DREDGED MATERIAL MANAGEMENT PROGRAM BIENNIAL REPORT

Dredging Years 2000/2001

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PREPARED BY THE DMMP AGENCIES

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EPA
Region 10

DREDGED MATERIAL MANAGEMENT PROGRAM BIENNIAL REPORT

Dredging Years 2000/2001

Puget Sound
Dredged Disposal Analysis

Grays Harbor/Willapa Bay Evaluation Procedures

Lower Columbia River Evaluation Framework (Washington)

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AET	Apparent Effects Threshold
BT	Bioaccumulation Trigger
COC	Chemical of Concern
CWA	Clean Water Act
CY	Cubic Yard
DAIS	Dredged Analysis Information System
DL	Detection Limit
DMMO	Dredged Material Management Office
DMMU	Dredged Material Management Unit
DNR	Washington Department of Natural Resources
DY	Dredging Year
EPA	Environmental Protection Agency
EPTA	Evaluation Procedures Technical Appendix
FC	Full Characterization
GIS	Geographic Information System
HPA	Hydraulic Project Approval
HPAH	High-molecular-weight PAH
LPAH	Low-molecular-weight PAH
ML	Maximum Level
MPR	Management Plan Report
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
PAH	Polynuclear Aromatic Hydrocarbon
PC	Partial Characterization
PCBs	Polychlorinated Biphenyls
PPB	Parts Per Billion
PPM	Parts Per Million
PSDDA	Puget Sound Dredged Disposal Analysis
PSEP	Puget Sound Estuary Program
PSNS	Puget Sound Naval Shipyard
QA/QC	Quality Assurance/Quality Control
SAP	Sampling and Analysis Plan
SDM	Suitability Determination
SMARM	Sediment Management Annual Review Meeting
SMS	Sediment Management Standards
SL	Screening Level
TOC	Total Organic Carbon
USACE	US Army Corps of Engineers
UCOWD	Unconfined Open Water Disposal
WDFW	Washington Department of Fish and Wildlife

CHAPTER 1

DREDGED MATERIAL MANAGEMENT PROGRAM (DMMP) EVALUATION ACTIVITIES for Dredging Years 2000 - 2001

A. INTRODUCTION

The Dredged Material Management Program (DMMP) represents an interagency approach to the management of dredged material in the State of Washington. Three separate, but closely related, dredged material programs exist under the DMMP: the Puget Sound Dredged Disposal Analysis (PSDDA), Grays Harbor and Willapa Bay, and the Lower Columbia River programs. The four cooperating agencies ("agencies") are: U.S. Army Corps of Engineers, Seattle District (Corps); U.S. Environmental Protection Agency, Region 10 (EPA); Washington Department of Ecology (Ecology); and Washington Department of Natural Resources (DNR). This chapter summarizes Dredged Material Management Program (DMMP) activities for Dredging Years 2000 and 2001.

The DMMP applies dredging evaluation guidelines to federal and permitted projects in Washington State, including Lake Washington, Puget Sound, Grays Harbor and Willapa Bay, and the Lower Columbia River. A dredging year includes all projects evaluated between June 16 of a given year and June 15 of the following year (DY00 = June 16, 1999 - June 15, 2000; DY01 = June 16, 2000 - June 15, 2001). Tables related to project-specific ranking, sampling, testing, and suitability determinations are presented in the first part of this chapter. The second half of the chapter presents an overall assessment of sampling and testing activities and data. Where projects involved unusual circumstances or the application of best professional judgment by the agencies, more detailed descriptions are provided in **Appendix A**.

During DY00/01 there were 28 projects that completed the DMMP process (**Tables 1-1a** and **1-1b**). Most projects were full characterizations (FC) of a project area intended to assess suitability of the proposed dredged material for open water disposal. The typical completion action by the DMMP is a suitability determination memorandum (SDM) that summarizes the results of the FC and provides an official determination on suitability for open water disposal. Other DMMP actions include volume revisions (when the project volume changes subsequent to characterization), frequency or recency

Table 1-1a. DY00 DMMP Evaluation Activities. These include all projects that concluded with an action by the DMMP between 6/15/99-6/14/00**.**

PROJECT	DMMP Action	Disposal Jurisdiction	Project Volume (cy)	Ranking Determination DY	SAP Review DY	Suitability Determination DY
James Hardie Gypsum	FC	PSDDA	10,000	1998[1]	1999/2000[2]	2000
Seattle, Port of, East Waterway Project, Stage II	FC	PSDDA	584,990	1998[1]	1999	2000
Seattle, Port of, Pier 66	FC	PSDDA	1,700	1998[1]	1999	2000
Tacoma, Port of, Blair Waterway Deepening	VR	PSDDA	+110,000	na	na	2000
Tacoma, Port of, Sitcum Waterway	FC	PSDDA	288,000	1998[1]	2000	2000
Tacoma, Port of, St. Paul Waterway CDF	FC	PSDDA	455,000	1999	1999	2000
USACE, Bay Center Entrance Channel, Willapa Bay	ED	GH/WB	165,000	1995[3]	na	2000
USACE, Duwamish O&M	FC	PSDDA	76,000	1998[1]	2000	2000
USACE, Olympia Harbor O&M	FC	PSDDA	635,000	1999	1999	2000
US Coast Guard Slip 36	FC	PSDDA	33,130	1998[1]	1999	2000
US Navy PSN Shipyard (Phases 1 & 2)	FC	PSDDA	368,050	1998[1]	1999/2000[2]	2000
US Navy PSNS Pit-CAD Characterization	FC	PSDDA	900,000	2000	2000	2000
Weyerhaeuser Bay City Dock	FC	PSDDA	12,000	1995[3]	1999	2000

DMMP Actions

FC = Full Characterization
PC = Partial Characterization
VR = Volume Revision
FD = Frequency Determination
ED = Exclusion Determination
RD = Recency Determination

Disposal Jurisdictions

CR = Columbia River
GH/WB = Grays Harbor/Willapa Bay
PSDDA = Puget Sound Dredged Disposal Analysis
NCD = Nearshore confined disposal

[1] Ranking source: PSDDA Users Manual, 1st edition, 1998
[2] Two SAPs were prepared for two different rounds of sampling
[3] Ranking source: Dredged material evaluation procedures and disposal site management, Grays Harbor and Willapa Bay, June 1995

Table 1-1b. DY01 DMMP Evaluation Activities. These include all projects that concluded with an action by the DMMP between 6/15/00-6/14/01**.**

PROJECT	DMMP Action	Disposal Jurisdiction	Project Volume (cy)	Ranking Determination DY	SAP Review DY	Suitability Determination DY
Anacortes, Port of, Cap Sante Marina	FC	PSDDA	345,000	1998[1]	1999	2001
Anacortes, Port of, Dakota Creek	FC	PSDDA	246,000	1998[1]	1999	2001
Anacortes, Port of, Pier 1	FC	PSDDA	32,000	1998[1]	1999	2001
Hylebos (Mouth, Murray Pacific) and Blair Slip One	FC	PSDDA	500,000	2000	2000	2001
Hylebos Wood Debris Group - Manke/Louisiana Pacific	FC	PSDDA	109,800	2000[4]	2000	2001
Hylebos Wood Debris Group - Weyerhaeuser	FC	PSDDA	39,900	2000[4]	2000	2001
Everett, Port of, Marina & 10th St. Boat Launch, Jetty Island Dock	FC	PSDDA	49,340	2000[4]	2000	2001
Everett, Port of, 12 Street Marina	FC	PSDDA	294,470	2001	2001	2001
Padden Creek - Bellingham DY 2001	FC	PSDDA	6,800	2000[4]	2000	2001
Skagit, Port of, LaConner Marina	FC	PSDDA	82,000	2000[4]	2001	2001
Tacoma Narrows Bridge Foundation Dredging	FC	PSDDA	110,000	2000[4]	2001	2001
USACE, Bay Center Marina/Inner Channel	FC	GH/WB	38,000	1995[3]	2001	2001
USACE, Everett Harbor & Snohomish River O&M	FD/ED	PSDDA	330,437	na	na	2001
USACE, Grays Harbor O&M	FC	GH/WB	1,860,000	1995[3]	2001	2001
USACE, Squalicum Waterway O&M, Bellingham Bay	FC	PSDDA	172,000	2000	2000	2001

[4] Ranking Source: DMMP PSDDA Users Manual, 2nd edition, February 2000

determinations, and other project-specific actions that document a DMMP decision on open-water disposal.

Of the projects listed in **Tables 1-1a** and **1-1b**, 13 had DMMP actions completed by June 15, 2000 and are considered DY00 projects. Fifteen projects had DMMP actions completed by June 15, 2001 and are considered DY01 projects. Puget Sound project locations for DY00 and DY01 are shown in **Figure 1-1a**. Projects located in Grays Harbor and Willapa Bay are shown in **Figure 1-1b**. During this biennium there were no projects from the lower Columbia River.

Several characterizations during the DY00/01 biennium were for large, complex projects that proceeded through more than one round of sampling and/or testing and that span more than one dredging year. Those are discussed more fully in **Appendix A**. Any project that has resulted in an SDM or other completion action since June 15, 2001 is considered a DY 2002 project and is not considered in this report.

B. DY00/01 PROJECTS

Ranking

Each jurisdiction under the DMMP has specific guidance that explains requirements for evaluating dredged material for open-water disposal. Sampling and analysis requirements under the PSDDA program are fully explained in the 1988 Phase I Evaluation Procedures Technical Appendix (EPTA) and the 2000 PSDDA Users Manual. Sampling and analysis requirements in Grays Harbor and Willapa Bay are explained in the Dredged Material Evaluation Procedures and Disposal Site Management Manual, Grays Harbor and Willapa Bay, Washington (GHDMEP). Sampling and analysis requirements for projects occurring within the Columbia River are found in the November 1998 Dredged Material Evaluation Framework – Lower Columbia River Management Area.[5] The PSDDA Users Manual and Columbia River DMEF can be accessed via the internet from the Corp's Dredged Material Management Office home page, at <http://www.nws.usace.army.mil/dmmo/homepage.htm>. A revised and updated version of the Grays Harbor Willapa Bay Users Manual is expected to be added to the same web site during 2002.

Under the jurisdictional specific guidelines summarized above, the initial appraisal of a proposed dredging project requires a careful examination of all

[5] Henceforth referred to as the Columbia River Dredged Material Evaluation Framework (DMEF)

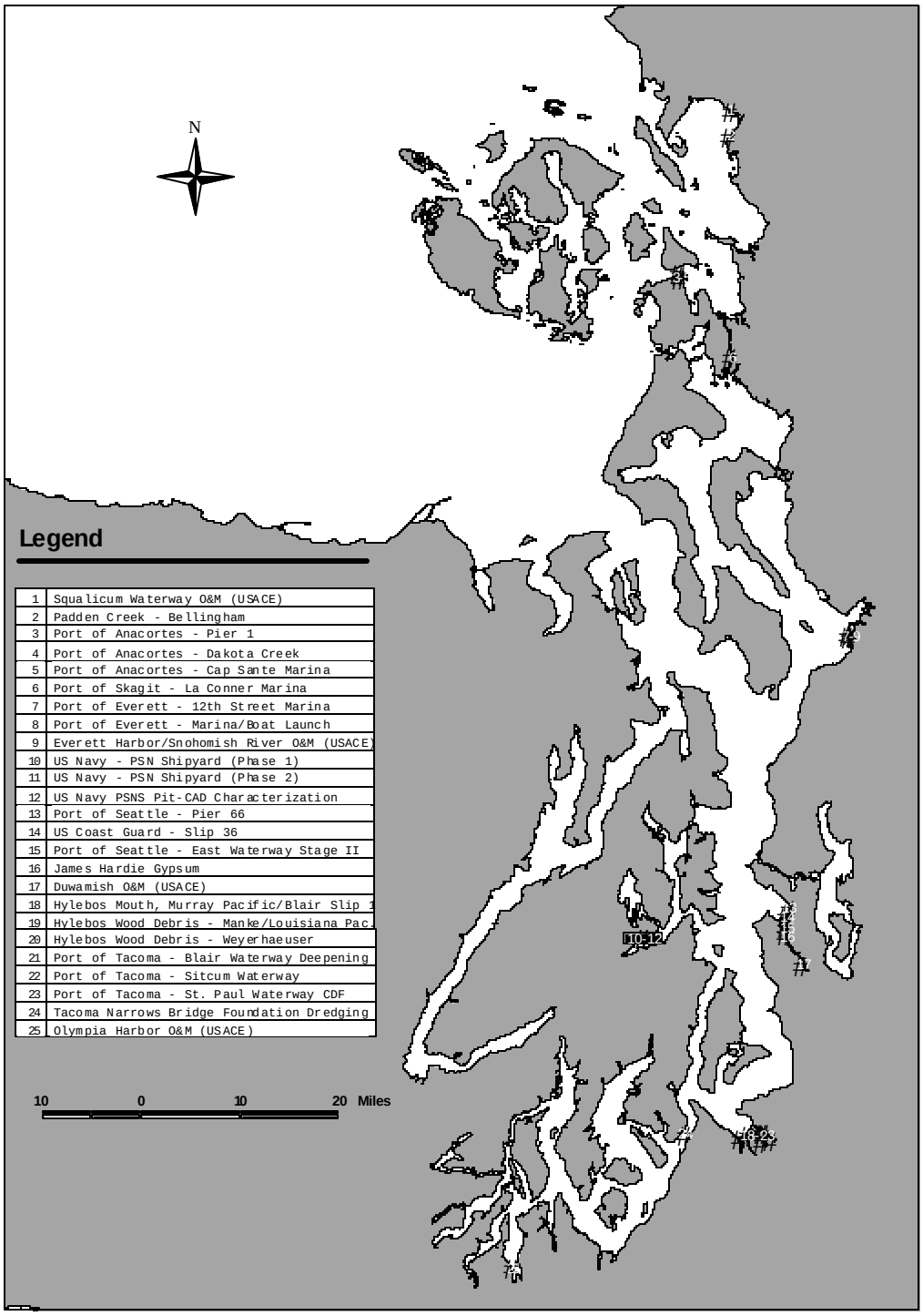


Figure 1-1a Dredging Year 2000/2001 DMMP Project Locations

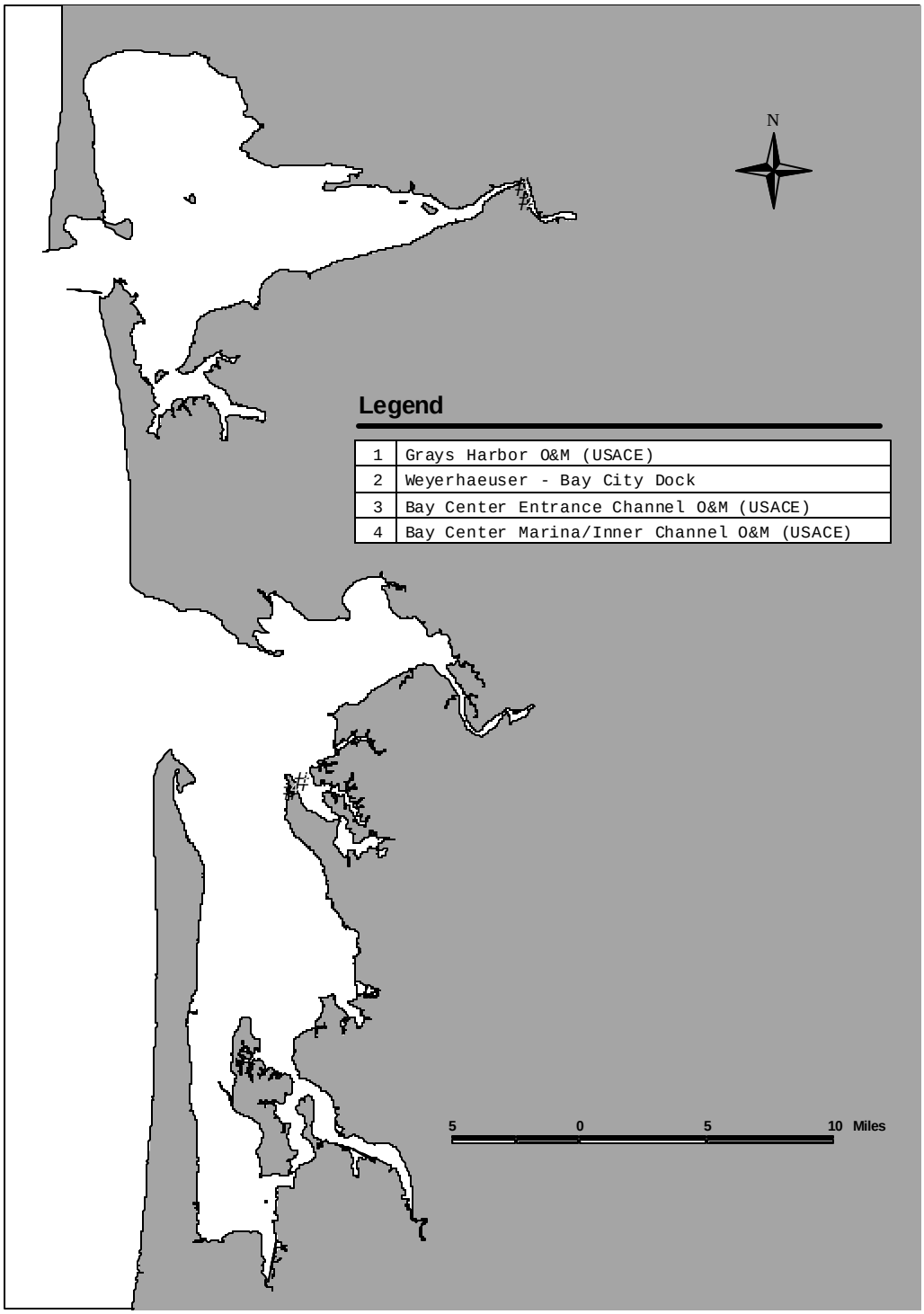


Figure 1-1b Dredging Year 2000/2001 DMMP Project Locations

existing sediment quality data within the dredging area. An initial area ranking is based on a "reason to believe" that chemicals of concern may or may not be present in the project area. The agencies have established ranks for general areas within each jurisdiction (e.g., Elliott Bay/PSDDA) and activities (e.g., marinas) based on historical data or awareness of active sources of contamination. In the absence of project-specific data, representatives of the agencies apply an initial ranking based on guidance contained in the jurisdictional specific documents (PSDDA Users Manual, Chapter 3; Grays Harbor/Willapa Bay Users Manual, Chapter 7; Columbia River DMEF, Chapter 5).

All three jurisdictional areas allow for a reconsideration of the initial ranking if the historical data at the site are adequate, or if the applicant conducts a partial characterization (PC) as described within each Users Manual to survey sediments in the project area for specific chemicals of concern. If the PC chemistry data support a lower ranking, sampling and analysis requirements for surface and subsurface sediments may be reduced during the full characterization (FC), commensurate with the revised ranking requirements. Chemicals of concern may also be eliminated for analysis during the FC, based on the PC data. **Tables 1-2a** and **1-2b** contain the initial and full characterization rankings of all DY00/01 projects. The "initial rank" was taken from the respective jurisdictional guidance rankings that were in effect at the time of project initiation. The "full characterization" rank was the rank actually used in the full characterization of project sediments.

Two out of eleven DY00 full characterizations (Port of Tacoma St. Paul Waterway CDF and US Navy PSNS Pit CAD) and two out of fourteen DY01 FCs (Hylebos Mouth/Murray Pacific, and Port of Everett 12th St. Marina) had rankings adjusted based on presentation of additional data. In all cases the rankings were adjusted downward. The two DY00 downranked projects were both for confined disposal facilities where dredging took place only to provide capacity for disposal of contaminated sediments. Both these projects included significant amounts of subsurface material and were sited in areas where contamination concerns were lower than in surrounding areas. Both the DY00 projects presented sufficient data from previous characterizations to support a downrank as outlined in the PSDDA Users Manual (2000). It should be noted that the DMMP does not track projects that have had downranking requests denied, based on insufficient "reason to believe" or inadequate data supporting the request.

Table 1-2a. DY00 Project Rankings.

PROJECT	Disposal Jurisdiction	Location	Waterbody	Initial Rank	Final Rank
James Hardie Gypsum	PSDDA	Seattle	Duwamish River	H	H
Seattle, Port of, East Waterway Project, Stage II	PSDDA	Seattle	East Waterway	H	H
Seattle, Port of, Pier 66	PSDDA	Seattle	Elliott Bay	H	H
Tacoma, Port of, Blair Waterway Deepening	PSDDA	Tacoma	Blair Waterway	L	L
Tacoma, Port of, Sitcum Waterway	PSDDA	Tacoma	Sitcum Waterway	L	L
Tacoma, Port of, St. Paul Waterway CDF	PSDDA	Tacoma	St. Paul Waterway	H	LM
US Coast Guard Slip 36	PSDDA	Seattle	East Waterway	H	H
US Navy PSN Shipyard (Phases 1 & 2)	PSDDA	Bremerton	Sinclair Inlet	H	H
US Navy PSNS Pit-CAD Characterization	PSDDA	Bremerton	Sinclair Inlet	H	H/LM
USACE, Bay Center Entrance Channel, Willapa Bay	GH/WB	Bay Center	Willapa Bay	L	L
USACE, Duwamish O&M	PSDDA	Seattle	Duwamish River	H	H
USACE, Olympia Harbor O&M	PSDDA	Olympia	Budd Inlet	L	L
Weyerhaeuser Bay City Dock	GH/WB	Cosmopolis	Chehalis River	LM	LM

L = Low
LM = Low/Moderate
M = Moderate
H = High
E = Meets Exclusionary guidelines

Table 1-2b. DY01 Project Rankings.

PROJECT	Disposal Jurisdiction	Location	Waterbody	Initial Rank	Final Rank
Anacortes, Port of, Cap Sante Marina	PSDDA	Anacortes	Guemes Channel	M	M
Anacortes, Port of, Dakota Creek	PSDDA	Anacortes	Guemes Channel	M	M
Anacortes, Port of, Pier 1	PSDDA	Anacortes	Guemes Channel	M	M
Everett, Port of, 12 Street Marina	PSDDA	Everett	Port Gardner Bay	M	LM
Everett, Port of, Marina & 10th St. Boat Launch, JI Dock	PSDDA	Everett	Port Gardner Bay	M	M
Hylebos (Mouth, Murray Pacific)/Blair Slip One	PSDDA	Tacoma	Hylebos Waterway	H/L	H/LM/ L
Hylebos Wood Debris Group - Manke/Louisiana Pacific	PSDDA	Tacoma	Hylebos Waterway	H	H
Hylebos Wood Debris Group - Weyerhaeuser	PSDDA	Tacoma	Hylebos Waterway	H	H
Padden Creek - Bellingham DY 2001	PSDDA	Bellingham	Padden Creek	H	H
Skagit, Port of, LaConner Marina	PSDDA	LaConner	Swinomish Channel	M	M
Tacoma Narrows Bridge Foundation Dredging	PSDDA	Tacoma	Tacoma Narrows	LM	LM
USACE, Bay Center Marina/Inner Channel	GH/WB	Bay Center	Willapa Bay	L	L
USACE, Everett Harbor & Snohomish River O&M	PSDDA	Everett	Snohomish River	LM	LM
USACE, Grays Harbor O&M	GH/WB	Grays Harbor	Grays Harbor	L	L
USACE, Squalicum Waterway O&M, Bellingham Bay	PSDDA	Bellingham	Squalicum Waterway	M/H	M/H

Sampling and Analysis Plans

Approved sampling and analysis plans (SAPs) are required before applicants collect sediment samples for either a PC or FC. The applicant or dredging consultant receives guidance in SAP development[6] based on the ranking that has been assigned to the proposed project. A conceptual dredging plan and representative sampling plan are established in close coordination with the Corps of Engineers Dredged Material Management Office (DMMO). Protocols for station positioning, decontamination, field sampling, sample compositing, chemical analysis, biological testing, QA/QC and data submittal are all included in the sampling and analysis plan. Once completed, DMMO coordinates review and approval of the plan with the DMMP agencies.

Tables 1-3a and **1-3b** contain data related to sampling plans approved for DY00/01 projects. Application of jurisdictionally specific sampling and analysis requirements resulted in the number of field samples and dredged material management units (DMMUs) formulated for each of the projects. Descriptions of those projects for which no testing was required, or for which best professional judgment was applied, are discussed in the project descriptions in **Appendix A**.

Sampling

Tables 1-4a and **1-4b** contain data related to sampling efforts during DY00/01. In this table the two phases of the US Navy Puget Sound Naval Shipyard characterization effort are listed separately to compare sampling efforts. The two phases of this characterization are considered one project, although they resulted in two suitability determinations.

Two general requirements existing within all three jurisdictions are to sample to the depth of dredging (including overdepth)[7], and to provide positioning data to a minimum precision of one-tenth of a second, latitude and longitude. A variety of positioning techniques were used to provide the required precision. Great emphasis is placed on positioning in order to provide high-quality data. Precise positioning is important to provide repeatability in

[6] Templates for large project and small project sampling and analysis plan development are contained on the Seattle District Dredged Material Management Office homepage at the following address: http://www.nws.usace.army.mil/dmmo/homepage.htm (select hypertext: toolbox).

[7] This requirement is less stringent in Grays Harbor/Willapa Bay in areas with high shoaling rates, which have been previously characterized to the limits of the dredging prism, and for areas generally meeting either Section 404 or Section 103 exclusionary criteria. In these cases sampling of the surface layer with a grab sampler is generally allowed.

Table 1-3a. DY00 Projects - Approved Sampling Plans. Includes information from any SAP submitted that resulted in a DMMP action in DY00. SAPs were not necessarily reviewed in DY00.

PROJECT	Rank	Total Volume (cy)	Surface Volume (cy)	Number of Surface Samples	Number of Surface DMMUs	Subsurface Volume (cy)	Number of Subsurface Samples	Number of Subsurface DMMUs
James Hardie Gypsum	H	9,200	9,200	5	5	0	0	0
Seattle, Port of, East Waterway Project, Stage II	H	584,990	232,530	60	60	352,460	60	39
Seattle, Port of, Pier 66	H	1,700	1,700	3	1	0	0	0
Tacoma, Port of, Sitcum Waterway	L	288,000	288,000	36	6	0	0	0
Tacoma, Port of, St. Paul Waterway CDF	LM	455,000	52,000	5	2	403,000	20 (archived)	8 (archived)
USACE, Duwamish O&M	H	76,000	57,708	54	18	18,292	6	2
USACE, Olympia Harbor O&M	L	635,000	479,145	64	13	145,126	28	4
US Coast Guard Slip 36	H	33,130	27,370	7	7	5,760	1	1
US Navy PSN Shipyard (Phase 1)	H	373,900	304,020	76	76	69,660	7	7
US Navy PSN Shipyard (Phase 2)	H	368,050	307,550	79	79	60,500	12	12
US Navy PSNS Pit-CAD Characterization	H/LM	900,000	111,500	30	30	278,600	40	8
Weyerhaeuser Bay City Dock	LM	12,000	12,000	4	1	0	0	0

Table 1-3b. DY01 Projects - Approved Sampling Plans. Includes information from any SAP submitted that resulted in a DMMP action in DY01. SAPs were not necessarily reviewed in DY01**.**

PROJECT	Rank	Total Volume (cy)	Surface Volume (cy)	Number of Surface Samples	Number of Surface DMMUs	Sub-Surface Volume (cy)	Number of Sub-surface Samples	Number of Sub-surface DMMUs
Anacortes, Port of, Cap Sante Marina	M	345,000	345,000	47	12	0	0	0
Anacortes, Port of, Dakota Creek	M	246,000	32,000	8	2	215,000	2	2
Anacortes, Port of, Pier 1	M	32,000	32,000	8	2	0	0	0
Everett, Port of, 12 Street Marina	LM	294,470	78,870	11	3	215,600	11	5
Everett, Port of, Marina & 10th St. Boat Launch, JI Dock	M	49,340	49,340	22	6	0	0	0
Hylebos (Mouth, Murray Pacific)/Blair Slip One	L/LM/ H	500,000	430,956	90	28	69,044	15	4
Hylebos Wood Debris Group - Manke/Louisiana Pacific	H	109,800	109,800	25	25	0	0	0
Hylebos Wood Debris Group - Weyerhaeuser	H	39,900	25,900	7	7	14,000	3	3
Padden Creek - Bellingham DY 2001	H	6,800	6,800	6	2	0	0	0
Skagit, Port of, LaConner Marina	M	82,000	82,000	20	5	0	0	0
Tacoma Narrows Bridge Foundation Dredging	LM	110,000	110,000	8	4	0	0	0

USACE, Bay Center Marina/Inner Channel	L	38,000	28,000	9	2	10,000	9	1
USACE, Grays Harbor O&M	L	1,860,000	1,860,000	82	11	0	0	0
USACE, Squalicum Waterway O&M, Bellingham Bay	M/H	172,000	127,646	37	12	44,258	18	5

TABLE 1-4a. DY00 Project Sampling. Grain sizes given are ranges from all samples for a given project.

PROJECT	GRAIN SIZE PERCENTAGES				SAMPLING EQUIPMENT	MAXIMUM SAMPLE DEPTH (FT)	MEAN SAMPLE DEPTH (FT)
	GRAVEL > 2 mm	SAND .063 - 2mm	SILT .004 - .063mm	CLAY < .004 mm			
James Hardie Gypsum	0 - 8.0	9.8 - 23.3	48.3 - 73.9	9.6 - 27.8	vibracore	~4	~4
Seattle, Port of, East Waterway Project, Stage II	0 - 16.2	7.5 - 81.8	9.2 - 70.7	3.7 - 36.8	vibracore	19.7	9.0
Seattle, Port of, Pier 66	60.4	36.0	2.63	0.97	vibracore	5.4	4.7
Tacoma, Port of, Sitcum Waterway	0	18 - 48	38 - 65	14 - 22	vanVeen grab	0.5	0.5
Tacoma, Port of, St. Paul Waterway CDF	0	33 - 37	52 - 53	10 - 15	vibracore	20	20
USACE, Bay Center Entrance Channel, Willapa Bay	-	>99	-	-	grab	0.5	0.5
USACE, Duwamish O&M	0.0 - 0.4	13.2 - 60.9	31.8 - 70.1	7.0 - 25.4	vibracore	8.0	4.4
USACE, Olympia Harbor O&M	0.6 - 32.7	18.3 - 71.3	10.7 - 49.8	6.3 - 33.9	vibracore		
US Coast Guard Slip 36	0.3 - 5.5	44.1 - 72.2	16.9 - 48.5	4.5 - 9.8	vibracore	12.6	8.8
US Navy PSN Shipyard (Phase 1)	0 – 61.1	4.4 – 79.7	6.4 – 67.4	0.1 – 43.5	vibracore	19.3	7.0
US Navy PSN Shipyard (Phase 2)	0 – 63.7	8.1 – 81.9	1.7 – 61.9	1.7 – 36.4	vibracore	12.9	6.1
US Navy PSNS Pit-CAD Characterization	0.0 - 4.6	0.8 - 69.0	15.6 - 66.9	15.5 - 48.4	Mudmole™	13	10
Weyerhaeuser Bay City Dock	0.2	15.6	60.2	24.1	grab	0.5	0.5

TABLE 1-4b. DY01 Project Sampling. Grain sizes given are ranges from all samples for a given project.

PROJECT	GRAIN SIZE PERCENTAGES				SAMPLING EQUIPMENT	MAXIMUM SAMPLE DEPTH (FT)	MEAN SAMPLE DEPTH (FT)
	GRAVEL > 2 mm	SAND .063 - 2mm	SILT .004 - .063mm	CLAY < .004 mm			
Anacortes, Port of, Cap Sante Marina	0 - 15	4 - 47	35 - 73	6 - 26	MudMole™	5.0	3.8
Anacortes, Port of, Dakota Creek	1 - 11	48 - 56	25 - 36	8 - 15	MudMole™	9.8	6.3
Anacortes, Port of, Pier 1	3 – 24	51 – 68	8 – 42	0 - 8	MudMole™	8.3	5.1
Everett, Port of, Marina & 10th St. Boat Launch, Jetty Is. Dock	0.9 - 2.1	19.2 - 51.1	37.8 - 63.0	8.3 - 17.1	vibracore	6.2	4.0
Everett, Port of, 12 Street Marina	0.2 - 2.6	29.9 - 59.8	31.6 - 54.3	7.2 - 13.1	vibracore	18	12.1
Hylebos (Mouth, Murray Pacific)/Blair Slip One	0 - 11.5	17 - 74	15 - 56	7.7 - 29	vibracore	16.6	6.4
Hylebos Wood Debris Group – Weyerhaeuser	0.9 - 9.6	22.5 - 54.9	27.8 - 52.9	11.0 - 26.4	MudMole™	5.4	2.7
Hylebos Wood Debris Group - Manke/Louisiana Pacific	0 - 50.6	15.9 - 83.6	4.2 - 54.6	1.4 - 29.3	impact core	14.0	5.6
Padden Creek - Bellingham DY 2001	18.3 - 20.2	56.2 - 67.4	9.0 - 15.5	5.3	vibracore	9.0	7.5
Skagit, Port of, LaConner Marina	0.2 - 0.8	<0.1 - 4.3	76.9 - 83.2	15.8 - 18.1	vibracore	2.6	~ 2
Tacoma Narrows Bridge Foundation Dredging	0.1 - 62.7	35.4 - 76.3	0.1 - 28.3	<0.1 - 2.9	grab	0.5	0.5
USACE, Bay Center Marina/Inner Channel	0 - 0.6	6.7 - 65.7	22.7 - 70.3	11.1 - 29.3	vibracore	11.0	8.0
USACE, Grays Harbor O&M	0.4 - 16.1	8.2 - 80.9	2.8 - 65.8	1.7 - 23.3	vanVeen grab	0.5	0.5
USACE, Squalicum Waterway O&M, Bellingham Bay	0 - 17.6	4.4 - 67.2	11.5 - 76.0	6.5 - 27.9	vibracore	12.3	7.4

sampling and to provide data that can be utilized in a geographical information system (GIS).

For the majority of the projects listed in the tables, the maximum sediment depths correspond to both the actual length of the deepest boring as well as to the maximum depth of the dredging prism, including overdepth. In high-ranked areas there is an additional requirement to provide an archived sample from the one-foot of sediment beyond the dredging prism ("Z" sample). This additional depth is not reflected in the table.

Chemical Testing

Chemical testing was conducted for 12 full characterizations in DY00 and 13 projects in DY01. For one DY00 project (Blair Waterway Deepening) the agencies used previous data to allow an increase in the project volume with no further testing. Another DY00 project (Bay Center Entrance Channel) met guidelines for site-specific exclusion from chemical testing under Grays Harbor/Willapa Bay jurisdictional guidelines. In DY01 only one project (USACE O&M of Everett Harbor and Snohomish River) did not require chemical testing. For this project the agencies reaffirmed the frequency determination for the bulk of the proposed dredged material, and found that additional material met guidelines for site-specific exclusion from further testing under PSDDA guidelines. Both projects with site-specific exclusions from testing were excluded based on the coarse-grained nature of the sediments.

In general, the QA/QC for projects undergoing chemical testing was acceptable by the DMMP agencies for regulatory decision-making. A complete listing of PSDDA sediment guideline value exceedances for DY00/01 is included in **Appendix C**.

Biological Testing

A total of 12 projects required acute bioassay testing (**Tables 1-5a** and **1-5b**) during the biennium. Six of these projects underwent biological testing in DY00, with one project (US Navy PSNS) requiring two rounds of biological testing. Six projects also underwent biological testing in DY01. Only two DY00 projects exclusively used tiered testing, performing biological tests on only those DMMUs that had exceedances of SLs. Three projects opted for concurrent biological testing, because of a reason-to-believe that at least one COC would exceed SL, and to save time in the testing process. The US Navy PSNS project used exclusively concurrent testing in its first round, and a mix of tiered and concurrent testing during its second round of biological testing.

Table 1-5a. DY00 Biological Testing Data. Summary of bioassay tests performed for DY00 projects.

PROJECT	Number of Bioassays		Number of analyses failing bioassays	Bioassay tests conducted			Control sediment location	Reference sediment location
	Undergoing tiered testing	Undergoing concurrent testing		Amphipod	Sediment Larval	20-day Growth		
James Hardie Gypsum	7	0	5	Aa	De	Na	Narragansett Bay, MA West Beach, WA	Carr Inlet, WA
Seattle, Port of, East Waterway Project, Stage II	0	99	27	Ee	Mg	Na	Beaver Creek, OR Yaquina Bay, OR	Carr Inlet, WA
US Coast Guard Slip 36	0	8	4	Ee	Mg	Na	Beaver Creek, OR Yaquina Bay, OR	Carr Inlet, WA
US Navy PSN Shipyard (Phase 1)[8]	0	83	76	Ee	Mg	Na	Beaver Creek, OR Yaquina Bay, OR	Carr Inlet, WA
US Navy PSN Shipyard (Phase 2)	52	10	0	Aa, Ee	Mg	Na	N. San Francisco Bay, CA; Yaquina Bay, OR	Carr Inlet, WA
US Navy PSNS Pit-CAD Characterization	0	30	1	Aa	Mg	Na	N. San Francisco Bay, CA; Yaquina Bay, OR	Carr Inlet, WA
USACE, Duwamish O&M	14	0	2	Aa	De	Na	N. San Francisco Bay, CA	Carr Inlet, WA

Aa = Ampelisca abdita
De = Dendraster excentricus
Ee = Eohaustorius estuaries
Mg = Mytilus galloprovincialus
Na = Neanthes arenaceodenta
Ra = Rhepoxynius abronius
Sp = Strongylocentrotus purpuratus

[8] See Appendix A for discussion of Phase I amphipod bioassay nontreatment testing issues resulting in amphipod retesting during Phase II

Table 1-5b. DY01 Biological Testing Data. Summary of bioassay tests performed for DY01 projects.

PROJECT	Number of Bioassays		Number of analyses failing bioassays	Bioassays Conducted			Control Sediment Location	Reference Sediment Location
	Undergoing concurrent testing	Undergoing tiered testing		Amphipod	Sediment Larval	20-day Growth		
Anacortes, Port of, Cap Sante Marina	0	1	0	*Aa*	*Sp*	*Na*	Narragansett Bay, MA	Carr Inlet, WA
Hylebos (Mouth, Murray Pacific)/Blair Slip One	0	19	16	*Ee*	*Mg*	*Na*	Yaquina Bay, OR	Carr Inlet
Hylebos Wood Debris Group - Manke/Louisiana Pacific	0	22	13	*Aa, Ra*	*De, Mg*	*Na*	Narrow River, RI; West Beach, WA Yaquina Bay, OR	Carr Inlet, WA; Narrow River, RI; West Beach, WA
Hylebos Wood Debris Group – Weyerhaeuser	0	9	4	*Aa, Ra*	*De, Mg*	*Na*	West Beach, WA; Yaquina Bay, OR; Narragansett Bay, RI	Carr Inlet, WA
Padden Creek - Bellingham DY 2001	0	1	0	*Ee*	*De*	*Na*	Yaquina Bay, OR	Carr Inlet, WA
USACE, Grays Harbor O&M	0	2	0	*Ee*	*De*	*Na*	Yaquina Bay, OR	GHS7/ Yaquina Bay, OR

Aa = Ampelisca abdita
De = Dendraster excentricus
Ee = Eohaustorius estuarius s
Mg = Mytilus galloprovincialus
Na = Neanthes arenaceodenta
Ra = Rhepoxynius abronius
Sp = Strongylocentrotus purpuratus

DMMP regulatory use of the saline Microtox® test has been suspended for regulatory decision-making since DY94. This suspension remains in force pending commitment of agency resources to effectively evaluate the continued use of this test, or a suitable replacement test, within each dredging/disposal jurisdiction.

Bioaccumulation Testing

Several project sediments exceeded BT values and so were required to pass bioaccumulation testing prior to being found suitable for open water disposal during the DY00/01 biennium (**Tables 1-6a** and **1-6b**). Though most projects performed three or fewer bioaccumulation analyses, the Port of Seattle East Waterway Deepening Project performed 25 bioaccumulation analyses. Further details on bioaccumulation testing can be found in **Appendix A**.

Suitability Determinations

A suitability determination outlines the evaluation procedures used in the characterization of project sediments, summarizes chemical and biological testing data and associated QA/QC issues, and documents the interpretation of testing results. The suitability determination is a technical memorandum, drafted by the Corps' DMMO and signed by DMMP representatives from the Corps of Engineers, Environmental Protection Agency, Department of Ecology and Department of Natural Resources. The suitability determination documents the suitability of proposed dredged sediments for open-water disposal at either one of the eight PSDDA sites, or two estuarine and one ocean sites in both Grays Harbor and Willapa Bay, or at appropriate in water sites in the Columbia River. It does not, however, constitute final project approval by the agencies. Comprehensive agency comments on the overall project are provided through the regulatory public notice and review process.

Tables 1-7a and **1-7b** contain information taken from the suitability determinations or other completion actions for each of the projects that completed their DMMP review during DY00 and DY01, respectively.

For the projects receiving suitability determinations in DY00, 38% of total number of DMMUs (16% of the total volume) were found unsuitable for unconfined-open-water disposal under relevant DMMP evaluation guidelines. For DY01, 27% of the total number of DMMUs (6% of the total volume) were found unsuitable for unconfined open-water disposal. The amount of unsuitable material varied considerably by project and location, with considerable portions of unsuitable material coming from the high-use areas of both the Ports of Seattle and Tacoma.

Table 1- 6a. DY00 BIOACCUMULATION TESTING DATA

PROJECT	Number of bioaccum analyses	Number of analyses failing bioaccum	TESTS CONDUCTED		Control Sediment Location(s)	Reference Sediment Location
			Macoma nasuta	*Nephtys caecoides*		
Seattle, Port of, East Waterway Project, Stage II	25	4	25	25	Dillon Beach, CA Yaquina Bay, OR Beaver Creek, OR	Carr Inlet, WA Sequim Bay, WA
USACE, Olympia Harbor O&M	2	0	2	2		
US Navy PSN Shipyard (Phase 2)	1	1	1	1	N. San Francisco Bay, CA	Carr Inlet, WA

Table 1- 6b. DY01 BIOACCUMULATION TESTING DATA

PROJECT	Number of bioaccum analyses	Number of analyses failing bioaccum	TESTS CONDUCTED		Control Sediment Location(s)	Reference Sediment Location
			Macoma nasuta	*Nephtys caecoides*		
Anacortes, Port of, Cap Sante Marina	2	0	2	2	Tomales Bay, CA	Sequim Bay, WA
Hylebos Wood Debris Group – Weyerhaeuser	3	0	3	3	Sequim Bay, WA; Tamales Bay, CA	Sequim Bay, WA; Tamales Bay, CA

Table 1-7a. DY00 SUITABILITY DETERMINATIONS

PROJECT	Rank	Total Volume (cy)	No. of chemical analyses	No. of bioassay analyses	No. of bioaccum analyses	DMMUs Failing	Volume Failing (cy)	DMMUs Passing	Volume Passing (cy)	Proposed DMMP Disposal Site
James Hardie Gypsum	H	9,200	10	7	0	5	4,743	5	4,486	Elliott Bay
Seattle, Port of, East Waterway Project, Stages 1 & 2	H	584,990	99	99	25	34	170,070	65	414,920	Elliott Bay
Seattle, Port of, Pier 66	H	1,700	1	0	0	0	0	1	1,700	Elliott Bay
Tacoma, Port of, Blair Waterway Deepening[9]	L	+110,000	0	0	0	0	na	na	+110,000	Commencement Bay
Tacoma, Port of, Sitcum Waterway	L	288,000	6	0	0	0	0	6	288,000	Commencement Bay
Tacoma, Port of, St. Paul Waterway CDF	LM	455,000	2	0	0	0	0	2	455,000	Commencement Bay
US Coast Guard Slip 36	H	33,130	8	8	0	4	15,790	4	17,340	Elliott Bay
US Navy PSN Shipyard (Phases 1 & 2)	H	368,050	98	155	1	17	77,210	74	290,840	Elliott Bay
US Navy PSNS Pit-CAD Characterization	H/LM	900,000	34	30	0	1	3,700	38	896,300	Elliott Bay
USACE, Bay Center Entrance Channel, Willapa Bay	L	165,000	0	0	0	0	na	na	165,000	Cape Shoalwater
USACE, Duwamish O&M	H	76,000	20	14	0	5	18,600	15	57,400	Elliott Bay
USACE, Olympia Harbor O&M	L	635,000	17	0	2	0	0	17	635,000	Anderson/Ketron
Weyerhaeuser Bay City Dock	LM	12,000	1	0	0	0	0	1	12,000	South Jetty/ Pt. Chehalis

[9] This action increased the amount of suitable dredging material but involved no additional testing; increase in material was from previously tested areas.

Table 1-7b. DY01 SUITABILITY DETERMINATIONS

PROJECT	Rank	Total Volume (cy)	No. of chemical analyses	No. of bioassay analyses	No. of bioaccum analyses	DMMUs Failing	Volume Failing (cy)	DMMUs Passing	Volume Passing (cy)	Proposed DMMP Disposal Site
Anacortes, Port of, Cap Sante Marina	M	345,000	12	1	2	0	0	12	345,000	Rosario Strait
Anacortes, Port of, Dakota Creek	M	246,000	2	0	0	1	16,000	3	230,000	Rosario Strait
Anacortes, Port of, Pier 1	M	32,000	2	0	0	0	0	2	32,000	Rosario Strait
Everett, Port of, 12 Street Marina	LM	294,470	3	0	0	0	0	8	294,470	Port Gardner
Everett, Port of, Marina & 10th St. Boat Launch, JI Dock	M	49,340	6	0	0	0	0	6	49,340	Port Gardner
Hylebos (Mouth, Murray Pacific)/Blair Slip One	L/LM/ H	500,000	32	19	0	19	155,000	13	345,000	Commencement Bay
Hylebos Wood Debris Group - Manke/Louisiana Pacific	H	109,800	25	22	0	13	57,700	12	51,100	Commencement Bay
Hylebos Wood Debris Group - Weyerhaeuser	H	39,900	10	9	3	4	14,200	6	25,700	Commencement Bay
Padden Creek - Bellingham DY 2001	H	6,800	2	1	0	0	0	2	6,800	Rosario Strait
Skagit, Port of, LaConner Marina	M	82,000	5	0	0	0	0	5	82,000	Rosario Strait
Tacoma Narrows Bridge Foundation Dredging	LM	110,000	4	0	0	0	0	4	110,000	Commencement Bay; BU

USACE, Bay Center Marina/Inner Channel	L	38,000	3	0	0	0	0	3	38,000	Goose Pt./ Cape Shoalwater
USACE, Everett Harbor & Snohomish River O&M	LM	330,437	0	0	0	0	na	na	330,437	Port Gardner
USACE, Grays Harbor O&M	L	1,860,000	11	2	0	0	0	11	1,860,000	South Jetty/ Pt. Chehalis
USACE, Squalicum Waterway O&M, Bellingham Bay	M/H	172,000	17	0	0	1	1,688	16	170,200	Rosario Strait; BU

C. SUMMARY AND ASSESSMENT OF DY00/01 DATA

Summary of Testing Results

Chemical Testing. **Table I-8** and **Appendix C** summarize the chemical testing results from DY 2000 and DY 2001. A total of 46 of the 58 DMMP COCs had their screening levels exceeded for at least one project. These included both detected exceedances (42 COCs) and detection limit exceedances (16 COCs). Ten COCs had detected concentrations above the BT, while eighteen were detected above the ML. **Table 1-9** highlights those chemicals that had detected concentrations exceeding SL, BT and ML most often. Also included are those chemicals for which the detection limit exceeded either the SL, BT, or ML most often.

The chemicals most often detected above SL and BT included mercury, TBT, fluoranthene, DDT, and total PCBs. Only mercury and DDT were quantitated in two or more projects. The chemicals for which detection limits were most often exceeded included hexachlorobenzene, hexachlorobutadiene, N-nitrosodiphenylamine. Detection limit exceedances were generally inconsequential, because other detected SL exceedances occurred, which triggered biological testing. Only two DMMUs triggered the need to conduct biological testing, by exceeding the SL detection limits with no other detected SL exceedances (**Appendix C**). Concurrent biological testing was conducted for a large number of projects including the East Waterway Project, U.S. Coast Guard Slip 36 Project, U.S. Navy Puget Sound Naval Shipyard Project, U.S. Navy Pit-CAD (CERCLA Cleanup), Weyerhaeuser Company (Hylebos Wood Debris Group), and Manke-Lumber Company (HWDG).

TABLE 1.8 - DY00/01 CHEMICAL TESTING SUMMARY

CHEMICAL OF CONCERN	# of DMMU D > SL	# of Projects D > SL	# of DMMU D > BT	# of Projects D > BT	# of DMMU D > ML	# of Projects D > ML	# of DMMU U > SL	# of Projects U > SL	# of DMMU U > BT	# of Projects U > BT	# of DMMU U > ML	# of Projects U > ML
METALS & ORGANOMETALS												
Arsenic	9	3										
Cadmium (1)	5	1										
Copper (1)	4	3										
Lead (1)	2	2										
Mercury	81	6	5	2	3	2						
Silver	2	2	2	2								
Zinc (1)	16	4										
TBT ion (porewater) (2)	42	9	42	9								
LPAH												
Naphthalene (1)	3	3			1	1						
Acenaphthene (1)	6	4			1	1						
Fluorene (1)	11	5			1	1						
Phenanthrene (1)	14	7			1	1						
Anthracene (1)	10	4										
2-Methylnaphthalene (1)	8	3			1	1						
Total LPAHs (1)	8	5			1	1						
HPAH												
Fluoranthene	27	8	5	4	1	1						
Pyrene (1)	20	8			1	1						
Benzo(a)anthracene (1)	9	6			1	1						
Benzofluoranthenes (b+k) (1)	8	4										
Chrysene (1)	24	7										
Benzo(a)pyrene	2	2	1	1	1	1						
Indeno(1,2,3-c,d)pyrene (1)	5	4			1	1						
Dibenzo(a,h)anthracene (1)	3	3					1	1				
Benzo(g,h,I)perylene (1)	1	1			1	1						
Total HPAHs (1)	12	6										
CHLORINATED HYDROCARBONS												
1,2,4-Trichlorobenzene (1)	1	1										
1,4-Dichlorobenzene	1	1										
Hexaclorobenzene (HCB)	6	1					26	6	2	2	1	1
PHTHALATES												
Bis(2-ethylheyesyl)phthalate (2)	1	1	1	1								
PHENOLS												
2-Methylphenol (1)							1	1				
4-Methylphenol (1)	1	1										
2,4-Dimethylphenol (1)	2	1					4	1				
Pentachlorophenol	3	3	2	2	1	1	4	1	3	1	1	1
MISCELANEOUS EXTRACTABLES												
Benzyl alcohol (1)							23	4				
Benzoic acid (1)	2	2	1	1	1	1						
Dibenzofuran (1)	3	3			1	1	1	1				
Hexachlorobutadiene	6	1					34	7	2		1	1
N-Nitrosodiphenylamine	1	1					30	5	2	1	2	1
VOLATILE ORGANICS												
Ethylbenzene	1	1										
PESTICIDES AND PCBs												
Total DDT	35	3	6	2	5	2	46	4	12	2	9	1
Aldrin (2)							21	2				
alpha-Chlordane (2)	1	1					10	2	1	1		
Dieldrin (2)	5	3					33	4	4	1		
Heptachlor (2)							15	2				
gamma-BHC (Lindane) (2)	4	2					3	2				
Total PCBs	132	10	34	2	8	1	4	1				

Total Projects = 15, total number of DMMUs = 316

D = Detected U = Undetected SL = Screening Level BT = Bioaccumulation Trigger ML = Maximum Level

(1) = No BT exists (2) = No ML exists (3) = No BT or ML exists

Table 1-9. Multiple Exceedances of DMMP Guideline Values.

CHEMICAL	CHEMICALS EXCEEDING SL IN AT LEAST 1/3 OF PROJECTS	CHEMICALS EXCEEDING BT IN AT LEAST 2 PROJECTS	CHEMICALS EXCEEDING ML IN AT LEAST 2 PROJECTS	CHEMICALS WITH DL's[1] EXCEEDING SL IN AT LEAST 1/3 OF PROJECTS
Mercury	X	X	X	
Silver		X		
TBT (porewater)	X	X		
Fluorene	X			
Phenanthrene	X			
Total LPAHs	X			
Fluoranthene	X	X		
Pyrene	X			
Benzo (a) anthracene	X			
Chrysene	X			
Total HPAHs	X			
Hexachlorobenzene				X
Hexachlorobutadiene				X
N-Nitrosodiphenylamine				X
Total DDT		X	X	
Total PCBs	X	X		

[1/] DLs = Detection Limits

Biological Testing. Biological testing was conducted on 12 of the 27 projects undergoing chemical testing during DY00/01. **Table 1-10** shows the number of times each of the three bioassays was conducted and the number of "hits" recorded for each bioassay for nondispersive and dispersive site disposal.

TABLE 1-10. – DY 00/01 Bioassay "Hits"

BIOASSAY	Number of DMMUs Tested		Number of Hits Under the "Two-Hit Rule"		Number of Hits Under the "Single-Hit Rule"		Total Hits (2H + 1H)
	ND	D	ND	D	D	ND	
Amphipod	310	2	24	0	0	23	47
Sediment Larval	310	2	170	0	0	40	210
Neanthes Growth	310	2	27	0	0	19	46

Legend: ND = nondispersive site interpretation guidelines; D = dispersive site interpretation guidelines

The table shows that all three bioassays in the test suite recorded hits, with the sediment larval bioassay (either *Dendraster excentricus* or *Mytilus galloprovincialis*) registering the most hits (2H + 1H) at 210 out of 312 bioassays (67.3%). The number of total hits recorded was similar for the amphipod and *Neanthes* growth bioassays, 47 (15.1%) versus 46 (14.7%), respectively. All the hits recorded were for the nondispersive site evaluations, with no hits noted for the two analyses utilizing the dispersive site guidelines.

Amphipod bioassay testing with *Eohaustorius estuarius* suggested that this species may be sensitive to sediments with a higher concentrations of clay (see Appendix A: U.S. Navy PSNS project). The DMMP agencies investigated this issue further using only Puget Sound reference area sediments (SAIC 2001) in order to eliminate the potential for unmeasured chemical toxicants to have influenced the Phase I resukts. While the study results were not conclusive, they did suggest that clay may have contributed to the toxicity that was observed.

Bioaccumulation Testing. Bioaccumulation testing frequency increased significantly during the two-year period covered by this report. A total of thirty-three DMMUs from five projects were subject to bioaccumulation testing during DY 00 and DY 01. **Table 1-11** summarizes the chemical specific testing outcomes for the seven chemicals evaluated during 45-day exposures[10]. Of the

[10] The exposure period was increased by DMMP (June 2000 Clarification Paper) from 28 days to 45 days to approximate steady-state tissue concentrations.

chemicals evaluated TBT was the most frequently tested with 25 tests and one failure among the four projects. Total PCBs was the second most frequently tested with 13 DMMUs tested with 3 failures for the one project tested. The third most frequently tested chemical was total DDT, where four DMMUs were evaluated among two projects with one failure. The remaining chemicals evaluated were mercury, silver, fluoranthene, pentachlorophenol and were only evaluated within a single DMMU and project, with no failures. The project specific bioaccumulation testing conducted during DY00/01 is discussed in detail in **Appendix A**.

Table 1-11. DY 00/01 Bioaccumulation Testing Summary.

Chemical	Project frequency	Macoma TTL[11] exceedances	Nephtys TTL[1] exceedances	TTL[1] Guideline	Pass freq.	Fail freq.
Mercury	1			1 mg/kg[12]	1	0
Silver	1			200 mg/kg[13]	1	0
TBT	4	1		3,000 ug/kg[14]	24	1
Fluoranthene	1			8,400 ug/kg[3]	1	0
Pentachlorophenol	1			900 ug/kg[3]	1	0
Total DDT	2			3,000 ug/kg[15]	3	1[16]
Total PCBs	1	3	3	750 ug/kg[17]	10	3

Cost Analysis

Total Costs. Total sampling and testing costs are generally related to the size of the project and the rank. Larger projects have lower unit costs than smaller projects due to economy of scale. Area rank influences costs by requiring larger numbers of analyses (DMMU) relative to lower ranked projects. **Figure 1-2** shows the relationship of average total cost per cubic yard to the total volume tested for all PSDDA projects submitting data from DY90 to DY01. The

[11] TTL = Target Tissue Level Interpretation Guideline (all values converted to wet weight basis). Test sediment tissue levels are compared statistically to the reference sediment tissue levels and to TTL guidelines in a one tailed t-Test.
[12] FDA Guideline.
[13] Human Health Guideline developed by PSDDA (see EPTA, 1988).
[14] Adopted by DMMP on interim basis as an Ecological Health TTL from 1999 EPA Superfund development effort for the West Waterway OU.
[15] Based on a literature review conducted for the Port of Seattle's T-18 Pier dredging project, ecological effects are expected to occur at a lower concentration than human health effects. A literature review 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.
[16] BPJ utilized by DMMP due to discrepancy between initial and resampled/retested DDT. See **Appendix A** (U.S. Navy PSNS Project) for discussion.
[17] The DMMP agencies in a December 1999 re-evaluation and development effort established an interim PCB TTL for human health for the East Waterway Stage II Project.

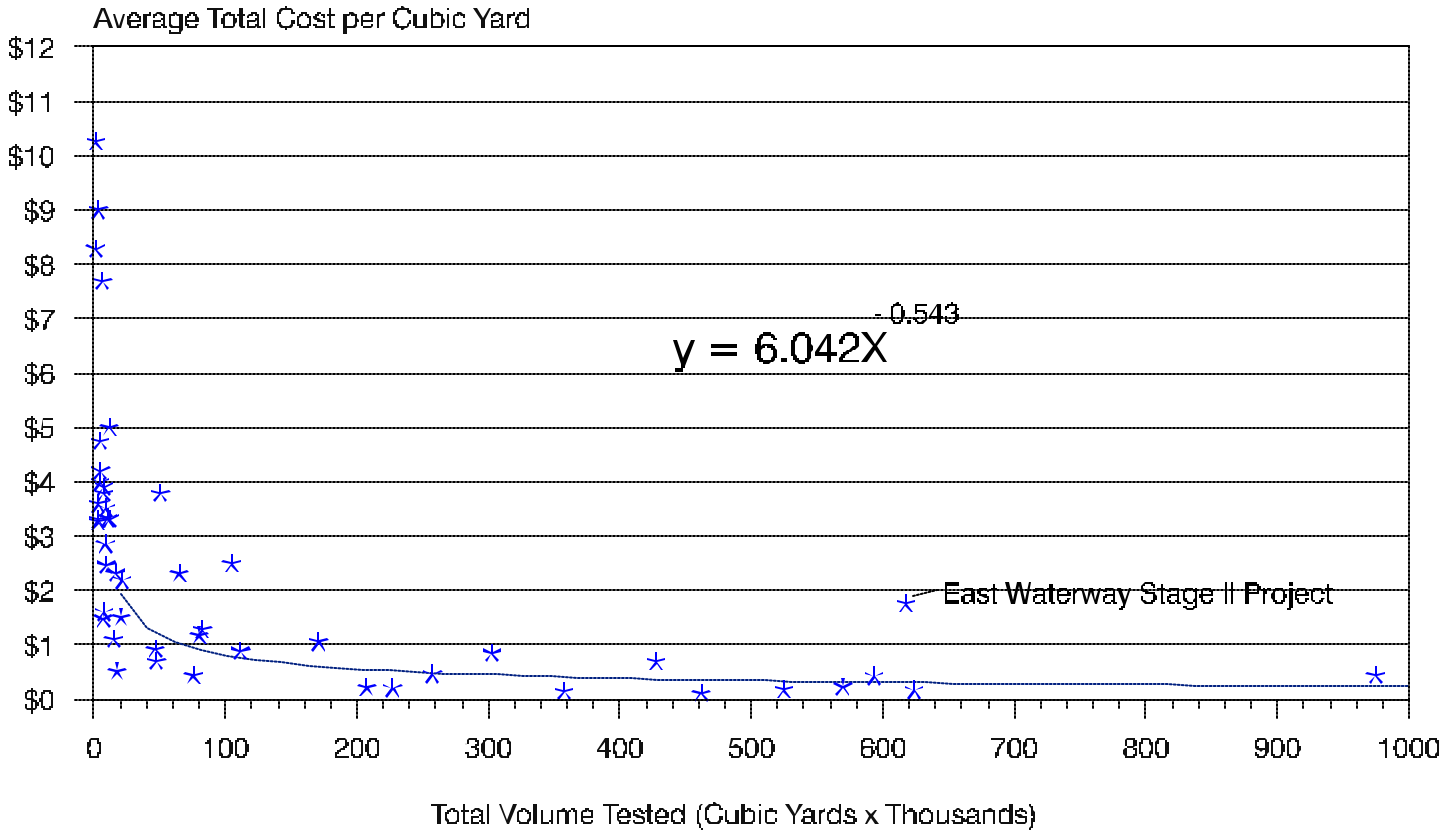
regression of these two variables resulted in a significant ($p<0.001$) correlation and regression equation noted in **Figure 1-2**, which can be used to estimate testing cost given the project size.

Testing Costs. Chemical testing costs are generally the most straightforward and readily discernible costs. Analytical laboratories performing DMMP analyses will provide quotes on unit costs. Average unit chemical testing costs (including QA/QC) for the past ten years are depicted in **Figure 1-3** as a function of the number of analyses for the standard suite of chemicals and for the cost for the standard suite plus special chemicals such as dioxin and tributyltin. The scatter plot depicted shows that as the number of analyses increases beyond three the unit costs drop sharply and steadily decrease for the most part to a low of around $1200 to $1500 per analysis. Projects with one or two analyses are especially costly, as the QA/QC costs cannot be distributed over several samples.

Evaluating bioassay costs shows that the unit costs generally relate well to the total number of analyses, as shown in **Figure 1-4**. There is a tremendous range in unit costs for projects with only one analysis, whereas the variability in unit costs drops sharply with additional analyses.

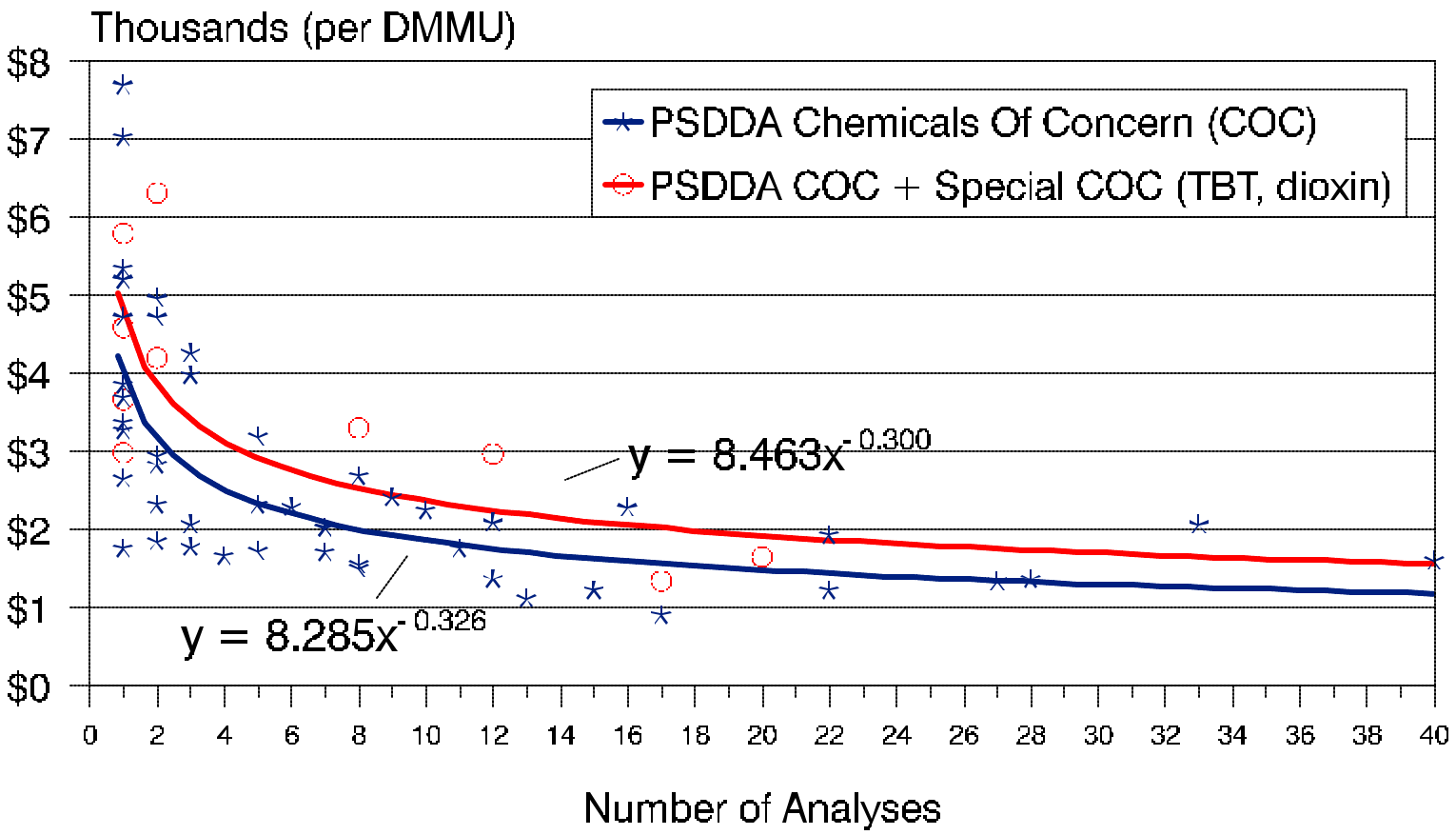
Bioaccumulation testing costs were analyzed for two dredging projects during DY00/01. The USACE/Port of Seattle East Waterway Stage II dredging project conducted 25 bioaccumulation tests (TBT, PCBs, Fluoranthene, total DDT) with an average bioaccumulation cost of $17,953/DMMU. The second project was the USACE Olympia Harbor Characterization Project, which conducted two bioaccumulation tests (TBT) at an average cost of $18,663/DMMU.

Figure 1-2. Project Size versus Unit Testing Cost



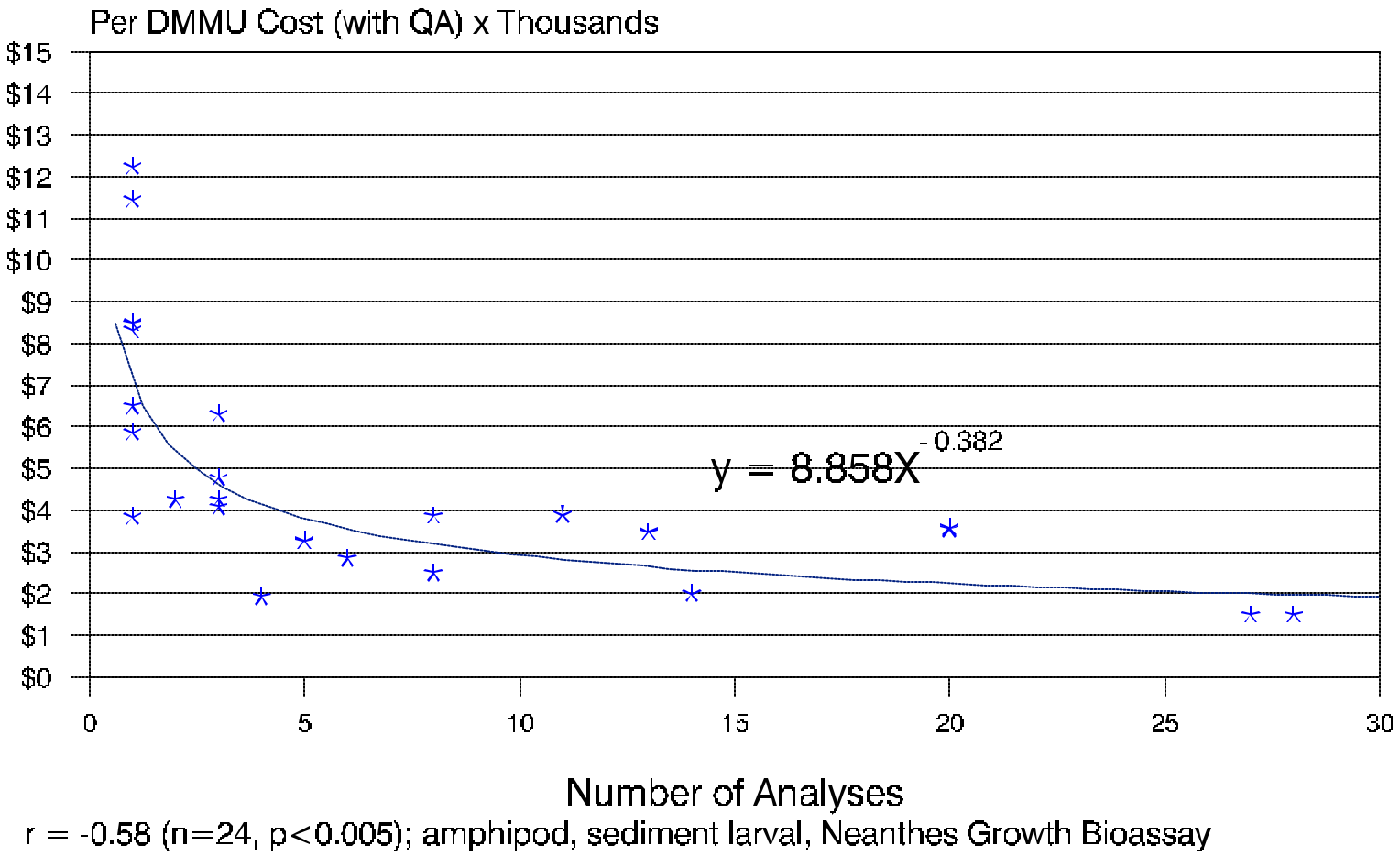
r=-0.50 (n=48, p<0.001)

Figure 1-3. Chemistry Unit Cost



r = -0.52 (n=48, p<0.001); PSDDA COC + Special COC: r = -0.78 (n=10, p<0.01)

Figure 1-4. Bioassay Suite Unit Cost Analysis



r = -0.58 (n=24, p<0.005); amphipod, sediment larval, Neanthes Growth Bioassay

Regulatory Processing

For the majority of dredging projects, DMMP sediment sampling and testing are a part of the regulatory requirements under Section 404 of the Clean Water Act, or under Section 103 of the Marine Protection, Research and Sanctuaries Act. For those dredging projects requiring sampling and testing, the regulatory process consists of a sequence of steps which must be taken before obtaining a permit. The majority of permit actions involve 404 jurisdiction, but the steps are similar for 103 actions. These are as follows:

(1) Prepare and submit application for permit.

(2) Prepare sampling and analysis plan (SAP) for characterization of proposed dredged material.

(3) Receive approval of SAP from DMMP agencies.

(4) Perform sampling and chemical/biological analysis and submit testing results.

(5) Receive suitability determination for open-water disposal from DMMP agencies.

(6) Complete application details required to issue public notice.

(7) Corps prepares and issues public notice.

(8) Corps transmits review comments to applicant after 30-day public comment period.

(9) Applicant provides Corps with responses to public comments.

(10) Corps completes public interest review, 404(b)1 evaluation, NEPA documentation and issues permit.

The average time requirements for steps 3 through 5 are included in Figure 1-5a, which was constructed using data from processing activities occurring in DY00/01

Permit Preparation and Submittal. An application for a Corps of Engineers Section 10/404 permit for dredging and dredged material disposal must be submitted before any DMMP processing may take place. An application number and Regulatory Branch Project Manager are assigned when an application is submitted and the Dredged Material Management Office begins review of information relevant to the proposed dredging. Permit preparation is part of

the regulatory process, but completely within the control of the permit applicant, so is not included in the analysis of processing time.

(1) Sampling and Analysis Plan Development. A sediment sampling and analysis plan must be developed and submitted to the DMMP agencies for review prior to commencement of field sampling. The time required for SAP development is highly variable and almost completely within control of the dredging applicant. In many cases a permit application is submitted at the same time as a draft SAP, while in other cases a permit application is submitted long before development of a SAP begins.

(2) Sampling and Analysis Plan Approval. Once a sediment SAP has been submitted, the DMMO coordinates review with the other DMMP agencies: EPA, DNR and Ecology. An approval letter, which includes DMMP agency comments and recommends modifications to the SAP, is then sent to the applicant. Once these comments and modifications have been acknowledged by the applicant, via telephone, letter or e-mail, sampling and analysis may proceed. It is the goal of the DMMO to complete the review of SAPs within three weeks. During DY 00/01 the average time from the submittal of the final SAP for a project to SAP approval was 12 days.

(3) Sampling and Analysis. During this phase, field sampling and chemical/ biological analysis are completed following the protocols established in the approved SAP. Data are compiled and submitted in a hard copy report. These data are entered into the Dredged Analysis Information System by a Corps contractor. Sampling, testing and reporting consume a substantial portion of the DMMP Process time budget, averaging 217 days during DY00/01. This is one of the project phases with the highest degrees of variability, with sampling and analysis taking anywhere from 49 to 563 days during this 2 year time period. Factors influencing the time required for this phase include weather, sampling difficulties, laboratory capacity and turn-around, QA problems arising during chemical and biological testing, and report compilation time. Those projects which include bioassay or bioaccumulation testing usually are those with the longer turn-around times.

(4) Data Review. Once a full set of chemical/biological testing data is submitted along with the sampling report, the DMMO conducts a data review with the other DMMP agencies. The result of this review is the signing, by DMMP agency representatives, of a Memorandum for Record documenting the determination reached on the suitability/unsuitability of each of the dredged material management units defined in the approved SAP. The goal of the DMMO is to complete this review within three weeks of data submittal. In DY00/01, the average time required was 35 days. In many cases, this review can be much shorter; time needed during this

biennium ranged from 3 days to 108 days. The longest reviews usually involve complications such as a change in dredge volume or especially large or complex data sets.

(5) Complete Permit Application. Once the suitability determination has been signed, the DMMO informs the Corps Regulatory Branch project manager and preparations are made to issue a public notice. However, if project details have not been fully developed by this time, or if project plans are modified subsequent to the suitability determination, new drawings or other information may be required of the applicant prior to the preparation of the public notice. In other cases, a shorelines development permit may not have yet been obtained by the applicant and a decision may be made to wait to go out to public notice until the local shoreline jurisdiction has issued a permit.

(6) Prepare and Issue Public Notice. By regulation, the Regulatory Branch must issue a public notice within fifteen days of the completion of the permit application

(7) Public Comment Period and Transmittal of Review Comments. A DMMP project typically undergoes a 30-day public comment period. Comments received during this period are collated by the Corps and transmitted to the applicant for response.

(8) Applicant Responds to Review Comments. The permit applicant is responsible for providing written responses to review comments and supporting data to the Corps before the Regulatory Branch project manager can complete a public interest review.

(9) Corps Completes Public Interest Review and Makes Permit Decision. The public interest review, including a Section 404(b)(1) alternatives analysis and NEPA evaluation, is completed and documented after the permit applicant provides responses to review comments. The Corps project manager prepares a permit decision upon completion of the public interest review.

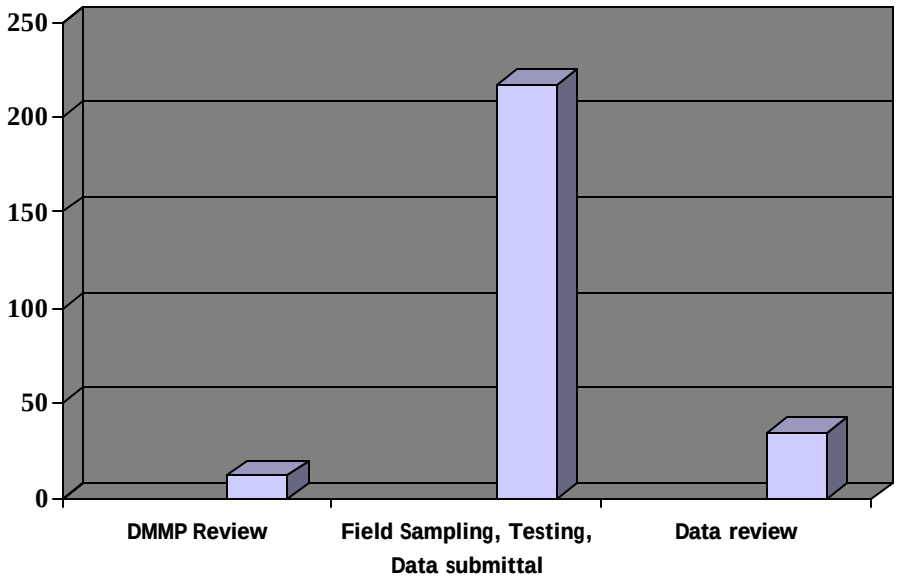
This stage of the process may be very time consuming. Dredging and DMMP processing are often only part of complex projects. Other elements may be involved, such as wetland fills, eelgrass bed impacts or Endangered Species Act issues. The addition of several species to the list of threatened and endangered species in Western Washington has led to a substantial backlog in permit review and approval. Resolution of controversial issues such as these may consume substantial amounts of time.

To improve regulatory response time, the Department of Ecology recommends that applicants seek a hydraulic project approval (HPA) from the Department of Fish and Wildlife, and resolve other problems as early as possible in the permit process.

The entire DMMP dredged material evaluation process, as depicted in Figure 1-5, includes final sampling and analysis plan review and approval, field sampling and analysis, data review and completion of the suitability determination. The average time required for the DMMP dredged material evaluation process was 264 days (ranging from 93 to 573 days) in DY00/01, with the majority of that time taken up by sampling, testing, and data report preparation by the applicant. Note that Figure 1-5 shows the average time required for each of the three phases of the dredged material evaluation process, the sum of which does not equal the mean time for the entire process.

Figure 1-5. DMMP Processing Time

Means for DY00/01 Projects (days)



CHAPTER 2

DISPOSAL SITE USE AND MONITORING

A. DISPOSAL ACTIVITY AND SITE USE

The Washington Department of Natural Resources (DNR) issues site-use authorizations to project proponents wishing to dispose of suitable dredged material at PSDDA and Grays Harbor/Willapa Bay (GH/WBDDA) designated disposal sites. These authorizations are issued for sediments that are 1) suitable for unconfined open-water disposal as determined by the Dredged Material management Program (DMMP) evaluation process, and 2) associated with dredging projects which have received all required regulatory permits (e.g., CWA 401/404 permits). This section of the report describes the PSDDA and GH/WBDDA disposal activity for Dredging Years 2000 and 2001 (i.e., June 16, 1999 through June 15, 2000 and June 16, 2000 through June 15, 2001). This information is discussed by year and individual disposal site.

Dredging Year 2000 (June 16, 1999 through June 15, 2000)

In DY00, a total of 1,254,353 cubic yards (cy) of dredged materials were deposited at two PSDDA sites, while 2,224,445 cy were deposited at GH/WBDDA disposal sites. The Commencement Bay disposal site received 893,776 cy of dredged material, primarily from the Blair Waterway Deepening Project, while Elliott Bay received 360,577 cy, primarily from the East Waterway. Grays Harbor received 2,224,445 cy of dredged material, 1,282,663 cy of which went to the South Jetty site. The remaining volume, 941,782 cy, was deposited at the Point Chehalis site. The Willapa Bay disposal sites were not utilized during DY00. These volumes are presented graphically in **Figures 2-1** and **2-2**, and are shown in **Tables 2-1** and **2-2**.

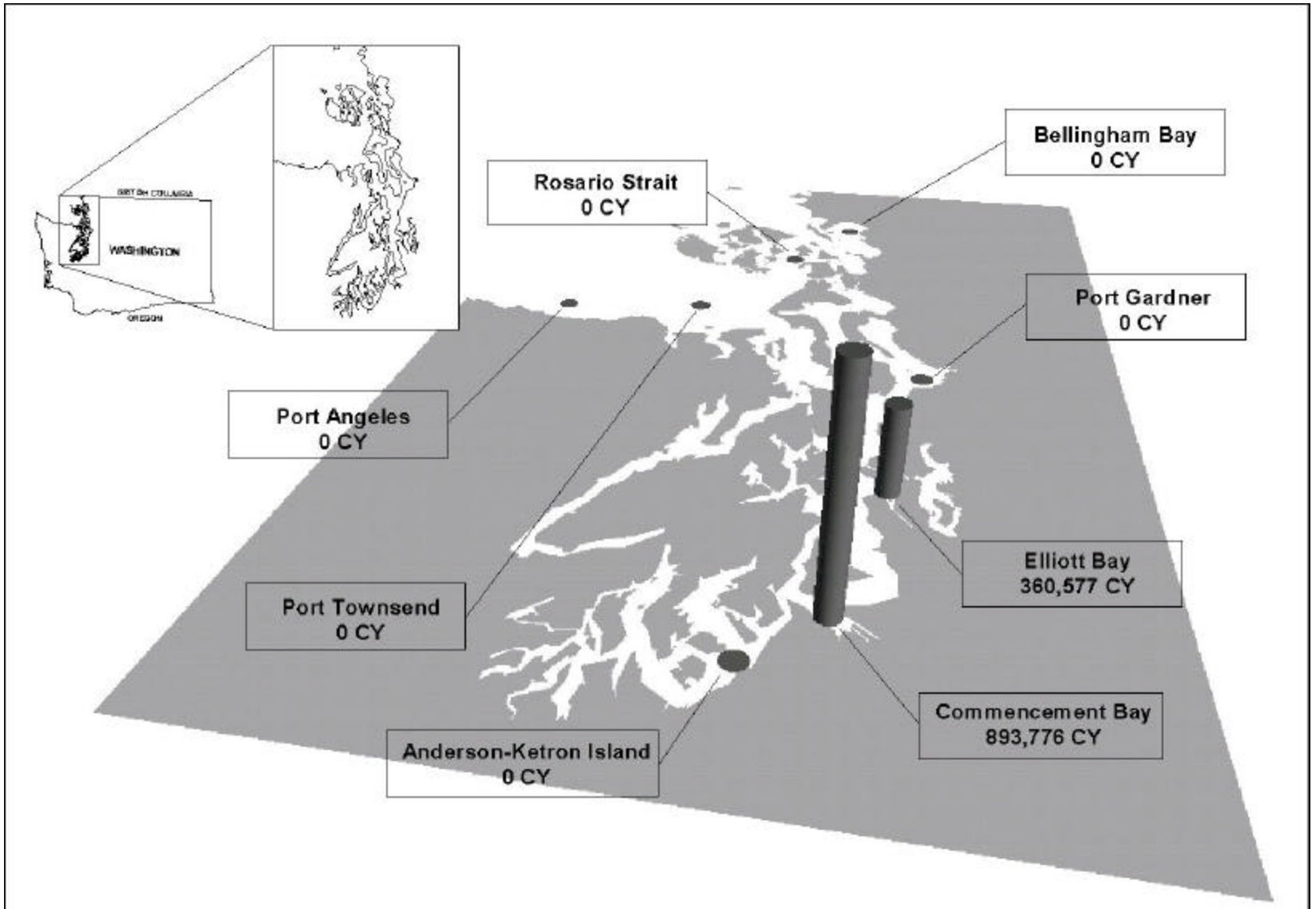


Figure 2-1. Dredging Year 2000 Disposal Volumes

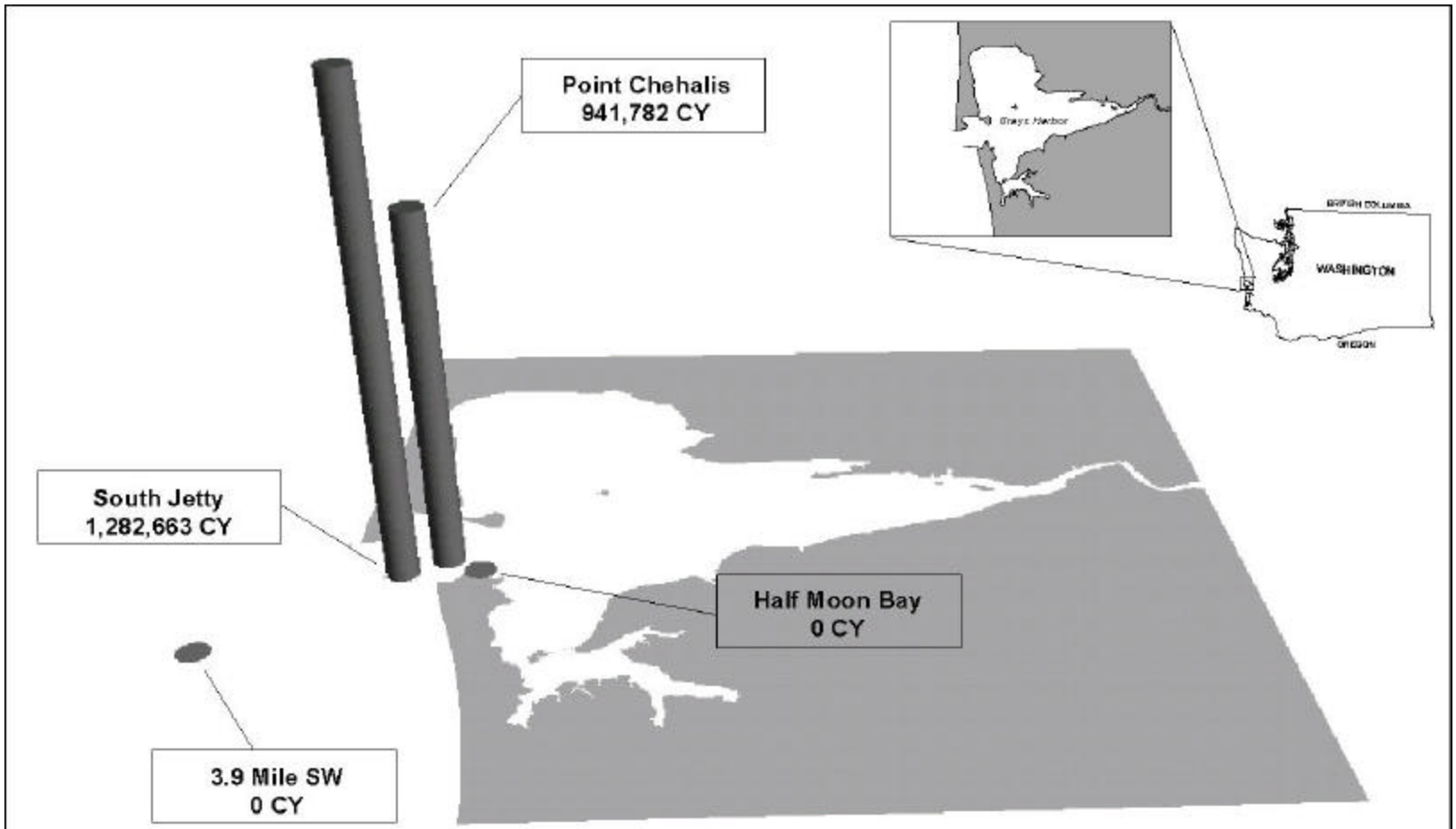


Figure 2-2. Dredging Year 2000 Disposal Volumes for Grays Harbor

Table 2-1. Disposal Site Activity Summary, DY00

Disposal Site	Jurisdiction	Number of Projects	Total Volume (cy)
Anderson/Ketron	PSDDA	0	0
Bellingham Bay	PSDDA	0	0
Commencement Bay	PSDDA	1	893,776
Elliott Bay	PSDDA	4	360,577
Port Angeles	PSDDA	0	0
Port Gardner	PSDDA	0	0
Port Townsend	PSDDA	0	0
Rosario Strait	PSDDA	0	0
Point Chehalis	Grays Harbor	1	941,782
South Jetty	Grays Harbor	2	1,282,663
Cape Shoalwater	Willapa Bay	0	0
Goose Point	Willapa Bay	0	0
All Sites within Jurisdiction	PSDDA	5	1,254,353
	Grays Harbor	3	2,224,445
	Willapa Bay	0	0

Table 2-2. Summary of Disposal Activity by Site and Proponent, DY00

Site	Proponent	Dredging Contractor	Disposal Volumes (cy)	# Barge Loads	Off site	Disposal Dates
CB	Port of Tacoma / Corps of Engineers	American Const. Co.	893,776	708	No	Sep 1999 – Feb 2000
EB	Port of Seattle	General Const. Co.	94,075	59	No	Dec 1999 – Jan 2000
EB	Port of Seattle	Manson Const. Co	56,135	50	No	Jan – Feb 2000
EB	Boyer Alaska Barge Line	A.H. Powers, Inc.	3880	3	No	Jul 1999
EB	Harold L. Hurlen	A.H. Powers, Inc.	5633	4	No	Jul 1999
EB	James Hardie Gypsum	Manson Const. Co.	3,682	12	No	Jan 2000
EB	U.S. Army Corps of Engineers	A.H. Powers, Inc. & General Construction	71,368 125,804	44 91	No	Jun 1999 Dec 1999 – Feb 2000
SJ	Port of Grays Harbor	Dutra Dredging Co.	14,832	5	No	Jul – Aug 1999
SJ	U.S. Army Corps of Engineers	Corps	492,187 281,353 746,600	131 72 409	No	Jun – Aug 1999 Mar – May 2000 Apr – May 2000
PC	U.S. Army Corps of Engineers	Corps	52,952 394,539 494,291	23 99 425	No	Jun 1999 Mar – May 2000 Apr – May 2000

Legend: CB = Commencement Bay, EB = Elliott Bay, SJ = South Jetty (Grays Harbor), PC = Point Chehalis (Grays Harbor)

Dredging Year 2001 (June 16, 2000 through June 15, 2001)

In DY01, a total of 1,072,172 cy of dredged materials were deposited at four PSDDA disposal sites. The Commencement Bay site received 265,867 cy of dredged material, while Elliott Bay received 557,340 cy. The Port Gardner and Rosario Strait disposal sites received 248,965 and 10,419 cy, respectively. Grays Harbor received 1,141,417 cy of dredged materials, 555,247 cy of which were deposited at the Point Chehalis site. 358,873 cy were deposited at the South Jetty site, and 227,297 cy were deposited at the Southwest beneficial use site. A total of 178,185 cy of dredged materials were deposited at Willapa Bay, all of which went to the Cape Shoalwater site. These volumes are presented graphically in **Figures 2-3** and **2-4**, and are shown in **Tables 2-3** and **2-4**.

Table 2-3. Disposal Site Activity Summary, DY01

Disposal Site	Jurisdiction	Number of Projects	Total Volume (cy)
Anderson/Ketron	PSDDA	0	0
Bellingham Bay	PSDDA	0	0
Commencement Bay	PSDDA	2	265,867
Elliott Bay	PSDDA	2	557,340
Port Angeles	PSDDA	0	0
Port Gardner	PSDDA	1	248,965
Port Townsend	PSDDA	0	0
Rosario Strait	PSDDA	1	10,419
Point Chehalis	Grays Harbor	2	555,247
South Jetty	Grays Harbor	1	358,873
Southwest Beneficial Use Site	Grays Harbor	1	227,297
Cape Shoalwater	Willapa Bay	1	178,185
Goose Point	Willapa Bay	0	0
All Sites within Jurisdiction Combined:	PSDDA	6	1,072,172
	Grays Harbor	4	1,141,417
	Willapa Bay	1	178,185

Table 2-4. Summary of Disposal Activity by Site and Proponent, DY01

Site	Proponent	Dredging Contractor	Disposal Volume (cy)	# Barge Loads	Off Site	Disposal Dates
CB	Port of Tacoma	American Const. Co.	46,393	40+	No	Aug – Dec 2000
CB	Port of Tacoma / U.S. Army Corps of Engineers	American Const. Co.	215,809	179	No	Aug – Nov 2000
CB	Louisiana Pacific	A.H. Powers, Inc.	3665	4	No	Feb 2001
EB	U.S. Navy	General Const. Co.	538,594	481	No	Jun 2000 – Feb 2001
EB	Duwamish Yacht Club	Manson Const. Co.	18,746	39	No	Oct – Dec 2000
PG	Port of Everett / U.S. Army Corps of Engineers	Manson Const. Co.	248,965	135	No	Jan – Feb 2001
RS	Port of Bellingham	A.H. Powers, Inc.	10,419	7	No	Feb 2001
SJ	Port of Grays Harbor	Dutra Dredging Co., Inc.	76,800	17	No	Jan – Feb 2001
SJ	U.S. Army Corps of Engineers	Corps	358,873	327	No	Apr – May 2001
PC	U.S. Army Corps of Engineers	Corps	241,167 314,080	61 96	No	Jul – Aug 2000 Jan – Feb 2001
SW	U.S. Army Corps of Engineers	Corps	227,297	45	No	May 2001
CS	U.S. Army Corps of Engineers	Manson Construction	178,185	192	No	Oct – Nov 2000

Legend: CB = Commencement Bay, EB = Elliott Bay, SJ = South Jetty (Grays Harbor), PC = Point Chehalis (Grays Harbor), SW = Southwest Beneficial Use Site (Grays Harbor)

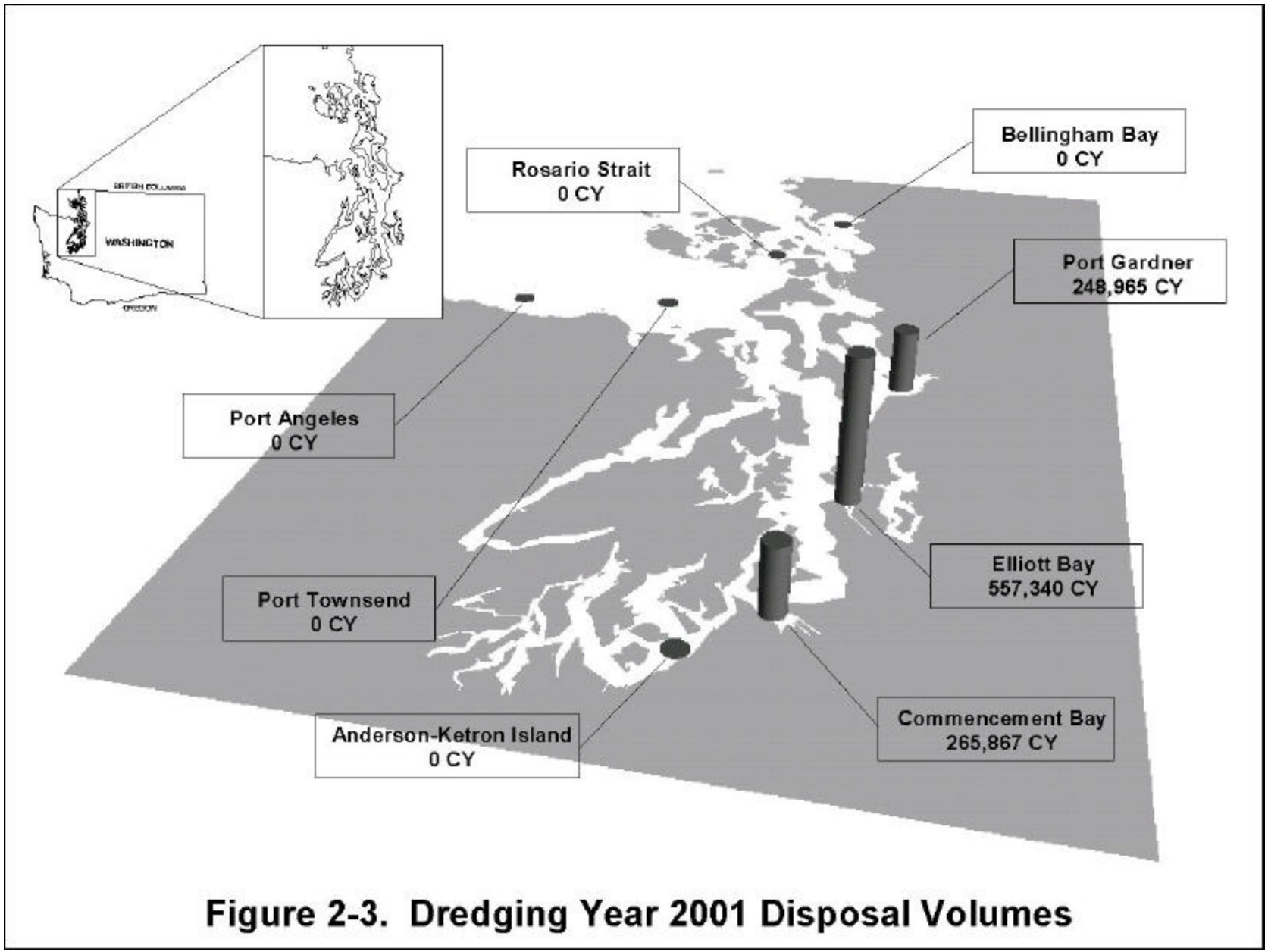


Figure 2-3. Dredging Year 2001 Disposal Volumes

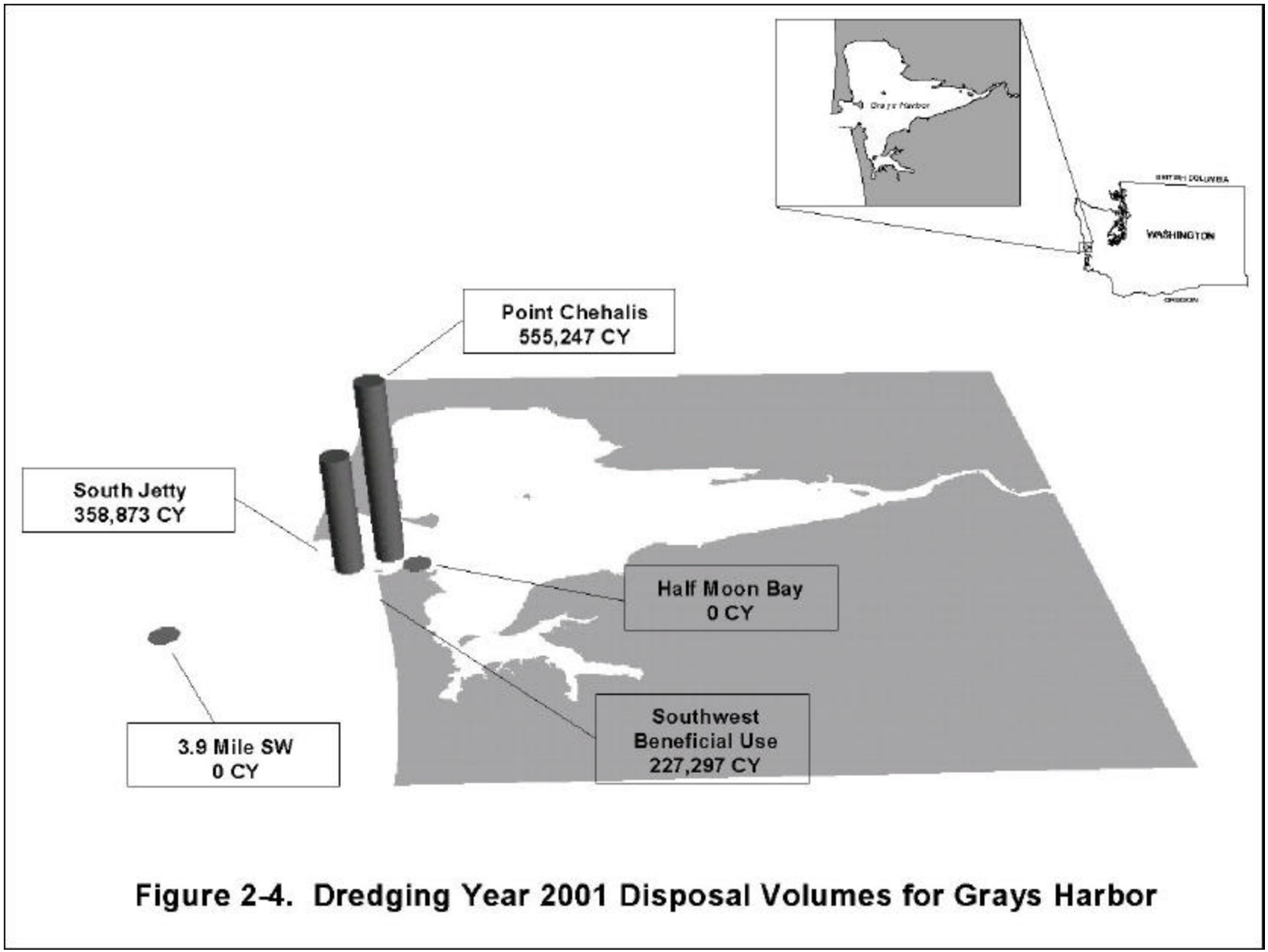


Figure 2-4. Dredging Year 2001 Disposal Volumes for Grays Harbor

B. POST-DISPOSAL SITE MONITORING

Overview: Environmental monitoring is the primary tool utilized in the management of PSDDA non-dispersive disposal sites. The main objective of post-disposal site monitoring is to determine whether the disposal of dredged materials has adversely affected the disposal site environment. Environmental monitoring includes physical, chemical, and biological assessment of the sediments and biological resources in, and adjacent to, the disposal site being monitored. The PSDDA monitoring program compares the post-disposal monitoring results to "baseline" values. Values for key environmental parameters, such as sediment chemistry, toxicity, and biological community structure, were determined for each PSDDA site and the associated benchmark stations prior to the first use of the sites to serve as baseline data for later reference (PTI, 1988; 1989). The DMMP agencies now use a time-trend analysis approach to evaluate changes in site chemistry over time. The new analysis technique was first used in 1996 to evaluate post-disposal monitoring data from Commencement Bay.

Post-disposal site monitoring surveys address these three major questions:

1. Is the dredged material deposited on site?

2. Is the deposited dredged material producing chemical and/or biological conditions on site beyond the "minor adverse effects" levels allowed by the PSDDA site management plans?

3. Is the dredged material causing any adverse impacts to biological resources beyond the disposal site boundaries?

Full PSDDA monitoring was designed to address all three questions; partial PSDDA monitoring addresses only questions 1 and 2. PSDDA monitoring is now designed to work in a tiered manner, with a partial monitoring event addressing questions 1 and 2. Question 3 is addressed if either of the first two questions is answered in the affirmative.

The U.S. Army Corps of Engineers (Corps) is responsible for physical monitoring, while DNR is responsible for chemical and biological monitoring of the PSDDA non-dispersive disposal sites. This environmental monitoring is conducted at irregular intervals based on the pattern of disposal site-use since the previous monitoring event. This pattern encompasses several important elements, such as volume and characteristics of the materials disposed at a given site, the nature and recency of previous site monitoring data, and site-specific environmental concerns. Each spring, DMMP technical staff review the previous year's disposal activity and determine, by consensus, which site(s), if any, will be monitored and at what intensity.

Based upon the aforementioned criteria, a full monitoring event was scheduled for the Elliott Bay disposal site in 2000. Based upon site use since the previous

monitoring event and the results of a 1998 physical survey of the Commencement Bay disposal site, at the end of DY01 the members of DMMP determined that a full monitoring event of the Commencement Bay site would be conducted in 2000. The results of that monitoring effort will be summarized in the next biennial report.

Full Monitoring at the Elliott Bay Disposal Site

The Elliott Bay disposal site was previously monitored in 1991 (Partial) and 1992 (Full). The disposal of 414,794 cy of dredged material on-site in DY99 prompted a Full Monitoring in 2000. In addition to meeting the goals of all monitoring efforts, the 2000 monitoring at Elliott Bay was also designed to address concerns related to dredged material disposal at PSDDA sites and the listing of Puget Sound Chinook and Bull Trout as threatened under the Endangered Species Act (ESA) of 1973. The tests used for ESA concerns included 45-day bioaccumulation tests using *Macoma* and *Nephtys*, and the P450RGS cell line assay with modifications by the U.S. Army Corps of Engineers Waterways Experiment Station (WES) for sediment and tissue. Physical, chemical, and biological analyses were conducted at up to 61 sampling locations.

Physical Monitoring

Physical monitoring consisted of analysis of the disposal site using the Sediment Vertical Profile System (SVPS), a camera/prism apparatus which allows photographic mapping of vertical profiles of sediment deposits (**Figure 2-5**). The resultant images are then used to determine presence and thickness of dredged materials at each sampling location. Sixty-seven stations were occupied during the 2000 monitoring event, with 210 images collected. One image from each station was analyzed for the aforementioned characteristics, and replicate images for approximately 20% of the stations were analyzed for intercomparison as part of the QA process. The images were analyzed for presence of dredged materials, depth of prism penetration, boundary roughness, depth of apparent Redox Potential Discontinuity (RPD), and infaunal successional stage.

Recently deposited dredged materials were found within the disposal site boundary, with no dredged materials existing off-site based upon analysis of the perimeter stations. The small lobe of materials observed outside of the site boundary in the southwest area of the site was placed in that location by design to cover historic PCB contamination deposited in 1974. The thickest deposits of dredged materials (greater than prism penetration) were found around the center of the disposal site. An elongated (north-south) deposit of bioturbated or relict dredged material surrounds that central deposit, with a slight excursion outside of the site boundary in the south-west (**Figure 2-5**). Again, no dredged materials were observed at any of the perimeter stations, the trigger for determination of off-site materials. Prism penetration was relatively high throughout the site, with a major mode of 16 to 17 cm. A notable exception was observed at perimeter station EBP13 (0.32 cm), which suggests a rocky or hard bottom at that location. The distribution of the grain size

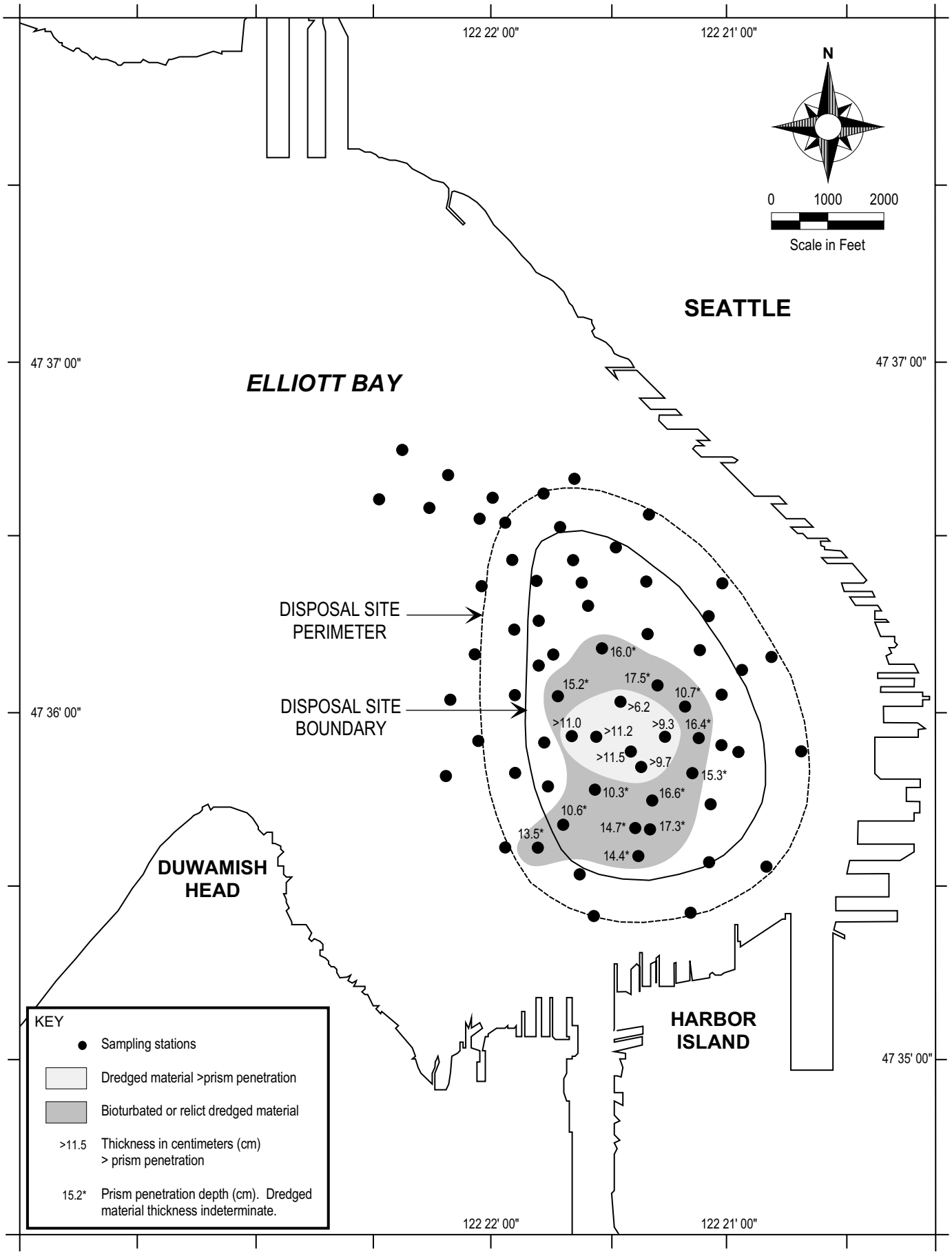


Figure 2-5. Dredged material (dm) footprint measured during the 2000 Elliott Bay SVPS survey. Thickness measured in centimeters (cm).

major modes showed that the site is covered by very fine sands and silts/clays. The very fine sands at the site center reflect the recent deposition of dredged materials. The sandy sediments in the southern portion of Elliott Bay are due either to Duwamish River discharge or historical dredged material disposal. The distribution of infaunal successional stages shows that highest benthic community successional stages exist throughout much of the site, with the lowest successional stage restricted to the disposal site center. These results are expected, as the site center is the area of greatest disturbance due to the frequency and volume of disposal activities.

Sediment Chemistry

Sediment conventional parameters were generally comparable to the 1988, 1990, and 1992 data. However, total organic carbon (TOC), ammonia, and total volatile solids (TVS) were slightly higher at the onsite stations than in 1992. Total sulfides concentrations were also somewhat higher at the onsite, perimeter, and benchmark stations than in 1992. The higher levels at the perimeter and benchmark stations, which did not show deposits of dredged materials, indicate that the increase in total sulfides was a bay-wide occurrence rather than a site-specific one. Mercury levels exceeded the PSDDA screening level (SL) in four samples, one of which also exceeded the Washington State Sediment Management Standards (SMS) criterion. Compared to 1992 results, cadmium concentrations were generally higher, while copper and silver concentrations were generally lower in 2000 than in 1992. Volatile organic compounds, chlorinated aromatic hydrocarbons, and pesticides were not detected in any of the sediment samples. No PSDDA SL or state SMS criteria were exceeded for PAHs. PCBs were lowest at the site center (undetected), while concentrations in 4 other samples at two stations exceeded the PSDDA SL criterion. It is notable that the highest concentration of PCBs observed was at perimeter station EBP07, which had no dredged material present. This may indicate historic contamination, or more recent contamination that was not covered by dredged material. Butyltin concentrations, which exceeded the PSDDA SL criteria in nine samples, were also lowest at the site center and highest at benchmark stations EBB01 and EBB02. Again, this probably indicates historic contamination since benchmark stations are located in areas removed from influences of dredged material disposal, but in the vicinity of other potential sources of contamination.

Tissue Chemistry

Tissue chemistry data was collected from triplicate samples of *Molpadia* sea cucumber tissue collected at transect stations EBT03 and EBT05. The samples were analyzed for metals, semi-volatile organic compounds, pesticides/PCBs, and butyltin compounds. No organic compounds were detected in any of the samples, and metals detected in all sample replicates were at low concentrations.

Bioassays

PSDDA bioassays were conducted using sediments from three on-site stations. The assays include the 10-day acute amphipod test using *Eohaustorius estuarius*, the sediment larval test using the sand dollar *Dendraster excentricus*, the 20-day polychaete *Neanthes* mean growth test, and the saline Microtox® test. The first amphipod test using *Eohaustorius* and sediments from the site-center station (EBZ01) resulted in high observed mortality (40%), a one-hit failure according to PSDDA guidelines that establish a maximum mortality of 20% over the control. The sediments used for the test were extremely fine-grained, with a clay content of 36.4%. High *Eohaustorius* mortality has been observed in other studies where high clay contents (>15% clay) were present (SAIC, 1999a; b).

Because the amphipod test results for EBZ01 were not consistent with those for the other two on-site stations, the test was run again on archived material using both *Eohaustorius estuarius* and *Ampelisca abdita.* The latter species is not known to be sensitive to clay. The mortality observed in the *Ampelisca* re-test was quite low (5%) and the re-test of *Eohaustorius* produced mortality results of 17%, neither of which is a hit under PSDDA interpretation guidelines.

A toxic response was also observed in the sediment larval test. The samples used during this test were not aerated as required by the DMMP protocol, which tends to reduce the effects of high fine fractions and ammonia levels on the larvae (EPA, 1993). Interstitial ammonia levels were relatively high, so it is quite possible that ammonia levels contributed to the observed toxicity. As a result, DMMP recommended that the sediment larval test be repeated. In attempting to conduct the larval test using *Dendraster excentricus* and the bivalve test using *Mytilus galloprovincialis* under aeration, the bioassay laboratory was unable to obtain viable animals for the tests. The remaining sediment was used during those attempts, so the sediment larval test was not successfully reanalyzed. The issue of aeration was not resolved, so the results of the first test remain suspect. Therefore, the sediment larval test results were not used to evaluate any of the hypotheses of the monitoring effort.

The results of the *Neanthes* test showed no mortality and no exceedances of the PSDDA bioassay evaluation guidelines for mean growth rates. The saline Microtox® test passed for all onsite sediments analyzed.

While any toxic response observed in the first round of bioassay testing would normally trigger the analysis of the benchmark samples, DMMP decided that those analyses would not be necessary for the following reasons:

- The high clay content in recently deposited dredged materials at the site-center station may have been a contributing factor to the toxic response observed.
- The toxic response was not supported by chemical analysis of the sediments.

- The toxic response was not supported by the results of either the *Neanthes,* Microtox® tests, and the amphipod retest.
- No toxicity was observed at the other two on-site stations.

Benthic Infaunal Analysis

Samples of benthic infauna, those organisms living in the sediment below the sediment-water interface, were identified and enumerated for transect stations EBT01, EBT03, and EBT05. Only samples collected from the top 10 cm of each boxcore sample that were sieved through a 1.0 mm sieve were analyzed. The total abundance of major taxa observed increased with distance from the site, as observed in 1988 and 1992. The differences between stations were not statistically significant. The mean number of polychaete worms was lowest at transect station EBT05, while the mean number of mollusks was higher at station five than at the other two stations. Mean crustacean abundances were similar among all three stations. The trend observed for the mean number of taxa, diversity, and Swartz's index was EBT01 > EBT03 > EBT01, which, although not statistically significant, was similar to the trend observed in the 1992 monitoring event.

The overall biomass results showed that transect station EBT05 had biomasses 7 and 15 times higher than stations EBT01 and EBT03, respectively. This is primarily due to the large sea cucumbers (*Molpadia*) collected in the second and fifth replicates at EBT05. The biomasses of other major taxa were comparable among stations, and generally reflected the differences in abundances for those taxa among stations. Numerically dominant species among the three stations included the bivalve *Axinopsida serricata,* the polychaete *Ampharete acutifrons,* the cumaceans *Eudorella pacifica* and *Eudorellopsis integra,* the ostracod *Euphilomedes producta,* the bivalve *Macoma carlottensis,* the amphipod *Harpiniopsis fulgens,* and the polychaete *Euclymeninae* sp.

Special Studies

45-Day Bioaccumulation: The 45-day bioaccumulation test using *Macoma nasuta* and *Nephtys caecoides* was conducted at one benchmark station (EBB02) and one composite of onsite stations (EBZ01, EBS02, and EBS04). Reference sediments were collected from Carr Inlet for parallel testing and comparison. The results of the test using *Macoma* showed significant increases in Silver (Ag), Copper (Cu), Lead (Pb), Antimony (Sb), Zinc (Zn), Mercury (Hg), and Tributyltin above reference sediments. None of those results exceeded standards for human health. The *Nephtys* tests showed significant increases above reference sediments for Lead (Pb) and Mercury (Hg), neither of which exceeded standards for human health.

PCB Analysis and WES Cell-Line Assay: Co-planar polychlorinated biphenyls (PCBs) analysis of tissue samples from the bivalve *Macoma* and the polychaete *Nephtys* were conducted to correlate determined concentrations with the results of the P450 Reported Gene System cell-line screening assay for polychlorinated dibenzo-p-dioxins

and related compounds. For tissues, the assay provides data on the relative amount of dioxin and dioxin-like compounds bioaccumulated by the organism in question (SAIC, 2001). In order for the cell-line test to be effective in screening for dioxin-like congeners in tissues and sediments, it should consistently identify those samples with higher concentrations of dioxin-like PCBs in relation to the other samples, and provide a quantitative estimate of the concentration of dioxin-like congeners that can be correlated with high resolution analytical data. Results of the analysis were inconclusive regarding the utility of using the cell line test to identify sediments and tissues of potential concern or estimate the ecological/human risk associated with those sediments. The lack of conclusive determination of the utility of the test was primarily due to the low levels of PCB contamination observed in both the sediment and tissue samples tested. The results do, however, provide valuable baseline information on cell line response and congeners associated with sediment and tissues from the Elliott Bay dredged material disposal site and surrounding environs. However, the results do show that PCB levels in dredged material disposed at the Elliott Bay site are low and probably not a concern for either endangered species passing through the site or benthic feeding demersal flatfish species that may be foraging at the disposal site.

Conclusions

Based upon the results of the analyses discussed above, the following conclusions have been reached:

1. Recently deposited dredged material is confined within the disposal site perimeter.
2. Chemical concentrations off-site have not increased as a result of dredged material disposal on-site.
3. Sediment chemical concentrations onsite do not exceed PSDDA Site Condition II guidelines due to dredged material disposal.
4. Sediment toxicity at the on-site stations does not exceed the PSDDA Site Condition II guidelines due to dredged material disposal.

C. SUMMARY: DMMP DISPOSAL SITE USE AND MONITORING FREQUENCY

The cumulative dredged material volumes disposed at each PSDDA site and Grays Harbor/Willapa Bay Site since program implementation are depicted in **Table 2-5** and **Figures 2-6 and 2-7**. All eight PSDDA sites have been used, and the two estuarine sites in Grays harbor and Willapa Bay have also been utilized. Thirteen year summaries of site use for the PSDDA sites generally show that site capacities appear to be sufficient to last at least thirty years relative to initial site forecasted volumes and site capacity estimates (**Figure 2-6**, **Table 2-6**). Over the thirteen years of PSDDA implementation (1989-2001) approximately 8,338,457 cubic yards total have been placed at all eight open-water sites, averaging 641,457 cubic yards per year.

Table 2-5. Cumulative Site use summary.

Disposal Site	Dredging Years Used	Cumulative Volumes Disposed (cubic yards)
PSDDA	**(1989 - 2001)**	
Anderson/Ketron (ND)	93, 95	18,874
Commencement Bay (ND)	89, 91, 95, 96, 98, 99, 00, 01	2,762.591
Elliott Bay (ND)	90, 91, 92, 93, 94, 95, 96, 97,98, 99, 00, 01	2,176,804
Port Gardner (ND)	90, 91, 93, 94, 95, 96, 97	1,971,848
Rosario Strait (D)	91, 92, 93, 94, 95, 96, 98, 99	1,278,970
Bellingham Bay (ND)	93, 96, 98	78,883
Port Townsend (D)	93, 98, 99	28,628
Port Angeles (D)	96	22,344
Total cumulative volume		**8,338.942**
GRAYS HARBOR	**(1996 - 2001)**	
Point Chehalis (D)	96, 97, 98, 99, 00, 01	4,350,369
South Jetty (D)	96, 97, 98, 99, 00, 01	6,208,824
Half Moon Bay (beneficial uses site)	96, 97, 98, 99	956,203
Southwest beach renourishment site	01	227,297
3.9 Mile Ocean (D)	not used	
Total cumulative volume		**11,742,693**
WILLAPA BAY	(1996-2001)	
Cape Shoalwater (D)	01	178,185
Goose Point (D)	99	27,647
Total cumulative volume		**205,832**

Legend: ND = nondispersive; D = dispersive

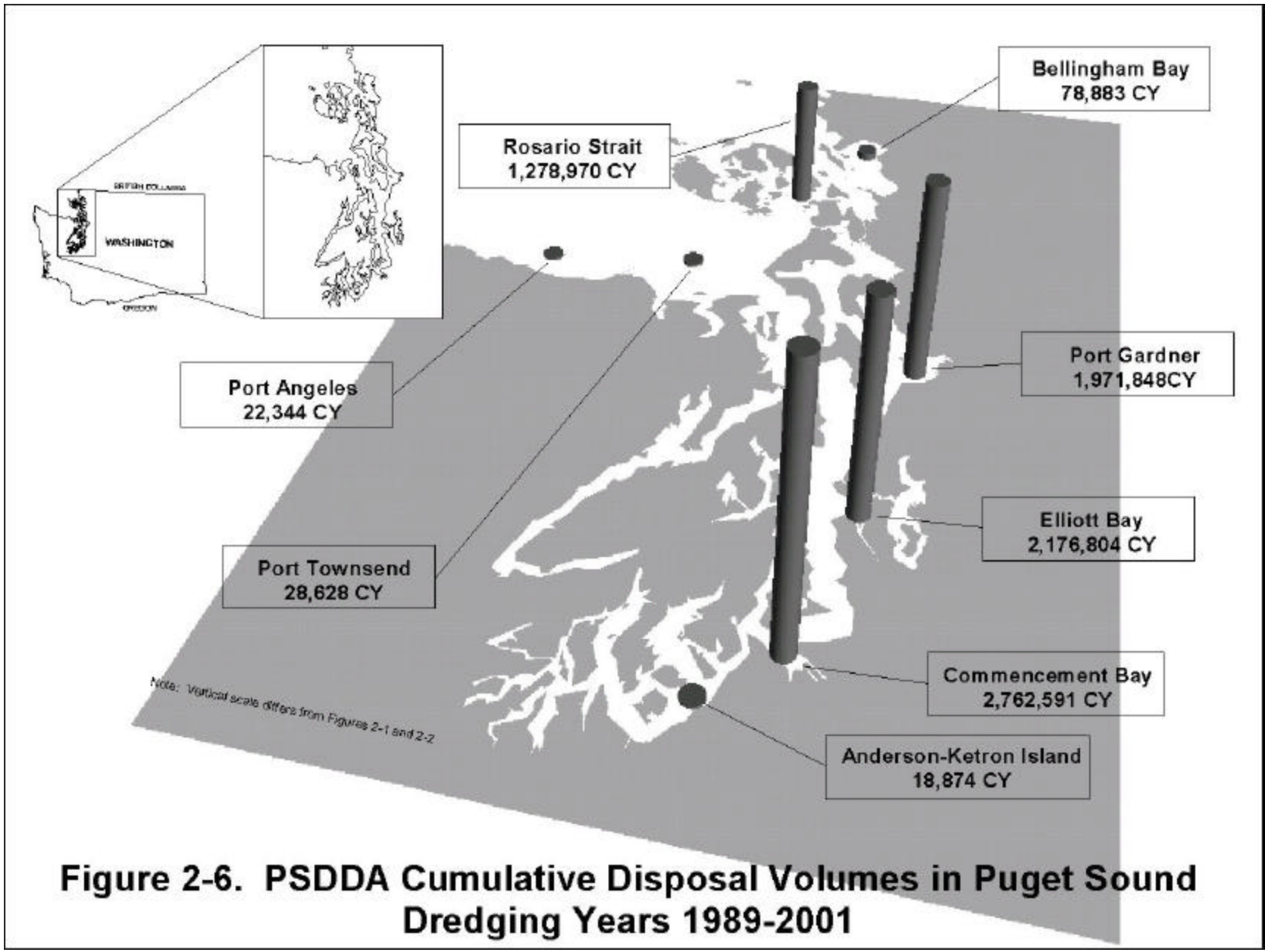


Figure 2-6. PSDDA Cumulative Disposal Volumes in Puget Sound Dredging Years 1989-2001

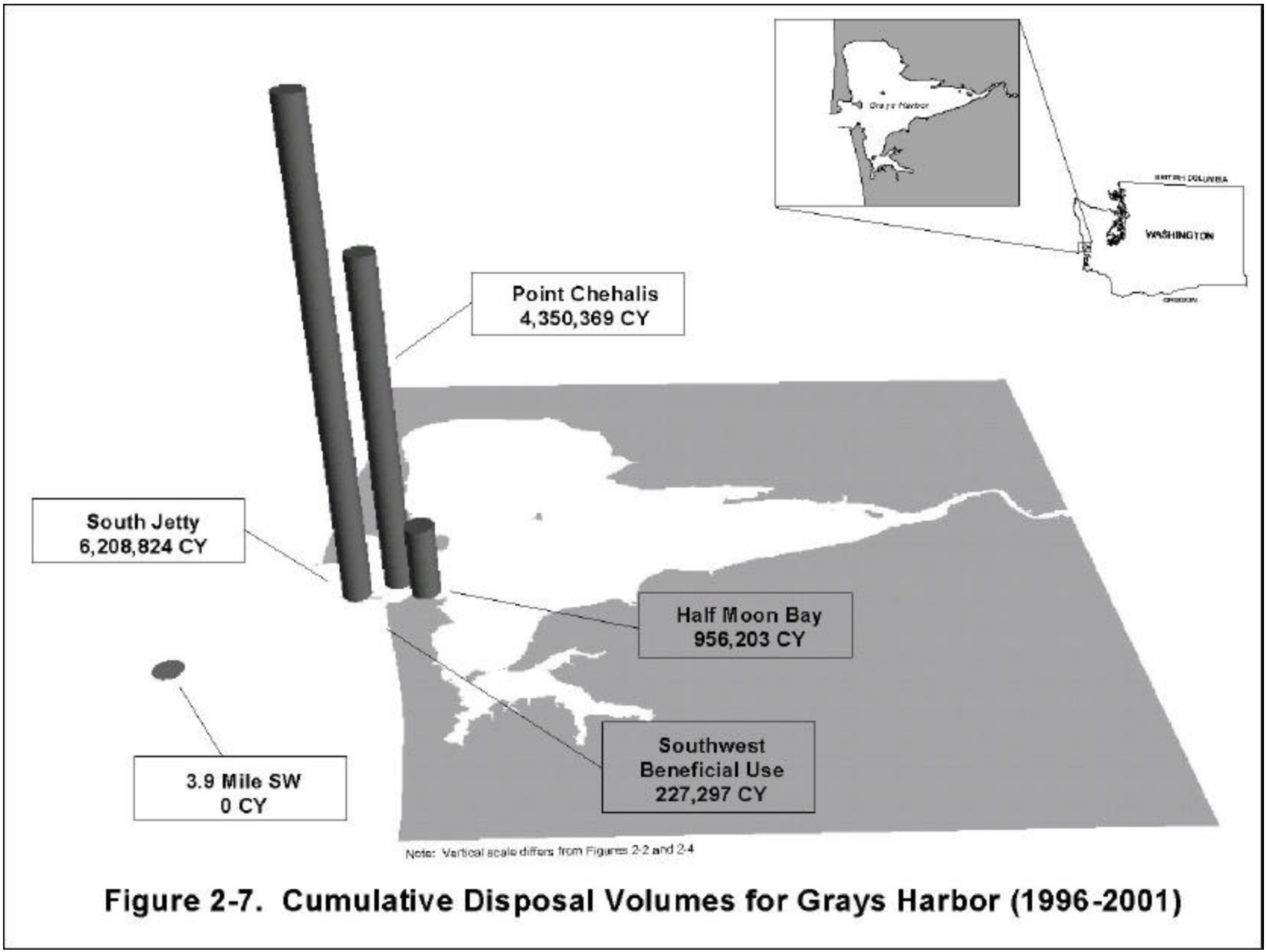


Figure 2-7. Cumulative Disposal Volumes for Grays Harbor (1996-2001)

Table 2-6. Thirteen Year (1989-2001) PSDDA Site Use Summary.

Nondispersive Disposal Site	Cumulative Volumes (CY)	Average Volume Per Year (CY/YR)	15-Year Predictions MPR Phase I/II (CY)	Percent of 15-Year Prediction	Estimated Time to Exceed Site Capacity[1] (Years)
Port Gardner (1989-2001)	1,971,848	151,681	8,243,000	23.9	46.3
Elliott Bay (1989-2001)	2,176,804	167,446	10,525,000	20.7	40.7
Bellingham Bay (1990-2001)	78,883	6,574	1,181,500	6.7	1,357
Commencement Bay (1989-2001)	2,762,591	212,507	3,929,000	70.3	29.4
Anderson/Ketron Island (1990-2001)	18,874	1,573	785,000	2.4	5,709
SUBTOTALS:	**7,009,000**	**539,154**	**24,763,500**	**28.3**	N/A
Dispersive Disposal Site	**Cumulative Volumes (CY)**	**Average Volume per Year (CY/YR)**	**15-Year Predictions MPR Phase I/II (CY)**	**Percent of 15-Year Prediction**	**Estimated Time to Exceed Site Capacity[2] (Years)**
Rosario Strait (1990-2001)	1,278,970	106,581	1,801,000	71.0	N/A
Port Townsend (1990-2001)	28,628	2,386	687,000	4.2	N/A
Port Angeles (1990-2001)	22,344	1,862	285,000	7.8	N/A
SUBTOTALS:	**1,329,942**	**110,829**	**2,773,000**	**48.0**	N/A
GRAND TOTALS:	**8,338,942**	**641,457**	**27,536,500**	**30.3**	N/A

[1] Site capacity estimated in Phase II Disposal Site Selection Technical Appendix for non-dispersive sites is approximately 9,000,000 cubic yards.

[2] Actual site capacity for dispersive sites is not limited, assuming complete dispersal of dredged material off site.

Table 2-7 lists the completed and scheduled DMMP disposal site monitoring events at the PSDDA nondispersive and dispersive sites. To date, the DMMP agencies have conducted ten post-disposal monitoring surveys at nondispersive sites - 4 full, 2 partial, and 2 tiered-full, 1 tiered-partial monitoring, and 1 SVPS only survey. Four of five nondispersive sites have been surveyed. The only nondispersive site not yet monitored is the Ketron/Anderson Island site, which has received relatively use to date. No monitoring at the Ketron/Anderson Island site is anticipated in DY02. Three bathymetric surveys have been conducted at the Rosario Strait dispersive site to date, which is the only dispersive site used on a frequent basis.

Table 2-7. PSDDA Disposal Site Monitoring Surveys.

Year	Disposal Site	Type of Survey
1990	Port Gardner	Full
1990	Elliott Bay	Partial
1992	Elliott Bay	Full
1991	Rosario Strait	Bathymetric
1993	Bellingham Bay	Partial
1994	Port Gardner	Tiered-Full
1994	Rosario Strait	Bathymetric
1995	Commencement Bay	Tiered-Full
1996	Commencement Bay	Tiered-Partial
1998	Commencement Bay	SVPS
1999	Rosario Strait	Bathymetric
2000	Elliott Bay	Full
2001	Commencement Bay	Full

Based on PSDDA site monitoring data collected to date (including physical mapping, on and offsite sediment chemistry, sediment toxicity, offsite infaunal bioaccumulation, and offsite benthic community structure data), dredged material disposal is not causing adverse impacts at or adjacent to any of the nondispersive sites. PSDDA evaluation procedures appear to adequately protect the environmental conditions at the disposal sites.

The overall goal of the PSDDA site monitoring program is to ensure that the PSDDA prescribed disposal site conditions are maintained and verify that PSDDA dredged material evaluation procedures adequately protect the environment. Monitoring surveys provide positive feedback to verify the adequacy of the PSDDA dredged material management process. Annual review meetings provide a forum to report on these post-disposal survey findings conducted during any given dredging year, and any adjustments to the management plan.

The PSDDA Management Plan Reports (MPR, 1988, 1989) recognize that intensive post-disposal monitoring surveys would be required early in the program implementation to gather data on the adequacy of the evaluation procedures to meet the site management objectives. Seven monitoring events to date have not detected unexpected adverse impacts at any of the four nondispersive sites that have been monitored. In accordance with the management plan, following the 1997 SMARM, the DMMP agencies reduced the frequency and scope of monitoring based on past documented compliance with the site management objectives. These modifications to the management plan formally incorporated tiered-full monitoring into the management plan, and to initiate monitoring when cumulative volumes approach or exceed 300,000 cubic yards since the last monitoring event. The DMMP agencies continue to assess the perimeter chemistry evaluation approach adopted and implemented following the 1997 SMARM.

The Corps, on behalf of the PSDDA agencies, in 1999, initiated a consultation process with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA) relative to the PSDDA disposal sites. Both NMFS and USFWS concurred in letters dated May 31, 2000 and June 19, 2000, respectively, with the findings of the Programmatic Biological Evaluation (PBE), that disposal of dredged material at the five non-dispersive disposal sites and three dispersive sites "may affect, but are not likely to adversely affect" the listed species.

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PTI, 1989. Puget Sound Dredged Disposal Analysis: Baseline Survey of Phase II Disposal Sites. Prepared for Washington Department of Ecology. PTI Environmental Services, Bellevue, WA.

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Appendix A

The following discussion includes those projects requiring explanation beyond the summaries provided in Chapter 1 for ranking, sampling plan development, chemical testing, biological testing, or those for which the DMMP agencies used best professional judgement.

Dredging Year 2000

USACE Olympia Harbor Maintenance Dredging. The Corps of Engineers and the Port of Olympia proposed to dredge approximately 635,000 cubic yards of sediment from Olympia Harbor. There were no exceedances of 1999 DMMP screening levels for the standard list of chemicals of concern for the Olympia Harbor Maintenance project. A tiered approach was used in the analysis for Tributyltin (TBT). Composites in the berthing are (B1 and B2) were analyzed for TBT. If there were no TBT exceedances in these samples, TBT testing would not be required for the rest of the samples. Composite B1 had a porewater TBT level of 0.28 ug/L, above the screening level of 0.15 ug/L. This exceedance triggered the requirement to test all remaining DMMUs for TBT. One of these DMMU also exceeded the screening level for TBT (TBW-1). DMMU exceeding the screening level for TBT are required to undergo bioaccumulation testing in order to determine suitability for open-water disposal.

A separate sampling and analysis effort was undertaken for the bioaccumulation testing of samples B1 and TBW-1. A sampling plan addendum was approved by the agencies in July 1999. Sampling for TBT bioaccumulation analysis was completed in August 1999.

Bioaccumulation testing was performed with bivalve *Macoma nasuta* and the polychaete *Nephtys caecoides*. The two species were tested together in the same 18-liter glass aquarium. At the time of project initiation, the standard DMMP bioaccumulation protocol called for 28-day test duration. The project proponents agreed to extend the test to 45 days, based on the recommendation of the DMMP agencies. The extended test provides a better approximation of steady-state tissue concentrations for TBT.

Six replicate aquaria (five test replicates and one replicate for steady state monitoring) were run for the two test sediments, the two reference sediments and the negative control.

Tissue concentrations from the 45-day exposure were compared to the reference sediments. Initial sediment chemistry was used to adjust the observed tissue concentrations. The sediment chemistry results between the first and second rounds of TBT testing differed, and so a ratio of the two was used to adjust the bioaccumulation tissue concentrations to reflect a "worst case" analytical result. These TBT chemistry results are as follows: DMMU B1

Initial (4/99) .28(?g/L), retest (8/99) 00.14 (?g/L), ratio I/R 2.0; DMMU TBW1: Initial (4/99) 0.16 (?g/L), retest (8/99) 0.02 (?g/L), ratio I/R 8.0.

The DMMP agencies agreed to use the target tissue level developed for the East Waterway project, 3 ppm dry weight of TBT in tissue, as the value appropriate for the Olympia Harbor Navigation Project. Given the limited residue-effects data for the Olympia area, it was determined that the number calculated for Elliott Bay would be the closest approximation available for making a determination of suitability. The method of calculation and the data supporting this value is documented in the suitability determination for the East Waterway project suitability determination (1999), paragraph 18, and in the "Review of Tissue Residue Effects Data for Tributyltin, Mercury and Polychlorinated Biphenyls", prepared by EVS solutions for the Port of Seattle.

TBT concentrations in tissues from *Macoma* and *Nephtys* exposed to test sediments were significantly less than the target tissue level of 3 ppm dry weight TBT in tissue. TBT tissue concentrations were also compared to reference and significant differences were observed for both DMMU. The DMMP agencies agreed that comparing statistical difference from reference is a necessary but not a sufficient condition to determine a DMMU unsuitable for open-water disposal. Sediments from these two DMMU are suitable because all TBT tissue concentrations are significantly less than the target tissue level, TBT is undetected in most test replicates and differs from reference only when conservative assumptions are applied to non-detected values, and TBT concentrations in the retested samples were all lower than the screening level.

East Waterway Stage II Project. The East Waterway Project was located in the high ranked lower Duwamish Waterway. The use of best professional judgement for this project was exercised during bioaccumulation testing. The bioassay testing results were relatively routine and will not be discussed here.

Of the 49 DMMUs that had bioaccumulation trigger (BT) exceedances 25 (including S-23) passed the DMMP bioassays interpretation guidelines for open-water-unconfined disposal during Phase 1 testing. **Table A-1** (also see **Appendix C**) highlights the 25 DMMUs and chemicals exceeding BTs that were subject to bioaccumulation testing during Phase 2.

The sediment analytical results for the initial and resampled/retested sediment for the 25 DMMUs requiring bioaccumulation testing are presented in **Table A-1**. The results of these sediment analyses indicated that there was often a large disparity between the Phase 1 and Phase 2 analytical results for the COCs that exceeded the BTs. When sediment chemistry results from Phase I testing exceeded those from Phase II, the ratio of the two was used to adjust the bioaccumulation tissue concentrations to reflect a "worst case" analytical result. In the cases where the ratio was less than 1 (Phase 1 < Phase II), no adjustments were made to the tissue concentration. Conventional sediment

parameters were also reanalyzed for the 25 DMMUs and indicated the sediment characteristics were largely similar between Phase 1 and 2.

As noted above, only 25 of 49 DMMUs with one or more BT exceedances in Phase 1 testing were subjected to bioaccumulation testing. The remaining 24 DMMUs failed Tier III bioassay testing and no additional testing (e.g., bioaccumulation) was required to complete the suitability determination.

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 8-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 (TBT, Fluoranthene, total DDT, and total PCBs), the applicant (Corps of Engineers/Port of Seattle) agreed to extend the exposure period to 45 days based on the recommendation of the DMMP agencies. The actual test was terminated at 44 days due to an increased rate of mortalities among the test species near the end of the test period.

Table A-1. DMMUs with bioaccumulation trigger exceedances.

DMMUs > BT	Sediment Concentrations exceeding BT			
	TBT **BT = 0.15** ?g/liter (porewater) Initial / Retest (I/R Ratio)	**Fluoranthene** **BT = 4,600** ?g/kg-DW Initial / Retest (I/R Ratio)	**Total DDT** **BT = 50** ?g/kg-DW Initial / Retest (I/R Ratio)	**Total PCBs** **BT = 38** mg/kg-OC norm.-DW Initial / Retest (I/R Ratio)
S4	0.18 / 0.11 (1.64)			
S5	0.31 MB / 0.09 (3.4)			103 / 53 (1.94)
S6	0.15 MB / 0.08 (1.9)			50 / 21 (2.4)
S7	0.19 MB / 0.09 (2.1)			
S8	0.17 M / 0.24 (0.7)			
S9				48 / 103 (0.46)
S10				42 / 329 (0.13)
S11			51 U / 47 (1.1)	**127 / 42 (3.0)**
S13				44 / 82 (0.54)
S14				56 / 98 (0.57)
S16			58 UJ / 61 (0.95)	**77 / 44 (1.75)**
S19				45 / 44 (1.02)
S21	0.15 M / 0.17 (0.9)			90 / 60 (1.5)
S23	0.28 J / 0.22 (1.3)		98 U / 43 (2.28)	**212 / 81 (2.6)**
S31	**0.35 B / 0.51 (0.6)**			
S39	0.23 M / 0.77 (0.3)			
S40	0.19 M / 1.05 (0.18)			
S41	0.23 M / 0.18 (1.3)			
S43	0.21 MB / 0.12 (1.75)			
S46	0.22 / 0.38 ((0.58)			
S47	0.83 / 4.0 (0.21)			
S49	0.25 MB / 0.24 (1.04)			38 / 90 (0.42)
S50	0.19 B / 0.12 (1.6)	6,400 / 800 (8.0)		88 / 41 (2.15)
S52	0.20 M / 0.17 (1.2)			
S57	0.92 MB / 0.47 (1.96)			

Legend: DW = dry weight; OC = organic carbon normalized value; M = estimated value; B = possible blank contamination; J = estimated value; U = Undetected at reported concentration; UJ = analyte not detected above the reported sample quantitation limit; Shaded cells denote DMMU's failing bioaccumulation test interpretation guidelines, which are discussed in text; I/R Ratio = highlighted yellow value: ratio of initial/retested for tested analyte.

Five replicate 8-gallon aquaria were run for the negative control, for each of the 3 reference sediments, and for each of the 25 tested DMMUs. In addition to the routine water quality metrics (temperature, salinity, dissolved oxygen, pH) that were monitored during the exposure period, the DMMP agencies recommended and the applicant agreed to collect an additional metric, wet-weight growth, during the exposure period to further assess the general health and well-being of the test animals. The results of growth and survival measurements taken for each species during the exposure period suggested

that for *Macoma nasuta* there was no apparent relationship between mean growth and survival during the exposure period. The results for *Nephtys caecoides* indicated there was a statistically significant ($p<0.01$) negative effect on survival with a reduction in mean growth during the exposure period.

Tissue concentrations of chemicals-of-concern from the 44-day exposures were compared statistically to the appropriate reference sediment, based on grain size similarity comparisons. As noted above, the calculated ratios of Phase 1 (initial)/Phase II (retest) sediment chemistry were used to adjust the observed tissue concentrations. Statistical comparisons of test DMMUs 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 **Table A-2** for each of the 25 DMMUs tested.

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 those DMMUs that were statistically greater than reference, a more in depth evaluation was 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 East Waterway Stage II bioaccumulation testing are as follows:

Tributyltin (TBT):	No guideline
Fluoranthene:	No guideline
DDT + DDE:	5.0 ppm wet weight (ww)
PCBs:	2.0 ppm ww

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 **fluoranthene** based on risk to humans consuming seafood is **8,400 ppm wet weight**.

As part of a suitability determination for the Port of Seattle T-18 dredging project (March 17, 1997 SDM), the PSDDA agencies re-evaluated the human health-based 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 **total DDT is 44 ppm wet weight.**

The DMMP agencies recently undertook a re-evaluation of the PCB TTL for human health. Recalculation of the PCB TTL for the Elliott Bay disposal site included using an updated cancer slope factor, recent fish consumption data, and consideration of PCB biomagnification due to trophic transfer. Based on this analysis, **an interim TTL for total PCBs (Aroclor) of 0.75 ppm wet weight** has been used to interprete bioaccumulation data from the East Waterway Phase II Project.

A recent effort by the Port of Seattle (May 1999)[1] involved compilation of the residue-effect literature for TBT. It was prepared for the Port of Seattle by EVS Solutions for submittal to the U.S. Environmental Protection Agency for the Harbor Island Superfund Site, Waterway Sediment Operable Unit. Using residue-effects data from this and other studies, EPA Superfund developed a tissue trigger level of 3 ppm dry weight of TBT in tissue (0.6 ppm wet weight) that was used to evaluate bioaccumulation data from the West Waterway OU (for more information see Appendix D of the May 1999 EVS report). This tissue concentration is protective for growth and reproduction endpoints in polychaetes, crustaceans, bivalves, and most gastropods. However, it might not protect the most sensitive species of meso- and neogastropods against imposex-related sterility. Considering that meso- and neogastropods are rare in Elliott Bay (Appendix D in EVS, 1999), the DMMP agencies have decided to use the West Waterway **TBT trigger level (3 ppm dry weight)** on an interim basis to interpret bioaccumulation relative to disposal at the Elliott Bay site.

To summarize, the DMMP agencies used the following TTLs to interpret the bioaccumulation test data for the East Waterway Stage II Project:

TBT:	3.0 ppm dry weight (dw) as TBT
Fluoranthene:	8,400 ppm ww
DDT + DDE:	3.0 ppm ww
PCB:	0.75 ppm ww

The agencies used best professional judgement in developing these interpretation guidelines to meet PSDDA disposal site management objectives; achievement of other sediment management objectives will require additional evaluation. These guidelines are subject to change for future PSDDA/DMMP projects as additional bioaccumulation data become available.

Each DMMU was compared to these interpretation guidelines using a one-tailed one-sample t-test (see **Table A-2**). An alpha level (the probability of making a Type I error, rejecting the null hypothesis of no difference between test and

[1] For TBT, the DMMP agencies relied upon Appendix D of a May 1999 report entitled: "Review of Tissue Residue Effects Data for Tributyltin, Mercury, and Polychlorinated Biphenyls". Prepared by EVS Solutions for the Port of Seattle.

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. DMMU S23 exceeded the interim PCB target tissue level (TTL) and thus failed the bioaccumulation test. Because S23 (ML Rule exceedance) failed the bioaccumulation test for PCBs, further testing under a Tier IV evaluation is unnecessary to make a suitability determination. Two additional DMMUs, S11 and S16 statistically exceeded the interim PCB TTL, and also failed the bioaccumulation test. DMMU S31 exceeded the interim TBT TTL and therefore failed the bioaccumulation test. No other DMMUs statistically exceeded the bioaccumulation interpretation guidelines. In summary, of the 25 DMMUs tested representing 95,340 cubic yards, 4 DMMUs failed the bioaccumulation test representing a total volume of 15,680 cubic yards.

Chemical/biological testing conducted for a portion of the East Waterway Stage II Project surfaced subsurface contamination issues that will require further examination of the subsurface sediment quality (e.g., Z-sample collection and analysis) of the proposed new-sediment surface following dredging to verify compliance with Washington State's antidegradation statute. These analyses have not yet been conducted and must be completed before dredging of those identified DMMUs can be conducted.

Table A-2. Worst Case Bioaccumulation Interpretation Summary (Adjusted values)

DMMU S4

CHEMICAL NAME	Units	Guideline	Macoma nasuta: DMMU tissue (Initial)	Macoma nasuta: DMMU tissue (adjusted)	Macoma nasuta: Reference (CR-23 Mod)	Macoma nasuta: Statistically different from reference	Macoma nasuta: statistically below guideline	Nephtys caecoides: DMMU tissue (Initial)	Nephtys caecoides: DMMU tissue (adjusted)	Nephtys caecoides: Reference (CR-23 Mod)	Nephtys caecoides: Statistically different from reference	Nephtys caecoides: statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	146	239	33.4	yes	yes	46.2	75.8	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

DMMU S5

CHEMICAL NAME	Units	Guideline	Macoma nasuta: DMMU tissue (Initial)	Macoma nasuta: DMMU tissue (adjusted)	Macoma nasuta: Reference (CR-23 Mod)	Macoma nasuta: Statistically different from reference	Macoma nasuta: statistically below guideline	Nephtys caecoides: DMMU tissue (Initial)	Nephtys caecoides: DMMU tissue (adjusted)	Nephtys caecoides: Reference (CR-23 Mod)	Nephtys caecoides: Statistically different from reference	Nephtys caecoides: statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	38.6	133	33.4	no	yes	103	354	65.0	yes	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750	334	441	9.88	yes	yes	607	802	15.9	yes	yes

DMMU S6

CHEMICAL NAME	Units	Guideline	Macoma nasuta: DMMU tissue (Initial)	Macoma nasuta: DMMU tissue (adjusted)	Macoma nasuta: Reference (CR-23 Mod)	Macoma nasuta: Statistically different from reference	Macoma nasuta: statistically below guideline	Nephtys caecoides: DMMU tissue (Initial)	Nephtys caecoides: DMMU tissue (adjusted)	Nephtys caecoides: Reference (CR-23 Mod)	Nephtys caecoides: Statistically different from reference	Nephtys caecoides: statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	29.4	55.3	33.4	no	yes	116	218	65.0	yes	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750	189	511	9.88	yes	yes	196	529	15.9	yes	yes

DMMU S7

CHEMICAL NAME	Units	Guideline	Macoma nasuta: DMMU tissue (Initial)	Macoma nasuta: DMMU tissue (adjusted)	Macoma nasuta: Reference (CR-23 Mod)	Macoma nasuta: Statistically different from reference	Macoma nasuta: statistically below guideline	Nephtys caecoides: DMMU tissue (Initial)	Nephtys caecoides: DMMU tissue (adjusted)	Nephtys caecoides: Reference (CR-23 Mod)	Nephtys caecoides: Statistically different from reference	Nephtys caecoides: statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	41.4	87.4	33.4	no	yes	38.6	81.5	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

DMMU S8

CHEMICAL NAME	Units	Guideline	Macoma nasuta: DMMU tissue (Initial)	Macoma nasuta: DMMU tissue (adjusted)	Macoma nasuta: Reference (CR-23 Mod)	Macoma nasuta: Statistically different from reference	Macoma nasuta: statistically below guideline	Nephtys caecoides: DMMU tissue (Initial)	Nephtys caecoides: DMMU tissue (adjusted)	Nephtys caecoides: Reference (CR-23 Mod)	Nephtys caecoides: Statistically different from reference	Nephtys caecoides: statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	107	107	33.4	no	yes	31.2	32.2	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

DMMU S9

CHEMICAL NAME	Units	Guideline	Macoma nasuta: DMMU tissue (Initial)	Macoma nasuta: DMMU tissue (adjusted)	Macoma nasuta: Reference (SB-Mac Control)	Macoma nasuta: Statistically different from reference	Macoma nasuta: statistically below guideline	Nephtys caecoides: DMMU tissue (Initial)	Nephtys caecoides: DMMU tissue (adjusted)	Nephtys caecoides: Reference (SB-Mac Control)	Nephtys caecoides: Statistically different from reference	Nephtys caecoides: statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000										
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750	340	340	17.2	yes	yes	615	615	17.3	yes	yes

DMMU S10

CHEMICAL NAME	Units	Guideline	Macoma nasuta: DMMU tissue (Initial)	Macoma nasuta: DMMU tissue (adjusted)	Macoma nasuta: Reference (SB-Mac Control)	Macoma nasuta: Statistically different from reference	Macoma nasuta: statistically below guideline	Nephtys caecoides: DMMU tissue (Initial)	Nephtys caecoides: DMMU tissue (adjusted)	Nephtys caecoides: Reference (SB-Mac Control)	Nephtys caecoides: Statistically different from reference	Nephtys caecoides: statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000										
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750	398	398	17.2	yes	yes	750	750	17.3	yes	yes

DMMU S11

CHEMICAL NAME	Units	Guideline	Macoma nasuta: DMMU tissue (Initial)	Macoma nasuta: DMMU tissue (adjusted)	Macoma nasuta: Reference (SB-Mac Control)	Macoma nasuta: Statistically different from reference	Macoma nasuta: statistically below guideline	Nephtys caecoides: DMMU tissue (Initial)	Nephtys caecoides: DMMU tissue (adjusted)	Nephtys caecoides: Reference (SB-Mac Control)	Nephtys caecoides: Statistically different from reference	Nephtys caecoides: statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000										
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000	16.5	18.0	0.44	yes	yes	21.5	23.4	0.76	yes	yes
Total PCBs	ug/kg-ww	750	490	1,532	17.2	yes	no	651	2,036	17.3	yes	no

DMMU S13

CHEMICAL NAME	Units	Guideline	Macoma nasuta: DMMU tissue (Initial)	Macoma nasuta: DMMU tissue (adjusted)	Macoma nasuta: Reference (SB-Mac Control)	Macoma nasuta: Statistically different from reference	Macoma nasuta: statistically below guideline	Nephtys caecoides: DMMU tissue (Initial)	Nephtys caecoides: DMMU tissue (adjusted)	Nephtys caecoides: Reference (SB-Mac Control)	Nephtys caecoides: Statistically different from reference	Nephtys caecoides: statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000										
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750	217	217	17.2	yes	yes	471	471	17.3	yes	yes

Note: (1) All tissue concentrations for Fluoranthene, Total DDT and Total PCBs were converted to wet weight to facilitate guideline comparisons. All TBT tissue concentrations are on a dry weight basis.
(2) Adjustments to tissue concentrations based on initial sediment versus retested sediment concentration ratios (see Appendix 5). Concentration ratios greater than 1 were adjusted. Concentration ratios less than 1 were not adjusted.

Table A-2. Worst Case Bioaccumulation Interpretation Summary (Adjusted values)

			DMMU S14										DMMU S16										DMMU S19									
			Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000																														
Fluoranthene	ug/kg-ww	8,400																														
Total DDT	ug/kg-ww	3,000											18.4	18.4	0.44	yes	yes	36.2	36.2	0.76	yes	yes										
Total PCBs	ug/kg-ww	750	385	385	17.2	yes	yes	800	**800**	17.3	yes	yes	507	**994**	17.2	yes	**no**	912	**1,787**	17.3	yes	**no**	233	238	9.88	yes	yes	437	446	15.9	yes	yes

			DMMU S21										DMMU S23										DMMU S31									
			Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 W)	Statistically different from reference	Statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 W)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	51.8	51.8	37.9	no	yes	132	132	89.0	yes	yes	20.4	25.9	37.9	no	yes	127	161.3	89.0	no	yes	**3,420**	**3,420**	20.3	yes	**no**	630	630	72.9	yes	yes
Fluoranthene	ug/kg-ww	8,400																														
Total DDT	ug/kg-ww	3,000											27.5	62.6	0.44	yes	yes	54.2	124	0.76	yes	yes										
Total PCBs	ug/kg-ww	750	315	337	17.2	yes	yes	577	618	17.3	yes	yes	780	**1,561**	17.2	yes	**no**	1,575	**3,150**	17.3	yes	**no**										

			DMMU S39										DMMU S40										DMMU S41									
			Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 W)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 W)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	DMMU tissue (adjusted)	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	134	134	33.4	yes	yes	45.7	45.7	65.0	no	yes	284	284	20.3	yes	yes	57.8	57.8	72.9	no	yes	222	284	33.4	yes	yes	44.2	56.6	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400																														
Total DDT	ug/kg-ww	3,000																														
Total PCBs	ug/kg-ww	750																														

Table A-2. Worst Case Bioaccumulation Interpretation Summary (Adjusted values)

DMMU S43

CHEMICAL NAME	Units	Guideline	Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	71.6	91.6	33.4	no	yes	73.0	93.4	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

DMMU S46

CHEMICAL NAME	Units	Guideline	Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	1,220	1,220	33.4	yes	yes	294	294	65.0	yes	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

DMMU S47

CHEMICAL NAME	Units	Guideline	Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	1,780	1,780	33.4	yes	yes	352	352	65.0	yes	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

DMMU S49

CHEMICAL NAME	Units	Guideline	Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	108	112	33.4	no	yes	82.4	85.7	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750	246	246	9.88	yes	yes	590	590	15.9	yes	yes

DMMU S50

CHEMICAL NAME	Units	Guideline	Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	158	250	33.4	yes	yes	86.6	137	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400	88.8	710	3.22	yes	yes	118	941	1.06	yes	yes
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750	246	523	9.88	yes	yes	364	775	15.9	yes	yes

DMMU S52

CHEMICAL NAME	Units	Guideline	Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	67.6	79.8	33.4	no	yes	50.2	59.2	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

DMMU S57

CHEMICAL NAME	Units	Guideline	Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	194	380	33.4	yes	yes	61.4	120	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

Target Tissue Guideline exceeded

U.S. Navy Puget Sound Naval Shipyard (PSNS) Pier Construction and Dredging Project. The PSNS project was located in the high ranked Sinclair Inlet within a Superfund cleanup site footprint. The following biological testing summary covers the use of best professional judgement exercised by the DMMP agencies during sediment testing for this project.

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. **Appendix B** 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 C** (pages C8-C14) summarizes the Phase I/Phase II bioassay toxicity testing outcomes 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. Summary results (Phase 1 + Phase II) for each bioassay test are depicted in Table 1 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.

As noted in **Table A-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. An examination of potential

nontreatment effects suggested that clay content may have been a contributing factor to the observed toxicity during Phase I, and this hypothesis was reconfirmed during Phase II testing for a small subset of samples retested with *Eohaustorius*. The possibility of high clay contents affecting *Eohaustorius* survival was sufficient for the DMMP agencies to authorize a retest of 62 DMMUs, in which clay contents exceeded 15 percent (See **Appendix C**, pages C8-C14). Subsequently, both the Phase I and II results for *Eohaustorius* were used for decision-making in the suitability determination, when the clay contents in tested sediment were 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* were not used for decision-making when the clay contents were 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 contributing to the observed toxicity.

The DMMP agencies also evaluated alternative hypotheses for the toxicity by conducting chemical testing utilizing Atomic Emission Detector (AED) screening analyses on six surface and two subsurface samples from the Piers D, B, and 3 subareas. These analyses identified and quantified two potentially toxic components, total phosphate compounds and tricresyl phosphate. These analyses also documented the presence of a petroleum product that is lighter than motor oil and heavier than diesel fuel. These data suggest that other potentially toxic substances in the pier subarea sediments may also have contributed to the toxicity observed during Phase I testing.

As noted in **Table A-3** and **Appendix C** (pages C8-C14), 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.

The results of the larval bivalve test (**Appendix C** and **Table A-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.

Overall interpretation of the bioassay responses combining the Phase I and II responses (See **Appendix C** and **Table A-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.

Table A-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 2 below)[2]	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 (10)**	**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**	

[2] 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.

As noted previously, a number of DMMUs passing bioassay interpretive guidelines, also exceeded bioaccumulation triggers. These are highlighted in **Table A-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 C**), 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 A-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

As noted in paragraph 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 **Table A-5**.

Table A-5. Comparative Initial/Resampled Chemical Sediment Concentrations evaluated during 45 day Bioaccumualtion Test of DMMU S51

CHEMICAL NAME	Units	Sediment Initial	Sediment Resample/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

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. 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 from 28 to 45 days based on the recommendation of the DMMP agencies.

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

Tissue concentrations of chemicals-of-concern measured during 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 **Table A-6** for the four chemicals tested in DMMU S51.

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 (East Waterwau Stage I) 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."

Table A-6. Bioaccumulation Testing Summary for DMMU S51.

CHEMICAL NAME	Units	TTL Guideline	DMMU S51									
			Macoma nasuta					*Nephtys caecoides*				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Carr Inlet Reference	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Carr Inlet Reference	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

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 used 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[3]. 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 used 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

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.

Each DMMU was compared to these interpretation guidelines using a one-tailed one-sample t-test. 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.

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 (**Table A-5**). The sediment analysis results

[3] 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).

indicated that silver, PCP and DDT all had ratios greater than 1, and the tissue concentrations were adjusted accordingly (**Table A-6**), whereas mercury was less than 1 and no adjustment was made. Because of the 50-fold 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 was considered unsuitable for UCOWD using BPJ.

USACE Duwamish Maintenance Dredging. The Corps routinely dredges only the turning basin and upper portion of the Duwamish River Navigation Channel, where low-ranked sediment deposits from the upper reaches of the river. The 2000 characterization was for the lower part of the navigation channel, where sedimentation rates are much lower but contamination issues are greater. All material sampled and tested as part of this characterization was high ranked, and though contamination was found and a portion of the proposed dredged material found unsuitable for open water disposal, for the most part the testing was routine.

The issue of note for this characterization was that a mapping error caused some samples to be taken outside the dredging prism. The error did not occur at the time of sampling, but at the time of Sampling and Analysis Plan (SAP) preparation. With no recent bathymetry maps available, the contractor used cross sections generated from the latest Corps survey to propose sampling locations. Unfortunately, those cross sections were interpreted "backwards," as if one were looking downstream, rather than upstream. In places were shoaling was evident on only one side of the navigation channel, this error resulted in a SAP with samples placed on the opposite side of the channel from the actual shoaling.

The SAP was approved by the DMMP agencies, sampling and analysis took place, and a suitability determination (3 February 2000) was signed. It was only when actual planning for the dredging took place that the error was discovered. The problem affects nine out of 20 DMMU: S1, S12, S13, S14, S15, S16, S17, S18, B2. From these DMMU, actual sampling was from areas with very little dredged material. Of this group, DMMU S1, S15 and B2 failed PSDDA guidelines for open-water disposal and the rest were considered suitable.

Though this sampling event may have accurately characterized the proposed dredging prism, there is no way whether to know whether this is the case. Therefore, with insufficient information for decision-making, DMMUs S12, S13, S14, S16, S17 and S18 cannot be considered suitable for open-water disposal.

Dredging Year 2001

Weyerhaeuser Company/Hylebos Wood Debris Group. The Weyerhaeuser Company dredging project was located at the head of Hylebos Waterway, Commencement Bay in a MTCA cleanup area. The following biological testing summary covers the use of best professional judgement exercised by the DMMP agencies during sediment testing for this project.

Standard bioassay testing was conducted on all nine DMMUs within the 56 day biological holding time. **Appendix B** summarizes the solid phase bioassay Quality Control (QC) performance guidelines and also summarizes the solid phase bioassay interpretative guidelines for nondispersive sites, which were used to evaluate the bioassay data discussed below. Reference sediment was collected from Carr Inlet to conduct DMMU specific test sediment comparisons for the three bioassay tests used during the three testing rounds. Amphipod bioassays conducted during Round 1 testing with *Ampelisca abdita* failed to meet the negative control performance standard, but the single DMMU tested with *Rhepoxynius abronius* met both the negative control and reference performance standards. Amphipod testing during round 2 was problematic, based on performance standard failures for both reference and negative control sediments for both amphipod species (*Rhepoxynius abronius* and *Ampelisca abdita*), which resulted in a requirement to retest a subset of the DMMUs tested. Round 3 amphipod resampling/retesting of 8 of 9 Round 1 DMMUs was conducted with *Ampelisca abdita,* and all Round 3 batches met both the negative control and reference sediment performance standards. Round 2 testing of Weyerhauser sediments was accomplished with the echinoderm (*Dendraster excentricus*), and the sediment larval bioassay meet both the negative control performance and reference performance standards. In general, the *Neanthes* growth bioassay met the DMMP performance standards for the negative control and reference sediments during Rounds 1 and 2 and the results will not be discussed further. Summary bioassay results for each DMMU are depicted in **Appendix C** relative to the DMMP nondispersive interpretative guidelines. Bioassay results are discussed below for the amphipod and sediment larval bioassays only.

a) **Amphipod Bioassay (*Ampelisca abdita, Rhepoxynius abronius*).** The cumulative results for amphipod bioassay testing conducted over three testing rounds are summarized in **Table A-7**. The testing resulted in 5 DMMUs among the three testing rounds exhibiting no-hit responses, 1 DMMU with 2-hit responses, and 3 DMMUs with a 1-hit response. DMMU B-3 had 1-hit responses from both the *Rhepoxynius abronius* and *Ampelisca abdita* bioassays during Round 1 and Round 1 retest.

b) **Bivalve Larval Bioassay (*Dendraster excentricus, Mytilus galloprovincialis*).** Of the Eight of nine DMMU's[4] tested, three passed the DMMP nondispersive guidelines for unconfined open-water disposal, and five exhibited a 2-hit responses (**Table A-7**). One of the three suitable DMMUs exceeded the 2-hit response guidelines, but when statistically compared to the appropriate reference sediment responses, was found to be "not statistically different" ($p<0.1$), and thus is not scored as a "hit" for regulatory decision-making (e.g., "suitable").

c) **DMMP Bioassay Determination.** Overall interpretation of the nine DMMU's tested by the DMMP bioassays demonstrated that five DMMUs exhibited bioassay responses that were suitable for unconfined open-water disposal (UOWD) and four exhibited responses that were unsuitable for UCOWD (**Appendix C**, **Table A-7**).

d) **Bioaccumulation Trigger Exceedances**. Of the six DMMUs that had BT exceedances for TBT, three passed the DMMP bioassays interpretation guidelines for open-water-unconfined disposal during bioassay testing Rounds 1-3. Therefore, three DMMUs (B-5, B-6, B-7) were subject to bioaccumulation testing during Round 4.

Table A-7. Bioassay interpretation summary[3]

Amphipod bioassay: (*Rhepoxynius abronius* & *Ampelisca abdita*)	**Pass**	**Two-Hit**	**One-Hit**	**Total:**
Weyerhaeuser Dock DMMUs	5	1	3	9
Sediment Larval Bioassay: (*Dendraster excentricus)*	**Pass**	**Two-Hit**	**One-Hit**	**Total:**
Weyerhaeuser Dock DMMUs	3	5	0	8
Neanthes Growth Bioassay: (*Neanthes arenaceodentata*)	**Pass**	**Two-Hit**	**One-Hit**	**Total:**
Weyerhaeuser Dock DMMUs	9	0	0	9
DMMP Bioassay Determination:	Number of Suitable DMMUs		Number of Unsuitable DMMUs	
Weyerhaeuser Dock DMMUs	5		4	

The sediment analytical chemical results for the 3 DMMUs that underwent bioaccumulation testing for TBT are presented in **Table A-8**. The results of these sediment analyses indicated that there was often a large

[4] The larval bioassay test was not rerun on DMMU B-3 (see **Appendix C**) in Round 2 because this DMMU exhibited Round-1 single-hit responses for both *Rhepoxynius abronius* and *Ampelisca abdita*.

disparity between the initial and resampled/retested analytical results for porewater-TBT. When the initial result exceeded the retested result, the ratio of the two was used to adjust the bioaccumulation tissue concentrations to reflect a "worst case" analytical result.

Table A-8. Ratio of Initial Sediment Porewater-TBT Concentrations to Retested Sediments for Bioaccumulation Testing

DMMU ID	Initial (ug/L)	Retest (ug/L)	Initial/Retest Ratio
B-5	0.67	0.23	2.91
B-6	0.33	0.16	2.06
B-7	0.17	0.073	2.33

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 8-gallon aquaria. The protocol used followed the recent DMMP protocol clarification (Kendall, 2000), which extended the standard bioaccumulation test duration from 28 days to 45 days. Five replicate 8-gallon aquaria were run for the negative control/reference sediments, and for each of the three tested DMMUs.

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. As noted above, the calculated ratios of Phase 1 (initial)/Phase II (retest) sediment chemistry were used to adjust the observed tissue concentrations (**Table A-8**). Statistical comparisons of test DMMUs 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 **Table A-9** for each of the 3 DMMUs tested.

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 those DMMUs that were statistically greater than reference, a more in depth evaluation was 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.

There are no FDA guidelines for Tributyltin (TBT).

A target tissue trigger level (TTL), of 3 ppm dry weight of TBT in tissue (0.6

ppm wet weight) was used to evaluate the Weyerhaeuser Dock tissue concentrations. This tissue concentration is protective for growth and reproduction endpoints in polychaetes, crustaceans, bivalves, and most gastropods. However, it might not protect the most sensitive species of meso- and neogastropods against imposex-related sterility. Considering that meso- and neogastropods are rare in Elliott Bay (Appendix D in EVS, 1999) and are thus presumed to be rare in Commencement Bay as well, the DMMP agencies have decided to extrapolate the use of the **TBT trigger level (3 ppm dry weight)** derived for the West Waterway on an interim basis to interpret bioaccumulation data relative to disposal at the Commencement Bay disposal site.

To summarize, the DMMP agencies used the following TTLs to interpret the bioaccumulation test data for the proposed Weyerhaeuser Dock dredging area:

TBT: 3.0 ppm dry weight (dw) as TBT

The agencies used best professional judgement in developing the interpretation guidelines to meet PSDDA disposal site management objectives; achievement of other sediment management objectives will require additional evaluation. The use of this guideline is subject to change for future PSDDA/DMMP projects as additional bioaccumulation data become available.

Each of the three DMMU's was compared to these interpretation guidelines using a one-tailed one-sample t-test (see **Table A-9**). 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 three DMMU's were found to be statistically less than the TBT target tissue level (TTL) and thus passed the bioaccumulation test.

Table A-9. Bioaccumulation Testing Summary for Weyerhaeuser DMMUs tested under DMMP.

			DMMU B-5									
			Macoma nasuta					*Nephtys caecoides*				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference	Statistically different from reference	Statstically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference	Statistically different from reference	Statstically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	125	363	4.4	yes	yes	28.1	81.9	0.9	yes	yes
			DMMU B-6									
			Macoma nasuta					*Nephtys caecoides*				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference	Statistically different from reference	Statstically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference	Statistically different from reference	Statstically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	176	364	4.4	yes	yes	37.6	78	0.9	yes	yes
			DMMU B-7									
			Macoma nasuta					*Nephtys caecoides*				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference	Statistically different from reference	Statstically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference	Statistically different from reference	Statstically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	107	250	4.4	yes	yes	25.2	59	0.9	yes	yes

Port of Anacortes, Cap Sante Marina. Nine of twelve DMMUs tested for the Cap Sante Marina project had screening level exceedances of tributyltin. Additional sediment was collected for bioaccumulation testing based on an addendum to the original sampling plan. Two test composites were created, one representing those samples with TBT detections above 0.30 uG/L and those with detections below 0.30 uG/L but above the SL. TBT exceedances are as follows:

	C1	C2	C6	C7	C8	C9	C10	C11	C12	Comp1	Comp2
TBT in ug/L	0.47	0.20	0.18	0.34	0.29	0.24	0.32	0.27	0.20	0.30	0.29

Bioaccumulation testing was performed with bivalve *Macoma nasuta* and the polychaete *Nephtys caecoides*. The two species were tested together in the same 18-liter glass aquarium. At the time of project initiation, the standard DMMP bioaccumulation protocol called for 28-day test duration. The project proponents agreed to extend the test to 45 days, based on the recommendation of the DMMP agencies. The extended test provides a better approximation of steady-state tissue concentrations for TBT.

Six replicate aquaria (five test replicates and one replicate for steady state monitoring) were run for the two test sediments, the two reference sediments and the negative control. Tissue concentrations from the 45-day exposure were compared to the reference sediments. Initial sediment chemistry was used to adjust the observed tissue concentrations.

The DMMP agencies agreed to use the target tissue level developed for the East Waterway project, 3 ppm dry weight of TBT in tissue, as the value appropriate for the Cap Sante project. Given the limited residue-effects data for the Anacortes area, it was determined that the number calculated for Elliott Bay would be the closest approximation available for making a determination of suitability. The method of calculation and the data supporting this value is documented in the suitability determination for the East Waterway project suitability determination (1999), paragraph 18, and in the "Review of Tissue Residue Effects Data for Tributyltin, Mercury and Polychlorinated Biphenyls", prepared by EVS solutions for the Port of Seattle.

TBT concentrations in tissues from *Macoma* and *Nephtys* exposed to test sediments were significantly less than the target tissue level of 3 ppm dry weight TBT in tissue. TBT tissue concentrations were also compared to reference and no significant differences were observed for both DMMU.

USACE Squalicum Waterway, Bellingham. The Squalicum Waterway is a federal navigation channel in Bellingham, Washington. It is of mixed rank, with

the outer portion ranked moderate and the head of the waterway, near historical industrial use, ranked high. Out of 17 DMMU, 13 had no detected or non-detected chemical exceedances of screening levels (**Table A-10**). Three of those DMMU with SL exceedances (C5, C6 and C7) exhibited borderline exceedances of nickel but no other chemicals of concern. The agencies used best professional judgment for waiving bioassays on these three DMMU, as described below. The fourth DMMU that exceeded screening levels was S2, with high levels of lead found. The agencies defined further testing for S2 before it could be found suitable for open-water disposal, also as described below.

Table A-10. Selected Squalicum Waterway chemistry results.[1]

PARAMETER		Chemical Guidelines			C5 (M)	C6 (M)	C7 (M)	S2 (H)
		SL	BT	ML				
Volume (cubic yards)					15,164	11,564	15,659	1,688
METALS (ppm)	**Lead**	450	--	1,200				2,100
	Nickel	140	370	370	140	141	140	
2,4-Dimethylphenol (ppb)		29	--	210				62

[1]Table includes all chemicals of concern (COCs) that exceeded PSDDA SL triggers. No additional COCs exceeded SLs.

1. Nickel Exceedances. Three DMMU (C5, C6 and C7) in the turning basin area of the navigation channel had nickel detected at or close to (140, 141 and 140 ppm, respectively) the SL (140 ppm). Analysis of the data showed that Ni concentrations were localized in the surface portion of the turning basin material, and concentrations decreased with increasing distance from the turning basin. Grain size showed a high negative correlation with Ni concentration (Figure 1). Similar concentrations have been found in the waterway in past sampling. Though SL exceedances usually trigger Tier 3 bioassays before being found suitable for open water disposal, the agencies' suspended this requirement for these DMMU. This "best professional judgement" decision was based on the following lines of evidence:

similar and greater levels of Ni found in the same area before have passed bioassays
there is circumstantial evidence that background levels of Ni in the Bellingham Bay area are high
there are no apparent anthropogenic sources
these DMMU showed no SL exceedances of any other COC

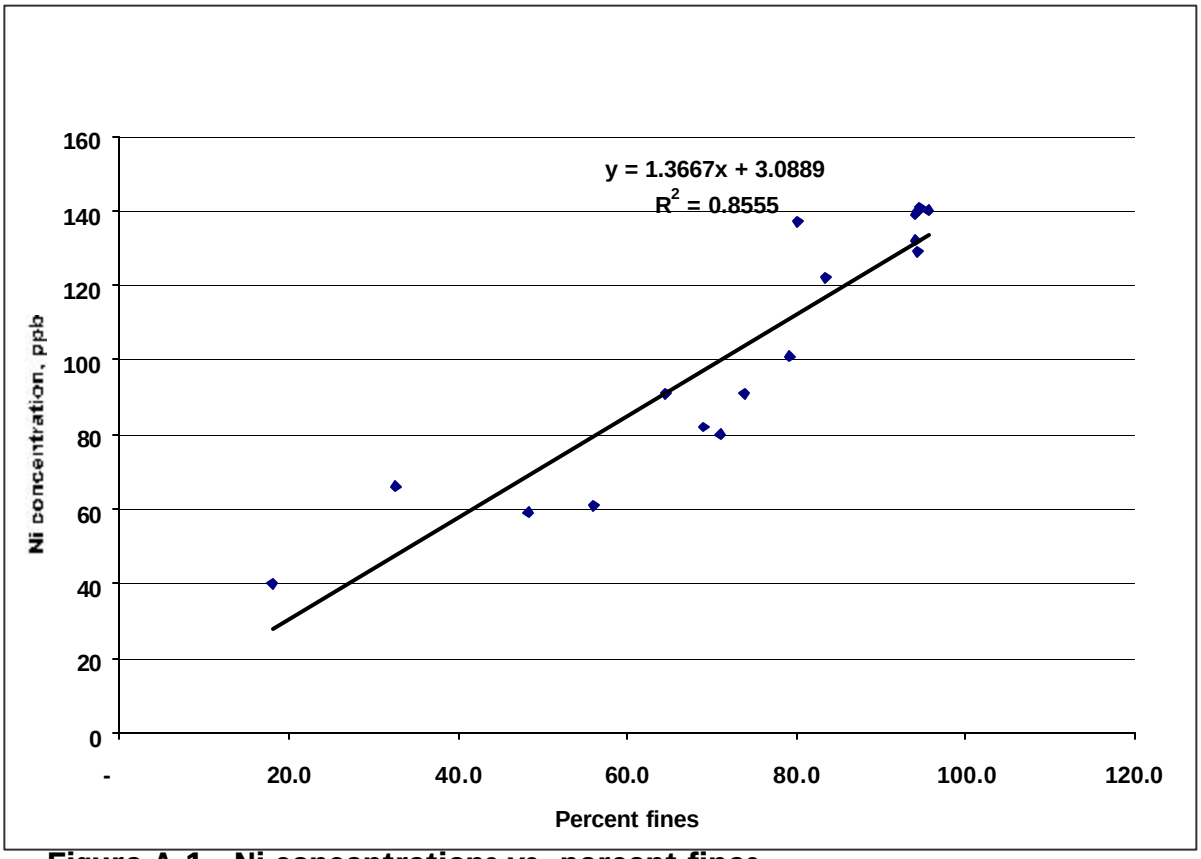

Figure A-1. Ni concentrations vs. percent fines.

2. Lead and 2,4-dimethylphenol Exceedances in S2. Subsurface DMMU S2, in the right berth area, had both an SL exceedance of 2,4-dimethylphenol and an ML exceedance of lead (Table A-10). This level of lead caused much more concern among the agency representatives than did the detections of nickel. To establish an approach for further testing of this DMMU, the agencies looked at the site history, laboratory QA/QC data, and potential human health and environmental effects of lead.

A review of the site history showed that both a plywood company and a boat building business have been located in the area north of the right berthing area since the 1920s. Boat building, of both metal and wooden boats, ceased in the 1960's, though a plywood company continues to operate today. This area was filled to its present shoreline in the 1940s and 50s. At present, the source or extent of subsurface contamination is undetermined.

The analytical laboratory reviewed its procedures and found no indication that the lead measurement was erroneous. There are also potential human as well as environmental effects of lead contamination.

With the above information, the agencies agreed on a plan for further evaluation of S2. The following Tier 3 tests were required before S2 could be considered for open water disposal:

- Acute bioassays with the usual suite of bioassay tests. *Mytilus* should be the species chosen for the larval bioassay due to its sensitivity to metals. Should the sediment fail these tests, it would be unsuitable for open-water disposal.
- 28-day bioaccumulation tests on two species before the sediment could be considered suitable for open-water disposal. Tissue analysis would be for Pb only.
- Should the area be dredged, regardless of disposal area, Z samples would need to be analyzed to make sure that the exposed surface does not exceed Ecology non-degradation standards. Further dredging may be necessary if contamination is shown to go deeper than the proposed dredging prism.
- Bioassay and bioaccumulation tests could be tiered or conducted concurrently.
- Though it was found suitable for open-water disposal, no portion of S1 (overlying S2) should be removed without further testing of subsurface sediments.

Bellingham Cold Storage chose not to pursue further action at this site as part of the current project.

USACE Grays Harbor Maintenance Dredging. Requirements for dredged material characterization in the Grays Harbor Navigation Channel vary in many ways from requirements in other parts of Washington. The channel is dredged annually of over a 1.5 million cubic yards of homogenous, low-ranked material deposited from a large river system into a relatively shallow estuary. The Grays Harbor/Willapa Bay Dredged Material Evaluation Procedures (GHDMEP) outlines a six-year rotation of sampling and testing, with one-third of the channel material tested every two years. The first six year testing cycle was completed in 1999, so the DY 2001 testing began the second cycle. This paragraph describes adaptations to the typical SAP used for this project, and the use of best professional judgment for the choice of sample used for safety-net bioassay testing.

1. Programmatic Sampling Plan. Some "lessons learned" during the first round of testing included:
   - keeping track of areas tested between testing events was difficult and confusing, leading to concerns that some areas or problems could be overlooked
   - material to be dredged is concentrated in the upper reaches of the channel, where the possibility of contamination is greatest, and is not easily divided into thirds for testing

To address these concerns, a Programmatic Sampling and Analysis Plan (PSAP) was prepared to outline the sampling approach for the entire six-year cycle. This PSAP looked at historic dredging volumes in various reaches of the navigation channel and devised a strategy for insuring that the sampling adequately represented those volumes. A SAP addendum was also prepared to address sampling issues specific to the DY 2001 sampling and testing event. If needed, addenda will also be prepared for subsequent sampling events during the six-year testing rotation.

2. Bioassay Sample Selection. Although no detected levels of chemicals of concern exceeded SLs, the detection levels of four COCs exceeded the SLs in one composite (C10). As per guidelines, the analytical laboratory did everything possible to bring down detection limits but was unable to in this sample. According to DMMP guidelines, exceedance of SLs solely by detection limits can trigger biological testing. In Grays Harbor, safety-net bioassay testing on at least two DMMU composites is required by the GHDMEP. Tiered testing due to SL exceedances (detected or non-detected) can be included in the two samples chosen for safety-net bioassays.

For several reasons, C10 was NOT one of the DMMUs chosen for safety-net bioassays. The selection process considers grain size (fine-grained sediments are preferred); sediment chemical results, and the proximity of the collected samples to known or potential contaminant sources. For this characterization, there were three general groups of grain sizes found in the composite samples:

- Fine grained: C1 through C6 all had over 70% fines (representing 58% of all characterized sediments)
- Intermediate grained: C7 and C8, with around 50% fines (representing 19% of all characterized sediments)
- Coarse grained: C9, C10 and C11 ranged from 5% to 27% fines (representing 23% of all characterized sediments)

Most of the sediments in the Cow Point area are very fine-grained, and they represent the bulk of material deposited annually from upstream sources and dredged in a given year. Because the fine-grained DMMUs all showed similar chemical results, C5, with 74% fine-grained material, was randomly chosen to represent this group of sediments. The remainder of the sediments included two intermediate grain-sized and three coarser-grained DMMU. The intermediate- and coarser-grained sediments were all from the area upstream of the Cow Pt. turning basin, in the Aberdeen and South Aberdeen Reaches. The coarser upstream sediments are less frequently dredged and are generally closer than the downstream sediments to known or potential contaminant sources, including the Weyerhaeuser pulp mill in Cosmopolis. It was field observations of the area and sediments sampled in C11 that led to its choice for safety-net biological sampling. In addition to the timber-related activities and paper mill, boat maintenance activities were observed in the area of

DMMU 11. The sediments collected for C11 exhibited a marked oily sheen and odors. Though chemical analysis of the coarse grained sediments showed no detected levels of COCs above the SL, C11 was chosen over C10 for safety-net testing because it was considered a higher risk for potential toxicity based on field observations.

APPENDIX B - DY00/01 GUIDELINE VALUES (CHEMISTRY)

CHEMICAL NAME	Units	SL	BT	ML	(SL+ ML)/2
METALS & ORGANOMETALS					
Antimony	mg/kg	150	150	200	175
Arsenic	mg/kg	57	507.1	700	378.5
Cadmium	mg/kg	5.1		14	9.55
Copper	mg/kg	390		1,300	845
Lead	mg/kg	450		1,200	825
Mercury	mg/kg	0.41	1.5	2.3	1.355
Nickel	mg/kg	140	370	370	255
Silver	mg/kg	6.1	6.1	8.4	7.25
Zinc	mg/kg	410		3,800	2105
TBT ion (porewater)	ug/L	0.15	0.15	--	
LPAH					
Naphthalene	ug/kg	2,100		2,400	2250
Acenaphthene	ug/kg	500		2,000	1250
Acenaphthylene	ug/kg	560		1,300	930
Fluorene	ug/kg	540		3,600	2070
Phenanthrene	ug/kg	1,500		21,000	11250
Anthracene	ug/kg	960		13,000	6980
2-Methylnaphthalene	ug/kg	670		1,900	1285
Total LPAHs	ug/kg	5,200		29,000	17100
HPAH					
Fluoranthene	ug/kg	1,700	4600	30,000	15850
Pyrene	ug/kg	2,600		16,000	9300
Benzo(a)anthracene	ug/kg	1,300		5,100	3200
Benzofluoranthenes (b+k)	ug/kg	3,200		9,900	6550
Chrysene	ug/kg	1,400		21,000	11200
Benzo(a)pyrene	ug/kg	1,600	3600	3,600	2600
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4400	2500
Dibenzo(a,h)anthracene	ug/kg	230		1900	1065
Benzo(g,h,I)perylene	ug/kg	670		3200	1935
Total HPAHs	ug/kg	12,000		69,000	40500
CHLORINATED HYDROCARBONS					
1,2,4-Trichlorobenzene	ug/kg	31		64	47.5
1,2-Dichlorobenzene	ug/kg	35	37	110	72.5
1,3-Dichlorobenzene	ug/kg	170	1,241	--	
1,4-Dichlorobenzene	ug/kg	110	120	120	115
Hexaclorobenzene (HCB)	ug/kg	22	168	230	126
PHTHALATES					0
Bis(2-ethylheyesyl)phthalate	ug/kg	8,300	13,870		4150
Butylbenzylphthalate	ug/kg	970		--	
Di-n-butylphthalate	ug/kg	5,100	10,200	--	
Di-n-octylphthalate	ug/kg	6,200		--	
Diethylphthalate	ug/kg	1,200		--	
Dimethylphthalate	ug/kg	1,400	1,400	--	

APPENDIX B - DY00/01 GUIDELINE VALUES (CHEMISTRY)

CHEMICAL NAME	Units	SL	BT	ML	(SL+ ML)/2
PHENOLS					
2-Methylphenol	ug/kg	63		77	70
4-Methylphenol	ug/kg	670		3,600	2135
2,4-Dimethylphenol	ug/kg	29		210	119.5
Pentachlorophenol	ug/kg	400	504	690	545
Phenol	ug/kg	420	876	1,200	810
MISCELANEOUS EXTRACTABLES					
Benzyl alcohol	ug/kg	57		870	463.5
Benzoic acid	ug/kg	650		760	705
Dibenzofuran	ug/kg	540		1,700	1120
Hexachlorobutadiene	ug/kg	29	212	270	149.5
Hexachloroethane	ug/kg	1,400	10,220	14,000	7700
N-Nitrosodiphenylamine	ug/kg	28	130	130	79
VOLATILE ORGANICS					
Ethylbenzene	ug/kg	10	27	50	30
Tetrachloroethene	ug/kg	57	102	210	133.5
Total Zylene (sum of o,m,p)	ug/kg	40		160	100
Trichloroethane	ug/kg	160	1,168	1,600	880
PESTICIDES AND PCBs					
Total DDT	ug/kg	6.9	50	69	37.95
Aldrin	ug/kg	10	37	--	
alpha-Chlordane	ug/kg	10	37	--	
Dieldrin	ug/kg	10	37	--	
Heptachlor	ug/kg	10	37	--	
gamma-BHC (Lindane)	ug/kg	10	--	--	
Total PCBs	ug/kg	130	38 (1)	3,100	1615

(1) mg/kg - carbon normalized

Appendix B. DY00/01 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

APPENDIX C – LEGEND

S	=	reported concentration exceeds screening level
SB	=	reported concentration exceeds screening level and bioaccumulation trigger
M	=	reported concentration exceeds maximum level
BM	=	reported concentration exceeds bioaccumulation trigger and maximum level
(U)	=	detection limit exceeds either screening level, bioaccumulation trigger, or maximum level
(B)	=	analyte detected in corresponding blank
(E)	=	estimate
(J)	=	detected between the SDL and the CRDL
(UJ)	=	analyte not detected above the sample quanititation limit; however the reported quantitation limit is approximate
(D)	=	compound required a dilution as a result of the matrix or the sample concentration
(M)	=	estimated value of analyte found and confirmed by analyst, but with low spectral match
(N)	=	estimate based on presumptive evidence
(G)	=	estimate is greater than value shown
(Y)	=	raised non-detect due to matrix interferences
NA	=	not analyzed
2H	=	a hit under two-hit interpretation guideline
1H	=	a hit under one-hit interpretation guideline
PASS	=	test sediment passes DMMP guidelines for open-water unconfined disposal
FAIL	=	test sediment fails DMMP guidelines for open-water unconfined disposal
FAIL(C)	=	DMMU found unsuitable for open-water disposal in the absence of bioaccumulation and/or Tier IV testing data
(BPJ)	=	best professional judgement applied to suitability determination
L	=	the highest reported concentration was below SL
LM	=	the highest reported concentration was between SL and (SL + ML)/2
M	=	the highest reported concentration was between (SL + ML)/2 and ML
H	=	the highest reported concentration exceeded ML
H*	=	the sediment rank is based on biological testing results

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	Eastwaterway Project (Phase 2)															
DMMU ID:	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium																
Copper																
Lead																
Mercury					S		S	S		S	S	S	S	S	S	S
Nickel																
Silver																
Zinc																
TBT ion (porewater)	SB			SB	SB (MB)	SB (MB)	SB (MB)	SB (M)								
LPAH																
Naphthalene																
Acenaphthene																
Acenaphthylene																
Fluorene																
Phenanthrene																
Anthracene																
2-Methylnaphthalene																
Total LPAHs																
HPAH																
Fluoranthene																
Pyrene								S								
Benzo(a)anthracene																
Benzofluoranthenes (b+k)																
Chrysene																
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene																
Dibenzo(a,h)anthracene																
Benzo(g,h,I)perylene																
Total HPAHs																
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)																
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol																
4-Methylphenol																
2,4-Dimethylphenol																
Pentachlorophenol																
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol																
Benzoic acid																
Dibenzofuran																
Hexachlorobutadiene																
Hexachloroethane																
N-Nitrosodiphenylamine																
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT	S (U)				S (U)	S (U)	S	S	S (UJ)	S (U)	SB (U)	SB (UJ)	S (UJ)	S (UJ)	S (UJ)	SB (UJ)
Aldrin											S (U)	S (U)	S (U)	S (U)		S (UJ)
alpha-Chlordane																
Dieldrin											S (U)	S (U)	S (U)	S (U)		S (U)
Heptachlor												S (U)		S (U)		S (U)
gamma-BHC (Lindane)																
Total PCBs	SB			S	SB	SB	S	S	SB	SB	BM	SB	SB	SB	S	SB
BIOASSAYS																
Amphipod																
Sediment Larval (Bivalve/Echinoderm)	1H	2H	2H		2H	2H	2H	2H		2H	2H	2H			2H	
Neanthes Growth									2H			2H				
Bioassay: (Pass/Fail)	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	PASS	PASS	PASS	PASS
BTs eyesceeded:	yes	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes
Bioaccumulation test conducted:	no			yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes		yes
Bioaccumulation (Pass/Fail):				PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL		PASS	PASS		FAIL
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	PASS	PASS	PASS	FAIL
HIGHEST RANKING:	H*	L	L	LM	LM	LM	LM	LM	M	LM	H*	H*	LM	M	LM	H*

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	Eastwaterway Project (Phase 2)															
DMMU ID:	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium								S	S							
Copper																
Lead																
Mercury	S						S	S						S		
Nickel																
Silver																
Zinc								S	S							
TBT ion (porewater)	SB (J)				SB (M)		SB (J)	SB (M)	SB (M)	SB (MB)					SB (B)	
LPAH																
Naphthalene																
Acenaphthene								S	S							
Acenaphthylene																
Fluorene								S	S							
Phenanthrene								S	S							
Anthracene																
2-Methylnaphthalene									S							
Total LPAHs									S							
HPAH																
Fluoranthene									S							
Pyrene																
Benzo(a)anthracene																
Benzofluoranthenes (b+k)																
Chrysene																
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene																
Dibenzo(a,h)anthracene																
Benzo(g,h,I)perylene																
Total HPAHs																
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)																
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol																
4-Methylphenol																
2,4-Dimethylphenol																
Pentachlorophenol																
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol																
Benzoic acid																
Dibenzofuran																
Hexachlorobutadiene																
Hexachloroethane																
N-Nitrosodiphenylamine																
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT	SB (UJ)		S (U)	S (U)	S (UJ)		BM (U)	BM (J)	BM (U)	S (UJ)	S (UJ)	S (J)	S (J)	S (J)		
Aldrin	S (UJ)				S (U)		S (U)	S (U)	S (U)							
alpha-Chlordane								S (U)	S (U)							
Dieldrin	S (U)				S (U)		S (U)	S (U)	SB (U)	S (U)						
Heptachlor	S (U)							S (U)	S (U)							
gamma-BHC (Lindane)																
Total PCBs	SB		SB	S	SB		BM	SB	S	S	S	S		S		
BIOASSAYS																
Amphipod	2H															
Sediment Larval (Bivalve/Echinoderm)	2H		2H	2H	2H	2H	2H	1H	2H	2H		2H		2H	2H	2H
Neanthes Growth	2H			2H				1H	1H	2H						
Bioassay: (Pass/Fail)	FAIL	PASS	PASS	FAIL	PASS	PASS	PASS	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS
BTs eyesceeded:	yes	no	yes	no	yes	no	yes	yes	yes	yes	no	no	no	no	yes	no
Bioaccumulation test conducted:	no		yes		yes		yes	no	no	no					yes	
Bioaccumulation (Pass/Fail):			PASS		PASS		FAIL								FAIL	
ML Rule exceeded:	no	no	no	no	no	no	**yes**	**yes**	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	FAIL	PASS	PASS	FAIL	PASS	PASS	FAIL	FAIL (c+b)	FAIL	FAIL	PASS	PASS	PASS	PASS	FAIL	PASS
HIGHEST RANKING:	H*	L	LM	H*	LM	L	H*	H*	H*	H*	LM	LM	LM	LM	H*	L

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	Eastwaterway Project (Phase 2)															
DMMU ID:	S33	S34	S35	S36	S37	S38	S39	S40	S41	S42	S43	S44	S45	S46	S47	S48
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium					S											
Copper																
Lead																
Mercury	S		S	S	S							S	S			S
Nickel																
Silver																BM
Zinc					S				S							S
TBT ion (porewater)			SB (MB)	SB (MB)		SB (M)	SB (M)	SB (M)	SB (M)		SB (MB)			SB	SB	SB (M)
LPAH																
Naphthalene					S											
Acenaphthene			S		S											
Acenaphthylene																
Fluorene			S		S											
Phenanthrene			S		S											
Anthracene																
2-Methylnaphthalene					S											S
Total LPAHs					S											
HPAH																
Fluoranthene			S	S	S											S
Pyrene			S													S
Benzo(a)anthracene																
Benzofluoranthenes (b+k)																
Chrysene																S(J)
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene																S (J)
Dibenzo(a,h)anthracene																S (J)
Benzo(g,h,I)perylene																S (J)
Total HPAHs			S													S (J)
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene				S												
Hexaclorobenzene (HCB)																
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																S (J)
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol																
4-Methylphenol	S															
2,4-Dimethylphenol	S															
Pentachlorophenol																
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol																
Benzoic acid																
Dibenzofuran																
Hexachlorobutadiene																
Hexachloroethane																
N-Nitrosodiphenylamine																
VOLATILE ORGANICS																
Ethylbenzene					S											
Tetrachloroethene																
Total Zylene (sum of o,m,p)					S (M)											
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT			SB (UJ)	BM (UJ)	BM (J)										S (UJ)	S (J)
Aldrin			S (U)	S (U)	S (U)	S (U)										
alpha-Chlordane					S (U)	S (U)										
Dieldrin				SB (U)	S (U)	S (U)										S (U)
Heptachlor			S (U)	S (U)	S (U)	S (U)										S (U)
gamma-BHC (Lindane)																
Total PCBs		S	SB	BM	BM	SB	S		S			S		S	S	SB
BIOASSAYS																
Amphipod													2H			
Sediment Larval (Bivalve/Echinoderm)	2H	1H	2H	1H	1H	1H	2H	2H	2H	2H	2H	2H	2H	2H	2H	1H
Neanthes Growth			2H	1H	1H	1H										2H
Bioassay: (Pass/Fail)	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	PASS	PASS	FAIL
BTs eyesceeded:	no	no	yes	yes	yes	yes	yes	yes	yes	no	yes	no	no	yes	yes	yes
Bioaccumulation test conducted:			no	no	no	no	yes	yes	yes		yes			yes	yes	no
Bioaccumulation (Pass/Fail):							PASS	PASS	PASS		PASS			PASS	PASS	
ML Rule exceeded:	no	no	no	**yes**	**yes**	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	PASS	FAIL	FAIL	FAIL (c+b)	FAIL (c+b)	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	PASS	PASS	FAIL
HIGHEST RANKING:	LM	H*	H*	H*	H*	H*	LM	LM	LM	L	LM	LM	H*	LM	LM	H*

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	Eastwaterway Project (Phase 2)																
DMMU ID:	S49	S50	S51	S52	S53	S54	S55	S56	S57	S58	S59	S60	D1	D2	D3	D4
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																	
Antimony																	
Arsenic																	
Cadmium			S														
Copper																	
Lead																	
Mercury	S	S	S														
Nickel																	
Silver																	
Zinc	S	S															
TBT ion (porewater)	SB (MB)	SB (B)		SB (M)					SB (MB)								
LPAH																	
Naphthalene																	
Acenaphthene		S	S														
Acenaphthylene																	
Fluorene		S	S														
Phenanthrene		S	S														
Anthracene		S															
2-Methylnaphthalene		S	S														
Total LPAHs		S	S														
HPAH																	
Fluoranthene		SB	S						S								
Pyrene		S	S						S								
Benzo(a)anthracene		S	S														
Benzofluoranthenes (b+k)																	
Chrysene		S	S														
Benzo(a)pyrene		S															
Indeno(1,2,3-c,d)pyrene		S															
Dibenzo(a,h)anthracene		S (J)															
Benzo(g,h,I)perylene		S (J)															
Total HPAHs		S (J)	S														
CHLORINATED HYDROCARBONS																	
1,2,4-Trichlorobenzene																	
1,2-Dichlorobenzene																	
1,3-Dichlorobenzene																	
1,4-Dichlorobenzene																	
Hexaclorobenzene (HCB)																	
PHTHALATES																	
Bis(2-ethylheyesyl)phthalate																	
Butylbenzylphthalate																	
Di-n-butylphthalate																	
Di-n-octylphthalate																	
Diethylphthalate																	
Dimethylphthalate																	
PHENOLS																	
2-Methylphenol																	
4-Methylphenol																	
2,4-Dimethylphenol																	
Pentachlorophenol																	
Phenol																	
MISCELANEOUS EXTRACTABLES																	
Benzyl alcohol																	
Benzoic acid																	
Dibenzofuran			S														
Hexachlorobutadiene																	
Hexachloroethane																	
N-Nitrosodiphenylamine																	
VOLATILE ORGANICS																	
Ethylbenzene																	
Tetrachloroethene																	
Total Zylene (sum of o,m,p)																	
Trichloroethane																	
PESTICIDES AND PCBs																	
Total DDT	S (UJ)	S (UJ)	BM (J)														
Aldrin		S (U)	S (U)														
alpha-Chlordane			S (U)														
Dieldrin	S (U)		SB (U)			S (U)											
Heptachlor			S (U)														
gamma-BHC (Lindane)																	
Total PCBs	SB	SB	BM	S		S			S	S		S					
BIOASSAYS																	
Amphipod																	
Sediment Larval (Bivalve/Echinoderm)	2H	2H	1H	2H	2H	2H		2H	2H		2H	2H			2H	2H
Neanthes Growth			1H														
Bioassay: (Pass/Fail)	PASS	PASS	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
BTs eyesceeded:	yes	yes	yes	yes	no	no	no	no	yes	no	no	no	no	no	no	no
Bioaccumulation test conducted:	yes	yes	no	yes					yes							
Bioaccumulation (Pass/Fail):	PASS	PASS		PASS					PASS							
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	PASS	PASS	FAIL (c+b)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
HIGHEST RANKING:	LM	LM	H*	LM	L	LM	L	L	LM	LM	L	LM	L	L	L	L

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	Eastwaterway Project (Phase 2)														
DMMU ID:	D5	D6	D7	**D7a**	**D7b**	**D7c**	D8	D9	D10	D11	D12	D13	D14	D15	D16
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS															
Antimony															
Arsenic															
Cadmium															
Copper												S			
Lead															
Mercury	S		S	BM	SB	S						S	S		
Nickel															
Silver												SB			
Zinc						S									
TBT ion (porewater)															
LPAH															
Naphthalene															
Acenaphthene															
Acenaphthylene															
Fluorene															
Phenanthrene															
Anthracene															
2-Methylnaphthalene															
Total LPAHs															
HPAH															
Fluoranthene															
Pyrene															
Benzo(a)anthracene															
Benzofluoranthenes (b+k)															
Chrysene															
Benzo(a)pyrene															
Indeno(1,2,3-c,d)pyrene															
Dibenzo(a,h)anthracene															
Benzo(g,h,I)perylene															
Total HPAHs															
CHLORINATED HYDROCARBONS															
1,2,4-Trichlorobenzene															
1,2-Dichlorobenzene															
1,3-Dichlorobenzene															
1,4-Dichlorobenzene															
Hexaclorobenzene (HCB)															
PHTHALATES															
Bis(2-ethylheyesyl)phthalate															
Butylbenzylphthalate															
Di-n-butylphthalate															
Di-n-octylphthalate															
Diethylphthalate															
Dimethylphthalate															
PHENOLS															
2-Methylphenol															
4-Methylphenol															
2,4-Dimethylphenol				S (U)	S (U)	S (U)									
Pentachlorophenol															
Phenol															
MISCELANEOUS EXTRACTABLES															
Benzyl alcohol				S (U)	S (U)	S (U)									
Benzoic acid															
Dibenzofuran															
Hexachlorobutadiene															
Hexachloroethane															
N-Nitrosodiphenylamine															
VOLATILE ORGANICS															
Ethylbenzene															
Tetrachloroethene															
Total Zylene (sum of o,m,p)															
Trichloroethane															
PESTICIDES AND PCBs															
Total DDT			BM (UJ)	SB (Y)	SB (Y)	BM (Y)			S (U)			S (UJ)	S (J)		
Aldrin															
alpha-Chlordane			SB (U)												
Dieldrin			SB (U)										S (U)		
Heptachlor															
gamma-BHC (Lindane)															
Total PCBs	S		BM	S	SB	SB		S	S			S	SB		
BIOASSAYS															
Amphipod			2H	1H	1H	1H									
Sediment Larval (Bivalve/Echinoderm)				2H	2H	1H			2H		2H	1H	1H	2H	2H
Neanthes Growth			1H	1H	1H	1H			2H			1H	1H	2H	
Bioassay: (Pass/Fail)	PASS	PASS	FAIL	FAIL	FAIL	FAIL	PASS	PASS	FAIL	PASS	PASS	FAIL	FAIL	FAIL	PASS
BTs eyesceeded:	no	no	yes	yes	yes	yes	no	no	no	no	no	yes	yes	no	no
Bioaccumulation test conducted:			no	no	no	no						no	no		
Bioaccumulation (Pass/Fail):															
ML Rule exceeded:	no	no	**yes**	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	PASS	PASS	FAIL (c+b)	FAIL	FAIL	FAIL	PASS	PASS	FAIL	PASS	PASS	FAIL	FAIL	FAIL	PASS
HIGHEST RANKING:	LM	L	H*	H*	H*	H*	L	LM	H*	L	L	H*	H*	H*	L

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	Eastwaterway Project (Phase 2)															
DMMU ID:	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31	D32
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium																
Copper																
Lead																
Mercury										S						
Nickel																
Silver																
Zinc																
TBT ion (porewater)																
LPAH																
Naphthalene																
Acenaphthene																
Acenaphthylene																
Fluorene																
Phenanthrene																
Anthracene																
2-Methylnaphthalene																
Total LPAHs																
HPAH																
Fluoranthene																
Pyrene																
Benzo(a)anthracene																
Benzofluoranthenes (b+k)																
Chrysene																
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene																
Dibenzo(a,h)anthracene																
Benzo(g,h,I)perylene																
Total HPAHs																
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)																
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol																
4-Methylphenol																
2,4-Dimethylphenol					S											
Pentachlorophenol																
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol																
Benzoic acid																
Dibenzofuran																
Hexachlorobutadiene																
Hexachloroethane																
N-Nitrosodiphenylamine																
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT																S (U)
Aldrin																
alpha-Chlordane																
Dieldrin																
Heptachlor																
gamma-BHC (Lindane)																
Total PCBs	S	S	S													SB
BIOASSAYS																
Amphipod																
Sediment Larval (Bivalve/Echinoderm)	2H	2H	2H	2H		2H		2H	2H							
Neanthes Growth														2H		1H
Bioassay: (Pass/Fail)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL
BTs eyesceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	yes
Bioaccumulation test conducted:																no
Bioaccumulation (Pass/Fail):																
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL
HIGHEST RANKING:	LM	LM	LM	L	LM	L	L	L	L	LM	L	L	L	L	L	H*

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	Eastwaterway Project (Phase 2)							US Coast Guard Slip 36							
DMMU ID:	D33	D34	D35	D36	D37	D38	D39	CG-S61	CG-S62	CG-S63	CG-S64	CG-S65	CG-S66	CG-S67	CG-D40
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS															
Antimony															
Arsenic															
Cadmium						S									
Copper													S		
Lead													S		
Mercury				S	S	S									
Nickel															
Silver													BM		
Zinc						S							S		
TBT ion (porewater)															
LPAH															
Naphthalene															
Acenaphthene															
Acenaphthylene															
Fluorene															
Phenanthrene															
Anthracene															
2-Methylnaphthalene	S														
Total LPAHs															
HPAH															
Fluoranthene									S						
Pyrene										S	S		S		
Benzo(a)anthracene															
Benzofluoranthenes (b+k)															
Chrysene															
Benzo(a)pyrene															
Indeno(1,2,3-c,d)pyrene															
Dibenzo(a,h)anthracene											S				
Benzo(g,h,I)perylene															
Total HPAHs											S				
CHLORINATED HYDROCARBONS															
1,2,4-Trichlorobenzene															
1,2-Dichlorobenzene															
1,3-Dichlorobenzene															
1,4-Dichlorobenzene															
Hexaclorobenzene (HCB)						S (U)									
PHTHALATES															
Bis(2-ethylheyesyl)phthalate															
Butylbenzylphthalate															
Di-n-butylphthalate															
Di-n-octylphthalate															
Diethylphthalate															
Dimethylphthalate															
PHENOLS															
2-Methylphenol						S (U)									
4-Methylphenol															
2,4-Dimethylphenol						S (U)									
Pentachlorophenol						S (U)									
Phenol															
MISCELANEOUS EXTRACTABLES															
Benzyl alcohol						S (U)									
Benzoic acid						S (U)									
Dibenzofuran															
Hexachlorobutadiene						S (U)									
Hexachloroethane															
N-Nitrosodiphenylamine						S (U)									
VOLATILE ORGANICS															
Ethylbenzene															
Tetrachloroethene															
Total Zylene (sum of o,m,p)															
Trichloroethane															
PESTICIDES AND PCBs															
Total DDT	BM (U)			BM (U)	BM (U)	BM (U)			S	S (J)	SB (J)	S	S	S	
Aldrin	S (U)				S (U)	S (U)									
alpha-Chlordane					S (U)	S (U)									
Dieldrin	S (U)			S	S (U)	S (U)									
Heptachlor						S (U)									
gamma-BHC (Lindane)															
Total PCBs	SB			BM	BM	SB	S		S	S	S		S		
BIOASSAYS															
Amphipod						2H									
Sediment Larval (Bivalve/Echinoderm)	1H	2H		1H	1H	1H		2H		1H	1H	1H	1H	2H	
Neanthes Growth	1H	1H	1H	1H	1H	1H	2H								
Bioassay: (Pass/Fail)	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	PASS	PASS
BTs eyesceeded:	yes	no	no	yes	yes	yes	no	no	no	no	no	np	yes	no	no
Bioaccumulation test conducted:	no			no	no	no							no		
Bioaccumulation (Pass/Fail):															
ML Rule exceeded:	no	no	no	**yes**	**yes**	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	FAIL	FAIL	FAIL	FAIL (c+b)	FAIL (c+b)	FAIL	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	PASS	PASS
HIGHEST RANKING:	H*	H*	H*	H*	H*	H*	LM	LM	LM	H*	H*	H*	H*	LM	L

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	US NAVY PSNS PROJECT															
DMMU ID:	S1	S1-R	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium																
Copper																
Lead																
Mercury		S			S				S	S	S					S
Nickel																
Silver																
Zinc																
TBT ion (porewater)																
LPAH																
Naphthalene																
Acenaphthene																
Acenaphthylene																
Fluorene																
Phenanthrene																
Anthracene																
2-Methylnaphthalene																
Total LPAHs																
HPAH																
Fluoranthene																
Pyrene																
Benzo(a)anthracene																
Benzofluoranthenes (b+k)																
Chrysene																
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene																
Dibenzo(a,h)anthracene																
Benzo(g,h,I)perylene																
Total HPAHs																
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)																
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol																
4-Methylphenol																
2,4-Dimethylphenol																
Pentachlorophenol																
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol																
Benzoic acid																
Dibenzofuran																
Hexachlorobutadiene																
Hexachloroethane																
N-Nitrosodiphenylamine																
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT																
Aldrin																
alpha-Chlordane																
Dieldrin																
Heptachlor																
gamma-BHC (Lindane)																
Total PCBs																
BIOASSAYS																
Amphipod																
Sediment Larval (Bivalve/Echinoderm)	2H		2H	2H	2H	2H	2H	2H	2H	2H	2H	2H	2H			2H
Neanthes Growth																
Bioassay: (Pass/Fail)		PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
BTs eyesceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Bioaccumulation test conducted:																
Bioaccumulation (Pass/Fail):																
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:		PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
HIGHEST RANKING:	L	LM	L	L	LM	L	L	L	LM	LM	LM	L	L	L	L	LM

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	US NAVY PSNS PROJECT															
DMMU ID:	S16	S17	S18	S19	S20	S21	S22	S22-R	S23	S23-R	S24	S25	S26	S26-R	S27	S28
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium																
Copper																
Lead																
Mercury	S							S						S		
Nickel																
Silver																
Zinc																
TBT ion (porewater)												SB				
LPAH																
Naphthalene																
Acenaphthene																
Acenaphthylene																
Fluorene																
Phenanthrene																
Anthracene																
2-Methylnaphthalene																
Total LPAHs																
HPAH																
Fluoranthene																
Pyrene																
Benzo(a)anthracene																
Benzofluoranthenes (b+k)																
Chrysene																
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene																
Dibenzo(a,h)anthracene																
Benzo(g,h,I)perylene																
Total HPAHs																
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)								S (UJ)		S (U)						
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol																
4-Methylphenol																
2,4-Dimethylphenol								S (UD)								
Pentachlorophenol																
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol								S (UD)		S (U)						
Benzoic acid																
Dibenzofuran																
Hexachlorobutadiene								S (UD)		S (U)						
Hexachloroethane																
N-Nitrosodiphenylamine								S (UD)		S (U)						
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT																
Aldrin																
alpha-Chlordane																
Dieldrin																
Heptachlor																
gamma-BHC (Lindane)																
Total PCBs																
BIOASSAYS																
Amphipod											2H					
Sediment Larval (Bivalve/Echinoderm)				2H	2H		2H		2H				2H			
Neanthes Growth			2H													
Bioassay: (Pass/Fail)	PASS	PASS	PASS	PASS	PASS	PASS		PASS		PASS	PASS	PASS		PASS	PASS	PASS
BTs eyesceded:	no	no	no	no	no	no	no	no	no	no	no	**yes**	no	no	no	no
Bioaccumulation test conducted:												no				
Bioaccumulation (Pass/Fail):																
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS		PASS		PASS	PASS	FAIL (C)		PASS	PASS	PASS
HIGHEST RANKING:	LM	L	L	L	L	L	L	LM	L	LM	L	H*	L	LM	L	L

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	US NAVY PSNS PROJECT															
DMMU ID:	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39	S40	S41	S42	S43	S44
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium																
Copper																
Lead																
Mercury																S
Nickel																
Silver																
Zinc																
TBT ion (porewater)																
LPAH																
Naphthalene																
Acenaphthene																
Acenaphthylene																
Fluorene																
Phenanthrene																
Anthracene																
2-Methylnaphthalene																
Total LPAHs																
HPAH																
Fluoranthene																
Pyrene																
Benzo(a)anthracene																
Benzofluoranthenes (b+k)																
Chrysene																
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene																
Dibenzo(a,h)anthracene																
Benzo(g,h,I)perylene																
Total HPAHs																
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)																
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol																
4-Methylphenol																
2,4-Dimethylphenol																
Pentachlorophenol																
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol																
Benzoic acid																
Dibenzofuran																
Hexachlorobutadiene																
Hexachloroethane																
N-Nitrosodiphenylamine																
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT																
Aldrin																
alpha-Chlordane																
Dieldrin																
Heptachlor																
gamma-BHC (Lindane)																
Total PCBs																
BIOASSAYS																
Amphipod	2H															
Sediment Larval (Bivalve/Echinoderm)		2H	2H		2H	2H	2H	2H	2H	2H	2H	2H	2H	2H	2H	
Neanthes Growth								2H								
Bioassay: (Pass/Fail)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
BTs eyesceded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Bioaccumulation test conducted:																
Bioaccumulation (Pass/Fail):																
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
HIGHEST RANKING:	L	L	L	L	L	L	L	H*	L	L	L	L	L	L	L	L

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	US NAVY PSNS PROJECT															
DMMU ID:	S45	S46	S47	S48	S48-R	S49	S50	S51	S52	S53	S54	S55	S56	S56-R	S57	S58
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium																
Copper																
Lead									S							
Mercury	S							SB	S		S	S				
Nickel																
Silver								SB								
Zinc								S								
TBT ion (porewater)																
LPAH																
Naphthalene																
Acenaphthene																
Acenaphthylene																
Fluorene																
Phenanthrene																
Anthracene																
2-Methylnaphthalene																
Total LPAHs																
HPAH																
Fluoranthene								S								
Pyrene								S								
Benzo(a)anthracene																
Benzofluoranthenes (b+k)																
Chrysene																
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene																
Dibenzo(a,h)anthracene																
Benzo(g,h,I)perylene																
Total HPAHs																
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene								S (UD)								
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)								S (UD)						S (UD)		
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol								S (UD)								
4-Methylphenol								S (UD)								
2,4-Dimethylphenol								S (UD)								
Pentachlorophenol								SB (UD)								
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol								S (UD)								
Benzoic acid								BM								
Dibenzofuran																
Hexachlorobutadiene								S (UD)						S (UD)		
Hexachloroethane																
N-Nitrosodiphenylamine								S (UD)								
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT								BM				BM				
Aldrin																
alpha-Chlordane								S								
Dieldrin								S								
Heptachlor																
gamma-BHC (Lindane)																
Total PCBs								S		S		S				
BIOASSAYS																
Amphipod							2H								2H	
Sediment Larval (Bivalve/Echinoderm)		2H		2H				2H	1H	2H	2H	2H	2H		2H	
Neanthes Growth																
Bioassay: (Pass/Fail)	PASS	PASS	PASS		PASS	PASS	PASS	PASS	FAIL	PASS	PASS	PASS		PASS	FAIL	PASS
BTs eyesceded:	no	no	no	no	no	no	no	yes	no	no	no	no	no	no	no	no
Bioaccumulation test conducted:								yes								
Bioaccumulation (Pass/Fail):								FAIL								
ML Rule exceeded:	no	no	no	no	no	no	no	yes	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	PASS	PASS	PASS		PASS	PASS	PASS	FAIL	FAIL	PASS	PASS	FAIL(C)		PASS	FAIL	PASS
HIGHEST RANKING:	LM	L	L	L	L	L	L	H*	H*	LM	LM	H	L	LM	H*	L

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	US NAVY PSNS PROJECT														
DMMU ID:	S59	S60	S61	**S62**	**S62-R**	**S63**	S64	S65	S66	S67	S68	S69	S70	S71	S71-R
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS															
Antimony															
Arsenic															
Cadmium															
Copper															
Lead															
Mercury	S	S	S			S	S		S	S	S	S	S		
Nickel															
Silver															
Zinc															
TBT ion (porewater)			SB (E)												
LPAH															
Naphthalene															
Acenaphthene															
Acenaphthylene															
Fluorene															
Phenanthrene															
Anthracene															
2-Methylnaphthalene															
Total LPAHs															
HPAH															
Fluoranthene															
Pyrene															
Benzo(a)anthracene															
Benzofluoranthenes (b+k)															
Chrysene															
Benzo(a)pyrene															
Indeno(1,2,3-c,d)pyrene															
Dibenzo(a,h)anthracene															
Benzo(g,h,I)perylene															
Total HPAHs															
CHLORINATED HYDROCARBONS															
1,2,4-Trichlorobenzene															
1,2-Dichlorobenzene															
1,3-Dichlorobenzene															
1,4-Dichlorobenzene															
Hexaclorobenzene (HCB)												S (UD)			
PHTHALATES															
Bis(2-ethylheyesyl)phthalate													SB (D)		
Butylbenzylphthalate															
Di-n-butylphthalate															
Di-n-octylphthalate															
Diethylphthalate															
Dimethylphthalate															
PHENOLS															
2-Methylphenol															
4-Methylphenol															
2,4-Dimethylphenol															
Pentachlorophenol															
Phenol															
MISCELANEOUS EXTRACTABLES															
Benzyl alcohol															
Benzoic acid															
Dibenzofuran															
Hexachlorobutadiene															
Hexachloroethane															
N-Nitrosodiphenylamine															
VOLATILE ORGANICS															
Ethylbenzene															
Tetrachloroethene															
Total Zylene (sum of o,m,p)															
Trichloroethane															
PESTICIDES AND PCBs															
Total DDT															
Aldrin															
alpha-Chlordane															
Dieldrin															
Heptachlor															
gamma-BHC (Lindane)															
Total PCBs						S	S			S	S		S		
BIOASSAYS															
Amphipod		2H								2H					
Sediment Larval (Bivalve/Echinoderm)	2H	2H		2H		2H	2H	2H	2H	2H	2H	2H		2H	
Neanthes Growth								2H							
Bioassay: (Pass/Fail)	PASS	FAIL	PASS		PASS	PASS	PASS	FAIL	PASS	FAIL	PASS	PASS	PASS	PASS	PASS
BTs eyesceded:	no	no	no	no	no	no	no	no	no	no	no	no	yes	no	no
Bioaccumulation test conducted:													no		
Bioaccumulation (Pass/Fail):															
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	PASS	FAIL	FAIL(C)		PASS	PASS	PASS	FAIL	PASS	FAIL	PASS	PASS	FAIL(C)		PASS
HIGHEST RANKING:	LM	H*	H	L	L	LM	LM	H*	LM	H*	LM	LM	H	L	L

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	US NAVY PSNS PROJECT																
DMMU ID:	S72	S73	S73-R	S77	S78	S80	D1	D2	D3	D3-R	D4a	D4b	D4c	D4d	D5	D6a
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																	
Antimony																	
Arsenic				S													
Cadmium																	
Copper				S	S												
Lead																	
Mercury	S			BM	BM		S										
Nickel																	
Silver																	
Zinc					S												
TBT ion (porewater)																	
LPAH																	
Naphthalene																	
Acenaphthene	S																
Acenaphthylene																	
Fluorene	S																
Phenanthrene	S (D)																
Anthracene	S																
2-Methylnaphthalene																	
Total LPAHs																	
HPAH																	
Fluoranthene	SB (D)																
Pyrene	S (D)																
Benzo(a)anthracene	S (D)																
Benzofluoranthenes (b+k)																	
Chrysene	S (D)																
Benzo(a)pyrene																	
Indeno(1,2,3-c,d)pyrene	S																
Dibenzo(a,h)anthracene																	
Benzo(g,h,I)perylene																	
Total HPAHs	S																
CHLORINATED HYDROCARBONS																	
1,2,4-Trichlorobenzene																	
1,2-Dichlorobenzene																	
1,3-Dichlorobenzene																	
1,4-Dichlorobenzene																	
Hexaclorobenzene (HCB)				S (UD)	S (UD)												
PHTHALATES																	
Bis(2-ethylheyesyl)phthalate																	
Butylbenzylphthalate																	
Di-n-butylphthalate																	
Di-n-octylphthalate																	
Diethylphthalate																	
Dimethylphthalate																	
PHENOLS																	
2-Methylphenol																	
4-Methylphenol																	
2,4-Dimethylphenol				S (UD)	S (UD)												
Pentachlorophenol																	
Phenol																	
MISCELANEOUS EXTRACTABLES																	
Benzyl alcohol				S (UD)													
Benzoic acid																	
Dibenzofuran																	
Hexachlorobutadiene				S (UD)	S (UD)												
Hexachloroethane																	
N-Nitrosodiphenylamine				S (UD)	S (UD)												
VOLATILE ORGANICS																	
Ethylbenzene																	
Tetrachloroethene																	
Total Zylene (sum of o,m,p)																	
Trichloroethane																	
PESTICIDES AND PCBs																	
Total DDT																	
Aldrin																	
alpha-Chlordane																	
Dieldrin																	
Heptachlor																	
gamma-BHC (Lindane)																	
Total PCBs	S			S	S												
BIOASSAYS																	
Amphipod	1H			2H	1H		2H								1H		
Sediment Larval (Bivalve/Echinoderm)	2H			1H	1H	2H	1H	2H	2H				2H	2H	2H		
Neanthes Growth				2H											2H		
Bioassay: (Pass/Fail)	FAIL		PASS	FAIL	FAIL	PASS	FAIL	PASS		PASS	PASS	PASS	PASS	PASS	FAIL	PASS	
BTs eyesceded:	yes	no	no	yes	yes	no	no	no	no	no	no	no	no	no	no	no	
Bioaccumulation test conducted:	no			no	no												
Bioaccumulation (Pass/Fail):																	
ML Rule exceeded:	no	no	no	yes	yes	no	no	no	no	no	no	no	no	no	no	no	
OVERALL PASS/FAIL:	FAIL			FAIL	FAIL	PASS	FAIL	PASS		PASS	PASS	PASS	PASS	PASS	FAIL	PASS	
HIGHEST RANKING:	H*	L	L	H*	H*	L	H*	L	L	L	L	L	L	L	H*	L	

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	US NAVY PSNS PROJECT						JAMES HARDIE GYPSUM							OLYMPIA HARB	
DMMU ID:	D6b	D6c	D8	SS101	SS102	SS103	S2B	S3	S5	CB	CC	CD	CE	B1	TBW1
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS															
Antimony															
Arsenic															
Cadmium															
Copper															
Lead															
Mercury												S			
Nickel															
Silver															
Zinc															
TBT ion (porewater)														SB	SB
LPAH															
Naphthalene															
Acenaphthene															
Acenaphthylene															
Fluorene															
Phenanthrene											S				
Anthracene															
2-Methylnaphthalene															
Total LPAHs															
HPAH															
Fluoranthene											S				
Pyrene											S				
Benzo(a)anthracene															
Benzofluoranthenes (b+k)															
Chrysene															
Benzo(a)pyrene															
Indeno(1,2,3-c,d)pyrene															
Dibenzo(a,h)anthracene															
Benzo(g,h,I)perylene															
Total HPAHs															
CHLORINATED HYDROCARBONS															
1,2,4-Trichlorobenzene															
1,2-Dichlorobenzene															
1,3-Dichlorobenzene															
1,4-Dichlorobenzene															
Hexaclorobenzene (HCB)															
PHTHALATES															
Bis(2-ethylheyesyl)phthalate															
Butylbenzylphthalate															
Di-n-butylphthalate															
Di-n-octylphthalate															
Diethylphthalate															
Dimethylphthalate															
PHENOLS															
2-Methylphenol															
4-Methylphenol															
2,4-Dimethylphenol															
Pentachlorophenol															
Phenol															
MISCELANEOUS EXTRACTABLES															
Benzyl alcohol															
Benzoic acid															
Dibenzofuran															
Hexachlorobutadiene															
Hexachloroethane															
N-Nitrosodiphenylamine															
VOLATILE ORGANICS															
Ethylbenzene															
Tetrachloroethene															
Total Zylene (sum of o,m,p)															
Trichloroethane															
PESTICIDES AND PCBs															
Total DDT															
Aldrin															
alpha-Chlordane															
Dieldrin												S			
Heptachlor															
gamma-BHC (Lindane)															
Total PCBs							S	S	S	S	S	SB	SB		
BIOASSAYS															
Amphipod			1H				1H	1H	2H	2H		2H			
Sediment Larval (Bivalve/Echinoderm)	2H	2H	2H	2H	2H	2H			1H		2H	1H			
Neanthes Growth											2H				
Bioassay: (Pass/Fail)	PASS	PASS	FAIL	PASS	PASS	PASS	FAIL	FAIL	FAIL	PASS	FAIL	FAIL	PASS	NA	NA
BTs eyesceded:	no	no	no	no	no	no	no	no	no	no	no	yes	yes	yes	yes
Bioaccumulation test conducted:												no	no	yes	yes
Bioaccumulation (Pass/Fail):														PASS	PASS
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	PASS	PASS	FAIL	PASS	PASS	PASS	FAIL	FAIL	FAIL	PASS	FAIL	FAIL	PASS	PASS	PASS
HIGHEST RANKING:	L	L	H*	L	L	L	H*	H*	H*	LM	H*	H*	M	LM	LM

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	USN PIT-CAD CHARACTERIZATION															
DMMU ID:	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium																
Copper																
Lead																
Mercury	S	S				S	S		S	S	S	S				S
Nickel																
Silver																
Zinc																
TBT ion (porewater)																
LPAH																
Naphthalene																
Acenaphthene																
Acenaphthylene																
Fluorene																
Phenanthrene																
Anthracene																
2-Methylnaphthalene																
Total LPAHs																
HPAH																
Fluoranthene																
Pyrene																
Benzo(a)anthracene																
Benzofluoranthenes (b+k)																
Chrysene																
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene																
Dibenzo(a,h)anthracene																
Benzo(g,h,I)perylene																
Total HPAHs																
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)																
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol																
4-Methylphenol																
2,4-Dimethylphenol																
Pentachlorophenol																
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol																
Benzoic acid																
Dibenzofuran																
Hexachlorobutadiene																
Hexachloroethane																
N-Nitrosodiphenylamine																
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT																
Aldrin																
alpha-Chlordane																
Dieldrin																
Heptachlor																
gamma-BHC (Lindane)																
Total PCBs																
BIOASSAYS																
Amphipod																
Sediment Larval (Bivalve/Echinoderm)	2H	2H	2H	2H	2H		2H	2H		2H			2H	2H		2H
Neanthes Growth			2H													
Bioassay: (Pass/Fail)	**PASS**	**PASS**	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
BTs eyesceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Bioaccumulation test conducted:																
Bioaccumulation (Pass/Fail):																
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	**PASS**	PASS	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
HIGHEST RANKING:	LM	LM	H*	L	L	LM	LM	L	LM	LM	LM	LM	L	L	L	LM

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	USN PIT-CAD CHARACTERIZATION														DUWAMISH O&M	
DMMU ID:	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S1	S3
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium																
Copper																
Lead																
Mercury	S	S				S	S	S		S	S		S	S		
Nickel																
Silver																
Zinc																
TBT ion (porewater)																SB
LPAH																
Naphthalene																
Acenaphthene																
Acenaphthylene																
Fluorene																
Phenanthrene																
Anthracene																
2-Methylnaphthalene																
Total LPAHs																
HPAH																
Fluoranthene																
Pyrene																
Benzo(a)anthracene																
Benzofluoranthenes (b+k)																
Chrysene																
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene																
Dibenzo(a,h)anthracene																
Benzo(g,h,I)perylene																
Total HPAHs																
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)																
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol																
4-Methylphenol																
2,4-Dimethylphenol																
Pentachlorophenol																
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol																
Benzoic acid																
Dibenzofuran																
Hexachlorobutadiene																
Hexachloroethane																
N-Nitrosodiphenylamine																
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT																
Aldrin																
alpha-Chlordane																
Dieldrin																
Heptachlor																
gamma-BHC (Lindane)																
Total PCBs															S	
BIOASSAYS																
Amphipod																
Sediment Larval (Bivalve/Echinoderm)	2H	2H	2H	2H		2H	2H	2H	2H	2H	2H	2H	2H	2H	2H	
Neanthes Growth															2H	
Bioassay: (Pass/Fail)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	NA
BTs eyesceeded:	no	no	no	no	no	no	no	no	no	no	no	**no**	no	no	no	yes
Bioaccumulation test conducted:																no
Bioaccumulation (Pass/Fail):																
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL(C)
HIGHEST RANKING:	LM	LM	L	L	L	LM	LM	LM	L	LM	LM	L	LM	LM	H*	H*

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	DUWAMISH O&M															WEYER
DMMU ID:	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	B1	B2	B1
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium																
Copper																
Lead																
Mercury																
Nickel																
Silver																
Zinc																
TBT ion (porewater)	SB (M)											SB				SB
LPAH																
Naphthalene																
Acenaphthene																
Acenaphthylene																
Fluorene																
Phenanthrene																
Anthracene																
2-Methylnaphthalene																
Total LPAHs																
HPAH																
Fluoranthene																
Pyrene																
Benzo(a)anthracene																
Benzofluoranthenes (b+k)																S
Chrysene																S
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene																
Dibenzo(a,h)anthracene																
Benzo(g,h,I)perylene																
Total HPAHs																
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)																S (U)
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol																
4-Methylphenol																
2,4-Dimethylphenol																
Pentachlorophenol																
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol																
Benzoic acid																
Dibenzofuran																
Hexachlorobutadiene																S (U)
Hexachloroethane																
N-Nitrosodiphenylamine																S (J)
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT																S (U)
Aldrin																
alpha-Chlordane																
Dieldrin																
Heptachlor																
gamma-BHC (Lindane)																
Total PCBs			S	S	S	S		S	S	S	S	S	S	S	S	S
BIOASSAYS																
Amphipod																2H
Sediment Larval (Bivalve/Echinoderm)									2H						2H	2H
Neanthes Growth		2H		2H	2H			2H						2H	2H	
Bioassay: (Pass/Fail)	NA	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	NA	PASS	PASS	FAIL	FAIL
BTs eyesceeded:	yes	no	no	no	no	no	no	no	no	no	no	yes	no	no	no	yes
Bioaccumulation test conducted:	no											no				no
Bioaccumulation (Pass/Fail):																
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	FAIL(C)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL(C)	PASS	PASS	FAIL	FAIL
HIGHEST RANKING:	H*	L	LM	LM	LM	LM	L	LM	LM	LM	LM	H*	LM	LM	H*	H*

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	WEYERHAEUSER CO. HWDG								MANKE LUMBER HWDG							
DMMU ID:	B2	B3	B5	B6	B7	B8	B9	B10	A1	A2	A3	A4	A5	A6	A7	A8
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic									S	S	S	S		S		
Cadmium																
Copper																
Lead																
Mercury														S		
Nickel																
Silver																
Zinc									S			S				
TBT ion (porewater)	SB		SB	SB	SB	SB										
LPAH																
Naphthalene																
Acenaphthene								S							S	
Acenaphthylene																
Fluorene															S	
Phenanthrene								S							S	
Anthracene															S	
2-Methylnaphthalene																
Total LPAHs								S							S	
HPAH																
Fluoranthene								S	S		S		SB		SB	S
Pyrene								S					S		S	
Benzo(a)anthracene								S					S		S	
Benzofluoranthenes (b+k)	S					S							S		S	
Chrysene	S			S		S	S	S	S		S		S		S	
Benzo(a)pyrene																
Indeno(1,2,3-c,d)pyrene	S							S								
Dibenzo(a,h)anthracene			S													S (U)
Benzo(g,h,I)perylene																
Total HPAHs													S		S	
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)	S (U)	S (U)	S (U)	S (U)			S (U)	S (U)		S (U)	S (U)	S (U)	S (U)	S (U)	S (U)	BM (U)
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol																
4-Methylphenol																
2,4-Dimethylphenol		S (U)	S (U)	S (U)				S (U)			S (U)					
Pentachlorophenol	SB													SB (U)		BM
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol	S (U)		S (U)	S (U)			S (U)	S (U)		S (U)		S (U)	S (U)	S (U)	S (U)	S (U)
Benzoic acid																
Dibenzofuran															S	
Hexachlorobutadiene	S (U)	S (U)	S (U)	S (U)			S (U)	S (U)		S (U)	S (U)	S (U)	S (U)	S (U)	S (U)	SB (U)
Hexachloroethane																
N-Nitrosodiphenylamine	S (U)	S (U)	S (U)	S (U)			S (U)	S (U)		S (U)	S (U)	S (U)	S (U)	S (U)	S (U)	BM (U)
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT	S (U)	S (J)	S (U)			S (U)	S (U)		S (U)		S (UJ)		S (U)	S (U)	S (U)	
Aldrin																
alpha-Chlordane																
Dieldrin																
Heptachlor																
gamma-BHC (Lindane)																
Total PCBs	S		S			S	S		S		S		S		S	
BIOASSAYS																
Amphipod	1H	1H				1H			1H	1H		1H	1H	1H		
Sediment Larval (Bivalve/Echinoderm)	2H					2H	2H	2H	2H		2H	2H	2H	2H	1H	
Neanthes Growth																
Bioassay: (Pass/Fail)	FAIL	FAIL	PASS	PASS	PASS	FAIL	PASS	PASS	FAIL	FAIL	PASS	FAIL	FAIL	FAIL	FAIL	NA
BTs eyesceeded:	yes	no	yes	yes	yes	yes	no	no	no	no	no	no	yes	yes	yes	yes
Bioaccumulation test conducted:	no		yes	yes	yes	no							no	no	no	no
Bioaccumulation (Pass/Fail):			PASS	PASS	PASS											
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	yes
OVERALL PASS/FAIL:	FAIL	FAIL	PASS	PASS	PASS	FAIL	PASS	PASS	FAIL	FAIL	PASS	FAIL	FAIL	FAIL	FAIL	FAIL(C)
HIGHEST RANKING:	H*	H*	LM	LM	LM	H*	LM	LM	H*	H*	LM	H*	H*	H*	H*	H

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	MANKE LUMBER HWDG														
DMMU ID:	A11	A12	A13	A14	A15	A16	A17	A18	A19	A21	A22	A23	A25	A26	A27
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS															
Antimony															
Arsenic												S	S		
Cadmium															
Copper															
Lead															
Mercury															
Nickel															
Silver															
Zinc													S		
TBT ion (porewater)															
LPAH															
Naphthalene															
Acenaphthene									S						
Acenaphthylene															
Fluorene									S						
Phenanthrene				S					S						
Anthracene									S						
2-Methylnaphthalene															
Total LPAHs															
HPAH															
Fluoranthene				S					S					S	
Pyrene															
Benzo(a)anthracene															
Benzofluoranthenes (b+k)															
Chrysene	S		S	S					S						
Benzo(a)pyrene															
Indeno(1,2,3-c,d)pyrene															
Dibenzo(a,h)anthracene															
Benzo(g,h,I)perylene															
Total HPAHs	S			S					S						
CHLORINATED HYDROCARBONS															
1,2,4-Trichlorobenzene															
1,2-Dichlorobenzene															
1,3-Dichlorobenzene															
1,4-Dichlorobenzene															
Hexaclorobenzene (HCB)	S (U)	S (U)	S (U)	SB (U)	S (U)	S (U)	S (U)		S (U)					S (U)	
PHTHALATES															
Bis(2-ethylheyesyl)phthalate															
Butylbenzylphthalate															
Di-n-butylphthalate															
Di-n-octylphthalate															
Diethylphthalate															
Dimethylphthalate															
PHENOLS															
2-Methylphenol															
4-Methylphenol															
2,4-Dimethylphenol					S (U)										
Pentachlorophenol	SB (U)			BM (U)					S (U)						
Phenol															
MISCELANEOUS EXTRACTABLES															
Benzyl alcohol	S (U)	S (U)		S (U)	S (U)		S (U)		S (U)				S (U)		
Benzoic acid															
Dibenzofuran									S (U)						
Hexachlorobutadiene	S (U)	S (U)	S (U)	S (U)	S (U)	S (U)	S (U)		S (U)				S (U)		
Hexachloroethane															
N-Nitrosodiphenylamine		S (U)	S (U)	BM (U)	S (U)	S (U)	S (U)		S (U)				S (U)		
VOLATILE ORGANICS															
Ethylbenzene															
Tetrachloroethene															
Total Zylene (sum of o,m,p)															
Trichloroethane															
PESTICIDES AND PCBs															
Total DDT	S (U)		S (U)	S (U)	S (U)	S (U)	S (U)	S (U)	S (U)		S (UJ)				
Aldrin															
alpha-Chlordane															
Dieldrin	S (U)														
Heptachlor															
gamma-BHC (Lindane)									S (U)						
Total PCBs	S	S	S	S	S	S	S	S	S		S	S		S	S
BIOASSAYS															
Amphipod	2H	1H		1H		1H			2H	1H	1H				
Sediment Larval (Bivalve/Echinoderm)	2H			2H		2H			2H	2H			2H		2H
Neanthes Growth															
Bioassay: (Pass/Fail)	FAIL	FAIL	PASS	FAIL	PASS	FAIL	PASS	PASS	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS
BTs eyesceeded:	yes	no	no	yes	no	no	no	no	no	no	no	no	no	no	no
Bioaccumulation test conducted:	no			no											
Bioaccumulation (Pass/Fail):															
ML Rule exceeded:	no	no	no	yes	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	FAIL	FAIL	PASS	FAIL	PASS	FAIL	PASS	PASS	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS
HIGHEST RANKING:	H	H*	LM	H	LM	H*	LM	LM	H*	H*	H*	LM	LM	LM	LM

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	POA-CAP SANTE MARINA			POB-PAD	POT-HYLEBOS/BLAIR SLIP ONE (MOUTH OF HYLEBOS)									(WAS.W)	POT-HYL(MP)	
DMMU ID:	C8	COMP1	COMP2	C1	C2	C4	C9	C10A	C11	C12	C16	C17	C43	C37	C18	C19
Testing Rank:	M	M	M	H	LM	H	LM	LM	LM	LM	LM	LM	H	H	H	H
METALS & ORGANOMETALS																
Antimony																
Arsenic																
Cadmium																
Copper																
Lead																
Mercury								S		S						
Nickel																
Silver																
Zinc																
TBT ion (porewater)		SB	SB					SB (G)		SB (G)				SB (G)		SB (G)
LPAH																
Naphthalene	S					M										
Acenaphthene				S		M										
Acenaphthylene																
Fluorene				S		M										
Phenanthrene				S		M										
Anthracene						S										
2-Methylnaphthalene				S		M										
Total LPAHs				S		M										
HPAH																
Fluoranthene	S			S		BM										
Pyrene	S					M										
Benzo(a)anthracene						M										
Benzofluoranthenes (b+k)						M										
Chrysene	S					S										
Benzo(a)pyrene						BM										
Indeno(1,2,3-c,d)pyrene						M										
Dibenzo(a,h)anthracene						S										
Benzo(g,h,I)perylene						M										
Total HPAHs	S															
CHLORINATED HYDROCARBONS																
1,2,4-Trichlorobenzene								S								
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Hexaclorobenzene (HCB)					S (M)	S (U)	S (M)	S	S	S		S (M)				
PHTHALATES																
Bis(2-ethylheyesyl)phthalate																
Butylbenzylphthalate																
Di-n-butylphthalate																
Di-n-octylphthalate																
Diethylphthalate																
Dimethylphthalate																
PHENOLS																
2-Methylphenol						S (U)										
4-Methylphenol																
2,4-Dimethylphenol						S (U)										
Pentachlorophenol						S										
Phenol																
MISCELANEOUS EXTRACTABLES																
Benzyl alcohol						S (U)										
Benzoic acid						S										
Dibenzofuran						M										
Hexachlorobutadiene					S	S (U)	S	S	S	S		S				
Hexachloroethane																
N-Nitrosodiphenylamine						S (U)										
VOLATILE ORGANICS																
Ethylbenzene																
Tetrachloroethene																
Total Zylene (sum of o,m,p)																
Trichloroethane																
PESTICIDES AND PCBs																
Total DDT					S		S	S (NG)	S (NG)	S (NG)	S (NG)	S (NG)		S	S	S
Aldrin											S (U)	S (U)				
alpha-Chlordane											S (U)	S (U)				
Dieldrin								S (Y)	S (Y)	S (Y)		S (U)			S (Y)	S (Y)
Heptachlor											S (U)	S (U)				
gamma-BHC (Lindane)								S	S	S (Y)		S				
Total PCBs						S		S (Y)	S (Y)		S (UE)	S (U)	S	S	S	S
BIOASSAYS																
Amphipod										2H	2H	2H	2H	2H		
Sediment Larval (Bivalve/Echinoderm)							1H	1H	1H	1H	1H	1H			1H	1H
Neanthes Growth								2H	2H							
Bioassay: (Pass/Fail)	PASS	NA	NA	PASS	PASS	NA	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	FAIL	FAIL
BTs eyesceeded:	no	yes	yes	no	no	yes	no	yes	no	yes	no	no	no	yes	no	yes
Bioaccumulation test conducted:		yes	yes			no		no		no				no		no
Bioaccumulation (Pass/Fail):		PASS	PASS													
ML Rule exceeded:	no	no	no	no	no	yes	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	FAIL(C)	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	FAIL(C)	FAIL	FAIL
HIGHEST RANKING:	LM	LM	LM	LM	LM	H	H	H	H	H	H	H	LM	H*	H*	H*

APPENDIX C - DY 00/01 EVALUATION GUIDELINE EXCEEDANCES

PROJECT:	POT-HYLEBOS/BLAIR SLIP ONE (MURRAY PACIFIC)									USACE GRAYS H. O&M		
DMMU ID:	C20	C21	C22	C23	C24	C25	C27	C36	C37	C5	C10	C11
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS												
Antimony												
Arsenic		S										
Cadmium												
Copper												
Lead												
Mercury												
Nickel												
Silver												
Zinc		S										
TBT ion (porewater)	SB	SB (G)		SB (G)	SB (G)				SB (G)			
LPAH												
Naphthalene												
Acenaphthene												
Acenaphthylene												
Fluorene												
Phenanthrene												
Anthracene												
2-Methylnaphthalene												
Total LPAHs												
HPAH												
Fluoranthene					S	SB	S					
Pyrene					S	S						
Benzo(a)anthracene					S	S						
Benzofluoranthenes (b+k)					S	S						
Chrysene	S				S	S	S					
Benzo(a)pyrene												
Indeno(1,2,3-c,d)pyrene												
Dibenzo(a,h)anthracene												
Benzo(g,h,I)perylene												
Total HPAHs					S	S						
CHLORINATED HYDROCARBONS												
1,2,4-Trichlorobenzene												
1,2-Dichlorobenzene												
1,3-Dichlorobenzene												
1,4-Dichlorobenzene												
Hexaclorobenzene (HCB)		S (U)		S (U)							S (U)	
PHTHALATES												
Bis(2-ethylheyesyl)phthalate												
Butylbenzylphthalate												
Di-n-butylphthalate												
Di-n-octylphthalate												
Diethylphthalate												
Dimethylphthalate												
PHENOLS												
2-Methylphenol												
4-Methylphenol												
2,4-Dimethylphenol		S (U)		S(U)							S(U)	
Pentachlorophenol												
Phenol												
MISCELANEOUS EXTRACTABLES												
Benzyl alcohol												
Benzoic acid												
Dibenzofuran												
Hexachlorobutadiene		S (U)		S (U)							S(U)	
Hexachloroethane												
N-Nitrosodiphenylamine		S (U)		S (U)								
VOLATILE ORGANICS												
Ethylbenzene												
Tetrachloroethene												
Total Zylene (sum of o,m,p)												
Trichloroethane												
PESTICIDES AND PCBs												
Total DDT	S	S	S	S (UE)	S (UE)	S (E)	S	S	S			
Aldrin												
alpha-Chlordane												
Dieldrin	S (Y)		S (Y)		S	S (Y)	S					
Heptachlor												
gamma-BHC (Lindane)	S (Y)		S (E)									
Total PCBs	S	S		S	S	S	S	S	S			
BIOASSAYS												
Amphipod						1H			2H			
Sediment Larval (Bivalve/Echinoderm)	1H	1H	1H	1H	1H	2H	2H	1H				
Neanthes Growth												
Bioassay: (Pass/Fail)	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	FAIL	PASS	PASS	NA	PASS
BTs eyesceeded:	yes	yes	no	yes	yes	yes	no	no	yes	no	no	no
Bioaccumulation test conducted:	no	no		no	no	no			no			
Bioaccumulation (Pass/Fail):												
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	FAIL	FAIL(C)	PASS	PASS (BPJ)	PASS
HIGHEST RANKING:	H*	H*	H*	H*	H*	H*	LM	H*	H*	L	LM	L