Prepared by:
The Dredged Material Management Office
Seattle District, U.S. Army Corps of Engineers

MEMORANDUM FOR RECORD **November 14, 2019**

SUBJECT: EVALUATION OF DREDGING PROPOSED FOR PACIFIC FISHERMEN SHIPYARD FOR COMPLIANCE WITH THE WASHINGTON STATE ANTIDEGRADATION STANDARD.

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 compliance of the sediment surface to be exposed by removal of approximately 2,000 cubic yards (cy) of dredged material from the Pacific Fishermen Shipyard in Salmon Bay, Seattle, Washington (Figure 1) with the State of Washington's antidegradation standard. All dredged material will be disposed at an upland location.

2. **Background**. Pacific Fishermen, Inc. proposes maintenance dredging beneath the dry dock (Figure 2) at Pacific Fishermen Shipyard (PFS) (Hart Crowser, 2018). The proposal consists of removing approximately 2,000 cy of sediment to a design depth of 0 feet (ft), plus one ft of overdepth, for a total dredge depth of -1 ft (COE 1919 datum). The estimated volume is based on a bathymetric survey conducted in October 2018.

   The site has been used continuously as a shipyard since the late 1880s and is included on the Department of Ecology's contaminated sites list due to sediment contamination (Hart Crowser, 2018). The site is contaminated with PAHs, PCBs, arsenic, lead, mercury and other metals above cleanup levels. Because of the known contamination, Pacific Fishermen, Inc. proposes disposal of the dredged sediment at an approved upland disposal site.

   Given the known contamination and plans for upland disposal, the objective of the DMMP agencies was to assess compliance of the sediment surface to be exposed by dredging with the State of Washington's antidegradation standard. In order to accomplish this, the DMMP agencies required sampling and testing of both the dredged material and sediment underlying the dredge prism.

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

Table 1. Project Summary

Project ranking	High
Proposed dredging volume	2,000 cubic yards
Proposed dredging depth	-1 ft (COE 1919 datum) including 1 ft of overdredge allowance
1st draft SAP received	November 29, 2018
Comments provided by DMMP agencies	December 4, 2018
2nd draft SAP received	December 17, 2018

Comments provided by DMMP agencies	December 19, 2018
Final SAP received	December 21, 2018
SAP approved	January 3, 2019
Sampling date	January 30, 2019
Draft data report received	July 8, 2019
Comments provided by DMMP agencies	July 29, 2019
Revised data report	Not submitted
DMMO tracking number	PAFIS-1-A-F-409
EIM study ID	PAFIS19
USACE Permit Application Number	TBD
Recency Determination	Not applicable

4. **Project Ranking and Sampling Requirements**. Projects in Salmon Bay are ranked "high" in the DMMP User Manual (DMMP, 2018). For a high-ranked project with heterogeneous sediment, the minimum number of samples and analyses are calculated using the following guidelines:
   - Maximum volume of sediment represented by each field sample = 4,000 cy
   - Maximum volume of sediment represented by each analysis in the upper 4-ft of the dredge prism (surface sediment) = 4,000 cy
   - Maximum volume of sediment represented by each analysis in the subsurface portion of the dredge prism = 12,000 cy

   The differential analysis requirements for surface and subsurface sediment are based on an assumption that contamination decreases with depth. It was unknown whether this was the case for PFS. However, given that the total dredge volume was less than the maximum volume allowed for a single surface analysis, the entire volume was considered to be a single dredged material management unit (DMMU).

   The DMMP sampling guidelines called for a minimum of one field sample to represent the dredge prism. However, in order to provide a better spatial representation of the dredge prism, four sampling locations were included in the sampling plan. Sediment collected from the dredge prism at these locations was to be composited into a single sample for analysis. Likewise, sediment collected from the stratum representing the post-dredge surface (aka the Z-layer) at these locations was to be composited into a single Z-sample for analysis. Figure 2 shows the DMMU boundary and target sampling locations.

5. **Sampling**. Sampling took place January 30, 2019 using a vibracore sampler. Holes were to be cut in the dry dock the day before sampling to permit access for vibracoring. However, it became apparent that the substructure of the dry dock would be compromised if holes were to be cut along the centerline as called for in the SAP (Hart Crowser, 2019). Therefore, the sampling stations were repositioned off center after discussion with DMMO.

   Sampling proved to be difficult, with core refusal being encountered at two of the four stations prior to reaching the Z-layer and issues with recovery at three stations. The sampling team

communicated with DMMO several times while in the field for instructions regarding processing of the cores. DMMO, in turn, coordinated with the other DMMP agencies. Following is a description of the sampling events in chronological order, as summarized by Hart-Crowser the day after sampling and as described in the draft report (Hart Crower, 2019):

a. Coring began at Station S4. In the first attempt, the acceptance criterion for penetration (90% of the target penetration) was met, but the 75% acceptance criterion for recovery was not met. A second attempt was made, with the same result. Both cores penetrated well beyond the Z-layer, so despite the poor recovery, a partial Z-sample was available from both cores and both cores were kept pending the sampling results from the other stations.

b. Two attempts were also made at Station S3, with both cores encountering refusal before reaching the Z-layer. The first core penetrated 6.5 feet, which was most of the way through the dredged material layer (aka the A-layer); recovery was 69%. The second core went in at an angle and only penetrated 3 feet. Sediment from the first core was kept to represent dredged material at S3. Sediment from the second core was discarded.

c. Due to time limitations, only one core was collected at Station S2. Refusal was again encountered prior to reaching the Z-layer, but the recovery was good, at 98%. The sediment from this core was kept to represent dredged material at S2.

d. The single core at Station S1 penetrated 8.25 feet, which was 3.24 feet beyond the bottom of the Z-layer. Upon retrieval, nearly the entire 12-ft long core tube was filled with sediment, which indicated that the sediment had swelled during the coring process. After discussion with DMMO, the upper 5 feet of sediment was kept, with the top 3 feet representing dredged material and the next 2 feet representing the Z-layer.

e. The shipyard was shutting down at this point and there was no opportunity to make further sampling attempts. After consultation with DMMO, equal amounts of sediment from the A-layer were collected from the four stations and composited to represent the DMMU. Equal amounts of sediment from the Z-layer were collected from Stations 1 and 4 and composited into a single Z-sample.

Deviations from the SAP were documented in the draft report (Hart Crowser, 2019). The report was not finalized, but the collected samples were deemed adequate to make a determination regarding compliance with the antidegradation standard. Table 2 includes sampling data from the draft report.

6. **Chemical Analysis**. Because this project is located in a freshwater environment, the results were compared to the state standards for freshwater sediment, as documented in Table 3. Table 4 includes results for all analytes tested, regardless of whether state standards exist for those chemicals.

As can be seen in Table 3, a number of COCs exceeded the cleanup screening level (i.e. the SL2) in the dredge prism. These included arsenic, chromium, copper, mercury, silver, tributyltin, tetrabutyltin, total PAHs, phenol, dibenzofuran, carbazole, total PCBs, TPH-diesel and TPH-residual. The results for the Z-layer were similarly elevated, but with some differences. The same COCs exceeded the CSL in the z-layer sample with the exception of carbazole and TPH-residual.

Additionally, nickel exceeded CSL in the z-layer only. Table 5 provides a summary of all CSL (SL2) exceedances.

There is no numeric state standard for dioxins/furans, but the concentration was very high in the dredge prism, less so in the Z-layer, with toxicity equivalent (TEQ) concentrations of 2,132 nanograms/kilogram (ng/kg) in the dredge prism and 186 ng/kg in the Z-layer. By comparison, the disposal site management objective for non-dispersive disposal sites in Puget Sound is only 4 ng/kg TEQ.

7. **Biological Testing**. Due to the high concentrations of COCs in both the dredge prism and Z-layer, Pacific Fishermen, Inc. decided not to pursue biological testing.

8. **Antidegradation Determination**. Sediment exposed by dredging must either meet the State of Washington Sediment Quality Standards (SQS) or the State's antidegradation standard (Ecology, 2013). In the case of PFS, concentrations of many COCs in the Z-layer sample were far above SQS and, as indicated earlier, thirteen COCs also exceeded CSLs.

   Under DMMP guidelines (DMMP, 2008), sediment to be exposed by dredging cannot exceed CSL. While the Z-layer concentrations for most COCs were less than those in the dredged material prism, the exceedance of thirteen CSLs in the Z-layer sample means that the sediment to be exposed by dredging does not comply with the State's antidegradation standard.

   For most dredging projects that fail to meet the antidegradation standard, the project proponent is required to dredge a foot deeper and place a one-foot layer of clean sand over the post-dredge surface. In this case, due to the magnitude and number of CSL exceedances, Ecology's Toxics Cleanup Program (TCP) was consulted and a one-foot sand cover was not deemed to be an adequate safeguard. Discussions are still underway between Pacific Fishermen, Inc. and the Department of Ecology regarding the best way to address the high level of contamination found at this project.

   If dredging proceeds at some point in the future, it is likely that TCP will oversee the dredging and any post-dredge remedial actions. However, should DMMP be tasked with oversight, a pre-dredge meeting with DNR, Ecology, EPA and the Corps of Engineers will be required at least 7 days prior to dredging. A dredging and disposal quality control plan will need to be developed and submitted to the Regulatory Branch of the Seattle District Corps of Engineers at least 14 days prior to the pre-dredge meeting. Dredging, de-watering, transloading and disposal will all need to be addressed with enough detail to provide assurance to the agencies that the dredge plan will be properly implemented. The plan must also include any post-dredge remedy required by TCP.

9. **References**.

DMMP, 2008. *Quality of Post-Dredge Sediment Surfaces (Updated).* A Clarification Paper Prepared by David Fox (USACE), Erika Hoffman (EPA) and Tom Gries (Ecology) for the Dredged Material Management Program, June 2008.

DMMP, 2018. *Dredged Material Evaluation and Disposal Procedures (User Manual)*. Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management

Program, December 2018.

Ecology, 2013. *Sediment Management Standards – Chapter 173-204 WAC*. Washington State Department of Ecology, February 2013.

Hart Crowser, 2018. *Sampling and Analysis Plan, Pacific Fishermen Shipyard.* Prepared by Hart Crowser for Pacific Fishermen, Inc., December 31, 2018.

Hart Crowser, 2019. *Dredged Material Characterization, Pacific Fishermen Shipyard.* Prepared by Hart Crowser for Pacific Fishermen, Inc., July 8, 2019.

10. Agency Signatures.

signed copy on file in DMMO - Seattle District office

Concur:

_____ _____
Date David Fox - Seattle District Corps of Engineers

_____ _____
Date Erika Hoffman - Environmental Protection Agency

_____ _____
Date Laura Inouye, Ph.D. - Washington Department of Ecology

_____ _____
Date Shannon Soto - Washington Department of Natural Resources

Copies furnished:

DMMP signatories
Colleen Anderson – Seattle District Regulatory
Anne Conrad – Hart Crowser
Doug Dixon – Pacific Fishermen, Inc.
Simon Yang – Department of Ecology Toxics Cleanup Program

0 1,000 2,000 4,000 Feet

N

Pacific Fishermen Shipyard SAP
Seattle, Washington

Vicinity Map

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HARTCROWSER

Figure 1

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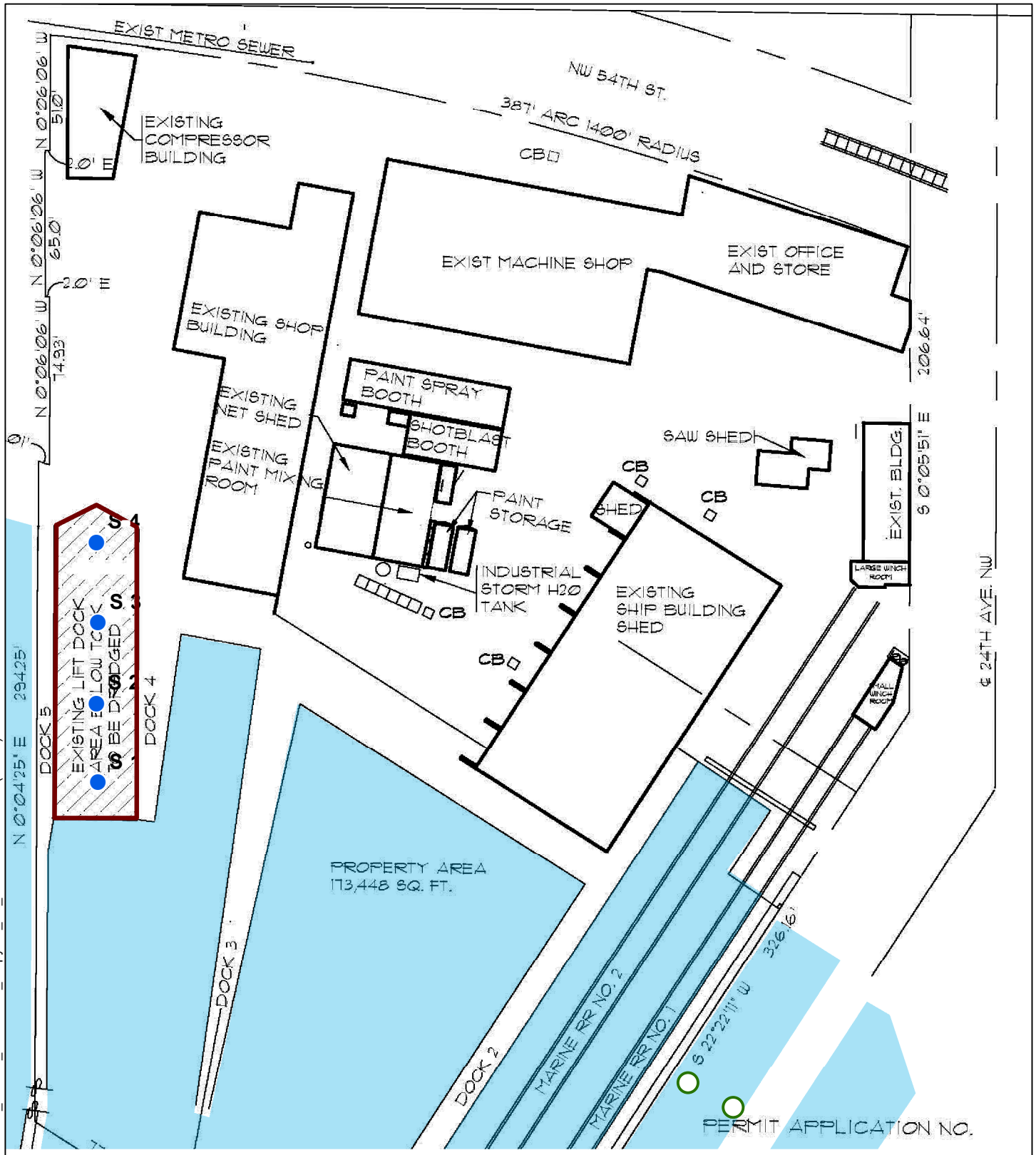

Source: Base map prepared from AutoCAD file created by Frank Hofmeister, PE, 2015.

Legend

- CSO
- Core Locations
- Dredge Area

0 30 60 120 Feet

N

Pacific Fishermen Shipyard SAP
Seattle, Washington

Site Plan and Core Locations

19394-00 6/19

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Figure 2

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Table 2 - Core and Sample Information (source: Table 1 from Hart Crowser, 2019)

Core Sample Location	Proposed Location				Actual Location				Core Penetration in Feet	Number of Cores Obtained	Number of Cores for Sampling	Percent Sediment Recovery[a]
	Latitude	Longitude	Northing	Easting	Latitude	Longitude	Northing	Easting				
PF-S1	47° 40.0290'N	122° 23.3557'W	247231.5	1257065.6	47° 40.0291'N	122° 23.3537'W	247231.9	1257074.3	8.25	1	1	145
PF-S2	47° 40.0350'N	122° 23.3556'W	247267.6	1257066.8	47° 40.0350'N	122° 23.3538'W	247267.9	1257074.4	5.0	1	1	98
PF-S3	47° 40.0407'N	122° 23.3555'W	247302.3	1257068.2	47° 40.0397'N	122° 23.3537'W	247295.9	1257075.3	6.5	2	1	69
PF-S4	47° 40.0463'N	122° 23.3555'W	247336.3	1257068.8	47° 40.0455'N	122° 23.3538'W	247331.3	1257076.0	10.0	2	2	62

Core Sample Location	Approximate Mudline Elevation[b]	Dredge Prism		Z-layer	
		Sample Interval Beneath Mudline	Dredge Prism Sample	Sample Interval Beneath Mudline	Z-Layer Sample
PF-S1	2.01	0 - 3.01'	PF-A	3.01 - 5.01'	PF-Z
PF-S2	5.31	0 - 4.9'			
PF-S3	6.01	0 - 4.5'			
PF-S4 (1)	4.31	0 - 5.31'		5.31' - 6.2'	
PF-S4 (2)		0 - 5.31'		5.31' - 5.8'	

Notes:
Latitude and Longitude in degrees and decimal minutes, NAD83
Northings and Eastings are NAD83

[a] Based on the cores used for sampling, and as measured in the field.
[b] Based on lead line measurement and Lake Washington Ship Canal elevation at the Hiram M. Chittenden Locks.

Table 3 - Sediment Chemical Analysis Results (SMS Freshwater Chemicals of Concern)

SMS Freshwater Chemicals of Concern Screening Levels			Dredge Prism	Z-Layer
CHEMICAL	SL1	SL2		
METALS (mg/kg)			PF-A	PF-Z
Arsenic	14	120	**707**	**897**
Barium[2]	---	---	**168**	**148**
Cadmium	2.1	5.4	**2.42**	**3.36 J**
Chromium	72	88	**270**	**234 J**
Copper	400	1,200	**4410**	**2020 J**
Lead	360	>1,300	**1050**	**1100 J**
Mercury	0.66	0.8	**11**	**2.22 J**
Nickel	38	110	**64.9**	**113 J**
Selenium	11	>20	0.85 U	**0.85 J**
Silver	0.57	1.7	**2.81**	**2.05 JT**
Zinc	3,200	>4,200	**3030**	**3730**
ORGANOMETALLIC COMPOUNDS				
Tributyltin (bulk; ug/kg)	47	320	**20400**	**6780 J**
Monobutyltin ion (bulk; ug/kg)	540	>4,800	**163 J**	**50 J**
Dibutyltin ion (bulk; ug/kg)	910	130,000	**3050**	**1000 J**
Tetrabutyltin ion (bulk; ug/kg)	97	>97	**388**	**124 J**
ORGANICS (ug/kg)				
PAHs				
Total LPAH	---	---	**34500**	**18200**
Naphthalene	---	---	**2810**	**608**
Acenaphthylene	---	---	**454**	**93.8 ***
Acenaphthene	---	---	**2500**	**1870**
Fluorene	---	---	**3070**	**1860**
Phenanthrene	---	---	**18500**	**10200**
Anthracene	---	---	**3770 ***	**1460 ***
2-Methylnaphthalene	---	---	**1780**	**869**
1-Methylnaphthalene	---	---	**1600**	**1200**
Total HPAH	---	---	**78100**	**41500**
Fluoranthene	---	---	**19500 ***	**11300**
Pyrene	---	---	**18200**	**9310**
Benz(a)anthracene	---	---	**7440**	**3950**
Chrysene	---	---	**8920**	**4290**
Benzofluoranthenes (b, j ,k)	---	---	**11300**	**5970**
Benzo(a)pyrene	---	---	**5920**	**3130**
Indeno(1,2,3-c,d)pyrene	---	---	**2870**	**1510**
Dibenz(a,h)anthracene	---	---	**1050**	**545**
Benzo(g,h,i)perylene	---	---	**2930**	**1490**
Total PAHs [3]	17,000	30,000	**113000**	**59700**
CHLORINATED HYDROCARBONS				
beta-Hexachlorocyclohexane	7.2	11	1 U	0.98 UJ
PHTHALATES				
Di-n-butyl phthalate	380	1,000	197 U	216 U
Bis(2-ethylhexyl) phthalate	500	22,000	**4500**	**1240**
Di-n-octyl phthalate	39	>1,100	*85.8* U**	*85.1* U**
PHENOLS				
Phenol	120	210	**480**	**282**
4-Methylphenol	260	2,000	**641**	195 U
Pentachlorophenol	1,200	>1,200	983 UJ	975 UJ

Source: Table 2 from Hart Crowser, 2019

Table 3 - Sediment Chemical Analysis Results (SMS Freshwater Chemicals of Concern)

SMS Freshwater Chemicals of Concern Screening Levels			Dredge Prism	Z-Layer
CHEMICAL	**SL1**	**SL2**		
MISCELLANEOUS EXTRACTABLES				
Benzoic acid	2,900	3,800	1970 UJ	1950 UJ
Dibenzofuran	200	680	**1590**	**897**
Carbazole	900	1,100	**2330**	**803**
PESTICIDES & PCBs (ug/kg)				
2,4'-DDE and 4,4'-DDE	21	33	2 U	*118* UJ
2,4'-DDD and 4,4'-DDD	310	860	160 U	59.1 UJ
2,4'-DDT and 4,4'-DDT	100	8,100	*110* U	98.4 UJ
Endrin Ketone	8.5	>8.5	2 U	*98.4* UJ
Dieldrin	4.9	9.3	2 U	1.97 UJ
Total PCBs	110	2,500	**2973 J**	**3544 J**
BULK PETROLEUM HYDROCARBONS (mg/kg)				
TPH-Diesel	340	510	**7300**	**3480**
TPH-Residual	3,600	4,400	**5130**	**2030**
DIOXINS/FURANS (pptr)				
Total TEQ	---	---	**2132 J**	**186 J**

1. This table lists results for only those compounds for freshwater sediments that have sediment screening levels.
2. This chemical will only be evaluated for upland disposal requirements.
3. Total PAHs is the sum of all PAHs listed.

Bolded values are detected concentrations.
Italicized values are non-detected results above the screening level.
U = Not detected at the indicated RL.
J = Estimated concentration due to QA/QC exceedance.
T = Estimated concentration due to value between MDL and method reporting limit.
* = Concentration reported from EPA 8270D-SIM analysis.
** = MDL reported because MRL was higher than screening level.

Table 4 - Analytical Results for all Chemicals Tested

Sample ID	SMS Freshwater Screening Levels		PF-A	PF-Z
Sampling Date			1/30/2019	1/30/2019
	SL1	SL2		
Conventionals in %				
Total Organic Carbon			4.08	1.18
Preserved Total Solids			49.71	80.43
Total Volatile Solids			7.5	3.59
Total Solids			55.86	82.94
Conventionals in mgkg				
Ammonia (NH3) as Nitrogen (N)			48.2	21.5
Sulfide			5.7	1.04 U
NWTPH-DX in mg/kg				
Diesel Range Organics	340	510	7300	3480
Lube Oil	3,600	4,400	5130	2030
Metals in mg/kg				
Antimony			11	10.1 J
Arsenic	14	120	707	897
Barium	---	---	168	148
Cadmium	2.1	5.4	2.42	3.36 J
Chromium	72	88	270	234 J
Copper	400	1,200	4410	2020 J
Lead	360	>1,300	1050	1100 J
Mercury	0.66	0.8	11	2.22 J
Nickel	38	110	64.9	113 J
Selenium	11	>20	0.85 U	0.85 J
Silver	0.57	1.7	2.81	2.05 JT
Zinc	3,200	>4,200	3030	3730
TCLP Metals in mg/L				
Arsenic			0.142 T	
Chromium			0.0041 T	
Lead			0.1 U	
Mercury			0.000016 JT	
Tributyltin Ion in ug/kg				
Butyltin	540	>4,800	163 J	50 J
Dibutyltin Ion	910	130,000	3050	1000 J
Tetrabutyltin	97	>97	388	124 J
Tributyltin Ion	47	320	20400	6780 J
Phenolics (Acids) in ug/kg				
2,4,5-Trichlorophenol			983 U	975 U
2,4,6-Trichlorophenol			983 U	975 U
2,4-Dichlorophenol			983 U	975 U
2,4-Dimethylphenol			983 U	975 R
2,4-Dinitrophenol			1970 UJ	1950 UJ
2-Chlorophenol			197 U	195 U
o-cresol			197 U	195 U
2-Nitrophenol			197 U	195 U
4,6-Dinitro-2-Methylphenol			1970 U	1950 U
4-Chloro-3-Methylphenol			983 U	975 U
p-cresol (4-Methylphenol)	260	2,000	641	195 U
4-Nitrophenol			983 U	975 U
Pentachlorophenol	1,200	>1,200	983 UJ	975 UJ
Phenol	120	210	480	282
Benzoic Acid	2,900	3,800	1970 UJ	1950 UJ

Source: Table 3 from Hart Crowser, 2019

Table 4 - Analytical Results for all Chemicals Tested

Sample ID Sampling Date	SMS Freshwater Screening Levels SL1	SL2	PF-A 1/30/2019	PF-Z 1/30/2019
Benzyl Alcohol			197 U	195 U
LPAHs in ug/kg				
1-Methylnaphthalene			1600	1200
2-Methylnaphthalene			1780	869
Acenaphthene			2500	1870
Acenaphthylene			454	195 U
Anthracene			3480 J	1920 J
Fluorene			3070	1860
Naphthalene			2810	608
Phenanthrene			18500	10200
Total LPAHs			34200	18500
HPAHs in ug/kg				
Benz[a]anthracene			7440	3950
Benzo(a)pyrene			5920	3130
Benzo(ghi)perylene			2930	1490
Benzofluoranthenes, Total (b+k+j)			11300	5970
Chrysene			8920	4290
Dibenzo(a,h)anthracene			1050	545
Fluoranthene			27400 J	11300
Indeno(1,2,3-cd)pyrene			2870	1510
Pyrene			18200	9310
Total HPAHs			86000	41500
Total PAHs	17,000	30,000	120000	60000
LPAHs (SIM) in ug/kg				
1-Methylnaphthalene			1590	1020
2-Methylnaphthalene			1950	890
Acenaphthene			2580	1300
Acenaphthylene			268	93.8
Anthracene			3770	1460
Fluorene			3830	2120
Naphthalene			2350	629
Phenanthrene			17000	9010
Total LPAHs			33300	16500
HPAHs (SIM) in ug/kg				
Benz[a]anthracene			7590	3610
Benzo(a)pyrene			6020	2660
Benzo(b)fluoranthene			5260	2070 J
Benzo(ghi)perylene			3670	1640
Benzo(j)fluoranthene			2950	1170
Benzo(k)fluoranthene			3110	1170
Benzofluoranthenes, Total (b+k+j)			3080	4420
Chrysene			7960	3590
Dibenzo(a,h)anthracene			920	428
Fluoranthene			19500	9760
Indeno(1,2,3-cd)pyrene			3660	1690
Pyrene			14000	6890
Total HPAHs			74600	34700
Total PAHs	17,000	30,000	108000	51200
Chlorinated Aromatics in ug/kg				
1,2-Dichlorobenzene			259	195 U

Table 4 - Analytical Results for all Chemicals Tested

Sample ID Sampling Date	SMS Freshwater Screening Levels SL1	SL2	PF-A 1/30/2019	PF-Z 1/30/2019
1,3-Dichlorobenzene			197 UJ	195 UJ
1,4-Dichlorobenzene			197 UJ	195 UJ
1,2,4-Trichlorobenzene			197 U	195 U
Hexachlorobenzene			197 U	195 U
Phthalates in ug/kg				
bis(2-ethylhexyl) Phthalate	500	22,000	4500	1240
Butyl benzyl phthalate			197 U	195 U
dibutyl phthalate	380	1,000	197 U	216 U
Diethyl phthalate			197 U	195 U
Dimethyl phthalate			197 U	195 U
Di-n-Octyl Phthalate	39	>1,100	197 U	195 U
Misc. Extractables in ug/kg				
Dibenzofuran	200	680	1590	897
Hexachlorobutadiene			197 U	195 U
Hexachloroethane			197 U	195 U
N-Nitrosodiphenylamine			197 U	195 U
2,4-Dinitrotoluene			983 U	975 U
2,6-Dinitrotoluene			983 U	975 U
2-Nitroaniline			983 UJ	975 UJ
3,3'-Dichlorobenzidine			983 U	975 U
4-Bromophenyl phenyl ether			197 U	195 U
4-Chloroaniline			983 U	975 U
4-chlorophenyl-Phenylether			197 U	195 U
4-Nitroaniline			983 U	975 UJ
Bis(2-chloro-1-methylethyl) ether			197 U	195 U
Bis(2-Chloroethoxy)Methane			197 U	195 U
bis(2-chloroethyl)Ether			197 U	195 U
Carbazole	900	1,100	2330	803
Hexachlorocyclopentadiene			983 UJ	975 UJ
Isophorone			197 U	195 U
m-Nitroaniline			983 U	975 U
Nitrobenzene			197 UJ	195 UJ
N-Nitrosodi-n-propylamine			197 U	195 U
pcn-002			197 U	195 U
Pesticide/PCBs in ug/kg				
PCB-aroclor 1016			3.9 U	4 U
PCB-aroclor 1221			3.9 U	4 U
PCB-aroclor 1232			3.9 U	4 U
PCB-aroclor 1242			3.9 U	4 U
PCB-aroclor 1248			1440	2050
PCB-aroclor 1254			1050 JP	1110 JP
PCB-aroclor 1260			483	384
PCB-aroclor 1262			3.9 U	4 U
PCB-aroclor 1268			3.9 U	4 U
Total PCBs	110	2,500	2973 J	3544 J
2,4'-DDD	310	860	2 U	1.97 UJ
2,4'-DDE	21	33	2 U	1.97 UJ
2,4'-DDT	100	8,100	2 U	1.97 UJ
4,4'-DDD	310	860	160 U	59.1 UJ
4,4'-DDE	21	33	2 U	118 UJ

Table 4 - Analytical Results for all Chemicals Tested

Sample ID Sampling Date	SMS Freshwater Screening Levels SL1	SL2	PF-A 1/30/2019	PF-Z 1/30/2019
4,4'-DDT	100	8,100	110 U	98.4 UJ
Aldrin			1 U	0.98 UJ
alpha-BHC			1 U	0.98 UJ
beta-BHC			1 U	0.98 UJ
cis-Chlordane			1 U	0.98 UJ
cis-Nonachlor			2 U	1.97 UJ
delta-BHC			1 U	0.98 UJ
Dieldrin	4.9	9.3	2 U	1.97 UJ
Endosulfan I			29.9 UJ	29.5 UJ
Endosulfan II			2 U	1.97 UJ
Endosulfan Sulfate			2 UJ	1.97 UJ
Endrin			2 U	1.97 UJ
Endrin Aldehyde			2 UJ	1.97 UJ
Endrin Ketone	8.5	>8.5	2 U	98.4 UJ
Heptachlor			1 U	0.98 UJ
Heptachlor Epoxide			1 U	0.98 UJ
Hexachlorobenzene			1 U	0.98 UJ
Hexachlorobutadiene			1 U	0.98 UJ
Lindane			1 U	0.98 UJ
Methoxychlor			9.97 U	9.84 UJ
Mirex			2 U	1.97 UJ
Oxychlordane			2 U	148 UJ
trans-Chlordane			99.7 U	0.98 UJ
trans-Nonachlor			2 U	1.97 UJ
Dioxins in ng/kg				
2,3,7,8-TCDD			15.2 U	3.83 T
1,2,3,7,8-PeCDD			476 T	23.9 T
1,2,3,4,7,8-HxCDD			2280 T	23.8 T
1,2,3,6,7,8-HxCDD			1530 T	155
1,2,3,7,8,9-HxCDD			1530 T	90.4 T
1,2,3,4,6,7,8-HpCDD			84400	7800
OCDD			501000 J	108000 J
2,3,7,8-TCDF			38.6 JT	12.3 JT
1,2,3,7,8-PeCDF			12.2 U	4.38 T
2,3,4,7,8-PeCDF			15.7 T	5.18 U
1,2,3,4,7,8-HxCDF			124 T	25.9 T
1,2,3,6,7,8-HxCDF			96.7 T	12.1 T
1,2,3,7,8,9-HxCDF			63.4 T	7.26 JT
2,3,4,6,7,8-HxCDF			189 T	24.4 T
1,2,3,4,6,7,8-HpCDF			6080	1010
1,2,3,4,7,8,9-HpCDF			638 T	63.6 T
OCDF			14100	6740
Total TEQ			2132 J	186 J

U = Analyte not detected.
J = Estimated value.
T = Concentration between the MDL and PQL.
P = Greater than 40 percent difference between the primary and secondary GC columns.
R = Analyte was rejected due to significant QC failure.

Table 5 – SMS Cleanup Screening Level (SL2) Exceedances

SMS Freshwater Chemicals of Concern Screening Levels			Dredge Prism	Z-Layer
CHEMICAL	**SL1**	**SL2**		
METALS (mg/kg)			**PF-A**	**PF-Z**
Arsenic	14	120	**707**	**897**
Chromium	72	88	**270**	**234 J**
Copper	400	1,200	**4,410**	**2,020 J**
Mercury	0.66	0.8	**11**	**2.22 J**
Nickel	38	110	*64.9**	**113 J**
Silver	0.57	1.7	**2.81**	**2.05 JT**
ORGANOMETALLIC COMPOUNDS				
Tributyltin (bulk; ug/kg)	47	320	**20,400**	**6,780 J**
Tetrabutyltin ion (bulk; ug/kg)	97	>97	**388**	**124 J**
ORGANICS (ug/kg)				
PAHs				
Total PAHs	17,000	30,000	**113,000**	**59,700**
PHENOLS				
Phenol	120	210	**480**	**282**
MISCELLANEOUS EXTRACTABLES				
Dibenzofuran	200	680	**1,590**	**897**
Carbazole	900	1,100	**2,330**	*803**
PCBs (ug/kg)				
Total PCBs	110	2,500	**2,973 J**	**3,544 J**
BULK PETROLEUM HYDROCARBONS (mg/kg)				
TPH-Diesel	340	510	**7,300**	**3,480**
TPH-Residual	3,600	4,400	**5,130**	*2,030**

*Did not exceed SL2

J = Estimated concentration due to QA/QC exceedance.
T = Estimated concentration due to value between MDL and method reporting limit.

Source: Adapted from Table 2 from Hart Crowser, 2019