CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD May 5, 2010 (Errata correction)[1]

SUBJECT: DETERMINATION ON THE SUITABILITY OF SUPPLEMENTAL CHARACTERIZATION OF PROPOSED MAINTENANCE DREDGED MATERIAL FROM PORT OF SEATTLE TERMINAL 5 (CORPS APPLICATION: NWS-2009-1559-WRD) DREDGING PROJECT IN ELLIOTT BAY, WASHINGTON EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL AT A DMMP NON-DISPERSIVE OPEN-WATER DISPOSAL SITE

1. The following summary reflects the supplemental suitability determination on additional characterization conducted at Terminal 5, and 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) on the suitability of an estimated 10,410 cy of maintenance material at Terminal 5 evaluated for open-water unconfined disposal at the Elliott Bay non-dispersive open-water disposal site in Seattle, Washington.

Table 1. Project DMMP Tracking Details

JARPA APPLICATION NO.	NWS-2009-1559-WRD
Supplemental SAP received	September 2, 2009
Supplemental SAP approved	September 10, 2009
Sampling dates: Vibracorer	September 24, 2009
Final data characterization report Supplemental data characterization report on archived z-sample analysis Revised Characterization Report (Dioxin data corrections)	February 1, 2010 March 2, 2010 April 29, 2010
Recency Determination: Berthing Area: High Concern (2 years)	September 2011
DAIS reference number: (Initial characterization: 5-26-2009 SDM) (Supplemental characterization: This SSDM)	POST5-1-B-F-269 POST5-1-A-F-283

Table 2. Terminal 5 DMMU Volumes in Initial and Supplemental Sampling Addendum.

DMMU	Original definition (2008)		Revised Definition (2009)	
	Volume (cy)	Extent*	Volume (cy)	Extent*
T5-S1	2,260	0+00 to 9+00	2,260	Horizontal: 0+00 to 9+00 Vertical: mudline to -47 ft. MLLW
T5-S2	1,760	9+00 to 16+00	--	--
T5-S2a	--	--	1,460	Horizontal: 9+00 to 16+00 Vertical: mudline to -52 ft MLLW
T5-S2b	--	--	300	Horizontal: 9+00 to 16+00 Vertical: -52 to -53 ft MLLW
T5-S3	6,390	Horizontal: 16+00 to 29+00 Vertical: mudline to -52 ft MLLW	--	--
T5-S3a	--	--	1,210	Horizontal: 16+00 to 19+00 Vertical: mudline to -53 ft MLLW
T5-S3b	--	--	5,180	Horizontal: 19+00 to 29+00 Vertical: mudline to -52 ft MLLW
Totals:	10,410	--	10,410	--

* Numbers refer to station numbering at T-5. Numbers to left of + sign are hundreds of feet; numbers to the right are feet

The yellow highlighted DMMU's S2-b and S3a represent the two DMMUs sampled in September 2009 (Table 1) for this supplemental suitability determination to supplement the 2008 sampling effort and 2009 SDM.

[1] The April 1, 2010 supplemental SDM is now rescinded and replaced by this updated version.

Table 3. Sample Identification Scheme

Core ID	Approximate Location Using Port of Seattle Station Numbering	Z-Layer Sample ID (Depth in ft.. MLLW)	DMMU (Composite Sample ID)
T5-S2-01	9+00	T5-S2-Z1 (-52 to -53)[a]	C1 (T5-S2-CS2: archived sediment from 2008 collected from -52 to -53 ft)
T5-S2-01a	9+00	T5-S2-Z1a (-53 to -54)[b]	
T5-S2-02	15+50	T5-S2-Z2 (-52 to -53) [a]	
T5-S2-03	16+00	T5-S2-Z3 (-53 to -54) [b]	C2 (T5-S2-CS3: sediment from T5-S2-03 and T5-S2-04 collected down to -53 ft)
T5-S2-04	19+00	T5-S2-Z4 (-53 to -54) [b]	

[a] Collected in 2008 and archived, with two archived samples subsequently composited and analyzed
[b] Collected in 2009 and archived as new Z-samples (yellow highlighted S2-Z3 analyzed)

Table 4. Sampling Coordinates and Penetration Depths at each Core Station

Core ID	Sampling Station Location		Estimated Mudline Elevation (ft. MLLW)	Penetration Depth (ft)	Volume for supplemental DMMU-S3a
	Latitude	Longitude			
T5-S2-01a	47.576329	122.36142	-51.0	8	Archived Z-sample (-53 to -54')
T5-S2-03	47.5789	122.361431	-47.8	10	1,210 cy
T5-S2-04	47.57808	122.36143	-46.3	10	

2. Background and Initial 2008 Characterization. This project is located in a High Concern CERCLA cleanup designated site within the Harbor Island Operational Unit, and portions of this project were previously characterized under DMMP guidelines in 1992 (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/POS-T5-DY92-SDM.pdf) and 1997 (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/POS-T5-DY97-SDM.pdf), and all material were found suitable for open-water disposal at the Elliott By disposal site. The project underwent a DMMP characterization for 10,410 cy of maintenance material in 2008, and the results of that characterization are documented in April 27, 2010 suitability determination, which corrects volume and dioxin errors. The initial 2008 characterization proposed maintenance dredging of an estimated 10,410 cy along 2,900 linear feet of container cargo pier margin (e.g., estimated dredging prism thickness of 3-7 ft, within the berthing area which has authorized depth of 45 ft MLLW + 2 ft of allowable overdredge depth (South end of berthing area), and 50 ft MLLW + 2 feet allowable overdredge depth (Northern end of berthing area dredging prism).

3. Sampling Addendum and SAP Addendum. Subsequent to the initial SDM the Port of Seattle elected to expand the dredge area at Berth 2 in both the horizontal and vertical directions, therefore requiring additional characterization data are required. Also, with this engineering redesign of their maintenance dredging requirements, the estimated total project volume remained at 10,410 cy, although the volumes for DMMUs 2 and 3 changed based on reconfigured boundary delineations (See Tables 2-3). The characterization area at Berth 2 now would extend from stations 9+00 to 19+00 (1,000 linear feet), so that an additional 300 feet (from stations 16+00 to 19+00) section required characterization through this supplemental sampling effort (see Figure 1). In the vertical dimension, the Port of Seattle also required an elevation of -51 ft, plus 2 ft of allowable overdepth, for a total characterization elevation of -53 ft, MLLW, which is one foot deeper than the depth characterized in 2008. To achieve this objective, two archived Z-samples (-52' to -53' MLLW) from 2008 characterization effort were composited for analysis, as DMMU-S2b, and an additional Z-sample (S2-01a) was collected and archived at the southern end of DMMU-2 (2008 SDM), and two core samples were collected at the new northern addition to DMMU-2 and analyzed as DMMU-S3a as depicted in Figure 1 and Tables 3 and 4 as required from the SAP Addendum. The two core stations for DMMU-S3a also had Z-samples collected and archived as S2-Z3 and S2-

Z4, as depicted in Table 3, and Figure 1. The Supplemental SAP was submitted to DMMP agencies on September 2, 2009, and approved on September 10, 2009.

4. Sampling. The sampling was initiated and completed on September 24, 2009, and three samples from this High Ranked area were collected by vibracorer to characterize 1,210 cy of material in the expanded DMMU-2 footprint as depicted in Table 4 and Figure 1. The two vibracore samples (S2-03 and S2-04) were composited for DMMU-S3a (S2-CS3), and the two archived z-samples (e.g. -52 ft to -53 ft MLLW) were analyzed as DMMU-S2b (S2-CS2) and the results of those analyses are summarized in Tables 5 and 6.

5. The testing included evaluation of dioxins/furans, as well as the PSDDA/DMMP Chemical of Concern list, including TBT. For the archived z-sample analysis of DMMU-S2b (S2-CS2) bulk-TBT analysis was conducted due to insufficient pore-water. The approved sampling and analysis plan was generally followed. The sampling and analysis characterization report was submitted on February 1, 2010 to the DMMP agencies for review, and a revised report was submitted on April 26, 2010, which corrected dioxin testing results. After reviewing, 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. Chemical Analysis and Comparison with DMMP Marine Guidelines. The Agencies' approved sampling and analysis plan was followed and quality assurance/quality control guidelines specified by PSEP and DMMP were generally complied with. A summary of chemical analysis results for all COC except dioxins/furans is provided in Table 5, and demonstrates that chemicals other than dioxin, for the archived DMMU-S2b (S2-CS2) analyzed, had no detected or undetected chemicals exceeding DMMP-Marine guidelines. The results summary for DMMU-3a (S2-CS3) had a TBT pore water Screening Level (SL)/Bioaccumulation Trigger exceedance quantitated at 0.73 ppb, and Fluoranthene and Total PCB exceedances of the SL and SQS. The applicant elected not to conduct either toxicity testing or bioaccumulation testing for TBT, and therefore DMMU-S3a is unsuitable for open-water disposal without that testing using best-professional-judgment.

7. Dioxin Testing Results Summary. Table 6 provides the results of dioxin/furan testing results for the two DMMUs, as follows: DMMU-S2b (S2-CS2) = 0.271 pptr-TEQ, and DMMU-S3a (S2-CS3) = 6.65 pptr-TEQ (U = ½ detection limit).

8. Dioxin Interim Interpretative Framework. The DMMP agencies are currently using an interim process for interpreting dioxin data (http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=DMMO&pagename=Dioxin_Guidelines) pending the development of a programmatic regulatory framework, expected sometime in 2010. The interim guidelines provides a project specific comparison of dioxin/furan concentrations in project dredged material to the disposal site background outside the disposal site. The guidelines applicable to the Elliott Bay non-dispersive disposal site specify the following:

    a. Comparison of dioxin in test sediments to disposal-site background
    b. Background is defined using disposal site specific monitoring, which defined an offsite maximum concentration of 12.2 pptr-TEQ, and an offsite average concentration of 8.7 pptr-TEQ
    c. Dioxin concentrations in any given DMMU may not exceed the site maximum (12.2 pptr-TEQ)
    d. Average dioxin concentrations (weighted to the volume of each DMMU cannot exceed the mean site concentration (**8.7 pptr-TEQ**)

TERMINAL 5

8+00 8+50 9+00 9+50 10+00 10+50 11+00 11+50 12+00 12+50 13+00 13+50 14+00 14+50 15+00 15+50 15+75 16+00 16+50 17+00 17+50 18+00 18+50 19+00 19+50 20+00

T5-S2-01a

T5-S2-01a

T5-S2-03

T5-S2-03

T5-S3-04

T5-S2-04

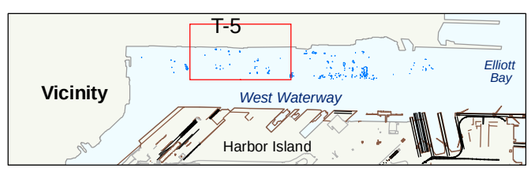
-15 ft -25 ft -30 ft -20 ft -35 ft -40 ft -49 ft -47 ft -50 ft -52 ft -51 ft -53 ft -54 ft -55 ft -57 ft -56 ft -60 ft -61 ft -59 ft -58 ft -64 ft -62 ft -63 ft -65 ft -66 ft

Sediment sampling locations
- Proposed location
- Reported actual location

Stationing
- T5-S1 DMMU
- T5-S2 DMMU
- T5-S3 DMMU
- Shoaling area

2008 multibeam bathymetry
- Contour (1-foot interval)
- Index contour (5-foot interval)
- -51-foot contour
- -46-foot contour

Wind Ward environmental LLC



0 50 100 150 200 Feet

0 25 50 Meters

N

Figure 1. T-5 proposed and actual sediment sampling locations

Prepared by CEH, 12/16/09; MAP 3647; W:\Projects\T-18_T-5 dredging\Data\GIS\T5

Table 5. Port of Seattle Terminal 5 Supplemental Testing Summary (2009 Addendum, Errata Correction: 4/27/2010).

						DMMU ID:		DMMU-S2b (T5-S2-CS2)			DMMU-S3a (T5-S2-CS3)			Z-sample analysis (DMMU-S3a: S2-Z3)		
								(Archived Z-layer from 2008)			(Composite from 2009)			(Uncomposited archived sample: 2009)		
	DMMP					SMS		mg/kg-dry wgt	mg/kg-OC	VQ	mg/kg-dry wgt	mg/kg-OC	VQ	mg/kg-dry wgt	mg/kg-OC	VQ
CHEMICAL NAME	Units	SL	BT	ML	Units	SQS	CSL	DMMP	SMS		DMMP	SMS		DMMP	SMS	
Antimony		150		200				6.0		uj	7.0		uj			
Arsenic	mg/kg	57	507.1	700	mg/kg	57	93	6.0		u	**10.0**					
Cadmium	mg/kg	5.1	11.3	14	mg/kg	5.1	6.7	0.20		u	0.30		u			
Chromium	mg/kg	(2)	267	(2)	mg/kg	260	270	**10.0**			**19.9**					
Copper	mg/kg	390	1,027	1,300	mg/kg	390	390	**9.2**			**191.0**		j			
Lead	mg/kg	450	975	1,200	mg/kg	450	530	2.0		u	**30.0**					
Mercury	mg/kg	0.41	1.5	2.3	mg/kg	0.41	0.59	na			**0.35**		j			
Nickel	mg/kg	140	370	370	mg/kg	--	--	**7.0**			**13.0**					
Selenium	mg/kg	(2)	**3**	(2)	mg/kg	--	--	2.0		u	**0.7**		u			
Silver	mg/kg	6.1	6.1	8.4	mg/kg	6.1	6.1	0.3		u	0.40		u			
Zinc	mg/kg	410	2,783	3,800	mg/kg	410	960	**22.0**			**120.0**		j			
TBT ion (bulk-sediment)	ug/kg	73.2	73.2					**3.4**						**99.0**		
TBT ion (porewater)	ug/L	0.15	0.15		ug/L	0.05	0.35				**0.73**					
Naphthalene	ug/kg	2,100		2,400	mg/kg-OC	99	170	19.0	11.5	u	**14.0**	**0.50**	j			
Acenaphthylene	ug/kg	560		2,000	mg/kg-OC	66	66	19.0	11.5	u	**17.0**		j			
Acenaphthene	ug/kg	500		2,000	mg/kg-OC	16	57	19.0	11.5	u	**43.0**	**5.9**				
Fluorene	ug/kg	540		3,600	mg/kg-OC	23	79	19.0	11.5	u	**44.0**	**6.07**				
Phenanthrene	ug/kg	1,500		2,100	mg/kg-OC	100	480	19.0	11.5	u	**260.0**	**35.9**				
Anthracene	ug/kg	560		13,000	mg/kg-OC	220	1,200	19.0	11.5	u	**140.0**	**19.3**				
2-Methylnapthalene	ug/kg	670		1,900	mg/kg-OC	38	64	19.0	11.5	u	19.0	2.62	u			
Total LPAH	ug/kg	5,200		29,000	mg/kg-OC	370	780	19.0	11.5	u	**518.0**	**71.4**				
Fluoranthene	ug/kg	1,700	4,600	30,000	mg/kg-OC	160	1,200	19.0	11.5	u	**1,800.0**	**248.3**		**330.0**	**32.4**	
Pyrene	ug/kg	2,600	11,980	16,000	mg/kg-OC	1,000	1,400	19.0	11.5	u	**1,400.0**	**193.1**				
Benzo(a)anthracene	ug/kg	1,300		5,100	mg/kg-OC	110	270	19.0	11.5	u	**520.0**	**71.7**				
Chrysene	ug/kg	1,400		21,000	mg/kg-OC	110	460	19.0	11.5	u	**740.0**	**102.1**				
Total Benzo(b+k)fluoranthenes	ug/kg	3,200		9,900	mg/kg/OC	230	450	19.0	11.5	u	**430.0**	**59.3**				
Benzo(a)pyrene	ug/kg	1,600		3,600	mg/kg-OC	99	210	19.0	11.5	u	**380.0**	**52.4**				
Indeno(1,2,3-cd)pyrene	ug/kg	600		4,400	mg/kg-OC	34	88	19.0	11.5	u	**210.0**	**29.0**	j			
Dibenzo(a,h)anthracene	ug/kg	230		1,900	mg/kg-OC	12	33	19.0	11.5	u	**23.0**	**3.2**				
Benzo(g,h,I)perylene	ug/kg	670		3,200	mg/kg-OC	31	78	19.0	11.5	u	**170.0**	**23.4**				
Total HPAH	ug/kg	12,000		69,000	mg/kg-OC	960	5,300	19.0	11.5	u	**6,100**	**841.4**				
1,3-Dichlorobenzene	ug/kg	170			mg/kg-OC	2.3	2.3	19.0	11.5	u	1.1	0.2	uj			
1,4-Dichlorobenzene	ug/kg	110		120	mg/kg-OC	3.1	9	19.0	11.5	u	1.1	0.2	uj			
1,2-Dichlorobenzene	ug/kg	35		110	mg/kg-OC	2.3	2.3	19.0	11.5	u	1.1	0.2	uj			
1,2,4-Trichlorobenzene	ug/kg	31		64	mg/kg-OC	0.81	1.8	19.0	11.5	u	1.1	0.2	uj			
Hexachlorobenzne (HCB)	ug/kg	22	168	230	mg/kg-OC	0.38	2.3	0.98	0.59	u	1.0	0.1	u			
Dimethylphthalate	ug/kg	71		1,400	mg/kg-OC	53	53	19.0	11.5	u	19.0	2.6	u			
Diethylphthalate	ug/kg	200		1,200	mg/kg-OC	61	110	19.0	11.5	u	19.0	2.6	u			
Di-n-butylphthalate	ug/kg	1,400		5,100	mg/kg-OC	220	1,700	19.0	11.5	u	19.0	2.6	u			
Butylbenzylphthalate	ug/kg	63		970	mg/kg-OC	4.9	64	19.0	11.5	u	**24.0**	3.3				
Bis(2-ethylhexyl)phthalate	ug/kg	1,300		8,300	mg/kg-OC	47	78	19.0	11.5	u	**140.0**	19.3				
Di-n-octylphthalate	ug/kg	6,200		6,200	mg/kg-OC	58	4,500	19.0	11.5	u	19.0	2.6	u			
Phenol	ug/kg	420		1,200	ug/kg	420	1,200		-			-				
2-Methylphenol	ug/kg	63		77	ug/kg	63	63	19.0	11.5	u	19.0	2.6	u			
4-Methylphenol	ug/kg	670		3,600	ug/kg	670	670	19.0	11.5	u	**19.0**	2.6	u			
2,4-Dimethylphenol	ug/kg	29		210	ug/kg	29	29	19.0	11.5	u	**19.0**	2.6	u			
Pentachlorophenol	ug/kg	400		690	ug/kg	360	690	96.0	58.2	u	**97.0**		u			
Benzyl alcohol	ug/kg	57		87	ug/kg	57	73	19.0		u	**19.0**	2.6	u			
Benzoic acid	ug/kg	650		760	ug/kg	650	650	19.0		u	190.0	26.2	uj			
Dibenzofuran	ug/kg	540		1,700	mg/kg-OC	15	58	19.0	11.5	u	**68.0**	**9.4**				
Hexachloroethane	ug/kg	600		1,600	mg/kg-OC			19.0	11.5	u	19.0		u			
Hexachlorobutadiene	ug/kg	29		270	mg/kg-OC	3.9	6.2	0.98	0.59	u	0.97	0.13	u			
N-Nitrosodiphenylamine	ug/kg	280		130	mg/kg-OC	11	11	19.0	11.5	u	19.0	2.6	u			
Trichloroethene	ug/kg	160		1,600	ug/kg	--	--	na			1.1		uj			
Tetrachloroethene	ug/kg	57		210	ug/kg	--	--	na			1.1		uj			
Ethylbenzene	ug/kg	10		50	ug/kg	--	--	na			1.1		uj			
Total Zylene (sum of o-,m-,p-)	ug/kg	40		160	ug/kg	--	--	na			1.1		uj			
4,4'-DDE	ug/kg							2.0		u	1.9		u			
4,4'-DDD	ug/kg							2.0		u	1.9		u			
4,4'-DDT	ug/kg							2.0		u	1.9		u			
Total DDT (sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT)	ug/kg	6.9	50	69		--	--	2.0		u	1.9		u			
Aldrin	ug/kg	10				--	--	0.98		u	0.97		u			
Chlordane	ug/kg	10	37			--	--	2.0		u	1.9		u			

Table 5. Port of Seattle Terminal 5 Supplemental Testing Summary (2009 Addendum, Errata Correction: 4/27/2010).

						DMMU ID:		DMMU-S2b (T5-S2-CS2) (Archived Z-layer from 2008)			DMMU-S3a (T5-S2-CS3) (Composite from 2009)			Z-sample analysis (DMMU-S3a: S2-Z3) (Uncomposited archived sample: 2009)		
	DMMP					SMS		mg/kg-dry wgt	mg/kg-OC	VQ	mg/kg-dry wgt	mg/kg-OC	VQ	mg/kg-dry wgt	mg/kg-OC	VQ
CHEMICAL NAME	Units	SL	BT	ML	Units	SQS	CSL	DMMP	SMS		DMMP	SMS		DMMP	SMS	
Dieldrin	ug/kg	10				--	--	2.0		u	1.9		u			
Heptachlor	ug/kg	10				--	--	0.98		u	0.97		u			
Alpha-BHC	ug/kg		10			--	--	0.98		u	0.97		u			
Gamma-BHC (Lindane)	ug/kg	10				--	--	0.98		u	0.97		u			
Aroclor 1016	ug/kg							19.0		u	20.0		u			
Aroclor 1221	ug/kg							19.0		u	20.0		u			
Aroclor 1232	ug/kg							19.0		u	20.0		u			
Aroclor 1242	ug/kg							19.0		u	20.0		u			
Aroclor 1248	ug/kg							19.0		u	**26.0**					
Aroclor 1254	ug/kg							19.0		u	**58.0**					
Aroclor 1260	ug/kg							19.0		u	**68.0**					
Total PCBs	ug/kg	130	38***	3,100	mg/kg-OC	12	65	19.0	11.5	u	**152.0**	**21.0**		**229.0**	**22.5**	
Dioxin (TEQ: see Table 6 for detailed results)	ng/kg							**0.271**			**6.65**					
Total Solids	%							na			**65.5**			**65.6**		
Total Volatile Solids	%							na			na					
Total Organic Carbon	%							**0.165**		j	**0.725**			**1.02**		
Total Ammonia	mg/kg							na			**22.2**					
Total Sulfides	mg/kg							na			**1,060.0**					
Gravel	%							na			**9.7**					
Sand	%							na			**69.9**					
Silt	%							na			**12.4**					
Clay	%							na			**8.0**					
Fines (percent silt + clay)	%							na			**20.4**					
Bioassay Determination: (P/F)								**NA**			**NA**					
BTs exceeded:								**no**			**Yes**					
Bioaccumulation conducted:								**no**			**no**					
ML Rule exceeded:								**no**			**no**					
PSDDA Determination:								**PASS**			**FAIL (C)**	**SQS**			**FAIL AD**	
DMMU Volume:	cy							**300**			**1,210**					
Rank								**H**			**H**					
Mean Core sampling depth	ft							**1 (archived-Z: -52' to -53')**			**9.3**					
Maximum sampling depth (mudline) (with Z-sample)	ft							**1 (archived-Z: -52' to -53')**			**10**					
DMMU ID:								**DMMU-S2b (T5-S2-CS2)**			**DMMU-S3a (T5-S2-CS3)**			**Z-sample analysis (DMMU-S3a: S2-Z3)**		

Legend:

SL = Screening Level exceedance
BT = Bioaccumulation Trigger exceedance
P = Pass (Suitable for UCOWD)
F(C) = Failure (UCOWD Unsuitable wo biological testing)
FAIL AD = Fails Antidegradation evaluation of new surface
SQS = Sediment Quality Standards exceedance (SMS)
CSL = Cleanup Screening Level exceedance (SMS)

VQ = Validation Qualifier
UCOWD = Unconfined open-water disposal
u = undetected at the reporting limit
uj = result undetected at the estimated reporting limit shown

j = Estimated Concentration (< reporting limit)

Table 6. Port of Seattle Terminal 5 Supplemental Dioxin Testing Results Summary (errata correction 4/27/2010)

Dioxin/furan	WHO (05) TEF	DMMU ID	S2b (T5-S2-CS2)			S3a (T5-S2-CS3)		
		Sample Depth	-52 to -53 ft (MLLW)		Archived Z-sample	-46.3 - 51 to -56.3 - 59 ft (MLLW)		
		Unit	T5-S2-CS2	LQ	TEQ	T5-S2-CS3	LQ	TEQ
2,3,7,8-TCDD	1	ng/kg dw	0.131	u	0.0655	**0.245**	j	**0.245**
1,2,3,7,8-PeCDD	1	ng/kg dw	0.167	u	0.0835	0.821	UE	0.4105
1,2,3,4,7,8-HxCDD	0.1	ng/kg dw	0.136	u	0.0068	**1.33**	j	**0.133**
1,2,3,6,7,8-HxCDD	0.1	ng/kg dw	0.117	UE	0.00585	**6.85**		**0.685**
1,2,3,7,8,9-HxCDD	0.1	ng/kg dw	0.107	UE	0.00535	**2.78**	J	**0.278**
1,2,3,4,6,7,8-HpCDD	0.01	ng/kg dw	**4.41**		**0.0441**	**206**		**2.06**
OCDD	0.0003	ng/kg dw	**39.2**		**0.01176**	**2010**		**0.603**
2,3,7,8-TCDF	0.1	ng/kg dw	0.103	u	0.00515	**1.23**		**0.123**
1,2,3,7,8-PeCDF	0.03	ng/kg dw	0.131	u	0.001965	**0.891**	j	**0.02673**
2,3,4,7,8-PeCDF	0.3	ng/kg dw	0.119	u	0.01785	**2.45**	j	**0.735**
1,2,3,4,7,8-HxCDF	0.1	ng/kg dw	0.107	u	0.00535	**4.39**		**0.439**
1,2,3,6,7,8-HxCDF	0.1	ng/kg dw	0.0491	u	0.002455	**1.46**	j	**0.146**
1,2,3,7,8,9-HxCDF	0.1	ng/kg dw	0.0749	u	0.003745	**0.92**	j	**0.092**
2,3,4,6,7,8-HxCDF	0.1	ng/kg dw	0.0525	u	0.002625	**1.99**	j	**0.199**
1,2,3,4,6,7,8-HpCDF	0.01	ng/kg dw	**0.784**	j	**0.00784**	**41.3**		**0.413**
1,2,3,4,7,8,9-HpCDF	0.01	ng/kg dw	0.119	u	0.000595	2.79	UE	0.01395
OCDF	0.0003	ng/kg dw	**2.32**	j	**0.000696**	**167**		**0.0501**
Total TEQ: (u = 1/2)					**0.271**			**6.65**
Total TEQ: (U = 0)					**0.064**			**6.23**
Total TOC, %:					**0.165**			**0.725**

Legend: u = undetected at detection limit; j = estimate quantitated below the Reporting limit; UE = EMPC = 1/2 DL

Table 7. Volume Weighted Average (VWA) Dioxin Concentrations for Port of Seattle Terminal 5 Dredging Project (errata 4/27/2010)

DMMU Core ID	Depth, ft	Volume (CY)	TCDD/F TEQ	ng/kg-dw	Product (Vol x TEQ)	ng x cy/kg x DMMU	Product/total	Proportional contribution/Suitable DMMU
S1	-40 to -47'	2,260	12.1	ng/kg-dw	27,346	ng x cy/kg	82.5%	% of Total DMMU
S2a	-47.2 to -52'	1,460	3.93	ng/kg-dw	5,738	ng x cy/kg	17.3%	% of Total DMMU
S2b	-52 - -53'	300	0.271	ng/kg-dw	81	ng x cy/kg	0.2%	% of Total DMMU
Totals (Suitable):		4,020 cy			33,165 ng x cy/kg		8.25	ng/kg-dw/Project (VWA)

All 3 DMMUs meet the offsite maximum of 12.2 pptr-TEQ, and the volume wgt'd average is below the Interim Elliott Bay offsite average of 8.7 pptr-TEQ
S3a not included in VWA due to other chemical exceedances (TBT, PCBs, Fluoranthene)

9. Dioxin Interpretation on Suitability for Unconfined-Open-Water Disposal. As summarized in paragraph 7 above, DMMU-S2b was quantitated below the site maximum of 12.2 pptr-TEQ. As noted in the initial updated 2009 suitability determination, DMMU-S1 (12.1 pptr-TEQ) and DMMU-S2a (3.93 pptr-TEQ) were both quantitated below 12.2 pptr-TEQ. Table 7 provides the volume weighted averages for DMMU's S1, S2a, and S2B. DMMU-S3a was not included because of chemical exceedances noted in paragraph 6, which make this DMMU unsuitable without bioaccumulation / toxicity testing. The volume weighted average concentration for the three DMMUs (S1, S2a, and S2b) totaling 4,020 cy of characterized material is 8.25 pptr-TEQ, which is below the interim Elliott Bay offsite average of 8.7 pptr-TEQ, and all three DMMUs would be suitable for disposal at the Elliott Bay disposal site based on these dioxin testing results, with the stipulation that DMMU-1 must be dredged during the same dredging cycle as DMMUs S2a and S2b.

10. Antidegradation Evaluation at DMMU-S3a. Because DMMU-S3a is unsuitable for open-water disposal, z-sample analysis was required. The Port elected to analyze one of the two archived Z-samples (S2-Z3) for the constituents exceeding DMMP guidelines in overlying DMMU-S3a, and those results are summarized in Table 5. The results indicate that Fluoranthene was quantitated under the SL and SQS. PCBs in the z-sample, however, were quantitated above the SL and SQS (229 ppb, and 22 ppm-oc-normalized, respectively) and were higher than PCBs quantitated in the overlying dredge prism (152 ug/kg). TBT was analyzed as bulk TBT, rather than porewater TBT, because of the limited amount of porewater in the archived z-sample. As a result, the results of the z-sample analysis can not be directly compared to that of the dredge prism in order to evaluate whether degradation will occur. The results of the z-sample analysis indicate bulk TBT at 99 ug/kg, which is 1.3 times the DMMP bulk TBT SL (73.2 ug/kg). The overlying sediment had a porewater TBT concentration of 0.73 ug/L, which is 4.9 times the porewater TBT SL (0.15 ug/L). Comparison of these results with the overlying DMMU-S3a are depicted in Figure 2. Based on the PCB and TBT results, the DMMP has concluded that the z-sample results are not in compliance with the antidegradation standard.

11. Antidegradation Evaluation at DMMU-S1. Due to elevated dioxins at DMMU-S1 (12.1 pptr-TEQ) insuring compliance with the antidegradation standard is required. The Z-samples underlying this DMMU are out of the one-year holding time (e.g., collected in September 2008), and therefore to address the antidegradation concern, the Port of Seattle proposes the following:

    a. Dredge between 0+00 to 9+00 an additional one-foot of material (-47 to -48' MLLW) beyond the required maintenance depth (-45' + 2 ft of allowable overdepth MLLW).
    b. Collect grab samples of the newly exposed post-construction surface sediment at the two previously occupied core stations (S1-01, and S1-02) and analyzed for dioxin/furans, TBT, PCBs, and Fluoranthene.
    c. If the results of these analyses show that the newly exposed surface is not in compliance with the antidegradation standard, the Port of Seattle will place a 0.5 ft clean sand cover over the exposed surface.

12. Suitability for Unconfined-Open Water Disposal. Tables 8 and 9 summarizes the adjusted volume weighted average testing outcomes for DMMU's S1, which includes an additional foot of dredging at S1b, and S2a from initial 2009 revised suitability determination and characterization, and the two tested DMMU-2b and DMMU-3a in this supplemental suitability determination. The adjusted volume weighted average is 8.52 pptr-TEQ, which is below the offsite Average of 8.7 pptr-TEQ. Based on the supplemental chemical testing results for DMMU-S2b this DMMU is suitable for unconfined-open-water-disposal, and can be added to the overlying material that was previously found to be suitable in DMMU-2a (Table 2), as can the 2,260 cy from DMMU-S1 for a total suitable volume of 4,320 cy (2,260 cy + 300 cy + 1,460 cy + 300 cy). The supplemental testing outcome for DMMU-S3a demonstrated that the 1,210 cy of material characterized in this DMMU is not suitable for open-water disposal and must be disposed at an Ecology approved upland site.

Table 8. Addendum to Volume Weighted Average (VWA) Dioxin Concentrations for Port of Seattle Terminal 5 Dredging Project

DMMU Core ID	Depth, ft	Volume (CY)	TCDD/F TEQ	ng/kg-dw	Product (Vol x TEQ)	ng x cy/kg x DMMU	Product/total	Proportional contribution/Suitable DMMU
S1	-40 to -47'	2,260	12.1	ng/kg-dw	27,346	ng x cy/kg	74.3%	% of Total DMMU
S1b*	-47 to -48'	300	12.1	ng/kg-dw	3,630	ng x cy/kg	9.9%	% of Total DMMU
S2a	-47.2 to -52'	1,460	3.93	ng/kg-dw	5,738	ng x cy/kg	15.6%	% of Total DMMU
S2b	-52 - -53'	300	0.271	ng/kg-dw	81	ng x cy/kg	0.2%	% of Total DMMU
Totals (Suitable):		4,320 cy			36,795 ng x cy/kg		8.52	ng/kg-dw/Project (VWA)

* estimated contribution to volume weighted average for dredging additional foot within DMMU-S1 to accommodate clean sand cover

All 3 DMMUs meet the offsite maximum of 12.2 pptr-TEQ, and the volume wgt'd average is below the Interim Elliott Bay offsite average of 8.7 pptr-TEQ

S3a not included in VWA due to other chemical exceedances (TBT, PCBs, Fluoranthene)

13. Table 8 summarizes the DMMU specific testing outcome summary for the total project collectively characterized in 2008 and 2009.

Table 9. DMMU specific and Total Project Testing Outcome Summary.

DMMU ID:	Volume (cubic yards)	DMMP Suitability (Suitable, Unsuitable)
S1	2,260	Suitable (VWA this SDM)
S1b	300	Suitable (dredging for clean cover placement)
S2a	1,460	Suitable
S2b	300	Suitable (this SDM)
S3a	1,210	Unsuitable (this SDM)
S2-Z3	--	Not in compliance with Antidegradation
S3b	5,180	Unsuitable (initial SDM)
S1 + S1b + S2a + S2b	4,320	Total Suitable
S3a +S3b	6,390	Total Unsuitable
Total Project:	10,710	(Suitable + Unsuitable)

14. In response to the DMMP concerns about degradation of the new sediment surface that would be expressed underlying DMMU-S3a as well as during dredging of adjacent suitable and unsuitable DMMU s, the Port of Seattle provided a proposal to address anti-degradation in their March 11, 2010 letter (Attachment 1). In light of the Port's proposal, DMMP staff comments, and new information provided by the Port on March 30, 2010, the DMMP has amended the original proposal as follows:

    a. The toe wall is designed for a dredging depth to -51' MLLW. The Port intends to establish -51 ft. MLLW as the required dredging depth, and will require any overdepth dredging be backfilled with clean sand and leveled to restore grade to -51 ft. MLLW

    b. The design of the dredging project, including provisions for overdepth dredging, is expected to result in an average placement of clean sand backfill on the order of 1.5 ft (1.25 ft + 0.25 ft).

    c. The dredging QA/QC plan will include a buffer between Stations with "suitable" and "unsuitable" sediments, in coordination with the DMMP agencies.

    d. The above referenced provisions for overdepth and clean sand backfill apply to the entire dredge area from station 9+00 to 19+00 (DMMU 2 and DMMU-S3a). If the dredging design is revised such that backfill is not required for structural integrity of the retaining wall, i.e. the project depth becomes more shallow for whatever reason, then the port must submit a revised plan to the DMMP that reflects 1' of overdredge specifically to accommodate a 6" minimum thickness clean sand cover for anti-degradation purposes.

    e. The Port will conduct post-dredge monitoring within Berth 2 dredging area (Station 9+00 to 19+00) to collect grab samples at 4 Stations to evaluate the newly expressed surface sediment quality.

    f. If post-dredge monitoring results reveal that the anti-degradation standards have not been met, the Port will undertake the placement of additional clean sand cover over the dredge area, at all locations that are out of compliance.

15. This memorandum supplements the initial suitability determination and documents the suitability testing outcome for the supplemental testing conducted for the proposed dredging at the Port of Seattle Terminal 5 maintenance

dredging area for unconfined-open-water disposal at the Elliott Bay non-dispersive disposal site. It also documents the requirements to evaluate the exposed post-dredge surface to assess antidegradation compliance, and proposed remedy to address this concern. However, this suitability determination does not constitute final agency approval of the project. A dredging plan for this project must be completed as part of the final project approval process. A final decision will be made after full consideration of agency input, and after an alternatives analysis is done under Section 404(b)(1) of the Clean Water Act.

Concur:

5/5/2010
Date

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

5/5/10
Date

Erika Hoffman, Environmental Protection Agency

05/05/2010
Date

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

05/06/2010
Date

Dave Vagt, Washington Department of Natural Resources

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DMMO file

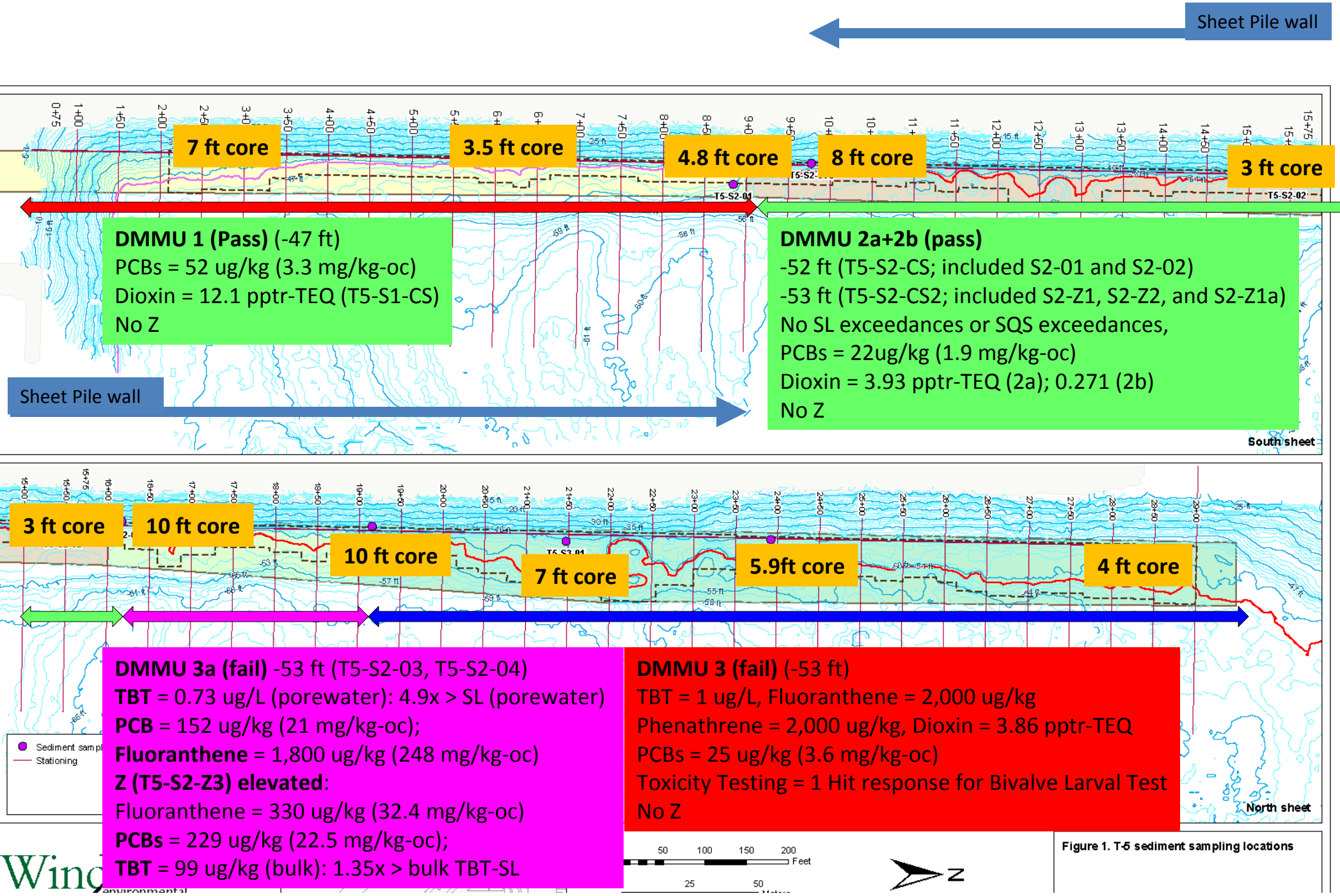

Figure 2. Schematic displaying the testing results for 2008 and 2009 characterizations at Terminal 5.

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Attachment 1

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March 11, 2010

David R. Kendall, Ph.D.
Chief, Dredged Material Management Office
Seattle District Corps of Engineers
PO Box 3755
Seattle, WA 98124-3755

RE: Port of Seattle - Terminals 5 & 18

Dear Dr. Kendall:

On March 23, the port's Capital Development Division will be updating the Port of Seattle Commission regarding the status of various dredging projects. If it's possible for the DMMP to have reached conclusions about anti-degradation issues associated with maintenance dredging at Terminals 5 and 18 by that time, it would be very helpful to the Port and its Commissioners.

If the issues require more deliberation and collaborative discussion, we'd be happy to organize a teleconference. In the meanwhile, we would like to take the opportunity to propose a path forward for both projects. We believe that these proposals are careful to consider the unique circumstances of each project and we are confident that they will adequately achieve the DMMP's anti-degradation objectives.

Terminal 18

Terminal 18 maintenance dredging was completed during the 2008/2009 in-water construction window. Post dredge sampling revealed exceedances of sediment management standards for TBT. This has triggered DMMP's interest and now requires a decision regarding compliance with Washington State anti-degradation standards.

To help inform this decision, the Port presented information to the DMMP on March 4, 2010. The information presented related to the existence of a rock (rip-rap) keyway that was constructed to support the slope beneath the cargo pier. The keyway relates to the anti-degradation issue inasmuch as its presence may confound short term remedial options, and also as a factor regarding the nature of the post-dredge surface and the validity of post dredge sampling.

The keyway extends +/- 30' from the pier face and vertically at least several feet below project depth (-51 MLLW). The volume of rock placed in the keyway during its construction, particularly at the south end, is substantial. Because of its documented presence, we assume that post dredge sediment samples have likely been taken from either pockets between the rock or from a thin layer of sediment immediately above the rock. In either case, the samples have been taken from a post-dredge surface that would not be considered typical in the context of anti-degradation standards.

The analytical results from the above referenced samples reveal exceedances for TBT. However, it should be noted that contamination levels are generally lower than that of the pre-dredge surface. By some accounts, the sample data would suggest that the post-dredge surface is non-compliant with anti-degradation standards. However, as noted above it should be recognized that the post-dredge surface is not typical. It reflects material that has either deposited in or on top of the keyway and which is routinely remobilized by currents and prop wash.

Moreover, it should be acknowledged that the port lacks a cost-effective short term remedy in this instance. To wit, removal of portions of the rock keyway to permit remedial measures would destabilize the slope and necessitate the installation of a more complex retaining wall. The port does not think this would be a practical or appropriate requirement in advance of the completion of the ongoing SRI/FS for the East Waterway. This clearly would tip over into long term cleanup solutions rather than anti-degradation compliance.

In light of the above, the port proposes that the resolution of the perceived anti-degradation issue at T-18 is best met by focusing on the longer term remedies that will be determined though the current SRI/FS process. To that end, the Port has revised the East Waterway Subsurface Sampling QAPP to include additional sampling to better understand contamination issues revealed by the T-18 maintenance dredging project. These revisions were discussed and agreed to by the EPA and Corps of Engineers at a meeting held outside the DMMP process on February 18, 2010. The Port proposes to take no other action to address anti-degradation issues at T-18.

Terminal 5

Currently, the port is proposing to perform maintenance dredging at Terminal 5, from station 9+00 to 19+00 (Berth 2) in two separate DMMUs. This is Phase I of a multi-phase 10 year dredging program. Analysis of Z-layer samples collected for this phase have revealed that the post-dredge surface will exceed sediment management standards for some contaminants, though it should be noted that levels are comparable to the pre-dredge surface, with the exception of PCBs which are a bit higher (229 ppb in the z-layer and 152ppb in the overlying composite.)

A rock keyway may also be present under portions of Berth 2, but its extent is likely to be significantly less than at T-18. The reason for this is that the majority of it was removed when the berth was deepened from -45 MLLW to -50 MLLW several years ago. To replace the stabilizing function of the keyway, a sheet pile retaining wall was installed.

Because there is significantly less rock under Berth 2 in Terminal 5, there may be an opportunity to over-dredge and place clean sand in strategic areas to meet anti-degradation objectives. The port anticipated that this may be needed and as such requested authorization for backfilling in the submitted JARPA. However, it should be noted that the overdredging necessary to accommodate the clean sand cover would need to be assessed from an engineering perspective in the context of slope stability and the integrity of the existing retaining wall. Structural limitations of the slope and wall limit the extent of additional overdredging that is possible.

As discussed at the DMMP meeting on March 4, we again point out that sediments under the T-5 cargo berths tend to move around and accumulate at the toe of the sheet pile wall as a result of prop wash and underpier sloughing. Because of this phenomenon, any sand placed as an anti-degradation measure would not act as a stable 'cap'. Some of it would mix in to the post-dredge surface while some would be mobilized and end up being dredged in a future maintenance event. In either case, it would still further the DMMP's anti-degradation objectives by mixing into the post-dredge surface and diluting contamination, but only marginally and at a high cost.

Given the availability of a clean sand cover as an anti-degradation remedy, the issue at T-5 would be best addressed by a proposal that includes sampling the post-dredge surface, then undertaking the above described sand cover strategy depending on what the sampling reveals. If the engineering analysis is favorable, we would propose to include up to 1.0’ of overdepth in the dredge design to accommodate a nominal 6” cover of clean sand (6”-12”). This strategy of post-dredge sampling would provide us with better data upon which to base decisions and is also better suited to reflect dredge residuals as well as contamination at the level of the actual post-dredge surface (Z-layer). A secondary benefit of this strategy is that we would have the information gathered during the dredging event about the presence and location of keyway rock. This information could be helpful to qualitatively assess whether and how much rock may be remaining in the post-dredge sediments.

Summary of T-18 Proposal

The port proposes to revise the subsurface sampling QAPP for the East Waterway to include additional sampling for a better understanding of TBT levels in and around T-18. Based on the atypical nature of the post-dredge surface, which includes substantial amounts of structural keyway rock, in addition to the inavailability of practicable remedies, the Port takes no further action in the context of anti-degradation compliance. The port acknowledges that contamination at T-18 will need to be addressed in the ongoing CERCLA SRI/FS for East Waterway and may require long term remedial solutions.

Summary of T-5 Proposal

The port's proposed path forward involves a series of steps:

1. The port will assess the stability of the retaining wall and slope in Berth 2 to verify the extent to which overdredging can occur to accommodate the placement of clean sand cover.
2. If the engineering analysis determines that 1.0' of overdepth dredging is feasible without compromising the structural integrity of the retaining wall and slope, the port will design the dredging project to include sufficient overdepth to accommodate a 6" minimum thickness cover of clean sand.
3. The port will revise the Sampling and Analysis Plan to include several post-dredge grab samples for the current phase of dredging (Berth 2- Station 9+00 to 19+00).
4. If samples do not meet DMMP guidelines for anti-degradation, the port will undertake the placement of of the clean sand cover over the dredge area.

We are confident that this strategy of pre-accomodation for clean sand cover (if structurally permitted), along with post-dredge sampling to characterize the extent and magnitude of areas exceeding sediment management standards within the dredge footprint, adequately meets our responsibilities under the Clean Water Act and Washington State anti-degradation standards. Moreover, this strategy for post-dredge sampling will provide us with better data upon which to base decisions and is also better suited to reflect dredge residuals as well as contamination at the level of the actual post-dredge surface (z-layer). Please recognize that this proposal is independent of future phases, which may or may not require similar remedies depending on the project-specific circumstances that exist.

The port is confident that the above proposed solutions provide a reasonable path forward that will balance our long term business and environmental objectives without forcing us to commit to costly and potentially counter-productive short term remedies.

Sincerely,

Jon Sloan
Seaport Environmental Programs

c Catherine Chu, Port of Seattle
Doug Hotchkiss, Port of Seattle
Paul Meyer, Port of Seattle
Tad Deshler, Windward Environmental
Paul Fuglevand, Dalton, Olmsted and Fuglevand
Nancy Case O'bourke, Dalton, Olmsted and Fugle