CENWS-OD-TS-NR

MEMORANDUM FOR: RECORD December 10, 2015

SUBJECT: SUPPLEMENTAL DETERMINATION REGARDING THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM THE MUKILTEO MULTIMODAL PROJECT, MUKILTEO, WASHINGTON, EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR UNCONFINED OPEN-WATER DISPOSAL AT THE PORT GARDNER NON-DISPERSIVE DISPOSAL SITE

1. Introduction. This memorandum reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Washington State Department of Ecology, Washington State Department of Natural Resources, and the Environmental Protection Agency) regarding the suitability of up to 2,800 cubic yards (cy) of previously uncharacterized dredged material from the Mukilteo Multimodal Project for open-water disposal at the Port Gardner non-dispersive site.

2. Background. The Washington State Department of Transportation (WSDOT) Ferries Division proposed the Mukilteo Multimodal Project to improve the operations and facilities serving the mainland terminus of the Mukilteo-Clinton ferry route in Washington State. The entire project will include a new ferry berth, loading area, waiting area, and associated infrastructure to be located approximately 1,800 feet to the northeast of the existing Mukilteo ferry terminal. The project location is shown on the Vicinity Map and Site Plan (Figures 1 and 2).

   The dredging project is located at the site of the Mukilteo Tank Farm and associated Tank Farm Pier. The project includes removing the pier and dredging through a sediment mound located beneath the pier to create a channel to accommodate the passage of ferry boats to and from the new terminal.

   A partial suitability determination was issued on June 5, 2014 for a portion of the proposed Mukilteo Multimodal dredging project. As described in that suitability determination, sampling difficulties resulted in the inability to collect sediments from the nearshore sub-unit of DMMU 3. Subsequent characterization of that portion of the dredge prism was required by the DMMP agencies, and is the subject of this suitability determination.

3. Project Summary. Table 1 includes project summary and tracking information for the nearshore sub-unit of DMMU 3 – hereafter called DMMU 3C.

Table 1. Project Summary

Project ranking	High
Proposed dredging volume	2,800 cy
Proposed dredging depth	-30 ft MLLW (including 2 ft of overdredge)
1st draft SAP addendum received	May 18, 2015
Comments provided on 1st draft SAPA	June 2, 2015

Table 1. Project Summary

2nd draft SAP addendum received	July 2, 2015
Comments provided on 2nd draft SAPA	July 16, 2015 and August 3, 2015
Final SAPA received	August 13, 2015
SAPA approved	August 18, 2015
Sampling dates	August 19, 2015
Draft data report received	November 25, 2015
Comments provided on draft report	December 9, 2015
Final data report received	not yet received
DMMP Tracking #	MUKMU-1-A-F-347
EIM Study ID	MUKMU13
Recency Determination	August 2018

4. Project Ranking and Sampling Requirements. Due to the amount of previous sampling in the area and the history of increased contamination with depth, the DMMP agencies originally ranked the subsurface (>4 ft) DMMUs high. The number of samples and analyses needed for a high rank were calculated using the following guidelines (DMMP, 2014):

   High Rank:
   - Maximum volume of sediment represented by each field sample = 4,000 cubic yards
   - Maximum volume of sediment represented by each analysis in the subsurface portion of the dredging prism = 12,000 cubic yards

   Following these guidelines, one core and one analysis was required to characterize DMMU 3C. Sampling difficulties were anticipated based on the previous sampling problems and the known presence of debris in the dredge prism, therefore two sampling locations were proposed in the approved SAP Addendum.

Table 2. Planned and actual sampling scheme

DMMU	Material Represented	Rank	DMMU vol. (cy)	Cores required	Cores taken	Analyses required	Analyses taken
3C	Nearshore 1/3 of DMMU 3 from 7 feet below mudline to -30 feet MLLW.	High	2,800	1	3	1	1

5. Sampling. Following pier removal, sampling took place on August 19, 2015, using a Vibracore sampler operated by Gravity Environmental. As expected, sampling difficulties were encountered due to buried debris within the dredge prism Real-time coordination with the Dredged Material Management Office occurred as required and all changes to the sampling plan were approved by the DMMP agencies.

Four attempts were made at each of the two proposed sampling locations, MMP-1C and MMP-1D before an acceptable core was collected in the final attempt at MMP-1D, however only a small amount of material was collected from within DMMU 3C, not enough to be representative of the dredge prism. On the day of sampling, in consultation with the DMMO via phone, two additional sampling locations, MMP-1E and MMP-1F, were identified. Sample location MMP-1E was not attempted due to a higher than expected mudline elevation which diminished the chances of reaching the dredge prism. Four additional attempts were made at location MMP-1F and the last two attempts yielded acceptable cores with good penetration into the dredge prism. Sediment from all three cores collected was composited into one sample for analysis. Compositing information is presented in Table 3. Core penetration did not reach the z-samples at any of the stations so no z-samples were collected.

. Table 3. Mukilteo Multimodal sampling coordinates and compositing information

Core	Sample Coordinates		Mudline (ft MLLW)	Interval	Target Sampling Elevation (ft MLLW)	Actual Sampling Elevation (ft MLLW)	Analytical Composite Sample
	Lat.	Long.					
MMP 1C	47.950823°	-122.297831°	---	C	-23 to -30	not collected due to refusal	
				Z	-30 to -32		
MMP-1D	47.950990°	-122.297705°	-18.62	C	-23 to -30	-23.5 to -23.63	DMMU-3C
				Z	-30 to -32	Did not achieve Z-layer depth	
MMP-1F Attempt 3	47.950873°	-122.297127°	-19.09	C	-23 to -30	-23.8 to -28.2	DMMU-3C
				Z	-30 to -32	Did not achieve Z-layer depth	
MMP-1F Attempt 4	47.950891°	-122.297171°	-19.63	C	-23 to -30	-23.8 to -26	DMMU-3C
				Z	-30 to -32	Did not achieve Z-layer depth	

Datum: MLLW = 0.0 (Everett, 1983 to 2001 Epoch) NAD 83

6. Chemical Analysis. The approved sampling and analysis plan addendum (BergerABAM, 2015) was followed, with sampling exceptions noted above, and analysis exceptions noted below. Quality control guidelines specified by the DMMP program were generally met.

A single composited sample was submitted for physical and chemical analysis to Analytical Resources Inc. (ARI) in Tukwila, Washington. The standard list of DMMP chemicals of concern, including TBT and dioxins/furans, were analyzed. The sediment conventional results are presented in Table 4. The sediment was very coarse, consisting of primarily sand and gravel with only 10% fines (silt and clay).

Chemical results are compared to DMMP guidelines in Table 4. There were multiple SL exceedances of PAHs within DMMU 3C, including exceedances of fluoranthene, pyrene, chrysene and total HPAHs. All other DMMP COC's were below SLs.

Dioxin results are presented in Table 5. Dioxin results, calculated as toxicity equivalents (TEQs) with U = ½ estimated detection limit, were below the DMMP site management objective of 4 pptr

TEQ.

Chemical results were also compared to SMS criteria (Table 6). There were multiple SQS exceedances, but no CSL exceedances. All SQS exceedances were for PAHs – including fluorene, fluoranthene, chrysene, benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, benzo(g,h,i)perylene and total HPAHs.

7. Biological Testing. Due to the DMMP guideline exceedances described above, DMMU-3C was subjected to the standard suite of three marine bioassays to determine if the proposed dredged material is suitable for open-water disposal. Bioassay tests were conducted by Northwest Aquatic Sciences (NWAS) of Newport, Oregon.

The reference sediment sample was collected from Holmes Harbor by Gravity Environmental on September 22, 2015. A power grab sampler was used to collect a 0-1 foot sample. A suitable grain size match to the test sediment was obtained from the second sampling location, which is indicated on Figure 3. Wet sieving in the field indicated the reference sample contained 10% fines.
The control sediment was collected from the *Eohaustorius estuarius* amphipod collection site in lower Yaquina Bay, Oregon on October 6th, 2015.

Pre-purge testing was conducted by NWAS according to the instructions set out in the 2014 DMMP Clarification Paper on Ammonia and Sulfide Triggers (DMMP, 2014). All pre-purge test results indicated that no purging was needed for any of the bioassay tests. The larval test was initiated on October 1, 2015 and the Amphipod and *Neanthes* tests were initiated on October 9th, 2015, within the 56-day bioassay holding time requirement. Negative control and reference sediments met the respective performance criteria for all bioassays. Water quality and positive control results were also within their acceptance ranges for all three bioassays. Therefore, all three tests were considered valid by the DMMP agencies.

Amphipod Mortality. The 10-day amphipod bioassay was run using *Eohaustorius estuarius* as the test species. Water quality and positive control results were within their acceptance ranges. Results of this test are considered valid by the DMMP agencies.

Test results are shown in Table 7. The test sediment mortality was statistically significantly different than the reference sediment, but the difference in mortality between the test and control sediments was less than 20%, so all conditions for a hit under the 2-hit rule were not met. There were no hits under the 1-hit or 2-hit rule.

Larval Development. The larval development bioassay was run using Mytilus galloprovincialis. Water quality and positive control results were within their acceptance ranges. Results of this test are considered valid by the DMMP agencies.
Test results are shown in Table 8. There were no hits under the 1-hit or 2-hit rule.

Polychaete Growth. The 20-day juvenile polychaete growth test was conducted using Neanthes arenaceodentata as the test species. All water quality observations were within acceptance ranges, except for salinity. Several salinity measurements slightly exceeded the specified range for the *Neanthes* test. The laboratory indicated that the test met all other applicable acceptability criteria,

including positive control performance; therefore, no corrective measures were taken. Results of this test are considered valid by the DMMP agencies.

Test results are shown in Table 9. There were no hits under the 1-hit or 2-hit rule.

Bioassay Conclusion

In summary, there were no hits in any of the bioassays, therefore DMMU 3C passed bioassay testing (Table 10).

8. Sediment Exposed by Dredging. The sediment to be exposed by dredging must either meet the State of Washington Sediment Quality Standards (SQS) or the State's antidegradation standard (Ecology, 2013) as described in DMMP guidance (DMMP, 2008b). For this project, no z-samples were collected due to core refusal.

   There were multiple SQS exceedances of PAHs within the dredge prism (Table 6), raising the concern that there could be increasing contamination with depth. However, the likely source of PAHs within DMMU 3C is from the creosote piles. Removal of the pier and associated piles within the dredge prism was completed prior to sampling DMMU 3C, whereas the previous round of sampling occurred prior to removal of the pier. There are two likely mechanisms by which the removal of the pier and associated piles caused the higher PAH levels. One mechanism is that removal of the piles resulted in mobilization of PAHs into sediments, which caused the higher concentrations of PAHs in DMMU 3C. The other mechanism is that the location of the cores used to characterize DMMU 3C were much closer or adjacent to the former location of a pile, which previously would not have been possible since sampling occurred between piles before pier was removed. In either case, the fact that the pier and pilings have been removed means that the likely source of PAHs to the sediments has also been removed.

   Thus, the DMMP agencies have determined that there is no concern of increasing contamination with depth and that this project is in compliance with the State of Washington antidegradation standard.

9. Debris Management. In general, debris is not allowed to be disposed at the DMMP open-water disposal sites. This includes all anthropogenic debris as well as all floatable debris and large non-floatable debris such as logs, piling, rip-rap and concrete. During dredging, a 2-ft by 2-ft steel mesh grid must be used to remove debris. Post-disposal monitoring may be required at the disposal site, on a case-by-case basis, to verify the absence of problem debris.

10. Suitability Determination. This memorandum documents the evaluation of the suitability of sediment from DMMU 3C proposed for dredging from the Mukilteo Multimodal project for open-water disposal at the Port Gardner non-dispersive disposal site. The approved sampling and analysis plan was generally followed. The data gathered were deemed sufficient and acceptable for regulatory decision-making under the DMMP program for DMMU 3C. Based on the results of the previously described testing, the DMMP agencies conclude that the all 2,800 cy of proposed dredged material from DMMU 3C of the Mukilteo Multimodal project are suitable for open-water disposal at the Port Gardner non-dispersive site.

A pre-dredge meeting with DNR, Ecology and the Corps of Engineers occurred on October 27, 2015. A dredging quality control plan was submitted to the Regulatory Branch of the Seattle District Corps of Engineers at least 7 days prior to the pre-dredge meeting. The final dredging quality control plan was approved by Ecology and the DMMP agencies prior to the start of dredging. A DNR site use authorization has been acquired.

9. References.

BergerABAM, 2015. Revised Final Sampling and Analysis Plan Addendum, Mukilteo Multimodal Project Dredged Material Characterization. Prepared for Washington State Department of Transportation, Ferries Division, Seattle WA. 13 August 2015.

BergerABAM, 2015. Mukilteo Multimodal Project Dredge Material Characterization. Prepared for Washington State Department of Transportation, Ferries Division, Seattle, WA.

DMMP, 2014. *Dredged Material Evaluation and Disposal Procedures (User Manual)*. Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program, December 2014.

DMMP, 2011. *Marine Sediment Quality Screening Levels: Adopting RSET Marine SLs for Use in DMMP.* A Clarification Paper prepared by Laura Inouye (Ecology) and David Fox (USACE) for the Dredged Material Management Program, June 2011.

DMMP, 2008b. *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.

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

10. Agency Signatures.

The signed copy of this memo is on file at the Dredged Material Management Office.

Concur:

_____ _____
Date Kelsey van der Elst - Seattle District Corps of Engineers

_____ _____
Date Justine Barton - Environmental Protection Agency

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

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Date Celia Barton - Washington Department of Natural Resources

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Marsha Tolon, WSDOT Environmental Coordinator
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Table 4. Chemical results compared to DMMP regulatory guidelines.

CHEMICAL	DMMP Guidelines SL	BT	ML	DMMU 3C conc	LQ
CONVENTIONALS				conc	LQ
Gravel, %				34.9	
Sand, %				54.8	
Silt, %				7.2	
Clay, %				2.9	
Fines (Silt + Clay), %				10.1	
Total Solids, %				72.3	
Volatile Soilids, %				2.45	
Total Organic Carbon, %				0.832	
Total Sulfides, mg/kg				437	
Total Ammonia, mg N/kg				4.31	
METALS (mg/kg dry)					
Antimony	150	---	200	30	U
Arsenic	57	507	700	8.5	J
Cadmium	5.1	11.3	14.0	1	U
Chromium	260	260	---	27	U
Copper	390	1,027	1,300	5.9	J
Lead	450	975	1,200	10	U
Mercury	0.41	1.5	2.3	0.04	
Selenium	---	3	---	0.22	J
Silver	6.1	6.1	8.4	2	U
Zinc	410	2,783	3,800	68	
ORGANOMETALLIC COMPOUNDS (ug/kg)					
Bulk Tributyltin (ion)	73	73	---	3.7	U
PAHs (ug/kg dry)					
Total LPAH	5,200	---	29,000	1820	
Naphthalene	2,100	---	2,400	280	
Acenaphthylene	560	---	1,300	150	
Acenaphthene	500	---	2,000	120	
Fluorene	540	---	3,600	210	
Phenanthrene	1,500	---	21,000	700	
Anthracene	960	---	13,000	360	
2-Methylnaphthalene	670	---	1,900	49	
Total HPAH	12,000	---	69,000	12340	
Fluoranthene	1,700	4,600	30,000	1900	
Pyrene	2,600	11,980	16,000	4300	
Benzo(a)anthracene	1,300	---	5,100	690	
Chrysene	1,400	---	21,000	1500	
Total benzofluoranthenes	3,200	---	9,900	2200	
Benzo[a]pyrene	1,600	---	3,600	840	
Indeno(1,2,3-c,d)pyrene	600	---	4,400	360	
Dibenzo(a,h)anthracene	230	---	1,900	170	
Benzo(g,h,i)perylene	670	---	3,200	380	
CHLORINATED BENZENES (ug/kg dry)					
1,2-Dichlorobenzene	35	---	110	2.9	J
1,4-Dichlorobenzene	110	---	120	2.6	J
1,2,4-Trichlorobenzene	31	---	64	4.8	U
Hexachlorobenzene	22	168	230	2.3	J

Table 4. Chemical results compared to DMMP regulatory guidelines.

CHEMICAL	DMMP Guidelines SL	BT	ML	DMMU 3C	
PHTHALATE ESTERS (ug/kg dry)					
Dimethyl phthalate	71	---	1,400	3.8	J
Diethyl phthalate	200	---	1,200	30	
Di-n-butyl phthalate	1,400	---	5,100	19	U
Butyl benzyl phthalate	63	---	970	4.8	
Bis(2-ethylhexyl)phthalate	1,300	---	8,300	48	U
Di-n-octyl phthalate	6,200	---	6,200	19	U
PHENOLS (ug/kg dry)					
Phenol	420	---	1,200	47	
2 Methylphenol	63	---	77	9.6	J
4 Methylphenol	670	---	3,600	8.3	
2,4-Dimethylphenol	29	---	210	14	J
Pentachlorophenol	400	504	690	19	U
MISCELLANEOUS EXTRACTABLES (ug/kg dry)					
Benzoic acid	650	---	760	59	J
Benzyl alcohol	57	---	870	19	U
Dibenzofuran	540	---	1,700	130	
Hexachlorobutadiene	11	---	270	4.8	U
N-Nitrosodiphenylamine	28	---	130	4.8	U
PESTICIDES (ug/kg dry)					
Aldrin	10	---	---	0.49	U
Total Chlordane	3	37	---	1.5	Y
Dieldrin	2	---	---	0.99	U
Heptachlor	2	---	---	0.49	U
p,p'-DDE	9	---	---	0.99	U
p,p'-DDD	16	---	---	0.99	U
p,p'-DDT	5	---	---	0.99	U
Total DDT		50	69	0.99	U
PCBs (ug/kg dry)					
Total PCBs	130	---	3,100	4.9	Y
Total PCBs (mg/kg OC)	---	38	---	0.589	Y
DMMP DETERMINATION					
DMMU volume				2,800 CY	
Rank				High	
Mean sample depth					
Maximum sampling depth					
Suitability Determination				PASSED bioassays	
	SL	BT	ML	DMMU 3C	

J = estimated concentration
U = undetected
OC = organic carbon
SL = screening level
BT = bioaccumulation trigger
ML = maximum level
SL exceedance

Table 5. Dioxin/Furan results

CHEMICAL	TEF	DMMU 3C			
DIOXINS/FURANS		conc	VQ	TEQ (U = 0)	TEQ (U = 1/2 RL)
2,3,7,8-TCDD	1	0.261	JEMPC	0.000	0.131
1,2,3,7,8-PeCDD	1	0.694	J	0.694	0.694
1,2,3,4,7,8-HxCDD	0.1	0.458	JEMPC	0.000	0.023
1,2,3,6,7,8-HxCDD	0.1	1.44		0.144	0.144
1,2,3,7,8,9-HxCDD	0.1	1.04		0.104	0.104
1,2,3,4,6,7,8-HpCDD	0.01	32		0.320	0.320
OCDD	0.0003	233		0.070	0.070
2,3,7,8-TCDF	0.1	0.821	J	0.082	0.082
1,2,3,7,8-PeCDF	0.03	0.373	JEMPC	0.000	0.006
2,3,4,7,8-PeCDF	0.3	0.633	JEMPC	0.000	0.095
1,2,3,4,7,8-HxCDF	0.1	0.635	J	0.064	0.064
1,2,3,6,7,8-HxCDF	0.1	0.695	JEMPC	0.000	0.035
1,2,3,7,8,9-HxCDF	0.1	0.294	J	0.029	0.029
2,3,4,6,7,8-HxCDF	0.1	1.19		0.119	0.119
1,2,3,4,6,7,8-HpCDF	0.01	19.8		0.198	0.198
1,2,3,4,7,8,9-HpCDF	0.01	0.384	J	0.004	0.004
OCDF	0.0003	22.8		0.007	0.007
TOTAL TEQ				1.835	2.123

Table 6. Chemical results compared to SMS regulatory guidelines.

CHEMICAL	SMS Guidelines		DMMU 3C	
	SQS	CSL	conc	LQ
Total Organic Carbon, %			0.832	
METALS (mg/kg dry)				
Arsenic	57	93	8.5	J
Cadmium	5.1	6.7	1	U
Chromium	260	270	27	U
Copper	390	390	5.9	J
Lead	450	530	10	U
Mercury	0.41	0.59	0.04	
Silver	6.1	6.1	2	U
Zinc	410	960	68	
PAHs (mg/kg OC)				
Total LPAH	370	780	218.75	
Naphthalene	99	170	33.65	
Acenaphthylene	66	66	18.03	
Acenaphthene	16	57	14.42	
Fluorene	23	79	25.24	
Phenanthrene	100	480	84.13	
Anthracene	220	1200	43.27	
2-Methylnaphthalene	38	64	5.89	
Total HPAH	960	5300	1483.17	
Fluoranthene	160	1200	228.37	
Pyrene	1000	1400	516.83	
Benzo(a)anthracene	110	270	82.93	
Chrysene	110	460	180.29	
Benzofluoranthenes	230	450	264.42	
Benzo(a)pyrene	99	210	100.96	
Indeno(1,2,3-c,d)pyrene	34	88	43.27	
Dibenzo(a,h)anthracene	12	33	20.43	
Benzo(g,h,i)perylene	34	88	45.67	
CHLORINATED BENZENES (mg/kg OC)				
1,2-Dichlorobenzene	2.3	2.3	0.3	
1,4-Dichlorobenzene	3.1	9	0.3	
1,2,4-Trichlorobenzene	0.81	1.8	0.6	U
Hexachlorobenzene	0.38	2.3	0.3	

Table 6. Chemical results compared to SMS regulatory guidelines.

CHEMICAL	SMS Guidelines		DMMU 3C	
	SQS	CSL	conc	LQ
PHTHALATE ESTERS (mg/kg OC)				
Dimethyl phthalate	53	53	0.5	
Diethyl phthalate	61	110	3.6	
Di-n-butyl phthalate	220	1700	2.3	U
Butyl benzyl phthalate	4.9	64	0.6	
Bis(2-ethylhexyl)phthalate	47	78	5.8	U
Di-n-octyl phthalate	58	4500	2.3	U
PHENOLS (ug/kg dry)				
Phenol	420	1200	47	
2 Methylphenol	63	63	9.6	J
4 Methylphenol	670	670	8.3	
2,4-Dimethylphenol	29	29	14	J
Pentachlorophenol	360	690	19	U
MISCELLANEOUS EXTRACTABLES (mg/kg OC)				
Dibenzofuran	15	58	15.6	
Hexachlorobutadiene	3.9	6.2	0.6	U
N-Nitrosodiphenylamine	11	11	0.6	U
PCBs (mg/kg OC)				
Total PCBs (mg/kg carbon)	12	65	0.6	U
MISCELLANEOUS EXTRACTABLES (ug/kg dry)				
Benzyl alcohol	57	73	19	U
Benzoic acid	650	650	59	J

U = undetected
QL = laboratory qualifier
OC = organic carbon
SMS = Sediment Management Standards
SQS = sediment quality standard
CSL = cleanup screening level
SQS exceedance

Table 7. *Eohaustorius Estuarius* 10-day mortality results

	Mean Mortality (%)	+/-	M_T - M_C	M_T - M_C > 20% ?	Transformation	Statistically less than reference?	M_T - M_R	M_T - M_R > 15% ?	1-Hit Criteria: M_T - M_C > 20% and M_T vs. M_R ss. (p=0.05) and M_T - M_R > 30%	2-Hit Criteria: M_T - M_C > 20% and M_T vs. M_C SS (p=0.05)	Interpretation
Control	0.0	0.0									
Reference	3.0	2.7									
DMMU 3C	17.0	7.6	17.0	no	none	yes	14.0	no	no hit	no hit	no hits

M = percent mortality

Table 8. *Mytilus galloprovincialis* survival results

	Mean Normal Count	+/-	N_T /N_C	N_T /N_C < 0.80 ?	Transformation	Statistically less than reference?	N_R /N_C - N_T /N_C	N_R /N_C - N_T /N_C > 0.30 ?	1-Hit Criteria: N_R/N_C - N_T/N_C <0.80 and N_T/N_C vs. N_R/N_C SS (p=0.10) and N_R/N_C - N_T/N_C > 0.30	2-Hit Criteria: N_R /N_C - N_T /N_C <0.80 and N_T/N_C vs. N_R/N_C SS (p=0.10)	Interpretation
Control	228	10									
Reference	206	11									
DMMU 3C	205	14	0.90	no	none	no	0.004	no	no hit	no hit	no hits

N = normal count

Table 9. *Neanthes arenaceodentata* 20-day growth results

	Growth - mean individual AFDW (mg)		MIG_T/MIG_C	$MIG_T/MIG_C < 0.8$	Transformation	Statistically less than reference?	MIG_T/MIG_R	$MIG_T/MIG_R < 0.50$	1-Hit Criteria: $MIG_T/MIG_C < 0.8$ and MIG_T ss. $< MIG_R$ (p=0.05) and $MIT_T/MIG_R < 0.50$	2-Hit Criteria: $MIG_T/MIG_C < 0.8$ and MIG_T ss. $< MIG_R$ (p=0.05)	Interpretation
Control	0.75	0.05									
Reference	0.73	0.14									
DMMU 3C	0.82	0.08	1.09	no	none	no	1.12	no	no hit	no hit	no hits

MIG = mean individual growth rate (mg AFDW/individual/day)

Table 10. Summary of bioassay results

Sample	*Hyallella* Survival	*Chironomus* survival	*Chironomus* growth	Summary interpretation
DMMU 3C	no hit	no hit	no hit	pass

no hit = passes SMS guidelines
X = hit under the 2-hit rule (minor hit)
XX = hit under the 1-hit rule (major hit)

NOTES:

1. THE LOCATIONS OF FEATURES SHOWN ARE APPROXIMATE.
2. THIS FIGURE IS FOR INFORMATION PURPOSES AND IS INTENDED TO ASSIST IN SHOWING FEATURES DISCUSSED IN THE ATTACHED DOCUMENT.

250 0 250 500
scale feet

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FIGURE 1: VICINITY MAP

PIER SECTION REMOVED PRIOR TO SUBSURFACE SAMPLING[3]

MMP-1D

MMP-1C

MMP-1F (3 & 4)

MMP-1 & MMP-1B

MMP-2

MMP-3

PROPOSED FERRY BERTH

BLDG

NOTES:

1. THE LOCATION OF FEATURES SHOWN ARE APPROXIMATE.
2. THIS FIGURE IS FOR INFORMATION PURPOSES AND IS INTENDED TO ASSIST IN SHOWING FEATURES DISCUSSED IN THE ATTACHED DOCUMENT.
3. THE UPPER 7 FEET OF MATERIAL IN NEARSHORE $\frac{1}{3}$ OF THE DREDGE PRISM WAS CHARACTERIZED IN NOVEMBER 2013.

SURFACE DMMU BOUNDARY

DMMU SUBUNIT BOUNDARY

BOUNDARY OF DREDGE PRISM

AREA CHARACTERIZED NOVEMBER 2013[3]

MMP-2 LOCATION OF NOVEMBER 2013 VIBRACORE

MMP-1C LOCATION OF AUGUST 2015 VIBRACORE

50 0 50 100
scale feet

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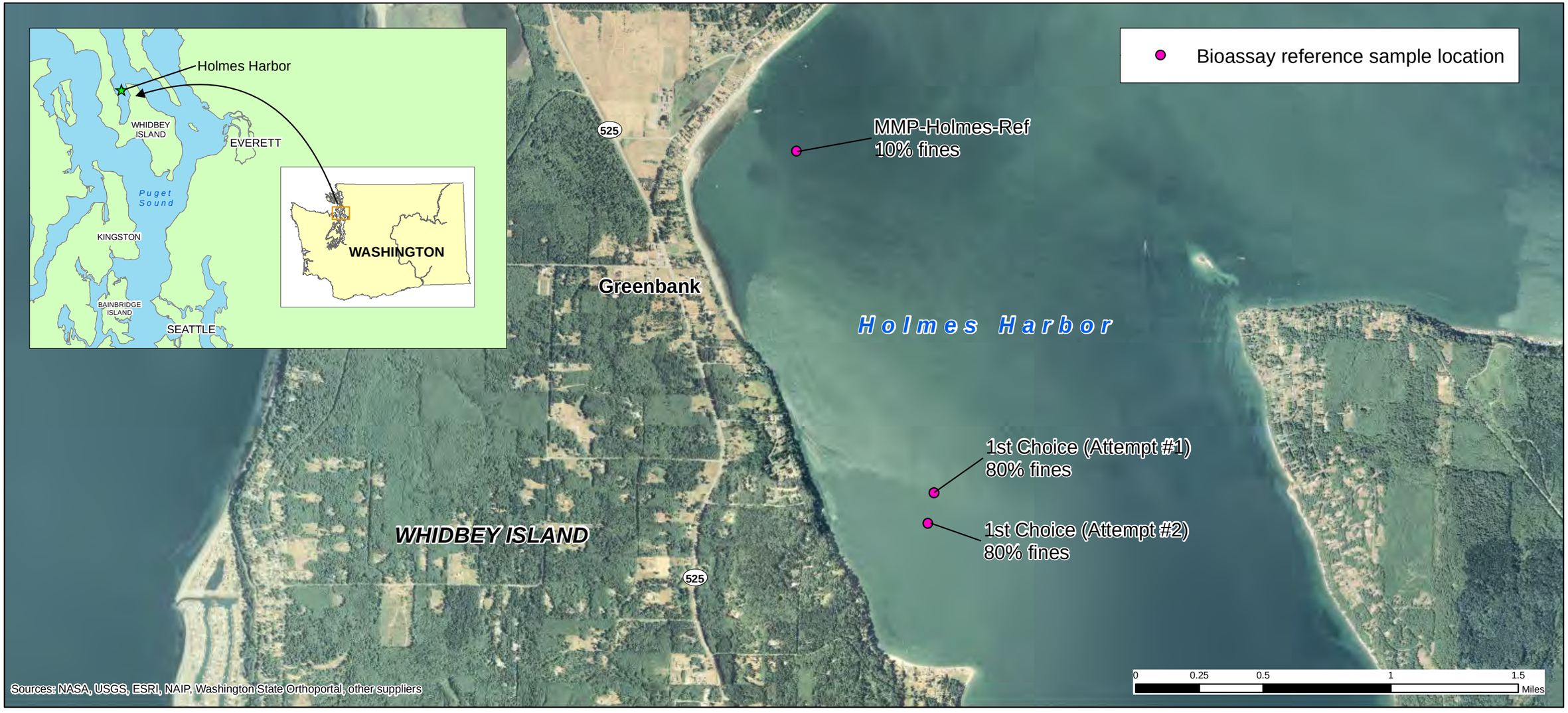
FIGURE 2: SITE PLAN - DREDGE PRISM AND VIBRACORE LOCATIONS



NOTES:

1. THE LOCATIONS OF FEATURES SHOWN ARE APPROXIMATE.
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Figure 3. Bioassay Reference Sample Location Map