Deck crane way extension. Physical analysis, run on four sediments, indicated the material ranges from gavel to very fine sand, with largest fractions in the coarse to medium sand range. Chemical analysis, run on five sediments, included metals, pesticides/polychlorobiphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), total organic carbon (TOC), acid volatile sulfide (AVS), phenols and dioxin screen (P450). The portion of the sample submitted to the lab is representative of the material that was dredged, except for the woody debris. Since the wood is waterlogged and would not be a navigation hazard, covered under the Clean Water Act (CWA), it will be placed in-water with the sediment as requested by the National Marine Fisheries Service (NMFS).

Introduction

1. Bonneville Second Powerhouse is located at River Mile (RM) 145 on the north side of the Columbia River.

2. There has been no prior sampling at Bonneville Second Powerhouse. Informational sampling and analysis was done on sediment downstream from the First Powerhouse Navigational Lock, on the south side of the river, in 1991 (1), with results acceptable for unconfined in-water or upland disposal. This same downstream area was dredged in1986 and in the late 1970s.

3. This project was conducted for emergency debris removal and maintenance dredging of the Second Powerhouse forebay. The debris build up resulted from high water due to floods of 1996.

Methods

4. As previously mentioned, on July 24,1997 two sediment samples were taken by divers inside the AWS conduit located at the south end of the Second Powerhouse forebay (Figure 1). These samples, PH#1 and PH#2, were submitted for chemical analysis only, due to lack of volume for physical analyses. Three surface sediment samples, B2-GC-1 (lost due to rupturing of the plastic bag containing the sample), B2-

GC-2 and B2-GC-3 (Figure 1), were taken with a Benthos gravity corer at the north end of the forebay on July 28,1997. These samples were difficult to recover because of an unusually large percentage of shell fragments and woody debris, which would not allow the sampler's retainer to close and hold the sample properly. However, the portion of the samples sent to the laboratory did not contain large amounts of volatile solids (B2-GC-1 (lost), 2.77% for B2-GC-2 and 2.44 % for B2-GC-3). Two samples, taken July 28, 1997, B2-G-1 and B2-G-2 (Figure 1), were collected from the sediment removed from the north AWS intake trash rack by clamshell and stockpiled on Cascade Island (only chemical analysis were run on these samples). Samples were collected by removing the exposed outer surface and collecting only damp unexposed sediment. Physical samples were placed in zip-lock bags and shipped to Columbia Analytical Services (CAS), Kelso Washington, for dredge analysis (particle size, hydrometer, particle shape, void ratio, dry bulk density and volatile solids). Chemical samples were placed in, pre-cleaned, EPA approved, glass jars and chilled to 4° C ± 2°C. Samples were shipped, using EPA approved methods for shipping and handling, to Columbia Analytical Services (CAS) for analysis of metals, acid volatile sulfide (AVS), pesticides/ polychlorobiphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs) by SIM method, total organic carbon (TOC), phenols and dioxin screen (P-450). All sampling and analysis were performed according to EPA/USACE approved methods (4). Laboratory quality control (QC) standards were run by CAS laboratory during sample analysis.

Results/Discussion

5. The results of physical analysis are shown in Table 1. There was little variance between samples. The percent passing the No. 200 screen ranged from 4.7 % to 7.7 % with volatile solids from 1.6 % to 3.6 %. However, based on the difficulty of obtaining samples with the gravity corer, and the large volume of large woody debris in the sediments removed from the AWS trash rack, the samples collected are considered representative of only the sediment portion of the material to be dredged. Woody debris observed in the stockpiles of materials removed from the forebay prior to the sampling operation ranged from a few millimeters to more than 10 meters in length. The stockpiled materials were removed from the AWS intakes using both a 4 cubic meter trash rake that collects material by raking the intake screen (approximately 6-inch by 6-inch mesh) and a 1.5 cubic meter clamshell bucket that can reach up to 10 meters away from the powerhouse intakes. Neither of these devices is reported to get good recovery of the sediment fraction of the material taken from the forebay. The trash rake retrieved a 2 cubic meter bulk sample from which B2-G-1 and B2-G-2 were obtained. It was visually estimated to contain 5% woody debris, most of which was small bark fragments, but several pieces of wood roughly 1 meter long and 3cm diameter were also in the partially filled rake. Allowing for the 500ml sample size, which was found to contain around 2.7 % volatile solids, the 5% visual estimate of woody debris in the sediment probably represents the bulk percentage of wood to be expected in the total volume of material to be dredged.

6. The concentrations of metals and TOC are shown in Table 2. All concentrations are below established screening levels of concern (SLC) (3). Zinc was the metal with the highest concentration with a low of 97 ppm and a high of 114 ppm. The average level of zinc at 104 ppm is only 65 % of the SLC. Cadmium had the second highest concentration level with an average of .32 ppm, which is only 33 % of the SLC. All of the other metals were less than 15 % of the SLC.

7. The results of organic analysis are shown in Table 3 & Table 4. PCBs were not detected in any of the samples. Pesticides (4,4'-DDT and Lindane) were detected in three of the samples, but similar levels were also found in the method blank. The samples were re-extracted past recommended holding time with only one sample showing a concentration (4,4'-DDT = 3 ppb < half of the SLC) above the method detection limit. PAHs were less than 30% of the SLC. Phenols analyses were all less than the SLC, with 4 methylphenol detected at 100ppb (83% of the SLC) in sample B2-GC-1. The other phenols were less than 17% of the SLC, with most below the method detection limit. All concentrations of organics are below established concern levels (3).

8. The results of physical and chemical analyses of the sediment compare with the samples taken downstream of the Bonneville Navigational Lock in 1991. The material is similar to that of other Columbia River sediment studies (5). This and previous sediment quality evaluations in the area conclude that no unacceptable, adverse environmental impacts would be expected from its disposal. The disposal of this material meets the provisions of the Clean Water Act (CWA) for both unconfined in-water and upland disposal without further testing required.

References

1. Briton J. U.S. Army Corps of Engineers, Portland District. September 1991. Bonneville Navigation Lock Sediment Evaluation

2. U. S. Environmental Protection Agency and U. S. Army Corps of Engineers. February 1991. Evaluation of Dredge Material proposed for Ocean Disposal (Testing Manuel).

3. U. S. Army Corps of Engineers, Portland District. November 1991. Levels of Concern Tier II Analysis. (A list of chemicals and associated concern levels in bulk sediment, established as a temporary guideline useful in evaluating toxicity of sediment. These levels of concern are subject to change as new information warrants.)

4. U. S. Environmental Protection Agency. Guidelines for /specification of Disposal Sites for Dredging or Fill Material. Code of Federal Regulations, 40 CFR 190.01, 1985.

5. U. S. Army Corps of Engineers, Portland District. October 1991. Columbia River Pool Lowering (MOP).

Figure 1
Bonneville Powerhouse #2 Sediment Sampling, July 1997

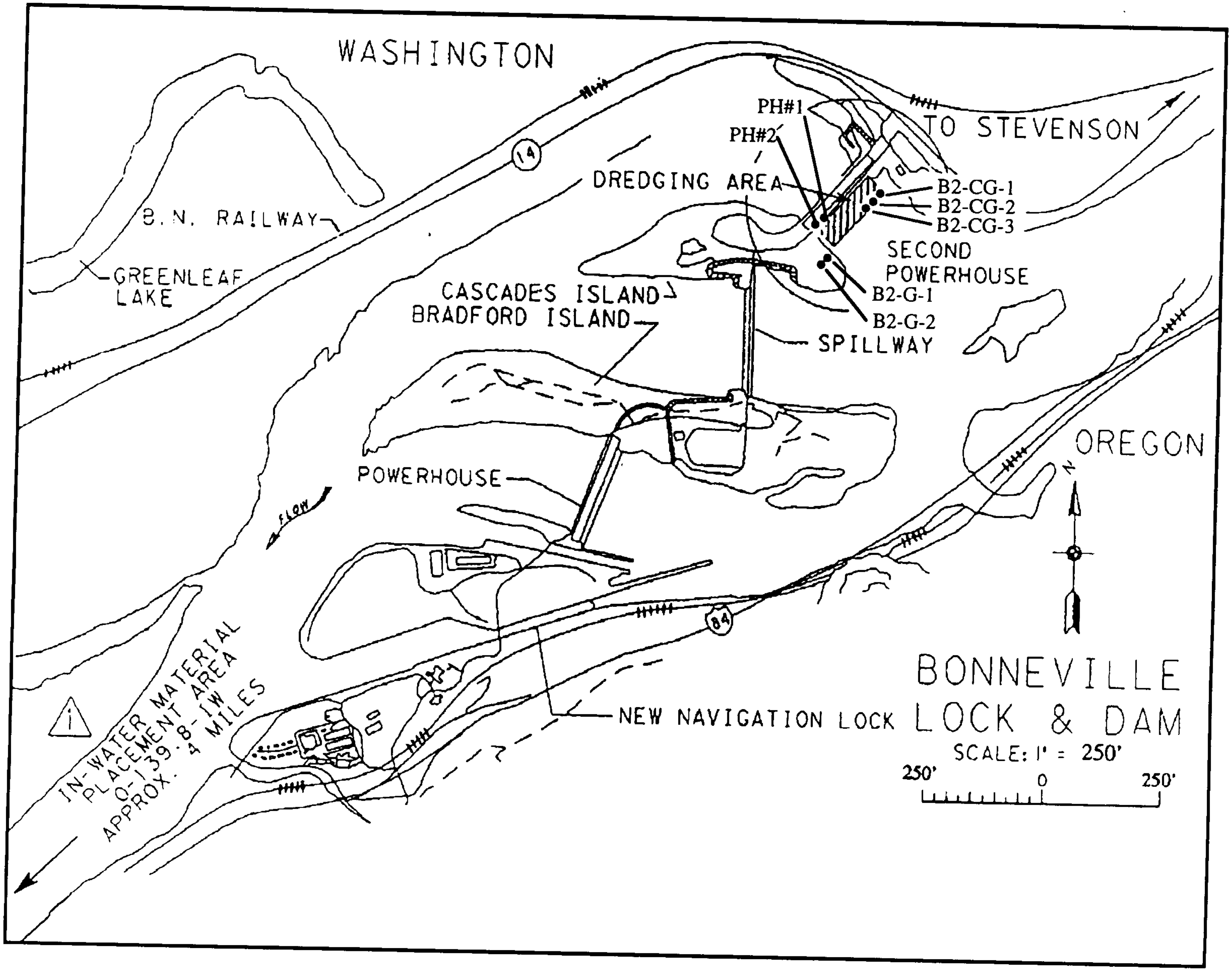

Table 1

Bonneville Powerhouse #2 Sediment - Physical Analysis

	mm	>No.10 >2.0mm	No. 20-200 0.85-0.075mm	<N0. 200 <0.075mm	%
sample	median grain size	gravel	sand	fine	volitle solids
B2-GC-1*	*	*	*	*	*
B2-GC-2	0.13000	2.1	93.2	<4.7	2.77
B2-GC-3	0.13500	1.8	90.5	<7.7	2.44
B2-G1	0.13500	1.6	93.2	<5.2	3.62
B2-G2	0.13400	0.6	94.1	<5.3	1.57

* Sample B2-GC-1 Lost when bag ruptured.

Table 2

Bonneville Powerhouse #2 Sediment - Inorganic and Total Organic Carbon (TOC) Analysis

	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	AVS	TOC
					ppm					ppm	%
B2-GC-1	4	0.44	10.0	16.3	7.66	<0.05	11.1	0.10	97.8	2.0	0.43
B2-GC-2	3	0.25	9.3	10.0	7.58	<0.05	11.1	0.06	96.9	<0.3	0.39
B2-GC-3	5	0.39	9.2	14.9	8.60	<0.05	10.3	0.11	105	<0.3	0.21
PH2 #1	2	0.26	10.9	10.6	8.86	<0.05	11.4	0.06	108	2.3	0.35
PH2 #2	15	0.26	11.2	10.7	8.75	<0.05	10.6	0.07	114	2.1	0.08

Table 3

Bonneville Powerhouse #2 Sediment - Organic Analysis

	PCB - 7 arochlor analytes (ppb)	Pesticides - **19organochlorine analytes (ppb)		
		alapha-BHC	gamma-BHC (Lindane)	4,4'-DDT
B2-GC-1	ND	<0.2	0.2* (r = <0.2)	0.7* (r = <0.2)
B2-GC-2	ND	<0.2	<0.2	<0.3
B2-GC-3	ND	<0.2	0.3* (r = <0.2)	2* (r = 3)
PH2 #1	ND	<0.2	<0.2	0.5* (r = <0.2)
PH2 #2	ND	0.2	0.3* (r = <0.2)	1* (r = <0.2)
Method Blank	ND	<0.2	0.2* (r = <0.2)	0.8* (r = <0.2)

ND = none detected

** table shows only analytes where detection was noted

*Low level concentrations of Lindane and 4,4-DDT were present in the Method Blank.
The affected samples were reextracted past the recommended holding time. The results from both are reported.
r = rerun

Table 4a

Bonneville Powerhouse #2 Sediment - Organic Analysis (cont'd)
Polynuclear Aromatic Hydrocarbons (PAH) - 8 (low density) analytes

	Acenapththene	Acenaphthylene	Anthracene	Dibenzofuran	Fluorene
B2-GC-1	18	0.7	13	1	10
B2-GC-2	1	2	<0.6	<0.5	0.9
B2-GC-3	2	6	4	1	1
PH2 #1	<0.5	0.2	<0.6	<0.5	<0.5
PH2 #2	1	0.6	0.9	<0.5	0.7

	2-Methylnapthalene	Naphthalene	Phenanthrene	**Total Low PAHs**
B2-GC-1	3	3	29	77.7
B2-GC-2	2	4	1	10.9
B2-GC-3	3	3	4	24
PH2 #1	1	0.8	0.9	2.9
PH2 #2	2	3	3	11.2

Table 4b

Bonneville Powerhouse #2 Sediment - Organic Analysis (cont'd)
Polynuclear Aromatic Hydrocarbons (PAHs) - 10 (high density) analytes

	Benz(a)anthracene	Benzo(b)fluroanthene	Benzo(k)fluroanthene	Benzo(g,h,I)perylene	Benzo(a)pyrene
B2-GC-1	5	4	4	7	7
B2-GC-2	<0.7	<0.8	<0.6	1	1
B2-GC-3	2	3	2	2	2
PH2 #1	1	1	1	1	2
PH2 #2	<0.7	<0.8	<0.6	0.5	<0.5

	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Pyrene
B2-GC-1	7	3	22	7	27
B2-GC-2	0.8	0.6	1	1	1
B2-GC-3	5	1	13	1	11
PH2 #1	1	<0.5	2	1	2
PH2 #2	0.6	<0.5	2	<0.7	1

	Total High PAHs
B2-GC-1	93.0
B2-GC-2	6.4
B2-GC-3	42.0
PH2 #1	12.0
PH2 #2	4.1

Table 5

Bonneville Powerhouse #2 Sediment - Phenol Analysis (ppb)

	Phenol	2-Methylphenol	4-Methylphenol	2,4-Dimethylphenol	Pentachlorophenol
B2-GC-1	**10**	<30	**100**	<50	<50
B2-GC-2	<8	<30	<50	<50	<50
B2-GC-3	<8	<30	<50	<50	<50
PH2 #1	**20**	<30	<50	<50	<50
PH2 #2	<8	<30	<50	<50	<50