CENWS-OD-TS-DM
MEMORANDUM FOR RECORD 21 March 2000

SUBJECT: FINAL DETERMINATION ON THE SUITABILITY OF DREDGED MATERIAL TESTED FOR THE PUGET SOUND NAVAL SHIPYARD DREDGING PROJECT (1998-01967) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT (CWA) FOR OPEN-WATER DISPOSAL AT THE ELLIOTT BAY DISPOSAL SITE.

1. The following summary provides the consensus determination of the Dredged Material Management Program (DMMP) Agencies' (U.S. Army Corps of Engineers, Department of Ecology, Department of Natural Resources, and the Environmental Protection Agency) with jurisdiction on dredging and disposal on the suitability of the estimated 368,050 cubic yards of dredged material proposed for dredging from the U.S. Navy's dredging project, at Bremerton, Washington, in Sinclair Inlet for disposal at a PSDDA unconfined open-water disposal site (Elliott Bay nondispersive site). This determination of suitability replaces the 24 August 1999 suitability determination (Appendix 1), and documents results of the Initial Phase I testing and the Phase II retesting authorized by the DMMP agencies (Appendices 2a, 2b, 2c, 2d). This determination is based on the acceptability of the Phase I data and Phase II resampling conducted between October 12-28, 1999 and all relevant test data contained in Phase II Sediment Characterization Summary Report submitted by Science Applications International Corporation (SAIC) to the Dredged Material Management Office (DMMO) on February 23, 2000, and the Bioaccumulation Letter Summary Report submitted on March 3, 2000. These reports were distributed to and reviewed by the DMMP agencies.

2. The Phase II Sampling and Analysis plan (SAP) was submitted to the DMMP agencies on October 11, 1999 and was approved by the DMMP agencies on October 12, 1999. The sampling and analyses generally followed the specifications proposed in the SAP. The data collected from these analyses were sufficient and acceptable for decision making by the Agencies based on best professional judgement. See Appendix 1 for a review of the Phase I sampling/testing results.

3. Relevant dates for regulatory tracking purposes are included in Table 1.

Table 1. Regulatory Tracking Dates

Phase I SAP submittal:	September 14, 1998
Phase I SAP Approval date:	October 6, 1998
Phase I Sampling date(s):	January 11-February 4, 1999
Phase I Data Report submittal date:	July 6, 1999
Phase I Interim Suitability Determination Date:	August 24, 1999
Phase II Retesting SAP Submittal date:	October 11, 1999
Phase II Retesting SAP Approval date:	October 12, 1999
Phase II Retesting Sampling date(s):	October 12-28, 1999
Phase II Supplemental Retesting Data report submittal date: Phase II Bioaccumulation Data Report submittal date:	February 23, 2000 March 3, 2000
Recency Determination Date: High (2 years)	October 2001

Phase I Testing Summary

4. All the potential dredged material was ranked high for DMMP testing purposes, and Phase I sampling consisted of collecting vibracorer samples for 76 uncomposited surface DMMUs and 7 composited subsurface DMMUs from a proposed dredging footprint of 373,900 cy (see Figure 1a-g in Appendix I). Phase I testing results are summarized in Interim Suitability Determination Memorandum dated 24 August, 1999 (Appendix 1).

Phase II Testing Summary

5. The redesigned footprint based on the combination of Phase I and Phase II sampling/testing is represented by a total of 91 dredged material management units (DMMUs). The DMMP approved Phase II resampling and analysis plan initiated vibracorer resampling at 62 of the 83 Phase I DMMUs, which represented 262,060 cubic yards out of a redesigned dredging footprint of 368,050 cubic yards (Figure 1a-f). The purpose of the retest was primarily to reanalyze the amphipod toxicity with a species less sensitive to clay, (*Ampelisca abdita)* for those 62 DMMUs authorized for retesting by the DMMP agencies (Appendix 2). Ten of the sixty-two DMMUs also underwent *Eohaustorius estuarius* retesting to reconfirm the potential sensitivity to clay. DMMU S51 was resampled for bioaccumulation testing. An additional 12,480 cubic yards was characterized from three new surface DMMUs within the Turning Basin/Inner Channel dredging footprint, that were not previously characterized during Phase I. Additionally, two subsurface composited DMMUs, D4 and D6, that were found previously unsuitable during Phase I testing, were authorized by the DMMP agencies to be resampled and reanalyzed as seven individual uncomposited DMMUs (Appendix 2b, Appendix 3).

Chemical Testing Summary

6. The Phase II retesting results included sediment conventional analyses on all retested DMMUs, and chemical recharacterization for a subset of 10 of the sixty-two DMMUs (S1, S22, S23, S26, S48, S56, S62, S71, S73, D3), and for seven uncomposited subsurface DMMUs (D4a, D4b, D4c, D4d, D6a, D6b, and D6c), and for the three new surface DMMUs from the Turning Basin/Inner Channel (S101, S102, S103). Furthermore, the Phase I chemical data set was re-examined for tentatively-identified-compounds (TIC's) to explore the potential presence of other chemicals that may have contributed to the apparent toxicity observed during the Phase I bioassay results. Also, a subset of six resampled DMMUs during Phase II (S56, S62, S71, S73, S70, S61) were subject to specialized analyses using a Gas Chromatogram Atomic Emission Detector (AED) Screen, to evaluate other potential sources of toxicity noted in the Phase I results. Additionally, three field duplicate samples were collected to quality assure the sediment conventional and chemistry data.

7. Appendix 3 provides a summary of the sediment conventional parameters including grain size and total organic carbon contents for all 91 DMMUs (Phase I + Phase II). Table 2 summarizes some of the percent fines and clay content distinctions between the surface sediments within the turning basin and inner channel and surface sediments from Piers D, B, and 3. The surface sediments are also contrasted with the subsurface sediments characterized at Piers D, B, and 3. The surface sediments from the turning basin and inner channel were much finer and exhibited much higher clay contents than surface sediment within Piers D, B, and 3. Comparatively, the subsurface sediments at Piers D, B, and 3 were much coarser than those found at surface subarea locations.

Table 2. Comparative conventional sediment characteristics from the proposed dredging subareas.

Parameter	Surface: Turning Basin and Inner Channel	Surface: Piers D, B, 3	Subsurface: Piers D, B, 3
Volume (cubic yards)	212,690 cy	94,860 cy	60,500 cy
Number of DMMUs	53 + 3 field duplicates	26 + 2 field duplicate	12 + 3 field duplicates
Total Sand + Gravel Content	Average = 10.9 % Range: 6.7 – 17.1	Average = 35.7 Range: 13.1 – 74.8	Average = 63.8 % Range: 13.3 – 96.4
Total Fines Content (% silt + clay)	Average = 89.1 % Range: 75.7 – 94.6 %	Average = 64.3 % Range: 22.5 – 86.8 %	Average = 36.2 % Range: 3.4 – 86.7 %
Total Clay Content	**Average = 35.6 %** **Range: 27.0 – 42.3 %**	**Average = 19.8 %** **Range: 5.1 – 29.3 %**	**Average = 10.6** **Range: 0.1 – 30.5 %**
Total Organic Content (% TOC)	Average = 2.4 % Range: 1.9 – 6.0 %	Average = 1.8 % Range: 0.38 – 5.1 %	Average = 0.89 % Range: 0.05 – 2.1 %

8. A review summary of the chemical testing results for all 91 DMMUs and 8 field duplicate samples tested during Phase I and II indicated that 46 of the 79 surface DMMUs (38 of 53 DMMUs from Turning Basin/Inner Channel, 8 of 26 DMMUs from Pier area) and 11 of 12 subsurface DMMUs from the Pier area had no detected screening level (SL) exceedances of 1998 DMMP chemical guidelines (Appendix 3). Thirty-one chemicals of concern exceeded (detected or undetected) DMMP chemical guidelines among the remaining 34 DMMUs. Mercury was the chemical most frequently exceeding DMMP guidelines, with 31 DMMUs exceeding the SL. PCBs exceeded PSDDA SLs in 11 DMMUs, although there were no BT or ML exceedances for this chemical.

9. Maximum level exceedances were noted for Mercury (S77: 2.3X ML; S78: 2.3 X ML), DDT (S51: 10.8X ML; S55: 1.4X ML), and Benzoic Acid (S51: 1.0 X ML). Three management units (S51, S77, S78) exceed the ML rule (e.g., two ML exceedances within DMMU and/or one ML exceedance greater than 2X ML) and are generally considered unsuitable for open-water disposal based on the elevated chemistry[1].

10. Bioaccumulation Trigger exceedances were observed for Mercury (S51, S77, S78), Silver (S51), TBT (S25, S61), DDT (S51, S55), Fluoranthene (S72), Pentachlorophenol (S51), and Bis(2-ethylhexyl)phthalate (S70). The Navy elected to conduct bioaccumulation testing on DMMU S51 and the results of this testing are discussed below. As part of the tiered testing process, DMMUs S25, S55, S61, and S70 were subject to Phase II amphipod bioassay retesting first, before bioaccumulation testing could be initiated. The Navy decided after bioassay retesting was completed not to conduct bioaccumulation testing on S25, S55, S61, and S70[2]. Therefore, in the absence of required bioaccumulation testing, DMMUs S25, S55, S61, and S70 are unsuitable for open-water-open-water disposal based on the application of best professional judgement (BPJ) by the DMMP agencies (Appendix 3).

11. The results of the Atomic Emission Detector (AED) screen analysis on six surface samples from the Piers D, B, 3 subarea and two samples from the subsurface Piers D, B, 3 subarea identified and quantified two

[1] An applicant has the option to conduct Tier IV testing on material exceeding the ML rule if it also passes routine bioassay testing. If the applicant elects to not pursue Tier IV testing, the DMMU(s) exceeding the rule are considered unsuitable for unconfined-open-water disposal.

[2] No samples for bioaccumulation testing were collected and archived for these DMMUs during Phase II.

potentially toxic components, total phosphate compounds and specifically tricresyl phosphate (Appendix 3). These analyses also documented the presence of a petroleum product that is lighter than motor oil, but heavier than diesel fuel. These data are only suggestive of the presence of other potentially toxic substances in the Pier subarea sediments that may have contributed to the toxicity observed during Phase I testing. However, the DMMP consensus is that the major contributing factor to the amphipod mortalities observed was probably the presence of high clay fractions in the tested sediment. See discussion below on the initial/retesting confirmatory correlation's observed between the amphipod, *Eohaustorius estuarius* mortalities and clay contents of the tested sediments.

12. The analysis of TICs[3] in the Phase I chemical testing data identified compounds which appear to be hydrocarbons at concentrations which range from 370 to 800 ug/kg. The report acknowledges that the possibility exists that other compounds in much higher concentrations, may have been removed during the GPC cleanup step, and these compounds could have contributed to the observed toxicity[3].

Bioassay Testing Summary

13. During Phase I testing, the Navy elected to conduct concurrent bioassay testing on all eighty-three DMMUs (Phase I + Phase II DMMUs totaled 91 due to addition of three additional DMMUs and two subsurface DMMUs, D4 and D6, reanalyzed as 7 uncomposited DMMUs) because of timing considerations and concerns about exceeding bioassay holding times. The results of the Phase I and II bioassay results are summarized below.

    Standard bioassay testing was conducted on all eighty-three Phase I DMMUs within the 56 day biological holding time. Ten DMMUs sampled during Phase II (e.g., 3 new DMMUs and 7 retested subsurface DMMUs) were subject to concurrent bioassay testing with the standard bioassay testing suite (amphipod, bivalve larval, and *Neanthes* growth bioassays). The three surface DMMUs from the Turning basin/Inner Channel (S101, S102, S103) used *Ampelisca abdita* in lieu of *Eohaustorius estuarius* due to high clay contents (27 – 36.4%). The seven retested Pier subarea subsurface DMMUs were tested using both amphipod species. The DMMP agencies specified retesting with *Eohaustorius estuarius*, and the Navy also elected to run *Ampelisca abdita*, when sediment conventional results indicated that two of the seven uncomposited DMMUs had clay contents greater than 15 percent. Sixty-two DMMUs were subject to amphipod bioassay retesting with *Ampelisca abdita*, whereas a subset of 10 DMMUs were also retested with *Eohaustorius estuarius* bioassay to reconfirm the clay sensitivity relationship noted during Phase I testing (see Appendix 2). Appendix 4 summarizes the solid phase bioassay Quality Control (QC) performance guidelines as well as the solid phase bioassay interpretative guidelines for nondispersive sites, which were used to evaluate the bioassay data discussed below. Appendix 3 summarizes the Phase II batch-specific bioassay toxicity testing outcomes (e.g., Appendix 5a: amphipod: *Eohaustorius estuarius*; Appendix 5b: amphipod: *Ampelisca abdita*; Appendix 5c: Bivalve Larval; Appendix 5d: *Neanthes*-growth) for the tested DMMUs. Three reference samples were collected from Carr Inlet to block for grain size effects. In general, all negative control and reference sediments met the DMMP performance limits for each of the four bioassay tests (e.g., 2 amphipod species, bivalve larval, and *Neanthes*) to assess toxicity (see Appendix 5e). Summary results (Phase 1 + Phase II) for each bioassay test are depicted in Table 3 for each of the three subareas characterized relative to the DMMP nondispersive interpretative guidelines. These bioassay results are discussed below for each of the bioassay tests.

[3] Tentatively Identified Compound's are identified as those compounds that have an instrument response greater than ten percent of that of the corresponding nearest internal standard.

Table 3. Phase I and II (parenthesis) Bioassay interpretation summary for each PSNS subarea.

Amphipod Bioassay: (*Eohaustorius estuarius*)	**Two-Hit** Phase I (Phase II)	**One-Hit** Phase I (Phase II)	**No-Hit** Phase I (Phase II)	**Total:** Phase I (Phase II)
Turning Basin (surface) Clay < 15 %: (see footnote 4 below)[4]	11 (1) **0**	39 (4) **0**	0 (0) **0**	50 (5) **0**
Piers D, B, 3 (surface) Clay < 15 %:	5 (2) **4**	17 (0) **5**	4 (2) **4**	26 (4) **13**
Piers D, B, 3 (subsurface) Clay < 15 %:	2 (1) **1**	4 (1) **1**	1 (6) **6**	7 (8) **8**
Subtotal: Clay < 15%:	18 (4) **5**	60 (5) **6**	5 (8) **10**	83 (17) **21**
Amphipod Bioassay: (*Ampelisca abdita*)	**Two-Hit** Phase II only	**One-Hit** Phase II only	**No-Hit** Phase II only	**Total:** Phase II only
Turning Basin (surface)	0	0	49	49
Piers D, B, 3 (surface)	0	0	15	15
Piers D, B, 3 (subsurface)	0	0	8	8
Subtotal:	0	0	72	72
Bivalve Larval Bioassay: (*Mytilus galloprovincialis*)	**Two-Hit** Phase I (Phase II)	**One-Hit** Phase I (Phase II)	**No-Hit** Phase I (Phase II)	**Total:** Phase I (Phase II)
Turning Basin (surface)	33 (3)	0 (0)	17 (0)	50 (3)
Piers D, B, 3 (surface)	19 (0)	3 (0)	4 (0)	26 (0)
Piers D, B, 3 (subsurface)	6 (4)	1 (0)	0 (3)	7 (7)
Subtotal:	58 (7)	4 (0)	21 (3)	83 (10)
Neanthes Bioassay: (*Neanthes arenaceodentata*)	**Two-Hit** Phase I (Phase II)	**One-Hit** Phase I (Phase II)	**No-Hit** Phase I (Phase II)	**Total:** Phase I (Phase II)
Turning Basin (surface)	2 (0)	0 (0)	48 (3)	50 (3)
Piers D, B, 3 (surface)	2 (0)	0 (0)	24 (0)	26 (0)
Piers D, B, 3 (subsurface)	1 (0)	0 (0)	6 (7)	7 (7)
Subtotal:	5 (0)	0 (0)	78 (7)	83 (10)
DMMP Bioassay Determination: (Phase I + Phase II)	**Number of Suitable DMMUs**		**Number of Unsuitable DMMUs**	
Turning Basin (surface)	52		1	
Piers D, B, 3 (surface)	18		8	
Piers D, B, 3 (subsurface)	9		3	
Subtotal:	79		12	

[4] Bolded value denotes the number of DMMUs observed during Phase I testing with clay contents < 15 %, for which *Eohaustorius* bioassay results were used to make a final suitability determination. The remaining *Eohaustorius* results with clay contents > 15 % were not used in the final suitability determination.

a) **Amphipod Bioassay (*Eohaustorius estuarius*).** As noted in Table 3, the amphipod bioassay results tested during Phase I with *Eohaustorius estuarius* showed significant toxicity being expressed among the 83 DMMU. This was later reconfirmed during Phase II retesting testing with a 10 sample subset of the retested DMMUs (See Appendicies 3 and 5a). An examination of potential nontreatment effects identified clay content potentially to be a major contributing factor to the observed toxicity during Phase I. This relationship was reconfirmed during Phase II (Figures. 2a-b). The apparent effect of high clay contents on *Eohaustorius* survival was sufficient that the DMMP agencies authorized a retest of 62 DMMUs, where clay contents exceeded 15 percent (See Appendicies 2 and 3). Subsequently, the Phase I and II results for *Eohaustorius* are used for decision-making in this suitability determination, when the clay contents in tested sediment are less than 15 percent. Fifteen percent clay represents the upper end in the range of the reference sediments tested (11.7 –12.3 %), where relatively low toxicity was observed. Correspondingly, results for *Eohaustorius* are not being used for decision-making when the clay contents are greater than 15%. Other factors, such as test animal acclimation (salinity, temperature, etc,) were evaluated during the Phase II retest and found not to be a significant factor to the observed toxicity.

b) **Amphipod Bioassay (*Ampelisca abdita*).** As noted in Table 3 and Appendix 5b, the amphipod bioassay retesting of 62 DMMUs, and 7 uncomposited subsurface DMMUs (D4 and D6), and of 3 new DMMUs from the Turning Basin/Inner Channel with *Ampelisca abdita,* showed no toxity with all 72 DMMUs tested passing the nondispersive site disposal guidelines.

c) **Bivalve Larval Bioassay (*Mytilus galloprovincialis*).** The results of the larval bivalve test (Appendicies 3 and 5c and Table 3) also showed significant toxicity being expressed although not to the extent shown in the amphipod bioassay. A total of 58 Phase I DMMUs had two-hit and 4 exhibited one-hit toxicity responses, with 21 DMMUs exhibiting no-hit responses according to the nondispersive interpretive disposal guidelines. The results of the Phase II testing, where 10 DMMUs were subject to bivalve larval bioassay testing, appeared to mimic the Phase I results, with 7 two-hit responses and 3 no-hit responses. An examination of potential clay effects on the larval bivalve toxicity after removing the Pier data did show a significant but weak correlation ($r = 0.46$, $p < 0.001$, $n = 62$) for the Turning Basin/Inner Channel, where fewer chemical guideline exceedances were noted. No retesting of the Sediment Larval bioassay was authorized by the DMMP agencies and the Phase I and II results were used in the DMMP non-dispersive site regulatory decision.

d) ***Neanthes* 20-day Growth Bioassay (*Neanthes arenaceodentata*).** The results of the *Neanthes* growth bioassay (Appendicies 3 and 5d and Table 3) showed low toxicity among the 83 Phase I DMMUs characterized, with 5 DMMUs exhibiting two-hit responses, and the remaining 78 DMMUs passing the nondispersive disposal guidelines for this bioassay. All 10 DMMUs tested during Phase II also showed no-hit responses for this bioassay.

e) **DMMP Bioassay Determination.** Overall interpretation of the bioassay responses combining the Phase I and II responses (See Appendicies 3 and 5a-e and Table 3) indicates that virtually all the material from the Turning Basin/Inner Channel passed the unconfined-open-water disposal guidelines (52 of 53 passing), whereas 18 out of 26 Pier surface DMMUs and 9 of 12 subsurface DMMUs passed the DMMP guidelines. Five of the Pier Surface DMMUs (S51, S25, S55, S61, S70) passed the bioassay testing guidelines, and were subject to required bioaccumulation testing because of bioaccumulation trigger exceedances. These DMMUs are discussed below.

f) **Bioaccumulation Trigger Exceedances**. As noted in paragraph 6, a number of DMMUs passing bioassay interpretive guidelines, also exceeded bioaccumulation triggers. These are highlighted in Table 4 below. Additionally, two DMMUs (S77, S78) with mercury BT/ML exceedances do not need to be considered further because they are unsuitable based on bioassay testing results. Another DMMU (S72) had a Fluoranthene BT exceedance, but also failed bioassy testing guidelines, and no further testing is necessary. The DMMP agencies deliberated on S51, which passed Phase I bioassays, but also exceeded the ML rule, and decided that standard bioaccumulation testing with a 45-day exposure would provide sufficient data in a Tier IV evaluation to enable a DMMP suitability determination to be completed. The Navy elected to proceed with bioaccumulation testing on S51, and the results of the testing of this DMMU is described below. The Navy decided not to archive bioaccumulation samples for S25, S55, S61, S70 during the Phase II resampling effort. After reviewing the Phase II bioassay retesting results, S25, S55, S61, and S70 passed the bioassay interpretative guidelines (see Appendix 3), but the Navy decided not to pursue bioaccumulation testing of these four DMMUs because of schedule and timing considerations. Therefore, these four DMMUs are considered unsuitable for unconfined-open-water disposal based on DMMP BPJ.

Table 4. DMMUs passing bioassays with sediment bioaccumulation trigger exceedances.

Chemical	S51	S25	S55	S61	S70
Mercury **BT = 1.5 ppm**	1.75				
Silver **BT = 6.1 ppm**	6.5				
TBT **BT = 0.15 ppb (porewater)**		0.15		0.17	
DDT **BT =50 ppb**	748		96.9		
Pentachlorophenol **BT = 504 ppm**	620				
Bis(2-ethylhexyl)phthalate **BT =13,870 ppb**					31,000

Bioaccumulation Testing Summary

14. As noted in paragraph 13f above only one of the eight DMMUs with bioaccumulation trigger exceedances (S51) was subjected to bioaccumulation testing. The remaining seven DMMUs either failed Tier III bioassay testing (S72, S77, S78), or failed to conduct bioaccumulation testing as required for unconfined open-water disposal (UCOWD) consideration (S25, S55, S61, S70). Therefore, these seven DMMUs are unsuitable for UCOWD. The sediment analytical results of the resampled DMMU S51 are depicted in Appendix 6.

15. The bioaccumulation testing was performed with *Macoma nasuta*, a facultative deposit feeding/suspension feeding bivalve and *Nephtys caecoides*, a burrowing facultative deposit feeding/carnivorous polychaete. The two species were tested together in the same 10-gallon aquaria. The standard PSDDA bioaccumulation test duration is 28 days. However, to provide a better approximation of steady-state tissue concentrations for the tested chemicals (mercury. silver, DDT, pentachlorophenol), the applicant agreed to extend the exposure period to 45 days based on the recommendation of the DMMP agencies.

16. Five replicate 10-gallon aquaria were run for the negative control, reference sediment, and for the tested DMMU S51.

Tissue Chemistry

17. Tissue concentrations of chemicals-of-concern from the 45-day exposures were compared statistically to the appropriate reference sediment, based on grain size similarity comparisons. The calculated ratios of Phase 1 (initial)/Phase II (retest) sediment chemistry were used to adjust the observed tissue concentrations. When sediment chemistry results from Phase I testing exceed those from Phase II, the ratio of the two are used to adjust the bioaccumulation tissue concentrations to reflect a "worst case" analytical result (Phase I / Phase II > 1). When the ratio is less than 1 (Phase 1 / Phase II < 1), no adjustments are made to the tissue concentration. Statistical comparisons of the test tissue (DMMU S51) and reference tissue concentrations for the final interpretation "worst case" analyses were based on the adjusted tissue concentrations. The summary tissue chemistry interpretation for each of the measured chemicals is provided in Appendix 6 for the four chemicals tested in DMMU S51.

Bioaccumulation Interpretation:

18. The DMMP agencies agreed that comparing statistical differences from reference is a necessary, but not sufficient condition to determine a DMMU unsuitable for open-water disposal. For each chemical measured within DMMU-S51 that were statistically greater than reference, a more in depth evaluation is required to determine the significance of the bioaccumulation that had occurred. This evaluation focused on **a)** Food and Drug Administration (FDA) Action Levels for Poisonous and Deleterious Substances in Fish and Shellfish for Human Food; **b)** PSDDA target tissue concentration values for chemicals of concern to human health, and **c)** ecological residue-effects data from the literature.

    a) The FDA guidelines for the chemicals of concern addressed by the bioaccumulation testing are as follows:

mercury (methyl mercury):	1.0 ppm wet weight (ww)
silver:	no guideline
DDT + DDE:	5.0 ppm wet weight (ww)
Pentachlorophenol:	no guideline

    b) A risk-based approach was adopted by the PSDDA program in 1988 to set target tissue levels (TTL) for human health. The TTL calculated for **silver** based on risk to humans consuming seafood is **200 ppm wet weight,** and is **900 ppm wet weight** for **Pentachlorophenol.**

    As part of a suitability determination for the Port of Seattle T-18 dredging project (March 17, 1997 SDM), the DMMP agencies re-evaluated the human health-based Target Tissue Levels (TTLs) for PCBs, total DDT, mercury, and TBT. In recalculating these TTLs, the PSDDA agencies used updated cancer slope factors and reference doses, as well as estimates of fish home range. The TTL developed for **mercury is 450 ppm wet weight**, and for **total DDT is 44 ppm wet weight.**

    c) The DMMP agencies conducted a literature review of ecological effects, relative to tissue concentrations (1997 Port of Seattle T-18 Suitability Determination). The agencies reviewed the literature data in the context of DMMP site management objectives:

"The biological testing guidelines for Site Condition II, which allow for minor significant effects in the laboratory tests, suggest that some biological effects may be expected at the disposal site. The severity and extent of biological effects are not expected to be great because the majority of the species found at the preferred disposal sites are not known to be acutely sensitive to chemicals of concern. Effects associated with Site Condition II will include sublethal effects and, potentially, an increase in the mortality of the more sensitive but less abundant crustacean species. Cumulative effects are expected to consist of a reduction in population and community biomass and an increase in the tissue concentration levels of chemicals of concern."

d) It was clear from the literature review, that for mercury, human health concerns occurred at lower tissue concentrations than ecological effects. Thus, the DMMP agencie are using the FDA guideline (**1.0 ppm ww**) as the mercury TTL. Conversely, for DDT, ecological effects are expected to occur at a lower concentration than human health effects. A literature review conducted as part of the T-18 dredging project identified a concentration range of 3-5 ppm ww in gonads or liver for croakers and cutthroat trout associated with induction of sterility and other reproductive effects[5]. Therefore, the DMMP agencies selected **3.0 ppm ww** for the total DDT TTL to comply with Site Condition II.

e) To summarize, the DMMP agencies will use the following TTLs to interpret the bioaccumulation test data for DMMU-S51:

Mercury (methyl mercury):	1.0 ppm ww
Silver:	200 ppm ww
DDT + DDE:	3.0 ppm ww
Pentachlorophenol:	900 ppm ww

19. The agencies used best professional judgement in developing these interpretation guidelines to meet DMMP disposal site management objectives. These guidelines are subject to change for future DMMP projects as additional bioaccumulation guidance become available.

20. Each DMMU was compared to these interpretation guidelines using a one-tailed one-sample t-test (see Appendix 6. An alpha level (the probability of making a Type I error, rejecting the null hypothesis of no difference between test and reference responses when, in fact, they are not different) of 0.1 was selected for these statistical comparisons by the DMMP agencies to reflect the higher within sample variability, and to increase the power of the test to discriminate between reference and test responses. All four chemicals measured in S51 *Macoma* and *Nephtys* tissue were judged to be statistically below the chemical guideline using the adjusted values.

21. However, the results of the sediment reanalysis of S51 indicated that there was a large disparity between the Phase 1 and Phase 2 analytical results for the COCs that exceeded the BTs, especially for DDT, which was measured at 2 percent of the Phase I result (Appendix 6). The sediment analysis results indicated that silver, PCP and DDT all had ratios greater than 1, and the tissue concentrations were adjusted accordingly (Appendix 6), whereas mercury was less than 1 and no adjustment was made. Because of the 50-fold

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[5] Allison, D.B., B.J. Kallman, O.B. Cope, and C.C. Van Valin. 1964. Some chronic effects of DDT on cutthroat trout. Washington, DC.: U.S. Fish and Wildlife Service, Bureau of Sport Fish. 30 pp.

Childress, R., Texas Parks and Wildlife Department, Levels of concentration and incidence of various pesticide residues in Texas. (unpublished report, 1971).

discrepancy in the total DDT sediment concentration between the retested (15 ppb) and the initial sediment (748 ppb), the DMMP agencies had serious concerns about the validity of the DDT concentrations measured in the tissues of *Macoma* and *Nephtys*. The agencies were concerned that the DDT bioaccumulation observed in the retested sediments was not a realistic evaluation of bioavailable DDT associated with this DMMU. The discrepancy in sediment DDT was only brought to the attention of the DMMP agencies after the bioaccumulation test had been completed. The DMMP agencies deliberated and concurred that the data for DDT was insufficient for regulatory decision-making and that the test would have to be repeated using a higher DDT exposure concentration closer to the Initial Phase I concentration to be valid for decision-making. The Navy when informed of this decided not to resample and retest S51. Therefore, DMMU-S51 is considered unsuitable for UCOWD using BPG.

Suitability Determination

22. The DMMP agencies accepted all the data discussed herein as sufficient to make a suitability determination for open-water disposal. Appendix 3 summarizes the final suitability determination outcome for each of the 91 DMMUs representing a total volume of 368,050 cubic yards, and summarizes the essential chemical and biological testing information forming the basis for these determinations.

23. A total of 290,840 cubic yards of potential dredged material in 74 DMMUs passed DMMP evaluation guidelines and are suitable for open-water disposal at the Elliott Bay non-dispersive site. Seventeen DMMUs representing 77,210 cubic yards failed either the DMMP bioassay, BT/ML guidelines, or bioaccumulation testing requirements, and are unsuitable for open-water unconfined disposal.

24. This memorandum documents the suitability of the dredged material within the U.S. Navy Shipyard dredging project in Sinclair Inlet for disposal at the Elliott Bay non-dispersive open-water disposal site. 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.

SUBJECT: FINAL DETERMINATION ON THE SUITABILITY OF DREDGED MATERIAL TESTED FOR THE PUGET SOUND NAVAL SHIPYARD DREDGING PROJECT (1998-01967) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT (CWA) FOR OPEN-WATER DISPOSAL AT THE ELLIOTT BAY DISPOSAL SITE.

Concur:

22 March 2000 Date	David Kendall, Ph.D., Seattle District Corps of Engineers
4/3/00 Date	Tom Gries, Washington Department of Ecology
29 March 2000 Date	Erika Hoffman, Environmental Protection Agency
4.3.00 Date	Rick Vining, Washington Department of Ecology
04/03/00 Date	Ted Benson, Washington Department of Natural Resources

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Rick Vining, Ecology
Tom Gries, Ecology
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DMMO File

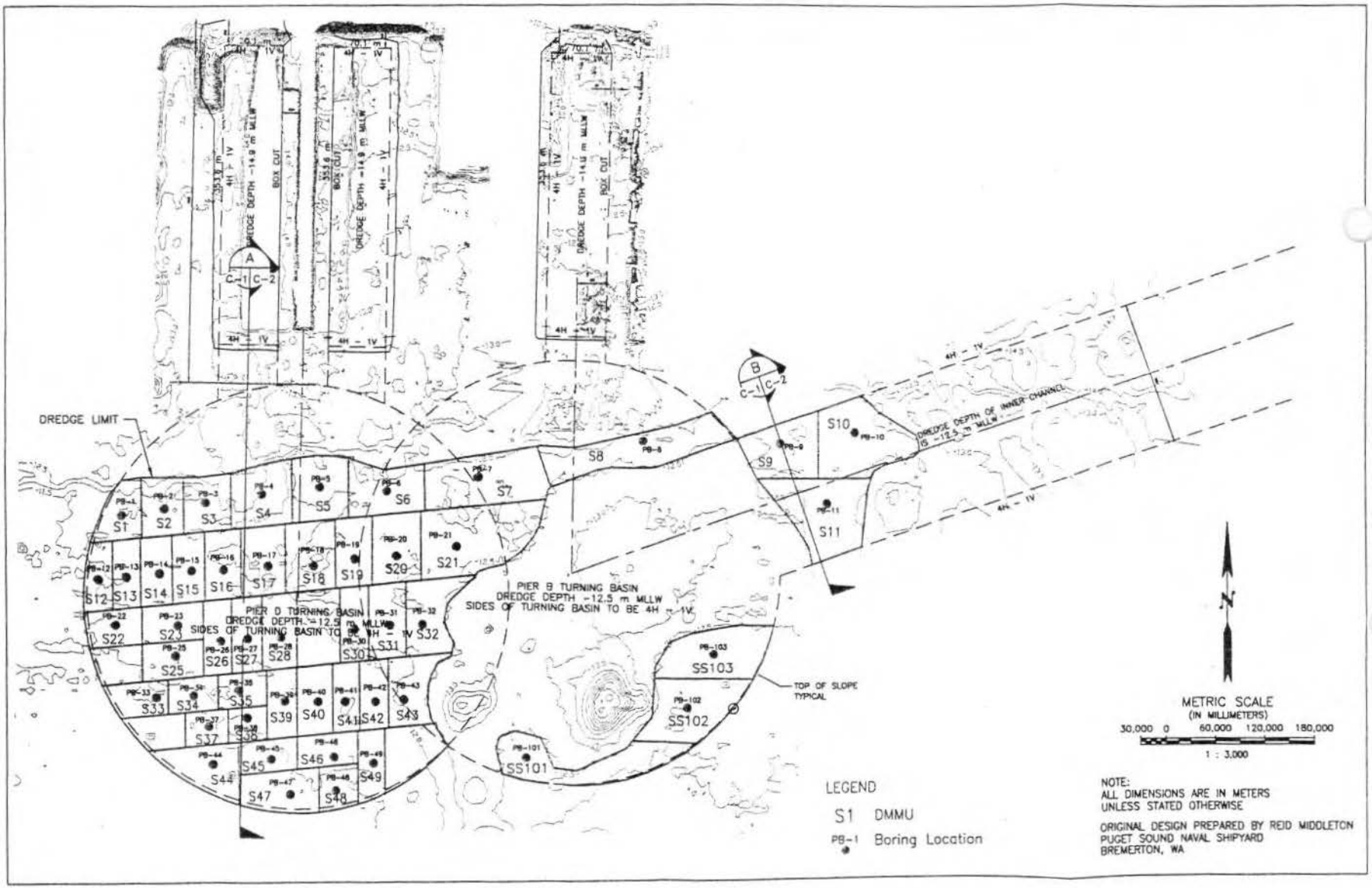


Figure 1 a ~~Figure 1-1~~. Turning basin and inner channel boring locations and surface DMMUs.

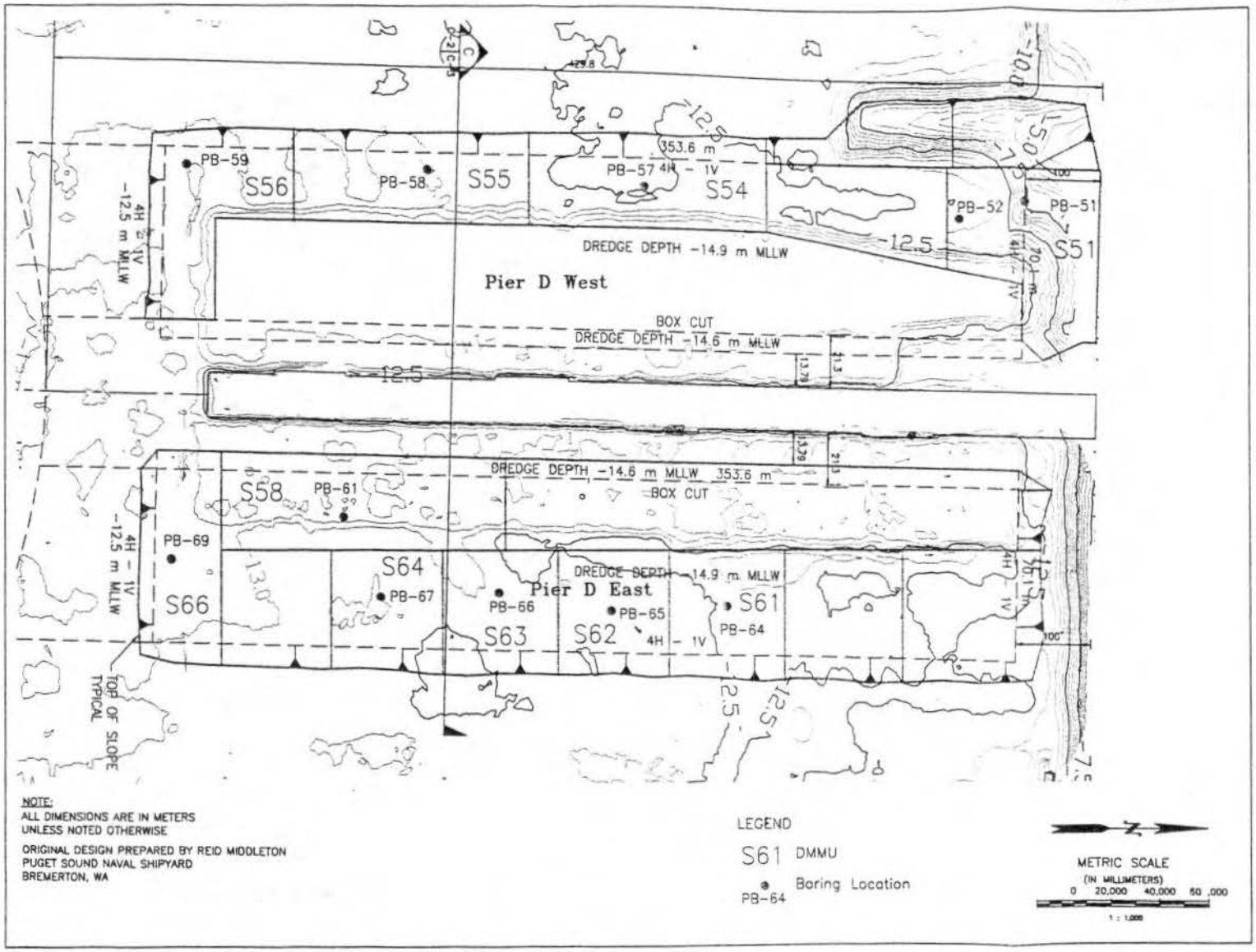
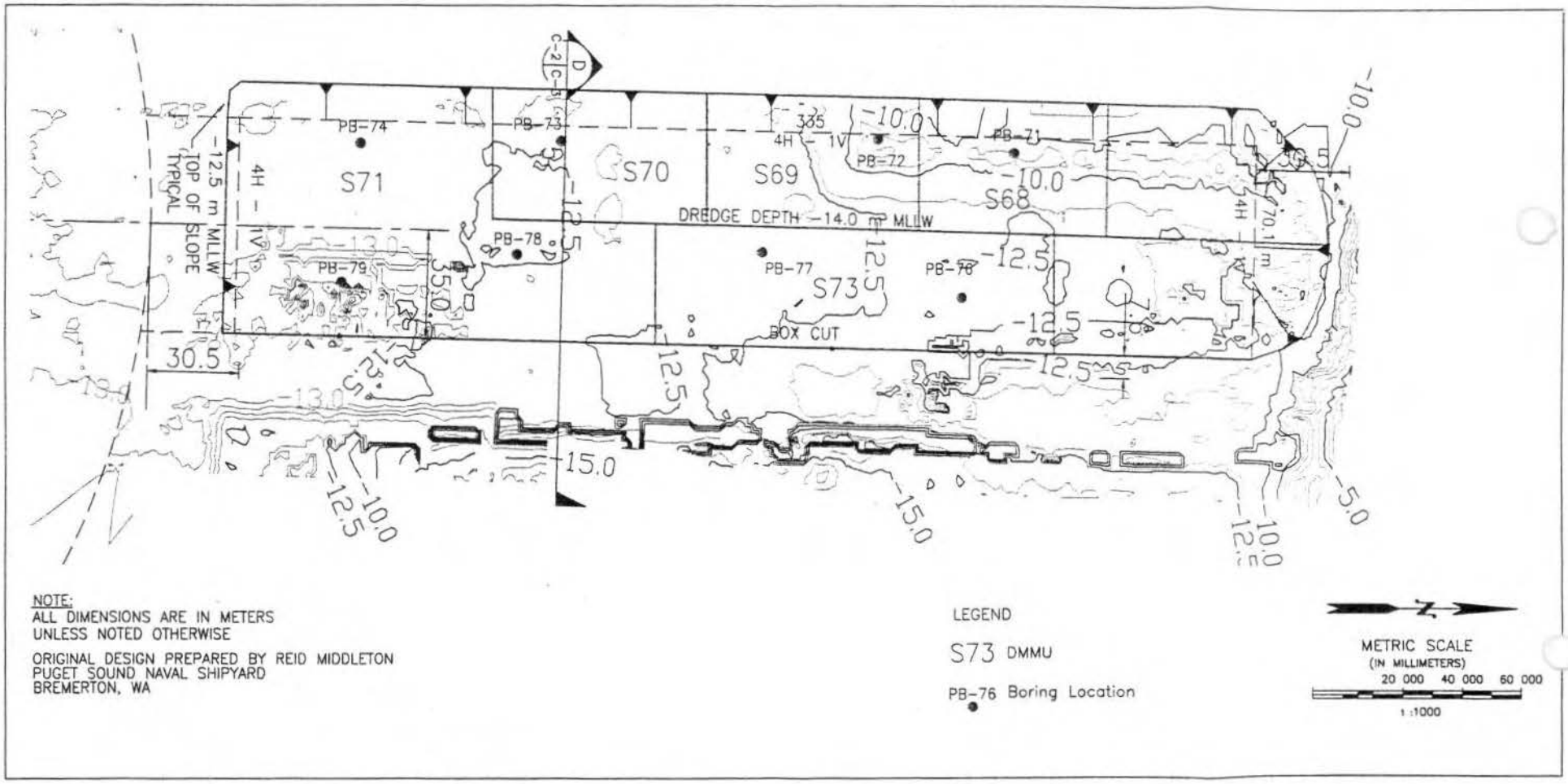


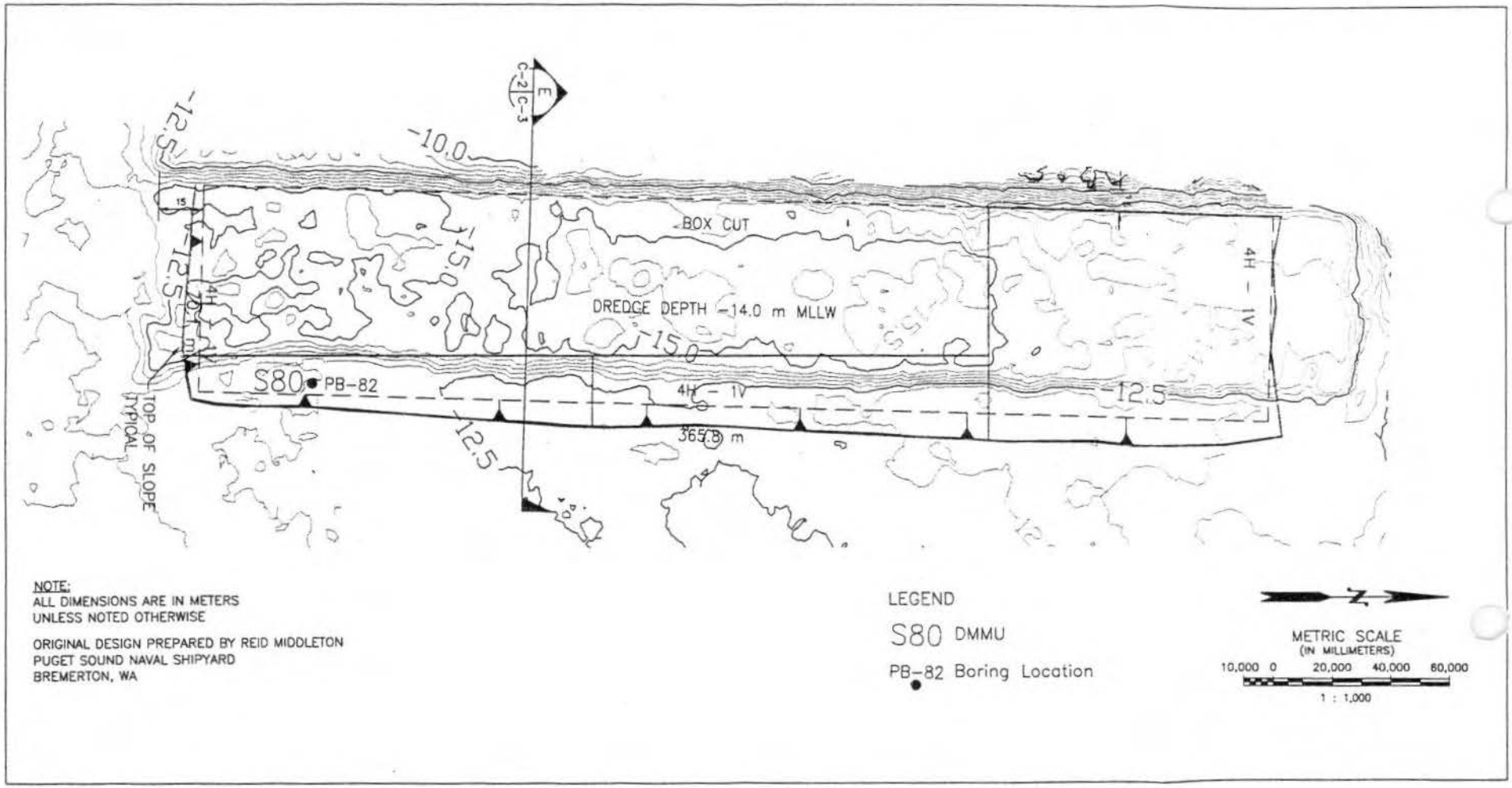
Figure 1b.

~~Figure 1.~~ Pier D East and West boring locations and surface DMMUs.



~~Figure 4-8~~. Pier B boring locations and surface DMMUs.

Figure 1c.



~~Figure 4-4~~. Pier 3 boring locations and surface DMMUs.

Figure 1d.

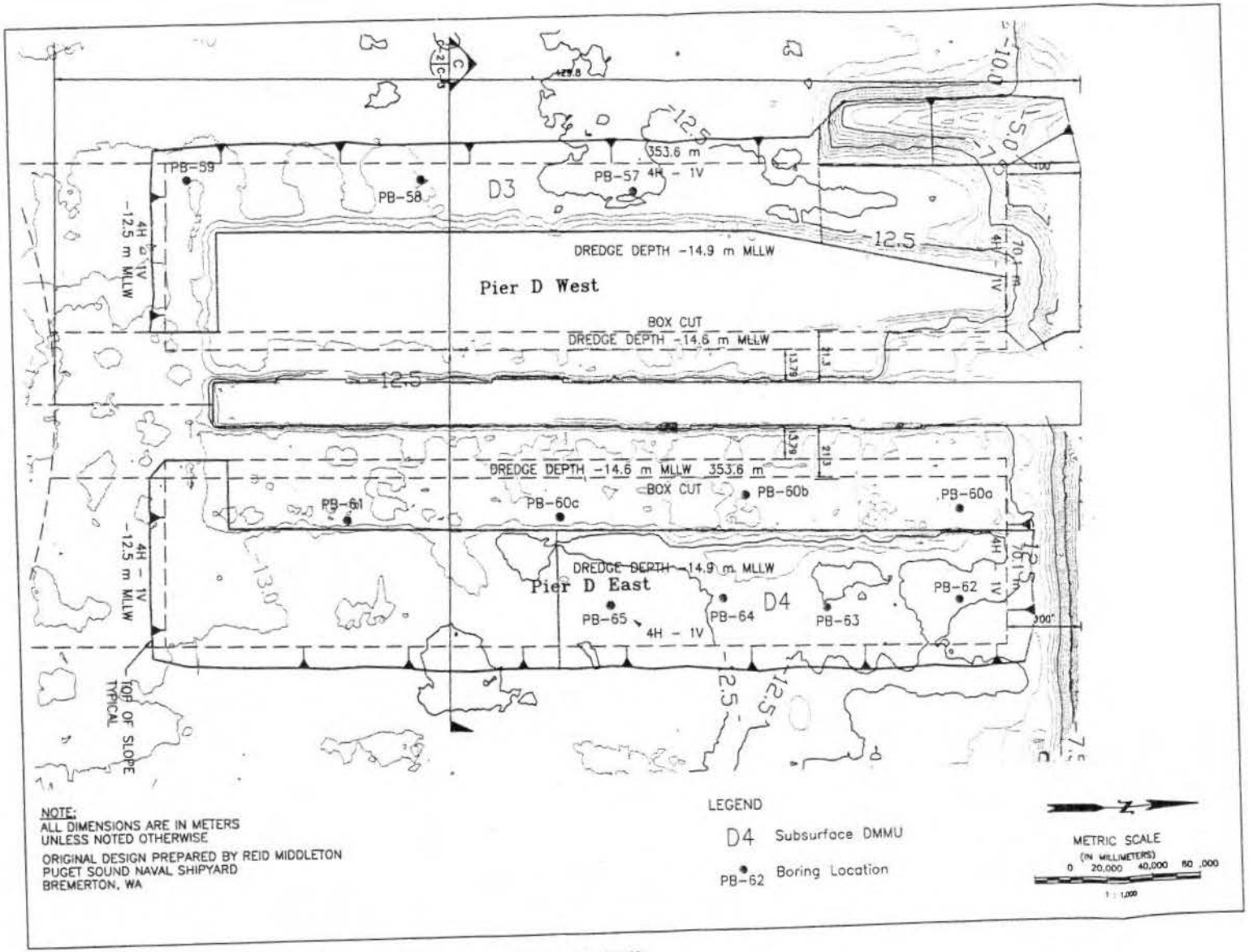
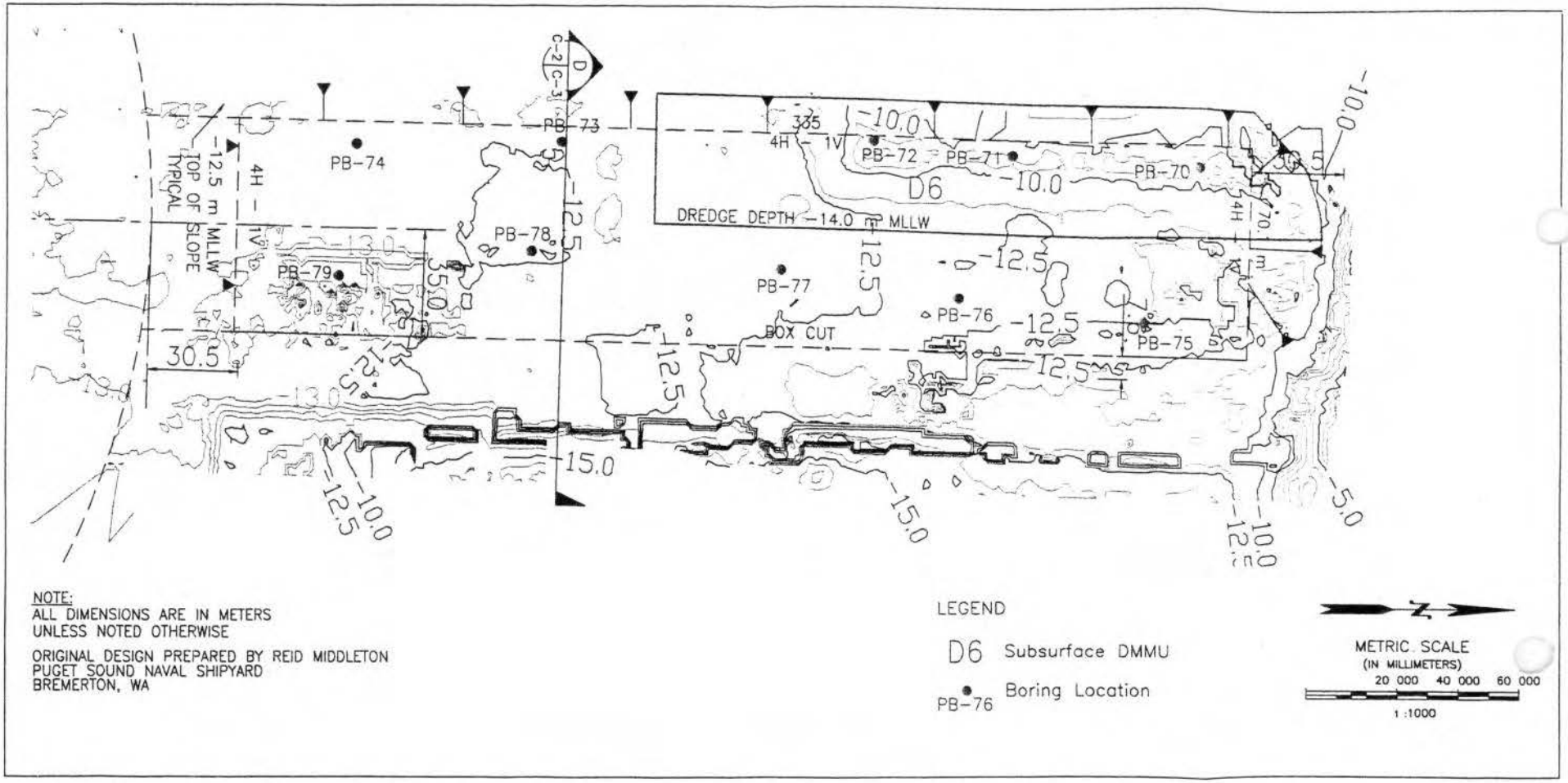


Figure 1e.

Figure 3-6. Pier D East and West boring locations and subsurface DMMUs.



~~Figure 4.8~~. Pier B boring locations and subsurface DMMUs.

Figure 1f.

Figure 2a. Scatter Plot of Eohaustorius Mortality versus Clay Content

Turning Basin and Inner Channel (Phase I Testing)

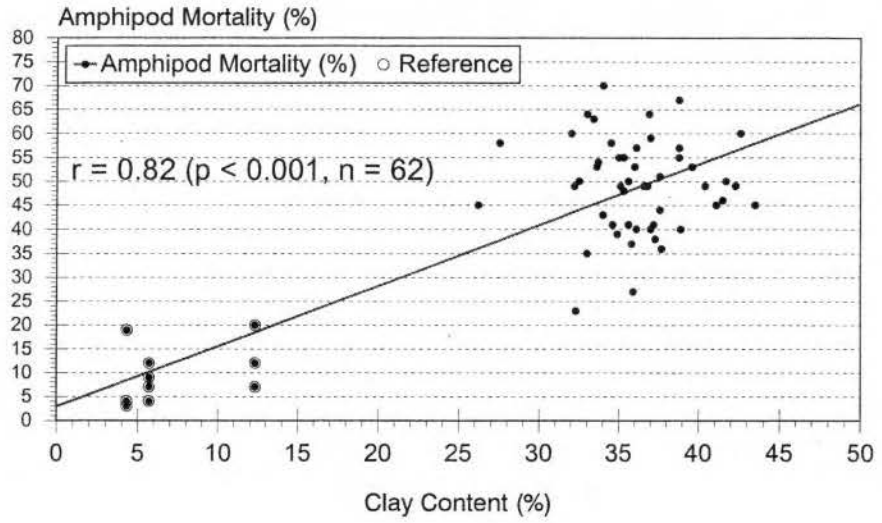
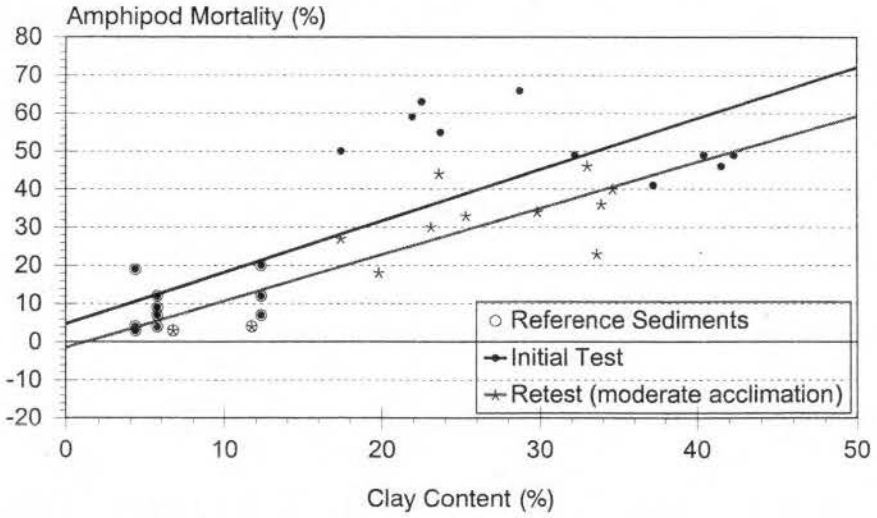


Figure 2b. Scatter Plot of Amphipod Mortality versus Clay Content

DMMUs selected for Eohaustorius retest



Initial: r = 0.79, n = 22, p<0.001; Retest: r = 0.79, n-12, p<0.005

CENWS-OD-TS-DM
MEMORANDUM FOR RECORD 24 August 1999

SUBJECT: INTERIM DETERMINATION ON THE SUITABILITY OF DREDGED MATERIAL TESTED FOR THE PUGET SOUND NAVAL SHIPYARD DREDGING PROJECT (1998-01967) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT (CWA) FOR OPEN-WATER DISPOSAL AT THE ELLIOTT BAY DISPOSAL SITE.

Appendix 1

1. The following summary reflects the consensus determination of the Dredged Material Management Program (DMMP) Agencies' (U.S. Army Corps of Engineers, Department of Ecology, Department of Natural Resources, and the Environmental Protection Agency) with jurisdiction on dredging and disposal on the suitability of the estimated 373,900 cubic yards of dredged material proposed for dredging from the U.S. Navy's dredging project, at Bremerton, Washington, in Sinclair Inlet for disposal at a PSDDA unconfined open-water disposal site (Elliott Bay nondispersive site). The determination of suitability is based on the acceptability of the sampling conducted between January 11 and February 4, 1999 and all relevant test data contained in letter Data Summary Report submitted by Science Applications International Corporation (SAIC) to the Dredged Material Management Office (DMMO) on July 6, 1999 for distribution to and review by the DMMP agencies.

2. The Sampling and Analysis plan (SAP) was submitted to the DMMP agencies on September 14, 1998 and was approved by the DMMP agencies on October 6, 1998. The sampling and analyses generally followed the specifications proposed in the SAP. The data collected from these analyses were sufficient and acceptable for decision making by the Agencies based on best professional judgement.

3. Relevant dates for regulatory tracking purposes are included in Table 1.

Table 1. Regulatory Tracking Dates

SAP Approval date:	October 6, 1998
Sampling date(s):	January 11 – February 4, 1999
Data report submittal date:	July 6, 1999
Recency Determination Date: High (2 years)	February 2001

4. The DMMP approved conceptual sampling and analysis plan included a total dredging footprint of some 397,100 cubic yards, where 315,600 cubic yards come from the surface sediments (0-4 ft.) and approximately 81,500 cubic yards in the subsurface sediments (> 4 ft.). However, during actual field sampling observed depth differences at a number of locations (no samples collected at S74, S75, S76, and D7 because these locations are already at project design depths) amounted to a net reduction in the total project volume to 373,900 cubic yards, where 303,900 cubic yards occur in the surface and 70,000 cubic yards occur in subsurface sediments. Minimum PSDDA sampling and analysis requirements for this High Ranked project specify seventy-six uncomposited surface dredged material management units (DMMUs) and seven composited

Appendix 1

subsurface DMMUs for a total of 83 DMMUs (see Figure 1a-g). At the request of the DMMP agencies DMMU S57 was composited with 3 vibracore samples to provide a better spatial representation of the surface material within the DMMU in an area where previous testing had shown concerns for elevated PCBs. Subsurface DMMUs generally consisted of compositing three or four vibracore samples within each DMMU. Additionally, five field duplicate samples were collected to quality assure the sediment conventional and chemistry data.

5. Appendix I provides a summary of the sediment conventional parameters including grain size and total organic carbon contents for all 83 DMMUs. Table 2 summarizes some of the percent fines and clay content distinctions between the surface sediments within the turning basin and inner channel and surface sediments from Piers D, B, and 3. The surface sediments are also contrasted with the subsurface sediments characterized at Piers D, B, and 3. The surface sediments from the turning basin and inner channel were much finer and exhibited much higher clay contents than surface sediment within Piers D, B, and 3. Comparatively, the subsurface sediments at Piers D, B, and 3 were coarser than those found at surface subarea locations.

Table 2. Comparative selected conventional sediment characteristics from the proposed dredging subareas.

Parameter	Surface: Turning Basin and inner channel	Surface: Piers D, B, 3	Subsurface: Piers D, B, 3
Volume (cubic yards)	200,180 cy	104,060 cy	69,660 cy
Number of DMMUs	50 + 2 field duplicates	26 + 1 field duplicate	7 + 2 field duplicates
Total Fines (% silt+clay)	Average = 90.9 % Range: 83.4 – 95.6 %	Average = 64.4 % Range: 25.2 – 88.3 %	Average = 32.0 % Range: 9.8 – 86.7 %
Total Organic Content (% TOC)	Average = 36.1 % Range: 26.2 – 43.5 %	Average = 20.4 % Range: 5.1 – 33.9 %	Average = 9.0 % Range: 0.1 – 30.5 %

6. The results of chemical analyses of the 83 DMMUs and five field duplicate samples indicated that 48 of the 76 surface DMMUs and 6 of 7 subsurface DMMUs had no screening level (SL) exceedances of 1998 DMMP chemical guidelines (Appendix 1). All 3 surface field duplicate samples and 1 of 2 subsurface field duplicates also had no SL exceedances. Thirty-one chemicals of concern exceeded DMMP chemical guidelines among the remaining 29 DMMUs. Mercury was the chemical most frequently exceeding DMMP guidelines, exceeding the SL in 23 DMMUs. PCBs exeeded PSDDA SLs in 10 DMMUs, although there were no BT or ML exceedances for this chemical. Bioaccumulation Trigger exceedances were observed for Mercury (S51, S77, S78), Silver (S51), TBT (S25, S61), DDT (S51, S55), Fluoranthene (S72), Pentachlorophenol (S51), and Bis(2-ethylhexyl)phthalate (S70). Maximum level exceedances were noted for Mercury (S77: 2.3X ML; S78: 2.3 X ML), DDT (S51: 10.8X ML; S55: 1.4X ML), and Benzoic Acid (S51: 1.0 X ML). Three management units (S51, S77, S78) exceed the ML rule (e.g., two ML exceedances within DMMU and/or one ML exceedance greater than 2X ML) and are generally considered unsuitable for open-water disposal based on the elevated chemistry[1]. The Navy elected to conduct concurrent bioassay testing on all eighty-three DMMUs because of timing

[1] An applicant has the option to conduct Tier IV testing on material exceeding the ML rule if it also passes routine bioassay testing. If the applicant elects to not pursue Tier IV testing, the DMMU(s) exceeding the rule are considered unsuitable for unconfined-open-water disposal.

considerations and concerns about exceeding bioassay holding times. Therefore, DMMP agency determinations on the suitability of these dredged material for unconfined open-water disposal rest on the outcome of the biological testing results.

7. Standard bioassay testing was conducted on all eighty-three DMMUs within the 56 day biological holding time. Appendix 2 summarizes the solid phase bioassay Quality Control (QC) performance guidelines and also summarize the solid phase bioassay interpretative guidelines for nondispersive sites, which were used to evaluate the bioassay data discussed below. Appendix 3 summarizes the batch specific bioassay toxicity testing outcomes (e.g., Appendix 3a: amphipod; Appendix 3b: Bivalve Larval; Appendix 3c: *Neanthes*-growth) for all eighty-three DMMUs. Three reference samples were collected from Carr Inlet to block for grain size effects. In general, all negative control and reference sediments met the DMMP performance limits for each of the three bioassay tests to assess toxicity. Summary results for each bioassay test are depicted in Table 3 for each of the three subareas characterized relative to the DMMP nondispersive interpretative guidelines. These bioassay results are discussed below for each of the bioassay tests.

Table 3. Bioassay interpretation summary for each PSNS subarea.

Amphipod Bioassay: (*Eohaustorius estuarius*)	**Two-Hit**	**One-Hit**	**Pass**	**Total:**
Turning Basin (surface)	11	39	0	50
Piers D, B, 3 (surface)	5	17	4	26
Piers D, B, 3 (subsurface)	2	4	1	7
Subtotal:	18	60	5	83
Bivalve Larval Bioassay: (*Mytilus galloprovincialis*)	**Two-Hit**	**One-Hit**	**Pass**	**Total:**
Turning Basin (surface)	33	0	17	50
Piers D, B, 3 (surface)	19	3	4	26
Piers D, B, 3 (subsurface)	6	1	0	7
Subtotal:	58	4	21	83
Neanthes Growth Bioassay: (*Neanthes arenaceodentata*)	**Two-Hit**	**One-Hit**	**Pass**	**Total:**
Turning Basin (surface)	2	0	48	50
Piers D, B, 3 (surface)	2	0	24	26
Piers D, B, 3 (subsurface)	1	0	6	7
Subtotal:	5	0	78	83
DMMP Bioassay Determination:	**Number of Suitable DMMUs**		**Number of Unsuitable DMMUs**	
Turning Basin (surface)	3		47	
Piers D, B, 3 (surface)	3		23	
Piers D, B, 3 (subsurface)	1		6	
Subtotal:	7		76	

a) **Amphipod Bioassay (*Eohaustorius estuarius*).** Amphipod bioassay results showed significant toxicity being expressed among the 83 DMMU as noted in Appenidix 3a and Table 3. Only 5 of 83 DMMUs had no toxicity being expressed. A total of 18 two-hit and 60 one-hit toxicity responses were observed among the 83 DMMUs. An examination of potential nontreatment effects indicated that clay content may be contributing to the

observed toxicity. An examination of the total data set showed a correlation of 0.63 ($p<0.001$, $n = 83$) between *Eohaustorius* mortality and clay content (Figure 2). Excluding the Pier material (Piers D, B, 3) from the turning basin and inner channel material increased the correlation to 0.82 ($p<0.001$, $n = 62$)(Figure 3). The apparent effect of clay on *Eohaustorius* was sufficient that the DMMP agencies have authorized a retest of 62 DMMUs, where clay contents exceed 15 percent (Appendicies 4, 5). Therefore, the results of the initial amphipod bioassay testing outcomes are only being used to make an interim suitability determination. After the amphipod retesting is completed and the data submitted to the agencies, the DMMP agencies will evaluate the data and make a supplemental suitability determination.

b) **Bivalve Larval Bioassay (*Mytilus galloprovincialis*).** The results of the larval bivalve test (Appendix 3b and Table 3) also showed significant toxicity being expressed although not to the extent shown in the amphipod bioassay. A total of 58 DMMUs had two-hit and 4 exhibited one-hit toxicity responses, with 21 DMMUs passing the nondispersive interpretive disposal guidelines. An examination of potential clay effects on the larval bivalve toxicity for the entire data set showed no correlation, but an examination of the Turning Basin and Inner Channel data after excluding the Pier data did show a significant but weak correlation ($r = 0.46$, $p < 0.001$, $n = 62$)(Figure 4). No retesting of the Sediment Larval bioassay is authorized by the DMMP agencies and the results from this bioassay stand for DMMP regulatory decision making.

c) ***Neanthes* 20-day Growth Bioassay (*Neanthes arenaceodentata*).** The results of the *Neanthes* growth bioassay (Appendix 3c and Table 3) showed low toxicity among the 83 DMMUs characterized, with 5 DMMUs exhibiting two-hit responses, and the remaining 78 DMMUs passing the nondispersive disposal guidelines for this bioassay.

d) **DMMP Bioassay Determination.** Overall interpretation of the bioassay responses on an interim basis (See Appendicies 1 and 3a-c and Table 3) indicates that 7 of the DMMUs passed the DMMP unconfined-open-water disposal guidelines (DMMUs S24, S29, S50, S51, S53, S59, and D2), while the remaining 76 DMMUs are unsuitable. However, S51 is considered unsuitable due to the exceedance of the ML rule (see paragraph 6 above), and is unsuitable pending a decision by the applicant whether or not to conduct a Tier IV analysis to assess the risks of this DMMU for open-water disposal.

e) **Bioaccumulation Trigger Exceedances**. As noted in paragraph 6, a number of DMMUs had bioaccumulation trigger exceedances. These are highlighted in Table 4 below. However, except for S51, all DMMUs with BT exceedances also failed the interim DMMP bioassay determinations (see Appendix 1), and hence do not need additional biological testing at this time. Additionally, two DMMUs (S77, S78) had mercury BT exceedances, but do not need to be considered further because they are unsuitable based on the Sediment Larval and Neanthes bioassay results, and would be unsuitable even without the amphipod bioassay results. If the Navy decides to conduct a Tier IV analysis on S51, special bioaccumulation testing (e.g., time series), which could include risk assessment may be required to assess this DMMU for UCOWD. If amphipod retesting results in any of the identified DMMUs with BT exceedances passing the DMMP bioassay testing, these DMMU would then be required to undergo bioaccumulation testing prior to making a supplemental suitability determination.

Table 4. DMMUs with bioaccumulation trigger exceedances.

Chemical	S51	S25	S55	S61	S70
Mercury **BT = 1.5 ppm**	1.75				
Silver **BT = 6.1 ppm**	6.5				
TBT **BT = 0.15 ppb (porewater)**		0.15		0.17	
DDT **BT =50 ppb**	748		96.9		
Pentachlorophenol **BT = 504 ppm**	620				
Bis(2-ethylhexyl)phthalate **BT =13,870 ppb**					31,000

8. The agencies concluded on an interim basis pending review of amphipod retesting results, that all but six DMMUs (S24, S29, S50, S53, S59, and D2) are unsuitable for unconfined open-water-disposal at the Elliott Bay non-dispersive site (see Appendix 1 for a complete inventory of suitable and unsuitable DMMUs). The volume of unsuitable dredged material is 344,440 cubic yards and the volume of suitable material is 29,460 cubic yards. Therefore, 29,460 cubic yards of dredged material is suitable for placement at the Elliott Bay disposal site.

9. This memorandum documents the suitability of the dredged material within the U.S. Navy Shipyard dredging project in Sinclair Inlet for disposal at the Elliott Bay non-dispersive open-water disposal site. 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:

August 24, 1999
Date — David R. Kendall, Ph.D., Seattle District Corps of Engineers

8/30/99
Date — Thomas H. Gries, Tom Gries, Washington Department of Ecology

8/30/99
Date — Erika Hoffman, Environmental Protection Agency

8/25/99
Date — Richard L. Vining, Rick Vining, Washington Department of Ecology

25 AUG 99
Date — Ted R. Benson, Ted Benson, Washington Department of Natural Resources

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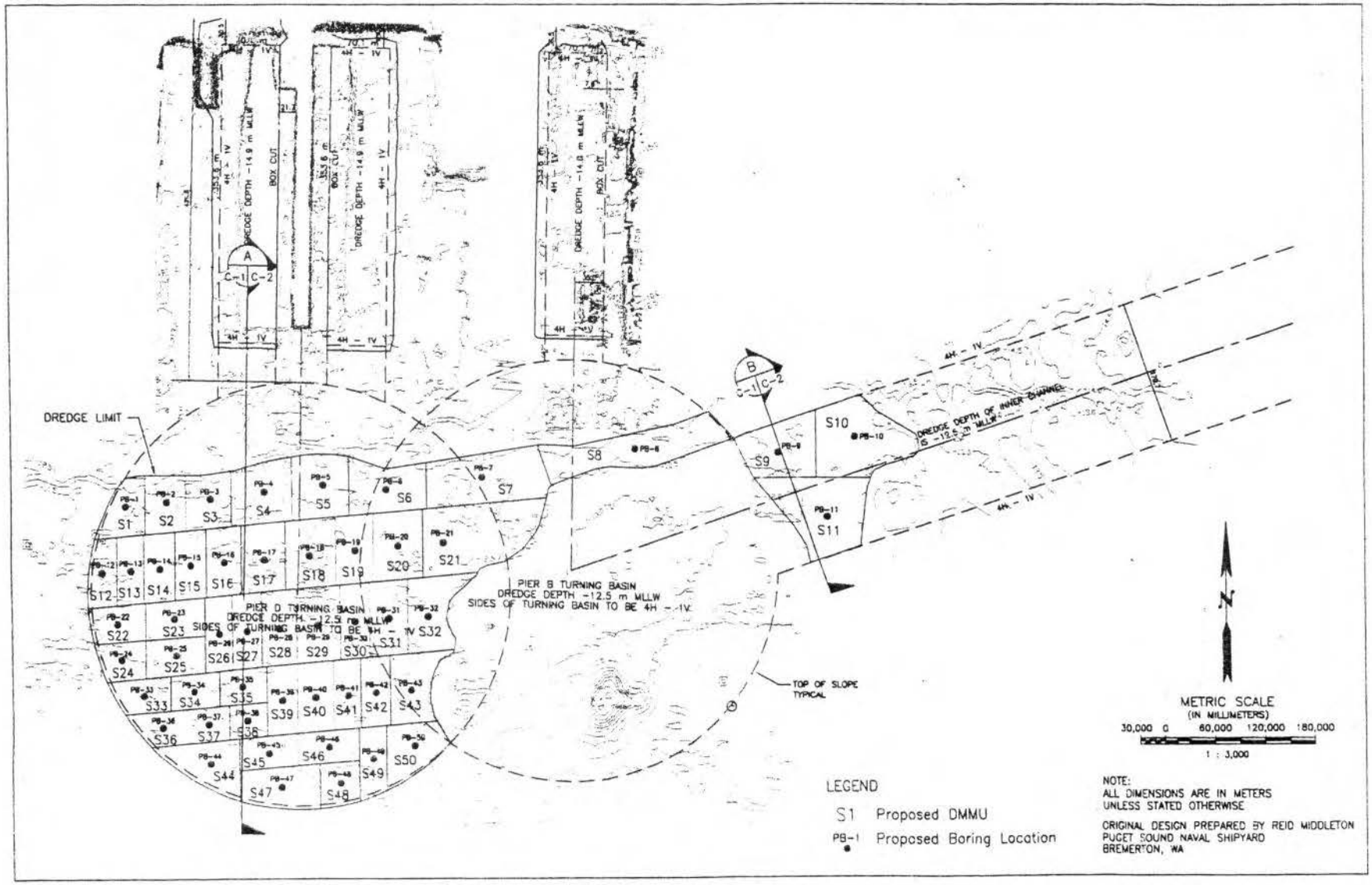
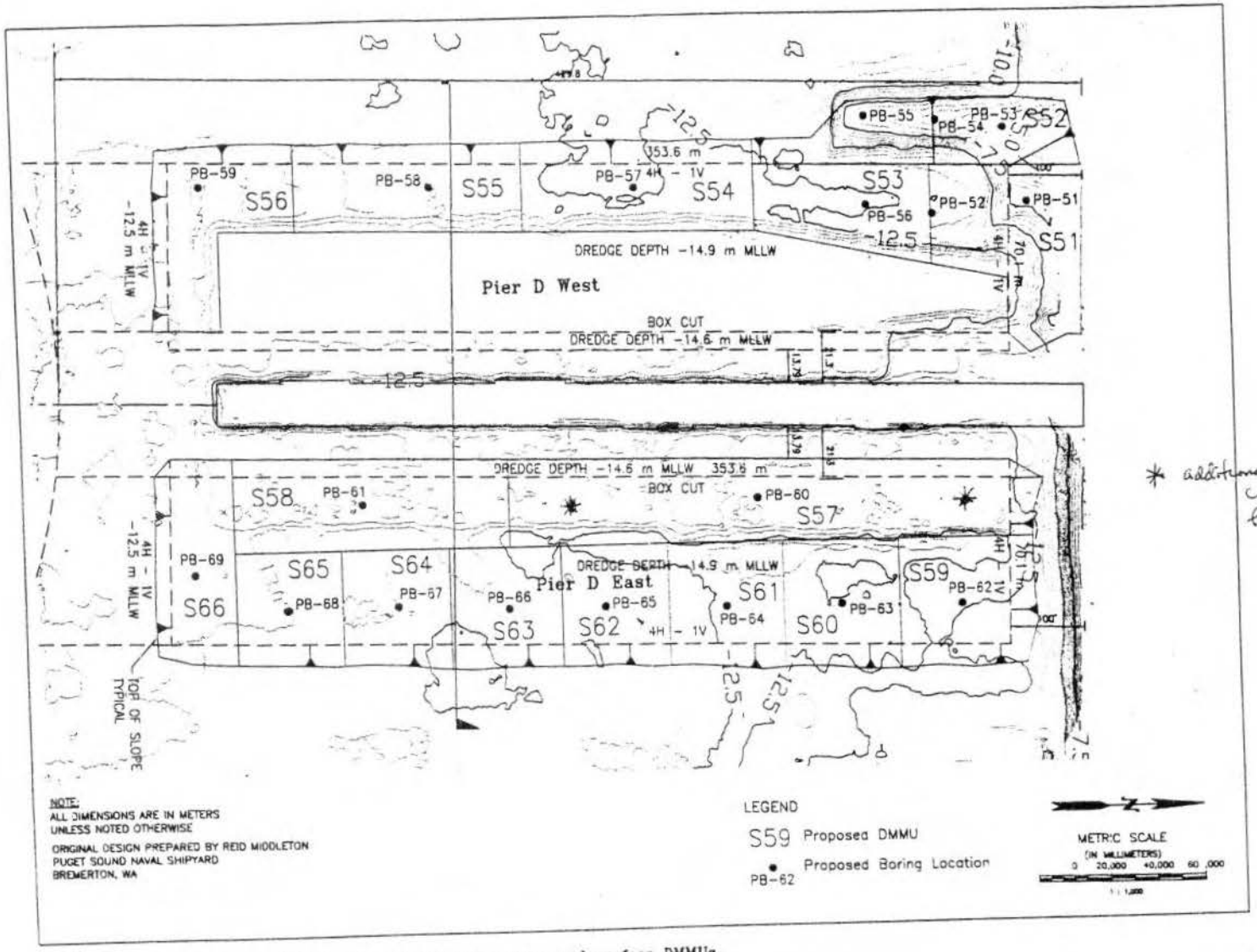


Figure 11-1. Turning basin and inner channel proposed boring locations and surface DMMUs.

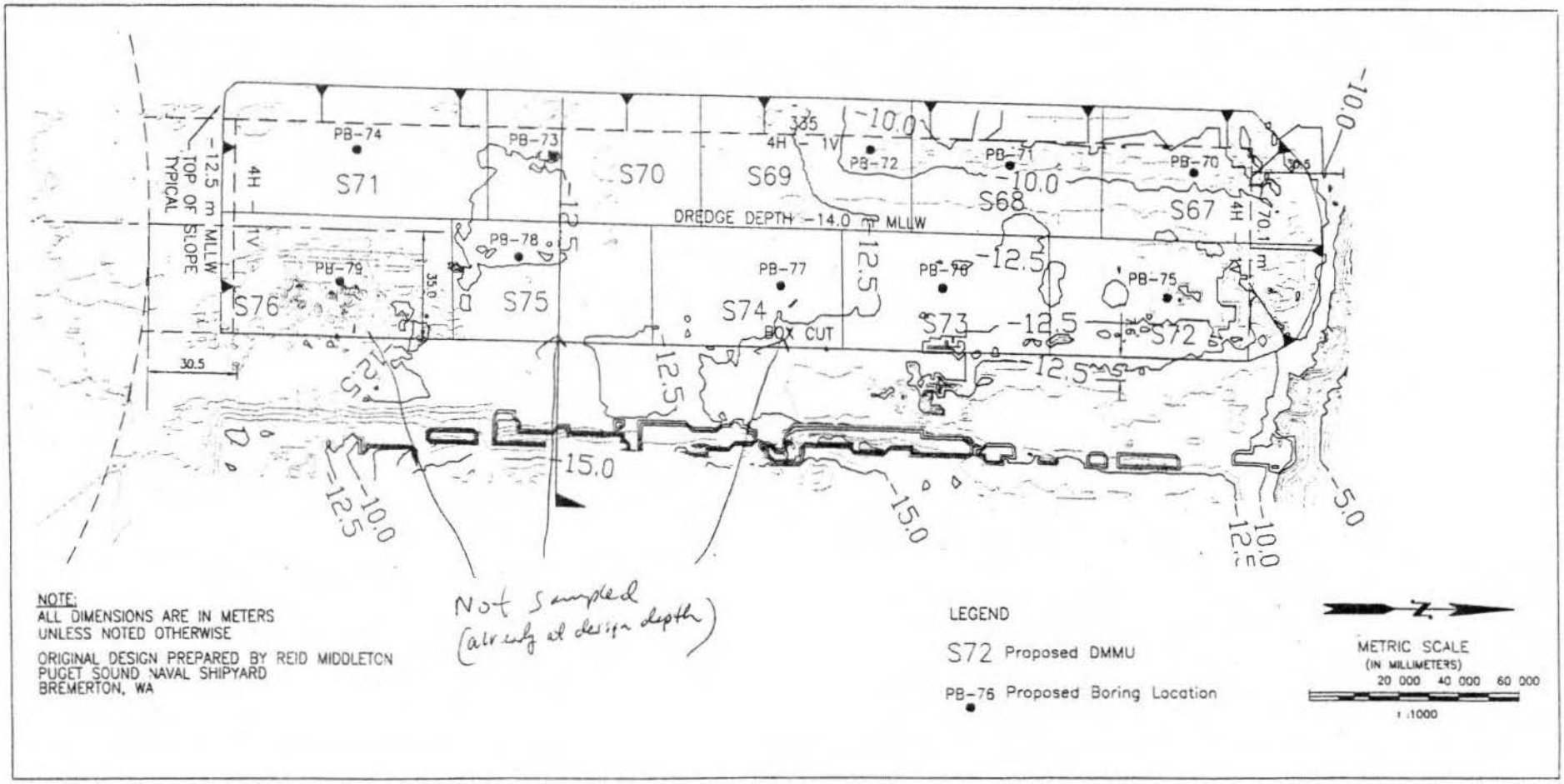
Figure 1a.



* additional cores to be collected within DMMU S57 for surface DMMU S57 characterization.

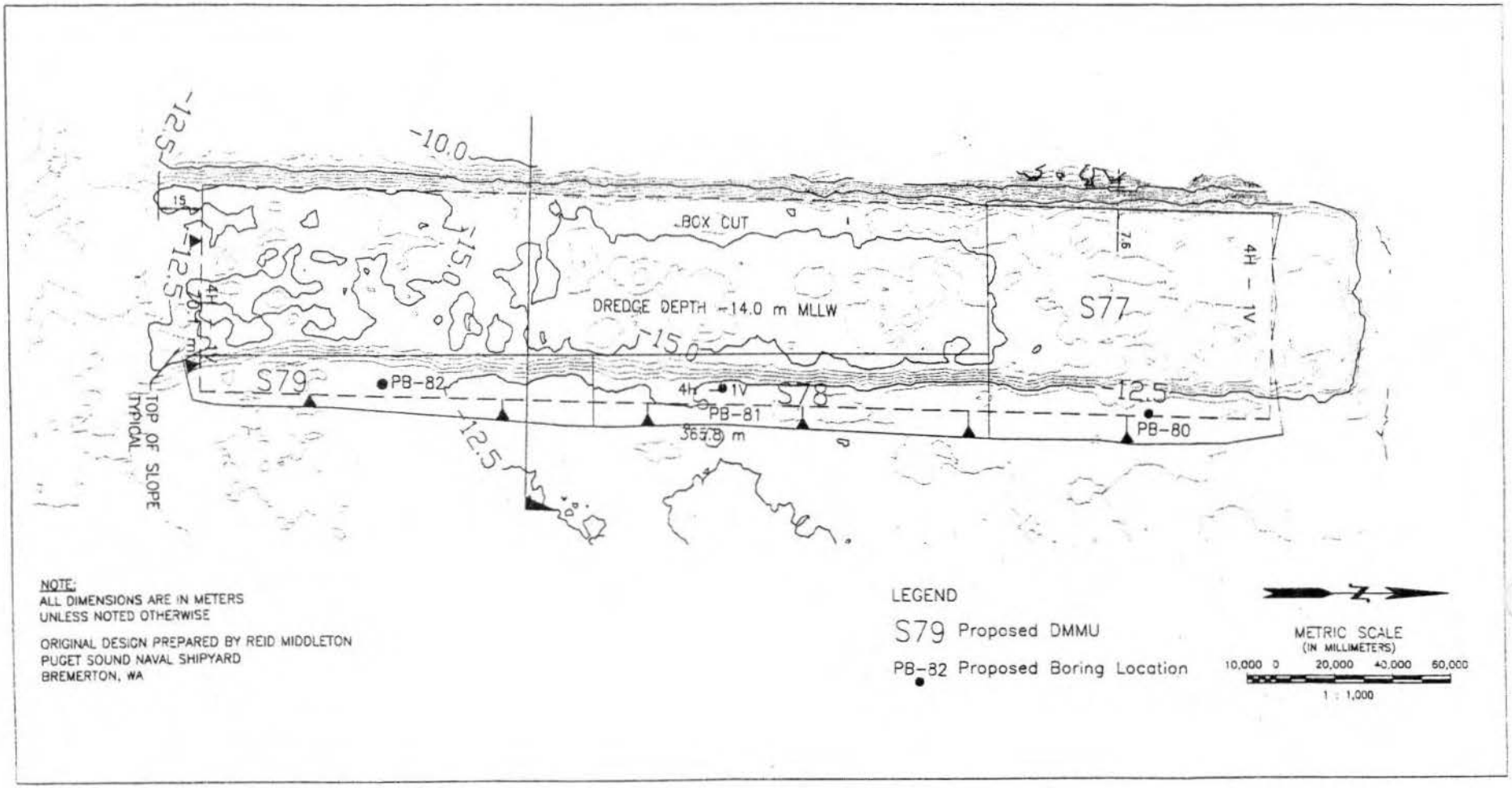
~~Figure 11-2.~~ Pier D East and West proposed boring locations and surface DMMUs.

Figure 1b.



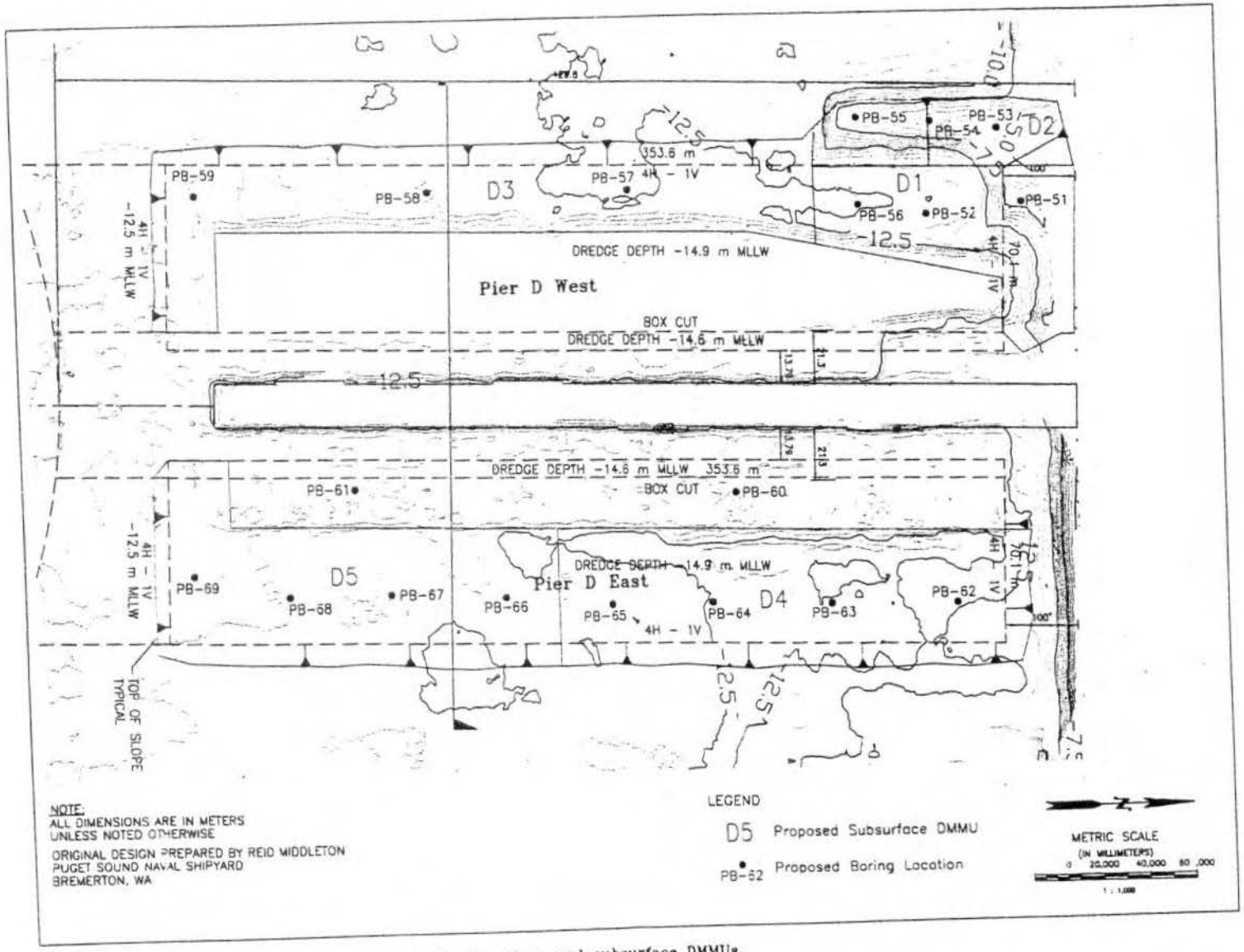
~~Figure 11-3~~. Pier B proposed boring locations and surface DMMUs.

Figure 1c.



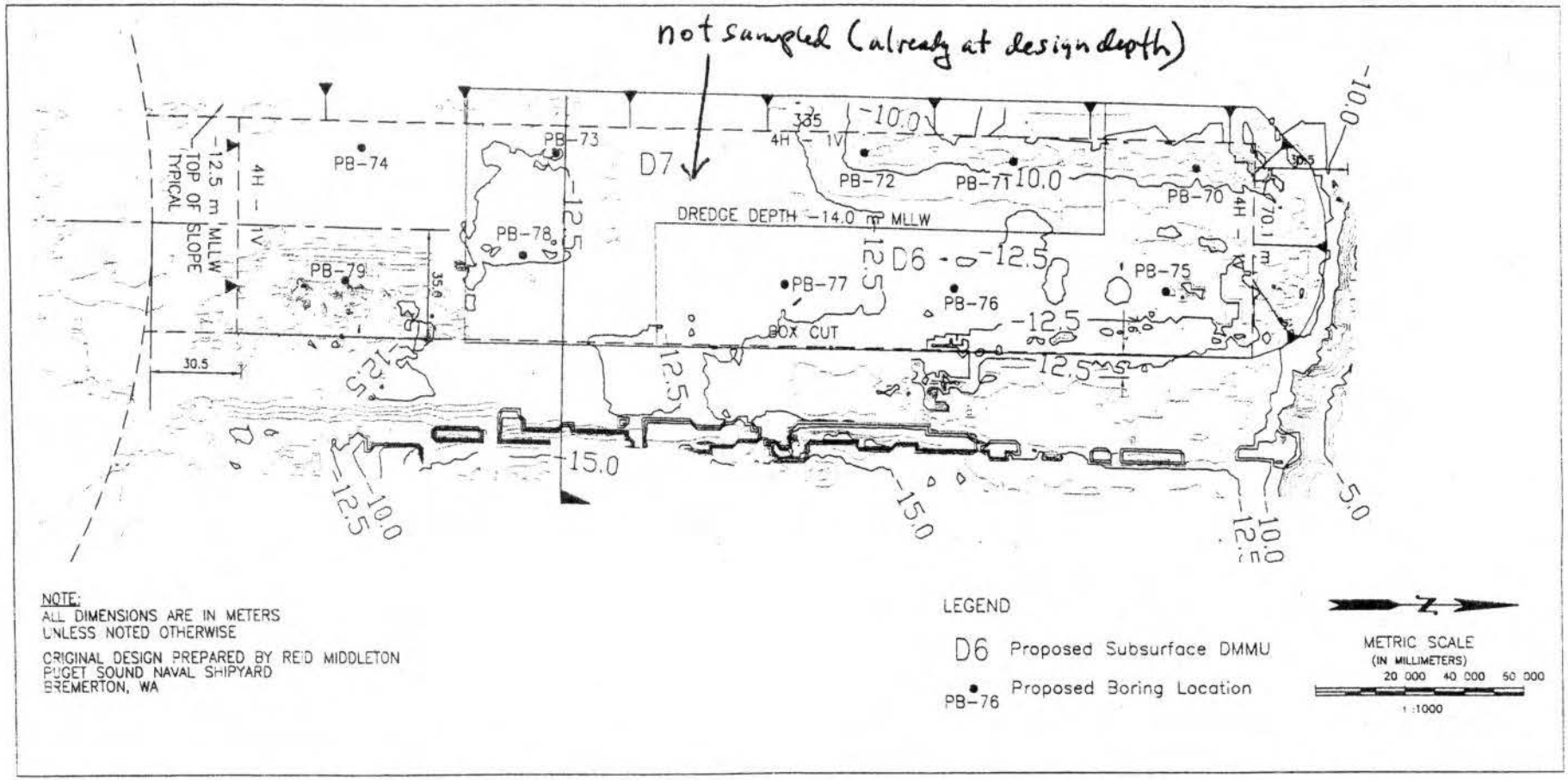
~~Figure 1~~. Pier 3 proposed boring locations and surface DMMUs.

Figure 1d.



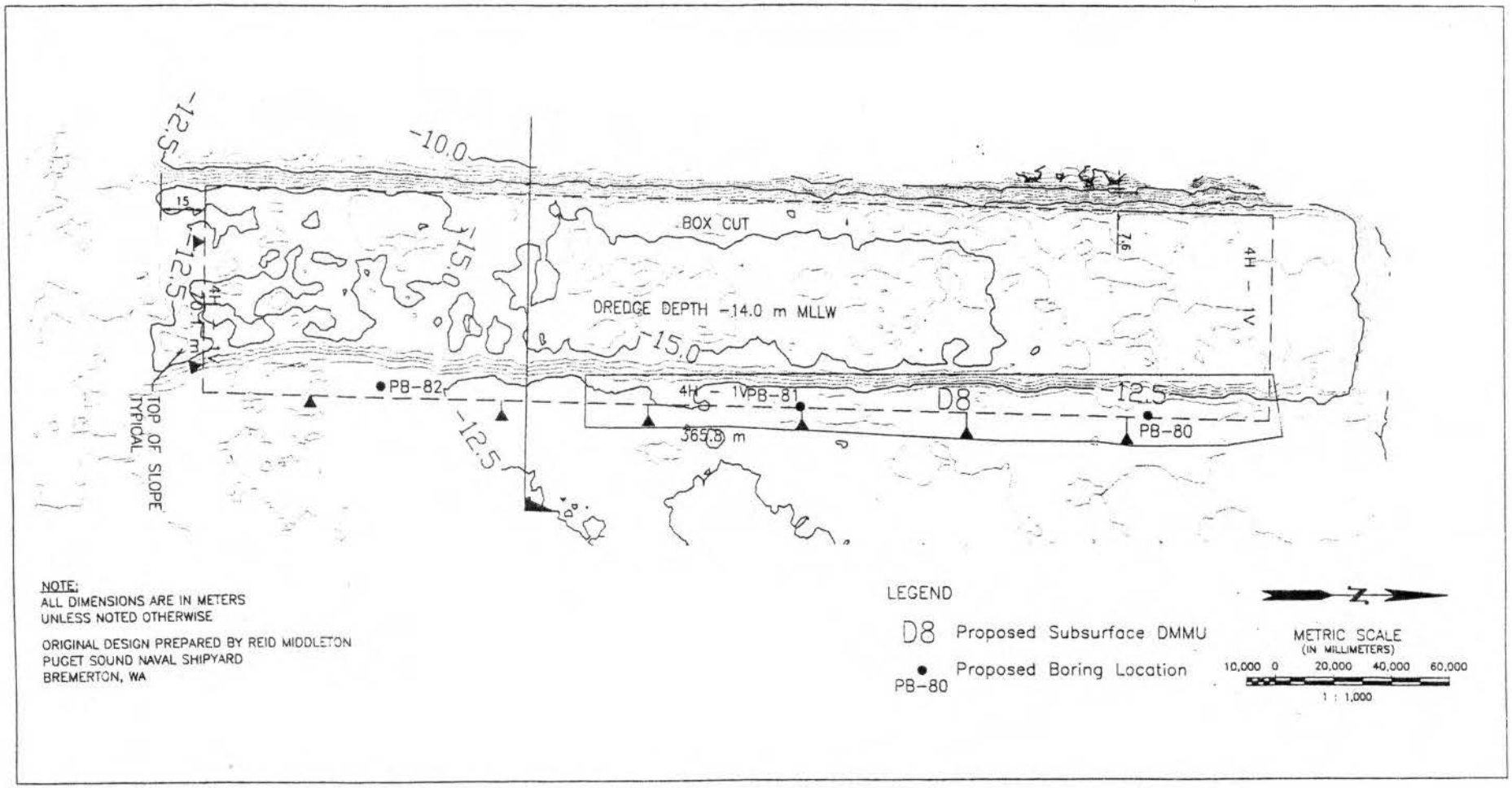
[redacted]. Pier D East and West proposed boring locations and subsurface DMMUs.

Figure 1e.



[redacted]. Pier B proposed boring locations and subsurface DMMUs.

Figure 1f.

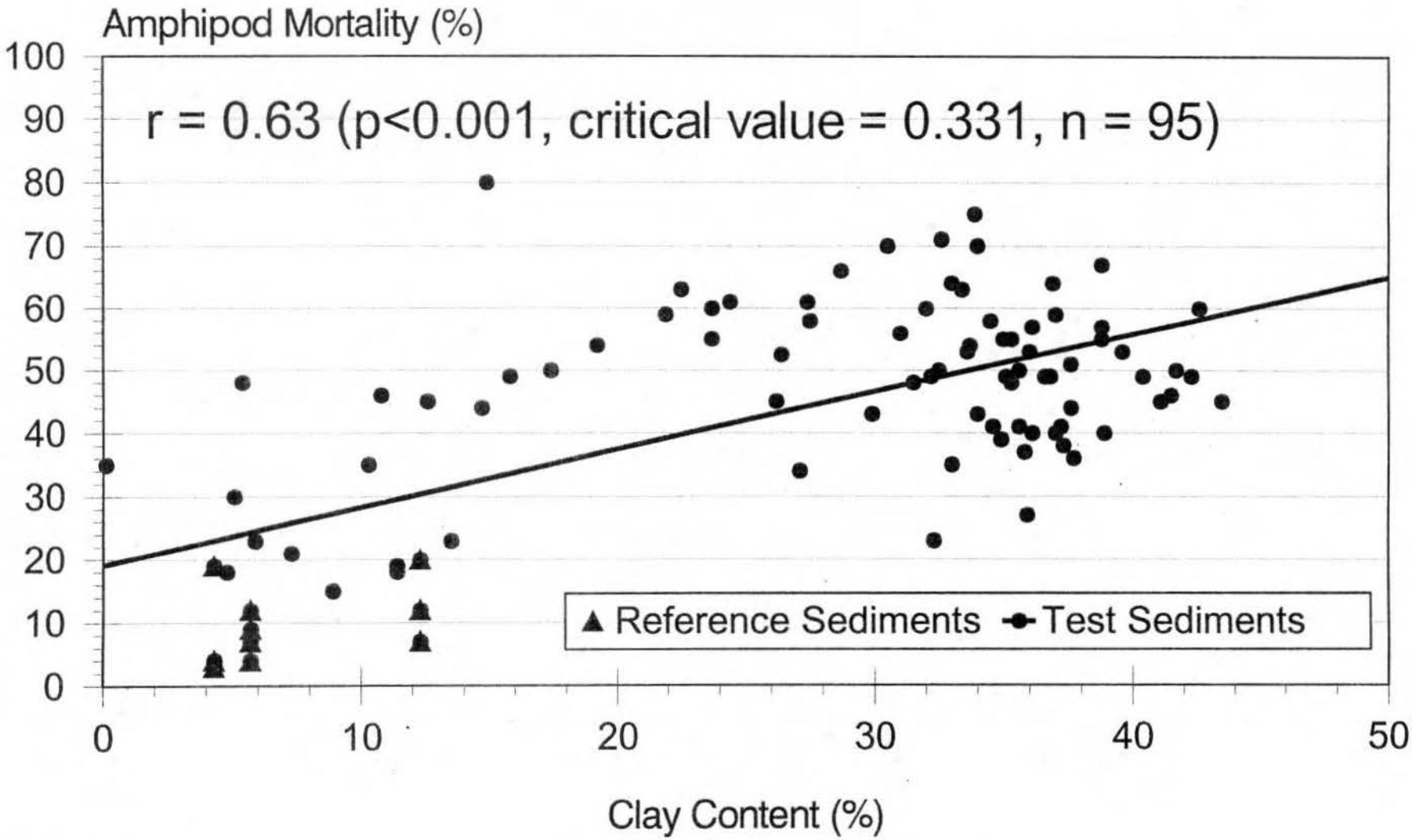


~~Figure 11.6~~. Pier 3 proposed boring locations and subsurface DMMUs.

Figure 1g.

Figure 2

Scatter Plot of Amphipod Mortality versus Clay Content



All DMMUs

Figure 3

Scatter Plot of Eohaustorius Mortality versus Clay Content

Turning Basin and Inner Channel

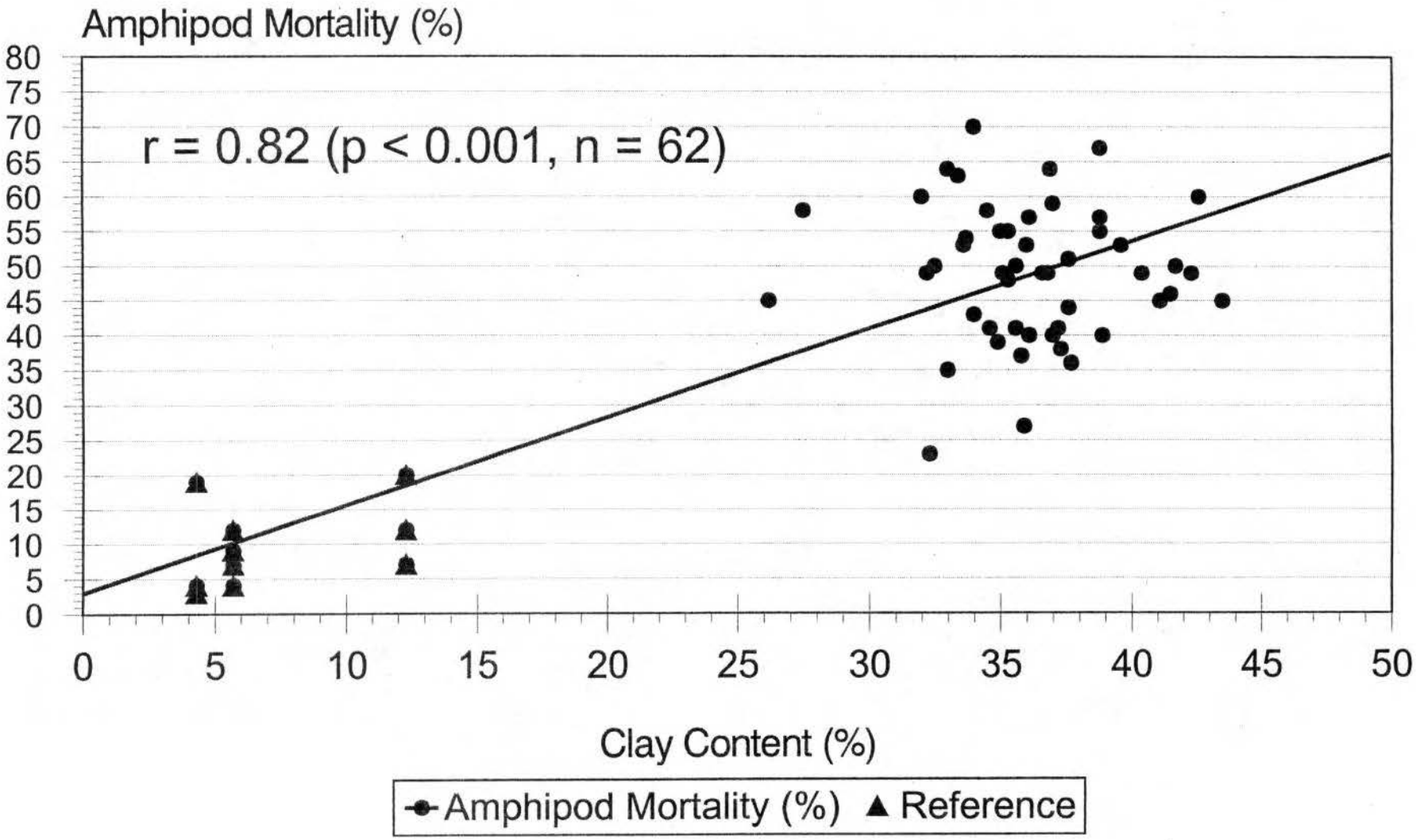
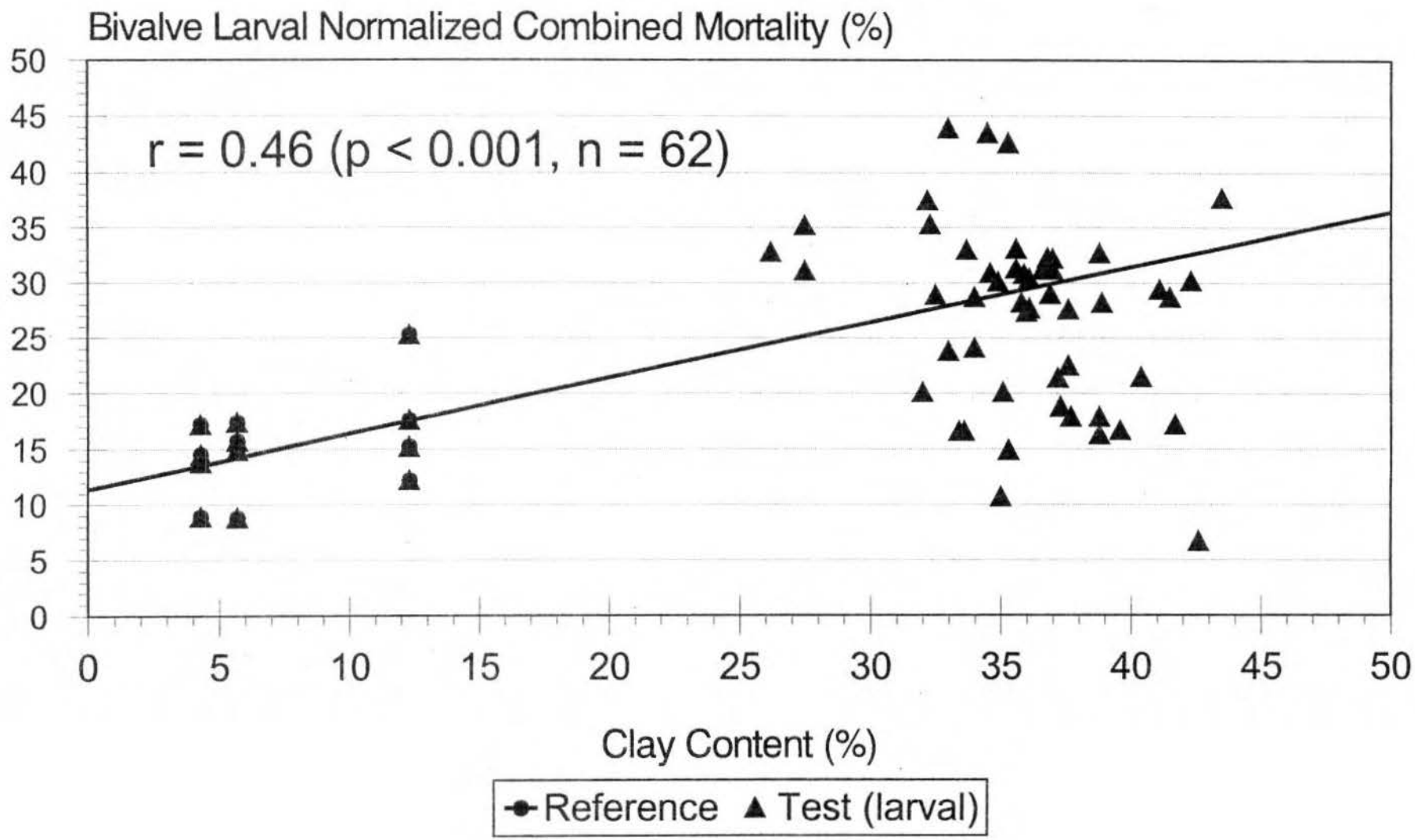


Figure 4

Scatter Plot of Mytilus Larvae Mortality versus Clay Content

Turning Basin and Inner Channel



Appendix 1. Puget Sound Naval Shipyard, Bremerton, WA.
DMMP Evaluation Summary

				DMMU ID	S14		S15		S16		S17		S18		S19		S20		S21		S22		S23		S24		S25		S26	
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700																										
Copper	mg/kg	390		1,300																										
Lead	mg/kg	450		1,200																										
Mercury	mg/kg	0.41	1.5	2.3			0.471		0.605																					
Silver	mg/kg	6.1	6.1	8.4																										
Zinc	mg/kg	410		3,800																										
Tributyltin ion (porewater)	ug/L	0.15	0.15	--																							0.15			
Acenaphthene	ug/kg	500		2,000																										
Fluorene	ug/kg	540		3,600																										
Phenanthrene	ug/kg	1,500		21,000																										
Anthracene	ug/kg	960		13,000																										
Fluoranthene	ug/kg	1,700	4,600	30,000																										
Pyrene	ug/kg	2,600		16,000																										
Benzo(a)anthracene	ug/kg	1,300		5,100																										
Chrysene	ug/kg	1,400		21,000																										
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																										
Total HPAHs	ug/kg	12,000		69,000																										
1,2,4-Trichlorobenzene	ug/kg	31		64																										
Hexaclorobenzene (HCB)	ug/kg	22	168	230																										
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--																										
2-Methylphenol	ug/kg	63		77																										
2,4-Dimethylphenol	ug/kg	29		210																										
Pentachlorophenol	ug/kg	400	504	690																										
Benzoic Acid	ug/kg	650		760																										
Benzyl alcohol	ug/kg	57		870																										
Hexachlorobutadiene	ug/kg	29	212	270																										
N-Nitrosodiphenylamine	ug/kg	28	130	130																										
alpha-Chlordane	ug/kg	10	37																											
Dieldrin	ug/kg	10	37																											
Total DDT	ug/kg	6.9	50	69																										
Total PCBs	ug/kg	130		3,100																										
Total PCBs (TOC- normalized)	mg/kg		38																											
Total Solids	%				37.6		37.6		38.7		40.6		42.0		39.8		39.4		39.5		37.6		37.1		35.5		36.6		37.2	
Total Volatile Solids	%				6.6		7.3		7.6		7.9		7.0		7.8		6.4		7.1		6.6		7.1		8.6		7.5		6.5	
Total Organic Carbon	%				2.7		2.9		2.0		2.4		2.3		2.6		2.9		3.2		3.2		2.8		25.0		3.0		2.6	
Total Ammonia	mg/kg				47.0		40.0		39.0		61.0		58.0		45.0		29.0		30.0		51.0		55.0		52.0		57.0		54.0	
Total Sulfides	mg/kg				72		74		55		22	U	23	U	30	U	29		30	U	28	U	26	U	29	U	51		67	
Gravel (percent)	%				-		-		0.3		0.2		0.2		0.3		2.6		-		0.6		-		-		-		0.8	
Sand (percent)	%				8.8		6.3		8.1		10.0		10.0		9.5		13.6		10.0		9.1		10.5		7.1		8.5		5.9	
Silt (percent)	%				49.5		50.2		53.0		57.6		56.3		52.8		48.9		50.6		48.0		49.1		55.1		48.9		56.1	
Clay (percent)	%				**41.7**		**43.5**		**38.8**		**32.0**		**33.6**		**37.6**		**35.1**		**39.6**		**42.3**		**40.4**		**37.7**		**42.6**		**37.2**	
Fines (percent silt + clay)	%				91.2		93.7		91.8		89.8		89.9		90.4		84.0		90.2		90.3		89.5		92.8		91.5		93.3	
preferred reference match:					82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7	
Eohaustorius estuarius hits:					1-H		1-H		1-H		1-H		1-H		1-H		1-H		1-H		1-H		1-H		2-H		1-H		2-H	
Mytilus galloprovincialis hits:							2-H								2-H		2-H				2-H		2-H						2-H	
Neanthes arenaceodentata hits:													2-H																	
Bioassay Pass/Fail:																									Pass					
BTs exceeded:																											yes			
Bioaccumulation conducted:																											no			
Bioaccumulation Pass/Fail:																														
ML Rule exceeded:																														
PSDDA Determination:																									Pass					
DMMU Volume:	cy				4,020		4,030		3,970		3,980		4,030		3,970		4,030		4,000		3,980		3,980		3,920		3,960		3,960	
DMMU ID:					S14		S15		S16		S17		S18		S19		S20		S21		S22		S23		S24		S25		S26	
					4,020		4,030		3,970		3,980		4,030		3,970		4,030		4,000		3,980		3,980				3,960		3,960	
Passed:																									3,920					
Eohaustorius retest																					yes		yes						yes	
Amphipod (Ampelisca) retest					4,020		4,030		3,970		3,980		4,030		3,970		4,030		4,000		3,980		3,980				3,960		3,960	

Appendix 1. Puget Sound Naval Shipyard, Bremerton, WA.
DMMP Evaluation Summary

				DMMU ID	S1		S2		S3		S4		S5		S6		S7		S8		S9		S10		S11		S12		S13	
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc	VQ	Conc	VQ	Conc	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700																										
Copper	mg/kg	390		1,300																										
Lead	mg/kg	450		1,200																										
Mercury	mg/kg	0.41	1.5	2.3							0.773								0.872		0.548		0.915							
Silver	mg/kg	6.1	6.1	8.4																										
Zinc	mg/kg	410		3,800																										
Tributyltin ion (porewater)	ug/L	0.15	0.15	--																										
Acenaphthene	ug/kg	500		2,000																										
Fluorene	ug/kg	540		3,600																										
Phenanthrene	ug/kg	1,500		21,000																										
Anthracene	ug/kg	960		13,000																										
Fluoranthene	ug/kg	1,700	4,600	30,000																										
Pyrene	ug/kg	2,600		16,000																										
Benzo(a)anthracene	ug/kg	1,300		5,100																										
Chrysene	ug/kg	1,400		21,000																										
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																										
Total HPAHs	ug/kg	12,000		69,000																										
1,2,4-Trichlorobenzene	ug/kg	31		64																										
Hexaclorobenzene (HCB)	ug/kg	22	168	230																										
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--																										
2-Methylphenol	ug/kg	63		77																										
2,4-Dimethylphenol	ug/kg	29		210																										
Pentachlorophenol	ug/kg	400	504	690																										
Benzoic Acid	ug/kg	650		760																										
Benzyl alcohol	ug/kg	57		870																										
Hexachlorobutadiene	ug/kg	29	212	270																										
N-Nitrosodiphenylamine	ug/kg	28	130	130																										
alpha-Chlordane	ug/kg	10	37																											
Dieldrin	ug/kg	10	37																											
Total DDT	ug/kg	6.9	50	69																										
Total PCBs	ug/kg	130		3,100																										
Total PCBs (TOC- normalized)	mg/kg		38																											
Total Solids	%				41.3		40.5		40.4		39.6		44.2		40.7		40.6		40.0		42.0		40.1		41.1		38.7		38.1	
Total Volatile Solids	%				9.0		6.3		8.1		8.1		7.4		6.5		6.0		6.7		5.5		5.9		6.3		8.6		6.8	
Total Organic Carbon	%				2.2		1.2		2.6		2.8		2.2		2.4		2.0		2.1		1.8		2.2		2.0		2.4		2.6	
Total Ammonia	mg/kg				43.0		50.0		42.0		28.0		46.0		42.0		44.0		18.0		23.0		36.0		36.0		49.0		33.0	
Total Sulfides	mg/kg				89	J	63	J	210	J	130	J	26	U	48	J	98		27	U	39		50		78		46		26	U
Gravel (percent)	%				0.2		0.5		-		-		1.8		0.2		0.2		0.3		0.9		0.4		0.2		0.6		-	
Sand (percent)	%				8.7		6.9		9.6		10.9		11.6		11.0		9.9		8.7		15.7		13.2		14.6		7.8		6.8	
Silt (percent)	%				58.2		56.5		54.7		56.8		53.0		52.8		55.6		52.4		47.3		50.4		50.6		52.9		57.9	
Clay (percent)	%				**32.2**		**36.1**		**35.6**		**32.3**		**33.7**		**35.9**		**34.0**		**38.8**		**36.1**		**35.8**		**34.6**		**38.9**		**35.3**	
Fines (percent silt + clay)	%				90.9		92.6		90.3		89.1		86.7		88.7		89.7		91.2		83.4		86.2		85.2		91.8		93.2	
preferred reference match:					82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7	
Eohaustorius estuarius hits:					1-H		1-H		1-H		2-H		1-H		2-H		1-H		1-H		1-H		2-H		1-H		1-H		1-H	
Mytilus galloprovincialis hits:					2-H		2-H		2-H		2-H		2-H		2-H		2-H		2-H		2-H		2-H		2-H		2-H			
Neanthes arenaceodentata hits:																														
Bioassay Pass/Fail:																														
BTs exceeded:																														
Bioaccumulation conducted:																														
Bioaccumulation Pass/Fail:																														
ML Rule exceeded:																														
PSDDA Determination:																														
DMMU Volume:	cy				4,050		3,980		4,000		3,980		4,100		4,090		3,950		3,950		4,030		4,050		4,080		3,870		3,940	
DMMU ID:					S1		S2		S3		S4		S5		S6		S7		S8		S9		S10		S11		S12		S13	

					4,050		3,980		4,000		3,980		4,100		4,090		3,950		3,950		4,030		4,050		4,080		3,870		3,940	
Passed:																														
Eohaustorius retest					yes																									
Amphipod (Ampelisca) retest					4,050		3,980		4,000		3,980		4,100		4,090		3,950		3,950		4,030		4,050		4,080		3,870		3,940	

				DMMU ID	S79		S40		S41		S42		S43		S44		S45		S46		S47		S48		S81		S49		S50		S51	
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700																												
Copper	mg/kg	390		1,300																												
Lead	mg/kg	450		1,200																												
Mercury	mg/kg	0.41	1.5	2.3											0.434		0.454														1.75	
Silver	mg/kg	6.1	6.1	8.4																											6.5	
Zinc	mg/kg	410		3,800																											520	
Tributyltin ion (porewater)	ug/L	0.15	0.15	--																												
Acenaphthene	ug/kg	500		2,000																												
Fluorene	ug/kg	540		3,600																												
Phenanthrene	ug/kg	1,500		21,000																												
Anthracene	ug/kg	960		13,000																												
Fluoranthene	ug/kg	1,700	4,600	30,000																											2,100	D
Pyrene	ug/kg	2,600		16,000																											3,300	D
Benzo(a)anthracene	ug/kg	1,300		5,100																												
Chrysene	ug/kg	1,400		21,000																												
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																												
Total HPAHs	ug/kg	12,000		69,000																												
1,2,4-Trichlorobenzene	ug/kg	31		64																											46	UD
Hexachlorobenzene (HCB)	ug/kg	22	168	230																											77	UD
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--																												
2-Methylphenol	ug/kg	63		77																											77	UD
2,4-Dimethylphenol	ug/kg	29		210																											77	UD
Pentachlorophenol	ug/kg	400	504	690																											620	UD
Benzoic Acid	ug/kg	650		760																											770	UD
Benzyl alcohol	ug/kg	57		870																											110	UD
Hexachlorobutadiene	ug/kg	29	212	270																											92	UD
N-Nitrosodiphenylamine	ug/kg	28	130	130																											77	UD
alpha-Chlordane	ug/kg	10	37																												27	D
Dieldrin	ug/kg	10	37																												16	D
Total DDT	ug/kg	6.9	50	69																											746	
Total PCBs	ug/kg	130		3,100																											1,115	
Total PCBs (TOC- normalized)	mg/kg		38																												21.9	
Total Solids	%				37.3		37.6		36.2		35.2		37.2		37.8		36.8		36.0		37.0		37.8		37.0		36.8		35.2		46.4	
Total Volatile Solids	%				9.4		8.8		6.5		10.0		8.1		11.0		8.6		8.0		7.0		8.6		7.4		7.1		7.9		8.7	
Total Organic Carbon	%				2.3		2.0		2.1		2.3		2.1		2.7		2.4		2.4		2.5		1.9		2.1		2.1		2.2		5.1	
Total Ammonia	mg/kg				57.0		21.0		45.0		59.0		53.0		70.0		55.0		62.0		81.0		88.0		81.0		65.0		53.0		39.0	
Total Sulfides	mg/kg				64		17	U	34		73		82		16		130		55		110		120		69		67		140		1,800	
Gravel (percent)	%				0.3		-		-		-		-		-		0.6		-		-		0.3		-		0.5		0.3		9.1	
Sand (percent)	%				7.8		7.4		9.5		10.1		8.3		7.1		7.1		7.9		6.8		7.5		6.2		7.8		10.0		46.3	
Silt (percent)	%				56.0		58.0		57.7		54.3		56.7		66.7		64.9		64.7		59.3		50.9		53.5		54.7		57.2		33.2	
Clay (percent)	%				**35.9**		**34.5**		**33.0**		**35.6**		**34.9**		**26.2**		**27.5**		**27.5**		**34.0**		**41.5**		**40.3**		**36.9**		**32.5**		**11.4**	
Fines (percent silt + clay)	%				91.9		92.5		90.7		89.9		91.6		92.9		92.4		92.2		93.3		92.4		93.8		91.6		89.7		44.6	
preferred reference match:					82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		58.2	
Eohaustorius estuarius hits:					--		1-H		1-H		2-H		2-H		1-H		1-H		1-H		1-H		1-H		--		1-H		2-H			
Mytilus galloprovincialis hits:					--		2-H		2-H		2-H		2-H						2-H				2-H		--						2-H	
Neanthes arenaceodentata hits:					--																				--							
Bioassay Pass/Fail:																													Pass		Pass	
BTs exceeded:																															yes	
Bioaccumulation conducted:																															no	
Bioaccumulation Pass/Fail:																																
ML Rule exceeded:																															yes	
PSDDA Determination:																													Pass			
DMMU Volume:	cy						3,970		3,950		4,060		3,950		4,150		3,980		4,050		4,080		4,120				4,020		4,030		4,050	
DMMU ID:					FD-S39		S40		S41		S42		S43		S44		S45		S46		S47		S48		FD-S48		S49		S50		S51	

Failed:							3,970		3,950		4,060		3,950		4,150		3,980		4,050		4,080		4,120				4,020				4,050	
Passed:																													4,030			
Eohaustorius retest																							yes									
Amphipod (Ampelisca) retest							3,970		3,950		4,060		3,950		4,150		3,980		4,050		4,080		4,120				4,020					

				DMMU ID	S27		S28		S29		S30		S31		S32		S33		S34		S35		S36		S37		S38		S39	
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700																										
Copper	mg/kg	390		1,300																										
Lead	mg/kg	450		1,200																										
Mercury	mg/kg	0.41	1.5	2.3																										
Silver	mg/kg	6.1	6.1	8.4																										
Zinc	mg/kg	410		3,800																										
Tributyltin ion (porewater)	ug/L	0.15	0.15	--																										
Acenaphthene	ug/kg	500		2,000																										
Fluorene	ug/kg	540		3,600																										
Phenanthrene	ug/kg	1,500		21,000																										
Anthracene	ug/kg	960		13,000																										
Fluoranthene	ug/kg	1,700	4,600	30,000																										
Pyrene	ug/kg	2,600		16,000																										
Benzo(a)anthracene	ug/kg	1,300		5,100																										
Chrysene	ug/kg	1,400		21,000																										
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																										
Total HPAHs	ug/kg	12,000		69,000																										
1,2,4-Trichlorobenzene	ug/kg	31		64																										
Hexachlorobenzene (HCB)	ug/kg	22	168	230																										
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--																										
2-Methylphenol	ug/kg	63		77																										
2,4-Dimethylphenol	ug/kg	29		210																										
Pentachlorophenol	ug/kg	400	504	690																										
Benzoic Acid	ug/kg	650		760																										
Benzyl alcohol	ug/kg	57		870																										
Hexachlorobutadiene	ug/kg	29	212	270																										
N-Nitrosodiphenylamine	ug/kg	28	130	130																										
alpha-Chlordane	ug/kg	10	37																											
Dieldrin	ug/kg	10	37																											
Total DDT	ug/kg	6.9	50	69																										
Total PCBs	ug/kg	130		3,100																										
Total PCBs (TOC- normalized)	mg/kg		38																											
Total Solids	%				37.1		37.8		37.1		38.0		38.2		39.0		36.9		36.7		38.0		39.0		37.9		37.3		38.3	
Total Volatile Solids	%				8.5		7.4		6.7		7.8		6.4		7.6		7.9		8.2		7.8		9.8		9.8		6.7		9.3	
Total Organic Carbon	%				2.2		2.1		2.5		3.2		2.2		2.2		2.7		2.3		2.3		2.5		2.3		2.3		2.0	
Total Ammonia	mg/kg				54.0		69.0		57.0		31.0		43.0		26.0		54.0		40.0		56.0		71.0		74.0		68.0		58.0	
Total Sulfides	mg/kg				29	U	26	U	78		71		60		36		54		100		130		74		91		55		32	
Gravel (percent)	%				-		-		-		0.3		0.8		0.3		-		0.3		-		0.3		4.3		-		0.8	
Sand (percent)	%				8.6		9.3		6.2		8.2		10.0		8.8		4.4		7.5		7.7		5.2		7.1		6.7		8.3	
Silt (percent)	%				56.3		51.9		56.6		54.5		56.4		57.7		59.0		51.0		55.5		57.0		52.0		58.0		54.9	
Clay (percent)	%				35.0		38.8		37.3		37.0		33.0		33.4		36.6		41.1		37.0		37.6		36.8		35.3		36.0	
Fines (percent silt + clay)	%				91.3		90.7		93.9		91.5		89.4		91.1		95.6		92.1		92.5		94.6		88.8		93.3		90.9	
preferred reference match:					82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7		82.7	
Eohaustorius estuarius hits:					1-H		1-H		2-H		1-H		2-H		1-H		1-H		1-H		2-H		1-H		1-H		1-H		1-H	
Mytilus galloprovincialis hits:											2-H		2-H				2-H		2-H		2-H		2-H		2-H		2-H		2-H	
Neanthes arenaceodentata hits:																							2-H							
Bioassay Pass/Fail:									Pass																					
BTs exceeded:																														
Bioaccumulation conducted:																														
Bioaccumulation Pass/Fail:																														
ML Rule exceeded:																														
PSDDA Determination:									Pass																					
DMMU Volume:	cy				3,960		3,990		4,010		4,000		3,950		3,980		3,970		4,020		3,940		3,990		3,990		3,960		4,160	
DMMU ID:					S27		S28		S29		S30		S31		S32		S33		S34		S35		S36		S37		S38		S39	

					3,960		3,990				4,000		3,950		3,980		3,970		4,020		3,940		3,990		3,990		3,960		4,160	
Passed:									4,010																					
Eohaustorius retest																														
Amphipod (Ampelisca) retest					3,960		3,990				4,000		3,950		3,980		3,970		4,020		3,940				3,990		3,960		4,160	

				DMMU ID	S52		S53		S54		S55		S56		S57		S58		S59		S60		S61		S62		S63		S64	
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700																										
Copper	mg/kg	390		1,300																										
Lead	mg/kg	450		1,200	460																									
Mercury	mg/kg	0.41	1.5	2.3	-1.07				0.510		0.859								0.929		1.32		0.958				0.701		0.590	
Silver	mg/kg	6.1	6.1	8.4																										
Zinc	mg/kg	410		3,800																										
Tributyltin ion (porewater)	ug/L	0.15	0.15	--																			0.17	E						
Acenaphthene	ug/kg	500		2,000																										
Fluorene	ug/kg	540		3,600																										
Phenanthrene	ug/kg	1,500		21,000																										
Anthracene	ug/kg	960		13,000																										
Fluoranthene	ug/kg	1,700	4,600	30,000																										
Pyrene	ug/kg	2,600		16,000																										
Benzo(a)anthracene	ug/kg	1,300		5,100																										
Chrysene	ug/kg	1,400		21,000																										
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																										
Total HPAHs	ug/kg	12,000		69,000																										
1,2,4-Trichlorobenzene	ug/kg	31		64																										
Hexaclorobenzene (HCB)	ug/kg	22	168	230																										
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--																										
2-Methylphenol	ug/kg	63		77																										
2,4-Dimethylphenol	ug/kg	29		210																										
Pentachlorophenol	ug/kg	400	504	690																										
Benzoic Acid	ug/kg	650		760																										
Benzyl alcohol	ug/kg	57		870																										
Hexachlorobutadiene	ug/kg	29	212	270																										
N-Nitrosodiphenylamine	ug/kg	28	130	130																										
alpha-Chlordane	ug/kg	10	37																											
Dieldrin	ug/kg	10	37																											
Total DDT	ug/kg	6.9	50	69							96.9																			
Total PCBs	ug/kg	130		3,100			198				185																213		136	
Total PCBs (TOC- normalized)	mg/kg		38				11.6				7.7																9.7		7.6	
Total Solids	%				64.8		63.7		46.5		45.4		56.7		78.3		48.4		72.2		58.7		44.9		48.9		42.1		42.7	
Total Volatile Solids	%				4.7		3.4		6.5		8.0		4.7		2.5		4.4		2.5		4.0		6.9		5.7		6.7		8.0	
Total Organic Carbon	%				2.3		1.7		2.2		2.4		1.9		1.4		1.3		1.2		1.6		1.8		2.0		2.2		1.8	
Total Ammonia	mg/kg				2.8		6.5		20.0		39.0		18.0		4.8		130.0		2.4		3.9		14.0		20.0		24.0		46.0	
Total Sulfides	mg/kg				360	J	890		60	U	61		44	U	3	UJ	11	U	150		27		82		74		120		61	
Gravel (percent)	%				18.3		25.6		0.2		-		-		13.8		0.6		15.0		2.9		-		0.4		0.5		0.4	
Sand (percent)	%				55.6		43.6		21.6		15.0		40.9		61.0		11.1		59.6		44.1		21.6		17.3		13.5		11.2	
Silt (percent)	%				17.2		19.3		51.1		53.5		41.7		20.1		54.3		18.3		39.6		52.1		53.5		56.1		55.7	
Clay (percent)	%				**8.9**		**11.4**		**27.1**		**31.5**		**17.4**		**5.1**		**33.9**		**7.3**		**13.5**		**26.4**		**28.7**		**29.9**		**32.6**	
Fines (percent silt + clay)	%				26.1		30.7		78.2		85.0		59.1		25.2		88.2		25.6		53.1		78.5		82.2		86.6		88.3	
preferred reference match:					27.0		27.0		82.7		82.7		58.2		27.0		82.7		27.0		58.2		82.7		82.7		82.7		82.7	
Eohaustorius estuarius hits:									2-H		1-H		1-H		2-H		1-H				2-H		1-H		1-H		1-H		1-H	
Mytilus galloprovincialis hits:					1-H		2-H		2-H		2-H		2-H		2-H				2-H		2-H				2-H		2-H		2-H	
Neanthes arenaceodentata hits:																														
Bioassay Pass/Fail:							Pass												Pass											
BTs exceeded:											yes												yes							
Bioaccumulation conducted:											no												no							
Bioaccumulation Pass/Fail:																														
ML Rule exceeded:																														
PSDDA Determination:							Pass												Pass											
DMMU Volume:	cy				3,960		4,020		4,040		4,010		4,120		3,470		4,040		4,520		4,330		4,200		4,270		4,350		4,190	
DMMU ID:					S52		S53		S54		S55		S56		S57		S58		S59		S60		S61		S62		S63		S64	

					3,960				4,040		4,010		4,120		3,470		4,040				4,330		4,200		4,270		4,350		4,190	
Passed:							4,020												4,520											
Eohaustorius retest													yes												yes					
Amphipod (Ampelisca) retest									4,040		4,010		4,120				4,040						4,200		4,270		4,350		4,190	

				DMMU ID	S65		S66		S67		S68		S69		S70		S71		S82		S72		S73		S77		S78		S80	
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700																					72					
Copper	mg/kg	390		1,300																					670		690			
Lead	mg/kg	450		1,200																										
Mercury	mg/kg	0.41	1.5	2.3			0.529		0.836		1.09		1.17		0.720						0.949				5.26		5.27			
Silver	mg/kg	6.1	6.1	8.4																										
Zinc	mg/kg	410		3,800																							960			
Tributyltin ion (porewater)	ug/L	0.15	0.15	--																										
Acenaphthene	ug/kg	500		2,000																	860									
Fluorene	ug/kg	540		3,600																	710									
Phenanthrene	ug/kg	1,500		21,000																	2,200	D								
Anthracene	ug/kg	960		13,000																	1,000									
Fluoranthene	ug/kg	1,700	4,600	30,000																	6,200	D								
Pyrene	ug/kg	2,600		16,000																	5,500	D								
Benzo(a)anthracene	ug/kg	1,300		5,100																	2,100	D								
Chrysene	ug/kg	1,400		21,000																	2,000	D								
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																	620									
Total HPAHs	ug/kg	12,000		69,000																	20,700									
1,2,4-Trichlorobenzene	ug/kg	31		64																										
Hexachlorobenzene (HCB)	ug/kg	22	168	230									23	UD											45	UD	34	UD		
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--											31,000	D														
2-Methylphenol	ug/kg	63		77																										
2,4-Dimethylphenol	ug/kg	29		210																					45	UD	34	UD		
Pentachlorophenol	ug/kg	400	504	690																										
Benzoic Acid	ug/kg	650		760																										
Benzyl alcohol	ug/kg	57		870																					73	UD				
Hexachlorobutadiene	ug/kg	29	212	270																					55	UD	40	UD		
N-Nitrosodiphenylamine	ug/kg	28	130	130																					45	UD	34	UD		
alpha-Chlordane	ug/kg	10	37																											
Dieldrin	ug/kg	10	37																											
Total DDT	ug/kg	6.9	50	69																										
Total PCBs	ug/kg	130		3,100					220		310				134						390				290		370			
Total PCBs (TOC- normalized)	mg/kg		38						13.8		28.2				8.9						30				16.1		19.5			
Total Solids	%				45.3		44.8		59.2		54.9		59.4		44.6		54.2		52.8		61.2		69.2		56.8		42.9		46.2	
Total Volatile Solids	%				6.9		7.8		4.2		4.3		3.5		4.8		4.7		4.4		3.7		1.9		5.5		7.8		7.8	
Total Organic Carbon	%				2.0		2.0		1.6		1.1		1.2		1.5		1.6		2.4		1.3		0.38		1.8		1.9		2.0	
Total Ammonia	mg/kg				36.0		41.0		4.1		4.0		2.2		13.0		31.0		31.0		4.3		3.2		4.2		15.0		30.0	
Total Sulfides	mg/kg				21		16	U	51		180		74		31		98		10	U	190		10	U	25	J	580	J	79	
Gravel (percent)	%				0.4		0.4		1.5		3.8		3.6		0.9		2.2		1.5		3.3		1.1		6.7		0.4		0.3	
Sand (percent)	%				14.4		13.3		59.0		36.6		46.1		15.9		31.8		28.3		44.0		19.8		40.3		19.5		7.8	
Silt (percent)	%				54.3		61.8		24.8		40.4		34.7		55.8		43.3		44.0		37.9		57.2		42.7		67.4		56.0	
Clay (percent)	%				**31.0**		**24.4**		**14.7**		**19.2**		**15.8**		**27.4**		**22.5**		**26.3**		**14.9**		**21.9**		**10.3**		**12.6**		**23.7**	
Fines (percent silt + clay)	%				85.3		86.2		39.5		59.6		50.5		83.2		65.8		70.3		52.8		79.1		53.0		80.0		80.8	
preferred reference match:					82.7		82.7		27.0		58.2		58.2		82.7		58.2		58.2		58.2		82.7		58.2		82.7		82.7	
Eohaustorius estuarius hits:					1-H		1-H		2-H		1-H		1-H		1-H		1-H		--		1-H		1-H		2-H		1-H		1-H	
Mytilus galloprovincialis hits:					2-H		2-H		2-H		2-H		2-H				2-H		--		2-H				1-H		1-H		2-H	
Neanthes arenaceodentata hits:					2-H														--						2-H					
Bioassay Pass/Fail:																														
BTs exceeded:															yes						yes				yes		yes			
Bioaccumulation conducted:															no						no				no		no			
Bioaccumulation Pass/Fail:																														
ML Rule exceeded:																									yes		yes			
PSDDA Determination:																														
DMMU Volume:	cy				4,280		4,190		3,760		3,850		3,750		3,800		4,000				3,670		4,000		3,690		3,590		3,910	
DMMU ID:					S65		S66		S67		S68		S69		S70		S71		FD-S71		S72		S73		S77		S78		S80	
					4,280		4,190		3,760		3,850		3,750		3,800		4,000				3,670		4,000		3,690		3,590		3,910	
Passed:																														
Eohaustorius retest																	yes						yes							
Amphipod (Ampelisca) retest							4,190				3,850		3,750		3,800		4,000						4,000						3,910	

				DMMU ID	D1		D9		D2		D3		D4		D10		D5		D6		D8		CR-10	CR-23W	CR-24
				Rank:	H		H		H		H		H		H		H		H		H		REF	REF	REF
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ			
Arsenic	mg/kg	57	507.1	700																					
Copper	mg/kg	390		1,300																					
Lead	mg/kg	450		1,200																					
Mercury	mg/kg	0.41	1.5	2.3	0.830		0.517																		
Silver	mg/kg	6.1	6.1	8.4																					
Zinc	mg/kg	410		3,800																					
Tributyltin ion (porewater)	ug/L	0.15	0.15	--																					
Acenaphthene	ug/kg	500		2,000																					
Fluorene	ug/kg	540		3,600																					
Phenanthrene	ug/kg	1,500		21,000																					
Anthracene	ug/kg	960		13,000																					
Fluoranthene	ug/kg	1,700	4,600	30,000																					
Pyrene	ug/kg	2,600		16,000																					
Benzo(a)anthracene	ug/kg	1,300		5,100																					
Chrysene	ug/kg	1,400		21,000																					
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																					
Total HPAHs	ug/kg	12,000		69,000																					
1,2,4-Trichlorobenzene	ug/kg	31		64																					
Hexaclorobenzene (HCB)	ug/kg	22	168	230																					
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--																					
2-Methylphenol	ug/kg	63		77																					
2,4-Dimethylphenol	ug/kg	29		210																					
Pentachlorophenol	ug/kg	400	504	690																					
Benzoic Acid	ug/kg	650		760																					
Benzyl alcohol	ug/kg	57		870																					
Hexachlorobutadiene	ug/kg	29	212	270																					
N-Nitrosodiphenylamine	ug/kg	28	130	130																					
alpha-Chlordane	ug/kg	10	37																						
Dieldrin	ug/kg	10	37																						
Total DDT	ug/kg	6.9	50	69																					
Total PCBs	ug/kg	130		3,100																					
Total PCBs (TOC- normalized)	mg/kg		38																						
Total Solids	%				84.7		84.5		82.5		55.4		80.3		77.1		50.4		88.6		69.0				
Total Volatile Solids	%				2.2		2.0		1.6		5.8		2.2		2.4		8.2		0.86		3.3				
Total Organic Carbon	%				2.1		1.6		0.28		2.0		1.1		1.1		1.8		0.14		1.0				
Total Ammonia	mg/kg				6.9		7.0		7.8		61.0		26.0		29.0		100.0		1.0		19.0				
Total Sulfides	mg/kg				27	U	21	U	10	UJ	60	U	12	U	11	U	14	U	10	U	12	J			
Gravel (percent)	%				37.1		61.1		23.0		0.9		54.2		30.6		0.6		10.5		7.0		0.5	0.3	0.2
Sand (percent)	%				39.1		27.7		49.2		20.3		25.0		39.0		12.7		79.7		55.2		16.9	72.7	41.9
Silt (percent)	%				17.9		6.4		22.9		55.0		14.5		20.9		56.2		9.7		26.8		70.4	22.7	52.5
Clay (percent)	%				**5.9**		**4.9**		**4.8**		**23.7**		**5.4**		**9.4**		**30.5**		**0.1**		**10.8**		**12.3**	**4.3**	**5.7**
Fines (percent silt + clay)	%				23.8		11.3		27.7		78.7		19.9		30.3		86.7		9.8		37.6		82.7	27.0	58.2
preferred reference match:					27.0		27.0		27.0		82.7		27.0		27.0		82.7		27.0		27.0		-	-	-
Eohaustorius estuarius hits:					2-H		--				1-H		1-H		--		1-H		2-H		1-H				
Mytilus galloprovincialis hits:					1-H		--		2-H		2-H		2-H		--		2-H		2-H		2-H				
Neanthes arenaceodentata hits:							--								--		2-H								
Bioassay Pass/Fail:									Pass																
BTs exceeded:																									
Bioaccumulation conducted:																									
Bioaccumulation Pass/Fail:																									
ML Rule exceeded:																									
PSDDA Determination:									Pass																
DMMU Volume:	cy				10,500				8,960		9,300		13,730				12,220		12,000		2,950				
DMMU ID:					D1		FD-D1		D2		D3		D4		FD-D4		D5		D6		D8				

					10,500						9,300		13,730				12,220		12,000		2,950				
Passed:									8,960																
Eohaustorius retest											yes														
Amphipod (Ampelisca) retest											9,300		13,730						12,000						

				DMMU ID	DMMU
				Rank:	exceed. freq
CHEMICAL NAME	Units	SL	BT	ML	#/83 + 5 FD
Arsenic	mg/kg	57	507.1	700	1
Copper	mg/kg	390		1,300	2
Lead	mg/kg	450		1,200	1
Mercury	mg/kg	0.41	1.5	2.3	23
Silver	mg/kg	6.1	6.1	8.4	1
Zinc	mg/kg	410		3,800	2
Tributyltin ion (porewater)	ug/L	0.15	0.15	--	2
Acenaphthene	ug/kg	500		2,000	1
Fluorene	ug/kg	540		3,600	1
Phenanthrene	ug/kg	1,500		21,000	1
Anthracene	ug/kg	960		13,000	1
Fluoranthene	ug/kg	1,700	4,600	30,000	2
Pyrene	ug/kg	2,600		16,000	2
Benzo(a)anthracene	ug/kg	1,300		5,100	1
Chrysene	ug/kg	1,400		21,000	1
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400	1
Total HPAHs	ug/kg	12,000		69,000	1
1,2,4-Trichlorobenzene	ug/kg	31		64	1
Hexachlorobenzene (HCB)	ug/kg	22	168	230	3
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--	1
2-Methylphenol	ug/kg	63		77	1
2,4-Dimethylphenol	ug/kg	29		210	1
Pentachlorophenol	ug/kg	400	504	690	1
Benzoic Acid	ug/kg	650		760	1
Benzyl alcohol	ug/kg	57		870	2
Hexachlorobutadiene	ug/kg	29	212	270	3
N-Nitrosodiphenylamine	ug/kg	28	130	130	3
alpha-Chlordane	ug/kg	10	37		1
Dieldrin	ug/kg	10	37		1
Total DDT	ug/kg	6.9	50	69	2
Total PCBs	ug/kg	130		3,100	10
Total PCBs (TOC- normalized)	mg/kg		38		
Total Solids	%				
Total Volatile Solids	%				
Total Organic Carbon	%				
Total Ammonia	mg/kg				
Total Sulfides	mg/kg				
Gravel (percent)	%				
Sand (percent)	%				
Silt (percent)	%				
Clay (percent)	%				
Fines (percent silt + clay)	%				
preferred reference match:					
Eohaustorius estuarius hits:					
Mytilus galloprovincialis hits:					
Neanthes arenaceodentata hits:					
Bioassay Pass/Fail:					
BTs exceeded:					
Bioaccumulation conducted:					
Bioaccumulation Pass/Fail:					
ML Rule exceeded:					
PSDDA Determination:					
DMMU Volume:	cy				373,900 cy
DMMU ID:					

Legend:

1H = one hit failure (DMMP Guidelines)
2H = two hit failure (DMMP Guidelines)
P = Pass (Suitable for UCOWD)
[redacted]
UCOWD = Unconfined open-water disposal
VQ = Validation Qualifier
D = Associated compound required a dilution due to matrix or concentration
E = Estimated Value
U = Undetected
J = Positively identified; approximate concentration of the analyte in sample.
ML = Maximum Level (upper chemical guideline)
SL = Screening Level (lower chemical guideline)
BT = Bioaccumulation Trigger
FD = Field Duplicate (S39, S48, S71, D1, D4)

Notes:

58 DMMU with no SL, BT, ML guideline exceedances
S79 FD for S39 = no SLs exceeded
S81 FD for S48 = no SLs exceeded
S82 FD for S71 = no SLs exceeded
D9 FD for D1 = mercury exceedances in both DMMU
D10 FD for D4 = no SLs exceeded
51 DMMUs with bioassay failures and no SL exceedances

	Total		[redacted]		Suitable	
Turning Basin/Inner Channel (surface) DMMUs S1 - S50	200,180	cy	188,220	[redacted]	11,960	P
Piers D, B, 3 (surface) DMMUs S51 - S80	104,060	cy	95,520	[redacted]	8,540	P
Piers D, B, 3 (subsurface) DMMUs D1 - D8	69,660	cy	60,700	[redacted]	8,960	P
	Total Volumes (cy):		344,440	[redacted]	29,460	P

[redacted]	[redacted] cy	Unsuitable for UCOWD	92.1%	Unsuitable for UCOWD
Passed:	29,460 cy	Suitable for UCOWD		
Eohaustorius retest				
Amphipod (Ampelisca) retest	279,980 cy	Retesting Volume	74.9%	undergoing retesting for amphipod bioassay

Appendix 2. SOLID PHASE BIOASSAY PERFORMANCE STANDARDS AND EVALUATION GUIDELINES

Bioassay	Negative Control Performance Standard	Reference Sediment Performance Standard	Dispersive Disposal Site Interpretation Guidelines		Nondispersive Disposal Site Interpretation Guidelines	
			1-hit rule	2-hit rule	1-hit rule	2-hit rule
Amphipod	$M_C \leq 10\%$	$M_R - M_C \leq 20\%$	$M_T - M_C > 20\%$ and M_T vs M_R SD (p=.05) and		$M_T - M_C > 20\%$ and M_T vs M_R SD (p=.05) and	
			$M_T - M_R > 10\%$	NOCN	$M_T - M_R > 30\%$	NOCN
Larval	$N_C \div I \geq 0.70$	$N_R \geq N_C \geq 0.65$	$N_T \div N_C < 0.80$ and N_T/N_C vs N_R/N_C SD (p=.10) and		$N_T \div N_C < 0.80$ and N_T/N_C vs N_R/N_C SD (p=.10) and	
			$N_R/N_C - N_T/N_C > 0.15$	NOCN	$N_R/N_C - N_T/N_C > 0.30$	NOCN
Neanthes growth	$M_C \leq 10\%$ and $MIG_C > 0.38$	$M_R \leq 20\%$ and $MIG_R \div MIG_C \geq 0.80$	$MIG_T \div MIG_C < 0.80$ and MIG_T vs MIG_R SD (p=.05) and		$MIG_T \div MIG_C < 0.80$ and MIG_T vs MIG_R SD (p=.05) and	
			$MIG_T/MIG_R < 0.70$	NOCN	$MIG_T/MIG_R < 0.50$	$MIG_T/MIG_R < 0.70$

M = mortality, N = normals, I = initial count, MIG = mean individual growth rate (mg/individual/day)
SD = statistically different, NOCN = no other conditions necessary, N/A = not applicable
Subscripts: R = reference sediment, C = negative control, T = test sediment

Appendix 3a. 10-Day Acute Amphipod Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	1		1.0	Yes					
PSNS	D1	1	23.8	23.0		22.0	Y	19.0	Y	Two-hit
PSNS	D2	1	27.7	18.0		17.0	N	14.0		Pass
PSNS	S52	1	26.1	15.0		14.0	N	11.0		Pass
PSNS	S53	1	30.7	18.0		17.0	N	14.0		Pass
PSNS	CR-23W	1	27.0	4.0	Yes	3.0	N			
PSNS	S51	1	44.6	19.0		18.0	N	12.0		Pass
PSNS	S56	1	59.1	50.0		49.0	Y	**43.0**	Y	One-hit
PSNS	CR-24	1	58.2	7.0	Yes	6.0	N			
PSNS	D3	1	78.7	55.0		54.0	Y	**48.0**	Y	One-hit
PSNS	S1	1	90.9	49.0		48.0	Y	**42.0**	Y	One-hit
PSNS	S2	1	92.6	40.0		39.0	Y	**33.0**	Y	One-hit
PSNS	S3	1	90.3	50.0		49.0	Y	**43.0**	Y	One-hit
PSNS	S4	1	89.1	23.0		22.0	Y	16.0	Y	Two-hit
PSNS	S5	1	86.7	54.0		53.0	Y	**47.0**	Y	One-hit
PSNS	S6	1	88.7	27.0		26.0	Y	20.0	Y	Two-hit
PSNS	S7	1	89.6	43.0		42.0	Y	**36.0**	Y	One-hit
PSNS	S8	1	91.2	67.0		66.0	Y	**60.0**	Y	One-hit
PSNS	S9	1	83.4	57.0		56.0	Y	**50.0**	Y	One-hit
PSNS	S10	1	86.2	37.0		36.0	Y	30.0	Y	Two-hit
PSNS	S11	1	85.2	41.0		40.0	Y	**34.0**	Y	One-hit
PSNS	S12	1	91.8	40.0		39.0	Y	**33.0**	Y	One-hit
PSNS	S15	1	93.7	45.0		44.0	Y	**38.0**	Y	One-hit
PSNS	S54	1	78.2	34.0		33.0	Y	27.0	Y	Two-hit
PSNS	S55	1	85.0	48.0		47.0	Y	**41.0**	Y	One-hit
PSNS	CR-10	1	82.7	7.0	Yes	6.0	N			

* Apparent Failure. Statistical analyses have not yet been conducted for all samples.

Note: Bold values exceed 30% mortality in test sediments over the corresponding reference sediment (one-hit).
CR-23W, CR-10, and CR-24 are reference sediments.

Appendix 3a. 10-Day Acute Amphipod Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	2		1.0	Yes					
PSNS	S59	2	25.6	21.0		20.0	N	17.0	Y	Pass
PSNS	CR-23W	2	27.0	4.0	Yes		N			
PSNS	S60	2	53.1	23.0		22.0	Y	19.0	Y	Two-hit
PSNS	CR-24	2	58.2	4.0	Yes		N			
PSNS	S13	2	93.2	48.0		47.0	Y	**36.0**	Y	One-hit
PSNS	S14	2	91.2	50.0		49.0	Y	**38.0**	Y	One-hit
PSNS	S16	2	91.8	55.0		54.0	Y	**43.0**	Y	One-hit
PSNS	S17	2	89.6	60.0		59.0	Y	**48.0**	Y	One-hit
PSNS	S18	2	89.9	53.0		52.0	Y	**41.0**	Y	One-hit
PSNS	S19	2	90.4	44.0		43.0	Y	**32.0**	Y	One-hit
PSNS	S20	2	84.0	49.0		48.0	Y	**37.0**	Y	One-hit
PSNS	S21	2	90.2	53.0		52.0	Y	**41.0**	Y	One-hit
PSNS	S22	2	90.3	49.0		48.0	Y	**37.0**	Y	One-hit
PSNS	S23	2	89.5	49.0		48.0	Y	**37.0**	Y	One-hit
PSNS	S24	2	92.8	36.0		35.0	Y	24.0	Y	Two-hit
PSNS	S25	2	91.5	60.0		59.0	Y	**48.0**	Y	One-hit
PSNS	S26	2	93.3	41.0		40.0	Y	29.0	Y	Two-hit
PSNS	S27	2	91.3	55.0		54.0	Y	**43.0**	Y	One-hit
PSNS	S28	2	90.7	57.0		56.0	Y	**45.0**	Y	One-hit
PSNS	S29	2	93.9	38.0		37.0	Y	26.0	Y	Two-hit
PSNS	S30	2	91.5	59.0		58.0	Y	**47.0**	Y	One-hit
PSNS	S32	2	91.1	63.0		62.0	Y	**51.0**	Y	One-hit
PSNS	S33	2	95.6	49.0		48.0	Y	**37.0**	Y	One-hit
PSNS	S61	2	78.5	52.5		51.5	Y	**40.5**	Y	One-hit
PSNS	CR-10	2	82.7	12.0	Yes	11.0	N			

* Apparent Failure. Statistical analyses have not yet been conducted for all samples.

Note: Bold values exceed 30% mortality in test sediments over the corresponding reference sediment (one-hit).
CR-23W, CR-10, and CR-24 are reference sediments.

Appendix 3a. 10-Day Acute Amphipod Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	3		1.0	Yes					
PSNS	D4	3	19.9	48.0		47.0	Y	**45.0**	Y	One-hit
PSNS	D8	3	37.6	49.0		48.0	Y	**46.0**	Y	One-hit
PSNS	S57	3	25.2	30.0		29.0	Y	**27.0**	Y	Two-hit
PSNS	CR-23W	3	27.0	3.0	Yes	2.0	N			
PSNS	S77	3	53.0	35.0		34.0	Y	26.0	Y	Two-hit
PSNS	CR-24	3	58.2	9.0	Yes	8.0	N			
PSNS	D5	3	86.7	70.0		69.0	Y	**58.0**	Y	One-hit
PSNS	S31	3	89.4	35.0		34.0	Y	**23.0**	Y	Two-hit
PSNS	S34	3	92.1	45.0		44.0	Y	**33.0**	Y	One-hit
PSNS	S35	3	92.5	40.0		39.0	Y	**28.0**	Y	Two-hit
PSNS	S36	3	94.6	51.0		50.0	Y	**39.0**	Y	One-hit
PSNS	S37	3	88.8	49.0		48.0	Y	**37.0**	Y	One-hit
PSNS	S39	3	90.9	53.0		52.0	Y	**41.0**	Y	One-hit
PSNS	S42	3	89.9	41.0		40.0	Y	**29.0**	Y	Two-hit
PSNS	S43	3	91.6	39.0		38.0	Y	**27.0**	Y	Two-hit
PSNS	S44	3	92.9	45.0		44.0	Y	**33.0**	Y	One-hit
PSNS	S48	3	92.4	46.0		45.0	Y	**34.0**	Y	One-hit
PSNS	S62	3	82.2	66.0		65.0	Y	**54.0**	Y	One-hit
PSNS	S63	3	86.0	43.0		42.0	Y	**31.0**	Y	One-hit
PSNS	S64	3	88.3	71.0		70.0	Y	**59.0**	Y	One-hit
PSNS	S65	3	85.3	56.0		55.0	Y	**44.0**	Y	One-hit
PSNS	S66	3	86.2	61.0		60.0	Y	**49.0**	Y	One-hit
PSNS	S78	3	80.0	45.0		44.0	Y	**33.0**	Y	One-hit
PSNS	S80	3	80.8	60.0		59.0	Y	**48.0**	Y	One-hit
PSNS	CR-10	3	82.7	12.0	Yes	11.0	N			

* Apparent Failure. Statistical analyses have not yet been conducted for all samples.

Note: Bold values exceed 30% mortality in test sediments over the corresponding reference sediment (one-hit).
CR-23W, CR-10, and CR-24 are reference sediments.

Appendix 3a. 10-Day Acute Amphipod Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	4		10.0	Yes					
PSNS	D6	4	9.8	35.0		25.0	Y	16.0	Y	Two-hit
PSNS	S67	4	39.5	44.0		34.0	Y	25.0	Y	Two-hit
PSNS	CR-23W	4	27.0	19.0	Yes	9.0	N			
PSNS	S68	4	59.6	54.0		44.0	Y	**42.0**	Y	One-hit
PSNS	S69	4	50.5	49.0		39.0	Y	**37.0**	Y	One-hit
PSNS	S71	4	65.8	63.0		53.0	Y	**51.0**	Y	One-hit
PSNS	S72	4	52.8	80.0		70.0	Y	**68.0**	Y	One-hit
PSNS	CR-24	4	58.2	12.0	Yes	2.0	N			
PSNS	S38	4	93.3	55.0		45.0	Y	**35.0**	Y	One-hit
PSNS	S40	4	92.5	58.0		48.0	Y	**38.0**	Y	One-hit
PSNS	S41	4	90.7	64.0		54.0	Y	**44.0**	Y	One-hit
PSNS	S45	4	92.4	58.0		48.0	Y	**38.0**	Y	One-hit
PSNS	S46	4	92.2	58.0		48.0	Y	**38.0**	Y	One-hit
PSNS	S47	4	93.3	70.0		60.0	Y	**50.0**	Y	One-hit
PSNS	S49	4	91.6	64.0		54.0	Y	**44.0**	Y	One-hit
PSNS	S50	4	89.7	50.0		40.0	Y	30.0	Y	Two-hit
PSNS	S58	4	88.2	75.0		65.0	Y	**55.0**	Y	One-hit
PSNS	S70	4	83.2	61.0		51.0	Y	**41.0**	Y	One-hit
PSNS	S73	4	79.1	59.0		49.0	Y	**39.0**	Y	One-hit
PSNS	CR-10	4	82.7	20.0	Yes	10.0	N			

* Apparent Failure. Statistical analyses have not yet been conducted for all samples.

Note: Bold values exceed 30% mortality in test sediments over the corresponding reference sediment (one-hit).
CR-23W, CR-10, and CR-24 are reference sediments.

Appendix 3b. Sediment Larval Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	CMA (%)	Percent over Control [NCMA (%)]	Control or Reference Met Performance Criteria	Test NCMA >20%	Test Sediment NCMA minus Reference NCMA (%)	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	1		22.2		Yes				
PSNS	D1	1	23.8		50.7		Y	**36.9**	Y	**One-hit**
PSNS	D2	1	27.7		30.7		Y	16.9	Y	Two-hit
PSNS	S52	1	26.1		51.7		Y	**37.9**	Y	**One-hit**
PSNS	S53	1	30.7		33.0		Y	19.2	Y	Two-hit
PSNS	CR-23W	1	27.0		13.8	Yes	N			
PSNS	S51	1	44.6		46.6		Y	29.2	Y	Two-hit
PSNS	S56	1	59.1		28.6		Y	11.2	Y	Two-hit
PSNS	CR-24	1	58.2		17.4	Yes	N			
PSNS	D3	1	78.7		43.5		Y	25.9	Y	Two-hit
PSNS	S1	1	90.9		37.5		Y	19.9	Y	Two-hit
PSNS	S2	1	92.6		30.4		Y	12.8	Y	Two-hit
PSNS	S3	1	90.3		31.3		Y	13.7	Y	Two-hit
PSNS	S4	1	89.1		35.3		Y	17.7	Y	Two-hit
PSNS	S5	1	86.7		33.0		Y	15.4	Y	Two-hit
PSNS	S6	1	88.7		30.8		Y	13.2	Y	Two-hit
PSNS	S7	1	89.6		28.7		Y	11.1	Y	Two-hit
PSNS	S8	1	91.2		32.7		Y	15.1	Y	Two-hit
PSNS	S9	1	83.4		27.7		Y	10.1	Y	Two-hit
PSNS	S10	1	86.2		28.2		Y	10.6	Y	Two-hit
PSNS	S11	1	85.2		30.9		Y	13.3	Y	Two-hit
PSNS	S12	1	91.8		28.2		Y	10.6	Y	Two-hit
PSNS	S15	1	93.7		37.7		Y	20.1	Y	Two-hit
PSNS	S54	1	78.2		32.0		Y	14.4	Y	Two-hit
PSNS	S55	1	85.0		44.5		Y	26.9	Y	Two-hit
PSNS	CR-10	1	82.7		17.6	Yes	N			

* Apparent Failure. Statistics were conducted on preliminary data.

NCMA: Normalized combined mortality/abnormality (normalized to the control). Note the column headed percent over the control is the same as NCMA.

Note: Values in bold are those in which the test sediment had >30% normalized combined mortality/abnormality over the reference sediment (one-hit failure).

Appendix 3b. Sediment Larval Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	CMA (%)	Percent over Control [NCMA (%)]	Control or Reference Met Performance Criteria	Test NCMA >20%	Test Sediment NCMA minus Reference NCMA (%)	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	2		5.3		Yes				
PSNS	S59	2	25.6		37.0		Y	19.8	Y	Two-hit
PSNS	CR-23W	2	27.0		17.2	Yes				
PSNS	S60	2	53.1		20.8		Y	12.0	Y	Two-hit
PSNS	CR-24	2	58.2		8.8	Yes				
PSNS	S13	2	93.2		14.9		N	2.7		
PSNS	S14	2	91.2		17.2		N	5.0		
PSNS	S16	2	91.8		17.9		N	5.7		
PSNS	S17	2	89.6		20.1		Y	7.9	N	
PSNS	S18	2	89.9		16.6		N	4.4		
PSNS	S19	2	90.4		22.5		Y	10.3	Y	Two-hit
PSNS	S20	2	84.0		20.1		Y	7.9	Y	Two-hit**
PSNS	S21	2	90.2		16.7		N	4.5		
PSNS	S22	2	90.3		30.2		Y	18.0	Y	Two-hit
PSNS	S23	2	89.5		21.5		Y	9.3	Y	Two-hit
PSNS	S24	2	92.8		17.9		N	5.7		Pass
PSNS	S25	2	91.5		6.7		N	-5.5		Pass
PSNS	S26	2	93.3		21.4		Y	9.2	Y	Two-hit
PSNS	S27	2	91.3		10.7		N	-1.5		Pass
PSNS	S28	2	90.7		16.3		N	4.1		Pass
PSNS	S29	2	93.9		18.8		N	6.6		Pass
PSNS	S30	2	91.5		32.2		Y	20.0	Y	Two-hit
PSNS	S32	2	91.1		16.6		N	4.4		Pass
PSNS	S33	2	95.6		31.2		Y	19.0	Y	Two-hit
PSNS	S61	2	78.5		15.0		N	2.8		Pass
PSNS	CR-10	2	82.7		12.2	Yes				

* Apparent Failure. Statistics were conducted on preliminary data.

** For sample S20, it is likely that the agencies will not consider the result as a failure, because the percent over the control is only 0.1% over the criteria of less than or equal to 20% over the control.

NCMA: Normalized combined mortality/abnormality (normalized to the control). Note the column headed percent over the control is the same as NCMA.

Note: Values in bold are those in which the test sediment had >30% normalized combined mortality/abnormality over the reference sediment (one-hit failure).

Appendix 3b. Sediment Larval Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	CMA (%)	Percent over Control [NCMA (%)]	Control or Reference Met Performance Criteria	Test NCMA >20%	Test Sediment NCMA minus Reference NCMA (%)	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	3		19.1		Yes				
PSNS	D4	3	19.9		31.1		Y	16.6	Y	Two-hit
PSNS	D8	3	37.6		34.7		Y	20.2	Y	Two-hit
PSNS	S57	3	25.2		31.6		Y	17.1	Y	Two-hit
PSNS	CR-23W	3	27.0		14.5	Yes	N			
PSNS	S77	3	53.0		52.8		Y	**37.9**	Y	**One-hit**
PSNS	CR-24	3	58.2		14.9	Yes	N			
PSNS	D5	3	86.7		38.1		Y	22.9	Y	Two-hit
PSNS	S31	3	89.4		23.8		Y	8.6	Y	Two-hit
PSNS	S34	3	92.1		29.4		Y	14.2	Y	Two-hit
PSNS	S35	3	92.5		31.2		Y	16.0	Y	Two-hit
PSNS	S36	3	94.6		27.6		Y	12.4	Y	Two-hit
PSNS	S37	3	88.8		32.3		Y	17.1	Y	Two-hit
PSNS	S39	3	90.9		27.4		Y	12.2	Y	Two-hit
PSNS	S42	3	89.9		33.1		Y	17.9	Y	Two-hit
PSNS	S43	3	91.6		30.1		Y	14.9	Y	Two-hit
PSNS	S44	3	92.9		32.8		Y	17.6	Y	Two-hit
PSNS	S48	3	92.4		28.7		Y	13.5	Y	Two-hit
PSNS	S62	3	82.2		40.2		Y	25.0	Y	Two-hit
PSNS	S63	3	86.0		40.5		Y	25.3	Y	Two-hit
PSNS	S64	3	88.3		39.7		Y	24.5	Y	Two-hit
PSNS	S65	3	85.3		27.8		Y	12.6	Y	Two-hit
PSNS	S66	3	86.2		36.5		Y	21.3	Y	Two-hit
PSNS	S78	3	80.0		54.8		Y	**39.6**	Y	**One-hit**
PSNS	S80	3	80.8		22.8		Y	7.6	Y	Two-hit
PSNS	CR-10	3	82.7		15.2	Yes	N			

* Apparent Failure. Statistics were conducted on preliminary data.

NCMA: Normalized combined mortality/abnormality (normalized to the control). Note the column headed percent over the control is the same as NCMA.

Note: Values in bold are those in which the test sediment had >30% normalized combined mortality/abnormality over the reference sediment (one-hit failure).

Appendix 3b. Sediment Larval Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	CMA (%)	Percent over Control [NCMA (%)]	Control or Reference Met Performance Criteria	Test NCMA >20%	Test Sediment NCMA minus Reference NCMA (%)	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	4		10.4		Yes				
PSNS	D6	4	9.8		34.5		Y	25.6	Y	Two-hit
PSNS	S67	4	39.5		31.3		Y	22.4	Y	Two-hit
PSNS	CR-23W	4	27.0		8.9	Yes	N			
PSNS	S68	4	59.6		28.1		Y	12.4	Y	Two-hit
PSNS	S69	4	50.5		41.1		Y	25.4	Y	Two-hit
PSNS	S71	4	65.8		34.4		Y	18.7	Y	Two-hit
PSNS	S72	4	52.8		27.3		Y	11.6	Y	Two-hit
PSNS	CR-24	4	58.2		15.7	Yes	N			
PSNS	S38	4	93.3		42.6		Y	17.3	Y	Two-hit
PSNS	S40	4	92.5		43.5		Y	18.2	Y	Two-hit
PSNS	S41	4	90.7		43.9		Y	18.6	Y	Two-hit
PSNS	S45	4	92.4		31.1		Y	5.8	N	Pass
PSNS	S46	4	92.2		35.2		Y	9.9	Y	Two-hit
PSNS	S47	4	93.3		24.1		Y	-1.2	N	Pass
PSNS	S49	4	91.6		29.0		Y	3.7	N	Pass
PSNS	S50	4	89.7		28.9		Y	3.6	N	Pass
PSNS	S58	4	88.2		35.0		Y	9.7	N	Pass
PSNS	S70	4	83.2		23.9		Y	-1.4	N	Pass
PSNS	S73	4	79.1		27.2		Y	1.9	N	Pass
PSNS	CR-10	4	82.7		25.3	Yes	Y			

* Apparent Failure. Statistics were conducted on preliminary data, and statistics for Batch 4 have not yet been conducted.

NCMA: Normalized combined mortality/abnormality (normalized to the control). Note the column headed percent over the control is the same as NCMA.

Note: Values in bold are those in which the test sediment had >30% normalized combined mortality/abnormality over the reference sediment (one-hit failure).

Appendix 3c. 20-Day Neanthes Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	Mortality %	Growth Rate (indiv/mg/day)	Control or Reference Met Performance Criteria	Percent of Test or Reference Growth Rate (GR) of Control GR	Test Growth Rate <80% or >120% over Control Growth Rate	Percent of Test Growth Rate of Reference Growth Rate	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	1		0.0	0.97	Yes					
PSNS	D1	1	23.8	4.0	0.83		85.6	N	95.4		**Pass**
PSNS	D2	1	27.7	4.0	1.12		115.5	N	128.7		**Pass**
PSNS	S52	1	26.1	0.0	0.93		95.9	N	106.9		**Pass**
PSNS	S53	1	30.7	0.0	0.82		84.5	N	94.3		**Pass**
PSNS	CR-23W	1	27.0	0.0	0.87	Yes	89.7	N	100.0		
PSNS	S51	1	44.6	0.0	0.73		75.3	Y	88.0		**Pass**
PSNS	S56	1	59.1	0.0	0.93		95.9	N	112.0		**Pass**
PSNS	CR-24	1	58.2	0.0	0.83	Yes	85.6	N	100.0		
PSNS	D3	1	78.7	0.0	0.70		72.2	Y	83.3		**Pass**
PSNS	S1	1	90.9	0.0	0.77		79.4	Y	91.7		**Pass**
PSNS	S2	1	92.6	0.0	0.88		90.7	N	104.8		**Pass**
PSNS	S3	1	90.3	0.0	0.76		78.4	Y	90.5		**Pass**
PSNS	S4	1	89.1	4.0	0.82		84.5	N	97.6		**Pass**
PSNS	S5	1	86.7	0.0	0.81		83.5	N	96.4		**Pass**
PSNS	S6	1	88.7	0.0	0.85		87.6	N	101.2		**Pass**
PSNS	S7	1	89.6	0.0	0.75		77.3	Y	89.3		**Pass**
PSNS	S8	1	91.2	8.0	0.66		68.0	Y	78.6		**Pass**
PSNS	S9	1	83.4	0.0	0.89		91.8	N	106.0		**Pass**
PSNS	S10	1	86.2	0.0	0.88		90.7	N	104.8		**Pass**
PSNS	S11	1	85.2	4.0	0.98		101.0	N	116.7		**Pass**
PSNS	S12	1	91.8	0.0	0.73		75.3	Y	86.9		**Pass**
PSNS	S15	1	93.7	4.0	0.91		93.8	N	108.3		**Pass**
PSNS	S54	1	78.2	0.0	0.83		85.6	N	98.8		**Pass**
PSNS	S55	1	85.0	0.0	0.81		83.5	N	96.4		**Pass**
PSNS	CR-10	1	82.7	8.0	0.84	Yes	86.6	N	100.0		

* Apparent Failure. There were no apparent one-hit (test sediment < 50% of reference) or two-hit (test sediment <70% of reference) failures for this batch of samples.

Appendix 3c. 20-Day Neanthes Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	Mortality %	Growth Rate (indiv/mg/day)	Control or Reference Met Performance Criteria	Percent of Test or Reference Growth Rate (GR) of Control GR	Test Growth Rate <80% or >120% over Control Growth Rate	Percent of Test Growth Rate of Reference Growth Rate	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	2		0.0	0.92	Yes					
PSNS	S59	2	25.6	0.0	1.03		112.0	N	121.2		**Pass**
PSNS	CR-23W	2	27.0	0.0	0.85	Yes	92.4	N			
PSNS	S60	2	53.1	0.0	0.83		90.2	N	93.3		**Pass**
PSNS	CR-24	2	58.2	0.0	0.89	Yes	96.7	N			
PSNS	S13	2	93.2	8.0	0.71		77.2	Y	92.2		**Pass**
PSNS	S14	2	91.2	0.0	0.66		71.7	Y	85.7		**Pass**
PSNS	S16	2	91.8	0.0	0.76		82.6	N	98.7		**Pass**
PSNS	S17	2	89.6	0.0	0.76		82.6	N	98.7		**Pass**
PSNS	S18	2	89.9	0.0	0.49		53.3	Y	**63.6**	Y	Two-hit
PSNS	S19	2	90.4	0.0	0.85		92.4	N	110.4		**Pass**
PSNS	S20	2	84.0	0.0	0.83		90.2	N	107.8		**Pass**
PSNS	S21	2	90.2	0.0	0.64		69.6	Y	83.1		**Pass**
PSNS	S22	2	90.3	0.0	0.78		84.8	N	101.3		**Pass**
PSNS	S23	2	89.5	0.0	0.60		65.2	Y	77.9		**Pass**
PSNS	S24	2	92.8	4.0	0.83		90.2	N	107.8		**Pass**
PSNS	S25	2	91.5	0.0	0.72		78.3	Y	93.5		**Pass**
PSNS	S26	2	93.3	0.0	0.70		76.1	Y	90.9		**Pass**
PSNS	S27	2	91.3	0.0	0.67		72.8	Y	87.0		**Pass**
PSNS	S28	2	90.7	4.0	0.82		89.1	N	106.5		**Pass**
PSNS	S29	2	93.9	0.0	0.71		77.2	Y	92.2		**Pass**
PSNS	S30	2	91.5	4.0	0.94		102.2	N	122.1		**Pass**
PSNS	S32	2	91.1	4.0	0.70		76.1	Y	90.9		**Pass**
PSNS	S33	2	95.6	0.0	0.55		59.8	Y	71.4		**Pass**
PSNS	S61	2	78.5	0.0	0.83		90.2	N	107.8		**Pass**
PSNS	CR-10	2	82.7	8.0	0.77	Yes	83.7	N			

* Apparent Failure. There were no apparent one-hit (test sediment < 50% of reference) failures for this batch of samples.

Appendix 3c. 20-Day Neanthes Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	Mortality %	Growth Rate (indiv/mg/day)	Control or Reference Met Performance Criteria	Percent of Test or Reference Growth Rate (GR) of Control GR	Test Growth Rate <80% or >120% over Control Growth Rate	Percent of Test Growth Rate of Reference Growth Rate	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	3		0.0	1.02	Yes					
PSNS	D4	3	19.9	0.0	1.11		108.8	N	91.0		**Pass**
PSNS	D8	3	37.6	0.0	1.06		103.9	N	86.9		**Pass**
PSNS	S57	3	25.2	0.0	1.05		102.9	N	86.1		**Pass**
PSNS	CR-23W	3	27.0	0.0	1.22	Yes	119.6	N			
PSNS	S77	3	53.0	0.0	0.75		73.5	Y	**62.0**	Y	Two-hit
PSNS	CR-24	3	58.2	0.0	1.21	Yes	118.6	N			
PSNS	D5	3	86.7	0.0	0.78		76.5	Y	**65.0**	Y	Two-hit
PSNS	S31	3	89.4	8.0	0.89		87.3	N	74.2		**Pass**
PSNS	S34	3	92.1	4.0	0.83		81.4	N	**69.2**	Y	Two-hit
PSNS	S35	3	92.5	0.0	0.98		96.1	N	81.7		**Pass**
PSNS	S36	3	94.6	0.0	0.80		78.4	Y	**66.7**	Y	Two-hit
PSNS	S37	3	88.8	0.0	1.07		104.9	N	89.2		**Pass**
PSNS	S39	3	90.9	0.0	1.01		99.0	N	84.2		**Pass**
PSNS	S42	3	89.9	0.0	0.82		80.4	N	**68.3**	Y	Two-hit
PSNS	S43	3	91.6	0.0	1.10		107.8	N	91.7		**Pass**
PSNS	S44	3	92.9	4.0	0.89		87.3	N	74.2		**Pass**
PSNS	S48	3	92.4	0.0	0.88		86.3	N	73.3		**Pass**
PSNS	S62	3	82.2	0.0	1.05		102.9	N	87.5		**Pass**
PSNS	S63	3	86.0	0.0	0.88		86.3	N	73.3		**Pass**
PSNS	S64	3	88.3	0.0	1.12		109.8	N	93.3		**Pass**
PSNS	S65	3	85.3	0.0	0.77		75.5	Y	**64.2**	Y	Two-hit
PSNS	S66	3	86.2	4.0	1.06		103.9	N	88.3		**Pass**
PSNS	S78	3	80.0	0.0	0.95		93.1	N	79.2		**Pass**
PSNS	S80	3	80.8	0.0	0.89		87.3	N	74.2		**Pass**
PSNS	CR-10	3	82.7	0.0	1.20	Yes	117.6	N			

* Apparent Failure. There were no apparent one-hit (test sediment < 50% of reference) failures for this batch of samples.

Appendix 3c. 20-Day Neanthes Test Results for the PSNS Sediment Characterization

Project	Sample #	Batch	% Fines	Mortality %	Growth Rate (indiv/mg/day)	Control or Reference Met Performance Criteria	Percent of Test or Reference Growth Rate (GR) of Control GR	Test Growth Rate <80% or >120% over Control Growth Rate	Percent of Test Growth Rate of Reference Growth Rate	Sign. Diff. from Reference	Apparent Failure*
PSNS	Control	4		0.0	0.85	Yes	100.0	N			
PSNS	D6	4	9.8	0.0	0.95		111.8	N	91.3		**Pass**
PSNS	S67	4	39.5	0.0	0.86		101.2	N	82.7		**Pass**
PSNS	CR-23W	4	27.0	4.0	1.04	Yes	122.4	Y	100.0		
PSNS	S68	4	59.6	4.0	0.85		100.0	N	95.5		**Pass**
PSNS	S69	4	50.5	4.0	0.73		85.9	N	82.0		**Pass**
PSNS	S71	4	65.8	4.0	0.64		75.3	Y	71.9		**Pass**
PSNS	S72	4	52.8	0.0	0.71		83.5	N	79.8		**Pass**
PSNS	CR-24	4	58.2	4.0	0.89	Yes	104.7	N			
PSNS	S38	4	93.3	0.0	0.87		102.4	N	113.0		**Pass**
PSNS	S40	4	92.5	0.0	0.83		97.6	N	107.8		**Pass**
PSNS	S41	4	90.7	4.0	0.75		88.2	N	97.4		**Pass**
PSNS	S45	4	92.4	0.0	0.74		87.1	N	96.1		**Pass**
PSNS	S46	4	92.2	0.0	0.87		102.4	N	113.0		**Pass**
PSNS	S47	4	93.3	0.0	0.61		71.8	Y	79.2		**Pass**
PSNS	S49	4	91.6	0.0	0.78		91.8	N	101.3		**Pass**
PSNS	S50	4	89.7	0.0	0.73		85.9	N	94.8		**Pass**
PSNS	S58	4	88.2	0.0	0.65		76.5	Y	84.4		**Pass**
PSNS	S70	4	83.2	0.0	0.83		97.6	N	107.8		**Pass**
PSNS	S73	4	79.1	0.0	0.83		97.6	N	107.8		**Pass**
PSNS	CR-10	4	82.7	0.0	0.77	Yes	90.6	N			

* Apparent Failure. There were no apparent one-hit (test sediment < 50% of reference) or two-hit (test sediment <70% of reference) failures for this batch of samples.

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-2255

REPLY TO ATTENTION OF

August 16, 1999

Operations Division / Technical Support Branch
Dredged Material Management Office

Appendix 2a.

Peter Havens
U.S. Navy EFA Northwest
19917 7th Avenue NE
Poulsbo, WA 98370

Reference: 1998-01967
US Naval Shipyard, Bremerton

Dear Mr. Havens:

This letter provides the consensus decision by the DMMP agencies for retesting by the U. S. Navy for the Puget Sound Naval Shipyard (PSNS) dredging characterization that was prompted by equivocal amphipod bioassay testing results. The DMMP agency representatives (Erika Hoffman, Tom Gries, Ted Benson, and undersigned) and Marian Abbett discussed and agreed during a 9 August conference call that the following retesting of PSNS sediments should be conducted.

In the first round of testing, numerous DMMUs were observed to have single or double hit toxicity responses based on results of testing using the amphipod *Eohaustorius estuarius*. Correlation analysis conducted to evaluate physical and biological effects data from this project provides evidence that high clay content may have a negative effect on survival in this amphipod species. There did not, however, appear to be toxicity associated with clay content in the Carr reference samples (up to 12.3% clay), all of which passed performance standards for amphipod survival. Therefore, we believe that all DMMUs that failed due to amphipod hits and with clay contents greater than 15% should be retested using an amphipod species (*Ampelisca abdita*) that is known to be less sensitive to high clay contents. DMMUs with clay content less than 15% (or failing due to other biological responses or chemistry exceedances) will not be retested and the initial *Eohaustorius estuarius* testing result will be used for the DMMP suitability determination. Applying the above guidelines, retesting of 60 of the 83 dredged material management units (DMMU) is authorized to reassess the amphipod bioassay toxicity. The following DMMUs are authorized for retesting using *Ampelisca abdita* (**S1**, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S15, S16, S17, S18, S19, S20, S21, **S22**, **S23**, S25, **S26**, S27, S28, S30, S31, S32, S33, S35, S37, S38, S39, S40, S41, S43, S44, S45, S46, S47, **S48**, S49, S54, S55, **S56**, S58, S61, **S62**, S63, S64, S66, S68, S69, S70, **S71**, **S73**, S80, **D3**).

1. A subset of the above samples (S1, S22, S23, S26, S48, S56, S62, S71, S73, D3) for which chemical analysis showed no SL or ML exceedances will also be rerun using the

Appendix 2a.

Eohaustorius estuarius bioassay to reconfirm the clay sensitivity noted during the initial testing. The selected stations all exhibited elevated amphipod mortalities (41 – 66%) across a clay content range of 17.4% to 42.3% to capture a representative cross section of the tested sediments. During this retest care should be taken to replicate as much as practicable the testing protocols followed during the initial testing rounds, particularly organism holding times and acclimation rates.

2. Subsamples from each retested DMMU will also be collected in order to recharacterize sediment chemistry and conventional parameters. Conventional parameters will be reanalyzed for all 60 retested samples. Full sediment chemical analysis should be performed on each of the ten DMMUs selected for *Eohaustorius* retesting. Sediment samples will be archived for the remaining 50 DMMUs pending the bioassay retesting outcomes. After reviewing all the retesting data (e.g., bioassay retesting data for both amphipod species, sediment conventional and selected chemistry recharacterization data) the DMMP agencies will determine whether or not chemical analysis of the remaining 50 archived samples will be required.

As the Navy requested, an interim suitability determination will be drafted reflecting the initial testing results for those DMMUs clearly passing and failing DMMP open-water disposal guidelines, including those DMMUs for which amphipod retesting is proposed. This will enable the regulatory processing of the Section 10/404 permit to continue while retesting is undertaken and completed by the Navy. After the DMMP agencies evaluate the retesting data, a supplemental suitability determination will be prepared reflecting the final DMMP testing outcomes for the 60 retested DMMUs.

Please call me at (206)764-3768 if you have any questions regarding the DMMP agencies recommendations regarding the retesting option available to the U. S. Navy outlined in this letter.

Sincerely,

David R. Kendall, Ph.D
Chief, Dredged Material Management Office
Dredged Material Management Program

Enclosure:
Copies Furnished:
Jack Gossett, Regulatory Branch
Marian Abbett, Ecology
Tom Gries, Ecology
Rick Vining, Ecology
Nancy Harney, EPA
Erika Hoffman, EPA
Ted Benson, DNR
DMMO File

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-2255

REPLY TO
ATTENTION OF

September 1, 1999

Operations Division / Technical Support Branch
Dredged Material Management Office

Neil Bass
U.S. Navy EFA Northwest
19917 7th Avenue NE
Poulsbo, WA 98370

Reference: 1998-01967
US Naval Shipyard, Bremerton

Appendix 2b.

Dear Mr. Bass:

This letter provides the DMMP agencies consensus decision on the retesting issue raised by you in your e-mail memorandum (enclosure 1) on behalf of the U. S. Navy for the Puget Sound Naval Shipyard (PSNS) dredging characterization that was prompted by equivocal amphipod bioassay testing results. The DMMP agency representatives (Erika Hoffman, Tom Gries, Ted Benson, and undersigned) discussed and agreed during a 30 August conference call to the following retesting decisions on PSNS sediments.

1. Resampling and retesting of the two subsurface dredged material management units (DMMUs) D4 and D6 is authorized with the following conditions.

a) Each subsample making up the initial composited DMMU will now be analyzed separately as uncomposited samples. That would result in six uncomposited DMMUs that were formerly composited into two DMMUs.
b) The analyses will include complete sediment conventional and chemical recharacterization as previously accomplished during the initial characterization for D4 and D6. To identify compounds that may be causing the observed toxicity, the DMMP agencies will also require additional testing. The analyses that will be required, and the samples on which the analyses will be conducted, will be determined after further consultation with the Navy and regional analytical organochemists. The additional testing may include a complete atomic emission detector screening analysis, which may include using EPA method 8015C (by extraction) to identify and quantify the potential presence of higher carbon fuel oils, lubricating oils, motor oils, etc., not quantified with EPA method 8270 for semi-volatile aromatic hydrocarbons. This information will assist the DMMP agencies in understanding the potential presence of untested chemicals that might be contributing to the unexplained toxicity observed in most of the subsurface DMMUs, where clay effects were not an issue.
c) Each of the six uncomposited DMMUs will also undergo routine bioassay testing (amphipod bioassay: *Eohaustorius estuarius*, 20-day *Neanthes* growth bioassay: *Neanthes arenaceodenta*, bivalve larval bioassay: *Mytilus galloprovincialis*). During

Appendix 2b.

this retest care should be taken to replicate the testing protocols followed during the initial testing rounds as much as practicable, particularly organism holding times and acclimation rates.

2. The DMMP agencies do not support the retesting of surface DMMUs S60 and S67 as part of the retesting effort. The agencies established a very reasonable retesting trigger of 15 % clay based in part on direct observations within the reference samples (up to 12.3 % clay) and discussions with several regional experts on *Eohaustorius estuarius* (Drs Ted Dewitt and James Meador), who indicated that they would only expect some toxicity to be expressed in this amphipod species at clay contents greater than 20-30%. A 20-30% clay "trigger" level would have resulted in fewer retests being conducted. Therefore, we believe the trigger was reasonable and there is no justification for retesting samples with clay contents less than 15 % such as DMMUs S60 and S67. Therefore, no retesting of DMMUs S60 and S67 is authorized.

Please call me at (206)764-3768 if you have any questions regarding the DMMP agencies recommendations regarding the retesting option for DMMUs D4 and D6 as outlined in this letter.

Sincerely,

David R. Kendall

David R. Kendall, Ph.D
Chief, Dredged Material Management Office
Dredged Material Management Program

Enclosure:
Copies Furnished:
Peter Havens, USN, EFA Northwest
Jack Gossett, Regulatory Branch
Marian Abbett, Ecology
Tom Gries, Ecology
Rick Vining, Ecology
Nancy Harney, EPA
Erika Hoffman, EPA
Ted Benson, DNR
DMMO File

Kendall, David R NWS

From: Bass, Neil A [BassNA@EFANW.NAVFAC.NAVY.MIL]
Sent: Thursday, August 26, 1999 03:02 PM
To: David Kendall (E-mail)
Cc: Havens, Peter W; John Lunz (E-mail)
Subject: Re-sample for PSNS ref:1998-01967

Dr. Kendall, thanks for your candid phone advise this morning. As I explained, we are very pleased that the agencies understand our difficult circumstances and are working with us to reach our goals. I claim to have no particular sediment expertise and fully respect the DMMP agency decision making; however, upon further review of the data, I believe it would be worth our investment to gather some extra data during the re-sample for consideration by the DMMP agencies. If the agencies object, I will not ovide additional data.

Appendix 2c.

propose to include DMMUs D-4 & D-6 and S-60 & S-67 in the re-sample and nalysis program. As you might understand, there is significant material olume in submerged DMMUs, D-4 and D-6, and if suitable would reduce the verall disposal costs by about $2M. These submerged DMMUs show no hemistry and a 2 hit Mytilus galloprovincialis.

-4 and Overlying DMMU Discussion: The overlying surface units are S-59, 60, , & 62. S-59 passed, S-61 and S-62 are planned for re-testing. I propose re-test S-60 as chemistry was clear except for 1.32 mercury, the 13.5% clay content is very near the selected 15% clay re-sample guideline, and a 2 hit Mytilus galloprovincialis. I believe re-testing this group of surface and submerged DMMUs will provide for a wider composite view of this set of adjacent DMMUs. Because D-4 has a clay content of 5.4%, I propose to re-test with Eohaustorius, if the collected sample has <15% clay.

D-6 and Overlying DMMU Discussion: The overlying surface units are S-72, 73, & 67. S-72 has some chemistry present and a biological trigger. S-73 is planned for re-testing. I propose re-testing S-67 as chemistry was clear except for 0.837 mercury, a 2 hit Mytilus galloprovincialis, and the 14.7% clay content is very near the selected 15% clay re-sample guideline. D-6 has a reported clay content of 0.1% which appears to be extremely low in comparison to the overlying DMMUs (14.7% to 21.9%) and other submerged DMMUs. DMMU 2 has the next least clay content at 4.8%. I am therefore lead to question the validity or representative value of the D-6 data.

V/r,
Neil Bass
(360) 396-0902

Appendix 2c.

Kendall, David R NWS

From: Kendall, David R NWS
Sent: Friday, October 15, 1999 03:33 PM
To: 'Benson, Ted'; 'Gries, Tom'; 'Gries, Tom (Hoffman, Erika)'; 'Vining, Rick'; 'Peter Havens'; 'Lunz, John'
Subject: Additional DMMP specificity on the PSNS retesting of the navigation dredging material

Hi Peter and John:
The following guidance is provided to assist you in completing the retesting requirements to gather the information the DMMP agencies will need to complete our final suitability determination on the PSNS navigation dredged material.

Special Chemistry Analyses:
The following stations should be sampled for supplemental chemistry using methodologies described below (extracted from memo from Tom Gries to you on 14 October 1999), are as follows: The following pier surface DMMU stations should be analyzed for the pplemental chemistry: S56, S62, S71, S73, S70, S61. For the subsurface DMMUs D4 and D6, we would like to see one random MMU from each of the three uncomposited DMMUs collected for reanalysis from both the D4 and D6 DMMU stations analyzed ring the phase I testing.

Appendix 2d.

r the aforementioned DMMUs, the following two table top analyses should be conducted:

1). The Navy/SAIC should examine instrument records, e.g., chromatographs, from the previous PAH analyses of surface and bsurface PSNS samples for Tentatively Identified Compounds. This may reveal whether or not substantial amounts of petroleum-rived compounds/PAHs are present that the DMMP does not normally require reporting. We understand this analysis is currently derway.

2). The Navy/SAIC should also examine instrument records from the prior round of TBT analyses to see if they provide evidence slower eluting organotin compounds. Apparently, other rather toxic non-butyltin organotin compounds (e.g., cyclohexyl-, phenyl-) that are not routinely reported can be detected using the same butyltin protocols IF the elution is allowed to continue ... If the elution records do not contain the information on the potentially slower eluting organotin compounds, the organotin analysis should be repeated to look for these compounds in all the DMMUs.

B. In addition to the standard suite of DMMP chemicals, the aforementioned six suface DMMUs and two subsurface DMMUs will be tested for potential "unknown sources of toxicity". This will involve running a more sensitive screening method that will potentially detect and identify additional types of compounds not picked up in the typical DMMP analyses. This analysis involves a scan using an atomic emission detector (AED), which is probably not commercially available in the region outside of the Manchester lab. Therefore, we recommend that the Navy consider contracting these analyses with the EPA/Ecology's Manchester Lab to conduct eight AED scans, looking for and identifying nontarget chemicals. The approximate cost of this analysis is $300 per sample. Bob Carrell (360/871-8804) is a point of contact at the Manchester Lab for information on this analysis.

Tier IV analysis of S51.

The DMMP agencies deliberated on this DMMU which passed the DMMP nondispsersive disposal interpretive guidelines, but exceeded the ML Rule with maximum level exceedances for DDT (748 ppb) and Pentachlorophenol (770 ppb) and bioaccumulation trigger (BT) exceedances for mercury (1.75 ppm), Silver (6.5 ppm), Pentachlorophenol (620 ppb), and DDT (748 ppb). The DMMP consensus is that to complete the suitability determination for this DMMU a 45 day bioaccumulation test for the four chemicals exceeding BTs should be completed using the protocol most recently utilized for the East Waterway Project (e.g., co-testing of *Macoma nasuta* and *Nephtys caecoides* in 8 gallon aquaria).

Please contact me if you have any questions about our recommendations.

David

David R. Kendall, Ph.D.
Seattle District, Corps of Engineers
Phone: 206/764-3768
Fax: 206/764-6602
e-mail: david.r.kendall@nws02.usace.army.mil

Appendix 2d.

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

January 13, 2000

Operations Division / Technical Support Branch
Dredged Material Management Office

John Lunz
SAIC
18706 N. Creek Parkway
Suite 110
Bothell, WA 98011

Reference: 1998-01967
US Naval Shipyard, Bremerton

Dear ~~Mr.~~ John Lunz:

Appendix 2e.

This letter provides the requested Dredged Material Management Program (DMMP) response to the two "Special Chemistry" issues raised in your January 5, 2000 letter.

1. "… what is not clear is where the AED work is going, or how information from the AED analysis will be used to influence a suitability decision."

   Both the DMMP agencies and the Navy have been investigating the possible sources of the unexpected toxicity observed in Round 1 *Eohaustorius* tests of the PSNS dredging project. Possible sources of toxicity we have discussed include the method of acclimating the test organisms to salinity, effects of clay particles in test chambers, exposure to unmeasured toxic compounds, etc. Potential exposure to unmeasured compounds is being investigated following the approach depicted in the draft flow diagram titled "Source of Observed Toxicity" previously sent to the Navy (enclosure 1). This approach includes conducting AED analyses on a subset of sediments that otherwise showed few or no SL exceedences in order to determine if organic compounds were present in samples with hits from the first round of bioassay testing. In addition to the chemical retest results, the DMMP agencies will also carefully review the data from the amphipod retesting (paying particular attention to any correlations between mortality and percent clay), as well as information from any special studies. The agencies will use a "weight of evidence approach" to reach a consensus technical determination on the suitability of the dredged material being retested.

2. "… that the Navy requests formal direction from the DMMP regarding the need to conduct this analysis[1]".

   The DMMP agencies strongly recommend that the Navy conduct NWTPH-D analyses on the limited number of samples previously identified in order to assess the presence of fuel-derived petroleum hydrocarbon compounds not measured by standard PAH analyses. The Navy was given verbal permission to proceed with these analyses, without having to await AED results, at the December 9, 1999 DMMP meeting. We also encourage the Navy to

[1] NWTPH-D analysis

Appendix 2e.

conduct additional organotin analyses, looking for the presence of methyltin, phenyltin, etc. especially if this can be done using the standard tributyltin protocol with newly purchased internal standards to help identify these compounds. We would not support conducting additional organotin analyses if they prove to be substantially more complex. Any TPH and organotin results will be combined with other lines of evidence to make the suitability determination, as described above.

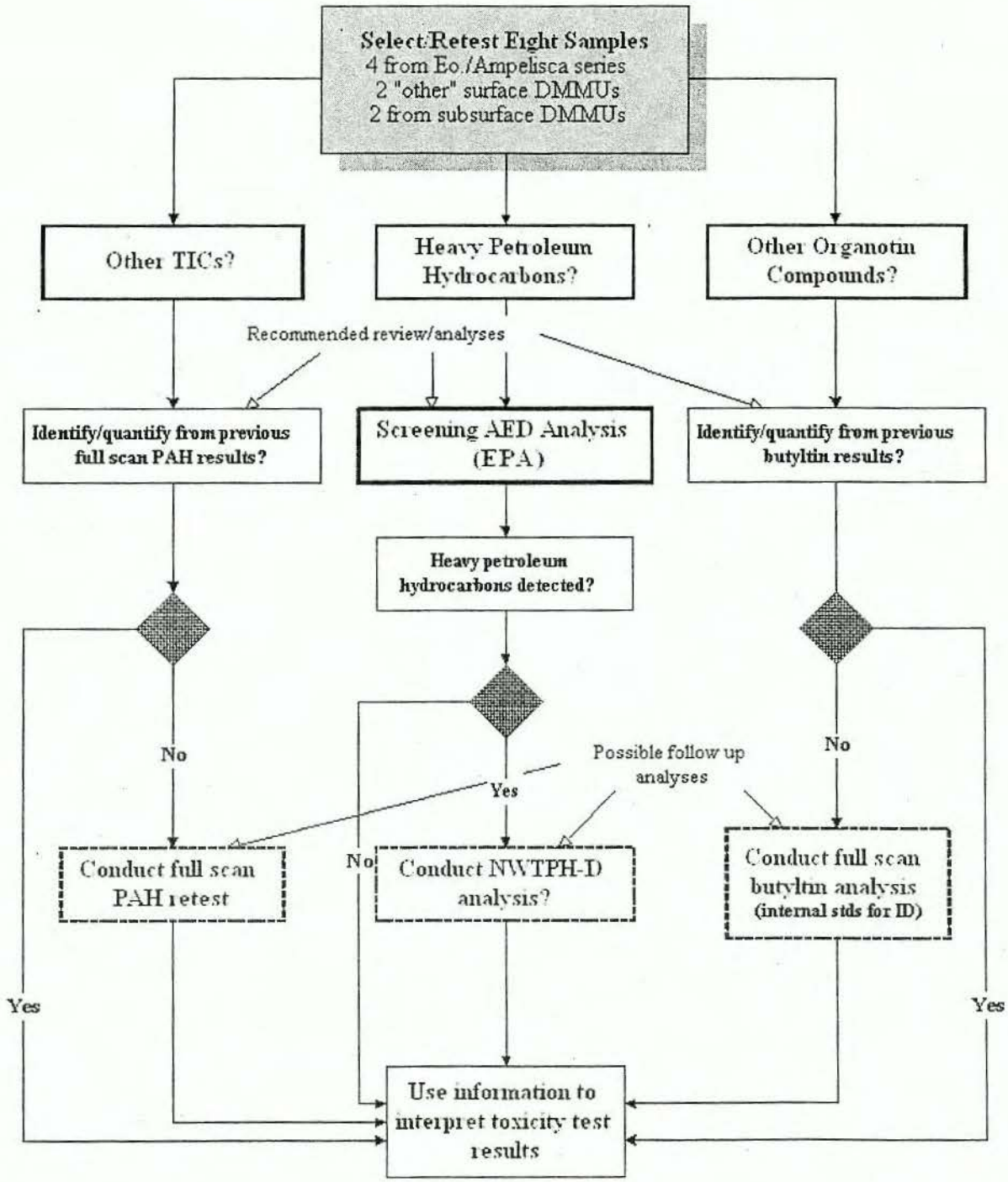
Please call me at 206-764-3768 if you have any questions about our response to your questions.

Sincerely,

David R. Kendall, Ph.D.
Chief, Dredged Material Management Office

Copies Furnished:
Peter Havens, U.S. Navy EFA Northwest
Erika Hoffman, EPA
Tom Greis, Ecology
Rick Vining, Ecology
Ted Benson, DNR
DMMO FILE

PSNS "Source of Observed Toxicity" Study
DRAFT Flow Diagram



Appendix 3. U.S. Navy Puget Sound Naval Shipyard, Bremerton, WA.
DMMP Final Evaluation Summary

					S1		S1-R		S2		S3		S4		S5		S6		S7		S8		S9		S10		S11		S12		S13		S14		S15	
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc	VQ	Conc	VQ	Conc	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700																																
Copper	mg/kg	390		1,300																																
Lead	mg/kg	450		1,200																																
Mercury	mg/kg	0.41	1.5	2.3			0.537						0.773								0.872		0.548		0.915										0.471	
Silver	mg/kg	6.1	6.1	8.4																																
Zinc	mg/kg	410		3,800																																
Tributyltin ion (porewater)	ug/L	0.15	0.15	--																																
Acenaphthene	ug/kg	500		2,000																																
Fluorene	ug/kg	540		3,600																																
Phenanthrene	ug/kg	1,500		21,000																																
Anthracene	ug/kg	960		13,000																																
Fluoranthene	ug/kg	1,700	4,600	30,000																																
Pyrene	ug/kg	2,600		16,000																																
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2-Methylphenol	ug/kg	63		77																																
2,4-Dimethylphenol	ug/kg	29		210																																
Pentachlorophenol	ug/kg	400	504	690																																
Benzoic Acid	ug/kg	650		760																																
Benzyl alcohol	ug/kg	57		870																																
Hexachlorobutadiene	ug/kg	29	212	270																																
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alpha-Chlordane	ug/kg	10	37																																	
Dieldrin	ug/kg	10	37																																	
Total DDT	ug/kg	6.9	50	69																																
Total PCBs	ug/kg	130		3,100																																
Total PCBs (TOC- normalized)	mg/kg		38																																	
Total Phosphate compounds	ug/kg	-	-	-																																
Tricresyl phosphate	ug/kg	-	-	-																																
Total Solids	%				41.3		39.2		40.0		40.6		43.0		44.6		39.7		40.5		37.8		42.6		39.8		41.0		38.0		37.5		36.6		40.5	
Total Volatile Solids	%				9.0		6.5		6.4		6.1		5.9		5.8		4.9		7.6		8.4		5.9		7.2		6.0		5.1		8.0		7.4		6.0	
Total Organic Carbon	%				2.2		2.3		2.5		2.4		2.3		2.2		2.5		2.2		2.1		2.2		2.1		2.3		2.4		2.3		2.4		2.3	
Total Ammonia	mg/kg				43.0		51.0		46.0		49.0		61.0		48.0		40.0		34.0		34.0		18.0		27.0		36.0		49.0		41.0		41.0		36.0	
Total Sulfides	mg/kg				89	J	88		69		180		45		71		170		130		110		36		98		130		96		370		120		27	
Gravel (percent)	%				0.2		0		-		-		-		0.4		-		2.9		1.6		0.7		-		0.5		-		1.3		-		1.9	
Sand (percent)	%				8.7		11		11.6		12.4		9.7		15.8		17.1		11.2		7.8		16.0		14.9		15.3		8.3		8.6		10.9		8.4	
Silt (percent)	%				58.2		55.5		50.3		49.5		52.3		47.8		42.0		55.4		54.2		49.7		51.7		51.5		54.1		50.7		53.2		53.9	
Clay (percent)	%				32.2		33.0		38.2		37.9		37.9		35.7		40.7		30.1		36.6		33.6		33.4		32.6		37.8		39.2		35.9		35.8	
Fines (percent silt + clay)	%				90.9		88.5		88.5		87.4		90.2		83.5		82.7		85.5		90.8		83.3		85.1		84.1		91.9		89.9		89.1		89.7	
preferred reference match:					82.7		78.7																													
Eohaustorius estuarius hits:					1-H(I)		1-H(R)		1-H(I)		1-H(I)		2-H(I)		1-H(I)		2-H(I)		1-H(I)		1-H(I)		1-H(I)		2-H(I)		1-H(I)		1-H(I)		1-H(I)		1-H(I)		1-H(I)	
Ampelisca abdita hits:							NH		NH		NH		NH		NH		NH		NH		NH		NH		NH		NH		NH		NH		NH		NH	
Mytilus galloprovincialis hits:					2-H				2-H		2-H		2-H		2-H		2-H		2-H		2-H		2-H		2-H		2-H		2-H		NH		NH		2-H	
Neanthes arenaceodentata hits:					NH				NH		NH		NH		NH		NH		NH		NH		NH		NH		NH		NH		NH		NH		NH	
Bioassay Pass/Fail:							Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
BTs exceeded:																																				
Bioaccumulation conducted:																																				
Bioaccumulation Pass/Fail:																																				
ML Rule exceeded:																																				
PSDDA Determination:							Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
DMMU Volume:	cy						4,050		3,980		4,000		3,980		4,100		4,090		3,950		3,950		4,030		4,050		4,080		3,870		3,940		4,020		4,030	
DMMU ID:					S1		S1-R		S2		S3		S4		S5		S6		S7		S8		S9		S10		S11		S12		S13		S14		S15	

Failed:																																				
Passed:							4,050		3,980		4,000		3,980		4,100		4,090		3,950		3,950		4,030		4,050		4,080		3,870		3,940		4,020		4,030	
Eohaustorius retest					yes																															
Amphipod (Ampelisca) retest					4,050				3,980		4,000		3,980		4,100		4,090		3,950		3,950		4,030		4,050		4,080		3,870		3,940		4,020		4,030	
Bioaccumulation testing req.																																				

Note: Highlighted results (Initial and retested DMMUs) with clay contents > 15%, not included in decision matrix for final SDM. See Final SDM for explanation.

Initial Test (I)

Gray Highlighted area denotes retested parameters (R)

Appendix 3. U.S. Navy Puget Sound Naval Shipyard, Bremerton, WA.
DMMP Final Evaluation Summary

					S16		S17		S18		S19		S20		S21		S22		S22-R		S23		S23-R		S24		S25		S26		S26-R		S27		S28		S29	
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H				H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700																																		
Copper	mg/kg	390		1,300																																		
Lead	mg/kg	450		1,200																																		
Mercury	mg/kg	0.41	1.5	2.3	0.605														0.537												0.440							
Silver	mg/kg	6.1	6.1	8.4																																		
Zinc	mg/kg	410		3,800																																		
Tributyltin Ion (porewater)	ug/L	0.15	0.15	--																							0.15											
Acenaphthene	ug/kg	500		2,000																																		
Fluorene	ug/kg	540		3,600																																		
Phenanthrene	ug/kg	1,500		21,000																																		
Anthracene	ug/kg	960		13,000																																		
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Pyrene	ug/kg	2,600		16,000																																		
Benzo(a)anthracene	ug/kg	1,300		5,100																																		
Chrysene	ug/kg	1,400		21,000																																		
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																																		
Total HPAHs	ug/kg	12,000		69,000																																		
1,2,4-Trichlorobenzene	ug/kg	31		64																																		
Hexachlorobenzene (HCB)	ug/kg	22	168	230															37	UD			29	U														
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--																																		
2-Methylphenol	ug/kg	63		77																																		
2,4-Dimethylphenol	ug/kg	29		210															37	UD																		
Pentachlorophenol	ug/kg	400	504	690																																		
Benzoic Acid	ug/kg	650		760																																		
Benzyl alcohol	ug/kg	57		870															75	UD			59	U														
Hexachlorobutadiene	ug/kg	29	212	270															45	UD			35	U														
N-Nitrosodiphenylamine	ug/kg	28	130	130															37	UD			29	U														
alpha-Chlordane	ug/kg	10	37																																			
Dieldrin	ug/kg	10	37																																			
Total DDT	ug/kg	6.9	50	69																																		
Total PCBs	ug/kg	130		3,100																																		
Total PCBs (TOC- normalized)	mg/kg		38																																			
Total Phosphate compounds	ug/kg	-	-	-																																		
Tricresyl phosphate	ug/kg	-	-	-																																		
Total Solids	%				38.0		39.2		39.7		39.0		39.7		36.2		37.6		36.6		37.1		36.0		35.5		36.6		37.2		39.1		37.5		36.3		37.1	
Total Volatile Solids	%				7.6		5.6		7.1		6.7		6.9		7.0		6.6		8.6		7.1		6.9		8.6		6.6		6.5		8.0		7.7		7.3		6.7	
Total Organic Carbon	%				2.4		2.1		2.3		2.3		2.3		2.1		3.2		2.5		2.8		2.3		2.5		2.4		2.6		2.3		2.4		2.3		2.5	
Total Ammonia	mg/kg				34.0		62.0		64.0		39.0		29.0		27.0		51.0		35.0		55.0		54.0		52.0		45.0		54.0		47.0		55.0		54.0		57.0	
Total Sulfides	mg/kg				22		130		32		10	U	56		100		28	U	120		26	U	71		29	U	74		67		75		120		44		78	
Gravel (percent)	%				0.5		0.5		1.1		0.5		0.3		6.6		0.6		3.6		-		-		-		0.5		0.6		-		-		0.3		-	
Sand (percent)	%				7.7		9.5		9.4		13.6		9.2		9.6		9.1		8.1		10.5		10.7		7.1		9.7		5.9		6.3		8.1		8.8		6.2	
Silt (percent)	%				55.9		53.9		53.7		46.8		54.7		45.0		48.0		58.5		49.1		55.6		55.1		49.9		56.1		57.1		55.0		52.7		56.5	
Clay (percent)	%				36.6		36.1		35.9		37.1		35.8		36.8		42.3		29.8		40.4		33.9		37.7		39.6		37.2		34.6		37.0		38.3		37.3	
Fines (percent silt + clay)	%				91.8		90.0		89.6		85.9		90.5		81.8		90.3		88.3		89.5		89.5		92.8		89.5		93.3		91.7		92.0		91.0		93.9	
preferred reference match:																	82.7		78.7		82.7		78.7		82.7				82.7		78.7		78.7		78.7		82.7	
Eohaustorius estuarius hits:					1-H(I)		1-H(I)		1-H(I)		1-H(I)		1-H(I)		1-H(I)		1-H(I)		1-H(R)		1-H(I)		1-H(R)		2-H(I)		1-H(I)		2-H(I)		1-H(R)		1-H(I)		1-H(I)		2-H(I)	
Ampelisca abdita hits:					NH		NH		NH		NH		NH		NH				NH				NH				NH				NH		NH		NH			
Mytilus galloprovincialis hits:					NH		NH		NH		2-H		2-H		NH		2-H				2-H				NH		NH		2-H				NH		NH		NH	
Neanthes arenaceodentata hits:					NH		NH		2-H		NH		NH		NH		NH				NH				NH		NH		NH				NH		NH		NH	
Bioassay Pass/Fail:					Pass		Pass		Pass		Pass		Pass		Pass				Pass				Pass		Pass		Pass				Pass		Pass		Pass		Pass	
BTs exceeded:																											yes											
Bioaccumulation conducted:																											no											
Bioaccumulation Pass/Fail:																																						
ML Rule exceeded:																																						
PSDDA Determination:					Pass		Pass		Pass		Pass		Pass		Pass				Pass				Pass		Pass		Fail (s)				Pass		Pass		Pass		Pass	
DMMU Volume:	cy				3,970		3,960		4,030		3,970		4,030		4,000				3,960				3,960		3,920		3,960				3,960		3,990		3,990		4,010	
DMMU ID:					S16		S17		S18		S19		S20		S21		S22		S22-R		S23		S23-R		S24		S25		S26		S26-R		S27		S28		S29	
Failed:																											3,960											
Passed:					3,970		3,960		4,030		3,970		4,030		4,000				3,960				3,960		3,920						3,960		3,990		3,990		4,010	
Eohaustorius retest																	yes				yes								yes									
Amphipod (Ampelisca) retest					3,970		3,960		4,030		3,970		4,030		4,000		3,960				3,960						3,960		3,960				3,960		3,990			
Bioaccumulation testing req.																											3,960											

Note: Highlighted results (Initial and retested DMMUs) with clay contents > 15%, not included in decision matrix for final SDM. See Final SDM for explanation.

Initial Test (I)

Gray Highlighted area denotes retested parameters (R)

Appendix 3. U.S. Navy Puget Sound Naval Shipyard, Bremerton, WA.
DMMP Final Evaluation Summary

					S30		S31		S32		S33		S34		S35		S36		S37		S38		S39		FD-S39-I		S40		S41		S42		S43	
				Rank:	H		H		H		H		H		H		H		H		H		H		S79-I		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
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Total HPAHs	ug/kg	12,000		69,000																														
1,2,4-Trichlorobenzene	ug/kg	31		64																														
Hexaclorobenzene (HCB)	ug/kg	22	168	230																														
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--																														
2-Methylphenol	ug/kg	63		77																														
2,4-Dimethylphenol	ug/kg	29		210																														
Pentachlorophenol	ug/kg	400	504	690																														
Benzoic Acid	ug/kg	650		760																														
Benzyl alcohol	ug/kg	57		870																														
Hexachlorobutadiene	ug/kg	29	212	270																														
N-Nitrosodiphenylamine	ug/kg	28	130	130																														
alpha-Chlordane	ug/kg	10	37																															
Dieldrin	ug/kg	10	37																															
Total DDT	ug/kg	6.9	50	69																														
Total PCBs	ug/kg	130		3,100																														
Total PCBs (TOC- normalized)	mg/kg		38																															
Total Phosphate compounds	ug/kg	-	-	-																														
Tricresyl phosphate	ug/kg	-	-	-																														
Total Solids	%				38.7		38.1		35.5		37.2		35.5		37.4		39.0		36.8		36.2		36.0		37.3		40.8		37.0		36.2		39.8	
Total Volatile Solids	%				6.0	J	4.6	J	7.4	J	5.3	J	4.6	J	6.3		9.8		5.4	J	5.2		5.6	J	9.4		14.0		7.1		7.1		17.0	
Total Organic Carbon	%				2.4		2.3		2.1		2.6		2.5		2.3		2.5		2.6		2.5		2.4		2.3		6.0		2.2		2.4		2.4	
Total Ammonia	mg/kg				37.0		46.0		28.0		60.0		47.0		49.0		71.0		57.0		45.0		51.0		57.0		26.0		71.0		44.0		40.0	
Total Sulfides	mg/kg				150		140		43		160		130		68		74		270		67		28		64		300		110		140		95	
Gravel (percent)	%				1.6		4.0		0.6		0.3		0.3		-		0.3		0.3		2.3		-		0.3		9.7		5.9		0.3		1.3	
Sand (percent)	%				8.9		10.8		13.0		7.3		8.1		8.5		5.2		8.9		7.2		9.6		7.8		14.4		8.6		10.9		8.6	
Silt (percent)	%				59.7		51.9		54.3		54.4		54.6		52.7		57.0		59.3		49.3		61.2		56.0		48.3		50.7		52.2		55.9	
Clay (percent)	%				29.9		33.4		32.3		38.1		37.0		38.8		37.6		31.5		41.3		29.0		35.9		27.4		34.7		35.7		34.4	
Fines (percent silt + clay)	%				89.6		85.3		86.6		92.5		91.6		91.5		94.6		90.8		90.6		90.2		91.9		75.7		85.4		88.9		90.3	
preferred reference match:					78.7		78.7		78.7		78.7		78.7		78.7		82.7		78.7		78.7		78.7		82.7		78.7		78.7		78.7		78.7	
Eohaustorius estuarius hits:					1-H(I)		2-H(I)		1-H(I)		1-H(I)		1-H(I)		2-H(I)		1-H(I)		1-H(I)		1-H(I)		1-H(I)		--		1-H(I)		1-H(I)		2-H(I)		2-H(I)	
Ampelisca abdita hits:					NH		NH		NH		NH		NH		NH				NH		NH		NH				NH		NH		NH		NH	
Mytilus galloprovincialis hits:					2-H		2-H		NH		2-H		2-H		2-H		2-H		NH		2-H		2-H		--		2-H		2-H		2-H		2-H	
Neanthes arenaceodentata hits:					NH		NH		NH		NH		NH		NH		2-H		NH		NH		NH		--		NH		NH		NH		NH	
Bioassay Pass/Fail:					Pass		Pass		Pass		Pass		Pass		Pass		Fail		Pass		Pass		Pass				Pass		Pass		Pass		Pass	
BTs exceeded:																																		
Bioaccumulation conducted:																																		
Bioaccumulation Pass/Fail:																																		
ML Rule exceeded:																																		
PSDDA Determination:					Pass		Pass		Pass		Pass		Pass		Pass		Fail		Pass		Pass		Pass				Pass		Pass		Pass		Pass	
DMMU Volume:	cy				4,000		3,950		3,980		3,970		4,020		3,940		3,990		3,990		3,960		4,160				3,970		3,950		4,060		3,950	
DMMU ID:					S30		S31		S32		S33		S34		S35		S36		S37		S38		S39		FD-S39-I		S40		S41		S42		S43	

Failed:																	3,990																	
Passed:					4,000		3,950		3,980		3,970		4,020		3,940				3,990		3,960		4,160				3,970		3,950		4,060		3,950	
Eohaustorius retest																																		
Amphipod (Ampelisca) retest					4,000		3,950		3,980		3,970		4,020		3,940				3,990		3,960		4,160				3,970		3,950		4,060		3,950	
Bioaccumulation testing req.																																		

Note: Highlighted results (Initial and retested DMMUs) with clay contents > 15%, not included in decision matrix for final SDM. See Final SDM for explanation.

Initial Test (I)

Gray Highlighted area denotes retested parameters (R)

Appendix 3. U.S. Navy Puget Sound Naval Shipyard, Bremerton, WA.
DMMP Final Evaluation Summary

					S44		S45		S46		S47		S48		FD-S48-I		S48-R		S49		S50		S51		S52		S53		S54		S55		S56		S56-R	
				Rank:	H		H		H		H		H		S81-I				H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700																																
Copper	mg/kg	390		1,300																																
Lead	mg/kg	450		1,200																					460											
Mercury	mg/kg	0.41	1.5	2.3	0.434		0.454																1.75		1.07				0.510		0.859					
Silver	mg/kg	6.1	6.1	8.4																			6.5													
Zinc	mg/kg	410		3,800																			520													
Tributyltin ion (porewater)	ug/L	0.15	0.15	--																																
Acenaphthene	ug/kg	500		2,000																																
Fluorene	ug/kg	540		3,600																																
Phenanthrene	ug/kg	1,500		21,000																																
Anthracene	ug/kg	960		13,000																																
Fluoranthene	ug/kg	1,700	4,600	30,000																			2,100	D												
Pyrene	ug/kg	2,600		16,000																			3,300	D												
Benzo(a)anthracene	ug/kg	1,300		5,100																																
Chrysene	ug/kg	1,400		21,000																																
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																																
Total HPAHs	ug/kg	12,000		69,000																																
1,2,4-Trichlorobenzene	ug/kg	31		64																			46	UD												
Hexachlorobenzene (HCB)	ug/kg	22	168	230																			77	UD											26	UD
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--																																
2-Methylphenol	ug/kg	63		77																			77	UD												
2,4-Dimethylphenol	ug/kg	29		210																			77	UD												
Pentachlorophenol	ug/kg	400	504	690																			620	UD												
Benzoic Acid	ug/kg	650		760																			770	UD												
Benzyl alcohol	ug/kg	57		870																			110	UD												
Hexachlorobutadiene	ug/kg	29	212	270																			92	UD											34	UD
N-Nitrosodiphenylamine	ug/kg	28	130	130																			77	UD												
alpha-Chlordane	ug/kg	10	37																				27	D												
Dieldrin	ug/kg	10	37																				16	D												
Total DDT	ug/kg	6.9	50	69																			748								96.9					
Total PCBs	ug/kg	130		3,100																			1,115				198				185					
Total PCBs (TOC- normalized)	mg/kg		38																				21.9				11.6				7.7					
Total Phosphate compounds	ug/kg	-	-	-																															430	
Tricresyl phosphate	ug/kg	-	-	-																															110	
Total Solids	%				36.8		36.0		35.8		36.9		37.8		37.0		36.0		37.1		35.2		46.4		64.8		63.7		49.0		42.9		56.7		49.2	
Total Volatile Solids	%				6.1		6.5	J	5.6		7.3	J	8.6		7.4		9.7		6.8	J	7.9		8.7		4.7		3.4		5.8		7.5		4.7		5.1	
Total Organic Carbon	%				2.4		2.5		2.2		2.6		1.9		2.1		2.4		2.6		2.2		5.1		2.3		1.7		1.4		1.8		1.9		1.8	
Total Ammonia	mg/kg				65.0		46.0		53.0		48.0		88.0		81.0		61.0		46.0		53.0		39.0		2.8		6.5		40.0		23.0		18.0		23.0	
Total Sulfides	mg/kg				120		28		76		290		120		69		77		220		140		1,800		380	J	890		23		280		44	U	71	
Gravel (percent)	%				0.3		1.2		0.9		0.3		0.3		-		0.6		0.3		0.3		9.1		18.3		25.6		1.0		1.2		-		0.2	
Sand (percent)	%				7.6		8.7		7.9		9.2		7.5		6.2		9.4		8.8		10.0		46.3		55.6		43.6		25.6		18.9		40.9		36.4	
Silt (percent)	%				52.6		54.8		56.0		57.8		50.9		53.5		56.4		55.6		57.2		33.2		17.2		19.3		52.8		57.2		41.7		40.5	
Clay (percent)	%				39.4		35.4		35.3		32.7		41.5		40.3		33.6		35.4		32.5		11.4		8.9		11.4		20.5		22.6		17.4		23.1	
Fines (percent silt + clay)	%				92.0		90.2		91.3		90.5		92.4		93.8		90.0		91.0		89.7		44.6		26.1		30.7		73.3		79.8		59.1		63.6	
preferred reference match:					78.7		78.7		78.7		78.7		82.7		82.7		78.7		78.7		82.7		58.2		27.0		27.0		78.7		78.7		58.2		78.7	
Eohaustorius estuarius hits:					1-H(I)		1-H(I)		1-H(I)		1-H(I)		1-H(I)		--		2-H(R)		1-H(I)		2-H(I)		NH(I)		NH(I)		NH(I)		2-H(I)		1-H(I)		1-H(I)		2-H(R)	
Ampelisca abdita hits:					NH		NH		NH		NH						NH		NH										NH		NH				NH	
Mytilus galloprovincialis hits:					NH		NH		2-H		NH		2-H		--				NH		NH		2-H		1-H		2-H		2-H		2-H		2-H			
Neanthes arenaceodentata hits:					NH		NH		NH		NH		NH		--				NH		NH		NH		NH		NH		NH		NH		NH			
Bioassay Pass/Fail:					Pass		Pass		Pass		Pass						Pass		Pass		Pass		Pass		Fail		Pass		Pass		Pass				Pass	
BTs exceeded:																							yes								yes					
Bioaccumulation conducted:																							yes								no					
Bioaccumulation Pass/Fail:																							Fail													
ML Rule exceeded:																							yes													
PSDDA Determination:					Pass		Pass		Pass		Pass						Pass		Pass		Pass		Fail		Fail		Pass		Pass		Fail (c)				Pass	
DMMU Volume:	cy				4,150		3,980		4,050		4,080						4,120		4,020		4,030		4,050		3,960		4,020		4,040		4,010				4,120	
DMMU ID:					S44		S45		S46		S47		S48		FD-S48-I		S48-R		S49		S50		S51		S52		S53		S54		S55		S56		S56-R	
Failed:																							4,050		3,960						4,010					
Passed:					4,150		3,960		4,050		4,080						4,120		4,020		4,030						4,020		4,040						4,120	
Eohaustorius retest													yes																				yes			
Amphipod (Ampelisca) retest					4,150		3,980		4,050		4,080		4,120						4,020										4,040		4,010		4,120			
Bioaccumulation testing req.																							4,050								4,010					

Note: Highlighted results (Initial and retested DMMUs) with clay contents > 15%, not included in decision matrix for final SDM. See Final SDM for explanation.

Initial Test (I)

Gray Highlighted area denotes retested parameters (R)

Appendix 3. U.S. Navy Puget Sound Naval Shipyard, Bremerton, WA.
DMMP Final Evaluation Summary

					S57		S58		S59		S60		S61		S62		S62-R		S63		S64		S65		S66		S67		S68		S69		S70	
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700																														
Copper	mg/kg	390		1,300																														
Lead	mg/kg	450		1,200																														
Mercury	mg/kg	0.41	1.5	2.3					0.929		1.32		0.958						0.701		0.590				0.529		0.836		1.09		1.17		0.720	
Silver	mg/kg	6.1	6.1	8.4																														
Zinc	mg/kg	410		3,800																														
Tributyltin ion (porewater)	ug/L	0.15	0.15	--									0.17	E																				
Acenaphthene	ug/kg	500		2,000																														
Fluorene	ug/kg	540		3,600																														
Phenanthrene	ug/kg	1,500		21,000																														
Anthracene	ug/kg	960		13,000																														
Fluoranthene	ug/kg	1,700	4,600	30,000																														
Pyrene	ug/kg	2,600		16,000																														
Benzo(a)anthracene	ug/kg	1,300		5,100																														
Chrysene	ug/kg	1,400		21,000																														
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																														
Total HPAHs	ug/kg	12,000		69,000																														
1,2,4-Trichlorobenzene	ug/kg	31		64																														
Hexachlorobenzene (HCB)	ug/kg	22	168	230																											23	UD		
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--																													31,000	D
2-Methylphenol	ug/kg	63		77																														
2,4-Dimethylphenol	ug/kg	29		210																														
Pentachlorophenol	ug/kg	400	504	690																														
Benzoic Acid	ug/kg	650		760																														
Benzyl alcohol	ug/kg	57		870																														
Hexachlorobutadiene	ug/kg	29	212	270																														
N-Nitrosodiphenylamine	ug/kg	28	130	130																														
alpha-Chlordane	ug/kg	10	37																															
Dieldrin	ug/kg	10	37																															
Total DDT	ug/kg	6.9	50	69																														
Total PCBs	ug/kg	130		3,100															213		136						220		310				134	
Total PCBs (TOC- normalized)	mg/kg		38																9.7		7.6						13.8		28.2				8.9	
Total Phosphate compounds	ug/kg	-	-	-									680				2,100																2,300	
Tricresyl phosphate	ug/kg	-	-	-									140				210																250	
Total Solids	%				78.3		46.8		72.2		58.7		47.1		48.9		42.9		39.0		37.9		45.3		43.4		59.2		59.2		60.1		42.2	
Total Volatile Solids	%				2.5		5.6		2.5		4.0		7.6		5.7		7.8		7.3		7.0		5.9		5.6		4.2		3.4		4.1		6.0	
Total Organic Carbon	%				1.4		1.8		1.2		1.6		1.6		2.0		2.0		2.2		2.1		2.0		1.6		1.6		1.4		1.2		1.8	
Total Ammonia	mg/kg				4.8		91.0		2.4		3.9		15.0		20.0		17.0		18.0		38.0		36.0		56.0		4.1		2.2		2.6		10.0	
Total Sulfides	mg/kg				3	UJ	14	U	150		27		130		74		180		230		290		21		180	U	51		240		N/A		180	
Gravel (percent)	%				13.8		1.1		15.0		2.9		0.2		0.4		1.2		0.3		2.3		0.4		0.4		1.5		5.9		3.5		1.3	
Sand (percent)	%				61.0		14.7		59.6		44.1		20.4		17.3		17.3		15.5		14.4		14.4		12.7		59.0		46.5		45.9		16.4	
Silt (percent)	%				20.1		60.7		18.3		39.6		53.3		53.5		56.2		56.9		56.4		54.3		59.2		24.8		32.3		31.5		53.0	
Clay (percent)	%				5.1		23.4		7.3		13.5		26.2		28.7		25.3		27.5		26.7		31.0		27.6		14.7		15.4		18.0		29.3	
Fines (percent silt + clay)	%				25.2		84.1		25.6		53.1		79.5		82.2		81.5		84.4		83.1		85.3		86.8		39.5		47.7		50.5		82.3	
preferred reference match:					27.0		78.7		27.0		58.2		78.7		82.7		78.7		78.7		78.7		82.7		78.7		27.0		43.7		43.7		78.7	
Eohaustorius estuarius hits:					2-H(I)		1-H(I)		NH(I)		2-H(I)		1-H(I)		1-H(I)		2-H(R)		1-H(I)		1-H(I)		1-H(I)		1-H(I)		2-H(I)		1-H(I)		1-H(I)		1-H(I)	
Ampelisca abdita hits:							NH						NH				NH		NH		NH				NH				NH		NH		NH	
Mytilus galloprovincialis hits:					2-H		NH		2-H		2-H		NH		2-H				2-H		2-H		2-H		2-H		2-H		2-H		2-H		NH	
Neanthes arenaceodentata hits:					NH		NH		NH		NH		NH		NH				NH		NH		2-H		NH		NH		NH		NH		NH	
Bioassay Pass/Fail:					Fail		Pass		Pass		Fail		Pass				Pass		Pass		Pass		Fail		Pass		Fail		Pass		Pass		Pass	
BTs exceeded:													yes																				yes	
Bioaccumulation conducted:													no																				no	
Bioaccumulation Pass/Fail:																																		
ML Rule exceeded:																																		
PSDDA Determination:					Fail		Pass		Pass		Fail		Fail (c)				Pass		Pass		Pass		Fail		Pass		Fail		Pass		Pass		Fail (c)	
DMMU Volume:	cy				3,470		4,040		4,520		4,330		4,200				4,270		4,350		4,190		4,260		4,190		2,850		2,190		1,660		1,010	
DMMU ID:					S57		S58		S59		S60		S61		S62		S62-R		S63		S64		S65		S66		S67		S68		S69		S70	
Failed:					3,470						4,330		4,200										4,260				2,850						1,010	
Passed:							4,040		4,520								4,270		4,350		4,190				4,190				2,190		1,660			
Eohaustorius retest															yes																			
Amphipod (Ampelisca) retest							4,040						4,200		4,270				4,350		4,190				4,190				2,190		1,660		1,010	
Bioaccumulation testing req.													4,200																				1,010	

Note: Highlighted results (Initial and retested DMMUs) with clay contents > 15%, not included in decision matrix for final SDM. See Final SDM for explanation.

Initial Test (I)

Gray Highlighted area denotes retested parameters (R)

Appendix 3. U.S. Navy Puget Sound Naval Shipyard, Bremerton, WA.
DMMP Final Evaluation Summary

					S71		FD-S71-I		S71-R		S72		S73		S73-R		FD-S73-R		S77		S78		S80		D1		FD-D1-I		D2		D3		D3-R	
				Rank:	H		S82-I				H		H						H		H		H		H		D9-I		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700															72.0															
Copper	mg/kg	390		1,300															670		690													
Lead	mg/kg	450		1,200																														
Mercury	mg/kg	0.41	1.5	2.3							0.949								5.26		5.27				0.830		0.517							
Silver	mg/kg	6.1	6.1	8.4																														
Zinc	mg/kg	410		3,800																	960													
Tributyltin ion (porewater)	ug/L	0.15	0.15	--																														
Acenaphthene	ug/kg	500		2,000							660																							
Fluorene	ug/kg	540		3,600							710																							
Phenanthrene	ug/kg	1,500		21,000							2,200	D																						
Anthracene	ug/kg	960		13,000							1,000																							
Fluoranthene	ug/kg	1,700	4,600	30,000							6,200	D																						
Pyrene	ug/kg	2,600		16,000							5,500	D																						
Benzo(a)anthracene	ug/kg	1,300		5,100							2,100	D																						
Chrysene	ug/kg	1,400		21,000							2,000	D																						
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400							620																							
Total HPAHs	ug/kg	12,000		69,000							20,700																							
1,2,4-Trichlorobenzene	ug/kg	31		64																														
Hexachlorobenzene (HCB)	ug/kg	22	168	230															45	UD	34	UD												
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--																														
2-Methylphenol	ug/kg	63		77																														
2,4-Dimethylphenol	ug/kg	29		210															45	UD	34	UD												
Pentachlorophenol	ug/kg	400	504	690																														
Benzoic Acid	ug/kg	650		760																														
Benzyl alcohol	ug/kg	57		870															73	UD														
Hexachlorobutadiene	ug/kg	29	212	270															55	UD	40	UD												
N-Nitrosodiphenylamine	ug/kg	28	130	130															45	UD	34	UD												
alpha-Chlordane	ug/kg	10	37																															
Dieldrin	ug/kg	10	37																															
Total DDT	ug/kg	6.9	50	69																														
Total PCBs	ug/kg	130		3,100							390								290		370													
Total PCBs (TOC- normalized)	mg/kg		38								30								16.1		19.5													
Total Phosphate compounds	ug/kg	-	-	-					240				310																					
Tricresyl phosphate	ug/kg	-	-	-					34				85																					
Total Solids	%				54.2		52.8		58.2		61.2		69.2		56.3		69.8		56.8		42.9		44.8		64.7		64.5		62.5		56.4		52.5	
Total Volatile Solids	%				4.7		4.4		5.1		3.7		1.9		6.9		2.9		5.5		7.8		4.5		2.2		2.0		1.6		5.8		4.7	
Total Organic Carbon	%				1.5		2.4		1.6		1.3		0.38		1.6		0.6		1.8		1.9		2.2		2.1		1.6		0.28		2.0		1.6	
Total Ammonia	mg/kg				31.0		31.0		22.0		4.3		3.2		61.0		3.9		4.2		15.0		18.0		6.9		7.0		7.8		61.0		100.0	
Total Sulfides	mg/kg				98		10	U	10	U	190		10	U	190		10	U	25		580	J	290		27	U	21	U	10	UJ	60	U	11	U
Gravel (percent)	%				2.2		1.5		4.8		3.3		1.1		2.0		1.7		6.7		0.4		5.1		37.1		61.1		23.0		0.9		1.0	
Sand (percent)	%				31.8		28.3		41.8		44.0		19.8		18.6		19.0		40.3		19.5		17.9		39.1		27.7		49.2		20.3		20.3	
Silt (percent)	%				43.3		44.0		33.7		37.9		57.2		61.9		56.1		42.7		67.4		49.0		17.9		6.4		22.9		55.0		56.2	
Clay (percent)	%				22.5		26.3		19.8		14.9		21.9		17.4		23.1		10.3		12.6		28.8		5.8		4.9		4.8		23.7		23.6	
Fines (percent silt + clay)	%				65.8		70.3		53.5		52.8		79.1		79.3		79.2		53.0		80.0		77.0		23.8		11.3		27.7		78.7		78.8	
preferred reference match:					58.2		58.2		43.7		58.2		82.7		78.7				58.2		62.7		78.7		27.0		27.0		27.0		62.7		78.7	
Eohaustorius estuarius hits:					1-H(I)		--		NH(R)		1-H(I)		1-H(I)		2-H(R)				2-H(I)		1-H(I)		1-H(I)		2-H(I)		--		NH		1-H(I)		1-H(R)	
Ampelisca abdita hits:									NH						NH								NH										NH	
Mytilus galloprovincialis hits:					2-H		--				2-H		NH						1-H		1-H		2-H		1-H		--		2-H		2-H			
Neanthes arenaceodentata hits:					NH		--				NH		NH						2-H		NH		NH		NH		--		NH		NH			
Bioassay Pass/Fail:									Pass		Fail				Pass				Fail		Fail		Pass		Fail				Pass				Pass	
BTs exceeded:											yes								yes		yes													
Bioaccumulation conducted:											no								no		no													
Bioaccumulation Pass/Fail:																																		
ML Rule exceeded:																			yes		yes													
PSDDA Determination:									Pass		Fail				Pass				Fail-a+c		Fail-b+c		Pass		Fail				Pass				Pass	
DMMU Volume:	cy								3,060		4,150				2,710				3,690		3,590		3,910		10,500				8,960				9,300	
DMMU ID:					S71		FD-S71-I		S71-R		S72		S73		S73-R		FD-S73-R		S77		S78		S80		D1		FD-D1-I		D2		D3		D3-R	

Failed:											4,150								3,690		3,590				10,500									
Passed:									3,060						2,710								3,910						8,960				9,300	
Eohaustorius retest					yes								yes																		yes			
Amphipod (Ampelisca) retest					3,060								2,710										3,910								9,300			
Bioaccumulation testing req.																																		

Note: Highlighted results (Initial and retested DMMUs) with clay contents > 15%, not included in decision matrix for final SDM. See Final SDM for explanation.

Initial Test (I)

Gray Highlighted area denotes retested parameters (R)

Appendix 3. U.S. Navy Puget Sound Naval Shipyard, Bremerton, WA.
DMMP Final Evaluation Summary

					D4		FD-D4-I		D4a		D4b		D4c		FD-D4c-R		D4d		D5		D6		D6a		D6b		D6c		D8		SS101		FD-SS101	
				Rank:	H		D10-I		PB-62		PB-63		PB-64		H		PB-65		H		H		PB-70		PB-71		PB-72		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Arsenic	mg/kg	57	507.1	700																														
Copper	mg/kg	390		1,300																														
Lead	mg/kg	450		1,200																														
Mercury	mg/kg	0.41	1.5	2.3																													0.464	
Silver	mg/kg	6.1	6.1	8.4																														
Zinc	mg/kg	410		3,800																														
Tributyltin ion (porewater)	ug/L	0.15	0.15	--																														
Acenaphthene	ug/kg	500		2,000																														
Fluorene	ug/kg	540		3,600																														
Phenanthrene	ug/kg	1,500		21,000																														
Anthracene	ug/kg	960		13,000																														
Fluoranthene	ug/kg	1,700	4,600	30,000																														
Pyrene	ug/kg	2,600		16,000																														
Benzo(a)anthracene	ug/kg	1,300		5,100																														
Chrysene	ug/kg	1,400		21,000																														
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																														
Total HPAHs	ug/kg	12,000		69,000																														
1,2,4-Trichlorobenzene	ug/kg	31		64																														
Hexachlorobenzene (HCB)	ug/kg	22	168	230																														
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,670	--																														
2-Methylphenol	ug/kg	63		77																														
2,4-Dimethylphenol	ug/kg	29		210																														
Pentachlorophenol	ug/kg	400	504	690																														
Benzoic Acid	ug/kg	650		760																														
Benzyl alcohol	ug/kg	57		870																														
Hexachlorobutadiene	ug/kg	29	212	270																														
N-Nitrosodiphenylamine	ug/kg	28	130	130																														
alpha-Chlordane	ug/kg	10	37																															
Dieldrin	ug/kg	10	37																															
Total DDT	ug/kg	6.9	50	69																														
Total PCBs	ug/kg	130		3,100					37	U													38	U	31	U								
Total PCBs (TOC- normalized)	mg/kg		38						74	U													76	U	39	U								
Total Phosphate compounds	ug/kg	-	-	-														NQ						U										
Tricresyl phosphate	ug/kg	-	-	-													5.1						280	U										
Total Solids	%				80.3		77.1		88.8		86.8		62.8		59.8		66.3		50.4		88.6		88.0		92.3		88.6		69.0		37.1		37.5	
Total Volatile Solids	%				2.2		2.4		1.0		1.8		5.6		6.3		2.8		8.2		0.86		1.0		1.6		0.87		3.3		10.0		9.7	
Total Organic Carbon	%				1.1		1.1		0.05	U	0.18		1.2		1.5		0.5		1.8		0.14		0.06	U	0.06		0.2		1.0		2.5		2.7	
Total Ammonia	mg/kg				26.0		29.0		0.4		2.0		78		77.0		3.2		100.0		1.0		1.6		1.0		1.3		19.0		29.0		27.0	
Total Sulfides	mg/kg				12	U	11	U	10	U	10	U	10.0	U	N/A		11		14	U	10	U	10	U	10	U	10	U	12	J	200		50	
Gravel (percent)	%				54.2		30.6		14.5		58.8		2.0		2.4		1.2		0.6		10.5		30.1		57.4		63.7		7.0		0.3		0.6	
Sand (percent)	%				26.0		39.0		81.9		29.8		35.3		28.7		19.9		12.7		79.7		66.6		32.8		28.2		55.2		10.4		9.9	
Silt (percent)	%				14.5		20.9		2.0		8.5		46.7		51.6		53.3		56.2		9.7		1.7		7.5		5.1		26.8		52.7		57.9	
Clay (percent)	%				5.4		9.4		1.7		3.1		16.2		17.3		25.5		30.5		0.1		1.7		2.4		3.8		18.8		36.4		31.7	
Fines (percent silt + clay)	%				19.9		30.3		3.7		11.6		62.9		68.9		78.8		86.7		9.8		3.4		9.9		8.1		37.6		89.1		89.6	
preferred reference match:					27.0		27.0		9.8		9.8		78.7				78.7		62.7		27.0		9.8		9.8		9.8		27.0		78.7			
Eohaustorius estuarius hits:					1-H(I)		--		NH		NH		NH				2-H		1-H(I)		2-H(I)		NH		NH		NH		1-H(I)					
Ampelisca abdita hits:									NH		NH		NH				NH						NH		NH		NH				NH			
Mytilus galloprovincialis hits:					2-H		--		NH		NH		2-H				2-H		2-H		2-H		NH		2-H		2-H		2-H		2-H			
Neanthes arenaceodentata hits:					NH		--		NH		NH		NH				NH		2-H		NH		NH		NH		NH		NH		NH			
Bioassay Pass/Fail:									Pass		Pass		Pass				Pass		Fail				Pass		Pass		Pass		Fail		Pass			
BTs exceeded:																																		
Bioaccumulation conducted:																																		
Bioaccumulation Pass/Fail:																																		
ML Rule exceeded:																																		
PSDDA Determination:									Pass		Pass		Pass				Pass		Fail				Pass		Pass		Pass		Fail		Pass			
DMMU Volume:	cy				13,730				3,430		3,430		3,430				3,430		12,220		2,850		950		950		950		2,950		4,160			
DMMU ID:					D4		FD-D4-I		D4a		D4b		D4c		FD-D4c-R		D4d		D5		D6		D6a		D6b		D6c		D8		SS101		FD-SS101	

Failed:
Passed:
Eohaustorius retest
Amphipod (Ampelisca) retest
Bioaccumulation testing req.

Failed:																			12,220										2,950					
Passed:									3,430		3,430		3,430				3,430						950		950		950				4,160			
Eohaustorius retest																																		
Amphipod (Ampelisca) retest					13,730																2,850													
Bioaccumulation testing req.																																		

Note: Highlighted results (initial and retested DMMUs) with clay contents > 15%, not included in decision matrix for final SDM. See Final SDM for explanation.

Initial Test (I)

Gray Highlighted area denotes retested parameters (R)

Appendix 3. U.S. Navy Puget Sound Naval Shipyard, Bremerton, WA.
DMMP Final Evaluation Summary

					SS102		SS103		CR-10	CR-22S	CR-24	DMMU
				Rank:	H		H		REF	REF	REF	exceed. freq
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ				#/91 + 8 FD
Arsenic	mg/kg	57	507.1	700								1
Copper	mg/kg	390		1,300								2
Lead	mg/kg	450		1,200								1
Mercury	mg/kg	0.41	1.5	2.3								31
Silver	mg/kg	6.1	6.1	6.4								1
Zinc	mg/kg	410		3,800								2
Tributyltin ion (porewater)	ug/L	0.15	0.15	--								2
Acenaphthene	ug/kg	500		2,000								1
Fluorene	ug/kg	540		3,600								1
Phenanthrene	ug/kg	1,500		21,000								1
Anthracene	ug/kg	960		13,000								1
Fluoranthene	ug/kg	1,700	4,600	30,000								2
Pyrene	ug/kg	2,600		16,000								2
Benzo(a)anthracene	ug/kg	1,300		5,100								1
Chrysene	ug/kg	1,400		21,000								1
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400								1
Total HPAHs	ug/kg	12,000		69,000								1
1,2,4-Trichlorobenzene	ug/kg	31		64								1(U)
Hexachlorobenzene (HCB)	ug/kg	22	168	230								7 (U)
Bis(2-ethylhexyl)phthalate	ug/kg	8,300	13,870	--								1
2-Methylphenol	ug/kg	63		77								1 (U)
2,4-Dimethylphenol	ug/kg	29		210								4 (U)
Pentachlorophenol	ug/kg	400	504	690								1 (U)
Benzoic Acid	ug/kg	650		760								1 (U)
Benzyl alcohol	ug/kg	57		870								4 (U)
Hexachlorobutadiene	ug/kg	29	212	270								6 (U)
N-Nitrosodiphenylamine	ug/kg	28	130	130								5 (U)
alpha-Chlordane	ug/kg	10	37									1
Dieldrin	ug/kg	10	37									1
Total DDT	ug/kg	6.9	50	69								2
Total PCBs	ug/kg	130		3,100								11
Total PCBs (TOC- normalized)	mg/kg		36									0
Total Phosphate compounds	ug/kg	-	-	-								detected 6 of 6
Tricresyl phosphate	ug/kg	-	-	-								detected 7 of 8
Total Solids	%				38.5		40.4		56.2	75.6	63.6	
Total Volatile Solids	%				9.5		7.5		3.7	1.8	1.9	
Total Organic Carbon	%				2.5		2.2		1.1	0.4	0.7	
Total Ammonia	mg/kg				23.0		31.0		7.9	13.0	11.0	
Total Sulfides	mg/kg				75		24		93	<10	<10	
Gravel (percent)	%				0.3		0.7		0.6	0.2	0.4	
Sand (percent)	%				13.3		15.3		20.7	90.0	56.0	
Silt (percent)	%				57.3		56.8		67.0	4.5	37.0	
Clay (percent)	%				29.3		27.8		11.7	5.3	6.7	
Fines (percent silt + clay)	%				86.6		83.8		78.7	9.8	43.7	
preferred reference match:					78.7		78.7		-	-	-	
Eohaustorius estuarius hits:												
Ampelisca abdita hits:					NH		NH					
Mytilus galloprovincialis hits:					2-H		2-H					
Neanthes arenaceodentata hits:					NH		NH					
Bioassay Pass/Fail:					Pass		Pass					
BTs exceeded:												
Bioaccumulation conducted:												
Bioaccumulation Pass/Fail:												
ML Rule exceeded:												
PSDDA Determination:					Pass		Pass					
DMMU Volume:	cy				4,160		4,160					
DMMU ID:					SS102		SS103					

Legend:

NH = No Hit (nondispersive guidelines)
2H = two hit failure (nondispersive guidelines)
1H = one hit failure (nondispersive guidelines)
P = Pass (Suitable for UCOWD)
F = Failure (Unsuitable for UCOWD)
UCOWD = Unconfined open-water disposal
VQ = Validation Qualifier
D = Associated compound required a dilution due to matrix or concentration
E = Estimated Value
U = Undetected
J = Positively identified; approximate concentration of the analyte in sample.
NQ = Not Quantifiable, but positive identification
ML = Maximum Level (upper chemical guideline)
SL = Screening Level (lower chemical guideline)
BT = Bioaccumulation Trigger
FD = Field Duplicate (S39, S48, S71, D1, D4, S73, D4c, S101)

			Unsuitable		Suitable		% unsuitable
Turning Basin/Inner Channel (surface)							
Total	212,690	cy	7,950	F	204,740	P	3.7%
DMMUs S1 - S50, SS101, SS102, SS103							
Piers D, B, 3 (surface)							
Total:	94,860	cy	43,590	F	51,270	P	46.0%
DMMUs S51 - S80							
Piers D, B, 3 (subsurface)							
	60,500	cy	25,670	F	34,830	P	42.4%
DMMUs D1 - D8							
Total Volumes (cy):	368,050		77,210	F	290,840	P	21.0%

Turning Basin	
Sand+Gravel	10.9
fines	89.1
clay	35.6
Volume	212,690
%TOC	2.4

Piers Surface	
Sand/Gravel	35.7
fines	64.3
clay	19.8
Volume	94,860
%TOC	1.8

Piers Subsurface	
Sand/Gravel	63.8
fines	36.2
clay	10.6
Volume	60,500
%TOC	0.89

Total Volume Tested
368,050 cy

Failed:		77,210 cy	21.0% Unsuitable for UCOWD
Passed:	4,160 4,160	290,840 cy	79.0% Suitable for UCOWD
Eohaustorius retest			
Amphipod (Ampelisca) retest		262,060 cy	Retesting Vol. 71.2% underwent retesting for amphipod bioassay
Bioaccumulation testing req.		17,230 cy	Bioaccumulation testing required (otherwise unsuitable for UCOWD)

Note: Highlighted results (initial and retested DMMUs) with clay contents > 15%, not included in decision matrix for final SDM. See Final SDM for explanation.

Initial Test (I)

Gray Highlighted area denotes retested parameters (R)

Appendix 4. DMMP BIOASSAY PERFORMANCE STANDARDS AND EVALUATION GUIDELINES

Bioassay	Negative Control Performance Standard	Reference Sediment Performance Standard	Dispersive Disposal Site Interpretation Guidelines		Nondispersive Disposal Site Interpretation Guidelines	
			1-hit rule	2-hit rule	1-hit rule	2-hit rule
Amphipod	$M_C \leq 10\%$	$M_R - M_C \leq 20\%$	$M_T - M_C > 20\%$ and M_T vs M_R SD (p=.05) and		$M_T - M_C > 20\%$ and M_T vs M_R SD (p=.05) and	
			$M_T - M_R > 10\%$	NOCN	$M_T - M_R > 30\%$	NOCN
Larval	$N_C \div I \geq 0.70$	$N_R \geq N_C \geq 0.65$	$N_T \div N_C < 0.80$ and N_T/N_C vs N_R/N_C SD (p=.10) and		$N_T \div N_C < 0.80$ and N_T/N_C vs N_R/N_C SD (p=.10) and	
			$N_R/N_C - N_T/N_C > 0.15$	NOCN	$N_R/N_C - N_T/N_C > 0.30$	NOCN
Neanthes growth	$M_C \leq 10\%$ and $MIG_C > 0.38$	$M_R \leq 20\%$ and $MIG_R \div MIG_C \geq 0.80$	$MIG_T \div MIG_C < 0.80$ and MIG_T vs MIG_R SD (p=.05) and		$MIG_T \div MIG_C < 0.80$ and MIG_T vs MIG_R SD (p=.05) and	
			$MIG_T/MIG_R < 0.70$	NOCN	$MIG_T/MIG_R < 0.50$	$MIG_T/MIG_R < 0.70$

M = mortality, N = normal survivors, I = initial count, MIG = mean individual growth rate (mg/individual/day)
SD = statistically different, NOCN = no other conditions necessary, N/A = not applicable
Subscripts: R = reference sediment, C = negative control, T = test sediment

Bioassay Summary Tables

Appendix 5

Appendix 5.

Appendix 5a.

Table H-2. 10-Day acute amphipod (*Eohaustorius estuarius*) test results for the PSNS Phase II sediment characterization.

Project	Sample #	Batch	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure*
		596-18								
PSNS Phase II	control	1		0.0	Yes					
PSNS Phase II	DD4-PB-62	1	3.7	3.0		3.0	N	2.0		No-hit
PSNS Phase II	DD4-PB-63	1	11.6	13.0		13.0	N	12.0		No-hit
PSNS Phase II	DD6-PB-70	1	3.4	11.0		11.0	N	10.0		No-hit
PSNS Phase II	DD6-PB-71	1	9.9	4.0		4.0	N	3.0		No-hit
PSNS Phase II	DD6-PB-72	1	8.1	4.0		4.0	N	3.0		No-hit
PSNS Phase II	CR-22S	1	9.8	1.0	Yes	1.0	N			
PSNS Phase II	DD4-PB-64	1	62.9	16.0		16.0	N	14.0		No-hit
PSNS Phase II	DD4-PB-65	1	78.8	31.0		31.0	Y	29.0	Y	Two-hit
PSNS Phase II	CR-10	1	78.7	2.0	Yes	2.0	N			

Notes:

1. There were no apparent one-hit failures for this test (one-hit = test sediment mortality is greater than 20% over the control, greater than 30% over the corresponding reference sediment, and significantly different from the reference sediment).
2. A two-hit failure is one in which the test sediment mortality is greater than 20% over the control, less than or equal to 30% over the corresponding reference, but significantly different from the reference sediment mortality.
3. CR-10 and CR-22S are reference sediments.
4. Control and reference sediment performance criteria are listed in the toxicity test data quality summary report.

Appendix 5a

Table H-3. 10-Day acute amphipod (*Eohaustorius estuarius*) test results for the PSNS Phase II sediment characterization Acclimation Study.

Project	Sample #	Acclimation	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure
		596-20								
PSNS Phase II	control	Extreme		3.0	Yes					
PSNS Phase II	SS1	Extreme	88.5	29.0		26.0	Y	28.0	Y	Two-hit
PSNS Phase II	SS22	Extreme	88.3	22.0		19.0	N	21.0		No-hit
PSNS Phase II	SS23	Extreme	89.5	33.0		30.0	Y	**32.0**	Y	**One-hit**
PSNS Phase II	SS26	Extreme	91.7	33.0		30.0	Y	**32.0**	Y	**One-hit**
PSNS Phase II	SS48	Extreme	90.0	28.0		25.0	Y	27.0	Y	Two-hit
PSNS Phase II	SS56	Extreme	63.6	26.0		23.0	Y	25.0	Y	Two-hit
PSNS Phase II	SS62	Extreme	81.5	18.0		15.0	N	17.0		No-hit
PSNS Phase II	SS73	Extreme	79.3	26.0		23.0	Y	25.0	Y	Two-hit
PSNS Phase II	DD3	Extreme	78.8	29.0		26.0	Y	28.0	Y	Two-hit
PSNS Phase II	CR-10	Extreme	78.7	1.0	Yes	-2.0	N			
PSNS Phase II	SS71	Extreme	53.5	24.0		21.0	Y	19.0	Y	Two-hit
PSNS Phase II	CR-24	Extreme	43.7	5.0	Yes	2.0	N			

Notes:

1. Statistical analyses were conducted when the test sediment mortality was greater than 20% over the control mortality.
2. Bold values exceed 30% mortality in test sediments over the corresponding reference sediment (one-hit).
3. A two-hit failure is one in which the test sediment mortality is greater than 20% over the control, less than or equal to 30% over the corresponding reference, but significantly different from the reference sediment mortality.
4. CR-10 and CR-24 are reference sediments.
5. Control and reference sediment performance criteria are listed in the toxicity test data quality summary report.

Appendix 5a

Table H-3. 10-Day acute amphipod (*Eohaustorius estuarius*) test results for the PSNS Phase II sediment characterization Acclimation Study.

Project	Sample #	Acclimation	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure
		596-22								
PSNS Phase II	control	Moderate		0.0	Yes					
PSNS Phase II	SS1	Moderate	88.5	46.0		46.0	Y	**42.0**	Y	**One-hit**
PSNS Phase II	SS22	Moderate	88.3	34.0		34.0	Y	30.0	Y	Two-hit
PSNS Phase II	SS23	Moderate	89.5	36.0		36.0	Y	**32.0**	Y	**One-hit**
PSNS Phase II	SS26	Moderate	91.7	40.0		40.0	Y	**36.0**	Y	**One-hit**
PSNS Phase II	SS48	Moderate	90.0	23.0		23.0	Y	19.0	Y	Two-hit
PSNS Phase II	SS56	Moderate	63.6	30.0		30.0	Y	26.0	Y	Two-hit
PSNS Phase II	SS62	Moderate	81.5	33.0		33.0	Y	29.0	Y	Two-hit
PSNS Phase II	SS73	Moderate	79.3	27.0		27.0	Y	23.0	Y	Two-hit
PSNS Phase II	DD3	Moderate	78.8	44.0		44.0	Y	**40.0**	Y	**One-hit**
PSNS Phase II	CR-10	Moderate	78.7	4.0	Yes	4.0	N			
PSNS Phase II	SS71	Moderate	53.5	18.0		18.0	N	15.0		No-hit
PSNS Phase II	CR-24	Moderate	43.7	3.0	Yes	3.0	N			

Notes:

1. Statistical analyses were conducted when the test sediment mortality was greater than 20% over the control mortality.
2. Bold values exceed 30% mortality in test sediments over the corresponding reference sediment (one-hit).
3. A two-hit failure is one in which the test sediment mortality is greater than 20% over the control, less than or equal to 30% over the corresponding reference, but significantly different from the reference sediment mortality.
4. CR-10 and CR-24 are reference sediments.
5. Control and reference sediment performance criteria are listed in the toxicity test data quality summary report.

Appendix 5a

Table H-3. 10-Day acute amphipod (*Eohaustorius estuarius*) test results for the PSNS Phase II sediment characterization Acclimation Study.

Project	Sample #	Acclimation	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure
		596-23								
PSNS Phase II	Control	Gradual		1.0	Yes					
PSNS Phase II	SS1	Gradual	88.5	39.0		38.0	Y	**34.0**	Y	**One-hit**
PSNS Phase II	SS22	Gradual	88.3	31.0		30.0	Y	26.0	Y	Two-hit
PSNS Phase II	SS23	Gradual	89.5	40.0		39.0	Y	**35.0**	Y	**One-hit**
PSNS Phase II	SS26	Gradual	91.7	22.0		21.0	Y	17.0	Y	Two-hit
PSNS Phase II	SS48	Gradual	90.0	37.0		36.0	Y	**32.0**	Y	**One-hit**
PSNS Phase II	SS56	Gradual	63.6	26.0		25.0	Y	21.0	Y	Two-hit
PSNS Phase II	SS62	Gradual	81.5	37.0		36.0	Y	**32.0**	Y	**One-hit**
PSNS Phase II	SS73	Gradual	79.3	23.0		22.0	Y	18.0	Y	Two-hit
PSNS Phase II	DD3	Gradual	78.8	55.0		54.0	Y	**50.0**	Y	**One-hit**
PSNS Phase II	CR-10	Gradual	78.7	5.0	Yes	4.0	N			
PSNS Phase II	SS71	Gradual	53.5	35.0		34.0	Y	20.0	Y	Two-hit
PSNS Phase II	CR-24	Gradual	43.7	15.0	Yes	14.0	N			

Notes:

1. Statistical analyses were conducted when the test sediment mortality was greater than 20% over the control mortality.
2. Bold values exceed 30% mortality in test sediments over the corresponding reference sediment (one-hit).
3. A two-hit failure is one in which the test sediment mortality is greater than 20% over the control, less than or equal to 30% over the corresponding reference, but significantly different from the reference sediment mortality.
4. CR-10 and CR-24 are reference sediments.
5. Control and reference sediment performance criteria are listed in the toxicity test data quality summary report.

Appendix 5b.

Table H-1. 10-Day acute amphipod (*Ampelisca abdita*) test results for the PSNS Phase II sediment characterization.

Project	Sample #	Batch	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure
		596-13								
PSNS Phase II	control	1		0.0	Yes					
PSNS Phase II	SS2	1	88.5	2.0		2.0	N	-6.0		No-hit
PSNS Phase II	SS3	1	87.4	1.0		1.0	N	-7.0		No-hit
PSNS Phase II	SS4	1	90.2	6.0		6.0	N	-2.0		No-hit
PSNS Phase II	SS5	1	83.5	9.0		9.0	N	1.0		No-hit
PSNS Phase II	SS6	1	82.7	2.0		2.0	N	-6.0		No-hit
PSNS Phase II	SS7	1	85.5	3.0		3.0	N	-5.0		No-hit
PSNS Phase II	SS8	1	90.8	4.0		4.0	N	-4.0		No-hit
PSNS Phase II	SS9	1	83.3	4.0		4.0	N	-4.0		No-hit
PSNS Phase II	SS10	1	85.1	2.0		2.0	N	-6.0		No-hit
PSNS Phase II	SS11	1	84.1	4.0		4.0	N	-4.0		No-hit
PSNS Phase II	SS12	1	91.9	6.0		6.0	N	-2.0		No-hit
PSNS Phase II	SS13	1	89.9	5.0		5.0	N	-3.0		No-hit
PSNS Phase II	SS14	1	89.1	2.5		2.5	N	-5.5		No-hit
PSNS Phase II	SS15	1	89.7	2.0		2.0	N	-6.0		No-hit
PSNS Phase II	SS16	1	91.8	6.0		6.0	N	-2.0		No-hit
PSNS Phase II	SS17	1	90.0	5.0		5.0	N	-3.0		No-hit
PSNS Phase II	SS18	1	89.6	4.0		4.0	N	-4.0		No-hit
PSNS Phase II	CR-10	1	78.7	8.0	Yes	8.0	N			
PSNS Phase II	CR-24	1	43.7	2.0	Yes	2.0	N			

Notes:

1. Statistical analyses were not necessary because all test sediment mortality results were less than 20% over the control mortality.
2. There were no apparent failures for this batch of testing.
3. CR-10 and CR-24 are reference sediments.
4. Control and reference sediment performance criteria are listed in the toxicity test data quality summary report.

Appendix 5b

Table H-1. 10-Day acute amphipod (*Ampelisca abdita*) test results for the PSNS Phase II sediment characterization.

Project	Sample #	Batch	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure
		596-14								
PSNS Phase II	control	2		3.0	Yes					
PSNS Phase II	SS19	2	85.9	3.0		0.0	N	-1.0		No-hit
PSNS Phase II	SS20	2	90.5	2.0		-1.0	N	-2.0		No-hit
PSNS Phase II	SS21	2	81.8	2.0		-1.0	N	-2.0		No-hit
PSNS Phase II	SS25	2	89.5	3.0		0.0	N	-1.0		No-hit
PSNS Phase II	SS27	2	92.0	2.0		-1.0	N	-2.0		No-hit
PSNS Phase II	SS28	2	91.0	5.0		2.0	N	1.0		No-hit
PSNS Phase II	SS30	2	89.6	7.0		4.0	N	3.0		No-hit
PSNS Phase II	SS31	2	85.3	4.0		1.0	N	0.0		No-hit
PSNS Phase II	SS32	2	86.6	5.0		2.0	N	1.0		No-hit
PSNS Phase II	SS33	2	92.5	4.0		1.0	N	0.0		No-hit
PSNS Phase II	SS34	2	91.6	3.0		0.0	N	-1.0		No-hit
PSNS Phase II	SS35	2	91.5	7.0		4.0	N	3.0		No-hit
PSNS Phase II	SS37	2	90.8	9.0		6.0	N	5.0		No-hit
PSNS Phase II	SS38	2	90.6	9.0		6.0	N	5.0		No-hit
PSNS Phase II	SS39	2	90.2	3.0		0.0	N	-1.0		No-hit
PSNS Phase II	SS40	2	75.7	1.0		-2.0	N	-3.0		No-hit
PSNS Phase II	SS41	2	85.4	4.0		1.0	N	0.0		No-hit
PSNS Phase II	CR-10	2	78.7	4.0	Yes	1.0	N			
PSNS Phase II	CR-24	2	43.7	7.0	Yes	4.0	N			

Notes:

1. Statistical analyses were not necessary because all test sediment mortality results were less than 20% over the control mortality.
2. There were no apparent failures for this batch of testing.
3. CR-10 and CR-24 are reference sediments.
4. Control and reference sediment performance criteria are listed in the toxicity test data quality summary report.

Appendix 5b.

Table H-1. 10-Day acute amphipod (*Ampelisca abdita*) test results for the PSNS Phase II sediment characterization.

Project	Sample #	Batch	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure
		596-17								
PSNS Phase II	Control	3		1.0	Yes					
PSNS Phase II	SS42	3	88.9	11.0		10.0	N	7.0		No-hit
PSNS Phase II	SS43	3	90.3	8.0		7.0	N	4.0		No-hit
PSNS Phase II	SS44	3	92.0	18.0		17.0	N	14.0		No-hit
PSNS Phase II	SS45	3	90.2	4.0		3.0	N	0.0		No-hit
PSNS Phase II	SS46	3	91.3	7.0		6.0	N	3.0		No-hit
PSNS Phase II	SS47	3	90.5	9.0		8.0	N	5.0		No-hit
PSNS Phase II	SS49	3	91.0	12.0		11.0	N	8.0		No-hit
PSNS Phase II	SS54	3	73.3	4.0		3.0	N	0.0		No-hit
PSNS Phase II	SS55	3	79.8	8.0		7.0	N	4.0		No-hit
PSNS Phase II	SS58	3	84.1	9.0		8.0	N	5.0		No-hit
PSNS Phase II	SS61	3	79.5	5.0		4.0	N	1.0		No-hit
PSNS Phase II	SS63	3	84.4	9.0		8.0	N	5.0		No-hit
PSNS Phase II	SS64	3	83.1	4.0		3.0	N	0.0		No-hit
PSNS Phase II	SS66	3	86.8	12.0		11.0	N	8.0		No-hit
PSNS Phase II	SS70	3	82.3	4.0		3.0	N	0.0		No-hit
PSNS Phase II	SS80	3	77.0	11.0		10.0	N	7.0		No-hit
PSNS Phase II	CR-10	3	78.7	4.0	Yes	3.0	N			
PSNS Phase II	SS68	3	47.7	5.0		4.0	N	-1.0		No-hit
PSNS Phase II	SS69	3	50.5	7.0		6.0	N	1.0		No-hit
PSNS Phase II	CR-24	3	43.7	6.0	Yes	5.0	N			

Notes:

1. Statistical analyses were not necessary because all test sediment mortality results were less than 20% over the control mortality.
2. There were no apparent failures for this batch of testing.
3. CR-10 and CR-24 are reference sediments.
4. Control and reference sediment performance criteria are listed in the toxicity test data quality summary report.

Appendix 5b

Table H-1. 10-Day acute amphipod (*Ampelisca abdita*) test results for the PSNS Phase II sediment characterization.

Project	Sample #	Batch	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure
		596-19								
PSNS Phase II	control	4		1.0	Yes					
PSNS Phase II	DD4-PB-62	4	3.7	3.0		2.0	N	3.0		No-hit
PSNS Phase II	DD4-PB-63	4	11.6	7.0		6.0	N	7.0		No-hit
PSNS Phase II	DD6-PB-70	4	3.4	7.0		6.0	N	7.0		No-hit
PSNS Phase II	DD6-PB-71	4	9.9	6.0		5.0	N	6.0		No-hit
PSNS Phase II	DD6-PB-72	4	8.1	4.0		3.0	N	4.0		No-hit
PSNS Phase II	CR-22S	4	9.8	0.0	Yes	-1.0	N			
PSNS Phase II	DD4-PB-64	4	62.9	3.0		2.0	N	-1.0		No-hit
PSNS Phase II	DD4-PB-65	4	78.8	1.0		0.0	N	-3.0		No-hit
PSNS Phase II	SS101	4	89.1	2.0		1.0	N	-2.0		No-hit
PSNS Phase II	SS102	4	86.6	9.0		8.0	N	5.0		No-hit
PSNS Phase II	SS103	4	83.8	1.0		0.0	N	-3.0		No-hit
PSNS Phase II	CR-10	4	78.7	4.0	Yes	3.0	N			

Notes:

1. Statistical analyses were not necessary because all test sediment mortality results were less than 20% over the control mortality.
2. There were no apparent failures for this batch of testing.
3. CR-10 and CR-22S are reference sediments.
4. Control and reference sediment performance criteria are listed in the toxicity test data quality summary report.

Appendix 5b.

Table H-1. 10-Day acute amphipod (*Ampelisca abdita*) test results for the PSNS Phase II sediment characterization.

Project	Sample #	Batch	% Fines	Mortality (%)	Control or Reference Met Performance Criteria	Percent of Test/Ref Mortality over Control Mortality	Test Mortality >20% over Control Mortality	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Apparent Failure
		596-21								
PSNS Phase II	Control	5		9.0	Yes*					
PSNS Phase II	SS1	5	88.5	5.0		-4.0	N	-4.0		No-hit
PSNS Phase II	SS22	5	88.3	5.0		-4.0	N	-4.0		No-hit
PSNS Phase II	SS23	5	89.5	6.0		-3.0	N	-3.0		No-hit
PSNS Phase II	SS26	5	91.7	5.0		-4.0	N	-4.0		No-hit
PSNS Phase II	SS48	5	90.0	6.0		-3.0	N	-3.0		No-hit
PSNS Phase II	SS56	5	63.6	6.0		-3.0	N	-3.0		No-hit
PSNS Phase II	SS62	5	81.5	4.0		-5.0	N	-5.0		No-hit
PSNS Phase II	SS73	5	79.3	4.0		-5.0	N	-5.0		No-hit
PSNS Phase II	DD3	5	78.8	4.0		-5.0	N	-5.0		No-hit
PSNS Phase II	CR10	5	78.7	9.0	Yes	0.0	N			
PSNS Phase II	SS71	5	53.5	3.0		-6.0	N	-8.0		No-hit
PSNS Phase II	CR24	5	43.7	11.0	Yes	2.0	N			

Notes:

1. Statistical analyses were not necessary because all test sediment mortality results were less than 20% over the control mortality.
2. There were no apparent failures for this batch of testing.
3. The average mortality for the control in Batch 5 met the performance criteria of less than or equal to 10% mortality. However, one replicate did not meet the performance criteria of less than or equal to 20% mortality for individual replicates. The mortality observed for the third replicate was 25%. Because the mortalities observed in the test sediments were all very low (<10% mortality), this was not considered a problem.
4. CR-10 and CR-24 are reference sediments.
5. Control and reference sediment performance criteria are listed in the toxicity test data quality summary report.

Appendix 5C.

Table H-4. Sediment larval (*Mytilus galloprovincialis*) test results for the PSNS Phase II sediment characterization.

Project	Sample #	Batch	% Fines	CMA (%)	Percent over Control [NCMA (%)]	Control or Reference Met Performance Criteria	Test NCMA >20%	Test Sediment NCMA minus Reference NCMA (%)	Sign. Diff. from Reference	Apparent Failure
			596-16							
PSNS Phase II	Control	1		20.4		Yes				
PSNS Phase II	DD4-PB-62	1	3.7		24.5		Y	3.5	N	No-hit
PSNS Phase II	DD4-PB-63	1	11.6		26.3		Y	5.3	N	No-hit
PSNS Phase II	DD6-PB-70	1	3.4		25.8		Y	4.8	N	No-hit
PSNS Phase II	DD6-PB-71	1	9.9		38.6		Y	17.6	Y	Two-hit
PSNS Phase II	DD6-PB-72	1	8.1		31.0		Y	10.0	Y	Two-hit
PSNS Phase II	CR-22S	1	9.8		21.0	Yes	Y			
PSNS Phase II	DD4-PB-64	1	62.9		27.5		Y	13.2	Y	Two-hit
PSNS Phase II	DD4-PB-65	1	78.8		33.3		Y	19.0	Y	Two-hit
PSNS Phase II	SS101	1	89.1		29.1		Y	14.8	Y	Two-hit
PSNS Phase II	SS102	1	86.6		27.2		Y	12.9	Y	Two-hit
PSNS Phase II	SS103	1	83.8		23.8		Y	9.5	Y	Two-hit
PSNS Phase II	CR-10	1	78.7		14.3	Yes	N			

Notes:

1. CMA: Combined mortality and abnormality.
2. NCMA: Normalized combined mortality/abnormality (normalized to the control). Note the column headed percent over the control is the same as NCMA.
3. Statistical analyses for differences between test and reference sediment NCMAs were conducted when the test sediment NCMA was greater than or equal to 20%.
4. Control and reference sediment performance criteria are listed in the toxicity test data quality summary report.
5. CR-22S and CR-10 are reference sediments.
6. There were no one-hit failures in which the test sediment had >30% normalized combined mortality/abnormality over the reference sediment.

Appendix 5d.

Table H-5. 20-Day *Neanthes* test results for the PSNS Phase II sediment characterization.

Project	Sample #	Batch	% Fines	Mortality %	Growth Rate (indiv/mg/day)	Control or Reference Met Performance Criteria	Percent of Test or Reference Growth Rate (GR) of Control GR	Test Growth Rate <80% or >120% over Control Growth Rate	Percent of Test Growth Rate of Reference Growth Rate	Sign. Diff. from Reference	Apparent Failure
		596-15									
PSNS Phase II	Control	1		0.0	0.92	Yes					
PSNS Phase II	DD4-PB-62	1	3.7	4.0	0.86		93.5	N	96.6		No-hit
PSNS Phase II	DD4-PB-63	1	11.6	0.0	0.86		93.5	N	96.6		No-hit
PSNS Phase II	DD6-PB-70	1	3.4	4.0	1.08		117.4	N	121.3		No-hit
PSNS Phase II	DD6-PB-71	1	9.9	0.0	0.95		103.3	N	106.7		No-hit
PSNS Phase II	DD6-PB-72	1	8.1	0.0	0.93		101.1	N	104.5		No-hit
PSNS Phase II	CR-22S	1	9.8	0.0	0.89	Yes	96.7	N			
PSNS Phase II	DD4-PB-64	1	62.9	0.0	0.66		71.7	Y	86.8		No-hit
PSNS Phase II	DD4-PB-65	1	78.8	0.0	0.55		59.8	Y	72.4		No-hit
PSNS Phase II	SS101	1	89.1	0.0	0.82		89.1	N	107.9		No-hit
PSNS Phase II	SS102	1	86.6	0.0	0.64		69.6	Y	84.2		No-hit
PSNS Phase II	SS103	1	83.8	0.0	0.73		79.3	Y	96.1		No-hit
PSNS Phase II	CR-10	1	78.7	0.0	0.76	Yes	82.6	N			

Notes:

1. There were no apparent one-hit (test sediment < 50% of reference) or two-hit (test sediment <70% of reference) failures for this batch of samples.
2. CR-22S and CR-10 are reference sediments.
3. Statistical analyses for differences between test and reference sediment growth rates are conducted when the test sediment growth rate is less than 70% of the reference sediment growth rate. All test sediment results were greater than 70% of the reference. Therefore, statistical analyses were not required for this batch of testing.
4. Control and reference sediment performance criteria are listed in the toxicity test data quality summary report.

Appendix 5e.

~~Table 3.~~ Summary of the reference sediment, negative control, and positive control results for the PSNS Phase II *Eohaustorius* bioassay.

Batch	Reference (% Mortality)			Positive Control (EC50) Cadmium Chloride	Positive Control (EC50) Ammonia	Negative Control % Mortality
	CR-22S	CR-24	CR-10			
1 596-18	1.0	NT	2.0	3.12 mg/L Cd LCL = 0.00 to 7.36 mg/L	NT	0.0
Extreme 596-20	NT	5.0	1.0	2.33 mg/L Cd LCL = 0.00 to 7.63 mg/L	159 mg/L NH_3-N	3.0
Moderate 596-22	NT	3.0	4.0	2.11 mg/L Cd LCL = 0.19 to 6.50 mg/L	134 mg/L NH_3-N	0.0
Gradual 596-23	NT	15.0	5.0	2.83 mg/L Cd LCL = 0.28 to 6.47 mg/L	178 mg/L NH_3-N	1.0
Performance Criteria	Reference Mortality minus Control Mortality ≤ 20%			EC50 within Laboratory Control Limits (LCL)	EC50 within Laboratory Control Limits (LCL)*	Mortality ≤ 10%

* Laboratory control limits for the ammonia reference toxicant test have not yet been established.

NT = Not tested in a given batch
Cd = Cadmium
NH_3-N = Total ammonia-N

Appendix 5e

~~Table 1.~~ Summary of the reference sediment, negative control, and positive control results for the PSNS Phase II *Ampelisca* amphipod bioassay.

Batch	Reference (% Mortality)			Positive Control (EC50) Cadmium Chloride	Positive Control (EC50) Sodium Dodecyl Sulfate	Negative Control % Mortality
	CR-22S	CR-24	CR-10			
1 596-13	NT	2.0	8.0	0.59 mg/L Cd LCL = 0.08 to 0.94 mg/L	8.42 mg/L SDS LCL = 3.85 to 24.5 mg/L	0.0
2 596-14	NT	7.0	4.0	0.70 mg/L Cd LCL = 0.09 to 0.91 mg/L	8.75 mg/L SDS LCL = 3.07 to 23.8 mg/L	3.0
3 596-17	NT	6.0	4.0	0.74 mg/L Cd LCL = 0.10 to 0.93 mg/L	9.07 mg/L SDS LCL = 2.72 to 23.1 mg/L	1.0
4 596-19	0.0	NT	4.0	0.53 mg/L Cd LCL = 0.12 to 0.97 mg/L	11.8 mg/L SDS LCL = 2.13 to 22.0 mg/L	1.0
5 596-21	NT	11.0	9.0	0.73 mg/L Cd LCL = 0.10 to 0.95 mg/L	7.28 mg/L SDS LCL = 2.62 to 22.5 mg/L	9.0*
Performance Criteria	Reference Mortality minus Control Mortality ≤ 20%			EC50 within Laboratory Control Limits (LCL)	EC50 within Laboratory Control Limits (LCL)	Mortality ≤ 10%

* One Batch 5 control replicate mortality result did not meet the performance criteria of ≤ 20% mortality for individual replicates (Replicate 3 = 25% mortality). Because the test sediment mortality results were all very low (<10% mortality), this was not considered to have adversely affected the test results.

NT = Not tested in a given batch SDS = Sodium dodecyl sulfate Cd = Cadmium

Appendix 5e

~~Table 5~~. Summary of the reference sediment, negative control, and positive control results for the PSNS Phase II bivalve bioassay.

Batch	Reference NCMA (%)			Positive Control Copper Sulfate	Positive Control Ammonia	Negative Control CMA (%)
	CR-22S	CR-24	CR-10			
1 596-16	21.0	NT	14.3	9.63 µg/L Cu LCL = 8.15 to 12.7 µg/L	7.97 mg/L NH_3-N LCL = 5.03 to 12.3 mg/L	20.4
Performance Criteria	NCMA ≤ 35% Seawater Control			EC50 within Laboratory Control Limits (LCL)	EC50 within Laboratory Control Limits (LCL)	CMA ≤ 30%

NCMA = normalized combined mortality/abnormality (normalized to the seawater control)
CMA = combined mortality and abnormality
NT = Not tested

Appendix 5e

~~Table 7~~. Summary of the reference sediment, negative control, and positive control results for the PSNS Phase II *Neanthes* bioassay.

Batch	Reference Sediment Growth Rate (mg/indiv/day)			Positive Control Cadmium Chloride	Negative Control Mortality (%)	Negative Control Growth Rate (mg/indiv/day)
	CR-22S	CR-24	CR-10			
1 596-15	0.89	NT	0.76	7.55 mg/L Cd LCL = 4.26 to 11.1 mg/L	0.0	0.92
Performance Criteria	Mean Individual Growth Rate ≥ 80% of Control			EC50 within Laboratory Control Limits (LCL)	Mortality ≤ 10%	Target growth rate is ≥ 0.72 mg/indiv/day QC failure if growth rate is ≤ 0.38 mg/indiv/day

NT = Not tested

Appendix 6. Worst Case Bioaccumulation Interpretation Summary (adjusted values)

			DMMU S51									
			Macoma nasuta					Nephtys caecoides				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Carr Inlet Reference	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
Mercury (Hg)	mg/kg-ww	1	0.51	0.51	0.12	yes	yes	0.015	0.015	0.038	no	yes
Silver (Ag)	mg/kg-ww	200	0.58	0.95	0.21	yes	yes	0.055	0.089	0.055	no	yes
Pentachlorophenol (PCP)	ug/kg-ww	900	57.0	69.3	51.6	no	yes	41.3	50.2	40.1	no	yes
Total DDT*	ug/kg-ww	3,000	48.7	2,429	4.0	yes	yes	58.7	2,927	0.54	yes	yes

* Bioaccumulation exposures for DDT rejected because of the large discrepancy in the initial to retested sediment concentrations, which were 1/50 of the initial sediment concentrations. The data for DDT are therefore not deemed usable for regulatory decisionmaking based on BPJ.

CHEMICAL NAME	Units	Sediment Initial	Sediment Retest	Initial/Retest ratio:
Mercury (Hg)	mg/kg-dw	1.75	2.95	0.59
Silver (Ag)	mg/kg-dw	6.5	4	1.63
Pentachlorophenol (PCP)	ug/kg-dw	620	510	1.22
Total DDT	ug/kg-dw	748	15	49.9