MEMORANDUM FOR RECORD

SUBJECT: DETERMINATION ON THE SUITABILITY OF MATERIAL TESTED FOR THE PORT OF ANACORTES PIER 2 AND CURTIS WHARF MAINTENANCE DREDGING PROJECT, ANACORTES, WASHINGTON (Regulatory Application #:NWS-2013-00056) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL.

1. The following summary reflects the consensus suitability determination of the Agencies that comprise the regional Dredged Material Management Program (DMMP) for the State of Washington on testing conducted for the evaluation of sediments within the Port of Anacortes Pier 2 and Curtis Wharf maintenance dredging projects in Anacortes, Washington, (**Figure 1, Vicinity map**). This characterization evaluates approximately 8,700 cubic yards (cy) of maintenance material within the Pier 2 maintenance dredging area, and 4,800 cy within the Curtis Wharf maintenance dredging area, for unconfined open-water disposal at either the Rosario Strait dispersive site or the Port Gardner non-dispersive site.

2. **Table 1** documents the regulatory tracking information and dates for the DMMP testing conducted.

Table 1. Regulatory Tracking Information and Dates

SAP submittal date	August 27, 2012
SAP approval date:	September 4, 2012
Sampling date(s):	November 13, 2012 (Curtis Wharf) November 14-16, 2012 (Pier 2)
Characterization Report submittal:	February 20, 2013
Volume Tested (# DMMUs), Sampling Method:	**Pier 2**: 8,700 cy (3 sampling stations composited for 1 surface DMMU & 1 subsurface DMMU **Curtis Wharf**: 4,800 cy (2 sampling stations, composited for 1 surface DMMU & 1 subsurface DMMU) Hollow Stem Auger (HAS)
DAIS Tracking Number:	PA2CW-1-A-F-332
Regulatory Application Number:	2013-00056
Recency Determination Dates: **Curtis Wharf Area Rank Moderate** = 5 **years** **Pier 2 Area Rank High =** 2 years	 November 2017 (Moderate) November 2014 (High)

Background:

3. Maintenance dredging at both locations has become necessary to minimize the potential for grounding of vessels moored at these facilities during lower tides. Both project areas are located along the southern shoreline of Guemes Channel. Guemes Channel is a narrow pass separating Guemes Island from Fidalgo Island and connecting the Rosario Strait with Fidalgo Bay and Padilla Bay (see Figure 1, vicinity map).

Table 2. Pier 2 and Curtis Wharf Characterization Approach Sampling Summary.

Project Area	Layer	Number of DMMUs	Dredged Material Volume (cy)	Number of sample cores
Pier 2	Surface DMMU P2-1-A-Comp*	1	5,800	3
	Subsurface DMMU P2-1-B-Comp	1	2,900	3
	Z-layer P2-1-Z-Comp		--	3
Curtis Wharf	Surface DMMU CW-1-A-Comp	1	3,700	2
	Subsurface DMMU CW-1-B-Comp	1	1,100	2
	Z-layer CW-1-Z-Comp		--	2

* Following initial chemistry results, the composited Pier 2 surface DMMU was separated into its three discrete sample components for additional TBT testing/DMMU refinement. These discrete DMMUs are P2-1-A (discrete), P2-2-A (discrete)(combined volume for P2-1-A + P2-2-A = 3,250 cy), and P2-3-A (discrete: volume = 2,550 cy).

Table 3. Pier 2 and Curtis Wharf Sample Coordinates, Design and Mudline Elevations.

Project Area	Sediment Core Location[1]	Sampling Date	Latitude and Longitude Coordinates		Design Elevation (feet, MLLW)	Mudline Elevation (feet, MLLW)
			Latitude	Longitude		
Pier 2	P2-1-1	11/14/2012	48^0 31' 19.8078"	-122^0 36'29.142"	-44 + 1 (AOD*)	-40.6
	P2-1-2	11/15/2012	48^0 31' 19.7646"	-122^0 36'25.2894"	-44 + 1 (AOD)	-40.7
	P2-1-3	11/16/2012	48^0 31' 19.6962"	-122^0 36'19.296"	-44 + 1 (AOD)	-39.5
Curtis Wharf	CW-1-1	11/13/2012	48^0 31' 18.2886"	-122^0 36'55.353"	-30 + 1 (AOD)	-26.0
	CW-1-2	11/13/2012	48^0 31' 19.0878"	-122^0 36'52.3836"	-30 + 1 (AOD)	-27.5

*AOD = Allowable Overdepth Dredging

4. The project was ranked **Moderate** for the DMMP characterization. The SAP was submitted to the DMMP agencies for review/approval on August 27, 2012, and approved by the DMMP agencies on September 4, 2012 with minor revisions (See **Table 1**).

[1] NAD83 = 1983 North American Datum

Sampling:

5. **Figure 2 and Tables 2-3** depict the three Hollow Stem Auger core sampling locations at Pier 2, and **Figure 3** and **Tables 2-3** depict the two HSA core sampling locations at Curtis Wharf. At Pier 2, three core stations were sampled and composited for a single surface DMMU (P2-1-A-Comp), and three subsurface samples at the same core locations were composited for a single subsurface DMMU (P2-1-B-Comp). At Curtis Wharf, two core samples were composited for a single surface DMMU (CW-1-A-Comp), and two subsurface samples at the same core locations were composited for a single subsurface DMMU (CW-1-B-Comp). The samples at both locations were collected between November 13-16, 2012 (**Table 3**), and submitted to the testing laboratory for analysis.

6. After the initial chemical data analyses were completed, the contractor (Dr. John Hertzog, Geoengineers, Inc.) coordinated the initial TBT porewater result for the surface DMMU at Pier 2 with the DMMP agencies, which was quantitated at 0.38 µg/L, an exceedance of the SL and BT, both set at 0.15 ug/L. The applicant proposed breaking up the DMMU into its three subareas relative to core sampling stations to analyze the three archived discrete core samples comprising the composited DMMU, to see if the TBT contamination was isolated in one or more of the three subsamples. The holding time for the three samples was exceeded (53-55 days), and was a concern for the DMMP agencies, but after deliberation, the DMMP agencies allowed these analyses to be conducted using best-professional-judgment (BPJ). The Data Characterization report documenting the initial analyses for the four initial DMMUs and the analyses of the three discrete subsamples for TBT for the Pier 2 surface DMMU (which became DMMUs P2-1-A (discrete), P2-2-A (discrete), and P2-3-A (discrete) was submitted to the DMMP agencies for review on February 20, 2013. The DMMP agencies concluded, after reviewing the data validation report, that the data was acceptable for decision-making using best professional judgment.

Chemical Testing Results:

7. The conventional and DMMP chemical analyses results are summarized in **Table 4.** It was noteworthy that the TOCs were uniformly low in all samples ranging from 0.125 % to 0.297 %. Because the TOCs were below 0.5%[2], carbon normalizing the dry weight chemicals was not performed for the SMS evaluation summary. Dioxin/furans were low, and all were quantitated below the DMMP dispersive disposal site screening level (SL) guideline (4 pptr) at both dredging locations, ranging from 0.076 to 0.151 pptr-TEQ, and are discussed further below.

8. **Pier 2 summary.** TBT porewater concentrations were quantitated at **0.38 µg/L** in Pier 2 surface **DMMU P2-1-A-Comp,** which exceeds both the screening level (SL) and bioaccumulation trigger (BT) of 0.15 ug/L. As described in paragraph 6 above, analyses of the three discrete archived samples comprising this DMMU, demonstrated elevated TBT in P2-1-A (**4.9 µg/L-**porewater**; 280 µg/kg-**bulk**)**, and P2-2-A (**0.45 µg/L**-porewater**; 91 µg/kg-**bulk**),** with the third sample, P2-3-A below the TBT screening level (**0.02 µg/L-**porewater**; 10 µg/kg-**bulk).

   There were no other chemicals exceeding DMMP marine screening levels and bioaccumulation guidelines at Pier 2. No chemicals exceeded the maximum levels. The applicant elected not to

[2] SMS does not recommend carbon normalizing chemicals when TOCs are below 0.5 %, and use dry weight values to assess SMS SQS and CSL exceedances.

perform necessary bioaccumulation testing to assess TBT BT exceedances in the initial TBT exceedance in DMMU-P2-1-A-Comp, or for the two discrete samples for TBT (P2-1-A and P2-2-A), and therefore, without this testing, all the proposed surface dredged material except for P2-3-A is unsuitable for unconfined-open-water disposal. All Pier 2 subsurface dredged material is suitable for unconfined-open-water disposal.

9. **Curtis Wharf summary.** There were no chemicals exceeding DMMP marine screening levels and bioaccumulation guidelines at Curtis Wharf, therefore all proposed surface and subsurface dredged material is suitable for unconfined-open-water disposal.

10. Evaluation of these data for the four initial DMMUs relative to SMS guidelines for compounds not normalized to organic carbon (see **Table 4**), indicate that there were no Sediment Quality Standard (SQS) exceedances (other than TBT) within the Pier 2 and no exceedances within the Curtis Wharf dredging area. All chemicals were below SMS dry weight values for SQS.

11. **Dioxin Interim Interpretative Framework.** The DMMP implemented new interim guidelines for interpreting dioxin data implemented on December 6, 2010. These are summarized below for both dispersive and non-dispersive disposal sites (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/New_Interim_Guidelines_for_Dioxins.pdf):

    a. **Dispersive Screening Levels**. DMMUs with dioxin concentrations below 4 pptr-TEQ will be allowed for open-water disposal at dispersive sites.

    b. **Nondispersive Screening Levels.** DMMUs with dioxin concentrations below 10 pptr-TEQ will be allowed for open-water disposal as long as the volume-weighted average concentration of dioxins in material from the entire dredging project does not exceed the Disposal Site Management Objective of 4 pptr-TEQ.

12. **Dioxin Interpretation on Suitability for Unconfined-Open-Water Disposal**. As summarized in paragraph 7 and Table 5, all four DMMUs were all quantitated well below the **4 pptr-TEQ** SL, the upper dioxin guideline limit for dispersive disposal, and non-dispersive site disposal (after volume weighted averaging), and below the DMMP BT of **10 pptr-TEQ**.

13. **Antidegradation.** Both Z-samples (P2-1-Z-Comp and CW-1-Z-Comp) were analyzed to assess antidegradation, and all SMS chemicals (including TBT and dioxin/furans) were below SQS (**Tables 4 and 5**). The DMMP agencies concluded that the concentrations of chemicals, including TBT, in the exposed surface were well below the DMMP SLs and the SMS SQS. The DMMP agencies used best-professional-judgment (BPJ) to conclude that the exposed surface would not exceed antidegradation based on these testing results.

Suitability Determination:

14. Therefore, the DMMP agencies conclude based on these testing results that the 3,250 cy of maintenance dredged material characterized by two of the three discrete surface samples (P2-1-A and P2-2-A) that originally comprised surface DMMU P2-1-A-Comp are unsuitable for unconfined open-water disposal at either dispersive or non-dispersive DMMP disposal sites. This is based on these testing results, lack of required bioaccumulation testing, and use of best professional judgment (BPJ). The remaining material at Pier 2 comprising 2,550 cy represented by discrete surface sample P2-3-A and all 2,900 cy of Pier 2 subsurface material (P2-1-B-

Composite), and the 4,800 cy of material at Curtis Wharf are suitable for either dispersive and/or non-dispersive site disposal.

15. Based on these TBT testing results, future DMMP characterizations will require testing at Pier 2 project at a **High Rank**.

16. This memorandum documents the suitability of material proposed for dredging from the Port of Anacortes Pier 2 and Curtis Wharf Dredging Projects, Anacortes, Washington, for open-water disposal. 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. Due to elevated TBT discovered in portions of the Pier 2 prism, the applicant should specifically coordinate with Ecology on this issue to ensure any water quality concerns can be anticipated and met during dredging operations. A final permit 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.

SUBJECT: DETERMINATION ON THE SUITABILITY OF MATERIAL TESTED FOR THE PORT OF ANACORTES PIER 2 AND CURTIS WHARF MAINTENANCE DREDGING PROJECT, ANACORTES, WASHINGTON EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL.

Signed SDM is on File in DMMO Project File

Concur:

_____	_____
Date	David Kendall, Ph.D., Seattle District Corps of Engineers
_____	_____
Date	Laura Inouye, Ph.D., Washington Department of Ecology
_____	_____
Date	Justine Barton, Environmental Protection Agency, Region 10
_____	_____
Date	Celia Barton, Washington Department of Natural Resources

Erin Legge, Corps Regulatory Project Manager
Laura Inouye, Ph.D., Ecology
Justine Barton, EPA
Celia Barton, DNR
DMMO File

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Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps

Projection: NAD 1983 UTM Zone 10N

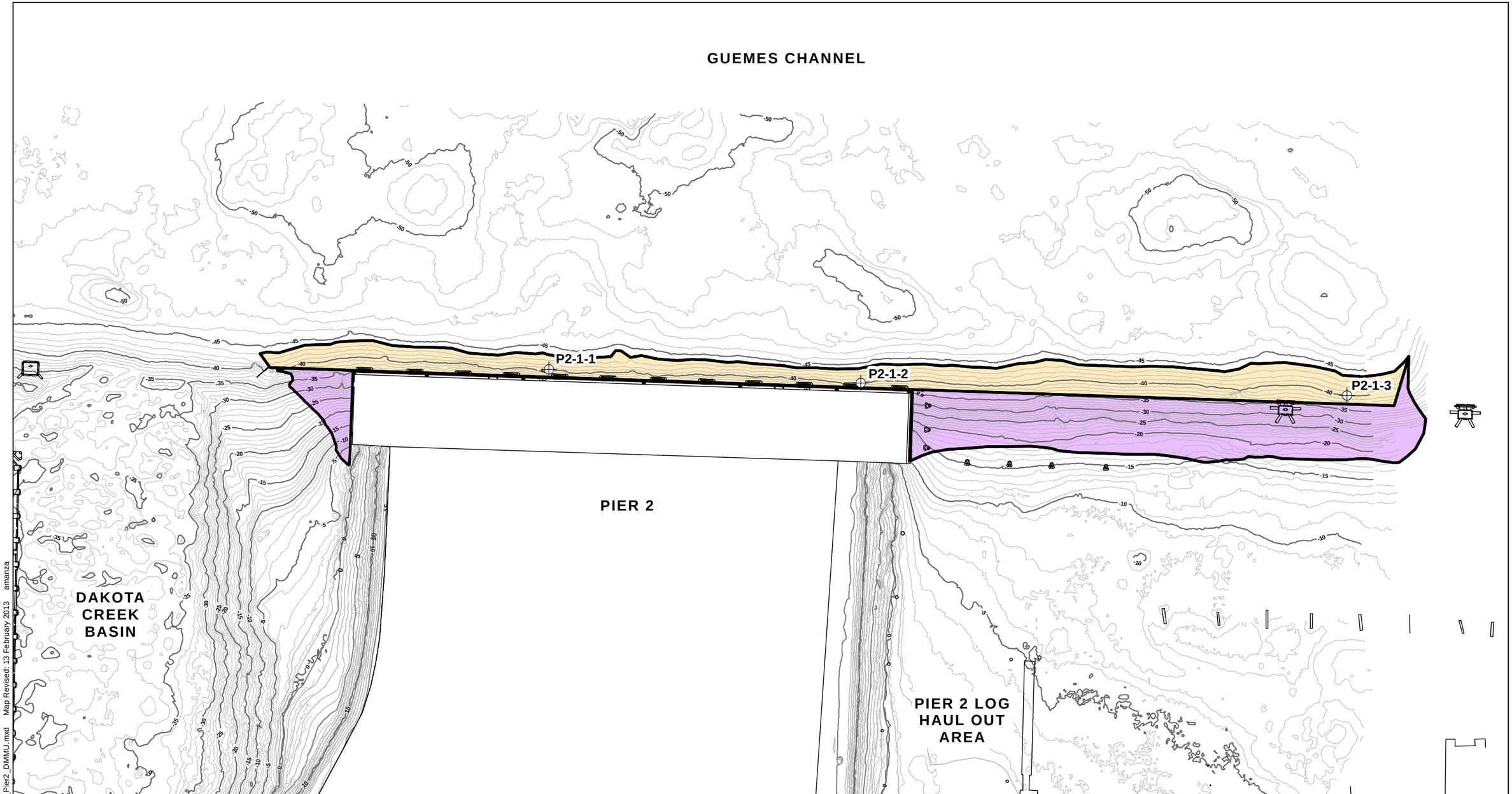
Vicinity Map

Port of Anacortes
Anacortes, Washington

GEOENGINEERS

Figure 1

Path: \\sea\projects\5\5147023\GIS\5147023OO_VicinityMap.mxd Map Revised: 31 January 2013 amanza



0 40 80 160
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LEGEND

- SEDIMENT SAMPLE LOCATION (GEOENGINEERS, 2012)
- EXISTING PIER FEATURES
- EXISTING BATHYMETRY CONTOURS
- PIER 2 DREDGING PROJECT DMMU
- AREA OF TRANSITION SLOPE TO EXISTING GROUND SURFACE
- AREA TO BE DREDGED TO EL. -45FT MLLW

MLLW = MEAN LOWER LOW WATER
DMMU = DREDGED MATERIAL MANAGEMENT UNIT

Pier 2 Dredging Project

Port of Anacortes
Anacortes, Washington

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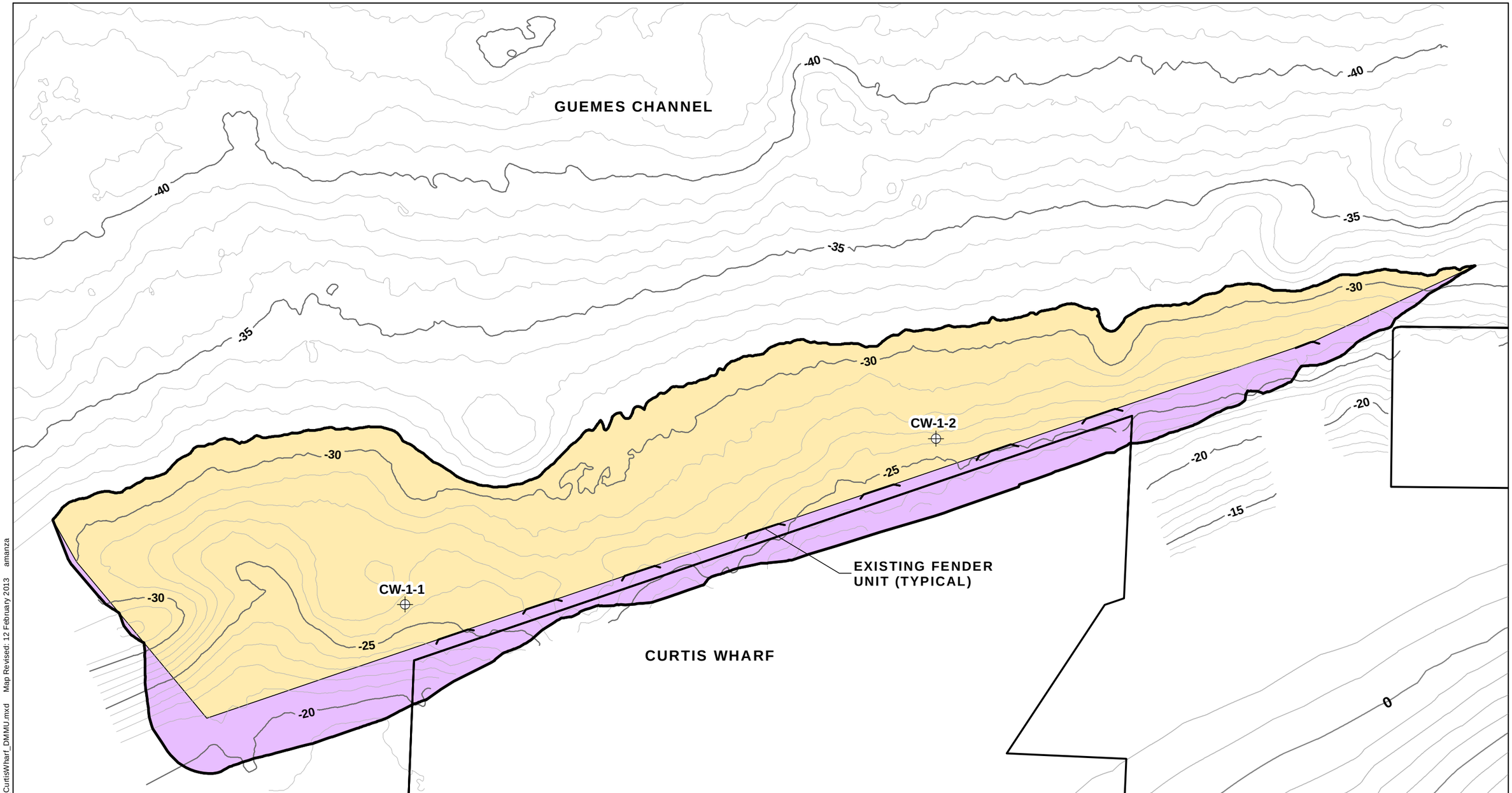
Figure 2

Path: \\sea\projects\5\5147023\GIS\5147023001_Pier2_DMMU.mxd Map Revised: 13 February 2013 amanza



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LEGEND

- SEDIMENT SAMPLE LOCATION (GEOENGINEERS, 2012)
- EXISTING BATHYMETRIC CONTOURS
- CURTIS WHARF DREDGING PROJECT DMMU
- AREA OF 2:1 TRANSITION SLOPE TO EXISTING GROUND SURFACE
- AREA TO BE DREDGED TO EL. -31FT MLLW

MLLW = MEAN LOWER LOW WATER

DMMU = DREDGED MATERIAL MANAGEMENT UNIT

Curtis Wharf Dredging Project

Port of Anacortes
Anacortes, Washington

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Figure 3

Path: \\sea\projects\5\5147023\GIS\5147023\01_CurtisWharf_DMMU.mxd Map Revised: 12 February 2013 amanza

Table 4. DMMP Characterization Results Summary for DMMU Sediment Samples collected for the Port of Anacortes Pier 2 and Curtis Wharf Project, Anacortes, WA

Chemical Name	DMMP Guidelines				SMS Guidelines			P2-1-A-Comp			P2-1-B-Comp			P2-1-Z-Comp			P2-1-A			P2-2-A		
	Unit	SL	ML	BT	Unit	SQS	CSL	Surface / composite		VQ	Subsurface / composite		VQ	Z-layer / composite		VQ	Surface / Discrete		VQ	Surface / Discrete		VQ
								DMMP	SMS		DMMP	SMS		DMMP	SMS		DMMP	SMS		DMMP	SMS	
Metals								dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm	
Antimony	mg/kg dw	150	200	-		--	--	**6**		J	**6**		J	**6**		J						
Arsenic	mg/kg dw	57	700	507.1	mg/kg	57	93	6		U	6		U	6		U						
Cadmium	mg/kg dw	5.1	14	11.3	mg/kg	5.1	6.7	**0.3**			**0.3**			0.2		U						
Chromium	mg/kg dw	260	-	260	mg/kg	260	270	**26.5**		J	**19**		J	**19.9**		J						
Copper	mg/kg dw	390	1300	1027	mg/kg	390	390	**22.2**			**16.2**			**14.5**								
Lead	mg/kg dw	450	1200	975	mg/kg	450	530	**4**			2		U	**4**								
Mercury	mg/kg dw	0.41	2.3	1.5	mg/kg	0.41	0.59	0.03		U	0.03		U	0.02		U						
Selenium	mg/kg dw	-	-	3	mg/kg	--	--	0.6		U	0.6		U	0.6		U						
Silver	mg/kg dw	6.1	8.4	6.1	mg/kg	6.1	6.1	**0.4**			0.4		U	0.3		U						
Zinc	mg/kg dw	410	3800	2783	mg/kg	410	960	**48**			**32**			**30**								
Tributyltin ion (interstitial water)	µg/L	0.15	--	0.15				**0.38**			--			--			**4.9**			**0.45**		
Tributiltin ion (bulk)	µg/kg dw	73	--	73				--			**3.7**			**2.9**		J	**280**			**91**		
PAHs																						
Total LPAHs	µg/kg dw	5200	29000	-	mg/kg-OC	370	780	**35**		J	18		U	19		U						
Naphthalene	µg/kg dw	2100	2400	-	mg/kg-OC	99	170	**17**		J	18		U	19		U						
Acenaphthylene	µg/kg dw	560	1300	-	mg/kg-OC	66	66	19		U	18		U	19		U						
Acenaphthene	µg/kg dw	500	2000	-	mg/kg-OC	16	57	19		U	18		U	19		U						
Fluorene	µg/kg dw	540	3600	-	mg/kg-OC	23	79	19		U	18		U	19		U						
Phenanthrene	µg/kg dw	1500	21000	-	mg/kg-OC	100	480	**18**		J	18		U	19		U						
Anthracene	µg/kg dw	960	13000	-	mg/kg-OC	220	1,200	19		U	18		U	19		U						
2-Methylnaphthalene	µg/kg dw	670	1900	-	mg/kg-OC	38	64	19		U	18		U	19		U						
Total HPAHs	µg/kg dw	12000	69000	-	mg/kg-OC	960	5,300	**539**			**10**		J	37		U						
Fluoranthene	µg/kg dw	1700	30000	4600	mg/kg-OC	160	1,200	**26**			18		U	19		U						
Pyrene	µg/kg dw	2600	16000	11980	mg/kg-OC	1,000	1,400	**250**			**10**		J	19		U						
Benzo(a)anthracene	µg/kg dw	1300	5100	-	mg/kg-OC	110	270	**15**		J	18		U	19		U						
Chrysene	µg/kg dw	1400	21000	-	mg/kg-OC	110	460	**30**			18		U	19		U						
Benzofluoranthene (b,j,k)	µg/kg dw	3200	9900	-	mg/kg/OC	230	450	**100**			37		U	37		U						
Benzo(a)pyrene	µg/kg dw	1600	3600	-	mg/kg-OC	99	210	**58**			18		U	19		U						
Indeno(1,2,3-cd)pyrene	µg/kg dw	600	4400	-	mg/kg-OC	34	88	**19**			18		U	19		U						
Dibenzo(a,h)anthracene	µg/kg dw	230	1900	-	mg/kg-OC	12	33	**15**			18		U	19		U						
Benzo(g,h,i)perylene	µg/kg dw	670	3200	-	mg/kg-OC	31	78	**26**			18		U	19		U						
Chlorinated Hydrocarbons																						
1,4-Dichlorobenzene	µg/kg dw	110	120	-	mg/kg-OC	3.1	9.0	3.2		J	4.6		U	4.6		U						
1,2-Dichlorobenzene	µg/kg dw	35	110	-	mg/kg-OC	2.3	2.3	4.7		U	4.6		U	4.6		U						
1,2,4-Trichlorobenzene	µg/kg dw	31	64	-	mg/kg-OC	0.81	1.8	4.7		U	4.6		U	4.6		U						
Hexachlorobenzene	µg/kg dw	22	230	168	mg/kg-OC	0.38	2.3	4.7		U	4.6		U	4.6		U						
Phthalates																						
Dimethyl phthalate	µg/kg dw	71	1400	-	mg/kg-OC	53.0	53.0	4.7		U	4.6		U	4.6		U						
Diethyl phthalate	µg/kg dw	200	1200	-	mg/kg-OC	61	110	4.7		U	4.6		U	4.6		U						
Di-n-butyl phthalate	µg/kg dw	-	-	-	mg/kg-OC	220	1,700	19		U	18		U	19		U						
Butyl benzyl phthalate	µg/kg dw	63	970	-	mg/kg-OC	4.9	64	4.7		U	4.6		U	4.6		U						
Bis(2-ethylhexyl) phthalate	µg/kg dw	1300	8300	-	mg/kg-OC	47	78	34		U	24		U	27		U						
Di-n-octyl phthalate	µg/kg dw	6200	6200	-	mg/kg-OC	58	4,500	19		U	18		U	19		U						
Phenols																						
Phenol	µg/kg dw	420	1200		ug/kg	420	1,200	19		U	18		U	19		U						
2-Methylphenol	µg/kg dw	63	77	-	ug/kg	63	63	4.7		U	4.6		U	4.6		U						
4-Methylphenol	µg/kg dw	670	3600	-	ug/kg	670	670	38		U	37		U	37		U						
2,4-Dimethylphenol	µg/kg dw	29	210	-	ug/kg	29	29	19		U	18		U	19		U						
Pentachlorophenol	µg/kg dw	400	690	504	ug/kg	360	690	47		U	46		U	46		U						
Miscellaneous Extractables																						
Benzyl Alcohol	µg/kg dw	57	870	-	ug/kg	57	73	19		U	18		U	19		U						
Benzoic Acid	µg/kg dw	650	760	-	ug/kg	650	650	380		U	370		U	370		U						
Dibenzofuran	µg/kg dw	540	1700	-	mg/kg-OC	15	58	19		U	18		U	19		U						
Hexachlorobutadiene	µg/kg dw	11	270	-	mg/kg-OC	3.9	6.2	4.7		U	4.6		U	4.6		U						
N-Nitrosodiphenylamine	µg/kg dw	28	130	-	mg/kg-OC	11	11	19		U	18		U	19		U						
Pesticides																						
4,4'-DDD	µg/kg dw	16	-	-		--	--	0.97		U	0.96		U	0.96		U						
4,4'-DDE	µg/kg dw	9	-	-		--	--	0.97		U	0.96		U	0.96		U						
4,4'-DDT	µg/kg dw	12	-	-		--	--	0.97		U	0.96		U	0.96		U						
Sum of 4,4"DDD,4,4'-DDE and 4,4'-DDT	µg/kg dw		69	50		--	--	0.97		U	0.96		U	0.96		U						
Aldrin	µg/kg dw	9.5	-	-		--	--	0.48		U	0.48		U	0.48		U						
Total chlordane (sum of cis, trans, cis-nonachlor, trans-nonachlor, oxychlordane)	µg/kg dw	2.8		37		--	--	0.97		U	0.96		U	0.96		U						
Dieldrin	µg/kg dw	1.9	-	-		--	--	0.97		U	0.96		U	0.96		U						
Heptachlor	µg/kg dw	1.5	-	-		--	--	0.48		U	0.48		U	0.48		U						
PCB Aroclors																						
Aroclor 1016	µg/kg dw	-	-	-		--	--															
Aroclor 1221	µg/kg dw	-	-	-		--	--															
Aroclor 1232	µg/kg dw	-	-	-		--	--															
Aroclor 1242	µg/kg dw	-	-	-		--	--															

Table 4. DMMP Characterization Results Summary for DMMU Sediment Samples collected for the Port of Anacortes Pier 2 and Curtis Wharf Project, Anacortes, WA

Chemical Name	DMMP Guidelines				SMS Guidelines			P2-1-A-Comp			P2-1-B-Comp			P2-1-Z-Comp			P2-1-A			P2-2-A		
	Unit	SL	ML	BT	Unit	SQS	CSL	Surface / composite		VQ	Subsurface / composite		VQ	Z-layer / composite		VQ	Surface / Discrete		VQ	Surface / Discrete		VQ
								DMMP	SMS		DMMP	SMS		DMMP	SMS		DMMP	SMS		DMMP	SMS	
Metals								dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm	
Aroclor 1248	µg/kg dw	-	-	-		--	--															
Aroclor 1254	µg/kg dw	-	-	-		--	--															
Aroclor 1260	µg/kg dw	-	-	-		--	--															
Aroclor 1262	µg/kg dw	-	-	-		--	--															
Aroclor 1268	µg/kg dw	-	-	-		--	--															
Total PCBs	µg/kg dw	130	3100	-	mg/kg/OC	**12.0**	**65.0**	3.8		U	3.8		U	3.8		U						
Total PCBs	mg/kg OC	-	-	38																		
Dioxin (TEQ: see Table 4 for detailed congener specific results)	**mg/kg**							**0.151**			**0.076**			**0.085**								
Total Solids	ng/kg							**79.4**			**80.5**			**82.1**								
Total Volatile Solids	%							**1.83**			**1.37**			**1.14**								
Total Organic Carbon	%							**0.21**			**0.125**			**0.145**								
Total Ammonia	%							**2.24**			**0.87**			**0.93**								
Total Sulfides	mg/kg							**94**			1.24		U	**1.21**		U						
Gravel	mg/kg							**1.2**			**0.3**			**0.2**								
Sand	%							**39.8**			**50.7**			**53.9**								
Silt	%							**50.9**			**44.5**			**39.3**								
Clay	%							**8.2**			**4.5**			**7**								
Fines (percent silt + clay)	%							**59.1**			**49**			**46.3**								
Bioassay Determination: **(P/F)**	%							**NA**			**NA**			**NA**			**NA**			**NA**		
BTs exceeded: Y/N								**Y**			**N**			**N**			**Y**			**Y**		
Bioaccumulation conducted: Y/N								**N**			**N**			**N**			**N**			**N**		
Bioaccumulation Determination: **(P/F)**								**NA**									**NA**			**NA**		
ML Rule exceeded: Y/N								**N**			**N**			**N**			**N**			**N**		
PSDDA Determination: (Suitable/Unsuitable)								**Unsuitable**			**Suitable**			**AD Comp.**			**Unsuitable**			**Unsuitable**		
DMMU Volume: (cy)								**5,800**			**2,900**			--			**3,250**					
Rank (Low = L, Moderate = M, Low-Moderate =LM, High = H)								**M**			**M**			**M**			**H**			**H**		
Mean Core sampling depth (ft)	cm							5.7			5.7			2			5.4			5.3		
DMMU ID:								**P2-1-A-Comp**			**P2-1-B-Comp**			**P2-1-Z-Comp**			**P2-1-A**			**P2-2-A**		

Legend:
VQ = Validation Qualifier
NA = not accomplished
BT = bioaccumulation trigger
SL = screening level
ML = maximum level
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DMMP = dredged material management program
DMMU = dredged material management unit
dw = dry weight
HPAHs = high molecular weight polycyclic aromatic hydrocarbons
LPAHs = low molecular weight polycyclic aromatic hydrocarbons
OC = organic carbon normalized
PCBs = polychlorinated biphenyls
RL = reporting limit

Table 4. DMMP Characterization Results Summary for DMMU Sediment Samples collected for the Port of Anacortes Pier 2 and Curtis Wharf Project, Anacortes, WA

Chemical Name	DMMP Guidelines				SMS Guidelines			P2-3-A			CW-1-A-Comp			CW-1-B-Comp			CW-1-Z-Comp		
	Unit	SL	ML	BT	Unit	SQS	CSL	Surface / Discrete		VQ	Surface / Composite		VQ	Subsurface / composite		VQ	Z-layer / composite		VQ
								DMMP	SMS		DMMP	SMS		DMMP	SMS		DMMP	SMS	
Metals								dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm	
Antimony	mg/kg dw	150	200	-		--	--				**6**		J	**6**		J	**6**		J
Arsenic	mg/kg dw	57	700	507.1	mg/kg	57	93				6		U	6		U	6		U
Cadmium	mg/kg dw	5.1	14	11.3	mg/kg	5.1	6.7				**0.2**			**0.3**			**0.3**		
Chromium	mg/kg dw	260	-	260	mg/kg	260	270				**27.8**		J	**64.7**		J	**55.6**		J
Copper	mg/kg dw	390	1300	1027	mg/kg	390	390				**7.9**			**17.4**			**25.5**		
Lead	mg/kg dw	450	1200	975	mg/kg	450	530				2		U	2		U	**3**		
Mercury	mg/kg dw	0.41	2.3	1.5	mg/kg	0.41	0.59				0.02		U	0.02		U	**0.04**		
Selenium	mg/kg dw	-	-	3	mg/kg	--	--				0.6		U	0.6		U	**0.7**		
Silver	mg/kg dw	6.1	8.4	6.1	mg/kg	6.1	6.1				0.3		U	0.4		U	0.4		U
Zinc	mg/kg dw	410	3800	2783	mg/kg	410	960				**25**			**35**			**48**		
Tributyltin ion (interstitial water)	µg/L	0.15	--	0.15				**0.02**			--			0.005		U	--		
Tributiltin ion (bulk)	µg/kg dw	73	--	73				**10**			3.7		U	--			3.4		U
PAHs																			
Total LPAHs	µg/kg dw	5200	29000	-	mg/kg-OC	370	780				19		U	19		U	19		U
Naphthalene	µg/kg dw	2100	2400	-	mg/kg-OC	99	170				19		U	19		U	19		U
Acenaphthylene	µg/kg dw	560	1300	-	mg/kg-OC	66	66				19		U	19		U	19		U
Acenaphthene	µg/kg dw	500	2000	-	mg/kg-OC	16	57				19		U	19		U	19		U
Fluorene	µg/kg dw	540	3600	-	mg/kg-OC	23	79				19		U	19		U	19		U
Phenanthrene	µg/kg dw	1500	21000	-	mg/kg-OC	100	480				19		U	19		U	19		U
Anthracene	µg/kg dw	960	13000	-	mg/kg-OC	220	1,200				19		U	19		U	19		U
2-Methylnaphthalene	µg/kg dw	670	1900	-	mg/kg-OC	38	64				19		U	19		U	19		U
Total HPAHs	µg/kg dw	12000	69000	-	mg/kg-OC	960	5,300				38		U	38		U	39		U
Fluoranthene	µg/kg dw	1700	30000	4600	mg/kg-OC	160	1,200				19		U	19		U	19		U
Pyrene	µg/kg dw	2600	16000	11980	mg/kg-OC	1,000	1,400				19		U	19		U	19		U
Benzo(a)anthracene	µg/kg dw	1300	5100	-	mg/kg-OC	110	270				19		U	19		U	19		U
Chrysene	µg/kg dw	1400	21000	-	mg/kg-OC	110	460				19		U	19		U	19		U
Benzofluoranthene (b,j,k)	µg/kg dw	3200	9900	-	mg/kg/OC	230	450				38		U	38		U	39		U
Benzo(a)pyrene	µg/kg dw	1600	3600	-	mg/kg-OC	99	210				19		U	19		U	19		U
Indeno(1,2,3-cd)pyrene	µg/kg dw	600	4400	-	mg/kg-OC	34	88				19		U	19		U	19		U
Dibenzo(a,h)anthracene	µg/kg dw	230	1900	-	mg/kg-OC	12	33				4.7		U	4.8		U	4.8		U
Benzo(g,h,i)perylene	µg/kg dw	670	3200	-	mg/kg-OC	31	78				19		U	19		U	19		U
Chlorinated Hydrocarbons																			
1,4-Dichlorobenzene	µg/kg dw	110	120	-	mg/kg-OC	3.1	9.0				4.7		U	4.8		U	4.8		U
1,2-Dichlorobenzene	µg/kg dw	35	110	-	mg/kg-OC	2.3	2.3				4.7		U	4.8		U	4.8		U
1,2,4-Trichlorobenzene	µg/kg dw	31	64	-	mg/kg-OC	0.81	1.8				4.7		U	4.8		U	4.8		U
Hexachlorobenzene	µg/kg dw	22	230	168	mg/kg-OC	0.38	2.3				4.7		U	4.8		U	4.8		U
Phthalates																			
Dimethyl phthalate	µg/kg dw	71	1400	-	mg/kg-OC	53.0	53.0				4.7		U	4.8		U	4.8		U
Diethyl phthalate	µg/kg dw	200	1200	-	mg/kg-OC	61	110				**59**			48		U	48		U
Di-n-butyl phthalate	µg/kg dw	-	-	-	mg/kg-OC	220	1,700				19		U	19		U	19		U
Butyl benzyl phthalate	µg/kg dw	63	970	-	mg/kg-OC	4.9	64				4.7		U	4.8		U	4.8		U
Bis(2-ethylhexyl) phthalate	µg/kg dw	1300	8300	-	mg/kg-OC	47	78				24		U	56		U	35		U
Di-n-octyl phthalate	µg/kg dw	6200	6200	-	mg/kg-OC	58	4,500				19		U	19		U	19		U
Phenols																			
Phenol	µg/kg dw	420	1200		ug/kg	420	1,200				19		U	19		U	19		U
2-Methylphenol	µg/kg dw	63	77	-	ug/kg	63	63				4.7		U	4.8		U	4.8		U
4-Methylphenol	µg/kg dw	670	3600	-	ug/kg	670	670				38		U	38		U	39		U
2,4-Dimethylphenol	µg/kg dw	29	210	-	ug/kg	29	29				19		U	19		U	19		U
Pentachlorophenol	µg/kg dw	400	690	504	ug/kg	360	690				47		U	48		U	48		U
Miscellaneous Extractables																			
Benzyl Alcohol	µg/kg dw	57	870	-	ug/kg	57	73				19		U	19		U	19		U
Benzoic Acid	µg/kg dw	650	760	-	ug/kg	650	650				380		U	380		U	390		U
Dibenzofuran	µg/kg dw	540	1700	-	mg/kg-OC	15	58				19		U	19		U	19		U
Hexachlorobutadiene	µg/kg dw	11	270	-	mg/kg-OC	3.9	6.2				4.7		U	4.8		U	4.8		U
N-Nitrosodiphenylamine	µg/kg dw	28	130	-	mg/kg-OC	11	11				19		U	19		U	19		U
Pesticides																			
4,4'-DDD	µg/kg dw	16	-	-		--	--				0.95		U	0.98		U	0.98		U
4,4'-DDE	µg/kg dw	9	-	-		--	--				0.95		U	0.98		U	0.98		U
4,4'-DDT	µg/kg dw	12	-	-		--	--				0.95		U	0.98		U	0.98		U
Sum of 4,4"DDD,4,4'-DDE and 4,4'-DDT	µg/kg dw		69	50		--	--				0.95		U	0.98		U	0.98		U
Aldrin	µg/kg dw	9.5	-	-		--	--				0.48		U	0.49		U	0.49		U
Total chlordane (sum of cis, trans, cis-nonachlor, trans-nonachlor, oxychlordane)	µg/kg dw	2.8		37		--	--				0.95		U	0.98		U	0.98		U
Dieldrin	µg/kg dw	1.9	-	-		--	--				0.95		U	0.98		U	0.98		U
Heptachlor	µg/kg dw	1.5	-	-		--	--				0.48		U	0.49		U	0.49		U
PCB Aroclors																			
Aroclor 1016	µg/kg dw	-	-	-		--	--												
Aroclor 1221	µg/kg dw	-	-	-		--	--												
Aroclor 1232	µg/kg dw	-	-	-		--	--												
Aroclor 1242	µg/kg dw	-	-	-		--	--												

Table 4. DMMP Characterization Results Summary for DMMU Sediment Samples collected for the Port of Anacortes Pier 2 and Curtis Wharf Project, Anacortes, WA

Chemical Name	DMMP Guidelines				SMS Guidelines			P2-3-A			CW-1-A-Comp			CW-1-B-Comp			CW-1-Z-Comp		
	Unit	SL	ML	BT	Unit	SQS	CSL	Surface / Discrete		VQ	Surface / Composite		VQ	Subsurface / composite		VQ	Z-layer / composite		VQ
								DMMP	SMS		DMMP	SMS		DMMP	SMS		DMMP	SMS	
Metals								dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm	
Aroclor 1248	µg/kg dw	-	-	-		--	--												
Aroclor 1254	µg/kg dw	-	-	-		--	--												
Aroclor 1260	µg/kg dw	-	-	-		--	--												
Aroclor 1262	µg/kg dw	-	-	-		--	--												
Aroclor 1268	µg/kg dw	-	-	-		--	--												
Total PCBs	µg/kg dw	130	3100	-	mg/kg/OC	**12.0**	**65.0**				3.8		U	3.9		U	3.9		U
Total PCBs	mg/kg OC	-	-	38															
Dioxin (TEQ: see Table 4 for detailed congener specific results)	**mg/kg**										**0.08**			**0.082**			**0.078**		
Total Solids	ng/kg										**88.3**			**94.4**			**78.2**		
Total Volatile Solids	%										**0.9**			**1.48**			**1.83**		
Total Organic Carbon	%										**0.287**			**0.233**			**0.29**		
Total Ammonia	%										**0.31**			**0.21**			**0.52**		
Total Sulfides	mg/kg										**1.38**			0.96		U	1.42		U
Gravel	mg/kg										**55.4**			**28**			**31.8**		
Sand	%										**39.9**			**42.7**			**33.9**		
Silt	%										**3.2**			**16.1**			**17.3**		
Clay	%										**1.5**			**13.1**			**16.7**		
Fines (percent silt + clay)	%										**4.7**			**29.2**			**34.2**		
Bioassay Determination: **(P/F)**	%							**NA**			**NA**			**NA**			**NA**		
BTs exceeded: Y/N								**N**			**N**			**N**			**N**		
Bioaccumulation conducted: Y/N								**N**			**N**			**N**			**N**		
Bioaccumulation Determination: **(P/F)**																			
ML Rule exceeded: Y/N								**N**			**N**			**N**			**N**		
PSDDA Determination: (Suitable/Unsuitable)								**Suitable**			**Suitable**			**Suitable**			**AD Comp.**		
DMMU Volume: (cy)								**2,550**			**3,700**			**1,100**			--		
Rank (Low = L, Moderate = M, Low-Moderate =LM, High = H)								**M**			**M**			**M**			**M**		
Mean Core sampling depth (ft)	cm							6.5			5.25			5.25			2		
DMMU ID:								**P2-3-A**			**CW-1-A-Comp**			**CW-1-B-Comp**			**CW-1-Z-Comp**		

Legend:
VQ = Validation Qualifier
NA = not accomplished
BT = bioaccumulation trigger
SL = screening level
ML = maximum level
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DMMP = dredged material management program
DMMU = dredged material management unit
dw = dry weight
HPAHs = high molecular weight polycyclic aromatic hydrocarbons
LPAHs = low molecular weight polycyclic aromatic hydrocarbons
OC = organic carbon normalized
PCBs = polychlorinated biphenyls
RL = reporting limit

Table 5. Dioxin/furan Summary for the Port of Anacortes Pier 2 and Curtis Wharf maintenance dredging project.

Analyte	WHO (05) TEF	P2-1-A-Comp			P2-1-B-Comp			P2-1-Z-Comp			CW-1-A-Comp		
		ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ
2,3,7,8-TCDD	1	0.126	BJEMPC	0.06300	0.108	BJEMPC	0.054	0.116	BJEMPC	0.05800	0.124	BJEMPC	0.062
1,2,3,7,8-PeCDD	1	0.0426	U	0.02130	0.0235	U	0.01175	0.0299	U	0.01495	**0.0718**	**BJ**	**0.0718**
1,2,3,4,7,8-HxCDD	0.1	0.0542	BJEMPC	0.00271	0.0254	U	0.00127	0.0378	U	0.00189	0.0439	U	0.002195
1,2,3,6,7,8-HxCDD	0.1	**0.261**	**J**	**0.02610**	0.0254	U	0.00127	0.0299	JEMPC	0.00150	0.0439	U	0.002195
1,2,3,7,8,9-HxCDD	0.1	**0.132**	**BJ**	**0.0132**	0.0332	BJEMPC	0.00166	0.0279	BJEMPC	0.00140	0.0379	BJEMPC	0.001895
1,2,3,4,6,7,8-HpCDD	0.01	**4.89**		**0.0489**	**0.35**	**BJ**	**0.0035**	**0.394**	**BJ**	**0.00394**	**0.54**	**BJ**	**0.0054**
OCDD	0.0003	**39.5**		**0.01185**	**3.76**	**BJ**	**0.001128**	**4.31**	**BJ**	**0.001293**	**3.94**	**BJ**	**0.001182**
2,3,7,8-TCDF	0.1	**0.11**	**J**	**0.01100**	0.0117	U	0.000585	0.0159	JEMPC	0.00080	0.0279	U	0.001395
1,2,3,7,8-PeCDF	0.03	0.0561	BJEMPC	0.0008415	0.0137	U	0.0002055	**0.0398**	**BJ**	**0.001194**	**0.0638**	**BJ**	**0.001914**
2,3,4,7,8-PeCDF	0.3	0.0271	U	0.00407	0.0137	U	0.002055	0.0199	U	0.00299	0.0399	BJEMPC	0.005985
1,2,3,4,7,8-HxCDF	0.1	0.0368	BJEMPC	0.00184	0.0117	BJEMPC	0.000585	0.0139	U	0.00070	0.0179	BJEMPC	0.000895
1,2,3,6,7,8-HxCDF	0.1	0.0348	BJEMPC	0.00174	0.0156	U	0.00078	0.0139	U	0.00070	0.0239	BJEMPC	0.001195
2,3,4,6,7,8-HxCDF	0.1	**0.0426**	**J**	**0.00426**	0.0176	U	0.00088	0.0159	U	0.00080	0.0199	U	0.000995
1,2,3,7,8,9-HxCDF	0.1	0.0348	JEMPC	0.00174	0.0196	U	0.00098	0.0179	U	0.00090	0.0219	U	0.001095
1,2,3,4,6,7,8-HpCDF	0.01	**0.596**	**BJ**	**0.00596**	0.0215	U	0.0001075	**0.0458**	**BJ**	**0.000458**	0.0658	BJEMPC	0.000329
1,2,3,4,7,8,9-HpCDF	0.01	0.0194	U	0.00010	0.045	BJEMPC	0.000225	0.0199	U	0.00010	0.0259	U	0.0001295
OCDF	0.0003	0.904	JEMPC	0.00014	0.0391	U	5.865E-06	0.0418	U	0.00001	0.112	BJEMPC	0.0000168
Total TEQ (u = 1/2):				**0.219**			**0.081**			**0.092**			**0.161**
Total TEQ (u=0):				**0.12**			**0.005**			**0.007**			**0.080**
TOC (%)				**0.21**			**0.13**			**0.15**			**0.29**

Legend:
LQ = laboratory qualifier
U = undetected at reporting limit
J = Estimated value, less than reporting limit, and/or QC parameter out of Control limits
JEMPC = estimated value, maximum possible concentration (treated as undetected)
BJEMPC = blank contaminated estimated value, maximum possible concentration (treated as undetected)
BJ = Method blank contaminated, estimated value

Table 5. Dioxin/furan Summary for the Port of Anacortes Pier 2 and Curtis Wharf maintenance dredging project.

Analyte	WHO (05) TEF	CW-1-B-Comp ng/kg-dw	CW-1-B-Comp LQ	CW-1-B-Comp TEQ	CW-1-Z-Comp ng/kg-dw	CW-1-Z-Comp LQ	CW-1-Z-Comp TEQ	Puget Sound SRM-112812 ng/kg-dw	Puget Sound SRM-112812 LQ	Puget Sound SRM-112812 TEQ	SRM Acceptance Limits ng/kg-dw (AVG)	SRM Acceptance Limits TEQ	SRM Acceptance Limits In/Out (Low/High)
2,3,7,8-TCDD	1	0.0996	U	0.0498	0.098	U	0.04900	**1.05**		**1.05000**	**1.05**	**1.05**	In (.525/1.57)
1,2,3,7,8-PeCDD	1	0.0319	U	0.01595	0.0275	U	0.01375	**1.14**		**1.14000**	**1.08**	**1.08**	In (.542/1.63)
1,2,3,4,7,8-HxCDD	0.1	0.0239	U	0.001195	0.0353	BJEMPC	0.00177	**1.49**	J	**0.14900**	**1.59**	**0.159**	In (0.797/2.39)
1,2,3,6,7,8-HxCDD	0.1	0.0239	U	0.001195	**0.0314**	J	**0.00314**	**3.95**		**0.39500**	**3.88**	**0.388**	In (1.94/5.82)
1,2,3,7,8,9-HxCDD	0.1	0.0598	BJEMPC	0.00299	0.0745	BJEMPC	0.00373	**2.69**		**0.26900**	**3.04**	**0.304**	In (1.52/4.55)
1,2,3,4,6,7,8-HpCDD	0.01	**0.691**	J	**0.00691**	**1.17**	BJ	**0.0117**	**105**		**1.05000**	**90.6**	**0.906**	In (45.3/136)
OCDD	0.0003	**8.09**		**0.002427**	**17**		**0.0051**	**977**		**0.29310**	**811**	**0.2433**	In (406/1217)
2,3,7,8-TCDF	0.1	0.0299	JEMPC	0.001495	0.0235	U	0.00118	**0.813**	J	**0.08130**	**1.11**	**0.111**	In (0.557/1.67)
1,2,3,7,8-PeCDF	0.03	0.0538	BJEMPC	0.000807	**0.0471**	BJ	**0.001413**	**1.11**	J	**0.03330**	**1.23**	**0.0369**	In (0.613/1.84)
2,3,4,7,8-PeCDF	0.3	0.0219	U	0.003285	0.0235	U	0.00353	**0.825**	J	**0.24750**	**1.07**	**0.321**	In (0.533/1.60)
1,2,3,4,7,8-HxCDF	0.1	0.0219	BJEMPC	0.001095	0.0216	U	0.00108	**3.02**		**0.30200**	**3.02**	**0.302**	In (1.51/4.53)
1,2,3,6,7,8-HxCDF	0.1	0.0219	U	0.001095	0.0216	BJEMPC	0.00108	**1.03**	J	**0.10300**	**1.09**	**0.109**	In (.545/1.64)
2,3,4,6,7,8-HxCDF	0.1	0.0259	U	0.001295	0.0235	U	0.00118	**2.14**		**0.21400**	**1.83**	**0.183**	In (.917/2.75)
1,2,3,7,8,9-HxCDF	0.1	0.0299	U	0.001495	0.0255	U	0.00128	0.645	JEMPC	0.03225	**0.511**	**0.0511**	In (.255/0.77)
1,2,3,4,6,7,8-HpCDF	0.01	0.0717	BJEMPC	0.0003585	0.0529	BJEMPC	0.00026	**22**		**0.22000**	**18.7**	**0.187**	In (9.36/28.1)
1,2,3,4,7,8,9-HpCDF	0.01	0.0179	U	0.0000895	0.0157	U	0.00008	**1.81**	J	**0.01810**	**1.63**	**0.0163**	In (.815/2.44)
OCDF	0.0003	0.0558	BJEMPC	0.00000837	0.0275	U	0.00000	**89.1**		**0.02673**	**58.4**	**0.01752**	Out (29.2/87.6)
Total TEQ (u = 1/2):				**0.091**			**0.099**			**5.624**		**5.465**	
Total TEQ (u=0):				**0.009**			**0.021**			**5.592**		**5.465**	
TOC (%)				**0.23**			**0.29**						

Legend:
LQ = laboratory qualifier
U = undetected at reporting limit
J = Estimated value, less than reporting limit, anc
JEMPC = estimated value, maximum possible cc
BJEMPC = blank contaminated estimated value,
BJ = Method blank contaminated, estimated valu