CENWS-OD-TS-DM

MEMORANDUM FOR FILE 3 December 2008

SUBJECT: DMMP EVALUATION OF THE SEDIMENT QUALITY OF MAINTENANCE MATERIAL DREDGED BEHIND THE MONROE STREET DAM (1997-4-00098) IN DOWNTOWN SPOKANE, WASHINGTON, SUBSEQUENTLY PLACED ON THE DAM APRON, IN RESPONSE TO SIERRA CLUB CONCERNS ABOUT POTENTIAL IMPACTS ON DOWNSTREAM RESOUCRES.

1. This memorandum is prepared on behalf of the Dredged Material Management Program (DMMP) agencies (Corps of Engineers, EPA, Region 10, Washington State Departments of Ecology and Natural Resources) and reflects a consensus determination on the sediment quality expressed from sampling of in situ material deposited behind the Monroe Street Dam for maintenance dredging with subsequent placement on the Dam Apron. The sampling and analysis was conducted by the applicant (Avista Utilities) after the Corps of Engineers received a letter from the Sierra Club, dated August 8, 2008 (**Attachment 1**) requesting testing to confirm the sediment quality of the on going dredging of maintenance material under the existing permit (1997-4-00098).

2. The maintenance dredging of approximately 3,000 – 10,000 cy of accumulated sediments (predominantly gravel and cobble) behind the Monroe Street Hydroelectric Development (Dam) forebay is required to prevent failure of the turbine trash racks and to restore full generating capacity of the hydroelectric plant. The dredged material is placed in front of the Dam on the Dam apron as required by the 1997 U.S. Army Corps permit in response to Washington Department of Fish and Wildlife in their 1997, 2002, and 2007 Hydraulic Project Approvals, so that the cobbles and gravels would continue to serve as potential source material for spawning habitat in the Spokane River system. Prior to 1997 permit, the dredged material was removed from the river and placed upland.

3. The DMMP agencies reviewed a sampling and analysis plan submitted for review on August 20, 2008, and approved the SAP on August 26, 2008. The DMMP agencies required collecting fresh samples of the material behind the Dam being dredged, and not analyzing subsamples of stockpiled material set aside for that purpose, as originally proposed.

4. A sediment sample of the ongoing dredged material was collected with a Clamshell Dredge Bucket on August 27, 2008. Two subsamples from this sample were collected, weighed and then placed on a 16 mm coarse sieve. The coarse gravel and cobble remaining on top of the 16 mm sieve was recovered and each sample weighed, and the material passing through the 16 mm sieve were collected, and weighed for further processing. The two subsample fractions passing through the 16 mm sieve were subsequently placed on a 2 mm sieve, and the portion remaining on top of the sieve was collected and weighed. Two subsamples of the material remaining on the 2mm sieve were collected for chemical analysis of the bulk in-situ fraction (e.g., < 16 mm, gravel, sand, fines). The two sample fractions passing through the 2 mm sieve were collected, weighed and two subsamples were collected for chemical analysis of the sand and fines fraction. **Figures 1-3** depict the sampling and sieving process discussed above.

5. The approved sampling and analysis plan was generally followed. The sampling and analysis characterization letter report on the two samples was submitted to the DMMP agencies for review on November 14, 2008, and the DMMP agencies concluded that the quality assurance/quality control guidelines specified by the DMMP were generally complied with, and these data were deemed suitable for decision-making using best-professional-judgment.

6. **Table 1** provides a breakdown on the dredged material Field Sieving and Grain Size results. It shows that between 37.8 to 44.8% of the in-situ material is larger than 16 mm in size, and that between 46.4 and 53.4% of the in-situ sediments were between 16 mm and 2 mm in size. Of the total sample collected, 8.7% to 8.8% of the in-situ material passed though the 2 mm Sieve and constituted the sand and silt/clay fraction.

Table 1. Field Sieving/Field Grain Size Results

Location ID: **Sample ID:** **Sample Date:**	**MSH-01** **MSH-01-SE-080827** **8/27/2008**	**MSH-02** **MSH-02-SE-080827** **8/27/2008**
Grain Size (% of Total)		
Larger than 16 mm (coarse gravel and cobbles)	37.8%	44.8%
Between 16 mm and 2 mm (fine gravel & coarse sand)	53.4%	46.4%
Less than 2 mm (medium to fine sand & silt/clay)	8.7%	8.8%

7. The chemical analysis results for the two samples submitted for analysis for the two <16 mm size subsamples and the two < 2 mm size subsamples are depicted in **Table 2 (< 16 mm)** and **Table 3 (< 2 mm)**. The chemical analysis results were compared to the DMMP Freshwater Sediment Evaluation Framework (SEF) Guidelines, or to SEF Marine Guidelines for chemicals with no existing freshwater guidelines. This comparison for the two < 16 mm fraction subsamples (**Table 2**) indicated that all chemicals were quantitated below the freshwater screening level (SL1) guidelines. Analysis results for the two < 2 mm sieved samples (**Table 3**) indicated that all chemicals were below the freshwater screening level guidelines except Zinc, which was quantitated at 420 ppm and 400 ppm, respectively, which exceeded the Zinc SL1 Guideline (130 ppm), and one of the samples exceeded the SL2 Guideline (SL2 = 400 ppm) at 420 ppm.

8. These results indicate that the chemicals evaluated in sediments dredged behind the dam are not at levels that would present a hazard to downstream resources, which also includes Zinc. To illustrate this, the DMMP agencies further evaluated the potential for dredging to result in exceedances of water quality criteria for zinc using conservative assumptions about river flow (assumed low), sediment distribution in the water column (assumed all material <2mm size fraction remains suspended) and dredging rates (assumed high)(**Attachment 2**). The maximum concentrations of zinc that would be expected in any given 24 hour period of time was determined to be 24 ug/L. This value is below Ecology's total dissolved zinc chronic freshwater standards of 33.4 ug Zn/L, based on a conservative water hardness (**Attachment 2**). Therefore,

based on this evaluation, the DMMP agencies conclude that it is unlikely that dredging of this material would have unacceptable adverse effects on water quality downstream of the dam.

Concur:

12/8/2008
Date

David R. Kendall, Ph.D., Seattle District Corps of Engineers

12/3/08
Date

Erika Hoffman, Environmental Protection Agency

Date

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

Date

Courtney Wasson, Washington Department of Natural Resources

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DMMO file

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Attachment 1.

SIERRA CLUB
FOUNDED 1892

Upper Columbia River Group

Box 413
Spokane, Washington 99210
www.idaho.sierraclub.org/uppercol/

August 8, 2008

Colonel Anthony Wright, District Engineer
U.S. Corps of Engineers Seattle District
P.O. Box 3755
Seattle, WA 98124-3755

VIA e-mail to: tim.r.erkel@usace.army.mil

Re: Revocation of Avista Dredging Permit

Dear Colonel Wright:

I am writing on behalf of Sierra Club to request that you rescind or revise USCOE § 404 Permit No. 1997-4-00098, issued to Washington Water Power, now Avista Utilities, authorizing dredging activities at the Monroe Street dam in downtown Spokane. This § 404 authorization was issued in 1997, and administratively extended for ten years on July 13, 2007. See Attachment 1.

Our fundamental concern is with the potential presence of toxic contaminants located in the Monroe Dam pool that may be disturbed by the dredging, and the impacts of that disturbance on downstream resources, including a native redband trout fishery and public access and use sites along the river. All of these sites are within a mile of dredging operations. There is no provision contained within the § 404 permit requiring sampling for contaminants or control of the movement of contaminants during dredging operations.

Avista has commenced dredging at the site, and is scheduled to continue until August 21, 2008. The Washington Department of Ecology has not issued a Section 401 certification for the project, and the Washington Department of Fish & Wildlife Hydraulic Project Approval does not explicitly require sampling for contaminants.

This request is made pursuant to the terms of the original 404 permit, at Section 5(b) under and 5(c) of the "Further Information" section, which indicates the Corps may re-evaluate the decision to issue the permit if:

> 5.b. The information provided in support of the application proves to have been false, incomplete or inaccurate.
>
> 5.c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

With respect to Section 5(b), Avista's application for a § 404 permit was incomplete and inaccurate because Avista did not disclose the potential presence of toxic materials at the dredging site, either in 1997 or in 2007.

With respect to Section 5(c), new information has become available since the Corps' issuance of the original (1997) § 404 permit that indicates that the public interest may be harmed by the dredging at the Monroe damsite. Most of this information was not available

when the original permit was issued. It also appears it was not considered by the Corps at the time the permit was administratively extended. This information includes the following:

- September 2002 U.S. Environmental Protection Agency issuance of the Record of Decision for the Coeur d'Alene Superfund cleanup, formally known as the Bunker Hill Mining and Metallurgical Complex Superfund Facility Operable Unit 3. The geographic scope of the Superfund site extends to wherever heavy metals (lead, zinc, arsenic, cadmium, etc.) within the watershed, including the Spokane River (see EPA's website with ROD at http://yosemite.epa.gov/r10/cleanup.nsf/sites/cda).
- 1998-2008 listings of Spokane River on the Washington's Clean Water Act 303(d) list for heavy metals and bio-accumulative toxic materials, including lead, various PCB congenors, and TCDD (see 2008 303(d) submittal and previous versions of the list at Ecology's website at http://www.ecy.wa.gov/programs/wq/303d/index.html).
- 1998 TMDL for Cadmium, Lead and Zinc in the Spokane River (Dept. of Ecology Publ. No. 98-329, may be viewed at http://www.ecy.wa.gov/biblio/98329.html)
- 1999 Spokane River Fish Consumption Health Advisory, issued by the Washington Department of Health and Spokane Regional Health District, recommending limited fish consumption due to toxic contamination, expanded in 2001 and 2003.
- August 2006, Department of Ecology issuance of the report "PCBs, PBDEs and Selected Metals in Spokane River Fish, 2005" indicating the highest contamination figures in the state of Washington (Dept. of Ecology Publ. No. 06-03-025, may be viewed at http://www.ecy.wa.gov/biblio/0603025.html).

There are a number of other studies and reports concerning toxic chemicals found in the waters, sediments and fish tissue of the Spokane River that have been issued since 1997. This partial list represents only a few of the more significant publications.

We believe it is essential that the Corps of Engineers intervene to protect the public interest and the public health. I would appreciate your prompt response to this request. I will be out of the office next week. Please reply to our attorney, Bonne Beavers at the Center for Justice, 509-835-5211, or bbeavers@cforjustice.org.

Thank you for your attention to this matter.

Yours very truly,

Rachael Osborn
Sierra Club Spokane River Project Coordinator

Cc:

- Bonne Beavers & Rick Eichstaedt, Center for Justice, Spokane
- Mark Wachtel, Regional Habitat Program Manager, Washington Dept. of Fish & Wildlife, Eastern Region, Spokane
- Jim Bellatty, Water Quality Section Supervisor, Washington Dept. of Ecology, Eastern Regional Office, Spokane
- Mike Hibble, Toxic Cleanup Section Supervisor, Washington Dept. of Ecology, Eastern Regional Office, Spokane

Attachment 2. Water Quality Assessment of Zn at Monroe Street Dam

Monroe St Dam

low flow =	2000	cfs	pg 12 of	http://www.nwcouncil.org/fw/subbasinplanning/admin/level2/intermtn/plan/21_spokane_overview.pdf
	28.3	L/cf		
	3600	s/hr		
	2.0E+08	L/h		
dredge volume	10000	cy, bulk		
	8.6	% passing 2 mm		
	98	% of fines that are sand		
	0.172	% of material that is silt/clay		
Zinc levels	420	mg/kg	max Zn conc in fines	

Assumptions:

calculation 1		all material in < 2 mm fraction will remain suspended
calculation 2		only silt/sand will remain suspended
both calcs (conversions)	1.2	g/mL, density of suspended material
	765	L/cy
dredge rate	5	cy/bucket
	150	cy per hour given 1 grab every 2 minutes
	137700	kg bulk sediment per hr

CALCULATION 1 (assume all material <2 mm remains suspended)		
24	ug/L	hourly rate
CALCULATION 2 (assume only sile/clay remain suspended)		
0.49	ug/L	hourly rate

			calculated DISSOLVED Zn WQ standard	
HARDNESS FOR SPOKANE RIVER RM 66-85			acute	chronic
26	min	mg CaCO3/L	36.8	33.4
72	max	mg CaCO3/L	86.6	79.2

data for hardness from http://www.epa.gov/waters/tmdldocs/9949.pdf

stds calculated using TSDCALC excell spreadsheet from http://www.ecy.wa.gov/programs/eap/pwspread/pwspread.html

Figure 1 Dredged Sample Material

Figure 2 Material Placed in Bucket, Weighed, and 16 mm Sieved

Figure 3 Material Smaller than 16 mm Recovered and 2 mm Sieved into Stainless Steel Bowl

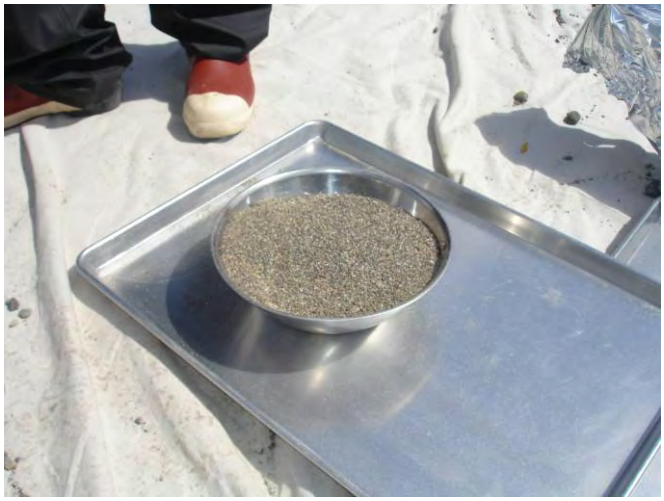

Table 2
Calculated Chemical Concentrations in Bulk In-Situ Materials (< 16 mm)

Location ID:	MSH-01	MSH-02	Freshwater Guidelines (Dry weight Basis)			SEF Marine Guidelines (Dry weight Basis)		
Sample ID:	MSH-01-SE-080827	MSH-02-SE-080827						
Sample Date:	8/27/2008	8/27/2008	Units	SL1	SL2	Units	SL1	SL2
Grain Size (pct)								
Coarse Sand and Larger	**91.3**	**91.2**						
Medium and Fine Sand	**8.5**	**8.6**						
Silt	**0.2**	**0.2**						
Clay	**-0.04**	**-0.09**						
Fines (Silt + Clay)	**0.2**	**0.2**						
Conventional Parameters (pct)								
Total organic carbon	**0.019%**	**0.019%**						
Metals (mg/kg)								
Antimony	3.2 U	3.1 U	**mg/kg**	**-**	**-**	mg/kg	**150**	**150**
Arsenic	**0.5**	**0.6**	**mg/kg**	**20**	**50**	mg/kg		
Cadmium	**0.1**	**0.1**	**mg/kg**	**1.1**	**1.5**	mg/kg		
Chromium	**1.0 J**	**0.6 J**	**mg/kg**	**95**	**100**	mg/kg		
Copper	**1.0**	**3.7**	**mg/kg**	**80**	**830**	mg/kg		
Lead	**6.5 J**	**6.2 J**	**mg/kg**	**340**	**430**	mg/kg		
Mercury	**0.0**	**0.0**	**mg/kg**	**0.28**	**0.75**	mg/kg		
Nickel	**0.5**	**0.6**	**mg/kg**	**60**	**70**	mg/kg		
Selenium	**0.007 J**	**0.004 J**	**mg/kg**	**-**	**-**	mg/kg		
Silver	1.1 U	1 U	**mg/kg**	**2**	**2.5**	mg/kg		
Zinc	**36.5**	**35.2**	**mg/kg**	**130**	**400**	mg/kg		
PCB Aroclors (µg/kg)								
Aroclor 1016	10 UJ	10 UJ	**ug/kg**	**-**	**-**	ug/kg		
Aroclor 1221	10 UJ	10 UJ	**ug/kg**	**-**	**-**	ug/kg		
Aroclor 1232	10 UJ	10 UJ	**ug/kg**	**-**	**-**	ug/kg		
Aroclor 1242	10 U	10 U	**ug/kg**	**-**	**-**	ug/kg		
Aroclor 1248	10 U	10 U	**ug/kg**	**-**	**-**	ug/kg		
Aroclor 1254	10 U	10 U	**ug/kg**	**-**	**-**	ug/kg		
Aroclor 1260	10 U	10 U	**ug/kg**	**-**	**-**	ug/kg		
Total PCB [5]	10 U	10 U	**ug/kg**	**60**	**120**	ug/kg		
Aromatic Hydrocarbons (µg/kg)								
Total LPAH [6]	**27.8**	**4.0**	**ug/kg**	**6600**	**9200**	ug/kg		
Naphthalene	**0.6**	**1.0**	**ug/kg**	**500**	**1300**	ug/kg		
Acenaphthylene	**0.2 J**	**0.5**	**ug/kg**	**470**	**640**	ug/kg		
Acenaphthene	**0.8**	**0.1 J**	**ug/kg**	**1100**	**1300**	ug/kg		
Fluorene	**1.1**	**0.2**	**ug/kg**	**1000**	**3000**	ug/kg		
Phenanthrene	**21.8 J**	**1.3**	**ug/kg**	**6100**	**7600**	ug/kg		
Anthracene	**3.4 J**	**0.9**	**ug/kg**	**1200**	**1600**	ug/kg		
2-Methylnaphthalene	**0.6**	**0.4**	**ug/kg**	**470**	**560**	ug/kg		
Total HPAH [7]	**139.2**	**20.2**	**ug/kg**	**31000**	**55000**	ug/kg		
Fluoranthene	**34.8 J**	**3.3**	**ug/kg**	**11000**	**15000**	ug/kg		
Pyrene	**31.3 J**	**3.6**	**ug/kg**	**8800**	**16000**	ug/kg		
Benzo(a)anthracene	**18.3 J**	**3.0**	**ug/kg**	**4300**	**5800**	ug/kg		
Chrysene	**17.4 J**	**3.2**	**ug/kg**	**5900**	**6400**	ug/kg		
Total Benzofluoranthenes (lab) [1]	**25.2 J**	**1.2**	**ug/kg**	**600**	**4000**	ug/kg		
Benzo(a)pyrene	**14.8 J**	**3.3**	**ug/kg**	**3300**	**4800**	ug/kg		
Indeno(1,2,3-c,d)pyrene	**8.2 J**	**1.8**	**ug/kg**	**4100**	**5300**	ug/kg		
Dibenzo(a,h)anthracene	**2.8**	**0.6**	**ug/kg**	**800**	**840**	ug/kg		
Benzo(g,h,i)perylene	**9.6 J**	**2.0**	**ug/kg**	**4000**	**5200**	ug/kg		
Chlorinated Hydrocarbons (µg/kg)								
1,3-Dichlorobenzene	5.3 U	5.1 U	**ug/kg**	**-**	**-**	ug/kg		
1,4-Dichlorobenzene	5.3 U	5.1 U	**ug/kg**	**-**	**-**	ug/kg	**110**	**110**
1,2-Dichlorobenzene	5.3 U	5.1 U	**ug/kg**	**-**	**-**	ug/kg	**35**	**50**
1,2,4-Trichlorobenzene	5.3 U	5.1 U	**ug/kg**	**-**	**-**	ug/kg	**31**	**51**
Hexachlorobenzene	5.3 U	**0.8**	**ug/kg**	**-**	**-**	ug/kg	**22**	**70**
Phthalates (µg/kg)								
Dimethyl phthalate	11 U	10 U	**ug/kg**	**46**	**440**	ug/kg		
Diethyl phthalate	11 U	10 U	**ug/kg**	**-**	**-**	ug/kg	**200**	**200**
Di-n-butyl phthalate	21 U	20 U	**ug/kg**	**-**	**-**	ug/kg	**1400**	**1400**
Butylbenzyl phthalate	11 U	**0.4 J**	**ug/kg**	**260**	**370**	ug/kg		
Bis(2-ethylhexyl) phthalate	**3.2 J**	**2.3 J**	**ug/kg**	**220**	**320**	ug/kg		
Di-n-octyl phthalate	21 U	20 U	**ug/kg**	**26**	**45**	ug/kg		
Phenols (µg/kg)								
Phenol	11 U	10 U	**ug/kg**	**-**	**-**	ug/kg	**420**	**1200**
2-Methylphenol (o-Cresol)	11 U	10 U	**ug/kg**	**-**	**-**	ug/kg	**63**	**63**
3-Methylphenol & 4-Methylphenol (m&p-Cres	21 U	20 U	**ug/kg**	**-**	**-**	ug/kg	**670**	**670**
2,4-Dimethylphenol	11 U	10 U	**ug/kg**	**-**	**-**	ug/kg	**29**	**29**

Table 2
Calculated Chemical Concentrations in Bulk In-Situ Materials (< 16 mm)

Location ID:	MSH-01	MSH-02	Freshwater Guidelines (Dry weight Basis)			SEF Marine Guidelines (Dry weight Basis)		
Sample ID:	MSH-01-SE-080827	MSH-02-SE-080827						
Sample Date:	8/27/2008	8/27/2008	Units	SL1	SL2	Units	SL1	SL2
Pentachlorophenol	11 U	10 U	ug/kg	-	-	ug/kg	400	690
Miscellaneous Extractables (µg/kg)								
Benzyl alcohol	11 U	10 U	ug/kg	-	-	ug/kg	57	73
Benzoic acid	260 UJ	250 UJ	ug/kg	-	-	ug/kg	650	650
Dibenzofuran	**0.7 J**	**0.2 J**	ug/kg	400	440	ug/kg		
Hexachloroethane	11 U	10 U	ug/kg	-	-	ug/kg		
Hexachlorobutadiene	5.3 U	5.1 U	ug/kg	-	-	ug/kg	11	120
N-Nitrosodiphenylamine	5.3 U	5.1 U	ug/kg	-	-	ug/kg	28	40
Volatile Organics (µg/kg)								
Trichloroethene	0.75 U	0.74 U	ug/kg	-	-	ug/kg	160	1600
Tetrachloroethene	0.75 U	0.74 U	ug/kg	-	-	ug/kg	57	210
Ethylbenzene (DMMP-Marine: SL/ML)	0.75 U	0.74 U	ug/kg	-	-	ug/kg	10	50
o-Xylene	0.75 U	0.74 U	ug/kg	-	-	ug/kg		
m,p-Xylene	1.5 U	1.5 U	ug/kg	-	-	ug/kg		
Total Xylene[2]	1.5 U	1.5 U	ug/kg	-	-	ug/kg	40	160
Pesticides & PCBs (µg/kg)								
4,4'-DDD (p,p'-DDD)	0.21 U	0.21 U	ug/kg	-	-	ug/kg	9	9.3
4,4'-DDE (p,p'-DDE)	0.21 U	0.21 U	ug/kg	-	-	ug/kg	16	28
4,4'-DDT (p,p'-DDT)	0.21 U	0.21 U	ug/kg	-	-	ug/kg	12	34
Total DDT[3]	0.21 U	0.21 U	ug/kg	-	-	ug/kg	6.9	69
Aldrin	0.21 U	0.21 U	ug/kg	-	-	ug/kg	9.5	9.5
alpha-Chlordane (cis-Chlordane)	0.21 U	0.21 U	ug/kg	-	-	ug/kg	2.8	4.5
Chlordane (technical)	0.21 U	0.21 U	ug/kg	-	-	ug/kg		
Oxychlordane	0.21 U	0.21 U	ug/kg	-	-	ug/kg		
cis-Nonachlor	0.21 U	0.21 U	ug/kg	-	-	ug/kg		
trans-Nonachlor	0.21 U	0.21 U	ug/kg	-	-	ug/kg		
Total Chlordane[4]	0.21 U	0.21 U	ug/kg	-	-	ug/kg		
Dieldrin	0.21 U	0.21 U	ug/kg	-	-	ug/kg	1.9	3.5
Heptachlor	0.21 U	0.21 U	ug/kg	-	-	ug/kg	1.5	2
gamma-BHC (Lindane) **(DMMP-Marine)**	0.21 U	0.21 U	ug/kg	-	-	ug/kg	10	

Notes:

Bold = Detected result

All results are calculated on a dry weight basis unless otherwise indicated.

J = Estimated value

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

(1) Total benzofluoranthenes was calculated at the lab

(2) Total xylene is the sum of o-, m-, p- isomers

(3) Total DDT consists of the sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT

(4) Total chlordane includes alpha-chlordane (cis-chlordane), beta-chlordane (trans-chlordane, gamma-chlordane), cis-nonaclor, trans-nonaclor and oxychlordane.

(5) Total PCB consists of the sum of seven aroclors

(6) Total LPAH consists of the sum of seven low molecular weight PAHs

(7) Total HPAH consists of the sum of nine high molecular weight PAHs

Exceeds Freshwater SL1 Guidelines

Exceeds Freshwater SL2 Guidelines

Table 3
Measured Chemical Concentrations in < 2 mm and Finer Sediments

Location ID:	MSH-01	MSH-02	Freshwater Guidelines (Dry weight Basis)			SEF Marine Guidelines (Dry weight Basis)		
Sample ID:	MSH-01-SE-080827	MSH-02-SE-080827						
Sample Date:	8/27/2008	8/27/2008	Units	SL1	SL2	Units	SL1	SL2
Grain Size (pct)								
Gravel	0	0						
Sand	98	98.2						
Silt	2.8	2.8						
Clay	-0.5	-1						
Fines (Silt + Clay)	2.3	1.8						
Conventional Parameters (pct)								
Total solids	94.0%	96.0%						
Total organic carbon	0.22%	0.22%						
Metals (mg/kg)								
Antimony	3.2 U	3.1 U	mg/kg	-	-	mg/kg	150	150
Arsenic	5.9	6.6	mg/kg	20	50	mg/kg		
Cadmium	1.1	1.1	mg/kg	1.1	1.5	mg/kg		
Chromium	12 J	7 J	mg/kg	95	100	mg/kg		
Copper	11	42	mg/kg	80	830	mg/kg		
Lead	75 J	71 J	mg/kg	340	430	mg/kg		
Mercury	0.13	0.11	mg/kg	0.28	0.75	mg/kg		
Nickel	5.8	6.3	mg/kg	60	70	mg/kg		
Selenium	0.081 J	0.05 J	mg/kg	-	-	mg/kg		
Silver	1.1 U	1 U	mg/kg	2	2.5	mg/kg		
Zinc	420	400	mg/kg	130	400	mg/kg		
PCB Aroclors (µg/kg)								
Aroclor 1016	10 UJ	10 UJ	ug/kg	-	-	ug/kg		
Aroclor 1221	10 UJ	10 UJ	ug/kg	-	-	ug/kg		
Aroclor 1232	10 UJ	10 UJ	ug/kg	-	-	ug/kg		
Aroclor 1242	10 U	10 U	ug/kg	-	-	ug/kg		
Aroclor 1248	10 U	10 U	ug/kg	-	-	ug/kg		
Aroclor 1254	10 U	10 U	ug/kg	-	-	ug/kg		
Aroclor 1260	10 U	10 U	ug/kg	-	-	ug/kg		
Total PCB [5]	10 U	10 U	ug/kg	60	120	ug/kg		
Aromatic Hydrocarbons (µg/kg)								
Total LPAH [6]	320	46	ug/kg	6600	9200	ug/kg		
Naphthalene	7	11	ug/kg	500	1300	ug/kg		
Acenaphthylene	1.9 J	6	ug/kg	470	640	ug/kg		
Acenaphthene	9.2	1.6 J	ug/kg	1100	1300	ug/kg		
Fluorene	13	2.3	ug/kg	1000	3000	ug/kg		
Phenanthrene	250 J	15	ug/kg	6100	7600	ug/kg		
Anthracene	39 J	9.9	ug/kg	1200	1600	ug/kg		
2-Methylnaphthalene	6.6	5.1	ug/kg	470	560	ug/kg		
Total HPAH [7]	1600	230	ug/kg	31000	55000	ug/kg		
Fluoranthene	400 J	37	ug/kg	11000	15000	ug/kg		
Pyrene	360 J	41	ug/kg	8800	16000	ug/kg		
Benzo(a)anthracene	210 J	34	ug/kg	4300	5800	ug/kg		
Chrysene	200 J	36	ug/kg	5900	6400	ug/kg		
Total Benzofluoranthenes (lab)[1]	290 J	14	ug/kg	600	4000	ug/kg		
Benzo(a)pyrene	170 J	37	ug/kg	3300	4800	ug/kg		
Indeno(1,2,3-c,d)pyrene	94 J	20	ug/kg	4100	5300	ug/kg		
Dibenzo(a,h)anthracene	32	6.5	ug/kg	800	840	ug/kg		
Benzo(g,h,i)perylene	110 J	23	ug/kg	4000	5200	ug/kg		
Chlorinated Hydrocarbons (µg/kg)								
1,3-Dichlorobenzene	5.3 U	5.1 U	ug/kg	-	-	ug/kg		
1,4-Dichlorobenzene	5.3 U	5.1 U	ug/kg	-	-	ug/kg	110	110
1,2-Dichlorobenzene	5.3 U	5.1 U	ug/kg	-	-	ug/kg	35	50
1,2,4-Trichlorobenzene	5.3 U	5.1 U	ug/kg	-	-	ug/kg	31	51
Hexachlorobenzene	5.3 U	9.6	ug/kg	-	-	ug/kg	22	70

Table 3
Measured Chemical Concentrations in < 2 mm and Finer Sediments

Location ID:	MSH-01	MSH-02	Freshwater Guidelines (Dry weight Basis)			SEF Marine Guidelines (Dry weight Basis)		
Sample ID:	MSH-01-SE-080827	MSH-02-SE-080827						
Sample Date:	8/27/2008	8/27/2008	Units	SL1	SL2	Units	SL1	SL2
Phthalates (µg/kg)								
Dimethyl phthalate	11 U	10 U	ug/kg	46	440	ug/kg		
Diethyl phthalate	11 U	10 U	ug/kg	-	-	ug/kg	200	200
Di-n-butyl phthalate	21 U	20 U	ug/kg	-	-	ug/kg	1400	1400
Butylbenzyl phthalate	11 U	**4.1 J**	ug/kg	260	370	ug/kg		
Bis(2-ethylhexyl) phthalate	**37 J**	**26 J**	ug/kg	220	320	ug/kg		
Di-n-octyl phthalate	21 U	20 U	ug/kg	26	45	ug/kg		
Phenols (µg/kg)								
Phenol	11 U	10 U	ug/kg	-	-	ug/kg	420	1200
2-Methylphenol (o-Cresol)	11 U	10 U	ug/kg	-	-	ug/kg	63	63
3-Methylphenol & 4-Methylphenol (m&p-Cres	21 U	20 U	ug/kg	-	-	ug/kg	670	670
2,4-Dimethylphenol	11 U	10 U	ug/kg	-	-	ug/kg	29	29
Pentachlorophenol	11 U	10 U	ug/kg	-	-	ug/kg	400	690
Miscellaneous Extractables (µg/kg)								
Benzyl alcohol	11 U	10 U	ug/kg	-	-	ug/kg	57	73
Benzoic acid	260 UJ	250 UJ	ug/kg	-	-	ug/kg	650	650
Dibenzofuran	**7.9 J**	**2.5 J**	ug/kg	400	440	ug/kg		
Hexachloroethane	11 U	10 U	ug/kg	-	-	ug/kg		
Hexachlorobutadiene	5.3 U	5.1 U	ug/kg	-	-	ug/kg	11	120
N-Nitrosodiphenylamine	5.3 U	5.1 U	ug/kg	-	-	ug/kg	28	40
Volatile Organics (µg/kg)								
Trichloroethene	0.75 U	0.74 U	ug/kg	-	-	ug/kg	160	1600
Tetrachloroethene	0.75 U	0.74 U	ug/kg	-	-	ug/kg	57	210
Ethylbenzene (DMMP-Marine: SL/ML)	0.75 U	0.74 U	ug/kg	-	-	ug/kg	10	50
o-Xylene	0.75 U	0.74 U	ug/kg	-	-	ug/kg		
m,p-Xylene	1.5 U	1.5 U	ug/kg	-	-	ug/kg		
Total Xylene[2]	1.5 U	1.5 U	ug/kg	-	-	ug/kg	40	160
Pesticides & PCBs (µg/kg)								
4,4'-DDD (p,p'-DDD)	0.21 U	0.21 U	ug/kg	-	-	ug/kg	9	9.3
4,4'-DDE (p,p'-DDE)	0.21 U	0.21 U	ug/kg	-	-	ug/kg	16	28
4,4'-DDT (p,p'-DDT)	0.21 U	0.21 U	ug/kg	-	-	ug/kg	12	34
Total DDT[3]	0.21 U	0.21 U	ug/kg	-	-	ug/kg	6.9	69
Aldrin	0.21 U	0.21 U	ug/kg	-	-	ug/kg	9.5	9.5
alpha-Chlordane (cis-Chlordane)	0.21 U	0.21 U	ug/kg	-	-	ug/kg	2.8	4.5
Chlordane (technical)	0.21 U	0.21 U	ug/kg	-	-	ug/kg		
Oxychlordane	0.21 U	0.21 U	ug/kg	-	-	ug/kg		
cis-Nonachlor	0.21 U	0.21 U	ug/kg	-	-	ug/kg		
trans-Nonachlor	0.21 U	0.21 U	ug/kg	-	-	ug/kg		
Total Chlordane[4]	0.21 U	0.21 U	ug/kg	-	-	ug/kg		
Dieldrin	0.21 U	0.21 U	ug/kg	-	-	ug/kg	1.9	3.5
Heptachlor	0.21 U	0.21 U	ug/kg	-	-	ug/kg	1.5	2
gamma-BHC (Lindane)(DMMP-Marine)	0.21 U	0.21 U	ug/kg	-	-	ug/kg	10	

Notes:

Bold = Detected result

All results are reported on a dry weight basis unless otherwise indicated

J = Estimated value

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

(1) Total benzofluoranthenes was calculated at the lab

(2) Total xylene is the sum of o-, m-, p- isomers

(3) Total DDT consists of the sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT

(4) Total chlordane includes alpha-chlordane (cis-chlordane), beta-chlordane (trans-chlordane, gamma-chlordane), cis-nonaclor, trans-nonaclor and oxychlordane.

(5) Total PCB consists of the sum of seven aroclors

(6) Total LPAH consists of the sum of seven low molecular weight PAHs

(7) Total HPAH consists of the sum of nine high molecular weight PAHs

Exceeds Freshwater SL1 Guidelines

Exceeds Freshwater SL2 Guidelines